

Bedrock Aquifer Systems of Vermillion County, Indiana

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The occurrence of bedrock aquifers depends on the original composition of the rocks and subsequent changes which influence the hydraulic properties. Post-depositional processes, which promote jointing, fracturing, and solution activity of exposed bedrock, generally increase the hydraulic conductivity (permeability) of the upper portion of bedrock aquifer systems. Because permeability in many places is greatest near the bedrock surface, bedrock units within the upper 100 feet are commonly the most productive aquifers.

Unconsolidated deposits ranging from less than 50 feet thick to more than 250 feet thick overlie bedrock aquifer systems in Vermillion County. Most of the bedrock aquifers in the county are under confined conditions. In other words, the potentiometric surface (water level) in most wells completed in bedrock rises above the top of the water-bearing formation.

The yield of a bedrock aquifer depends on its hydraulic characteristics and the nature of the overlying deposits. Shale and glacial till act as aquitards, restricting recharge to underlying bedrock aquifers. However, fracturing and/or jointing may occur in aquitards, which can increase recharge to the underlying aquifers. Hydraulic properties of the bedrock aquifers are highly variable.

The susceptibility of bedrock aquifer systems to surface contamination is largely dependent on the type and thickness of the overlying sediments. Because the bedrock aquifer systems have complex fracturing systems, once a contaminant has been introduced into a bedrock aquifer system, it will be difficult to track and remediate.

Three bedrock aquifer systems are identified for Vermillion County. They are, from youngest to oldest: the McLeansboro Group of Pennsylvanian age; the Carbondale Group of Pennsylvanian age; and the Raccoon Creek Group of Pennsylvanian age.

Pennsylvanian -- McLeansboro Group Aquifer System

The McLeansboro Group subcrop area is located in the southwestern corner of the county. Thickness of the McLeansboro Group ranges from 50 to 200 feet. This aquifer system consists in ascending order of the Shelburn, Patoka, Bond, and Mattoon Formations. However, in Vermillion County only the Shelburn and Patoka Formations are present.

The Patoka Formation consists primarily of shale and sandstone with clay, limestone, and coal. The underlying Shelburn Formation consists of shale, siltstone, sandstone, coal, and limestone. Two important members of the Shelburn Formation include the West Franklin Limestone at the

top of the formation and the Busseron Sandstone at the base. These are the primary aquifer units within the McLeansboro Group Aquifer System.

Few wells are reported in this system in Vermillion County. The depth to the bedrock surface ranges from 10 to 30 feet with total well depths typically ranging from 50 to 90 feet. The amount of rock penetrated generally ranges from 5 to 35 feet. Most domestic wells produce less than 10 gallons per minute (gpm) with a few (pumped) dry holes reported. Static water levels range from 10 to 30 feet below surface.

Most of the McLeansboro Group Aquifer System contains fine-grained materials that limit the movement of groundwater. However, in some areas alluvial materials directly overlie the bedrock surface. Therefore, the aquifer system is considered at moderate risk to contamination.

Pennsylvanian -- Carbondale Group Aquifer System

The Carbondale Group Aquifer System subcrops throughout much of Vermillion County. The group consists in ascending order of the Petersburg, the Linton, and the Dugger Formations. Bedrock deposits include mostly shale and sandstone with some limestone and commercially important coal. Thickness of the Carbondale Group in Vermillion County ranges from 300 to 350 feet.

Depth to the bedrock surface is typically from 45 to 140 feet below surface. Well depths range from 35 to 300 feet with most completed at depths between 60 and 160 feet. The amount of rock penetrated ranges from 5 to 280 feet. The Carbondale Group is considered a minor groundwater source with domestic wells typically pumping less than 10 gpm. Static water levels in the wells vary from 7 to 75 feet below the land surface, but are typically between 20 and 55 feet below the surface.

Most wells produce from the thicker sandstone and coal units in the upper formations of the Carbondale Group. Localized yields are greater in areas where outwash and alluvial sands and gravels directly overlie bedrock. A few (pumped) dry holes have been reported. Water quality from the deeper bedrock units is highly mineralized.

In areas where overlying clay materials are present, the Carbondale Group Aquifer System is at low risk to contamination. However, in some areas outwash and alluvial materials directly overlie the bedrock surface. These areas are at moderate to high risk from surface contamination.

Pennsylvanian -- Raccoon Creek Group Aquifer System

In Vermillion County the Raccoon Creek Group Aquifer System subcrops primarily in the northeastern, south-central, and eastern parts of the county. The group consists in ascending order of the Mansfield, Brazil, and Staunton formations. The basal formation of the group, the Mansfield Formation, rests unconformably on Mississippian rocks. Bedrock consists of mostly sandstone and shale with minor amounts of mudstone, coal, and limestone. Thickness of the

Raccoon Creek Group in Vermillion County ranges from about 100 to 500 feet as it dips beneath younger strata.

Few well records are available in the Raccoon Creek Group Aquifer System in Vermillion County. Most wells produce from the upper formations of the Raccoon Creek Group. However, the Mansfield Formation is considered a moderately dependable groundwater resource. The upper contact of the Mansfield Formation ranges from less than 50 feet to over 250 feet below surface. Completed wells range from 70 to 200 feet below surface. Domestic well production ranges from 5 to 15 gpm with a few (pumped) dry holes reported. Static water levels are generally 20 to 70 feet below surface. In general, water quality from deeper bedrock units is more mineralized than upper units. There is 1 registered significant groundwater withdrawal facility (1 well) with a reported capacity of 150 gpm.

In areas where overlying clay materials are present, the Raccoon Creek Group Aquifer System is at low risk to contamination from the surface or near surface. However, in some areas outwash and alluvial materials directly overlie the bedrock surface. These areas are at moderate to high risk from surface contamination.

Underground Mine Areas

In Vermillion County various coal seams within the Carbondale Group have been removed by underground mining methods. In underground mines, approximately 50 percent of the coal seam has been removed, leaving the potential for storage of substantial amounts of water in the larger mines. Although the Division has no records of wells drilled into these mines, yields of a few hundred gallons per minute are possible. A limitation on use of the water could be its more mineralized nature.

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