Can Groundwater Meet the Demand for New Water Uses in Montana?

Water Fact Sheet #4

Italicized terms are defined in Fact Sheet #10

Groundwater plays an important role in meeting Montana's demand for water. Underground layers of saturated sediment deposits or fractured bedrock—known as *aquifers*—store and transmit large amounts of water. Water can infiltrate into aquifers from precipitation, irrigation, streams, lakes, or wetlands. This water, known as aquifer recharge, replenishes the groundwater supply. Climate variability also factors into groundwater supply. The amount of groundwater stored in aquifers decreases during droughts, but often recovers in rainy seasons.

Groundwater and *surface water* are connected in all but rare conditions. Depending on the elevation of the water table relative to the stage of the stream, groundwater can discharge into surface water or surface water can recharge groundwater sources. During seasonal dry periods and droughts, many Montana streams would be reduced to trickles if not for groundwater inflow. Increased groundwater pumping will reduce flow in connected streams and increase the severity of impacts during droughts.

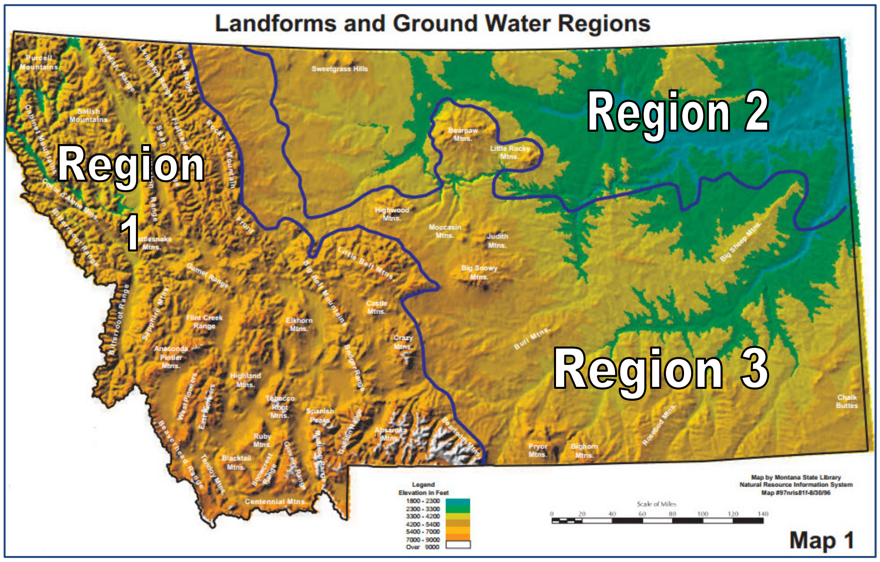

Figure 1- Landforms and Groundwater Regions

Different kinds of aquifers are found in various parts of the state. Differing land formations reflect differing geology and climate and give indication to the groundwater flow system(s) in the area. The mountainous, western third of the state lies within the Western Mountain Ranges Region (Figure 1- Region 1). Glaciers heavily covered this region, leaving behind deposits of loosely arranged sediment in the valleys when they melted. Loose sediment deposited by streams, known as alluvium, are characteristic of the valley bottoms in the intermountain regions of western Montana. These types of loose deposits often contain high yielding aquifers that supply many users. Groundwater development outside the valley bottoms is often from bedrock aquifers. In contrast to high yielding alluvial aquifers, the bedrock aquifers may not provide a reliable source of water.

Extensive plains with scattered mountain ranges characterize the remainder of the state. The northeastern region of the state (Figure 1- Region 2) contains the fewest mountains and lowest elevations. This region underwent several episodes of glaciation, and therefore is known as the Glaciated Central Region. As the glaciers melted, till and fine-grain sediment were left behind and dominate the geology in the region. Aquifers in these deposits generally yield small quantities of water; however, many wells obtain high yields in buried pre-glacial alluvial channels. Alluvial aquifers of modern streams, particularly the Missouri and Yellowstone Rivers, also are a source of high-yield wells. Bedrock sandstone aquifers are the source of lower yield wells, mostly for stock and domestic uses.

The final region of the state, the Non-Glaciated Central Region (Figure 1- Region 3), contains scattered mountain ranges, but was not covered by glaciers. Bedrock aquifers are the primary source of groundwater for much of the region. These aquifers generally support low-producing domestic and stock wells that have relatively poor water quality. Bedrock aquifers in the Kootenai and Madison formations may provide large volumes of groundwater; however, water quality can be a problem. Alluvial terrace deposits in central Montana provide groundwater for domestic, stock, and municipal uses. Alluvial deposits along the Yellowstone and other larger rivers in the region represent the most reliably productive aquifers.

Groundwater supplied less than three percent of the water *diverted* for *beneficial uses* in Montana in 2000, but this fact belies the importance of groundwater to water users in the state. Groundwater contributes 48 percent of Montana's public water supply (see Fact Sheet #3: *How Much Water Is There and How Is It Used?*). Currently, groundwater provides the main source of drinking water for major cities such as Missoula and Kalispell. Of the rural, self-supplied domestic systems in Montana, 95 percent operate on groundwater sources. In some parts of the state, groundwater is the only reliable source of drinking and stock water. Where surface water supplies are limited, groundwater is an important source for irrigation, industrial, and commercial uses.

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Many people wonder if groundwater could supply a greater share of the water used in Montana, particularly in areas where surface water supplies are heavily *appropriated*. The answer varies, depending on the hydraulic properties of the aquifer, its connection to surface water, and the legal availability of groundwater in the area. New wells require a *beneficial water use permit* from the Department of Natural Resources and Conservation (DNRC). Wells pumping less than 35 gallons per minute and producing under 10 acre-feet per year are *exempt* from the permitting process. To put that into context, exempt wells may pump a maximum volume of 10 acre-feet, which is equivalent to providing in-house use for 40 homes. Owners of exempt wells must file a Notice of Completion of Groundwater Development with the DNRC when the water is put to use. The DNRC can limit groundwater development to protect existing uses and/or public health by designating controlled groundwater areas. There are 15 active controlled groundwater areas in Montana (Figure 2).

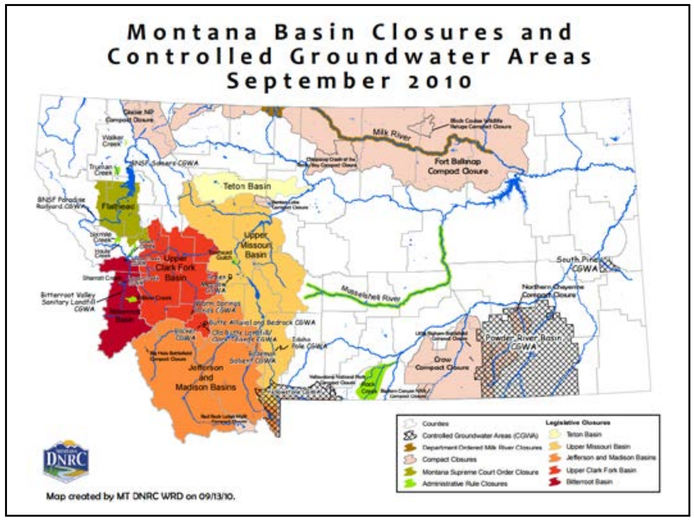

Figure 2- Controlled Groundwater Areas

Basin closures also occur in the state, either through legislation or by petition (see Fact Sheet #6: *How Is Water Managed in the Event of Water Shortages*). Much of the western portion of the state falls into basin closure areas. These basin closures restrict any new surface water appropriations for any use. Additionally, groundwater permits may only be issued if the applicant can show through a hydrologic study that the new appropriation will not adversely impact *senior water rights*. If adverse effects are expected, the applicant must provide a plan to mitigate the adverse effects, either through acquisition of a surface water right or through a recharge plan.

Montanans will continue to rely on groundwater as a water source. With each new development, careful analysis of the relationship between an aquifer and adjacent surface waters is required before groundwater can be allocated for new uses.