

# **Bedrock Aquifer Systems of Jackson County, Indiana**

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March 2004

The occurrence of bedrock aquifers depends on the original composition of the rocks and subsequent changes which influence the hydraulic properties. Post-depositional processes, such as jointing, fracturing, and solution activity, generally increase the hydraulic conductivity (permeability) of the upper portion of bedrock aquifer systems. Because permeability is generally 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. 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 Jackson County. They are, from west to east, youngest to oldest: Blue River and Sanders Group of Mississippian age; the Borden Group of Mississippian age; the New Albany Shale of Devonian and Mississippian age; and the Silurian and Devonian Carbonates.

The susceptibility of bedrock aquifer systems to surface contamination is largely dependent on the type and thickness of the overlying sediments. Just as recharge for bedrock aquifers cannot exceed that of overlying unconsolidated deposits, susceptibility to surface contamination will not exceed that of overlying deposits. However, because the bedrock aquifer systems may have complex fracturing systems, once a contaminant has been introduced into a bedrock aquifer system, it will be difficult to track and remediate.

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

The Blue River and Sanders Groups Aquifer System is limited to upland areas along the western edge of Jackson County. This Middle Mississippian age aquifer system encompasses two groups: the Blue River Group and the Sanders Group. In Jackson County, bedrock associated with the Blue River Group is not present.

The Sanders Group includes the Harrodsburg and Salem limestone formations. These are primarily limestone with some dolomitic limestone content. In Jackson County, the Sanders Group has a thickness of 25 feet or less because much of it has been eroded. Depth to bedrock is generally between 7 and 30 feet below land surface.

The Blue River and Sanders Groups Aquifer System is not regarded as a major ground-water resource in the county and no known wells produce from this aquifer system. Domestic wells in the outcrop/subcrop area commonly penetrate through the Sanders Group into the underlying Borden Group. However, it is possible that large diameter wells could meet the needs of domestic users.

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 risk to contamination; where thick, there is low risk.

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

The outcrop/subcrop area of the Mississippian age Borden Group Aquifer System includes nearly all of Jackson 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.

The Borden Group in Jackson County is up to 550 feet thick and generally thins as it dips to the southwest beneath younger rock formations. Well depths in the Borden Group Aquifer System range from 15 to 420 feet. However, most wells are completed at depths of 60 to 140 feet.

Because the Borden Group is generally not very productive, it is typically used only where overlying deposits do not contain an aquifer. The Borden Group is often described as an aquitard, and yields of wells completed in it are usually quite limited. Many wells, however, are able to produce sufficient water for domestic purposes by relying on extra well-bore storage created by drilling relatively large diameter and relatively deep wells. The yield of most domestic wells completed in the group range from 1 to 9 gallons per minute (gpm). Reported static water levels in the wells completed in the Borden aquifer are commonly between 15 and 40 feet below surface.

The Borden Group is composed primarily of fine-grained materials that limit the movement of ground water. In areas where overlying clay materials are present, the Borden Group Aquifer System is at low risk to contamination from the surface or near surface. However, in some areas the bedrock is overlain by outwash materials that may be capped by thin deposits of eolian derived loess, colluvium, or lacustrine silt. These areas are at moderate risk to contamination.

## **Devonian and Mississippian -- New Albany Shale Aquifer System**

The New Albany Shale Aquifer System in Jackson County is an extremely limited aquifer resource. This aquifer system consists mostly of brownish-black carbon-rich shale, greenish-gray shale, and minor amounts of dolomite and dolomitic quartz sandstone.

In Jackson County, thickness of the New Albany Shale ranges from 0 to 120 feet and generally thickens as it dips southwest beneath younger strata. The outcrop/subcrop area for the New Albany Shale is present along most of the eastern edge of the county. It is overlain by unconsolidated deposits that range in thickness from 5 to 115 feet.

This aquifer system is considered a poor aquifer resource and is often described as an aquitard. Dry holes and the occurrence of “sulphur” water and “salt” water have been reported. However, a few domestic wells have been completed in this system. Completed well depths are typically 20 to 65 feet. Typical capacities are from 2 to 9 gpm. Static water levels range from 15 to 35 feet below 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 (Beneath the New Albany Shale Aquifer System)**

The Silurian and Devonian Carbonates Aquifer System in Jackson County is limited to a very small outcrop/subcrop area in the extreme northeastern part of the county. This system includes middle-Devonian age carbonates (limestone and dolomite) of the Muscatatuck Group and the underlying carbonates of Silurian age. Because carbonate units of Silurian and Devonian age are similar, and cannot easily be distinguished on the basis of water well records, they are considered as a single water-bearing system.

In Jackson County the Muscatatuck Group is less than 75 feet thick and generally increases in thickness as it dips to the southwest beneath younger rock formations. The underlying Silurian carbonates range from 100 to 250 feet thick and also thicken as they dip to the southwest.

Very few wells are completed in this aquifer system due to the availability of unconsolidated aquifers in the area. However, a few wells do exist in the aquifer system, mostly in the outcrop/subcrop area of the New Albany Shale. Because the New Albany Shale is considered a poor aquifer, drillers typically bypass the shale and complete wells in the underlying carbonates.

Total well depths range from 25 to 225 feet, but are typically 90 to 160 feet. The amount of rock penetrated in the Silurian and Devonian Carbonates Aquifer System typically ranges from 5 to 70 feet beneath the New Albany Shale. New Albany Shale thickness ranges from 10 to 120 feet.

Water wells in the Silurian-Devonian Carbonates Aquifer System are capable of meeting the needs of domestic users. However, some wells note the occurrence of “sulphur water” and “salt water” and a few dry holes have been reported. Typical capacities are commonly from 2 to 10 gpm. Static water levels range from 20 to 90 feet below surface.

Where the Silurian-Devonian Carbonates Aquifer System is overlain by the New Albany Shale, the aquifer system is considered at low risk to contamination. However, in the outcrop/subcrop area, the aquifer system is overlain by 25 to 70 feet of unconsolidated deposits composed primarily of sand and gravel outwash materials. These deposits may have a thin clay at the surface. In such areas, the aquifer system is considered at moderate risk.

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