

Bedrock Aquifer Systems of Greene County, Indiana

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The occurrence of bedrock aquifers depends on the original composition of the geologic material 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.

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 bedrock aquifers are highly variable.

Most bedrock aquifers are under confined conditions, mainly a result of low vertical hydraulic conductivity clay-rich materials, such as glacial till, overlying the bedrock. Therefore, the potentiometric surface (water level) in most wells completed in bedrock rises above the top of the water-bearing zone.

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.

Four bedrock aquifer systems are identified for Greene County. They are, from west to east and younger to older: the Carbondale Group of Pennsylvanian age; the Raccoon Creek Group of Pennsylvanian age, the Buffalo Wallow, Stephensport, and West Baden Groups of Mississippian age; and the Blue River and Sanders Groups of Mississippian age. Bedrock aquifer systems in Greene County are overlain by unconsolidated deposits ranging in thickness from less than one foot in the southeastern corner of the county to over 195 feet southwest of an area known as the American Bottoms (Malott, 1919) located in central Greene County.

The unconsolidated sand and gravel outwash aquifer near the White River has far greater groundwater potential than the bedrock aquifers in the county. However, bedrock aquifers are widely used in Greene County where unconsolidated sediments are relatively thin and unproductive. Approximately 95 percent of all wells in this county are completed in bedrock. There are no registered significant groundwater withdrawal facilities utilizing the bedrock aquifer systems in Greene County.

Pennsylvanian -- Carbondale Group Aquifer System

The Carbondale Group Aquifer System subcrops in western Greene County. The group consists in ascending order of the Linton, Petersburg, and Dugger Formations. Bedrock deposits include mostly shale and sandstone with some limestone and commercially important coal.

The Carbondale Group is considered a minor groundwater source with most wells producing from the thicker sandstone and coal units present in the upper formations of the group. Depth to the Carbondale Group bedrock surface ranges from 5 to 75 feet but is typically from 15 to 40 feet. Well depths generally range from 80 to 230 feet with the amount of rock penetrated typically from 65 to 205 feet. Reported domestic well yields range from 2 to 8 gallons per minute (gpm) with static water levels ranging from 15 to 50 feet below the surface. Higher yields are typically associated with significant drawdowns. A few dry (pumped) holes have been reported. Water quality from the deeper bedrock units is highly mineralized.

Where the overlying sediment consists of thick fine-grained clay materials, the Carbondale Group Aquifer System in Greene County is at low risk to contamination from the surface or near surface sources. Where bedrock is shallow, risk to contamination from the surface or near surface sources is high.

Pennsylvanian -- Raccoon Creek Group Aquifer System

The Raccoon Creek Group Aquifer System subcrop area occurs throughout central Greene County. Bedrock consists of mostly sandstone and shale with minor amounts of siltstone, mudstone, coal, and limestone. The basal formation of the Raccoon Creek Group, the Mansfield Formation, rests unconformably on Mississippian rocks.

The Raccoon Creek Group is generally a limited groundwater resource. However, the Mansfield Formation is a moderately dependable source of groundwater. Depth to bedrock ranges from 10 to 45 feet. Wells completed in the Raccoon Creek Group are typically 120 to 260 feet deep with 85 to 240 feet of penetration into the bedrock. Domestic well capacities range from 2 to 12 gpm with static water levels of 25 to 100 feet below surface. Higher yields are commonly associated with significant to complete drawdown.

Clay materials that overlie bedrock are generally thick. These areas are considered at low risk to contamination. However, in some areas outwash, alluvial, and lacustrine sands and gravels directly overlie the bedrock surface. These areas are at high risk from surface contamination.

Mississippian -- Buffalo Wallow, Stephensport, and West Baden Groups Aquifer System

This Upper Mississippian bedrock aquifer system is present in the eastern portion of Greene County and consists of three groups, from oldest to youngest: West Baden, Stephensport, and Buffalo Wallow. However, no Buffalo Wallow strata are present in the county. The West Baden and Stephensport Groups are composed primarily of limestone, and sandstone with minor amounts of shale.

The depth to the bedrock surface is commonly from 10 to 45 feet. Depths of wells range from 100 to 250 feet with 55 to 235 feet of typical penetration into bedrock. The Buffalo Wallow, Stephensport, and West Baden Groups Aquifer System is not regarded as a major groundwater resource. However, most attempts to drill a domestic well are successful. Domestic well yields are generally 4 to 15 gpm and reported static water levels range from 25 to 190 feet below land surface.

In some areas of the Buffalo Wallow, Stephensport and West Baden Groups Aquifer System, bedrock is shallow and some karst has developed in the limestone beds. These conditions warrant considering the aquifer system as a whole to be somewhat susceptible to contaminants introduced at and near land surface.

Mississippian -- Blue River and Sanders Groups Aquifer System

The Blue River and Sanders Groups Aquifer System is present in valleys of Lick Creek, Richland Creek, and Indian Creek in the eastern portion of Greene County. The Sanders Group includes primarily limestone with some dolomitic limestone content. The overlying Blue River Group includes mostly limestones containing significant amounts of gypsum, anhydrite, shale, chert, and calcareous sandstone.

The Blue River and Sanders Groups Aquifer System is not regarded as a major groundwater resource in the county. Well depths in Greene County range from 90 to 145 feet. Depth to bedrock is generally between 15 and 30 feet below land surface. Domestic well capacities range from 5 to 20 gpm with reported static water levels that range from 30 to 60 feet below surface. Yields are commonly associated with low static water levels and significant to complete drawdown. There are no registered significant groundwater withdrawal facilities utilizing this system.

In areas where overlying clay materials are present, the Blue River and Sanders Group Aquifer System is at low risk to contamination. However, in some areas karst has developed in the limestone beds and outwash, alluvial, and lacustrine sands directly overlie the bedrock surface. These areas are at moderate to high risk from surface contamination.

Underground Mine Areas

In approximately 10 percent of the county various coal seams, within the Carbondale Group, have been extracted by underground mining methods. About 50 percent of most coal seams are removed during mining operations leaving the potential for storage of substantial amounts of water. Although the Division has no records of wells drilled into these mines significant yield may be obtainable. A limitation on use of the water could be its more mineralized nature.

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