Hydrogeologic Investigation and Groundwater Model of the Upper Gallatin Aquifer Upper Gallatin River Corridor, Big Sky, Montana

Montana Bureau of Mines and Geology – Ground Water Investigation Program
Proposed by the Gallatin River Task Force

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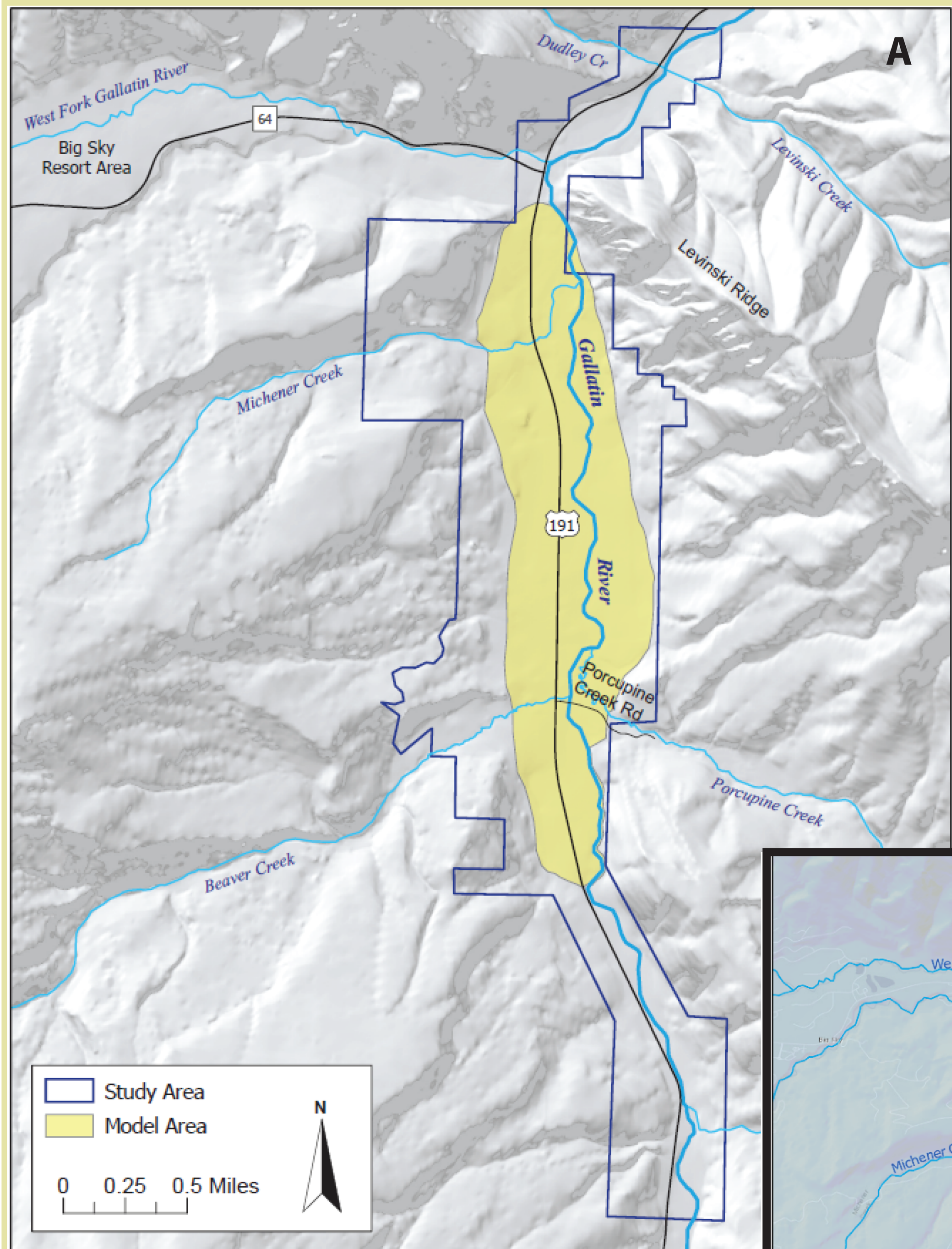
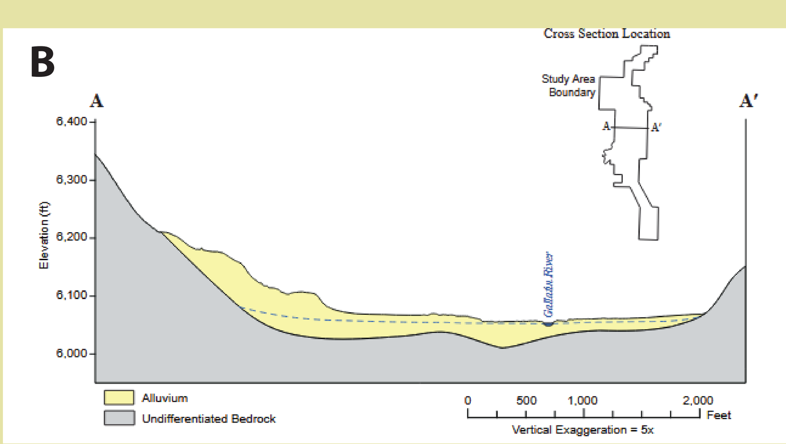


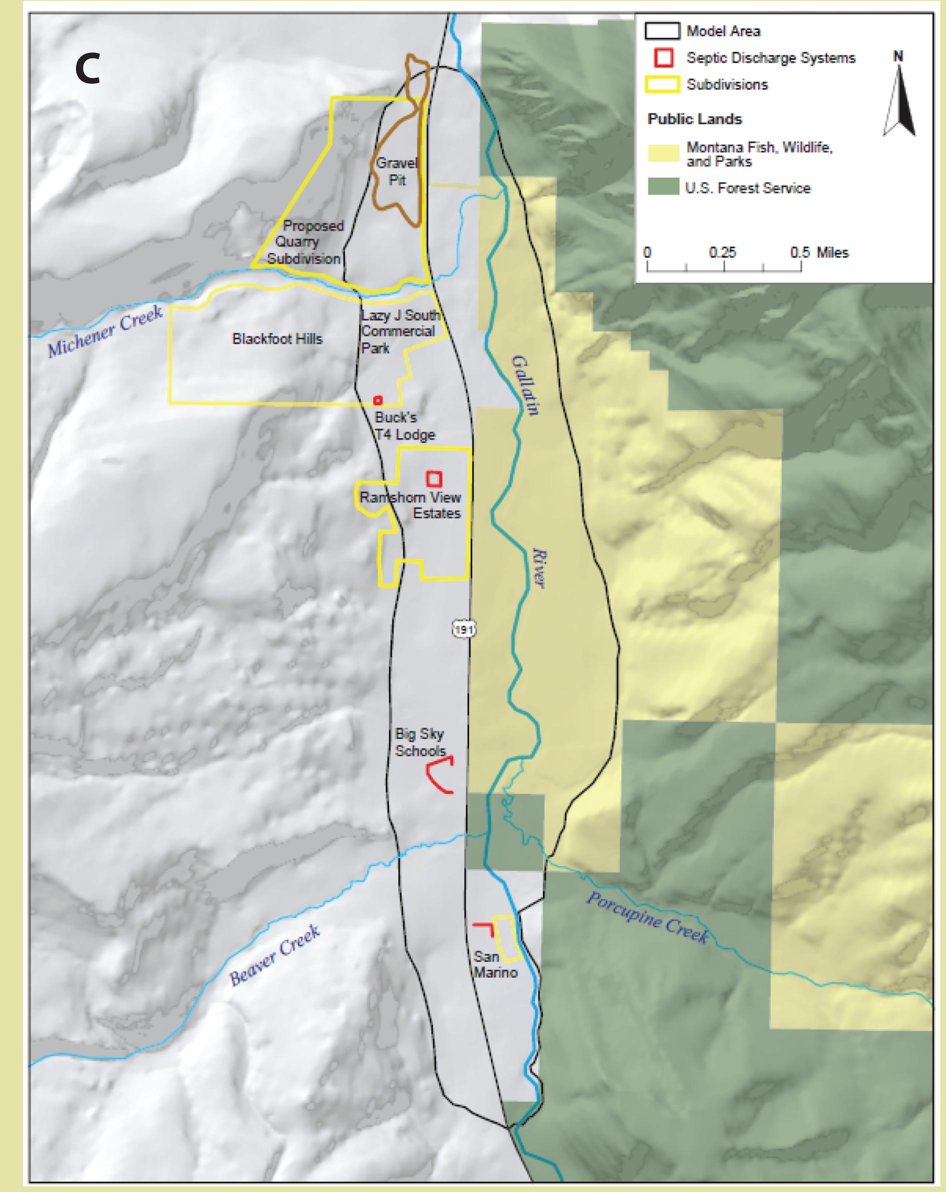
Project Area and Study Design

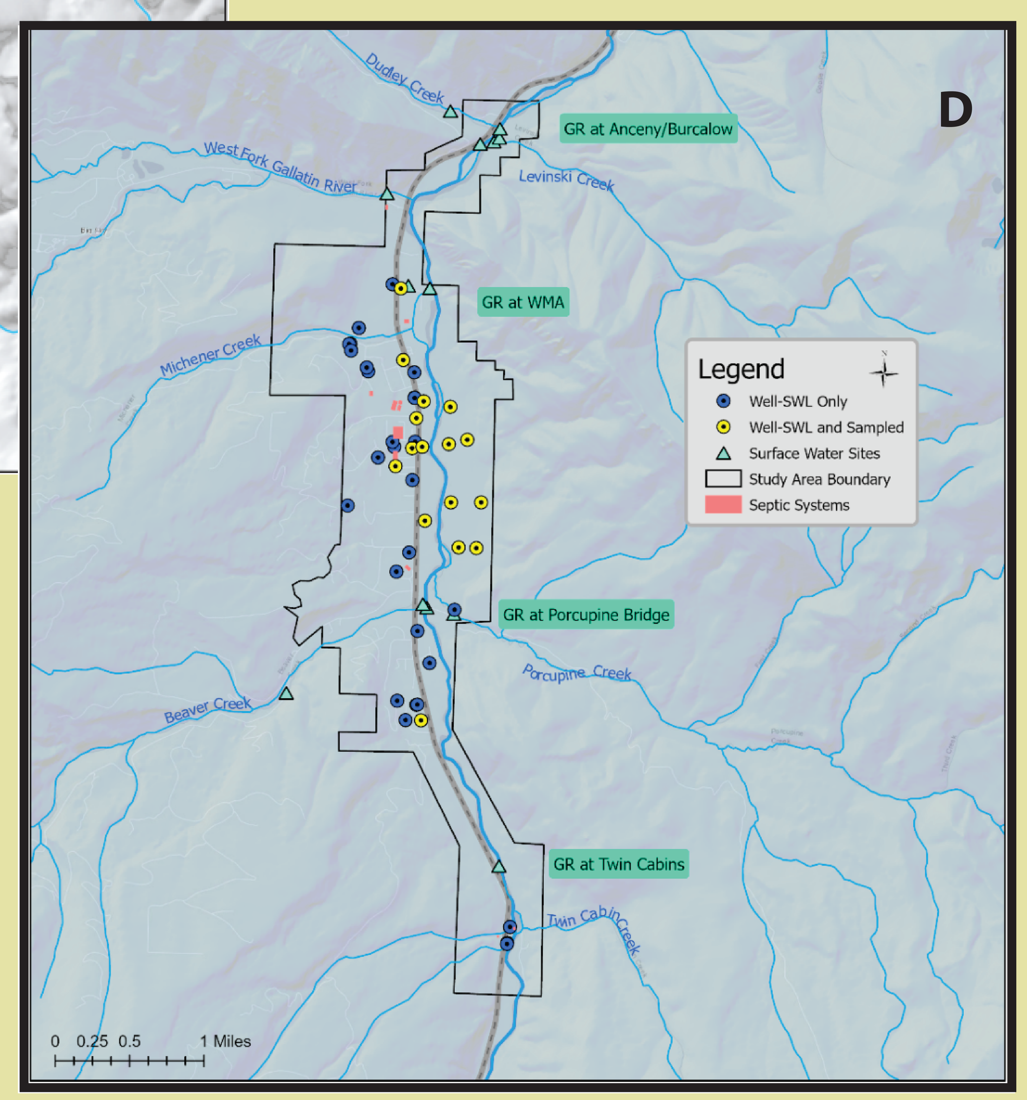
Concerns about the effect on the Gallatin River from development in the Canyon area, prompted the Gallatin River Task Force to request a study by the MBMG. The study included a 5-square mile area and 7-mile reach of the Gallatin River. The modeled area was a 2-square mile subarea of just the productive alluvial aquifer (A).

The alluvial aquifer is thin (less than 40 feet thick) and unconfined (B), making it vulnerable to contamination. The alluvial groundwater primarily discharges to the River.

To understand the influence of development (C) on the chemistry of the groundwater, seven wells were installed on the undeveloped east side of the river (D) to serve as an un-impacted baseline.

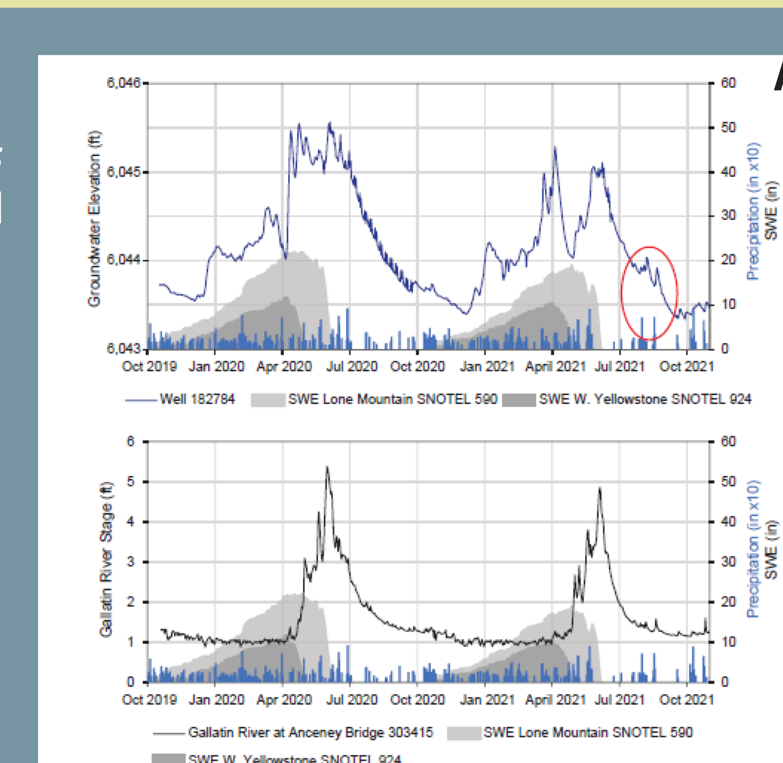


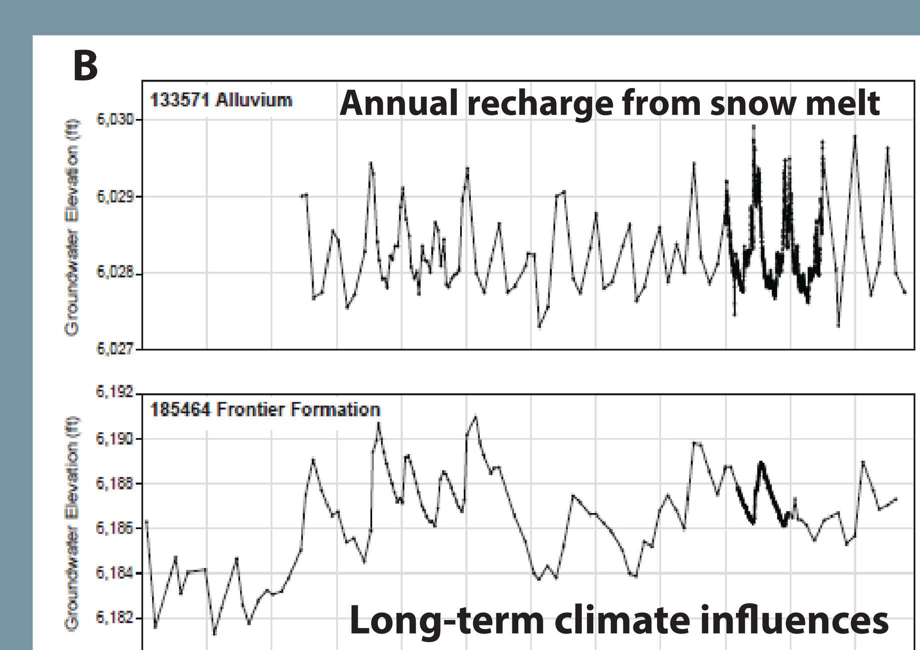




Water Level Responses

Surface water and alluvial-aquifer groundwater are strongly controlled by high- and low-elevation snow melt (A).



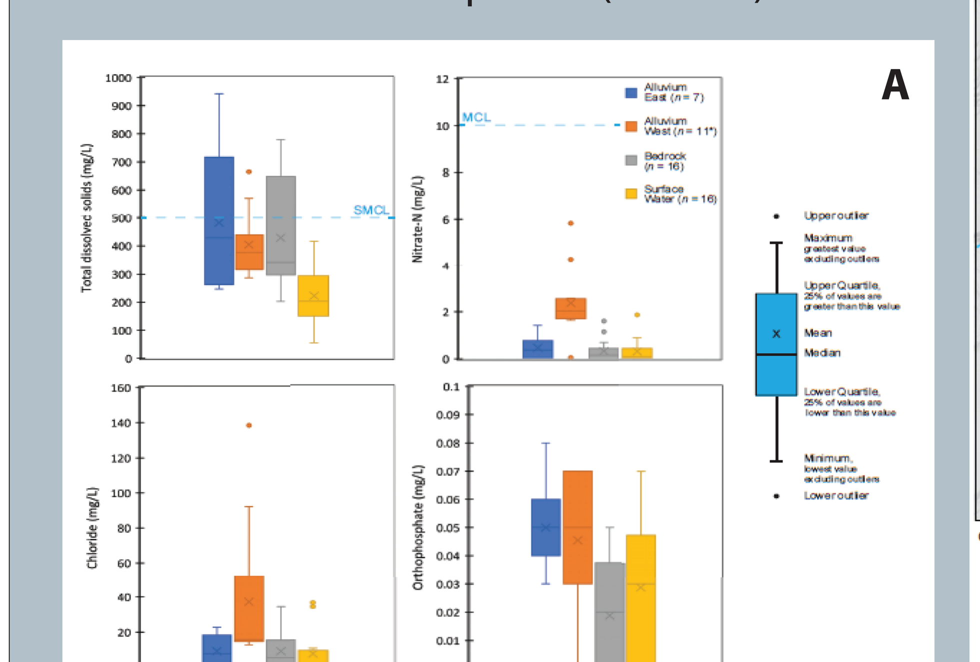


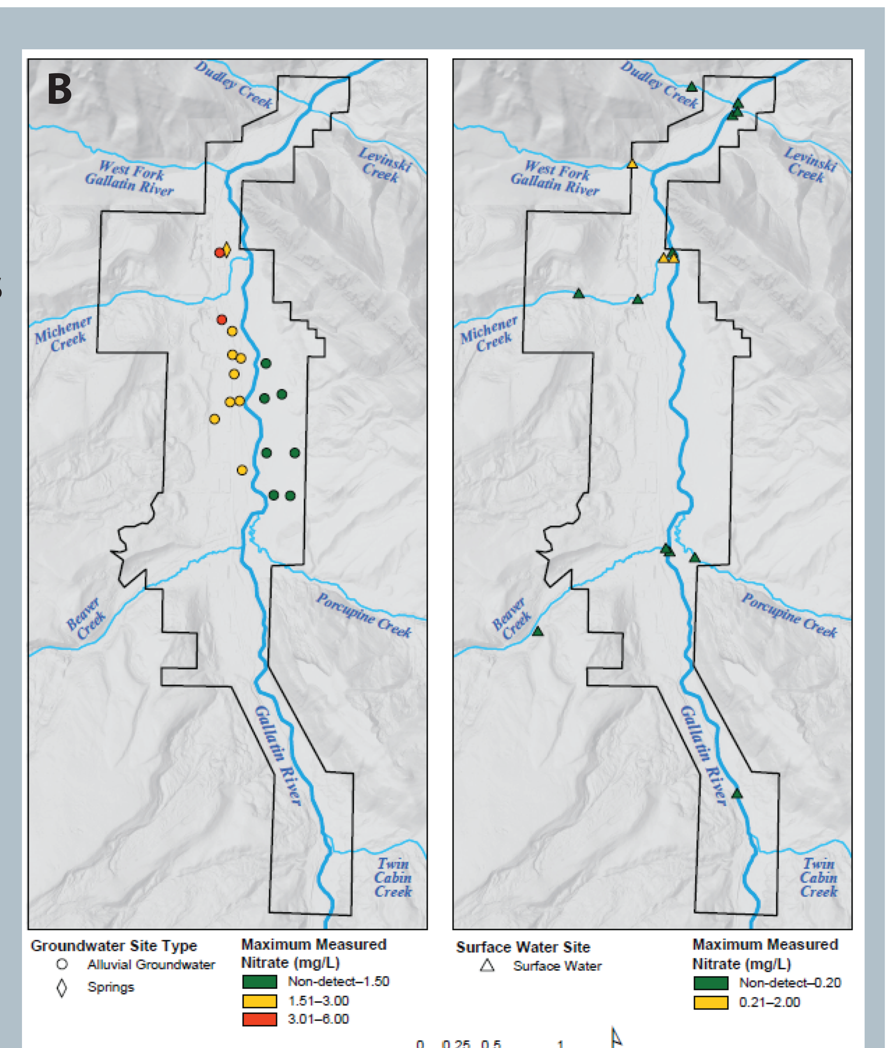
The shallow, alluvial aquifer water level responds annually to snow melt, whereas the deeper bedrock aquifer water levels respond to long-term climatic patterns (B).

There is no statistical change in alluvial and bedrock groundwater levels over the period of monitoring (~20 years).

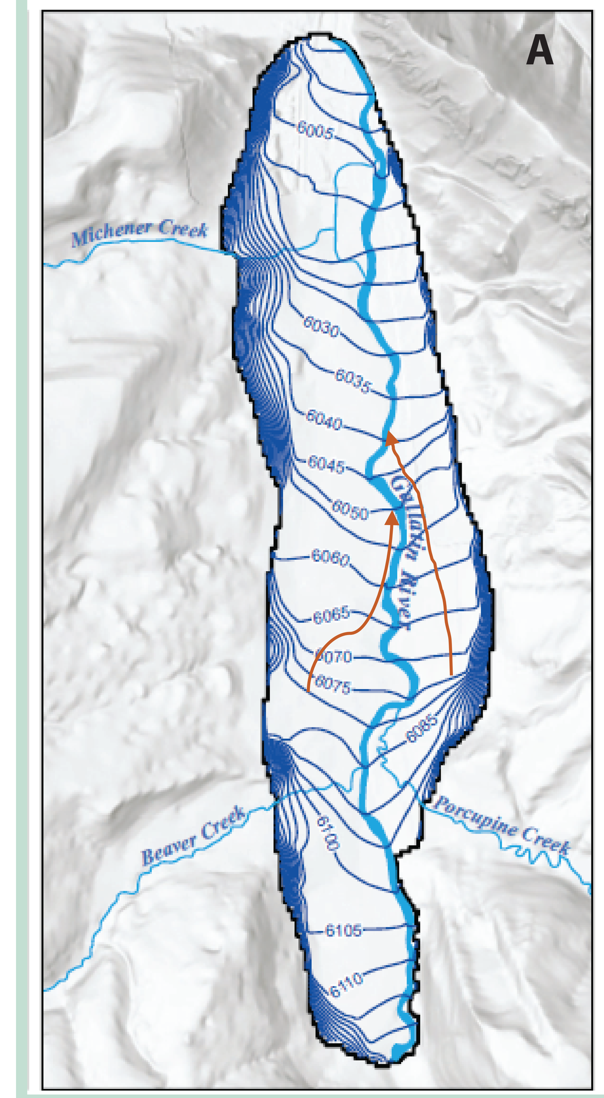
Geochemistry Results

Evidence of septic influences on the study area groundwater include higher chloride (A) in the groundwater on the west side as compared to the east side. Additionally, nitrate concentrations were higher in groundwater and some tributaries near development (A and B).

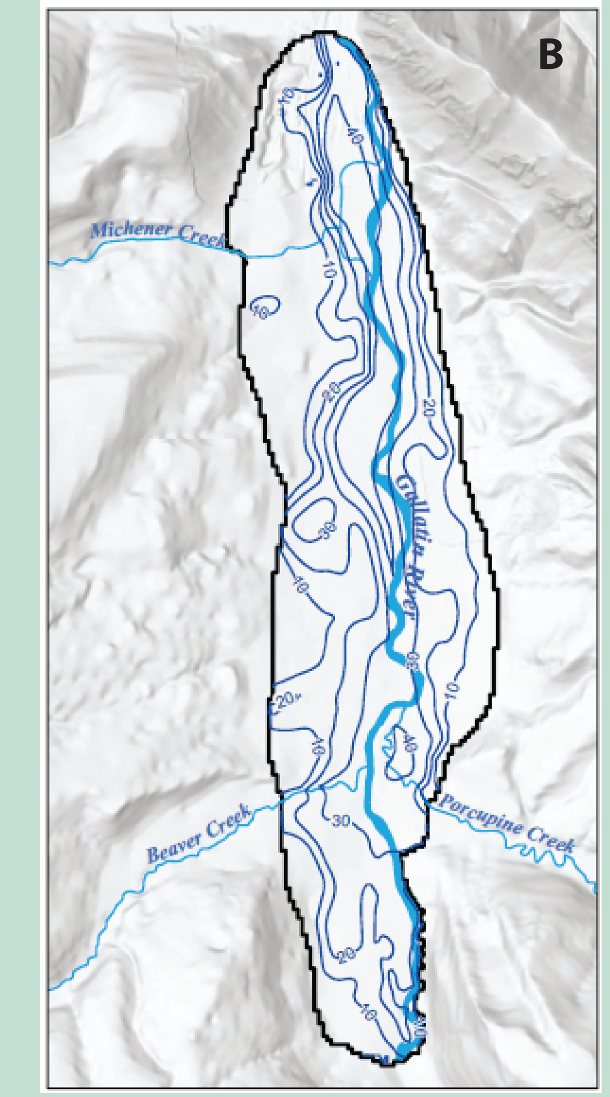




Groundwater Elevation



Alluvial Saturated Thickness

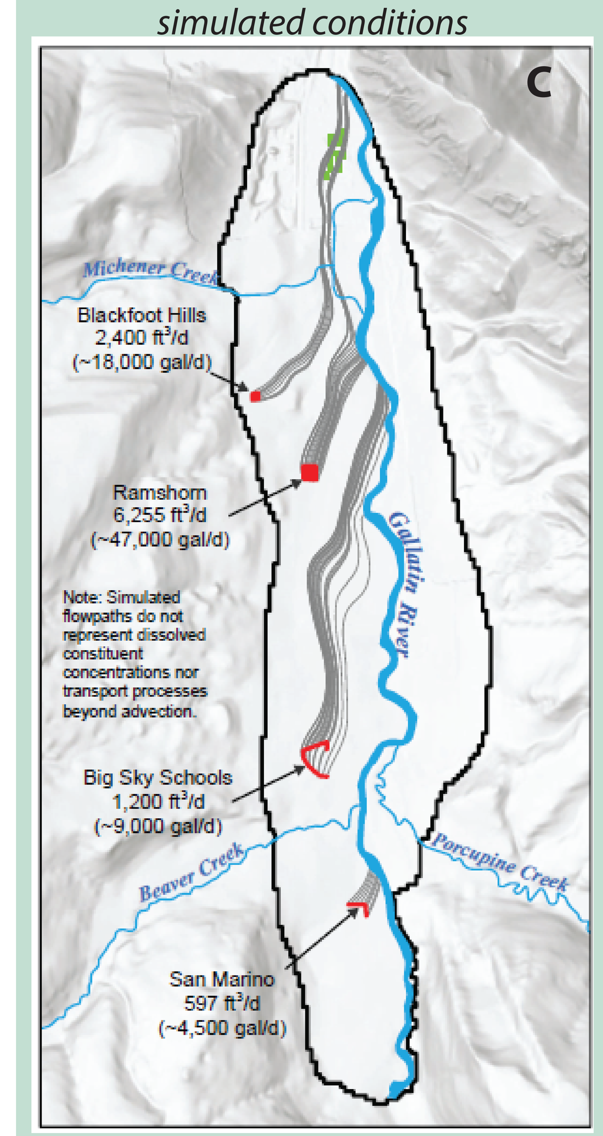


Modeling Results

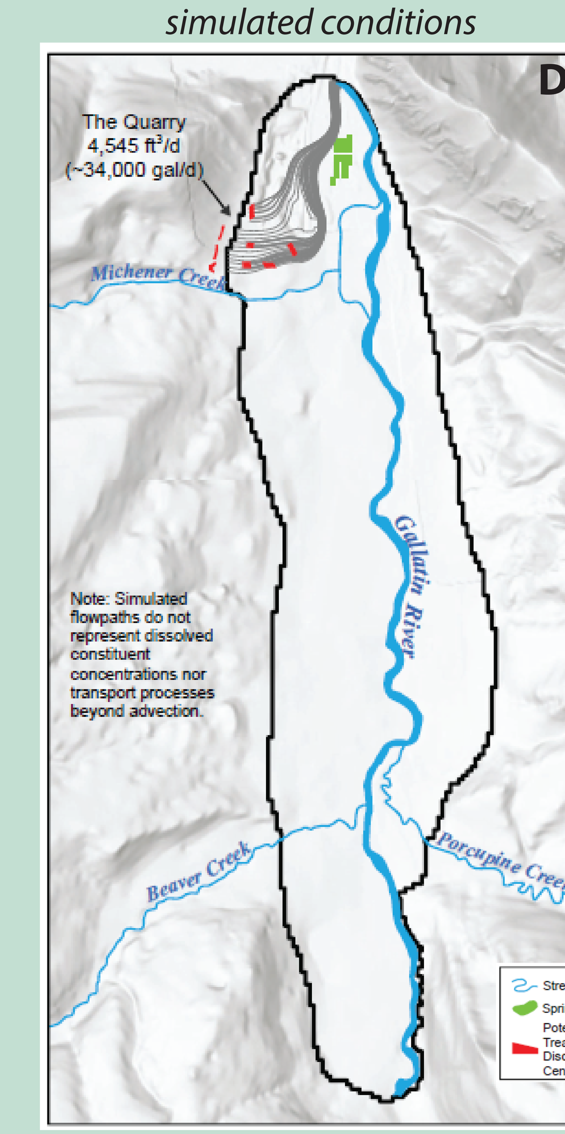
Groundwater generally flows south to north (A) and is directly interacting with the Gallatin River. Saturated thickness varies from less than 10 feet to over 40 feet (B). The aquifer relies primarily on recharge from the surrounding upland areas and discharges to the Gallatin River.

Particle tracking (C, D, E) shows the potential areas of discharge to the Gallatin River, Michener Creek, and springs (C, D, and E). The model does not predict contaminant concentrations or transport.

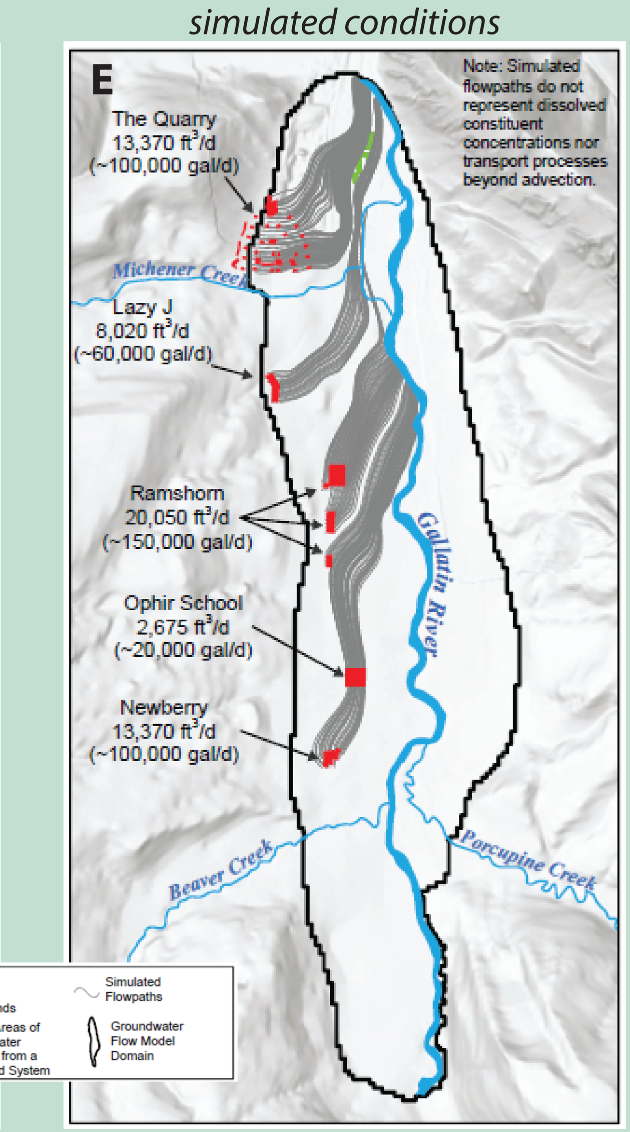
Existing Conditions
simulated conditions



The Quarry
simulated conditions



Centralized Wastewater Treatment
simulated conditions



For more information:

Meredith, E., Abdo, G., Myse, T., Breitmeyer, R., and Rose, J., 2025, Hydrogeologic investigation of the Upper Gallatin River Corridor, Big Sky, Montana: Montana Bureau of Mines and Geology Open-File Report 772.
https://mbmg.mtech.edu/mbmgcat/public/ListCitation.asp?pub_id=32779

Zeiler, K., Sutherland, M., and Breitmeyer, R., 2025, Groundwater model of the Upper Gallatin aquifer at Big Sky, Montana: Montana Bureau of Mines and Geology Open-File Report 771
https://mbmg.mtech.edu/mbmgcat/public/ListCitation.asp?pub_id=32777