

Bedrock Aquifer Systems of Tippecanoe 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 to over 400 feet thick. Bedrock is at or near the surface along Flint Creek in the west-central portion of the county, along the Wabash River in the northeastern corner of the county, and a small area west of Klondike around Indian Creek. Several deep buried bedrock valleys come together around Lafayette to form the main trunk of the Lafayette (Teays) Bedrock Valley System. One buried bedrock valley enters the county from the northeast just west of the Tippecanoe River. Another buried bedrock valley enters the county southeast of Romney. Several other buried valleys trending from the east to the west merge with these other buried bedrock valleys to form a broad bedrock lowland around Lafayette that exits the county south of the town of Otterbein. 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 Tippecanoe 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 20 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 in the southern third of Tippecanoe County and a few isolated areas in the northwest corner. 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 Tippecanoe County is overlain by unconsolidated deposits with a thickness ranging from outcropping to over 350 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. Some 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 80 to 190 feet deep. The amount of rock penetrated in this system typically ranges from 30 to 130 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 5 to 40 feet below the land surface. There is one registered significant ground-water withdrawal facility (2 wells) that penetrates this system. However, it is likely these wells are utilizing unconsolidated sand and gravel deposits on top of the bedrock. The facility is used for public water supply and the wells have reported capacities of 100 and 130 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. 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 Tippecanoe 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 outcrops/subcrops in a large area of central and northern Tippecanoe 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 20 to 85 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

The Silurian and Devonian Carbonates Aquifer System subcrops primarily in the north-central portion of Tippecanoe County. This aquifer system consists primarily of middle Devonian age carbonates of the Muscatatuck Group and underlying Silurian carbonates in this county. 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.

Only two reported wells utilize the Silurian and Devonian Carbonates Aquifer System in the subcrop area in Tippecanoe County, because of the availability of thick unconsolidated deposits in most of the subcrop area. The reported well depths are 200 and 261 feet deep and the wells penetrated 57 and 64 feet into the bedrock. Water wells completed in this system are generally expected to be capable of meeting the needs of most domestic users. Reported yields for the two wells are 20 and 30 gpm with static water levels of approximately 99 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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