

Bedrock Aquifer Systems of White County, Indiana

by

Randal D. Maier

Division of Water, Resource Assessment Section

March 2009

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.

Unconsolidated deposits of varying thickness overlies bedrock aquifer systems in White County. Thickness of unconsolidated deposits overlying bedrock generally range from 5 to 270 feet. Most of the bedrock aquifers, therefore, 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 formation.

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.

The susceptibility of bedrock aquifer systems to surface contamination is largely dependent on the type and thickness of the overlying sediments. 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.

Four bedrock aquifer systems are identified for White County. They are the Pennsylvanian Raccoon Creek Group; the Mississippian Borden Group; the Devonian and Mississippian New Albany Shale; and the Silurian and Devonian Carbonates.

Pennsylvanian -- Raccoon Creek Group Aquifer System

In White County the Raccoon Creek Group Aquifer System subcrops in two extremely small areas in the west central part of the county. Bedrock consists of mostly sandstone and shale with minor amounts of mudstone, coal, and limestone. Thickness of the Raccoon Creek Group in White County is generally less than 50 feet.

Because of the limited aerial extent of the Raccoon Creek Group Aquifer System only one well record is available in White County. The depth to bedrock is 25 feet with a total depth of 30 feet. The well produces 5 gallons per minute (gpm) with a static water level of 16 feet below surface.

Clay materials are generally thick and overlie a shallow bedrock surface. Therefore, the Raccoon Creek Group Aquifer System is considered at low to moderate risk to contamination from the surface or near surface.

Mississippian -- Borden Group Aquifer System

The Mississippian age Borden Group Aquifer System subcrop area is present in the southwestern part of White 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. Thickness of the Borden Group in White County is estimated up to 50 feet.

Few wells produce from the Borden Group Aquifer System in White County. Approximately 84 percent of wells drilled in the area penetrate beyond the estimated thickness of this system. Most wells in the area, therefore, are likely producing from the underlying Silurian and Devonian Carbonates Aquifer System. Depth to bedrock ranges from 25 to 65 feet and well depths are from 55 to 70 feet for the few wells that appear to utilize the Borden Group Aquifer System. Typical yield of domestic wells generally ranges from 5 to 20 gpm. However, higher yields are associated with greater drawdown. Static water levels range from 10 to 30 feet below surface.

The Borden Group is composed primarily of fine-grained materials that limit the movement of ground water and is overlain with thick clay materials. The Borden Group Aquifer System, therefore, is at low risk to contamination from the surface or near surface.

Devonian and Mississippian -- New Albany Shale Aquifer System

The New Albany Shale Aquifer System in White County is an extremely limited ground-water resource. The subcrop area for the New Albany Shale is present along most of the western part of White County. This aquifer system consists mostly of brownish-black carbon-rich shale, greenish-gray shale, and minor amounts of dolomite and dolomitic quartz sandstone.

Thickness of the New Albany Shale in White County is generally less than 150 feet. However, approximately 54 percent of bedrock wells in the New Albany subcrop area bypass the shale in favor of the underlying Silurian Devonian Carbonates Aquifer System. Thickness of the New Albany Shale in these wells range from 33 to 140 feet. Depth to bedrock ranges from 10 to 125 feet below surface.

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 generally range from 50 to 100 feet with 3 to 97 feet of penetration into bedrock. Typical yields are 5 gpm or less with some dry holes reported. Static water levels range from 5 to 15 feet below ground surface.

Because the permeability of shale materials is considered low and thick clay deposits generally overlie the New Albany Shale Aquifer System, susceptibility to contamination introduced at or near the surface is low.

Silurian and Devonian Carbonates Aquifer System

The Silurian and Devonian Carbonates Aquifer System subcrops over most of the eastern half of White County. The system includes Silurian age carbonate rock units of the Wabash Formation and Devonian age carbonate rock units of the Muscatatuck Group. Total thickness of the Silurian bedrock is up to 500 feet. Total thickness of the Devonian bedrock is up to 50 feet. Depth to the bedrock surface ranges from about 5 to 270 feet.

The Silurian and Devonian Carbonates Aquifer System is capable of meeting the needs of domestic and some high-capacity users. Total well depths are typically 70 to 165 feet with typical penetration into bedrock ranging from 20 to 70 feet. Domestic yields generally range from 10 to 45 gpm with static water levels ranging from 7 to 40 feet. There are 19 registered significant ground-water withdrawal facilities (45 wells) utilizing the Silurian and Devonian Carbonates Aquifer System with reported yields of individual wells ranging from 95 to 800 gpm.

Most of the Silurian and Devonian Carbonates Aquifer System in White County is overlain by thick clay deposits. These areas are generally considered at low risk to contamination.

Map Use and Disclaimer Statement

We request that the following agency be acknowledged in products derived from this map:
Indiana Department of Natural Resources, Division of Water.

This map was compiled by staff of the Indiana Department of Natural Resources, Division of Water using data believed to be reasonably accurate. However, a degree of error is inherent in all maps. This product is distributed "as is" without warranties of any kind, either expressed or implied. This map is intended for use only at the published scale.