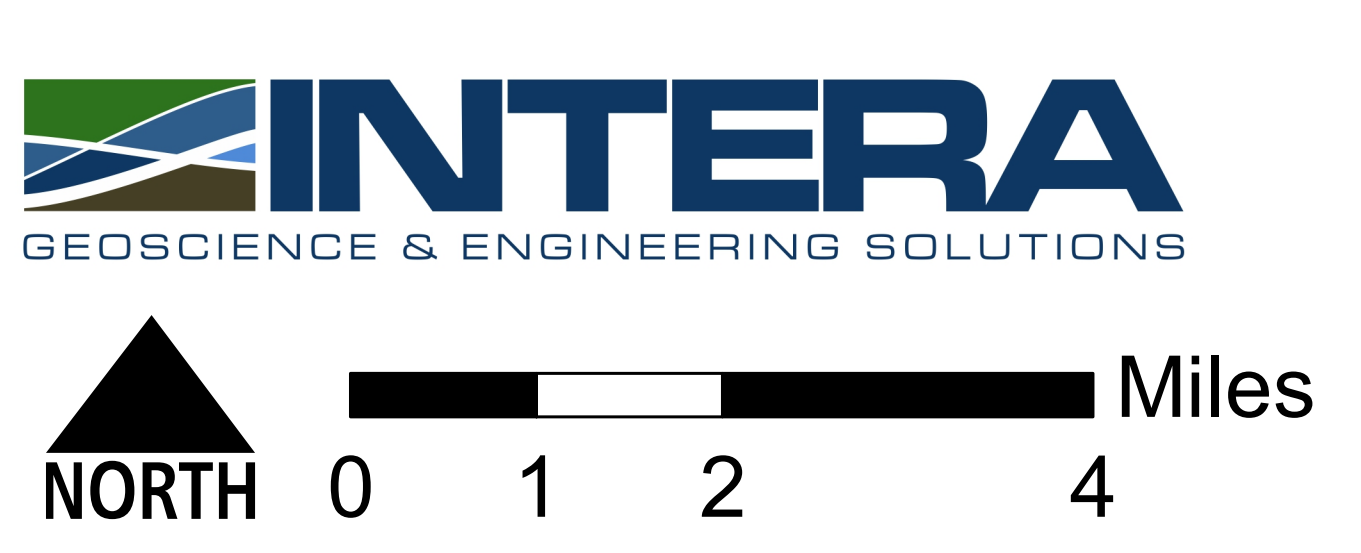
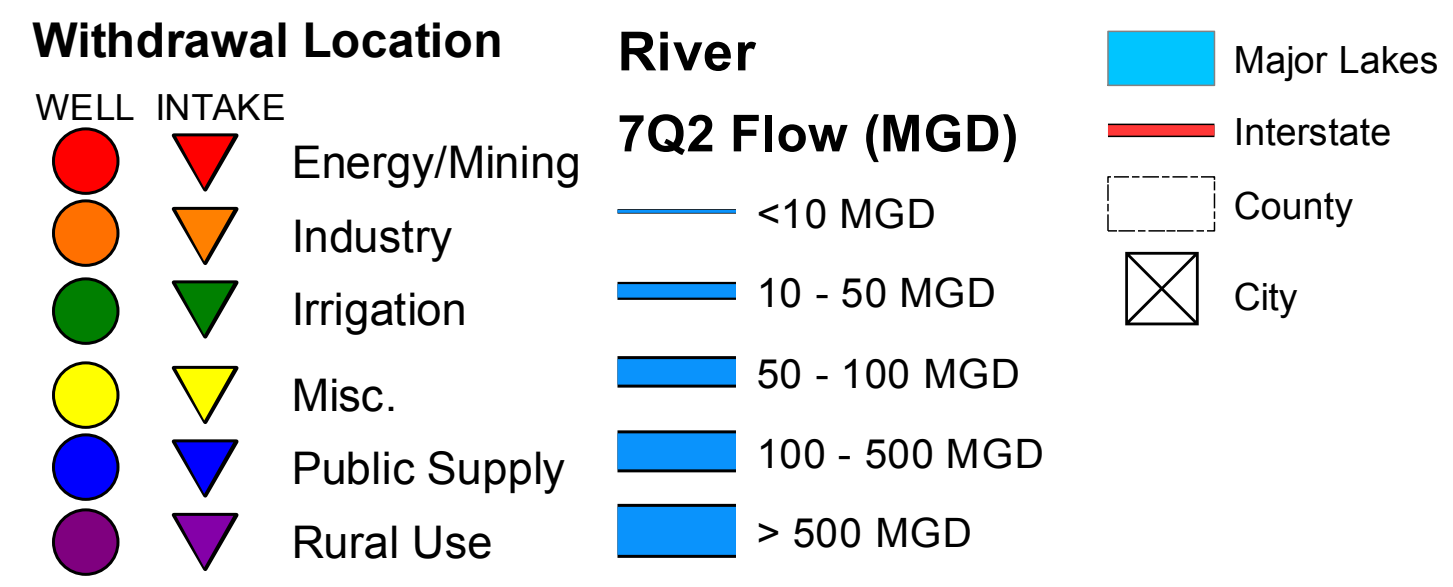
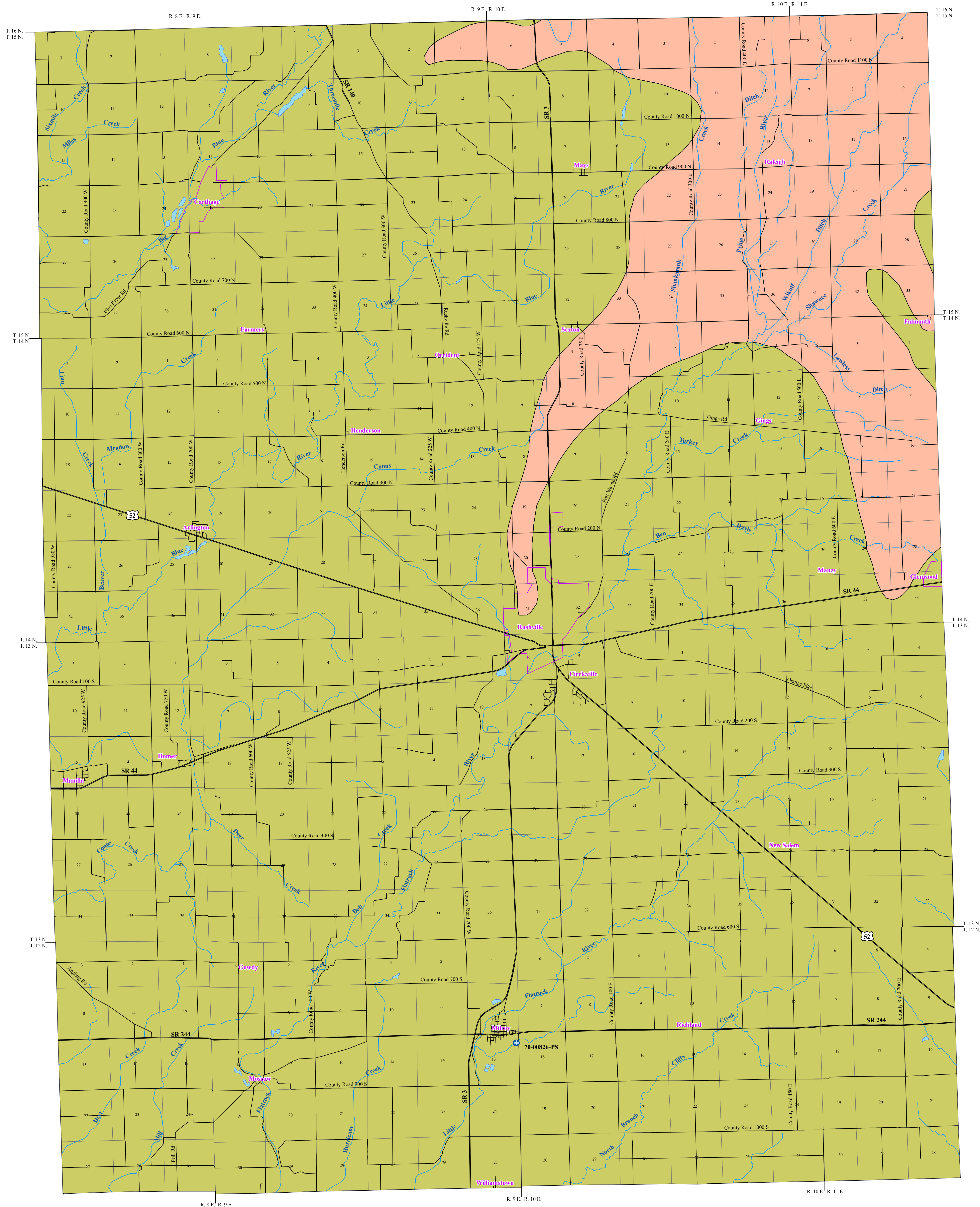


Water Resources and Use in Rush County

Data Sources: U.S. Geological Survey and Indiana Department of Natural Resources



BEDROCK AQUIFER SYSTEMS OF RUSH COUNTY, INDIANA



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 Rush County, rock types exposed at the bedrock surface are moderately productive limestones and dolomites with varying amounts of interbedded shales to poorly productive shale.

Two bedrock aquifer systems are identified for Rush County, from west to east and younger to older: the Silurian and Devonian Carbonates and the Maquoketa Group of Ordovician age. Nearly half of the wells in Rush County are completed in bedrock; and in the southern part of the county, nearly all wells are completed in bedrock. Most of the bedrock aquifers in Rush 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 bedrock aquifer systems in Rush County are overlain by unconsolidated deposits of varying thickness, ranging from less than one foot to more than 350 feet. However, for nearly half of the county, the depth to bedrock is 50 feet or less. This shallow area of bedrock lies primarily in the southern part of the county and along major streams.

The yield of a bedrock aquifer depends on its hydraulic characteristics and the nature of the overlying deposits. Shale and clay 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 aquifer. 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. However, because bedrock aquifer systems may have complex fracturing systems, once a contaminant is introduced into a bedrock aquifer system, it is difficult to track and remediate.

Silurian and Devonian Carbonates Aquifer System

The Silurian and Devonian Carbonates Aquifer System outcrops/subcrops throughout most of Rush County and consists of middle Devonian age carbonates of the Muscatatek Group and underlying Silurian carbonates. Because individual units of the Silurian and Devonian systems are composed 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. Total thickness of the Silurian and Devonian Carbonates Aquifer System in Rush County ranges from 0 in the deepest part of the major bedrock valleys to approximately 180 feet in much of the western part of the county.

The depth to bedrock is commonly 35 to 80 feet. Water wells producing from the Silurian and Devonian Carbonates Aquifer System in Rush County have reported depths that are generally 60 to 115 feet deep. The amount of rock penetrated in this system typically ranges from 5 to 40 feet. Static water levels are typically 5 to 30 feet below land surface.

Water wells completed in this system are generally capable of meeting the needs of domestic users and some high-capacity users in this county. Typical yields for domestic wells in Rush County range from 5 to 15 gallons per minute (gpm), although wells yielding 20 to 30 gpm are not uncommon. However, a few dry holes have also been reported. There is 1 registered significant ground-water withdrawal facility (2 wells) serving the town of Milroy that has reported capacities of about 100 gpm for each well. A table containing information about this facility accompanies the Aquifer Systems maps. There are also 5 known water wells that lie elsewhere within this system that have reported capacities of 60 to 80 gpm. Since there is no centralized location in the county for these higher-producing wells, the higher production is probably related to localized features.

Describing the susceptibility to surface contamination of the Silurian and Devonian Carbonates Aquifer System in Rush County is not simple, because it varies considerably from place to place. The system is not very susceptible to contamination in much of the northern part of Rush County due to thick till deposits. However, the aquifer system is moderately to highly susceptible in places where clay aquitards are absent and in the vicinity of the major river valleys where unconsolidated materials may consist primarily of sand and gravel outwash materials. In the southern part of the county where the thickness of till cover is highly variable, the aquifer system susceptibility to surface contamination is also variable.

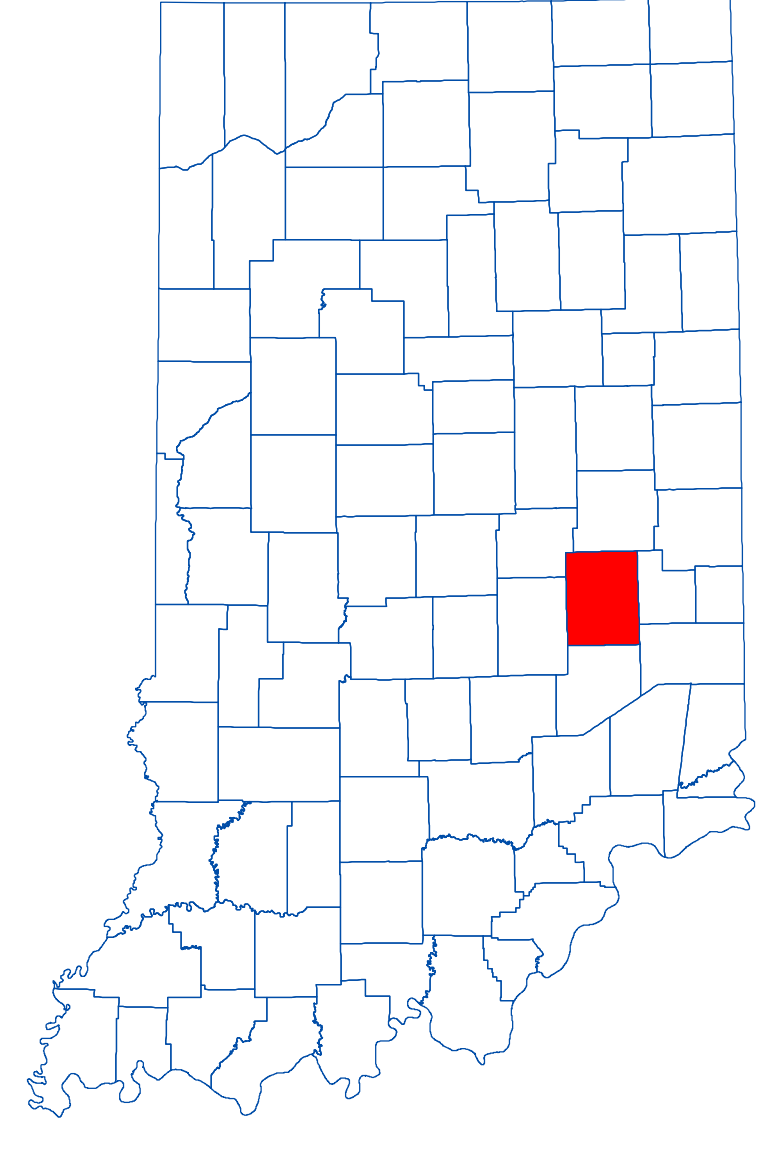
Ordovician - Maquoketa Group Aquifer System

The subcrop area of the Maquoketa Group occurs in buried pre-glacial valleys where the overlying Silurian and Devonian bedrock has been removed by erosion. The Maquoketa Group consists mostly of shales with interbedded limestone units.

There are only about a half dozen wells in Rush County that are thought to be completed in the Maquoketa Group Aquifer System. The wells range in depth from about 100 to 205 feet and are barely capable of meeting the needs of domestic users in Rush County. Static water levels are highly variable.

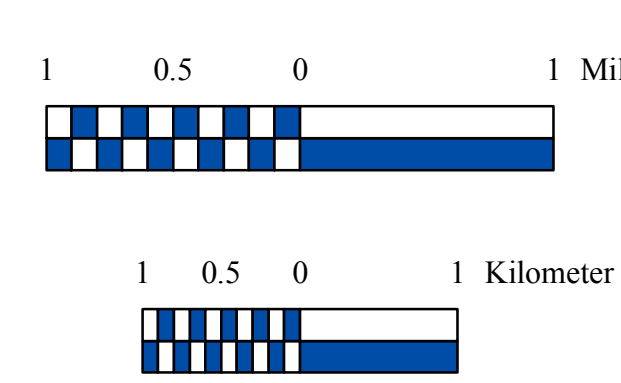
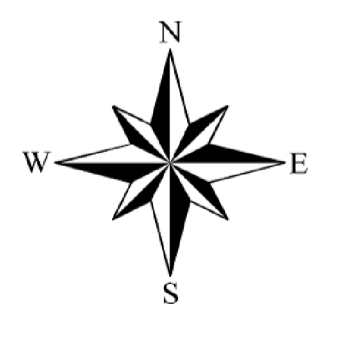
The few reported yields for domestic wells range from 2 to 4 gpm. One dry hole was reported. This aquifer system has a low susceptibility to surface contamination because of thick clay deposits which cover the subcrop area.

Location Map



EXPLANATION

- Registered Significant Ground-Water Withdrawal Facility
- Stream
- County Road
- State Road & US Highway
- Municipal Boundary
- Lake & River



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Bedrock Aquifer Systems of Rush County, Indiana

by
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Division of Water, Resource Assessment Section
February 2008

Map generated by Andrew D. Donlan and Glenn L. Cove
IDNR, Division of Water, Resource Assessment Section

UNCONSOLIDATED AQUIFER SYSTEMS OF RUSH COUNTY, INDIANA

The unconsolidated aquifer systems of Rush County are a result of many geologic factors, including the county's position along the broad top of the north end of the Cincinnati Arch, a major geologic structure in the Midwest. The county's resistant Silurian limestone forms the backslope of a regional escarpment that provides some of the highest bedrock elevations in the state. Drift is thin, and outcrops of the underlying bedrock are abundant along the east side of the regional slope and along some of the major drainages; but glacial deposits increase to the west and north. There is also a northward trending belt of fairly rugged moraine topography that lies over the escarpment in Rush County. Portions of three end moraine systems having a general northeast-southwest orientation provide the structure for the subparallel pattern of northeast-southwest draining streams in the county. Many of the streams follow inherited valleys formerly occupied by glacial drainage during the Pleistocene. Present-day aquifer systems are also affected by the glacial drainage divides and bedrock valleys. Because of these prominent geologic features, Rush County's unconsolidated aquifer systems are transitional with its neighbors. As such, the aquifer systems have characteristics of individual systems in each county without being identical.

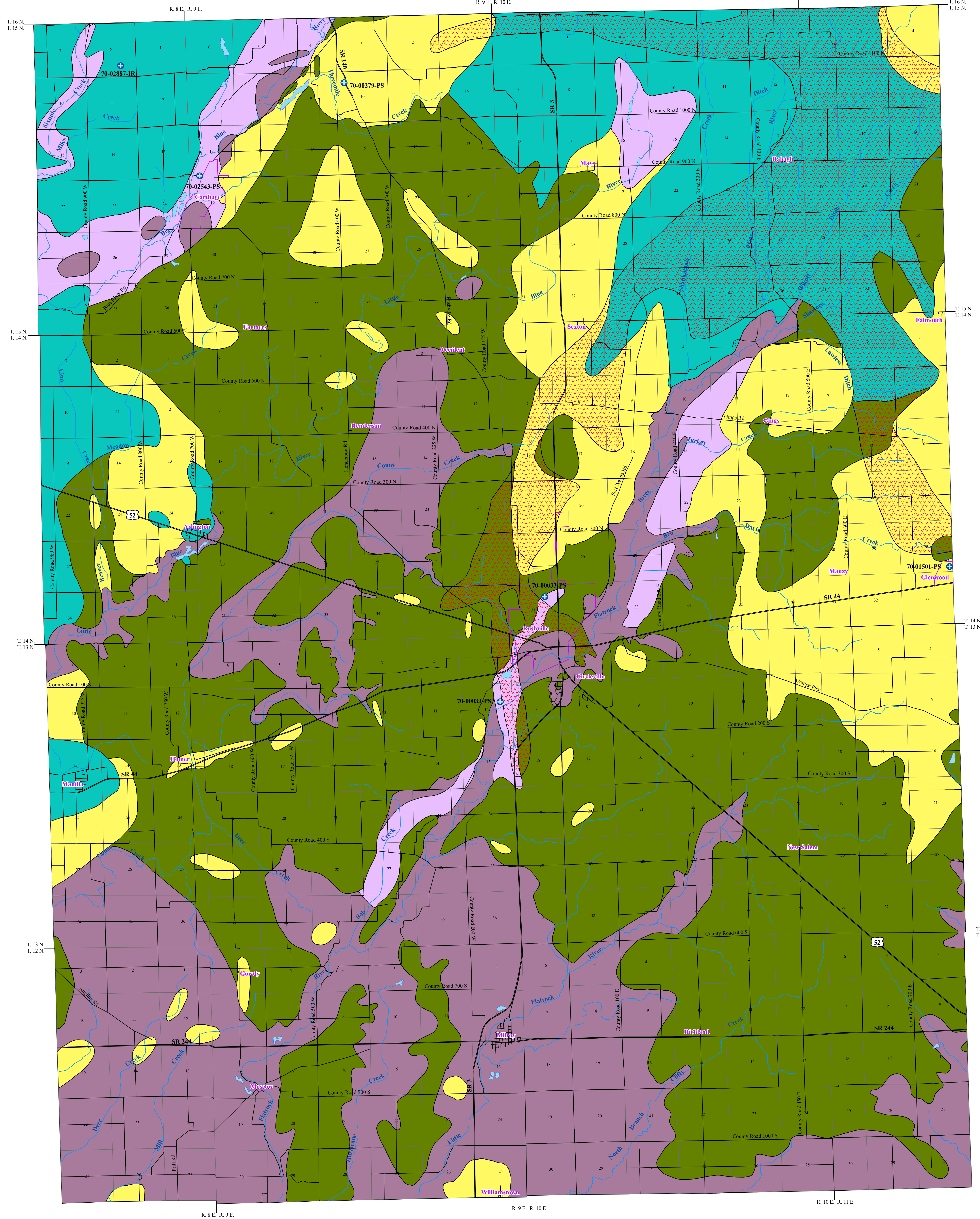
Five unconsolidated aquifer systems have been mapped in Rush County: the **Dissected Till and Residuum / Till Veneer**, the **New Castle Till**, the **New Castle Till Subsystem**, the **New Castle Complex**, and the **White River and Tributaries Outwash Aquifer Subsystem**. The first system includes relatively thin deposits left by continental ice sheets as well as eroded residuum (a product of bedrock weathering). The next four systems comprise sediments deposited by, or resulting from, glacial meltwater, and post-glacial events. Due to the area's complex glacial history, the boundaries between the systems are gradational and may include some small areas of other aquifer systems.

In places, four of these aquifer systems overlie deep buried bedrock valleys. The major valley outlines are provided on the accompanying map. During valley development, bedrock was eroded to create valleys that were then filled with unconsolidated sediment that was subsequently capped with glacial drift or, in places, by late Pleistocene outwash. Because adequate yields are generally found in shallower aquifers, there is little known about the deposits in the deeper portions of the bedrock valleys. The deepest wells drilled into the bedrock valley deposits are approximately 100 to 170 feet deep and do not provide much information regarding potential ground water availability. In nearby Henry County additional information is available to suggest there is little evidence for ground water potential in most of these buried bedrock valleys.

The thickness of unconsolidated sediments in Rush County is variable, from less than 50 feet in much of the southern part of the county and along major drainages, to in excess of 350 feet in a bedrock valley in northeastern Rush County near the Henry County line. Elsewhere in Rush County, unconsolidated deposits are commonly greater than 50 feet thick.

In general, there is little potential for significant ground-water production from the unconsolidated aquifer systems in much of the southern part of the county. Some areas in the county's midsection also have limited potential. However, much of the northern part of the county has good ground water availability, including the capability of supporting high-capacity use in some places.

Variations within geologic environments can cause variation in susceptibility of an aquifer system to surface contamination, therefore, regional estimates of aquifer susceptibility to contamination from the surface can differ considerably from local reality. In addition, man-made structures such as poorly constructed water wells, unplugged or improperly abandoned wells, and open excavations can provide contaminant pathways that bypass the naturally protective clays.



Dissected Till and Residuum Aquifer System / Till Veneer Aquifer System

In Rush County, the Dissected Till and Residuum Aquifer System and the Till Veneer Aquifer System are mapped as one system because they are similar in composition and in aquifer characteristics. As in counties to the south, the Dissected Till and Residuum Aquifer System includes areas where pre-Wisconsin and/or Wisconsin till is thin and dissected due to deep down-cutting by streams and other areas where soils have formed directly from bedrock due to weathering. The Till Veneer Aquifer System encompasses areas where the unconsolidated material is predominantly thin till overlying bedrock, chiefly the product of the deposition of glacial till over an uneven, eroded bedrock surface rather than erosion of till by younger streams. Also included in this aquifer system are relatively thin deposits of alluvium and colluvium in many stream valleys.

Much of southern Rush County is mapped as Dissected Till and Residuum, especially the southwestern part of the county and along the Rush/Decatur county line. Thin till over a bedrock high, west and northwest of Rushville, is mapped as the Till Veneer Aquifer System. Isolated patches located along the Big Blue River in northwestern Rush County are also mapped in this system. Areas along the Flat Rock River near Rushville and the southern part of the town itself are also mapped within this system. Similarly, isolated areas are mapped along the Little Blue River, southwest of Arlington to the Shelby County line.

There is little potential for ground-water production in the Dissected Till and Residuum Aquifer System or the Till Veneer Aquifer System in Rush County. Because the bedrock underlying this system is generally a more erodible material, very few wells are completed in unconsolidated materials. The total thickness of these systems is less than 50 feet, and static water levels commonly range from 10 to 30 feet below the surface. Where present, sand and gravel units are typically less than 3 feet thick. Large-diameter bored (bucket-rig) wells are typically used in this county to produce and store water from thin sands within the predominantly clay and silt materials of this aquifer system.

Together, the Dissected Till and Residuum Aquifer System and the Till Veneer Aquifer System have the most limited ground-water resources of the unconsolidated aquifer systems in the county. Because of the generally low permeability of the near-surface materials, these systems are not very susceptible to contamination from surface sources.

New Castle Till Aquifer System

The New Castle Till Aquifer System is composed primarily of glacial deposits that are generally thicker than 50 feet and are made up of till separated by intratill sand and gravel aquifers that, in general, have limited thickness and extent. Unconsolidated deposits within the boundaries of this system typically range in thickness from 50 feet to 150 feet, however, a small part of the system lying north of Rushville overlies a buried bedrock valley where it has a thickness in excess of 150 feet.

Geographically, the New Castle Till Aquifer System is comprised of large and small fragments scattered throughout the county. The largest contiguous areas mapped within this system lie east of Rushville near the Fayette County line, along State Road 3 north of Rushville, and south of Knightstown near the Henry County line.

Of special note are small isolated areas in the southwestern part of the county that are mapped as New Castle Till Aquifer System. These "pods" differ from most areas mapped within this system, but are so mapped because they differ significantly from the aquifer systems surrounding them. These "pods" occur primarily along or adjacent to narrow drainages where accumulations of sand and/or gravel have been deposited. Little is known about how areally extensive the coarse deposits extend, therefore they are mapped as small pods with alignments primarily from northeast to southwest, following previous and present drainage.

Potential aquifer materials include outwash sands and/or gravels that commonly range from 5 to 10 feet in thickness. However, thicknesses greater than 10 feet are not uncommon, especially in the area of this aquifer system located south of Knightstown near the Henry County line. Reported well depths are generally 40 to 90 feet; however, south of Knightstown, well depths in this system exceed 100 feet. Some flowing wells are reported, but static water levels generally range from 6 to 40 feet below the surface. In the area south of Knightstown however, static levels are generally 50 to 60 feet below the surface.

This system is capable of meeting the needs of domestic and some high-capacity users. Domestic well capacities are typically 10 to 25 gallons per minute (gpm). There are two registered significant ground-water withdrawal facilities in the New Castle Till Aquifer System in Rush County. One registered facility (2 wells), located in the part of the system lying south of Knightstown, reports individual well capacities of 250 gpm and 400 gpm. Another is located east of Rushville near the Fayette County line to supply the town of Glenwood (approximately 200 gpm). Other wells located in the area between Maury and Glenwood appear to have good potential for high-capacity usage. There are also discontinued registered facilities that are located in this aquifer system north of Rushville having reported capacities up to 500 gpm.

The New Castle Till Aquifer System is generally not susceptible to surface contamination because productive sands and gravels are generally overlain by thick low-permeability glacial till.

New Castle Till Aquifer Subsystem

Areas in Rush County where unconsolidated materials generally exceed 50 feet in thickness, yet have little aquifer potential, are mapped as New Castle Till Aquifer Subsystem. Unconsolidated materials in this system are typically 50 to 100 feet thick. Much of Rush County's northwest-southeast trending midsection is mapped as New Castle Till Aquifer Subsystem. In addition, there are a few isolated areas near the southern county line and in uplands on either side of Flat Rock River valley that are also included in this system.

Wells completed in this system in Rush County are typically 40 to 60 feet deep with static water levels commonly 15 to 25 feet below the surface. Potential aquifer materials include thin, intratill sand and gravel deposits that are typically less than 4 feet thick. Any aquifer material present is overlain by a till cap that is highly variable in thickness.

The New Castle Till Aquifer Subsystem is capable of meeting the needs of some domestic users in the county. However, most wells constructed in this system bypass the unconsolidated materials and use the generally more dependable underlying bedrock aquifer. Well yields from this system are commonly less than 10 gpm.

The New Castle Till Aquifer Subsystem is generally not very susceptible to surface contamination because its intratill sand and gravel units are generally overlain by thick till deposits.

New Castle Complex Aquifer System

The New Castle Complex Aquifer System is characterized by unconsolidated deposits that are highly variable in material and thickness. In general, this system may be thought of as a series of stacked, complex sequences of surficial and/or intratill sand and/or gravel deposits and inter-layered till deposits. In Rush County, this system typically has a thickness greater than 100 feet. However, in places the system overlies deep buried bedrock valleys where it reaches a maximum thickness of more than 350 feet in the northeast part of the county near the Henry County line. Sand and gravel aquifer deposits in the system vary from thin to massive and are in places, overlain by thick till. Water-bearing sand and/or gravel deposits in excess of 10 feet are common in this system.

The New Castle Complex Aquifer System is mapped in a large area of the northern part of Rush County, including areas near the Henry County line and the Hancock/Shelby county boundaries. This system also includes much of the area overlying a prominent bedrock valley in the northeastern part of the county and areas near the headwaters of bedrock valleys along the county's western boundary.

The system displays differing characteristics across the county. The primary aquifers within the system in the northwestern part of the county are generally thick intratill sands and/or gravels. These aquifers are highly variable in depth and lateral extent and are in places confined by variably thick clay or till sequences. The water-bearing deposits are generally deeper and have deeper static water levels than the recent surficial outwash deposits found in the northeastern part of this system in the county.

The surficial outwash plain deposits that overlie most of the New Castle Complex Aquifer System in northeast Rush County are a result of Pleistocene glaciation in the area. Static water levels are generally less than 20 feet beneath the surface, and water-bearing sands and/or gravels are very near the surface in many places. Typical well depths range from 35 to 90 feet, but many wells are at a depth in excess of 100 feet. This system is capable of meeting the needs of domestic and some high-capacity users in Rush County. Domestic well yields are commonly 10 to 40 gpm, and static water levels are generally 5 to 40 feet below the surface.

The only registered high-capacity ground-water facility in this aquifer system is located in northwest Rush County. The reported capacity for the registered facility is 2000 gpm. However, 6 water wells that lie elsewhere within this system have reported capacities in excess of 70 gpm. Based on well log descriptions, this system has greater yield potential than is currently being used. In nearby Henry County, high-capacity wells developed in this system report yields up to 1000 gpm. However, such high yields should not be expected in most of Rush County.

The New Castle Complex Aquifer System is not very susceptible to contamination where thick clay materials overlie aquifers, such as in northwest Rush County. However, in some areas where outwash is present at or near the surface and clay deposits are thin (in northeastern Rush County), the system is of moderate to high risk.

White River and Tributaries Outwash Aquifer Subsystem

The White River and Tributaries Outwash Aquifer Subsystem in the Upper East Fork White River Basin has somewhat different characteristics from what is found in many other parts of the state where these systems are mapped. In this watershed, bedrock elevations are among the highest in the state. Most modern streams have cut only a shallow valley or follow inherited glacial drainages. The glacial valleys carried outwash from the melting glaciers during Wisconsin and pre-Wisconsin glacial periods, but much of the outwash materials have been eroded by subsequent streams such as the Big Blue River, Flatrock River, and Hurricane Creek. Therefore, many outwash deposits in Rush County and the upper East Fork White River watershed are generally thinner than their counterparts in much of the rest of the state.

In Rush County, the White River and Tributaries Outwash Aquifer Subsystem is mapped in the northwest corner of the county near the Hancock County boundary, primarily in the valleys of the Little Blue and Big Blue Rivers. In the town of Rushville and along the Flatrock River valley to the northeast and southwest of the town, this aquifer system is present. However, in places, much of the outwash material has been eroded away by the Flatrock River. Northeast of town, the deposits still occur on the eastern side of valley, but consist of thin outwash over shallow bedrock having some potential, but probably limited. The same is true for the area mapped to the far southwest of town.

In the northeastern part of the county, a large area of contiguous outwash plain deposits is mapped as two different aquifer systems. The area northeast of the town of Maury is mapped as White River and Tributaries Outwash Aquifer Subsystem lies on a bedrock high that has unconsolidated deposits with a thickness of less than 100 feet. The area mapped as New Castle Complex has thick deposits as much as 350 feet that fill a bedrock valley.

Total thickness of unconsolidated deposits in the White River and Tributaries Outwash Aquifer Subsystem in Rush County ranges from less than 50 feet along the margins of streams to more than 125 feet along the valley of Scamle Creek in the northwest corner of the county. Well depths typically range from 25 to 60 feet. Sand and gravel aquifer deposits within this system are generally 5 to 30 feet thick. In a few areas, the bedrock is shallow and some drillers bypass the unconsolidated sediments and complete the wells in bedrock. It is likely that the overlying sands and gravels contribute significantly to the well yield.

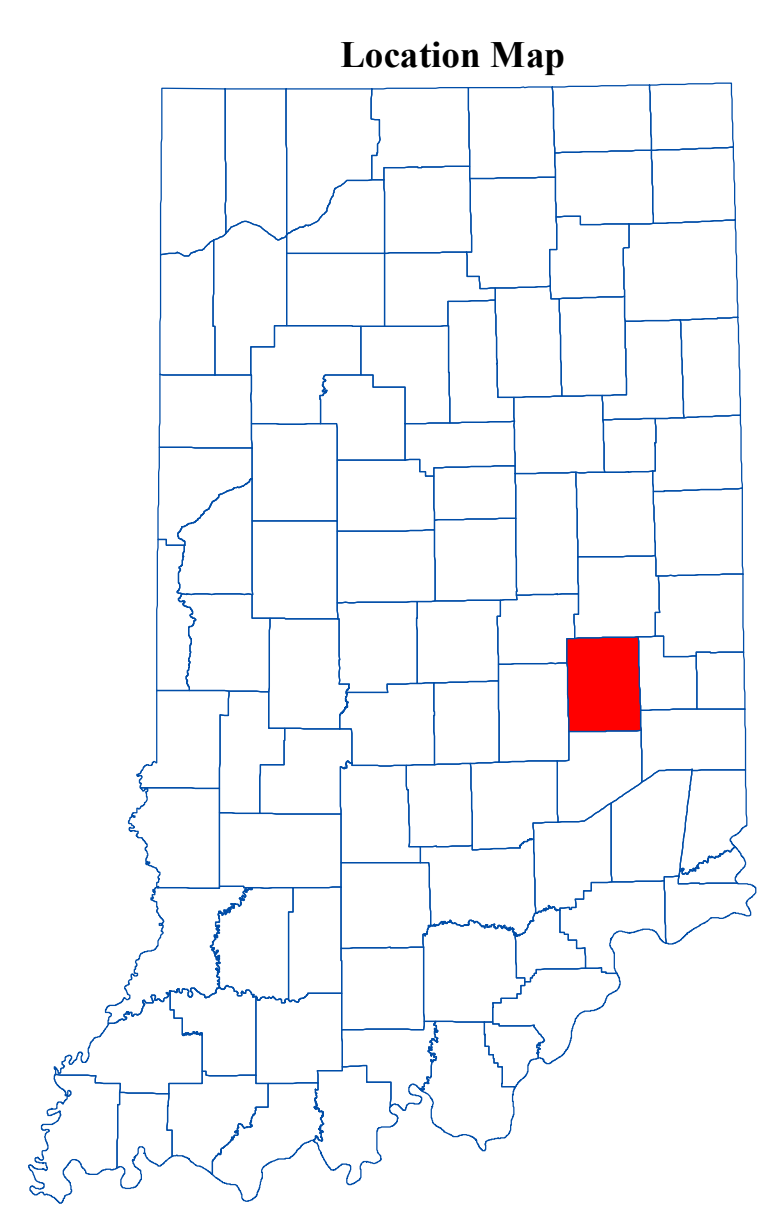
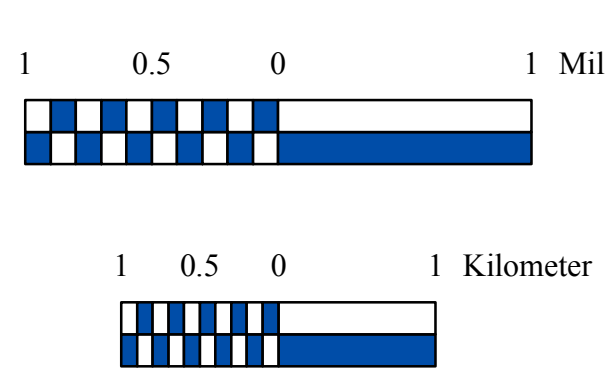
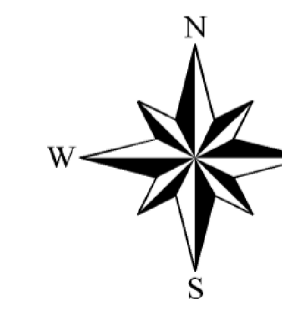
The White River and Tributaries Aquifer Subsystem in Rush County has the potential to meet the needs of domestic and some high-capacity users. Domestic well yields are typically 10 to 25 gpm with static water levels 10 to 30 feet below surface. There are 2 registered high-capacity ground-water withdrawal facilities in the county, Rushville (5 wells) and Carthage (2 wells). The town of Rushville has a reported total capacity of 1850 gpm. Carthage has a reported total capacity of 500 gpm. Although not a registered facility, a water well located in northwest Rush County south of Charlottesville has a reported deep, 40-foot sand and gravel deposit.

In general, the White River and Tributaries Aquifer Subsystem in Rush County is highly susceptible to surface contamination because most of the water bearing materials are close to the surface and are not overlain by significant clay or silt deposits.



EXPLANATION

- Registered Significant Ground-Water Withdrawal Facility
- Stream
- County Road
- State Road & US Highway
- Municipal Boundary
- Lake & River
- System over buried valley with no or unknown potential



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Unconsolidated Aquifer Systems of Rush County, Indiana

by
Judith E. Beatty
Division of Water, Resource Assessment Section
February 2008

Rush County

