

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

by

Glenn E. Grove

Division of Water, Resource Assessment Section

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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 along Sugar Creek in parts of western Boone County to over 350 feet in the north-central portion 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.

Three bedrock aquifer systems are identified for Boone County. They are, from west to east and younger to older: the Borden Group of Mississippian age, the New Albany Shale of Devonian and Mississippian age, and the Silurian and Devonian Carbonates. Bedrock wells represent about ten 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.

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

The Mississippian age Borden Group outcrops/subcrops primarily west of Interstate 65 in Boone 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 Boone County is overlain by unconsolidated deposits with a maximum thickness ranging from less than 5 feet to over 300 feet.

Because the Borden Group 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 either produce from the overlying unconsolidated deposits or penetrate through the shale and siltstone in favor of the underlying Silurian and Devonian Carbonates. Reported depths commonly range from 90 to 200 feet deep. The amount of rock penetrated in this system typically ranges from 50 to 175 feet. The typical domestic well in the subcrop area produces less than 15 gallons per minute (gpm). Many dry holes have been reported in this system. Static water levels commonly range from 10 to 40 feet below the land surface. There is one registered significant ground-water withdrawal facility (1 well) in the subcrop area of this system. However, the well is completed in the more productive underlying Silurian and Devonian Carbonates. This facility is used for public water supply and has a reported capacity of 100 gpm.

The Borden Group is composed of primarily fine-grained materials that limit the movement of ground water to fractures, joints, and along the bedrock surface. Thus, in most of the western portion of the county 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 Boone 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 is generally less than 100 feet thick and it subcrops in a thin band east of Interstate 65 in Boone County. About half of the domestic wells penetrate through the shale in favor of the underlying Silurian and Devonian Carbonates.

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. Domestic water wells commonly yield less than 10 gpm with typical static water levels ranging from 10 to 60 feet below the surface. Many dry holes have been reported. 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 Boone County, this aquifer system consists primarily of middle Devonian age carbonates of the Muscatatuck Group and underlying Silurian carbonates. It is composed of only Silurian carbonates where Muscatatuck Group rocks have been removed by erosion. 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.

Few wells utilize the Silurian and Devonian Carbonates Aquifer System in the subcrop area in Boone County due to availability of thick unconsolidated deposits. Reported depths range from 88 to 305 feet deep. The amount of rock penetrated in this system ranges from 2 to 132 feet. Water wells completed in this system are generally capable of meeting the needs of domestic users. Reported yields for domestic wells range from a few dry holes up to 65 gpm. Static water levels range from 16 to 100 feet below the land surface. This aquifer system has a low susceptibility to surface contamination due to thick clay deposits over most of the county.

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