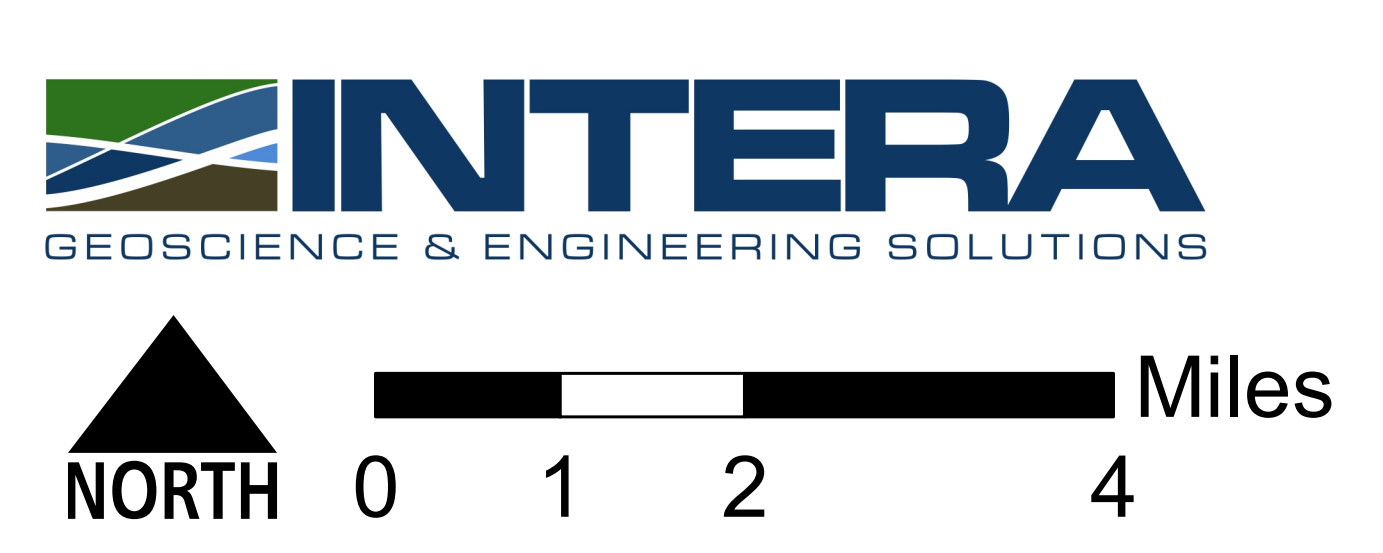
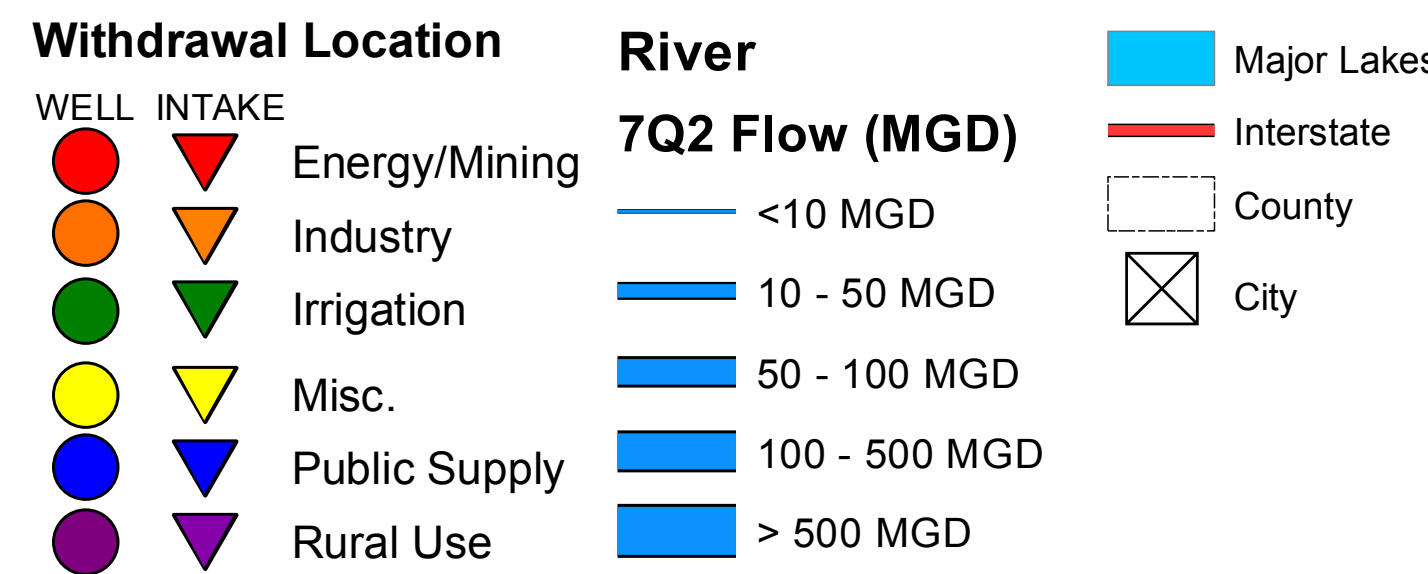
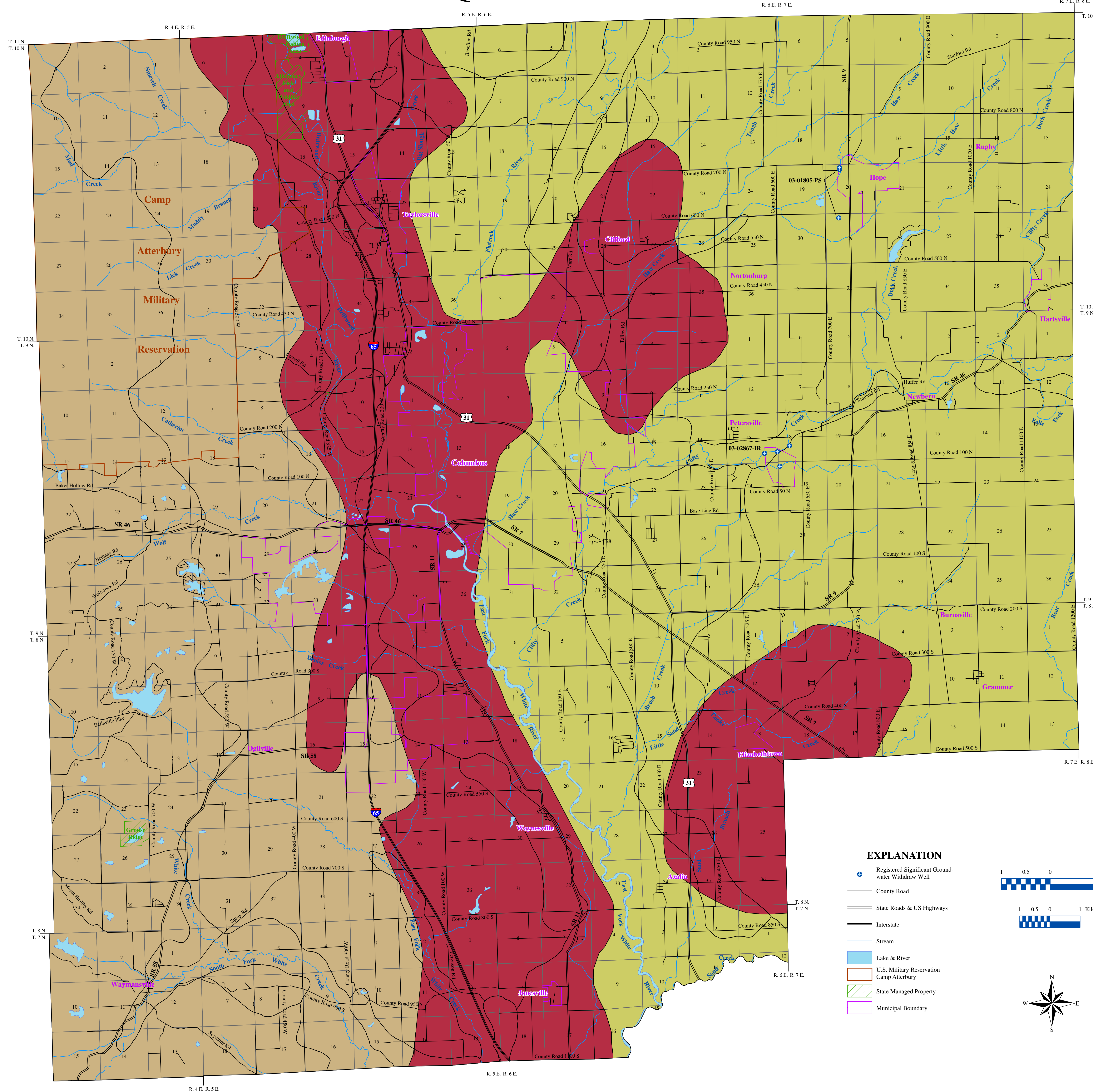


Water Resources and Use in Bartholomew County

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



BEDROCK AQUIFER SYSTEMS OF BARTHOLOMEW 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, such as jointing, fracturing, and solution activity, generally increase the hydraulic conductivity (permeability) of the upper portion of bedrock aquifer systems. Because permeability is generally greatest near the bedrock surface, bedrock units within the upper 100 feet are commonly the most productive aquifers.

Bedrock aquifer systems in the county are overlain by unconsolidated deposits of varying thickness. 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 zone.

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 jointing may occur in aquitards, which can increase recharge to the underlying aquifers. Hydraulic properties of the bedrock aquifers are highly variable.

Three bedrock aquifer systems are identified for Bartholomew County. They are, from west to east, youngest to oldest: the Borden Group of Mississippian age; the New Albany Shale of Devonian and Mississippian age; and the Silurian and Devonian Carbonates.

The susceptibility of bedrock aquifer systems to surface contamination is largely dependent on the type and thickness of the overlying sediments. Just as recharge for bedrock aquifers cannot exceed that of overlying unconsolidated deposits, susceptibility to surface contamination will not exceed that of overlying deposits. However, because the bedrock aquifer systems may have complex fracturing systems, once a contaminant has been introduced into a bedrock aquifer system, it will be difficult to track and remediate.

Mississippian -- Borden Group Aquifer System

In Bartholomew County, the Mississippian age Borden Group Aquifer System is present in most of the western third of the county. This bedrock aquifer system is composed mostly of siltstone and shale, but fine-grained sandstones are also common. Although carbonates are rare, discontinuous interbedded limestone lenses are present, mostly in the upper portion of the group.

The Borden Group in Bartholomew County is up to 600 feet thick and generally thins as it dips to the southwest beneath younger rock formations. Depth to bedrock is typically 20 to 55 feet. Well depths in the Borden Group Aquifer System range from 30 to 400 feet. However, wells are typically completed at depths of 40 to 85 feet and typically penetrate 5 to 50 feet of bedrock.

Because the Borden Group is generally not very productive, it is typically used only where overlying deposits do not contain an aquifer. The Borden Group is commonly described as an aquitard, and yields of wells completed in it are usually quite limited. Many wells, however, are able to produce sufficient water for domestic purposes by relying on extra well-bore storage created by drilling relatively large diameter and relatively deep wells. The yield of most domestic wells completed in the group is less than 10 gallons per minute (gpm). Dry wells have been reported. Static water levels are typically between 10 and 35 feet below surface.

The Borden Group is composed primarily of fine-grained materials that limit the movement of ground water. In areas where overlying clay materials are present, the Borden Group Aquifer System is at low risk to contamination from the surface or near surface. However, in some areas the bedrock is overlain by outwash materials that may be capped by thin deposits of eolian derived loess, colluvium, or lacustrine silt. These areas are at moderate risk to contamination.

Devonian and Mississippian -- New Albany Shale Aquifer System

The New Albany Shale Aquifer System in Bartholomew County is an extremely limited ground-water resource. This aquifer system consists mostly of brownish-black carbonaceous shale, greenish-gray shale, and minor amounts of dolomite and dolomitic quartz sandstone.

The New Albany Shale in Bartholomew County can be up to 120 feet thick and generally thickens as it dips southwest beneath younger strata. The outcrop/subcrop area is present along an approximate north-south band of the west-central portion of the county and along the eastern south-central edge of the county. Depth to bedrock is typically 30 to 75 feet. Completed well depths are typically 60 to 130 feet and penetrate 10 to 70 feet of bedrock.

This aquifer system is considered a poor ground-water resource and is generally described as an aquitard. However, a few domestic wells have been completed in this system. Typical yields are 10 gpm or less with some dry holes reported. Static water levels typically range from 10 to 40 feet below surface.

The permeability of shale materials is considered low. The New Albany Shale Aquifer System, therefore, has a low susceptibility to contamination introduced at or near the surface.

Silurian and Devonian Carbonates Aquifer System

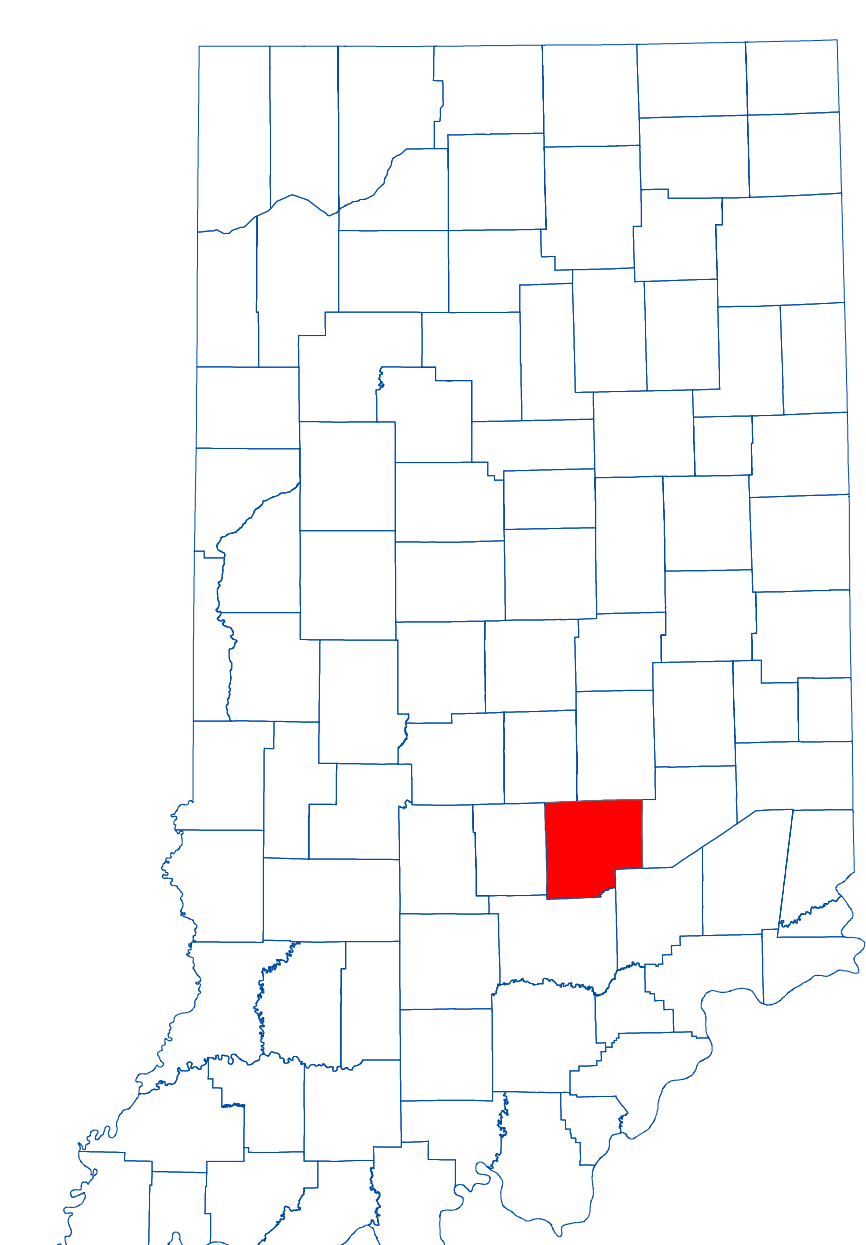
In Bartholomew County, the outcrop/subcrop area of the Silurian and Devonian Carbonates Aquifer System is present along most of the eastern half of the county. This system includes middle-Devonian age carbonates (limestone and dolomite) of the Muscatatuck Group and the underlying carbonates of Silurian age. Because carbonate units of Silurian and Devonian age are similar, and cannot easily be distinguished on the basis of water well records, they are considered as a single water-bearing system.

The Muscatatuck Group in Bartholomew County is up to 75 feet thick and generally increases in thickness as it dips to the southwest beneath younger rock formations. The underlying Silurian carbonates are up to 150 feet thick and also thicken as they dip to the southwest. The combined thickness, therefore, is up to 225 feet with depth to bedrock typically 20 to 50 feet below surface. Completed well depths range from 20 to 365 feet, but are typically 60 to 110 feet. The typical amount of bedrock penetrated ranges from 25 to 70 feet.

In Bartholomew County, water wells in the Silurian and Devonian Carbonates Aquifer System are capable of meeting the needs of domestic and some high-capacity users. Typical domestic yields range from 5 to 20 gpm. Two facilities with high-capacity wells have reported yields that range from 90 to 450 gpm. Static water levels range from 15 to 40 feet below surface with some drillers reporting "flowing" wells.

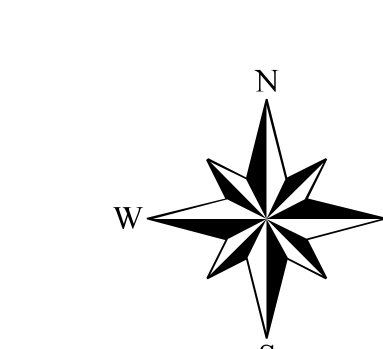
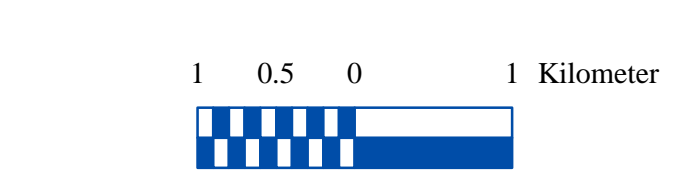
Most of the Silurian and Devonian Carbonates Aquifer System is overlain by thick clay deposits. Therefore, most of the aquifer system is considered at low risk to contamination. However, in some areas the aquifer system is overlain by unconsolidated deposits composed primarily of sand and gravel outwash materials. These deposits may have thin clay at the surface. In such areas, the aquifer system is considered at moderate to high risk.

Location Map



EXPLANATION

- Registered Significant Water Withdrawal Well
- County Road
- State Roads & US Highways
- Interstate
- Stream
- Lake & River
- U.S. Military Reservation
- Camp Atterbury
- State Managed Property
- Municipal Boundary



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.

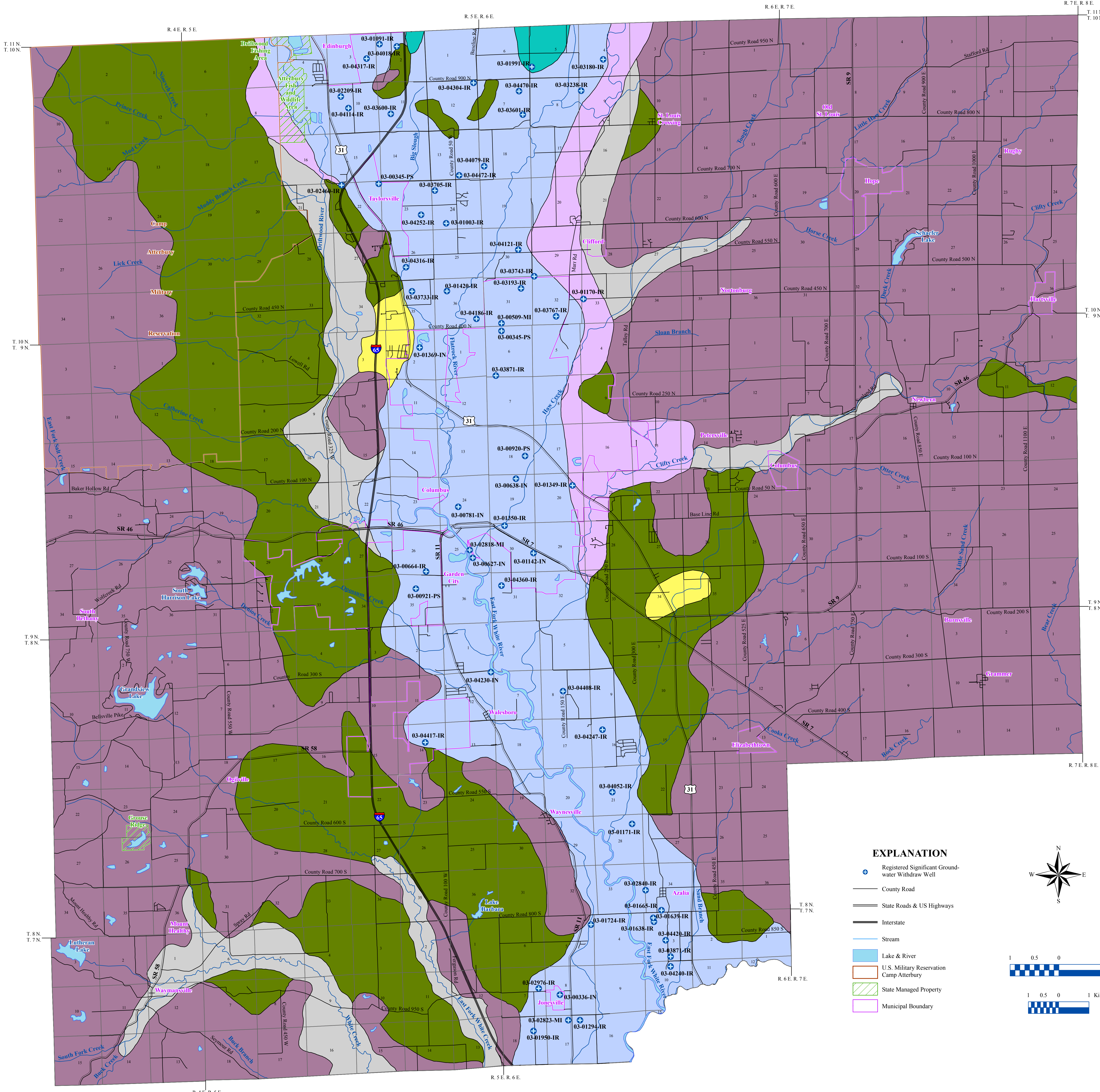
This map was created from several existing shapefiles. Township and Range Lines of Indiana (line shapefile, 20020621), Land Survey Lines of Indiana (polygon shapefile, 20020621) and County Boundaries of Indiana (polygon shapefile, 20020621), were all from the Indiana Geological Survey and based on a 1:24,000 scale, except the Bedrock Geology of Indiana (polygon shapefile, 20020318) which was at a 1:500,000 scale. Draft road shapefiles, System1 and System2 (line shapefiles, 2003), were from the Indiana Department of Transportation and based on a 1:24,000 scale. Populated Areas in Indiana: 2000 (polygon shapefile, 20021000) was from the U.S. Census Bureau and based on a 1:100,000 scale. Streams27 (line shapefile, 20000420) was from the Center for Advanced Applications in GIS at Purdue University. Managed Areas 96 (polygon shapefile, various dates) was from IDNR.

Bedrock Aquifer Systems of Bartholomew County, Indiana

by
Randal D. Maier
Division of Water, Resource Assessment Section

December 2004

UNCONSOLIDATED AQUIFER SYSTEMS OF BARTHOLOMEW COUNTY, INDIANA



Seven unconsolidated aquifer systems have been mapped in Bartholomew County: the Till Veneer / Dissected Till and Residuum, the Alluvial, Lacustrine, and Backwater Deposits, the New Castle / Scottsburg Till System, the New Castle / Scottsburg Till Subsystem, the New Castle / Scottsburg Complex, the White River and Tributaries Outwash, and the White River and Tributaries Outwash Subsystem. Boundaries of these aquifer systems are commonly gradational and individual aquifers may extend across aquifer system boundaries.

The thickness of unconsolidated sediments in Bartholomew County is quite variable. Sediments that overlie bedrock range from exposure near the east county line along portions of the Fall Fork of Clifty Creek, to as much as 155 feet.

Regional estimates of aquifer susceptibility to contamination from the surface can differ considerably from local reality. Variations within geologic environments can cause variation in susceptibility to surface contamination. 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.

Till Veneer / Dissected Till and Residuum Aquifer System

The Till Veneer / Dissected Till and Residuum Aquifer System is mapped along the western edge of Bartholomew County and over most of the eastern third of the county. It has the most limited groundwater resources of the unconsolidated aquifer systems.

Unconsolidated deposits of this aquifer system consist mostly of till with thin layers of stratified drift and, in some areas along the westernmost edge of the county, thin, eroded bedrock residuum. Thickness of these sediments typically ranges from less than 5 feet where only residuum is present, to 50 feet where thick glacial till deposits have filled small bedrock valleys.

Because this aquifer system is generally thin and not very productive, most drillers prefer to complete wells in the underlying bedrock aquifer. Approximately 88 percent of wells in the area are completed in bedrock. However, a few wells have been completed in the unconsolidated deposits. Large diameter bucket type wells are commonly used to enhance yield from thin, discontinuous silt, sand and gravel deposits.

Total well depths are commonly 35 to 50 feet. Where present, thin sands and gravels are commonly less than 5 feet thick and typical yields are less than a few gallons per minute (gpm). Because of the low permeability of the surface materials, this aquifer system is not very susceptible to contamination from surface sources.

Alluvial, Lacustrine, and Backwater Deposits Aquifer System

The Alluvial, Lacustrine, and Backwater Deposits Aquifer System is made up of heterogeneous bodies of alluvial, colluvial, and lacustrine materials within valley bottoms and terraces of some larger streams tributary to the East Fork White River.

Unconsolidated deposits within this system come from two sources. The first is alluvium deposited by streams along with colluvium eroded from valley walls and upland areas. The second source is lacustrine deposits formed in relatively stagnant lake water. The alluvial deposits are attributed to the White River valley becoming choked with outwash from receding glaciers. The outwash deposits effectively dammed the tributary streams, thus creating lakes in which fine-grained lacustrine deposits accumulated.

In Bartholomew County this system is mapped along portions of several tributaries to the East Fork White River. These include: Clifty Creek in the east central portion of the county; the Driftwood River in the north-central portion of the county; the south and east forks of White Lick Creek in the southwest portion of the county; and the Flatrock River and Hawk Creek to the northeast of Columbus.

Total thickness of unconsolidated materials overlying bedrock in this system is commonly less than 50 feet. In other counties where this system is mapped sand and gravel lenses, where present, are typically less than 5 feet thick. However, in isolated areas of Bartholomew County sand and gravel deposits can be up to 15 feet thick.

This aquifer system is a limited resource and there are no known wells that actually produce from these deposits. Drillers commonly bypass the unconsolidated deposits in favor of the underlying bedrock aquifer. In many places large-diameter bored (bucket-rig) wells could produce adequate water from sands within the predominantly clay and silt materials of this aquifer system to satisfy domestic needs.

This aquifer system is generally marked by thick surface deposits of soft silt and clay that have a low susceptibility to surface contamination. The susceptibility is greater in areas where the surficial silt and clay deposits are thin and directly overlie outwash deposits.

New Castle / Scottsburg Till Aquifer System

The New Castle / Scottsburg Till Aquifer System are limited to two small areas of central Bartholomew County. The mapped deposits generally include a thick clay unit that caps outwash deposits of variable thickness. Limited well data is available because only about 4 percent of all wells in the county completed in unconsolidated deposits are mapped in the New Castle / Scottsburg Till Aquifer System. Well depths generally range from 50 to 125 feet. Thickness of aquifer deposits range from 2 to 48 feet and are capped by clay ranging from 20 to 105 feet.

The New Castle / Scottsburg Till Aquifer System is capable of supplying domestic and some high capacity users. Domestic well yields range from 8 to 40 gpm with static water levels from 8 to 28 feet below surface. There are no known registered significant water withdrawal facilities in this county. This system is generally not very susceptible to surface contamination because the outwash aquifers are overlain by thick till deposits.

New Castle / Scottsburg Till Aquifer Subsystem

The New Castle / Scottsburg Till Aquifer Subsystem is mapped similar to the New Castle / Scottsburg Till Aquifer System, however, outwash aquifer deposits are generally much thinner and potential yield is less. In Bartholomew County this system is mapped predominantly along a north-south band in the west-central part of the county. It is also present in several smaller areas in the eastern half of the county.

Approximately 39 percent of wells completed in the area bypass the unconsolidated deposits in favor of the underlying bedrock aquifer system. However, this system is capable of meeting the needs of some domestic users. Well depths range from 20 to 157 feet but are typically 45 to 80 feet deep. Aquifer deposits are commonly 3 to 10 feet thick. Surficial clay and sandy-clay deposits overlying aquifer materials are commonly from 30 to 70 feet.

Well yields are typically 5 to 15 gpm with static water levels commonly from 20 to 45 feet below surface. Greater capacities are often associated with significant to complete drawdowns. Some dry holes have been reported. Also, many drillers continue borehole depths beneath the aquifer units to create storage.

The New Castle / Scottsburg Till Aquifer Subsystem is generally not very susceptible to surface contamination because aquifer units are overlain by thick till deposits. However, in a few places overlying clay deposits are not present. These areas are considered at high risk to contamination.

New Castle / Scottsburg Complex Aquifer System

The New Castle / Scottsburg Complex Aquifer System is mapped in two small areas along the north-central edge of Bartholomew County. Complex multiple glacial advances resulted in a sequence of till and outwash units that are quite variable in position and thickness. The sand and gravel deposits vary from thin to massive and are typically discontinuous and overlain by a till.

This system is a southernmost extension of Shelby County and data are extremely limited in Bartholomew County. However, reported information from nearby Shelby County note that wells are typically completed at depths from 50 to 90 feet. Outwash aquifer deposits are commonly 10 to 20 feet thick. This system is capable of meeting the needs of domestic and high capacity users. Domestic well capacities are generally 10 to 20 gpm with static water levels from 12 to 35 feet below surface. Reported high capacity well yields from registered significant groundwater withdrawal facilities in Shelby County range from 80 to 1000 gpm.

The New Castle / Scottsburg Complex Aquifer System is generally not susceptible to surface contamination where thick clays overlie aquifer deposits. However, in some areas outwash is near the surface and clay deposits are thin. These areas are at moderate to high risk to contamination.

White River and Tributaries Outwash Aquifer System

The White River and Tributaries Outwash Aquifer System is mapped along a wide north-south band across the central portion of Bartholomew County. This system contains large volumes of outwash and alluvial deposits that filled the river valley of the East Fork White River. Thickness of unconsolidated deposits overlying bedrock can be as much as 130 feet within this system. Well depths are typically 40 to 70 feet. Aquifer materials include predominantly sand and gravel deposits that range from 5 to 125 feet thick but are more commonly from 35 to 65 feet thick. In some areas 5 to 10 feet of clay or silt overlie the aquifer materials.

This system has the greatest potential of any aquifer system in Bartholomew County and can meet the needs of domestic and high-capacity users. Domestic well yields range from 5 to 35 gpm. There are 59 registered high-capacity facilities (117 wells) in this system. Reported well capacities are up to 2400 gpm but are typically 300 to 1000 gpm.

In areas that lack overlying clays, this aquifer system is highly susceptible to contamination from surface sources. Where the aquifer system is overlain by clay or silt deposits, the aquifer is moderately susceptible to surface contamination.

White River and Tributaries Outwash Aquifer Subsystem

The White River and Tributaries Outwash Aquifer Subsystem includes areas adjacent and parallel to the White River and Tributaries Outwash Aquifer System. The outwash subsystem typically occupies a higher topographic position than that of the outwash system and is marked by thinner outwash deposits that may be overlain by sandy clay, clay, or collan-derived loess and sand.

The White River and Tributaries Outwash Aquifer Subsystem is mapped along a small area in the northeast part of the county along the west edge of the Driftwood River and along Clifty Creek to the east of Columbus continuing north-northeast into Shelby County.

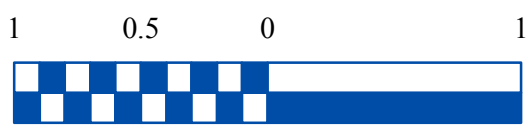
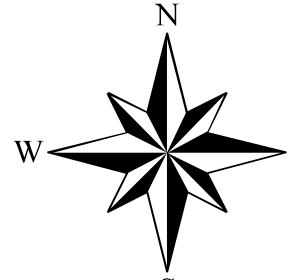
There are few wells available in the White River and Tributaries Outwash Aquifer Subsystem. Total thickness of unconsolidated deposits overlying bedrock ranges from 65 to 150 feet. The thickness of aquifer materials within the unconsolidated deposits are typically between 5 and 45 feet. Well depths range from 30 to 105 feet below surface but are typically between 30 to 60 feet below surface. Many wells do not penetrate the full thickness of the aquifer system.

This aquifer system has the potential to meet the needs of domestic and some high-capacity users. There are three registered significant water withdrawal facilities (4 wells) that report capacities of 180 gpm and 1000 gpm. Domestic well yields are typically from 10 to 30 gpm. Static water levels are typically between 10 and 20 feet below surface.

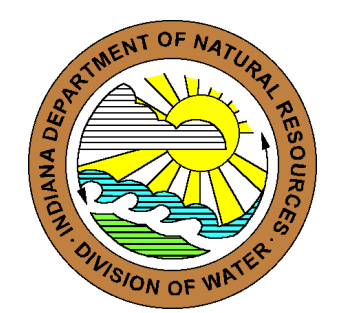
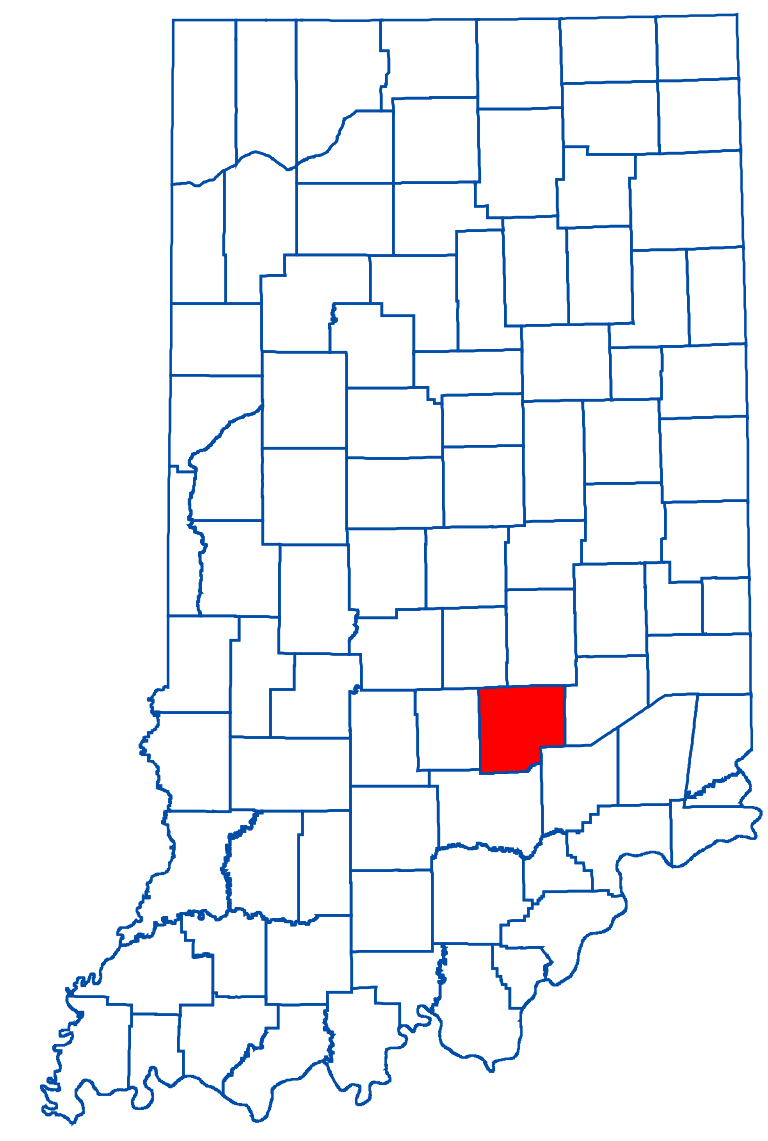
Areas within this aquifer system that have overlying clay or silt deposits are moderately susceptible to surface contamination; whereas, areas that lack overlying clay or silt deposits are highly susceptible to contamination.

EXPLANATION

- Registered Significant Groundwater Withdrawal Well
- County Road
- State Roads & US Highways
- Interstate
- Stream
- Lake & River
- U.S. Military Reservation
- Camp Atterbury
- State Managed Property
- Municipal Boundary



Location Map



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.

This map was created from several existing shapefiles. Township and Range Lines of Indiana (line shapefile, 20020621), Land Survey Lines of Indiana (polygon shapefile, 20020621) and County Boundaries of Indiana (polygon shapefile, 20020621), were from the Indiana Geological Survey and based on a 1:24,000 scale. Draft road shapefiles, System1 and System2 (line shapefiles, 2005), were from the Indiana Department of Transportation and based on a 1:24,000 scale. Populated Areas in Indiana 2000 (polygon shapefile, 20031000) was from the U.S. Census Bureau and based on a 1:100,000 scale. Streams27 (line shapefile, 20000420) was from the Center for Advanced Applications in GIS at Purdue University. Managed Areas 96 (polygon shapefile, various dates) was from DNR. Unconsolidated Aquifer Systems coverage (Maier, 2004, modified 2011) was based on a 1:24,000 scale.

Unconsolidated Aquifer Systems of Bartholomew County, Indiana

by
Randal D. Maier
Division of Water, Resource Assessment Section

December 2004

Bartholomew County

