

# **Bedrock Aquifer Systems of Jasper 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.

In Jasper County thickness of unconsolidated deposits overlying bedrock ranges from less than 2 feet in the east-central and southern portions of the county where bedrock is shallow to as much as 174 feet in the southwest portion of the county where a buried bedrock valley is present.

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.

Five bedrock aquifer systems are identified for Jasper County. They are the Pennsylvanian Raccoon Creek Group, the Mississippian Borden Group, the Devonian and Mississippian New Albany Shale, the Devonian and Mississippian Coldwater, Ellsworth and Antrim Shales; and the Silurian and Devonian Carbonates. Approximately 62 percent of all located wells in Jasper County are completed in bedrock.

## **Pennsylvanian -- Raccoon Creek Group Aquifer System**

The Raccoon Creek Group Aquifer System outcrop/subcrop area occurs in a small area of southern Jasper County. Bedrock consists of mostly sandstone and shale with minor amounts of mudstone, coal, and limestone. The basal formation of the Raccoon Creek Group, the Mansfield Formation, rests unconformably on Mississippian rocks. The Raccoon Creek Group is generally considered a limited groundwater resource. However, the Mansfield Formation is considered a moderately dependable source of groundwater.

Few wells are available in the Raccoon Creek Group subcrop area. Depth to bedrock ranges from 2 to 24 feet. Wells completed in the Raccoon Creek Group are typically 55 to 107 feet deep with 27 to 142 feet of penetration into the bedrock. Domestic well capacities range from 11 to 30 gallons per minute (gpm) with static water levels of 7 to 65 feet below surface. Greater capacities have been reported in isolated areas. However, greater yields are commonly associated with significant to complete drawdown.

Clay materials that overlie bedrock generally range in thickness from 2 to 24 feet. In general The Raccoon Creek Group has a low susceptibility to surface contamination; however, shallow wells where unconsolidated deposits are thin are moderately to highly susceptible.

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

The Borden Group Aquifer System outcrop/subcrop area is limited to a small area of southwestern Jasper 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.

Few wells are available in the Borden Group in Jasper County. Total well depths range from 40 to 285 feet with depths to bedrock generally 5 to 105 feet. Reported well yields range from 1 to 25 gpm with static water levels of 5 to 85 feet below surface.

The Borden Group is composed primarily of fine-grained materials 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 Jasper County is an extremely limited groundwater resource. The subcrop area for the New Albany Shale is present in much of the southern third of Jasper 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 Jasper County reportedly ranges from 2 to 198 feet.

Few wells are completed in the New Albany Shale Aquifer System. Approximately 63 percent of bedrock wells in the New Albany subcrop area bypass the shale in favor of the underlying Silurian Devonian Carbonates Aquifer System. This aquifer system is considered a poor groundwater resource and is generally described as an aquitard. However, a few domestic wells are completed in this system. Total well depths range from 30 to 146 feet with 2 to 113 feet of penetration into bedrock. Typical yields are 7 gpm or less with some dry holes reported. Capacities up to 20 gpm have been reported but are commonly associated with greater drawdown. Static water levels range from 3 to 30 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.

### **Devonian and Mississippian -- Coldwater, Ellsworth and Antrim Shales Aquifer System**

In Jasper County only the Ellsworth and Antrim Shales subcrop in the Coldwater, Ellsworth and Antrim Shales Aquifer System. The Ellsworth Shale overlies the Antrim Shale and is comprised of alternating beds of gray-green to brownish black shale. The Ellsworth Shale subcrops in a small area of the northeastern corner of Jasper County. The Antrim Shale is typically described as brownish-black shale and subcrops in northeastern and a portion of west-central Jasper County. Shale is commonly considered an aquitard and therefore, the system is an extremely limited groundwater resource. However, in some places the lower portion of the Antrim Shale may contain some limestone.

Depth to bedrock ranges from 35 to 153 feet with reported thickness of the shale in the subcrop areas ranging from 5 to 97 feet. Most wells bypass the shale in favor of the underlying Silurian and Devonian Carbonates Aquifer System or utilize the overlying unconsolidated resources. However, a few wells report capacities up to 15 gpm with static water levels up to 50 feet below surface.

Because the permeability of shale materials is considered low, susceptibility to contamination introduced at or near the surface is low. However, areas where outwash deposits directly overly fractured bedrock are at moderate to high risk to contamination.

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

The Silurian and Devonian Carbonates Aquifer System subcrops along much of the central and northwestern areas of Jasper County. The system includes Silurian age carbonates of the Wabash Formation overlain by Devonian age carbonate units of the Muscatatuck Group. Total combined thickness of the Silurian and Devonian bedrock is up to 575 feet.

Depth to the bedrock surface ranges from less than 2 feet in the east-central part of the county to 174 feet in the west-central part of the county where a buried valley is present. Total well depths range from 10 to 864 feet but are commonly 20 feet to 150 feet below surface. Many wells that penetrate deep into the bedrock are associated with high capacity usage.

The Silurian and Devonian Carbonates Aquifer System is capable of meeting the needs of domestic and some high-capacity users. It should be noted that groundwater conflicts caused by high-capacity pumpage of the Silurian and Devonian Carbonates Aquifer System have occurred in Newton and Jasper counties. For details, see the 1990 IDNR publication Water Resource Availability in the Kankakee River Basin, Indiana located on the Internet at [www.in.gov/dnr/water](http://www.in.gov/dnr/water). Domestic yields range from 10 to 65 gpm with static water levels ranging from 6 to 36 feet. There are 49 registered significant groundwater withdrawal facilities (81 wells) utilizing the Silurian and Devonian Carbonates Aquifer System with reported yields of

individual wells ranging from 80 to 1800 gpm. Because of historic groundwater conflicts, additional proposed high-capacity well sites should be evaluated with regard to not only individual needs but also proper well spacing that would help prevent or minimize interference with nearby wells and reduce impacts to the source aquifer.

Most of the Silurian and Devonian Carbonates Aquifer System in Jasper County is overlain by sands and gravels with intermittent clay deposits. These areas are generally considered at moderate to high risk to contamination. However, most wells completed in this aquifer system are outside the subcrop area and penetrate through the overlying Ellsworth and Antrim shales. These areas are at moderate to low risk to contamination.

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