

### Surficial Aquifers - Map 3

In general, the highest quality and most accessible water comes from aquifers contained in unconsolidated deposits of Cenozoic age in the western intermontane basins, in major stream valleys and their tributaries, and beneath terrace and pediment surfaces. All these aquifers are at, or near, the land surface, and are called surficial aquifers. The aquifers shown on Map 3 are composed mostly of unconsolidated sediments deposited by streams, glaciers, or by meltwater from glaciers. Included in this group are alluvial aquifers found in major stream valleys throughout the state (yellow areas); glacial till and outwash aquifers found in many tributary stream valleys and in some intermontane basins in western Montana (included in yellow areas in the west); and terrace and pediment gravel aquifers scattered throughout central and eastern Montana (orange-brown areas). Surficial aquifers are very important in Montana because they can be tapped by shallow wells and provide adequate water supply for most domestic and agricultural purposes. Surficial aquifers can be unconfined or partially confined.

When discussing the ground-water resources of the western intermontane basins, it is important to draw attention to the Tertiary sediments. The Tertiary sediments are not distinguished from the younger Quaternary alluvial deposits on Map 3 because detailed mapping in the western basins is not currently available in a form that can be included in this atlas. Even though Tertiary sediments are not formally grouped with the alluvial deposits, discussing them at this point is appropriate. Tertiary deposits consist of semi-consolidated beds of silt, sand, and gravel exposed on the flanks of most western basins. They are exceedingly thick, extending to more than 15,000 feet into the subsurface in some intermontane basins. While the Tertiary deposits represent important sources of ground water in the western basins, they usually yield less water to wells than younger Quaternary alluvial aquifers. Despite this fact, the use of Tertiary sediments to supply ground water is increasing as communities encroach onto the sides of the western basins. It is important to note that drilling wells in the Tertiary deposits is more risky than it is for alluvial sediments. It is not uncommon to drill deep into the Tertiary sediments and end up with a "dry hole." This underscores the need for thorough evaluation of ground-water resources before building individual homes or establishing subdivisions on the Tertiary sediments in the western basins.

As mentioned previously, Map 3 shows the general outline the western basins but does not show the distribution of the Quaternary alluvium and Tertiary sediments within the basins. If detailed mapping were available, it would show that most basins have alluvial deposits in their central part. Sometimes the alluvium is restricted to areas near stream channels. In other instances, the alluvium is quite extensive and covers much of the basin's land surface. The flanks of most western basins have Tertiary sediments beneath pediment surfaces. Detailed mapping in the Swan River and Kalispell valleys indicates that, unlike most western basins, glacial till and outwash deposits cover much of the valley floor. The glacial deposits overlie alluvial aquifers. Glacial outwash deposits, where thick enough, yield large volumes of water to wells.

In central and eastern Montana, surficial aquifers are found within the valleys of major rivers and their tributaries (yellow areas). These include the following rivers; Clarks Fork of the Yellowstone, Bighorn, Powder, Tongue, Yellowstone, Missouri, Judith, Musselshell, and Sun. Alluvium in the river valleys consists of gravel, sand, silt, and clay. Deposits of these sediments vary in thickness from a few feet to over 100 feet, and in many larger stream valleys, are several miles in width. These unconsolidated deposits represent a very important source of water.

Gravel deposits are also tapped to supply ground water in central and eastern Montana (orange-

brown areas on Map 3). These deposits are found primarily beneath terrace and pediment surfaces. Some of these gravel deposits can be productive aquifers. Other gravel deposits near Lewistown, also supply ground water. The gravels represent important surficial aquifers in central and eastern Montana.