Geologic Units - Map 2

There are about a dozen aquifers that are widely used and considered the state's principal sources of ground water. Figure 5 lists the principal aquifers. The aquifers consist of unconsolidated sediments and consolidated sedimentary rocks. Aquifers can occur as individual geologic layers, entire geologic formations, or groups of formations. In publications, such as ground-water reports and maps, aquifers are often referred to by their formal stratigraphic names. For example, the Fort Union Formation is used as an aquifer in eastern Montana, and the Madison Group is the source of several perennial springs in central Montana. Some sedimentary deposits do not have formal stratigraphic names. As a result, the aquifers within these deposits are often referred to by using descriptive terms like "unconsolidated sedimentary deposits," or simply "unconsolidated deposits." In some cases, the name of the geologic process that created the deposit is used when referring to the aquifer. For example, "fluvial" or "alluvial" deposits are important aquifers throughout the state and were laid down by running water within stream channels.

Figure 5 also shows how the principal aquifers are grouped according to their geologic age. It is important to note that there are other geologic formations within the three general age groups that are not listed in Figure 5 because they are not used as aquifers. They are either impermeable and do not transmit water readily, or they contain water that it unfit for public, domestic, stock, or industrial use. The age groups from Figure 5 are used in Map 2 to show the areal distribution of the principal aquifers, and other formations. The age groups are also used in the general geologic cross-section (Figure 4) to help illustrate the distribution of aquifers below the land surface.

Gray areas on Map 2 are designated as "Rocks without a principal aquifer." In general, these areas are underlain by consolidated sedimentary rocks or igneous and metamorphic rocks that are much less permeable than the principal aquifers listed in Figure 5. However, sometimes bedrock will yield water to wells but usually at lower rates and volumes than the principal aquifers. As a result, bedrock is used for water supply primarily where the principal aquifers are thin or absent. East of the Rocky Mountain Front, there are large expanses of land underlain by impermeable shale. One these areas is north of Great Falls. The shale outcrops are also included in the grey areas on Map 2.

Another useful way to examine Montana's ground-water resources is to separate the aquifers that occur within Quaternary unconsolidated sedimentary deposits from the aquifers that are found within older consolidated rocks (bedrock). The former are often very productive aquifers, yield high quality water, and are discussed in the next section entitled Surficial Aquifers. The latter, although widely used throughout Montana, are generally less productive and yield lower quality water. These aquifers are discussed in the section entitled Bedrock Aquifers.

ERA	Period	Principal Aquifers	Age:
CENOZOIC	Quaternary	Alluvium & Fluvial-Glacial Gravels	10,000 Years
	Tertiary	Alluvium Fluvial-Glacial Gravels (and equivalents) Terraces Fort Union Formation	1.6 MYBP
MESOZOIC	Cretaceous	Hell Creek-Fox Hills Formation Judith River Formation Eagle Formation	66.4 MYBP
	Jurassic	Kootenai Formation	
	Triassic	Ellis Group	245 MYBP
PALEOZOIC	Permian	No Principal Aquifers	
	Pennsylvanian	No Principal Aquifers	
	Mississippian	Madison Group	
	Devonian Silurian Ordovician Cambrian	No Principal Aquifers	570 MYBP

MYBP = Millions of Years Before Present

Figure 5 - General geologic time scale and principal aquifers.