

Bedrock Aquifer Systems of Dubois County, Indiana

by

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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 is commonly greatest near the bedrock surface, bedrock units within the upper 100 feet are commonly the most productive aquifers. In Dubois County, rock types exposed at the bedrock surface range from relatively unproductive shales to moderately productive limestones and sandstones.

Bedrock aquifer systems in the county are overlain by unconsolidated deposits of varying thickness. Refer to the map for unconsolidated aquifer systems for more information. 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.

In general, the potential for encountering mineralized or saline ground water in Dubois County increases rapidly for bedrock wells deeper than 300 feet. Mineralized water is noted in some springs and shallower wells. Therefore, the discussion and evaluation of the ground-water potential of the bedrock aquifers is essentially limited to those geologic units lying above the expected limits of nonpotable water.

In this report, three bedrock aquifer systems are identified for Dubois County based on bedrock surface lithology. They are, from east to west and oldest to youngest: Buffalo Wallow, Stephensport, and West Baden Groups of Mississippian age; Raccoon Creek Group of Pennsylvanian age; and Carbondale Group of Pennsylvanian age.

The bedrock aquifer systems extend across Dubois County generally as a series of bands trending north-northwest to south-southeast. In the county, the Mississippian age bedrock was truncated by thousands of years of erosion. Subsequent burial of the erosion surface by sedimentation during Pennsylvanian time created one of the most widespread regional unconformities in the world, the Mississippian-Pennsylvanian unconformity. Younger Pennsylvanian age rocks overlap onto progressively older Mississippian age rocks at increasing distances north of the Ohio River.

Bedrock aquifers are not used as much as unconsolidated aquifers in the northwestern and central portions of the county because adequate ground water is typically available from the shallower unconsolidated materials. In the southern and eastern portions of the county, however, bedrock aquifers are more commonly used. There, the unconsolidated materials are very thin, primarily consisting of weathered bedrock residuum.

Mississippian Buffalo Wallow, Stephensport, and West Baden Groups Aquifer System

This Upper Mississippian bedrock aquifer system is limited to a small area in the eastern portion of Dubois County. It is laterally discontinuous and has been truncated northward because of pre-Pennsylvanian erosion. The present near-surface thickness and occurrence of the deposits forming this bedrock aquifer system have been altered by the Mississippian-Pennsylvanian unconformity throughout the county.

This bedrock aquifer system, composed primarily of shale, limestone, and sandstone, consists of three groups, from oldest to youngest: West Baden, Stephensport, and Buffalo Wallow. The three groups comprising this bedrock aquifer system differ in their percentages of shale, limestone, and sandstone.

The West Baden Group consists dominantly of shale and mudstone (40 percent) and thin-bedded to cross-bedded sandstone (35 percent); however, it has limestone beds of variable thickness (25 percent). The Stephensport Group is comprised of limestone (approximately 40 percent), shale (25 percent), and cliff-forming sandstone (35 percent). The Buffalo Wallow Group is primarily shale, mudstone, and siltstone (approximately 75 percent). It also contains prominent beds of sandstone (20 percent) and limestone (5 percent), some of which are laterally extensive. The limestone and sandstone beds, principally in the lower part of the unit, are 1 to 15 feet thick and 5 to 90 feet thick, respectively. This Group thins progressively northward and is likely completely eroded at the Mississippian-Pennsylvanian unconformity in northern Dubois County.

The depth to the bedrock surface is typically less than 20 feet. Well depths in the Buffalo Wallow, Stephensport, and West Baden Groups Aquifer System range from 31 to 470 feet, with most wells completed at depths of about 100 to 240 feet. The amount of rock penetrated by a well typically ranges from about 60 to 175 feet, with a maximum of 333 feet. Most of the water will be found in the limestone and sandstone beds. However, no attempt has been made in this report to correlate yields with the amount of penetration or the individual geologic formations used.

Static water levels are highly variable in the wells completed in this aquifer system. Water levels range from 0 feet to 230 feet below land surface, but are generally between 33 and 110 feet.

The Buffalo Wallow, Stephensport, and West Baden Groups Aquifer System is not regarded as a major ground water resource. However, most attempts to drill a domestic well into it are successful. Most domestic wells completed in the system have been tested at 3 to 15 gpm. A few wells have been tested as high as 60 gpm. However, very few wells can sustain a pumping rate over 30 gpm.

In the outcrop/subcrop area of this aquifer system the rock is predominantly shallow and contains numerous, irregular joints. In limited areas, some karst has developed in the limestone beds. These conditions warrant considering the aquifer system as a whole to be somewhat susceptible to contaminants introduced at and near land surface. This aquifer system is bounded on the west by the Raccoon Creek Group of Pennsylvanian age.

Pennsylvanian Raccoon Creek Group Aquifer System

Aquifers contained within the Pennsylvanian age bedrock have generally low yielding capability. However, their value is most significant to the homes and farms using these sources. In general, well depths are greater in the Pennsylvanian rocks than in other aquifer systems in the state, and depths over 200 feet are common. Well casing diameters are generally six inches or greater, indicating the low yield capabilities of these aquifers. Because of the low permeability of the bedrock, the abundance of shale confining zones both above and below aquifer systems, and the limitation in available drawdown, it is seldom possible to divert large volumes of water into any particular pumping center.

The outcrop/subcrop area of the Raccoon Creek Group covers most of Dubois County. The group consists in ascending order of the Mansfield, Brazil, and Staunton Formations. The Mansfield Formation rests unconformably on rocks of late Mississippian age. This erosional contact surface is quite irregular in elevation, resulting in quite variable thickness of Mansfield rocks.

Total thickness of the group in the county ranges from 0 at the eastern crop line to about 600 feet near the western county line. Shale and sandstone compose approximately 95 percent of the group. Clay, coal, and limestone make up nearly all the rest. Shale is more common than sandstone and it is typically light gray to dark-gray in color. The shale may be soft, non-silty to hard, silty, and sandy. The sandstone is mostly fine grained. Where the sandstone is present in the subsurface, massive cross-bedded sandstone seems to be common. Coal beds are typically quite thin, but could be as thick as 5 feet in some areas. Clay beds from 1 to 6 feet thick underlie coal seams. Two limestone beds are 1 to 5 feet thick. The lowermost part of the Mansfield commonly contains a large percentage of sandstone. Much of it is cross-bedded and may contain a quartz-pebble and chert conglomerate.

The depth to the bedrock surface is typically less than 30 feet, except in parts of central and northwestern Dubois County where the depth to bedrock may be over 150 feet in a buried bedrock valley system. Well depths in the Raccoon Creek Group are highly variable, ranging from 30 to 472 feet. However, most are constructed at depths of 75 to 285 feet. The amount of rock penetrated by wells typically ranges from 35 to 150 feet, with a maximum of 385 feet. Static water levels in the wells vary from 0 (flowing) to 225 feet below the land surface, but they are typically between 20 and 76 feet below the surface.

In general, the Raccoon Creek Group is considered a dependable ground-water source in Dubois County with many wells producing from the basal Mansfield Formation. Most domestic wells produce between 2 and 10 gpm with localized yields of up to 20 gpm. A few dry holes have been reported. Well yields for light industrial, irrigation, farm operation, or small municipal usage of up to 50 gpm may be obtained locally. The town of Huntingburg drilled a well that was

tested at 235 gpm. Of course, this is not typical and such a high rate could not be sustained for a long period. Some of the larger abandoned underground coal mines represent a potential source for wells producing a few hundred gpm. However, the Division has no records of such wells in the county.

Water quality is generally good, but in areas of surface and underground coal mining, some localized contamination may have occurred. (Refer to the unconsolidated aquifer systems map for locations of surface coal mined areas.) Contaminants are typically dissolved solids, including calcium, magnesium, sulfate, bicarbonate, and iron. Natural water quality gets progressively worse (more salty) in wells ranging in depth from 250 feet to 450 feet as the strata dip beneath younger rocks to the southwest. The Raccoon Creek Group is bounded on the west by the Carbondale Group.

Pennsylvanian Carbondale Group Aquifer System

The outcrop/subcrop of the Carbondale Group in southwestern Dubois County is only a few square miles in size and occurs in a few very small areas along the Pike County line and possibly a few acres on hilltops next to the Warrick County line. The Carbondale Group consists in ascending order of the Linton, Petersburg, and Dugger Formations. It overlies the Raccoon Creek Group and underlies the McLeansboro Group. The Carbondale Group consists mostly of shales and sandstones with some coal and limestone. This group includes some laterally persistent limestones and four of Indiana's commercially important coals. Persistent shales and underclays are associated with several of these coals. Coal beds 5 to 8 feet thick are widespread. Clay beds as much as 10 feet thick underlie coals. Two limestone beds are 5 to 15 feet thick.

The only part of the Carbondale Group present in Dubois County is the Linton Formation. The Linton includes two coal members, sandstone, shale, and clay. Total thickness of the Carbondale Group in the county is probably less than 100 feet. The upper coal seam is not present.

West of Dubois County, where more data from well records are available, the Carbondale Group is considered a minor ground-water source with most wells producing from the thicker sandstone and coal units. Water quality is generally good and the aquifer system is not very susceptible to contamination from the land surface. However, in areas of surface and underground coal mining, some localized contamination may have occurred. (Refer to the unconsolidated aquifer systems map for locations of any areas surface mined for coal.) Contaminants are typically dissolved solids, including calcium, magnesium, sulfate, bicarbonate, and iron. The natural quality of well water gets progressively more mineralized (commonly changing from a calcium-magnesium-bicarbonate type to a sodium bicarbonate or sodium chloride type) as wells are drilled deeper than about 300 feet and the rock strata dip beneath younger rocks to the southwest. The Carbondale Group is bounded on the west by the McLeansboro Group.

Underground Mine Areas

In these areas various coal seams within the Raccoon Creek Group have been removed by underground mining methods. Approximately 50 percent of the coal seam has been 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.

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