

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

By

Randal D. Maier

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, 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 Floyd 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.

Five bedrock aquifer systems are identified for Floyd County. They are, from west to east, youngest to oldest: the Buffalo Wallow, Stephensport, and West Baden Groups of Mississippian age; the Blue River and Sanders Groups 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. Because 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 -- Buffalo Wallow, Stephensport, and West Baden Groups Aquifer System**

This Upper Mississippian bedrock aquifer system outcrops along two small areas in northwest and southwest Floyd County, mainly along ridge tops. The 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 the county.

Thickness of the West Baden Group in Floyd County is less than 10 feet and consists of varying amounts of limestone, shale, and sandstone. The depth to the bedrock surface is generally less than 20 feet and wells completed in the outcrop area are likely producing from the underlying Blue River and Sanders Groups Aquifer System.

In the outcrop/subcrop area of the West Baden Group the bedrock is shallow and is overlain by variable thickness of clay materials. These conditions warrant considering the aquifer system to be moderately susceptible to contaminants introduced at or near the land surface.

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

The Blue River and Sanders Groups Aquifer System is present along the western edge of Floyd County as well as a few isolated areas in the north-central part of the county, mainly along ridge tops. This Middle Mississippian age aquifer system encompasses two groups: the Blue River Group and the underlying Sanders Group. In Floyd County, the Sanders Group is generally less than 100 feet thick and includes the Ramp Creek, Harrodsburg and Salem formations, which are mostly limestone with some dolomitic content. The overlying Blue River Group is up to 350 feet thick and consists of the Paoli, Ste. Genevieve and St. Louis formations. The formations are mostly limestone but also include gypsum, anhydrite, shale, and calcareous sandstone.

Depth to bedrock is generally between 5 and 30 feet below land surface. However, there are some isolated areas where well records suggest karst development and the depth to solid bedrock can be up to 50 feet. Limestones of the Blue River Group are noted for development of karst features. In Floyd County, karst features are not very prevalent but there are a few sinkholes present, mainly in the northwest part of the county along ridge tops, as well as the description of “caves” in a few well records.

The Blue River and Sanders Groups Aquifer System is not regarded as a major ground-water resource in the county and few wells produce from this aquifer system. 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. Reported yields are less than 5 gallons per minute (gpm) and some dry holes are noted. Static water levels range from 15 to 110 feet below surface.

Clay materials of varying thickness overlie the Blue River and Sanders Group Aquifer System. Where the clay materials are thin and karst development is present the aquifer system has a moderate to high risk to contamination. However where overlying sediments are thick and there is no karst development, the risk is low.

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

In Floyd County, the Mississippian age Borden Group Aquifer System encompasses most of the areal extent of the county. This bedrock aquifer system is composed of siltstone and shale, but fine-grained sandstones are also common. Although carbonates are rare, discontinuous interbedded limestone lenses are present, mainly in the upper portion of the group.

The Borden Group in Floyd County has a maximum thickness of about 600 feet and generally thins as it dips to the southwest beneath younger rock formations. Depth to bedrock is generally 5 to 20 feet and well depths are commonly from 30 to 100 feet. However, in some areas bedrock is as much as 70 feet deep, especially near the Ohio River and in isolated areas where small buried valleys are present.

Few wells produce from the Borden Group Aquifer System in Floyd County. It is typically used only where overlying unconsolidated deposits do not contain an aquifer. However, many wells are able to produce sufficient water for some domestic users by relying on extra well-bore storage by drilling larger diameter and deeper wells. Typical yield of domestic wells is generally less than 5 gpm with some dry holes reported. Yields are greater in areas where alluvial deposits directly overlie bedrock. Static water levels are generally between 10 and 30 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 outwash, alluvial, and silt deposits directly overlie the bedrock surface. These areas are at moderate to high risk from surface contamination.

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

The New Albany Shale Aquifer System in Floyd County is an extremely limited ground-water resource. The outcrop/subcrop area for the New Albany Shale in Floyd County is present along a narrow strip from Silver Creek continuing south along the Ohio River. This aquifer system consists mostly of brownish-black carbon-rich shale, greenish-gray shale, and minor amounts of dolomite and dolomitic quartz sandstone.

The New Albany Shale in Floyd County has a maximum thickness of 120 feet and generally increases in thickness as it dips to the southwest beneath younger rock formations. Depth to bedrock is about 5 to 25 feet but is about 100 feet near the Ohio River where thick outwash deposits are present.

Very few wells are completed in the New Albany Shale Aquifer System. This aquifer system is considered a poor ground-water resource and is generally described as an aquitard. However, a few domestic wells are completed in this system. Total well depths

are generally 40 to 70 feet with 20 to 60 feet of penetration into bedrock. Typical yields are 5 gpm or less with some dry holes reported. In some cases, well productivity is greater where outwash and alluvial materials directly overlie the bedrock surface. Static water levels range from 25 to 55 feet below ground surface.

Because the permeability of shale materials is considered low and clay or silt deposits generally overlie the New Albany Shale Aquifer System, susceptibility to contamination introduced at or near the surface is low. However, in some areas alluvial and outwash materials directly overlie the bedrock surface. These areas are at moderate to high risk to contamination.

### **Silurian and Devonian Carbonates Aquifer System**

The Silurian and Devonian Carbonates Aquifer System is limited to an extremely small area near the Clark-Floyd County line where Silver Creek enters Floyd County. No known wells produce from this system in Floyd County. However, in nearby Clark County the Silurian and Devonian Carbonates Aquifer System is capable of meeting the needs of domestic users. Reported typical yields for domestic wells in Clark County range from 1 to 10 gpm with static water levels commonly from 10 to 45 feet below land surface.

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