

Bedrock Aquifer Systems of Benton 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.

Bedrock aquifer systems in the county are overlain by unconsolidated deposits of varying thickness, ranging from outcropping in areas located in the northern portion of the county to about 400 feet along the Lafayette (Teays) Bedrock Valley System, which is located along the southern boundary of the 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 zone.

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.

Four bedrock aquifer systems are identified for Benton County. They are, from younger to older: Raccoon Creek Group of Pennsylvanian age, Borden Group of Mississippian age, New Albany Shale of Devonian and Mississippian age, and the Silurian and Devonian Carbonates. Bedrock wells represent about 50 percent of all wells completed in the county.

The susceptibility of bedrock aquifer systems to surface contamination is largely dependent on the type and thickness of the overlying sediments. However, 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 Pennsylvanian age Raccoon Creek Group Aquifer System subcrops in an area located in the northwestern portion of the county. This bedrock aquifer system is composed mostly of sandstone and shale with minor amounts of mudstone, coal, and limestone. The system is overlain by unconsolidated deposits up to 100 feet in thickness. There are no reported wells completed in the Raccoon Creek Group for Benton County.

This system is often described as an aquitard and well yields are typically expected to be quite limited. Most domestic wells from adjacent counties that were completed in the Raccoon Creek Group Aquifer System generally have reported testing rates of less than 5 gallons per minute (gpm).

The Raccoon Creek Group is composed primarily of fine-grained materials that limit the movement of ground water to fractures, joints, and along the bedrock surface. This, along with the overlying, typically fine-grained clay materials, puts most of this system in Benton County at low risk to contamination from the surface or near surface sources.

Mississippian -- Borden Group Aquifer System

The Mississippian age Borden Group Aquifer System subcrops in most of the central and western portions of Benton County. This bedrock aquifer system is composed mostly of siltstone and shale, but fine-grained sandstones are common. Carbonates are rare, but do occur as discontinuous interbedded limestone lenses, mostly in the upper portion of the group. In Benton County, this system is overlain by unconsolidated deposits with a maximum thickness ranging from outcropping to about 400 feet.

Because this system is generally not very productive, it is typically used only where overlying deposits do not contain aquifer material. The Borden Group is often described as an aquitard, and yields of wells completed in it are typically quite limited. Most of the domestic wells in the mapped area either produce from the overlying unconsolidated deposits or penetrate through the shale and siltstone in favor of the underlying Silurian and Devonian Carbonates. Reported well depths in this system commonly range from 90 to 205 feet deep and the amount of rock penetrated in this system typically ranges from 15 to 95 feet. The typical domestic well in the subcrop area produces between 5 and 25 gpm with many dry holes reported. Static water levels commonly range from 15 to 50 feet below the surface.

This system is composed primarily of fine-grained materials that limit the movement of ground water to fractures, joints, and along the bedrock surface. However, shallow bedrock wells are at moderate to high risk to surface contamination. Where the overlying sediment consists of thick fine-grained clay materials, the Borden Group Aquifer System in Benton County is at low risk to contamination from the surface or near surface sources.

Devonian and Mississippian -- New Albany Shale Aquifer System

The New Albany Shale consists mostly of brownish-black carbon-rich shale, greenish-gray shale, and minor amounts of dolomite and dolomitic quartz sandstone. The New Albany Shale subcrops along the eastern portion of Benton County and in a small area trending northeast near Boswell. About half of the domestic wells penetrate through the shale in favor of the underlying Silurian and Devonian Carbonates. There are no registered significant ground-water withdrawal facilities completed in this system for Benton County.

Because the New Albany Shale is generally not very productive, it is typically used only where overlying deposits do not contain aquifer material. The New Albany Shale is often described as

an aquitard, and yields of wells completed in it are typically quite limited. Reported depths commonly range from 45 to 100 feet deep. The amount of rock penetrated in this system typically ranges from 10 to 60 feet. Domestic water wells commonly yield between 10 and 15 gpm with associated drawdowns commonly ranging from 25 to 55 feet, however; many dry holes have been reported in this system. Typical static water levels range from 5 to 20 feet below the surface. The permeability of shale materials is considered low. The New Albany Shale Aquifer System, therefore, has a low susceptibility to contamination introduced at or near the surface.

Silurian and Devonian Carbonates Aquifer System

In Benton County, this aquifer system consists primarily of middle Devonian age carbonates of the Muscatatuck Group and underlying Silurian carbonates. Because individual units of the Silurian and Devonian systems consist of similar carbonate rock types and cannot easily be distinguished on the basis of water well records, they are considered as a single water-bearing system. The Silurian and Devonian Carbonates Aquifer System subcrops in an area located in the northeast portion of Benton County.

This system is capable of meeting the needs of domestic and high-capacity users in the county. However, few wells utilize the Silurian and Devonian Carbonates Aquifer System in the subcrop area due to the overlying thick productive unconsolidated deposits. Reported depths range from 180 to 210 feet deep and the amount of rock penetrated in this system ranges from 15 to 40 feet. Water wells completed in this system are generally capable of meeting the needs of domestic users with reported yields ranging from 25 to 35 gpm, however; a few dry holes have been reported in this system. Static water levels range from 10 to 35 feet below the surface. There are four registered significant ground-water withdrawal facilities (7 wells) started in the Borden Group Aquifer System and finished in limestone of the Silurian and Devonian Carbonates Aquifer System. High-capacity well yields up to 900 gpm are reported. The Silurian and Devonian Carbonates Aquifer System has a low susceptibility to surface contamination due to thick clay deposits over most of the county.

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