Lone Peak LOOKOUT

State agency monitoring Big Sky water

courtesy of Mike Richter

Well head

It's easy to forget that the source of our community's water is right at our feet - and susceptible to pollution and other problems. Well heads like this one should remind us all to appreciate and protect this vital resource.

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This is the sixth in a series of articles being written by board members of the Blue Water Task Force. The articles present water issues from each individual's perspective and discuss how they became interested in the Gallatin watershed. Here's an article by Mike Richter, BWTF board member and Montana Bureau of Mines and Geology scientist. He has prepared an article focusing on Big Sky groundwater monitoring work that Bureau is doing.

When you drink the water, remember the spring.

- Chinese Proverb.

Big Sky's public water supply and most of the homes in the surrounding area obtain groundwater from wells, rather than springs, but the proverb's wisdom applies. Groundwater can seem mysterious because it is out of sight below the land surface, and the distribution of aquifers is inconsistent. Around Big Sky, the Montana Bureau of Mines and Geology (MBMG) Ground Water Characterization Program is working to systemically assess the area's groundwater resources and aquifers.

Information collected from water wells is a critical part of the groundwater assessment. Every month for the past three years, water-level measurements have been recorded from 30 wells around Big Sky to track seasonal fluctuations in groundwater storage. More than 100 other wells have been visited to measure water levels and assess water quality. The data gathered in the field, combined with geologic mapping, are being used to delineate known aquifers and assess their physical properties, chemical quality, and recharge patterns. At the completion of this project, a few wells will be incorporated into the statewide, long-term monitoring program to evaluate how Big Sky aquifers respond to climate variability and increased development. (A hydrograph from a monitoring site in the Meadow Village is shown in the figure.) All information from

the study is available online through the Montana Ground Water Information Center (GWIC) at http://mbmggwic.mtech.edu/.

Although groundwater is used extensively in the Big Sky area, in some places it is maddeningly elusive. The occurrence of groundwater is linked to the underlying geology. The rugged mountainous terrain contains varying consolidated rock layers that have been uplifted, folded, faulted, and sculpted by glaciers to create a complex assemblage of geologic units. The different rock types have different capacities to store and yield groundwater; for example, sandstone layers generally form aquifers (a geologic formation that holds water in its pore space and can yield that water to wells), whereas shale layers often do not. In the valley bottoms, layers of unconsolidated sand and gravel deposited by streams overlie the consolidated "bedrock" layers (sandstone, shale etc.). Where these unconsolidated deposits are more than 30 feet thick they form some of the area's best aquifers in terms of yield and water quality.

One of the most important unconsolidated aquifers is below the Big Sky Meadow Village and the Big Sky golf course. In this area groundwater occurs in a near-surface sand and gravel aquifer that is as much as 50 feet thick. This aquifer serves as a source of water for the Big Sky Water and Sewer District. Another sand and gravel aquifer occurs along the Gallatin River, beginning at about the Buck Ridge trail parking area and extending north to the junction of Route 64 and Highway 191. This aquifer supplies private homes and public water supplies, including the Ophir School. The Mountain Village also has a small sand and gravel aquifer southwest of Lake Levinsky at the base of the Big Sky Ski Area. For the most part, these sand and gravel aquifers produce good-quality water. However, near-surface aquifers are often vulnerable to surface contamination sources.

Outside the areas noted above, groundwater is obtained from consolidated, or bedrock, aquifers. These include sedimentary rocks, mostly alternating layers of sandstone and shale, limestone, and crystalline rocks that resemble granite. The Frontier Sandstone, the Mowry Shale, and the Muddy Sandstone are the formal geologic names of rock units exposed at the surface (and present in the subsurface) around Big Sky. Many private domestic wells are completed in these units. Wells that are completed in shale layers (or in areas where there is a lot of shale in the subsurface) typically produce water with elevated dissolved mineral content; many homes served by these wells have some type of water treatment system to improve water quality.

The Kootenai Formation is another sandstone aquifer; it is used by private and public water supplies south of Big Sky, near the Yellowstone Club, and by wells drilled for developments along the Ousel Falls View Road, Beaver Creek Road, and the North Fork Road northwest of the Meadow Village. This aquifer is buried too deeply to be used by wells near Meadow and Mountain Villages. The best well yields, including some artesian wells, are obtained from the basal (bottom) part of the sandstone. The water quality is variable. Low total dissolved mineral concentrations occur where the Kootenai is exposed at the land surface. Where the Kootenai is deeply buried, dissolved mineral concentrations increase and iron may be present at nuisance concentrations (for example, staining plumbing fixtures).

The Madison Limestone is an important aquifer where faulting has brought it near the surface. The limestone is exposed near the junction of Highway 191 and Route 64. Wells in this area are less than 100 feet deep, and several large springs discharge thousands of gallons per minute of high-quality groundwater to the Gallatin River. This consistent, year-round discharge likely contributes to making this river reach an excellent fishery. The Madison Limestone dips into the subsurface to the south and becomes too deeply buried to be utilized.

In the Gallatin River canyon north of Big Sky, along Highway 191, ancient fractured crystalline rock (Archean gneiss and schist) forms an aquifer. Fractures in the rock transmit water to domestic wells drilled into the lower slopes of the canyon or in places where the sand and gravel aquifer is nonexistent or thin. The water is good quality, with low dissolved mineral content, but does contain dissolved radon gas.

The data collection portion of the MBMG's Ground Water Characterization is nearly complete. The MBMG is grateful for the assistance it has received from Big Sky's friendly and helpful residents, the Big Sky Water and Sewer District, and the Blue Water Task Force. The cooperation has been top-notch and has truly made it a pleasure for MBMG staff to work in this, the eighth Ground Water Assessment area.