

Water Resources and Use in Spencer County

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

Withdrawal Location		River	Major Lakes
WELL INTAKE		7Q2 Flow (MGD)	Interstate
● Energy/Mining	▼ Energy/Mining	<10 MGD	County
● Industry	▼ Industry	10 - 50 MGD	City
● Irrigation	▼ Irrigation	50 - 100 MGD	
● Misc.	▼ Misc.	100 - 500 MGD	
● Public Supply	▼ Public Supply	> 500 MGD	
● Rural Use	▼ Rural Use		

INTERA
GEOSCIENCE & ENGINEERING SOLUTIONS

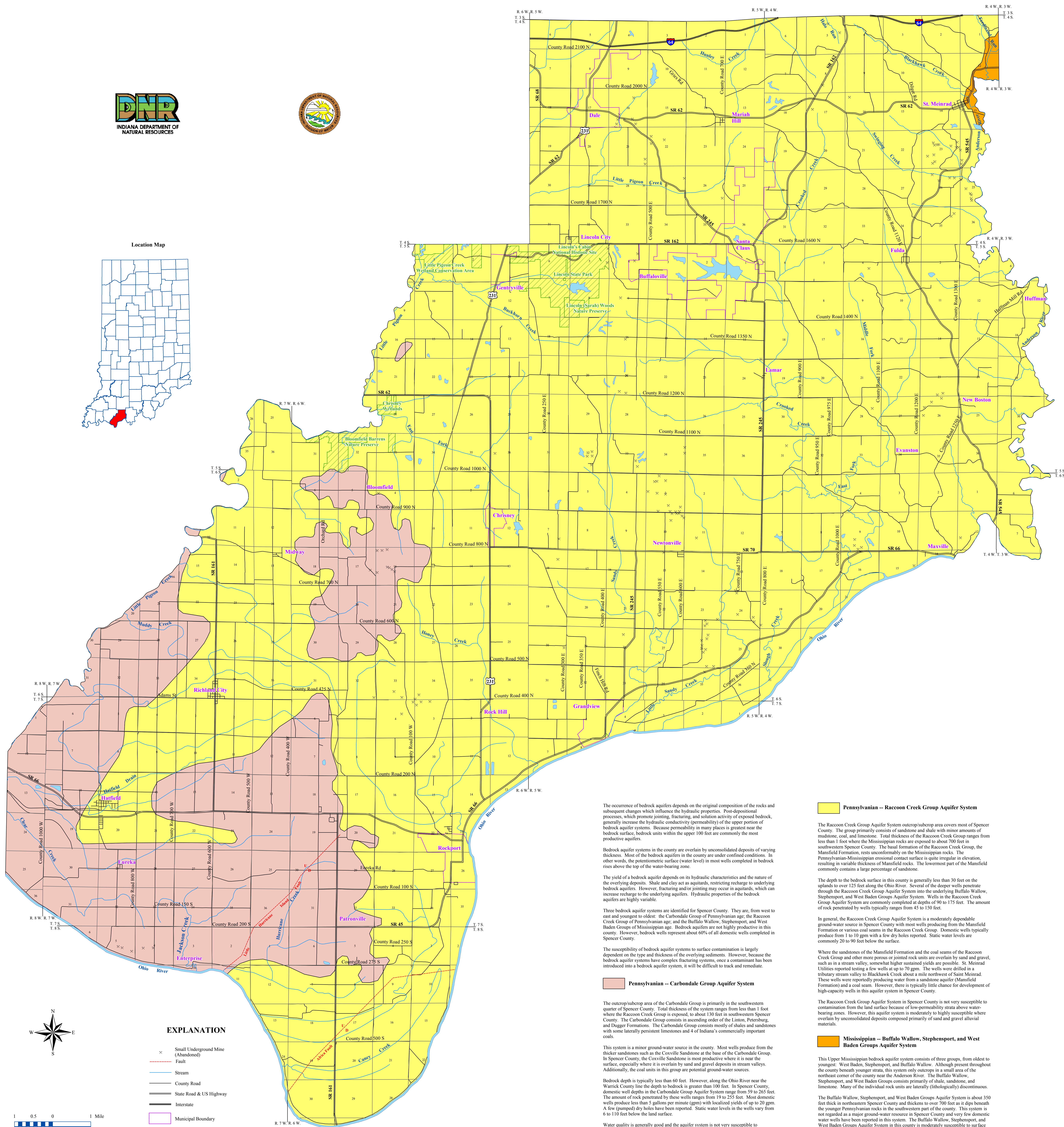
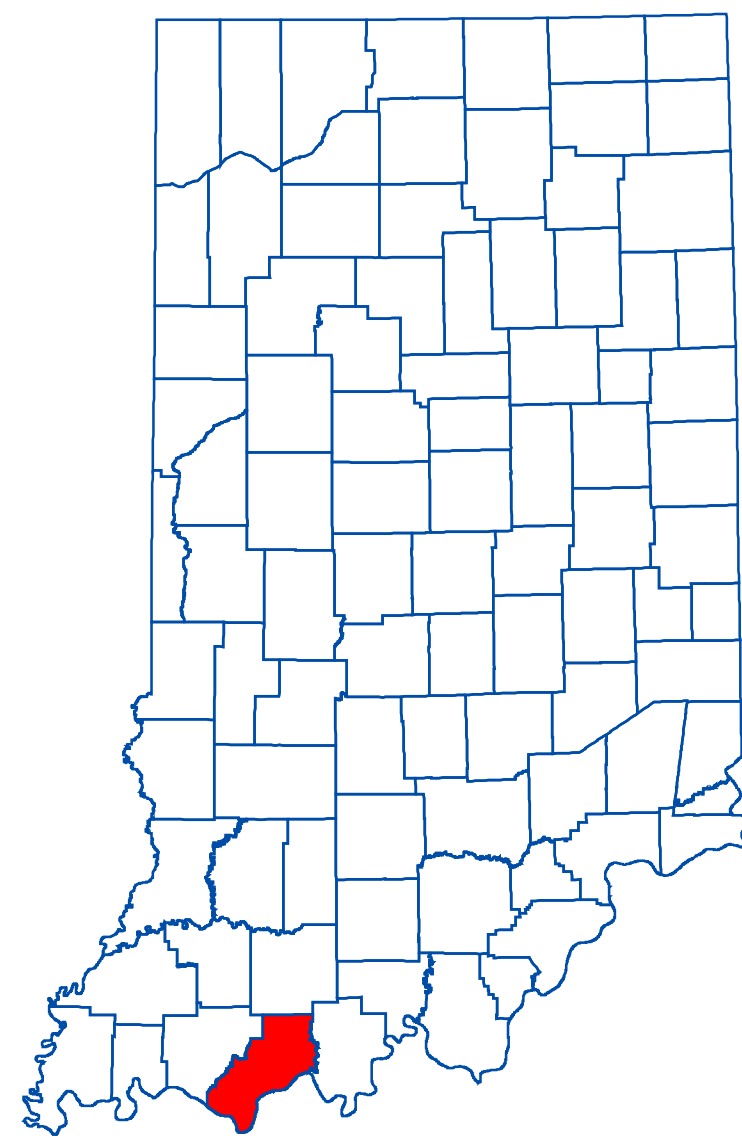
NORTH

0 1 2 4 Miles

BEDROCK AQUIFER SYSTEMS OF SPENCER COUNTY, INDIANA



Location Map



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.

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 clay act as aquicludes, restricting recharge to underlying bedrock aquifers. However, fracturing and/or jointing may occur in aquicludes, which can increase recharge to the underlying aquifers. Hydraulic properties of the bedrock aquifers are highly variable.

Three bedrock aquifer systems are identified for Spencer County. They are, from west to east and youngest to oldest: the Carbonale Group of Pennsylvanian age; the Raccoon Creek Group of Pennsylvanian age; and the Buffalo Wallow, Stephensport, and West Baden Groups of Mississippian age. Bedrock aquifers are not highly productive in this county. However, bedrock wells represent about 60% of all domestic wells completed in Spencer County.

The susceptibility of bedrock aquifer systems to surface contamination is largely dependent on the type and thickness of the overlying sediments. However, 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.

The outcrop/subcrop area of the Carbonale Group is primarily in the southwestern quarter of Spencer County. Total thickness of the system ranges from less than 1 foot where the Raccoon Creek Group is exposed, to about 130 feet in southwestern Spencer County. The Carbonale Group consists in ascending order of the Linton, Petersburg, and Dugger Formations. The Carbonale Group consists mostly of shales and sandstones with some laterally persistent limestones and 4 of Indiana's commercially important coals.

This system is a minor ground-water source in the county. Most wells produce from the thicker sandstones such as the Coville Sandstone at the base of the Carbonale Group. In Spencer County, the Coville Sandstone is most productive where it is near the surface, especially where it is overlain by sand and gravel deposits in stream valleys. Additionally, the coal units in this group are potential ground-water sources.

Bedrock depth is typically less than 60 feet. However, along the Ohio River near the Warrick County line the depth to bedrock is greater than 100 feet. In Spencer County, domestic well depths in the Carbonale Group aquifer system range from 50 to 265 feet. The amount of rock penetrated by these wells ranges from 19 to 255 feet. Most domestic wells produce less than 5 gallons per minute (gpm) with localized yields of up to 20 gpm. A few (pumped) dry holes have been reported. Static water levels in the wells vary from 6 to 110 feet below the land surface.

Water quality is generally good and the aquifer system is not very susceptible to contamination from the land surface because of low-permeability strata above water-bearing zones. The natural quality of well water gets progressively more mineralized as wells are drilled deeper than 250 feet. This aquifer system is moderately susceptible to surface contamination where overlain by unconsolidated deposits composed primarily of alluvial sands and gravels.

Pennsylvanian - Raccoon Creek Group Aquifer System

The Raccoon Creek Group Aquifer System outcrop/subcrop area covers most of Spencer County. The group primarily consists of sandstone and shale with minor amounts of mudstone, coal, and limestone. Total thickness of the Raccoon Creek Group ranges from less than 1 foot where the Mississippian rocks are exposed to about 700 feet in southwestern Spencer County. The basal formation of the Raccoon Creek Group, the Mansfield Formation, rests unconformably on the Mississippian rocks. The Pennsylvanian-Mississippian erosional contact surface is quite irregular in elevation, resulting in variable thickness of Mansfield rocks. The lowermost part of the Mansfield commonly contains a large percentage of sandstone.

The depth to the bedrock surface in this county is generally less than 30 feet on the uplands to over 125 feet along the Ohio River. Several of the deeper wells penetrate through the Raccoon Creek Group Aquifer System into the underlying Buffalo Wallow, Stephensport, and West Baden Groups of Mississippian age. Wells in the Raccoon Creek Group Aquifer System are commonly completed at depths of 90 to 175 feet. The amount of rock penetrated by wells typically ranges from 45 to 150 feet.

In general, the Raccoon Creek Group Aquifer System is a moderately dependable ground-water source in Spencer County with most wells producing from the Mansfield Formation or various coal seams in the Raccoon Creek Group. Domestic wells typically produce from 1 to 10 gpm with a few dry holes reported. Static water levels are commonly 20 to 90 feet below the surface.

Where the sandstones of the Mansfield Formation and the coal seams of the Raccoon Creek Group and other porous or jointed rock units are overlain by sand and gravel, such as in a stream valley, somewhat higher sustained yields are possible. St. Meinrad Utilities reported testing a few wells at up to 70 gpm. The wells were drilled in a tributary stream valley to Blackhawk Creek about a mile northwest of Saint Meinrad. These wells were reportedly producing water from a sandstone aquifer (Mansfield Formation) and a coal seam. However, there is typically little chance for development of high-capacity wells in this aquifer system in Spencer County.

The Raccoon Creek Group Aquifer System in Spencer County is not very susceptible to contamination from the land surface because of low-permeability strata above water-bearing zones. However, this aquifer system is moderately to highly susceptible where overlain by unconsolidated deposits composed primarily of sand and gravel alluvial materials.

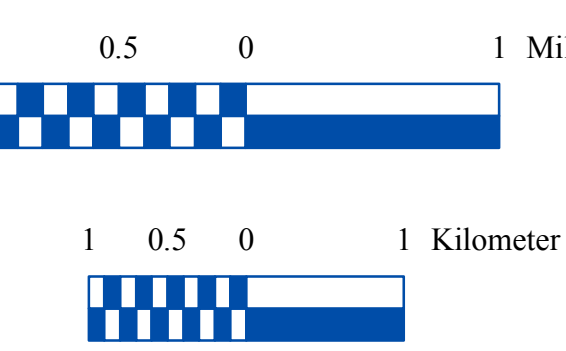
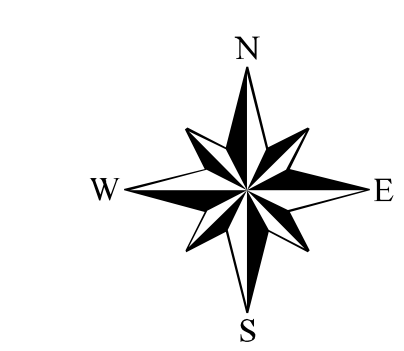
Mississippian - Buffalo Wallow, Stephensport, and West Baden Groups Aquifer System

This Upper Mississippian bedrock aquifer system consists of three groups, from oldest to youngest: West Baden, Stephensport, and Buffalo Wallow. Although present throughout the county beneath younger strata, this system only outcrops in a small area of the northeast corner of the county near the Anderson River. The Buffalo Wallow, Stephensport, and West Baden Groups consists primarily of shale, sandstone, and limestone. Many of the individual rock units are laterally (horizontally) discontinuous.

The Buffalo Wallow, Stephensport, and West Baden Groups Aquifer System is about 350 feet thick in northeastern Spencer County and thickens to over 700 feet as it dips beneath the younger Pennsylvanian rocks in the southwestern part of the county. This system is not regarded as a major ground-water resource in Spencer County and very few domestic wells have been reported in this system. The Buffalo Wallow, Stephensport, and West Baden Groups Aquifer System in this county is moderately susceptible to surface contamination where overlain by unconsolidated deposits composed primarily of alluvial materials along the Anderson River valley.

EXPLANATION

- Small Underground Mine (Abandoned)
- Fault
- Stream
- County Road
- State Road & US Highway
- Interstate
- Municipal Boundary
- State Managed Property
- Lake & River



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: Underground Coal Mines in Southwestern Indiana (polygon shapefile, 20001002), 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 Southwestern Indiana (polygon shapefile, 20001124), which was at a 1:500,000 scale. Population 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. Draft road shapefiles, System1 and System2 (line shapefiles, 2003), were from the Indiana Department of Transportation and based on a 1:24,000 scale. Structural Features of Indiana (line shapefile, 20020718) was from the Indiana Geological Survey and based on various scales.

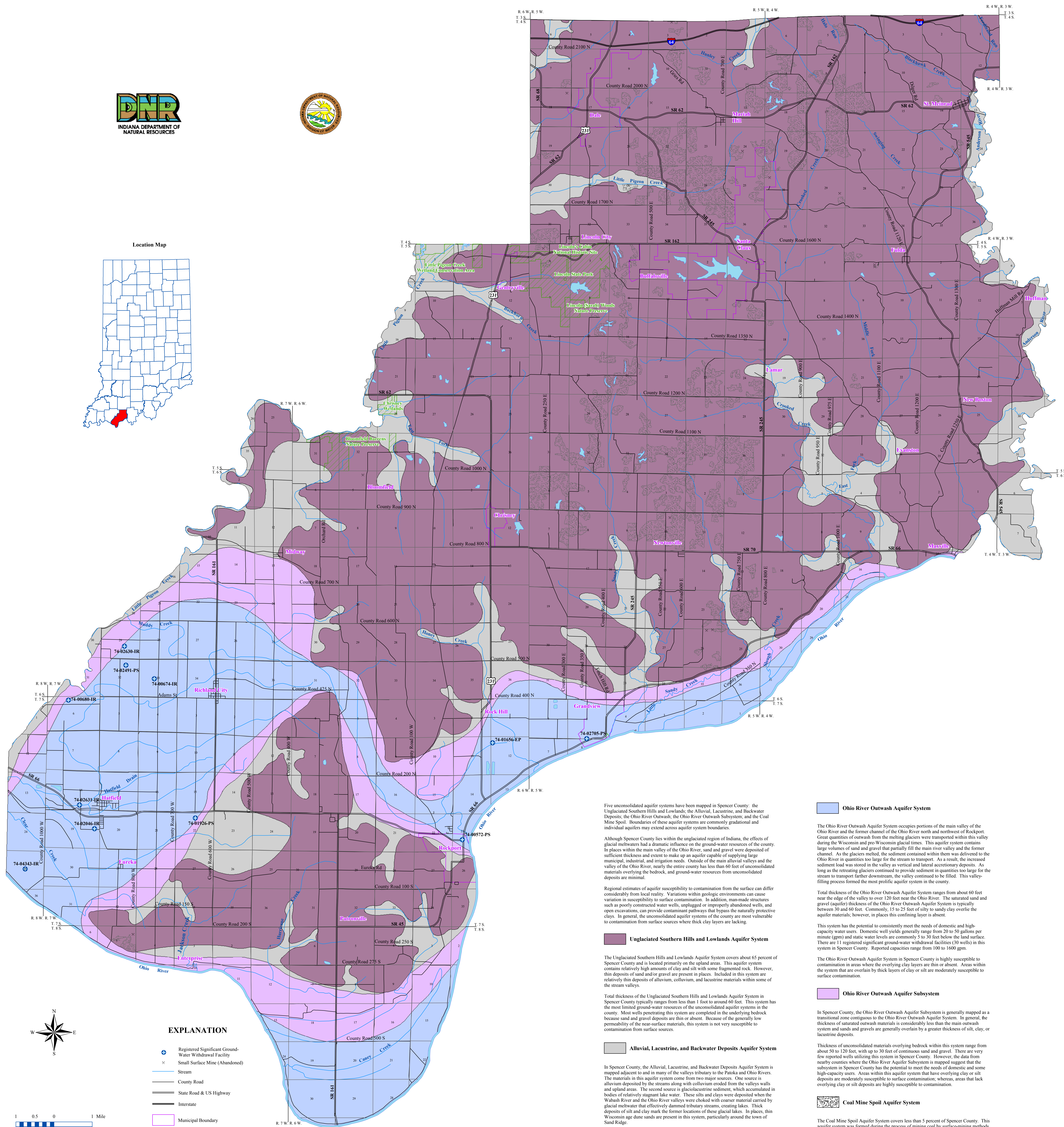
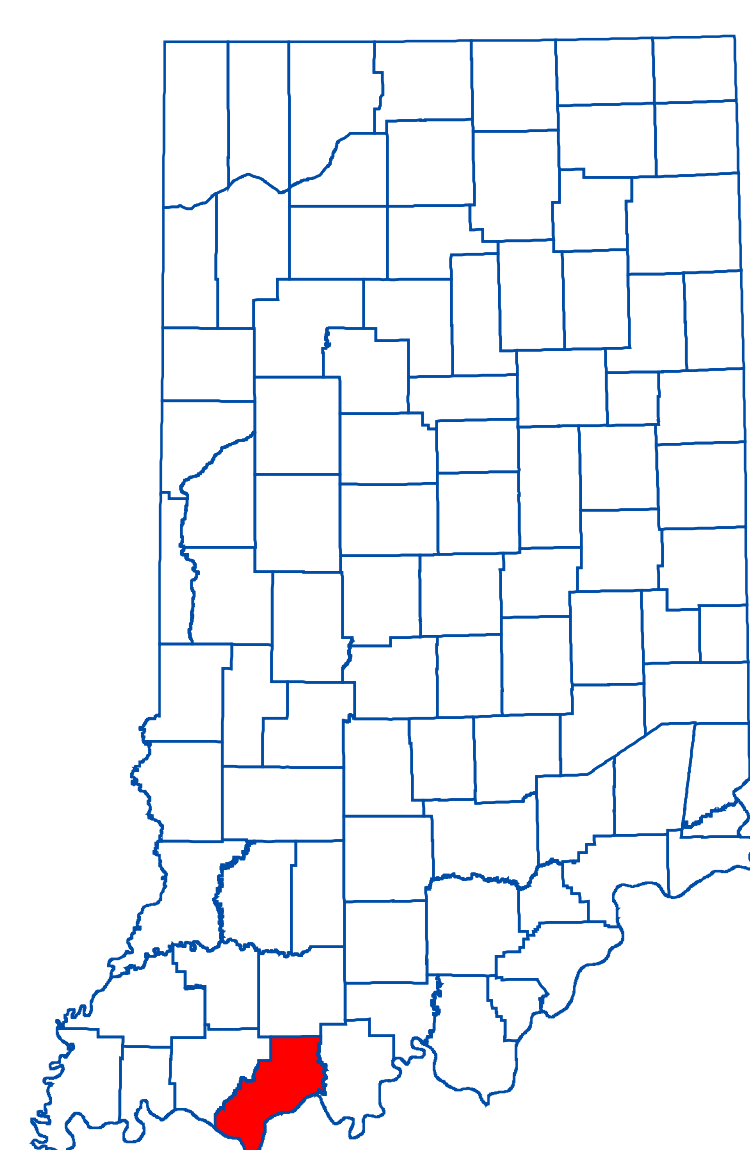
Bedrock Aquifer Systems of Spencer County, Indiana

by
Glenn E. Grove
Division of Water, Resource Assessment Section
May 2006

UNCONSOLIDATED AQUIFER SYSTEMS OF SPENCER COUNTY, INDIANA

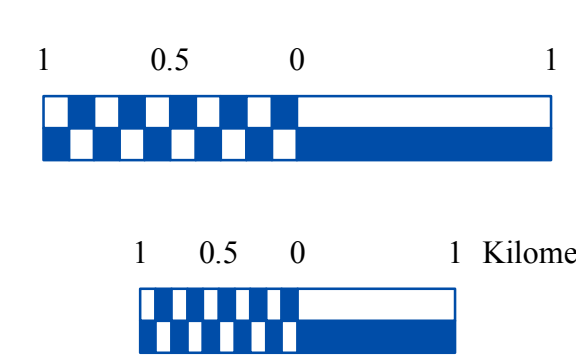


Location Map



EXPLANATION

- Registered Significant Ground-Water Withdrawal Facility
- Small Surface Mine (Abandoned)
- Stream
- County Road
- State Road & US Highway
- Interstate
- Municipal Boundary
- State Managed Property
- Lake & River



Five unconsolidated aquifer systems have been mapped in Spencer County: the Unglacial Southern Hills and Lowlands, Alluvial, Lacustrine, and Backwater Deposits, the Ohio River Outwash, the Ohio River Outwash Subsystem, and the Coal Mine Spoil. Boundaries of these aquifer systems are commonly gradational and individual aquifers may extend across aquifer system boundaries.

Although Spencer County lies within the unglaciated region of Indiana, the effects of glacial meltwaters had a dramatic influence on the ground-water resources of the county in places within the main valley of the Ohio River, sand and gravel were deposited of sufficient thickness and extent to make up an aquifer capable of supplying large municipal, industrial, and irrigation needs. Outside of the main alluvial valleys and the valley of the Ohio River, nearly the entire county has less than 60 feet of unconsolidated materials overlying the bedrock, and ground-water resources from unconsolidated deposits are minimal.

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, unpluged or improperly abandoned wells, and open excavations, can provide contaminant pathways that bypass the naturally protective clays. In general, the unconsolidated aquifer systems of the county are most vulnerable to contamination from surface sources where thick clay layers are lacking.

Unglacial Southern Hills and Lowlands Aquifer System

The Unglacial Southern Hills and Lowlands Aquifer System covers about 65 percent of Spencer County and is located primarily on the upland areas. This aquifer system contains relatively high amounts of clay and silt with some fragmented rock. However, thin deposits of sand and/or gravel are present in places. Included in this system are relatively thin deposits of alluvium, colluvium, and lacustrine materials within some of the stream valleys.

Total thickness of the Unglacial Southern Hills and Lowlands Aquifer System in Spencer County typically ranges from less than 1 foot to around 60 feet. This system has the most limited ground-water resources of the unconsolidated aquifer systems in the county. Most wells penetrating this system are completed in the underlying bedrock because sand and gravel deposits are thin or absent. Because of the generally low permeability of the near-surface materials, this system is not very susceptible to contamination from surface sources.

Alluvial, Lacustrine, and Backwater Deposits Aquifer System

In Spencer County, the Alluvial, Lacustrine, and Backwater Deposits Aquifer System is mapped adjacent to and in many of the valleys tributary to the Patoka and Ohio Rivers. The materials in this aquifer system come from two major sources. One source is alluvium deposited by the streams along with colluvium eroded from the valleys walls and upland areas. The second source is glaciolacustrine sediment, which accumulated in bodies of relatively stagnant lake water. These silts and clays were deposited when the Wabash River and the Ohio River valleys were choked with coarse material carried by glacial meltwater that effectively dammed tributary streams, creating lakes. Thick deposits of silt and clay mark the former locations of these glacial lakes. In places, thin Wisconsin-age sands are present in this system, particularly around the town of Sand Ridge.

This system is mapped in Spencer County along portions of most tributaries to the Ohio River. Additionally, this system is mapped along portions of Hunley Creek, which is a tributary to the Patoka River. In places, particularly in downstream areas near the Ohio River, this system exceeds 85 feet in thickness. However, farther upstream, the system gradually thins to about 30 feet.

The Alluvial, Lacustrine, and Backwater Deposits Aquifer System is a limited resource in Spencer County and the Division has few records of wells actually producing from these deposits. However, in places, some wells drilled in this system (especially large diameter bucket-rig wells) may yield sufficient water for domestic use. This system is marked by thick deposits of soft silt and clay that have low susceptibility to surface contamination.

Ohio River Outwash Aquifer System

The Ohio River Outwash Aquifer System occupies portions of the main valley of the Ohio River and the former channel of the Ohio River north and northwest of Rockport. Great quantities of outwash from the melting glaciers were transported within this valley during the Wisconsin and pre-Wisconsin glacial times. This aquifer system contains large volumes of sand and gravel that partially fill the main river valley and the former channel. As the glaciers melted, the sediment continued within them was delivered to the Ohio River in quantities too large for the stream to transport. As a result, the increased sediment load was stored in the valley as vertical and lateral accretionary deposits. As long as the retreating glaciers continued to provide sediment in quantities too large for the stream to transport farther downstream, the valley continued to be filled. This valley-filling process formed the most prolific aquifer system in the county.

Total thickness of the Ohio River Outwash Aquifer System ranges from about 60 feet near the edge of the valley to over 120 feet near the Ohio River. The saturated sand and gravel (aquifer) thickness of the Ohio River Outwash Aquifer System is typically between 30 and 60 feet. Commonly, 15 to 25 feet of silty to sandy clay overlie the aquifer materials; however, in places this confining layer is absent.

This system has the potential to consistently meet the needs of domestic and high-capacity water users. Domestic well yields generally range from 20 to 50 gallons per minute (gpm) and static water levels are commonly 5 to 30 feet below the land surface. There are 11 registered significant ground-water withdrawal facilities (30 wells) in this system in Spencer County. Reported capacities range from 100 to 1600 gpm.

The Ohio River Outwash Aquifer System in Spencer County is highly susceptible to contamination in areas where the overlying clay layers are thin or absent. Areas within the system that are overlain by thick layers of clay or silt are moderately susceptible to surface contamination.

Ohio River Outwash Aquifer Subsystem

In Spencer County, the Ohio River Outwash Aquifer Subsystem is generally mapped as a transitional zone contiguous to the Ohio River Outwash Aquifer System. In general, the thickness of saturated outwash materials is considerably less than the main outwash system and sands and gravels are generally overlain by a greater thickness of silt, clay, or lacustrine deposits.

Thickness of unconsolidated materials overlying bedrock within this system range from about 50 to 120 feet, with up to 30 feet of continuous sand and gravel. There are very few reported wells utilizing this system in Spencer County. However, the data from nearby counties where the Ohio River Aquifer Subsystem is mapped suggest that the subsystem in Spencer County has the potential to meet the needs of domestic and some high-capacity users. 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.

Coal Mine Spoil Aquifer System

The Coal Mine Spoil Aquifer System covers less than 5 percent of Spencer County. This aquifer system was formed during the process of surface mining by surface-mining methods. The overburden was typically broken up by blasting and moved aside to uncover the desired coal seam. In Spencer County, there are no reported wells actually producing from the Coal Mine Spoil Aquifer System. Information from surface coal mine areas in other counties indicates that the quality of ground water in this system is probably much poorer than that in the overburden before mining took place. Very generally, it is expected that aquifers in old spoil that was not graded and capped with compacted soil are highly susceptible to surface contamination, whereas new spoil areas benefiting from modern reclamation methods are likely to be only moderately susceptible.

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. Surface Coal Mines in Southwestern Indiana (polygon shapefile, 20001207), 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, 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 DNR. Unconsolidated Aquifer Systems coverage (Grove, 2006) was based on a 1:24,000 scale.

Unconsolidated Aquifer Systems of Spencer County, Indiana

by
Glenn E. Grove
Division of Water, Resource Assessment Section

May 2006

Spencer County

