

# **Bedrock Aquifer Systems of Putnam 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.

Bedrock aquifer systems in Putnam County are overlain by unconsolidated deposits of varying thickness ranging from outcropping to over 250 feet. Bedrock, in places, is at or near the surface along many streams in the county.

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 in the county 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.

Four bedrock aquifer systems are identified within Putnam County. They are, from youngest to oldest: the Raccoon Creek Group of Pennsylvanian age; and the Buffalo Wallow, Stephenson and West Baden Groups, the Blue River and Sanders Groups, and the Borden Group of Mississippian age. Approximately 72 percent of all wells in this county are completed in bedrock.

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.

## **Pennsylvanian -- Raccoon Creek Group Aquifer System**

The Raccoon Creek Group Aquifer System outcrops/subcrops throughout the majority of the western and southwestern portions of Putnam 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 mostly of shale, mudstone, and siltstone with minor amounts of coal, sandstone and limestone. The Raccoon Creek Group in Putnam County ranges from exposure at the ground surface to being overlain by up to approximately 140 feet of unconsolidated deposits.

Wells completed in the Raccoon Creek Group Aquifer System are generally capable of meeting the needs of most domestic users in this county. Wells in this system are completed at depths ranging from 40 to 400 feet. Yields for domestic wells range from 1 to 50 gallons per minute (gpm) with some dry holes reported. Static water levels range from flowing to 195 feet below the land surface. There are no registered significant groundwater withdrawal facilities in this system.

In the majority of Putnam County, the Raccoon Creek Group Aquifer System has a low susceptibility to surface contamination where thick clay deposits overlie the system. However, areas are at moderate to high risk to contamination where overlying clays are thin or absent, or where bedrock outcrops.

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

This Upper Mississippian bedrock aquifer system consists of three groups, from oldest to youngest: West Baden, Stephensport, and Buffalo Wallow. However, strata of the Stephensport and Buffalo Wallow groups are not present in Putnam County. The West Baden Group consists primarily of sandstone and limestone with minor amounts of shale, mudstone and siltstone. Many of the individual rock units of the West Baden Group are laterally discontinuous.

The Buffalo Wallow, Stephensport, and West Baden Groups Aquifer System is not regarded as a major groundwater resource in Putnam County. However, most attempts to drill a domestic well into it are successful. Well depths in the West Baden Group range from 30 to 620 feet with most wells completed between 50 to 70 feet. The depth to the bedrock surface is generally less than 65 feet. Static water level depths range from 10 to 200 feet, and domestic wells completed in the system are commonly tested at 15 gpm or less. There are no registered significant groundwater withdrawal facilities in this system.

This aquifer system in Putnam County is considered moderately susceptible to contamination from the land surface because of the shallow rock. Where the unconsolidated deposits consist of thick fine-grained clay materials, the susceptibility to contamination is lower.

### **Mississippian -- Blue River and Sanders Groups Aquifer System**

The Blue River and Sanders Groups Aquifer System is commonly present throughout most of the central portion of the county, generally trending from the northwest to the southeast. This Middle Mississippian age aquifer system encompasses two groups: the Blue River Group and the underlying Sanders Group. In Putnam County, the Sanders Group includes the Ramp Creek, Harrodsburg and Salem formations, which are mostly limestone with some dolomitic content. The overlying Blue River Group consists of the St. Louis, Ste. Genevieve and Paoli formations.

The formations are composed mostly of limestone, but also include gypsum, anhydrite, shale, and calcareous sandstone. The formations thicken as they dip to the west-southwest.

Depth to bedrock ranges from outcropping to about 190 feet below land surface. Limestones of the Blue River Group are noted for development of karst features, particularly in southern Indiana; however, only a few wells in Putnam County suggest any minor karst features are present.

This aquifer system is capable of meeting the needs of some domestic and high-capacity users in Putnam County. Reported yields are typically from 1 to 60 gpm with some dry holes noted. Static water levels range from flowing to 230 feet below surface. There are three registered significant groundwater withdrawal facilities (5 wells) using the Blue River and Sanders Groups Aquifer System. Reported capacities of the wells are 100 and 110 gpm. These facilities are used for public water supply.

Clay materials of varying thickness overlie the Blue River and Sanders Group Aquifer System. Where the clay materials are thin the aquifer system has a moderate to high risk to contamination. However, where overlying sediments consists of thick fine-grained clay materials, the risk is low.

### **Mississippian -- Borden Group Aquifer System**

The Borden Group outcrops/subcrops primarily in the northern and eastern portions of Putnam County. This bedrock aquifer system is composed of sandstone, siltstone, mudstone and shale. Although carbonates are somewhat rare, discontinuous interbedded limestone lenses are present. The Borden Group in Putnam County is overlain by unconsolidated deposits up to 200 feet in thickness; however, there are areas where the bedrock is exposed at the surface.

Wells in this system are commonly completed at depths ranging from 35 to 490 feet. Domestic well yields typically range from 2 to 60 gpm with some dry holes reported. Static water levels commonly range from flowing to 110 feet below surface. There is one registered significant groundwater withdrawal facility (3 wells) using the Borden Group Aquifer System. Reported capacities of the wells are 100, 130 and 150 gpm. This facility is used for public water supply.

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

### **Registered Significant Groundwater Withdrawal Facilities**

There are four registered significant groundwater withdrawal facilities (total of 8 wells) using bedrock aquifers in the county. These facilities utilize the Borden Group, and the Blue River and Sanders Groups aquifer systems. Reported capacities for individual wells range from 100 to 150 gpm. The use for these facilities is public water supply. Refer to the table for additional well details, and to the map for facility locations.

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