

Bedrock Aquifer Systems of Warrick County, Indiana

By
Randal D. Maier
Division of Water, Resource Assessment Section
May 2006

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 overlie bedrock aquifer systems in Warrick 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 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.

Three bedrock aquifer systems are identified for Warrick County. They are, from west to east, youngest to oldest: the McLeansboro Group of Pennsylvanian age; the Carbondale Group of Pennsylvanian age; and the Raccoon Creek Group of Pennsylvanian age.

Pennsylvanian -- McLeansboro Group Aquifer System

The McLeansboro Group outcrop/subcrop area is primarily located in the northwest part of the county with a few isolated areas to the southwest. Thickness of the McLeansboro Group ranges from less than 1 foot to about 160 feet. This aquifer system consists in ascending order of the Shelburn, Patoka, Bond, and Mattoon Formations. However, in Warrick County only the Shelburn and Patoka Formations are present.

The Patoka Formation consists primarily of shale and sandstone with clay, limestone, and coal. The underlying Shelburn Formation consists of shale, siltstone, sandstone, coal, and limestone. Two important members of the Shelburn Formation include the West Franklin Limestone at the

top of the formation and the Busseron Sandstone at the base. These are the primary aquifer units within the McLeansboro Group Aquifer System.

Few wells are reported in the McLeansboro Group Aquifer System in Warrick County. The depth to the bedrock surface ranges from 5 feet to 25 feet with well depths ranging from 30 to 100 feet. The amount of rock penetrated generally ranges from 1 to 30 feet, with a maximum of 90 feet. Most domestic wells produce less than 10 gallons per minute (gpm) with a few (pumped) dry holes reported. Static water levels range from 5 to 75 feet below surface.

Most of the McLeansboro Group Aquifer System contains fine-grained materials that limit the movement of ground water. However, in some areas alluvial and lacustrine materials directly overlie the bedrock surface. Therefore, the aquifer system is considered low to moderate risk to contamination.

Pennsylvanian -- Carbondale Group Aquifer System

The Carbondale Group Aquifer System outcrop/subcrop area covers the largest areal extent of the bedrock aquifer systems in Warrick County. The group consists in ascending order of the Linton, Petersburg, and Dugger Formations. Bedrock deposits include mostly shale and sandstone with some limestone and commercially important coal. Thickness of the Carbondale Group in Warrick County ranges from 0, where it is in contact with the underlying Raccoon Creek Group, to about 350 feet.

Depth to the bedrock surface is typically from 10 to 60 feet below surface. Well depths range from 50 to 320 feet with most completed at depths between 70 and 150 feet. The amount of rock penetrated ranges from 1 to 250 feet. The Carbondale Group is considered a minor ground-water source with domestic wells typically pumping less than 10 gpm. Static water levels in the wells vary from 5 to 140 feet below the land surface, but are typically between 5 and 30 feet below the surface.

Most wells produce from the thicker sandstone and coal units in the upper formations of the Carbondale Group. Localized yields are greater in areas where outwash and alluvial sands and gravels directly overlie bedrock. A few (pumped) dry holes have been reported. However, one discontinued coal mine dewatering well in nearby Vanderburgh County is completed in a deeper sandstone near the base of the Linton Formation. This well reports a yield of 200 gpm. Water quality, however, from the deeper bedrock units is highly mineralized.

In areas where overlying clay materials are present, the Carbondale Group Aquifer System is at low risk to contamination. However, in some areas outwash, alluvial, and lacustrine materials directly overlie the bedrock surface. These areas are at moderate to high risk from surface contamination.

Pennsylvanian -- Raccoon Creek Group Aquifer System

In Warrick County the Raccoon Creek Group Aquifer System outcrops/subcrops primarily in the northeastern part of the county. The group consists in ascending order of the Mansfield, Brazil, and Staunton formations. The basal formation of the group, the Mansfield Formation, rests unconformably on the Mississippian rocks. Bedrock consists of mostly sandstone and shale with minor amounts of mudstone, coal, and limestone. Thickness of the Raccoon Creek Group in Warrick County ranges from about 250 to 700 feet as it dips beneath younger strata.

Few well records are available in the Raccoon Creek Group Aquifer System in Warrick County. Most wells produce from the upper formations of the Raccoon Creek Group. However, the Mansfield Formation is considered a moderately dependable ground water resource. The upper contact of the Mansfield Formation ranges from about 240 to 300 feet below surface. The depth to the bedrock surface is typically less than 30 feet and completed wells range from 50 to 320 feet below surface. Domestic well production ranges from 1 to 15 gpm with a few (pumped) dry holes reported. Static water levels are generally 5 to 90 feet below surface. In general, water quality from deeper bedrock units is more mineralized than upper units.

In areas where overlying clay materials are present, the Raccoon Creek Group Aquifer System is at low risk to contamination from the surface or near surface. However, in some areas outwash, alluvial, and lacustrine materials directly overlie the bedrock surface. These areas are at moderate to high risk from surface contamination.

Underground Mine Areas

In Warrick County various coal seams within the Carbondale Group have been removed by underground mining methods. In underground mines, approximately 50 percent of the coal seam was typically removed, leaving the potential for storage of substantial amounts of water in the larger mines. Although the Division has no records of wells drilled into these mines, yields of a few hundred gpm are possible. A limitation on use of the water could be its more mineralized nature.

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.