

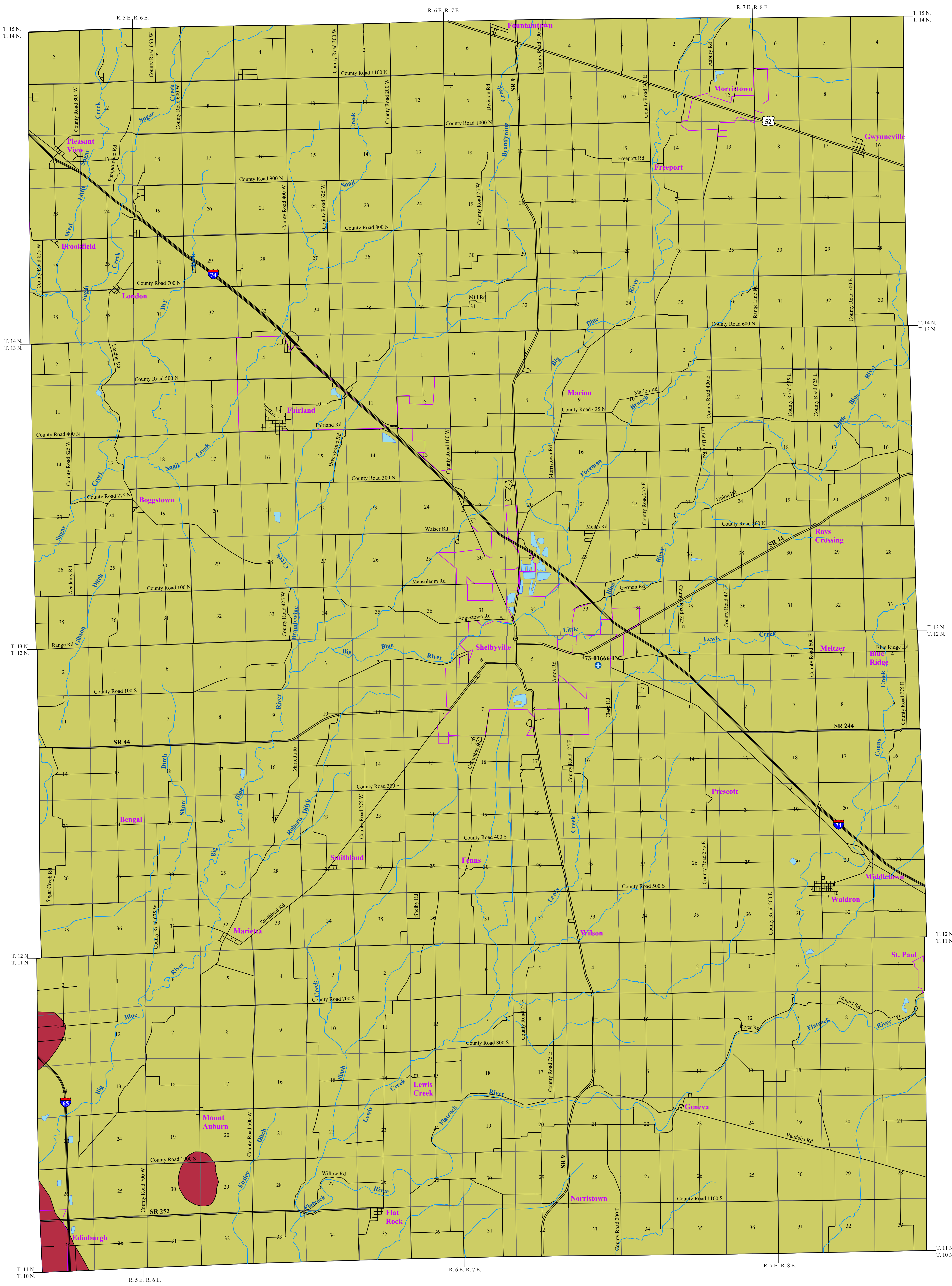
Water Resources and Use in Shelby County

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

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

■ Major Lakes	— Interstate	
□ County	⊠ City	

BEDROCK AQUIFER SYSTEMS OF SHELBY 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 Shelby County, rock types exposed at the bedrock surface are moderately productive limestones and dolomites with varying amounts of interbedded shales to poorly productive shale.

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

Two bedrock aquifer systems are identified for Shelby County. They are, from west to east and younger to older: New Albany Shale of Devonian and Mississippian age and the Silurian and Devonian Carbonates. Bedrock aquifers are not highly productive in this county. However, bedrock wells represent about 30% of all wells completed in the county.

The quality of water in bedrock aquifer systems in this county is generally acceptable for domestic use. 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 have complex fracturing systems, once a contaminant has been introduced into a bedrock aquifer system, it will be difficult to track and remediate.

Devonian and Mississippian - New Albany Shale Aquifer System

The New Albany Shale consists mostly of brownish-black carbon-rich shale, greenish-gray shale, along with minor amounts of dolomite and dolomitic quartz sandstone. In Shelby County, the New Albany Shale has a maximum thickness of about 20 feet, an areal extent of less than 3 square miles, and is only present in the extreme southwestern part of the county.

This aquifer system is considered a poor ground-water resource and is generally described as an aquitard. No wells penetrating the New Albany Shale in the county have been reported. The few known wells in this area utilize the prolific unconsolidated sand and gravel aquifers overlying the New Albany Shale. 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.

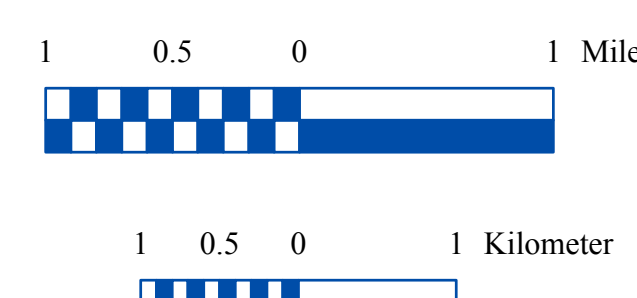
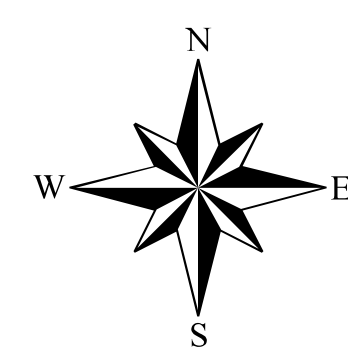
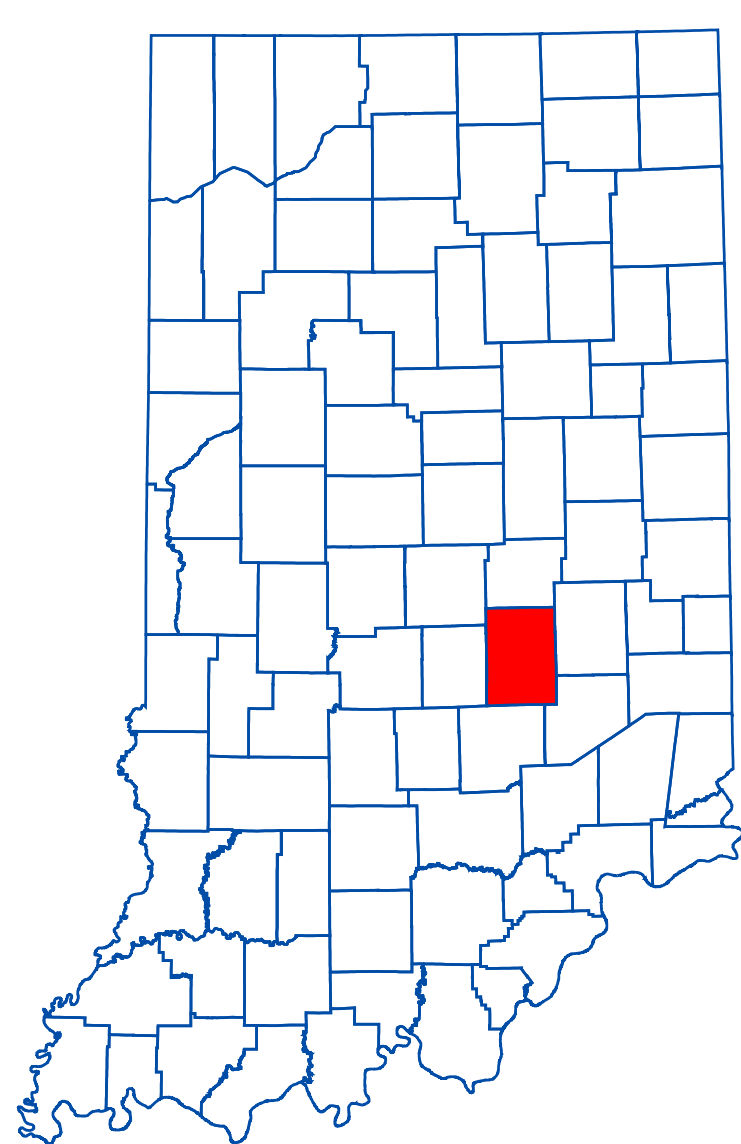
Silurian and Devonian Carbonates Aquifer System

In Shelby County this aquifer system consists primarily of middle Devonian age carbonates of the Muscatatuck Group and underlying Silurian carbonates. It is composed of only Silurian carbonates in buried pre-glacial valleys where Muscatatuck Group rocks have been removed by erosion. 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 Shelby County ranges from about 100 to 200 feet.

Wells utilizing the Silurian and Devonian Carbonates Aquifer System in Shelby County have reported depths ranging from 20 to 300 feet, but are commonly 55 to 175 feet deep. The amount of rock penetrated in this system typically ranges from 15 to 50 feet. 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 range from 5 to 15 gallons per minute (gpm). Static water levels typically range from 10 to 30 feet below land surface.

This aquifer system has a low susceptibility to surface contamination due to thick clay deposits over most of the county. However, the Silurian and Devonian Carbonate Aquifer System is moderately to highly susceptible where overlain by unconsolidated deposits composed primarily of sand and gravel outwash materials and in places where clay aquitards are absent.

Location Map



EXPLANATION

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



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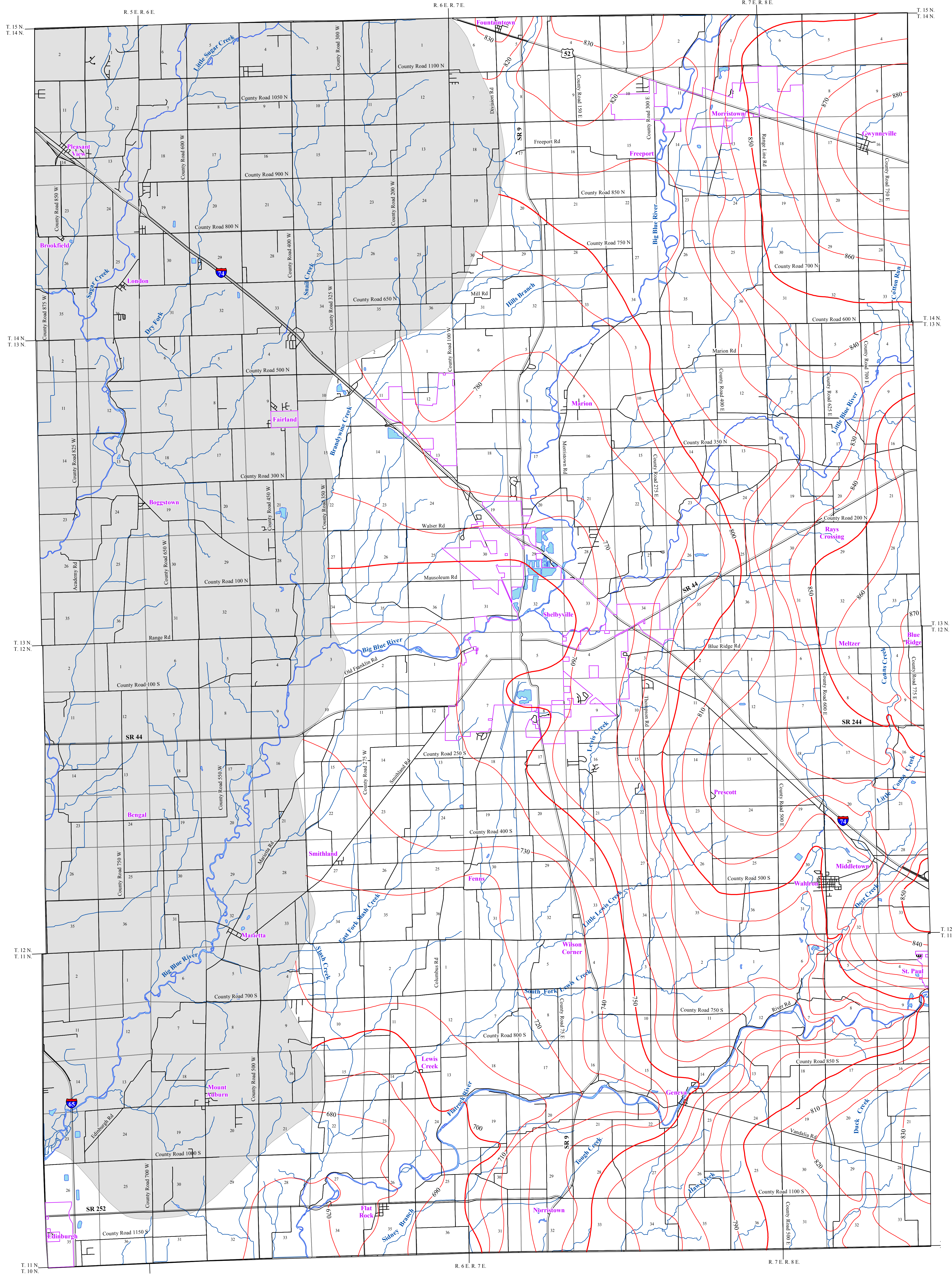
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Bedrock Aquifer Systems of Shelby County, Indiana

by
 Gregory P. Schraeder
 Division of Water, Resource Assessment Section

October 2005

POTENTIOMETRIC SURFACE MAP OF THE BEDROCK AQUIFERS OF SHELBY COUNTY, INDIANA



Shelby County, Indiana is located in the central portion of the state and is situated within the East Fork White River Drainage Basin.

The Bedrock Potentiometric Surface Map (PSM) of Shelby County was mapped by contouring the elevations of over 540 static water-levels reported on well records received over a 50 year period. These wells are completed in bedrock aquifers at various depths and typically under confined conditions (bounded by impermeable layers above and below the water bearing formation). However, some wells were completed under unconfined (not bounded by impermeable layers) settings. The potentiometric surface is a measure of the pressure on water in a water bearing formation. Groundwater levels in an unconfined aquifer system are at atmospheric pressure and will not rise in a well above the top of the water bearing formation, in contrast to water in a confined aquifer which is under hydrostatic pressure and will rise in a well above the top of the water bearing formation.

The western portion of Shelby County was not mapped due to most water wells in the area being finished in the unconsolidated material overlying the Silurian and Devonian Carbonates. However, in the eastern portion of Shelby County and in nearby Marion and Hancock Counties, the Silurian and Devonian Carbonates Aquifer System is capable of supporting domestic and some high-capacity users.

Static water-level measurements in individual wells used to construct county PSM's are indicative of the water-level at the time of well completion. The groundwater level within an aquifer constantly fluctuates in response to rainfall, evapotranspiration, groundwater movement, and groundwater pumping. Therefore, current site specific conditions may differ due to local or seasonal variations in measured static water-levels. Because fluctuations in groundwater are typically small, static water-levels can be used to construct a generalized PSM. Groundwater flow is naturally from areas of recharge toward areas of discharge. As a general rule, but certainly not always, groundwater flow approximates the overlying topography and intersects the land surface at major streams.

Universal Transverse Mercator (UTM) coordinates for the water wells were either physically obtained in the field, determined through address geocoding, or reported on water well records; however, the location of the majority of the water well records used to make the PSM were not field verified. Elevation data were either obtained from topographic maps or a digital elevation model. Quality control/quality assurance procedures were utilized to refine or remove data where errors were readily apparent.

Bedrock potentiometric surface elevations in Shelby County range from a high of approximately 890 feet mean sea level (msl) in the north-central region of the county, to a low of about 650 feet msl in the central portion of the county. Generalized groundwater flow direction for most of Shelby County is towards major drainage relevant to the East Fork White River Basin. Therefore, groundwater flow is generally southwest toward Big Blue River and Flatrock River.

In Shelby County, unconsolidated sedimentary deposits of varying thickness overlie the bedrock surface (Schrader, 2005). These unconsolidated deposits are generally 60 feet thick or greater throughout most of the county, however, in the southeast portion of the county, the deposits are commonly 30 feet or less with bedrock exposure along the Flatrock River. In areas where bedrock is shallow, the potentiometric surface is commonly under unconfined or semi-confined conditions. Where thicker sediments are present, the potentiometric surface is generally under confined conditions.

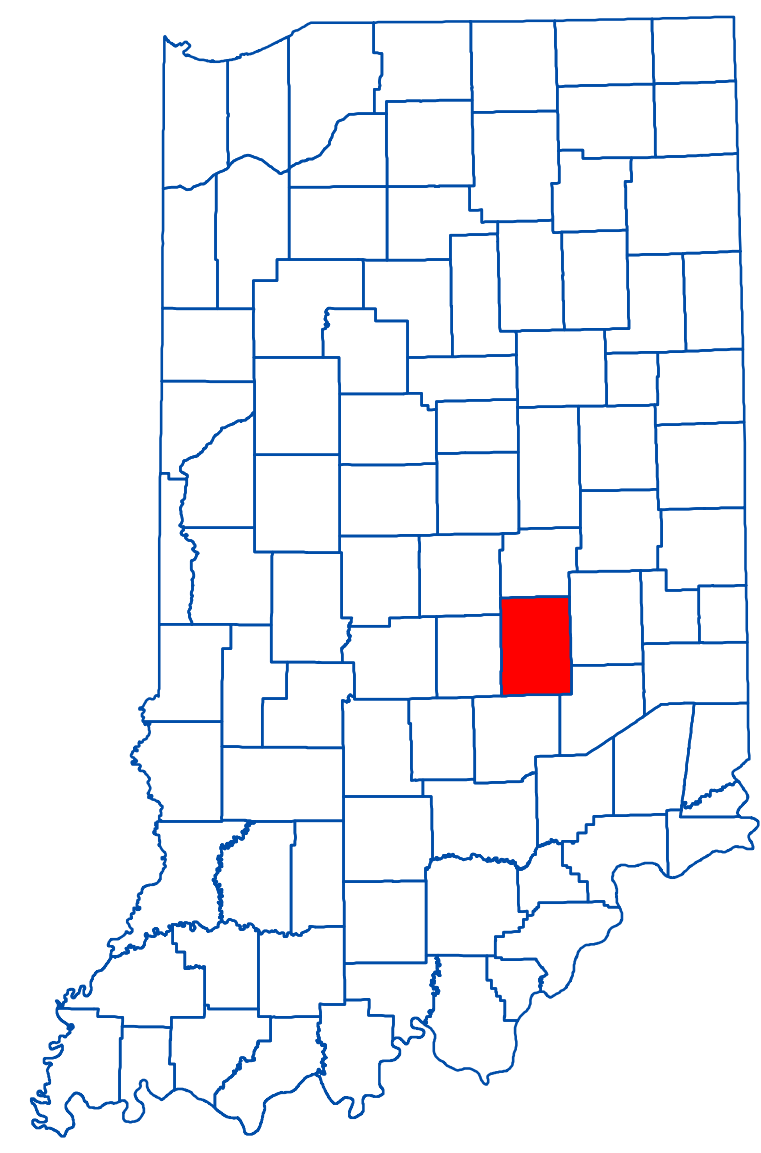
The county PSM can be used to define the regional groundwater flow path and to identify significant areas of groundwater recharge and discharge. County PSM's represent overall regional characteristics and are not intended to be a substitute for site-specific studies.

Schrader, 2005. Bedrock Aquifer Systems of Shelby County, Indiana: Indiana Department of Natural Resources, Division of Water, Aquifer Systems Map 19-B

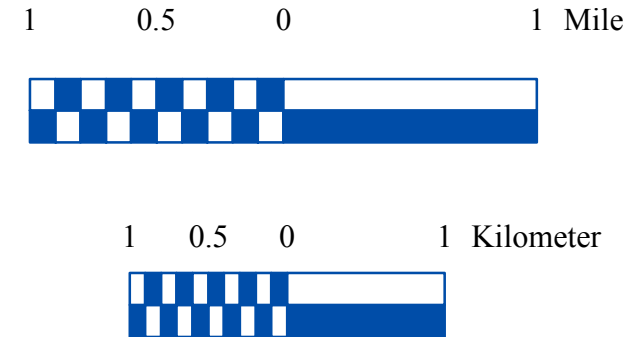
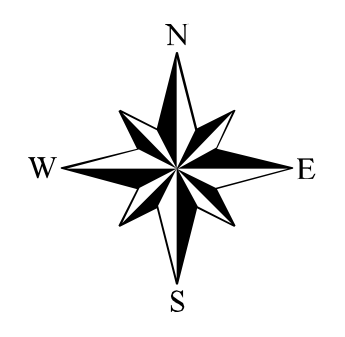
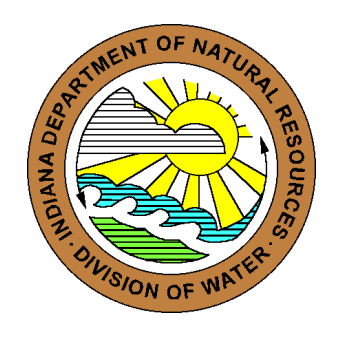
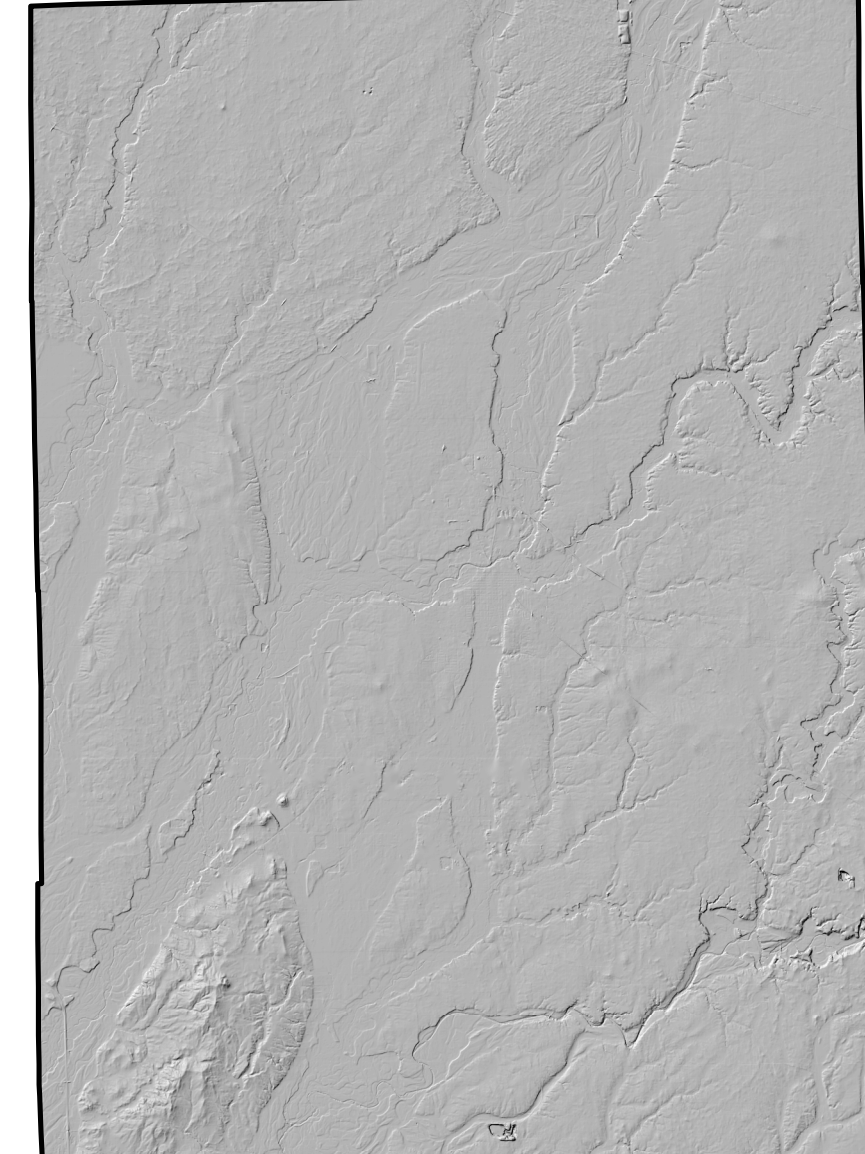
EXPLANATION

- Line of equal elevation, in feet above mean sea level
- Potentiometric Contour interval 10 feet
- Stream
- County Road
- State Road & US Highway
- Interstate
- Municipal Boundary
- Lake & River
- Limited Data

Location Map



Hillshade Map of Shelby County, Indiana



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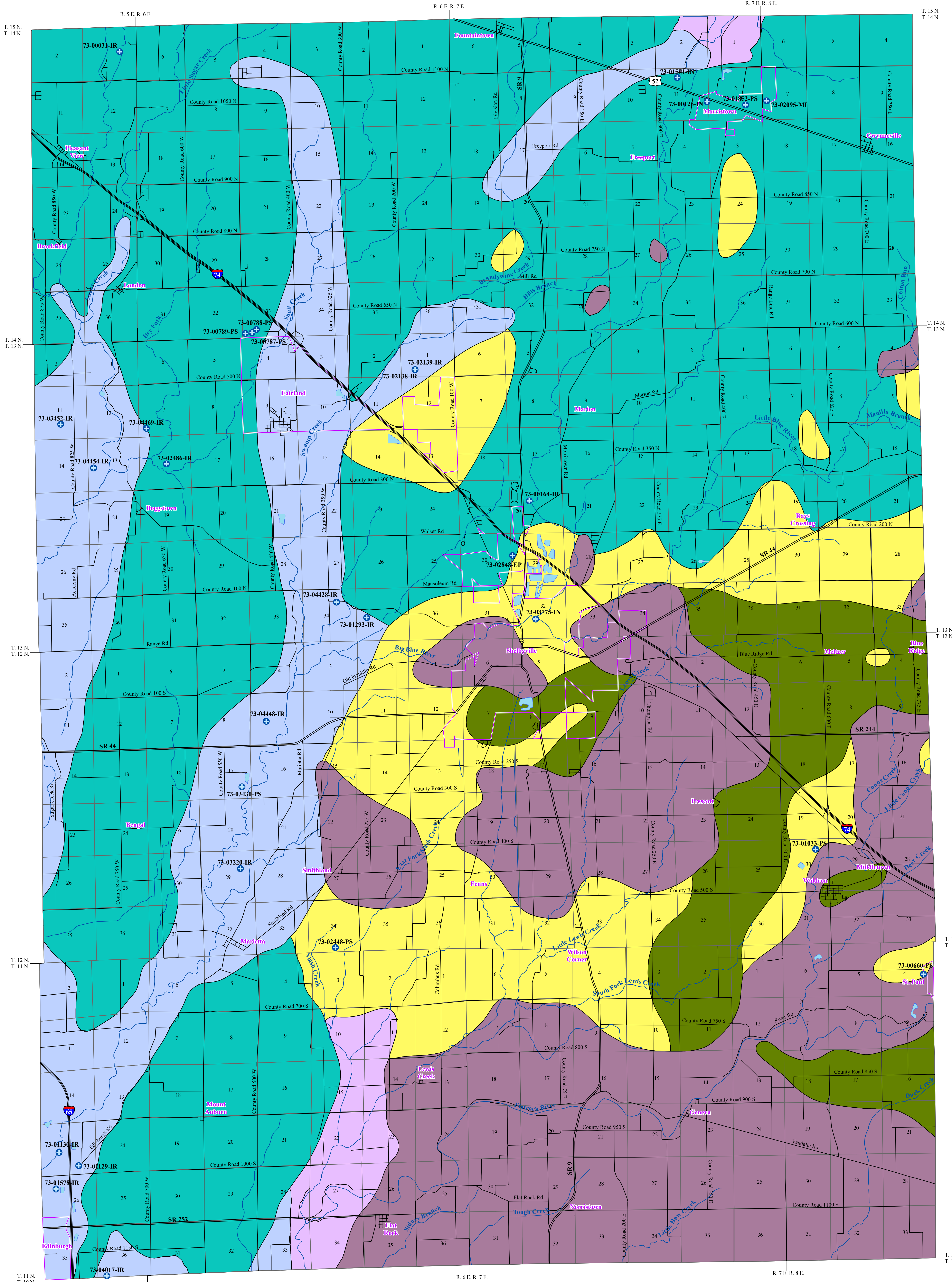
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Potentiometric Surface Map of the Bedrock Aquifers of Shelby County, Indiana
by
Robert A. Scott
Division of Water, Resource Assessment Section

September 2012

UNCONSOLIDATED AQUIFER SYSTEMS OF SHELBY COUNTY, INDIANA



Six unconsolidated aquifer systems have been mapped in Shelby County: the Dissected Till and Residuum Aquifer System, the Dissected Till and Residuum Aquifer System, the New Castle Till, the New Castle Till Subsystem, the New Castle/Scottsburg Complex, the White River and Tributaries Outwash, and the White River and Tributaries Outwash Subsystem. The first system includes relatively thin deposits left by continental ice sheets as well as eroded residuum (a product of bedrock weathering). The remaining systems comprise sediments deposited by, or resulting from, glacial meltwaters, and post-glacial precipitation events. Boundaries of these aquifer systems are commonly gradational and individual aquifers may extend across aquifer system boundaries.

The thickness of unconsolidated sediments in Shelby County is quite variable. In much of the southeastern part of the county, unconsolidated materials are less than 30 feet thick and bedrock is exposed in places along the Flatrock River. Elsewhere in Shelby County, unconsolidated deposits are commonly greater than 60 feet thick. Sediments overlying bedrock are thicker (up to 350 feet) in the southwestern part of the county near the town of Mount Auburn, where thick sequences of till and outwash have been stacked above a broad bedrock valley.

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.

Dissected Till and Residuum Aquifer System / Till Veneer Aquifer System

In Shelby 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 or Wisconsin till is thin and dissected due to deep down-cutting by streams and in places areas where soils have formed directly from bedrock due to weathering. Also included in this aquifer system are relatively thin deposits of alluvium and colluvium in many stream valleys. The Till Veneer Aquifer System encompasses areas where the unconsolidated material is predominantly thin till overlying bedrock. In these areas this thin till is chiefly the product of the deposition of Wisconsin glacial till over an uneven, eroded bedrock surface rather than erosion of till by younger streams. 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.

There is little potential for ground water production in the Dissected Till and Residuum Aquifer System of the Till Veneer Aquifer System in Shelby County. Only about 10 percent of reported wells penetrating these aquifer systems are completed in unconsolidated materials rather than the underlying bedrock. The total thickness of these systems typically ranges from about 15 to 45 feet and wells are commonly completed at depths of 30 to 45 feet. Where present, sand and gravel units are commonly less than 3 feet thick. 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 mapped mostly in the central and southeastern portions of Shelby County, where intertilt sand and gravel layers are typically thinner than in the western and northern parts of the county. Unconsolidated deposits range from 10 to 20 feet thick to more than 100 feet (where glacial deposits have filled bedrock valleys). Potential aquifer materials include outwash sands and/or gravels that typically range from 4 to 15 feet thick and are generally overlain by 30 to 50 feet of till.

This system is capable of meeting the needs of domestic and some high-capacity users. Wells are generally 40 to 65 feet deep. Domestic well capacities are typically 10 to 20 gallons per minute (gpm) and static water levels are commonly 10 to 25 feet below surface. High-capacity users (4 facilities, 10 wells) report yields of 30 to 250 gpm for individual wells.

The New Castle Till Aquifer System has a low susceptibility to surface contamination because intratill sand and gravel units are generally separated from the surface by till layers within the system.

New Castle Till Aquifer Subsystem

Areas where unconsolidated materials generally exceed 50 feet in thickness, yet have little aquifer potential, are mapped as New Castle Till Aquifer Subsystem in Shelby County. Wells completed in this system in Shelby County are typically 35 feet to 50 feet deep. Potential aquifer materials include thin, intratill sand and gravel deposits that are typically less than 7 feet thick. Where present, aquifer materials are capped by till that is generally 30 to 60 feet thick.

This system is capable of meeting the needs of some domestic users. However, about 70 percent of wells constructed in the area mapped as New Castle Till Aquifer Subsystem in this county bypass the unconsolidated materials and utilize the underlying bedrock aquifer.

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

New Castle / Scottsburg Complex Aquifer System

The New Castle / Scottsburg Complex Aquifer System is mapped throughout much of northern Shelby County as well as upland areas between the Big Blue River and Sugar Creek in the west-central part of the county, and to the southwest.

In Shelby County this system is characterized by unconsolidated deposits that are quite variable in materials and thickness. Sand and gravel aquifer deposits vary from thin to massive and are typically overlain by a thick till. To the southwest, outwash sand and gravel that underlies the thick drift is connected laterally to near-surface outwash that fills the modern stream valleys of the Big Blue River to the west, and the Flatrock River to the east. Total thickness of unconsolidated deposits in the New Castle / Scottsburg Complex Aquifer System ranges from about 100 feet near the Bartholomew County line, to over 350 feet near Mount Auburn.

This system is capable of meeting the needs of domestic and some high-capacity users in Shelby County. Wells in this system are typically completed at depths of 50 to 90 feet. Outwash aquifer materials are commonly 10 to 30 feet thick and are overlain by a till cap 30 to 60 feet thick. However, in the uplands near the town of Mount Auburn, this cap reaches a maximum thickness of about 250 feet. Domestic well capacities are commonly 10 to 20 gpm and static water levels are generally 10 to 35 feet below surface. There are 12 registered significant water withdrawal facilities (24 wells) utilizing this system and individual wells produce from 80 to 1000 gpm.

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

White River and Tributaries Outwash Aquifer System

The White River and Tributaries Outwash Aquifer System is mapped in western and northern Shelby County along portions of the Flatrock River, Big Blue River, Sugar Creek, Brandywine Creek, and Small Creek. This aquifer system contains large volumes of outwash and alluvial deposits that filled the river valleys of the White River and its major tributaries. As the glaciers melted, the quantity of sediment was too large for the streams to transport. As a result, the increased sediment load was stored in the valleys as vertical and lateral accretionary deposits. As long as the retreating glaciers continued to provide sediment in quantities too large for the streams to transport, the main valley continued to be filled. These deposits formed the most prolific aquifer system in the county.

Although unconsolidated deposits in this system are typically 60 to 100 feet thick in Shelby County, their total thickness exceeds 130 feet in places. Wells are commonly completed at depths of 40 to 70 feet. Aquifer materials include predominantly sand and gravel deposits that are typically 20 to 40 feet thick. In some areas clay or silt overlies the aquifer materials. Where present, this fine-grained cap is typically 10 to 25 feet thick.

This system has the greatest potential of any aquifer system in Shelby County and can meet the needs of domestic and high-capacity users. Domestic well yields commonly range from 10 to 25 gpm and static water levels are generally 10 to 30 feet below surface. There are 13 registered significant water withdrawal facilities (20 wells) utilizing the White River and Tributaries Outwash Aquifer System in this county. High-capacity wells in this system have been tested at rates ranging from 600 to 1200 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.

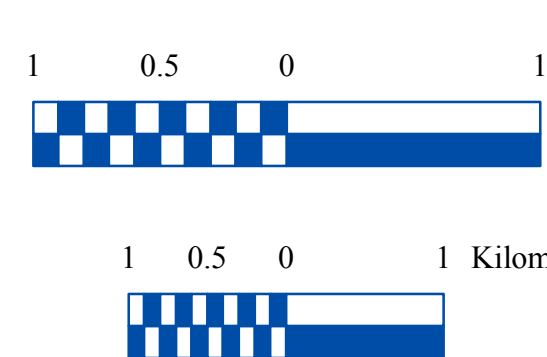
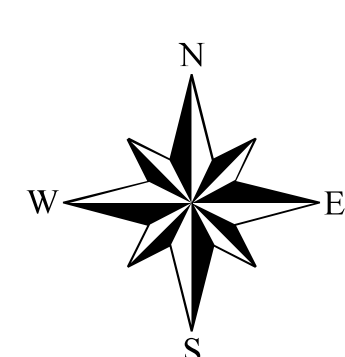
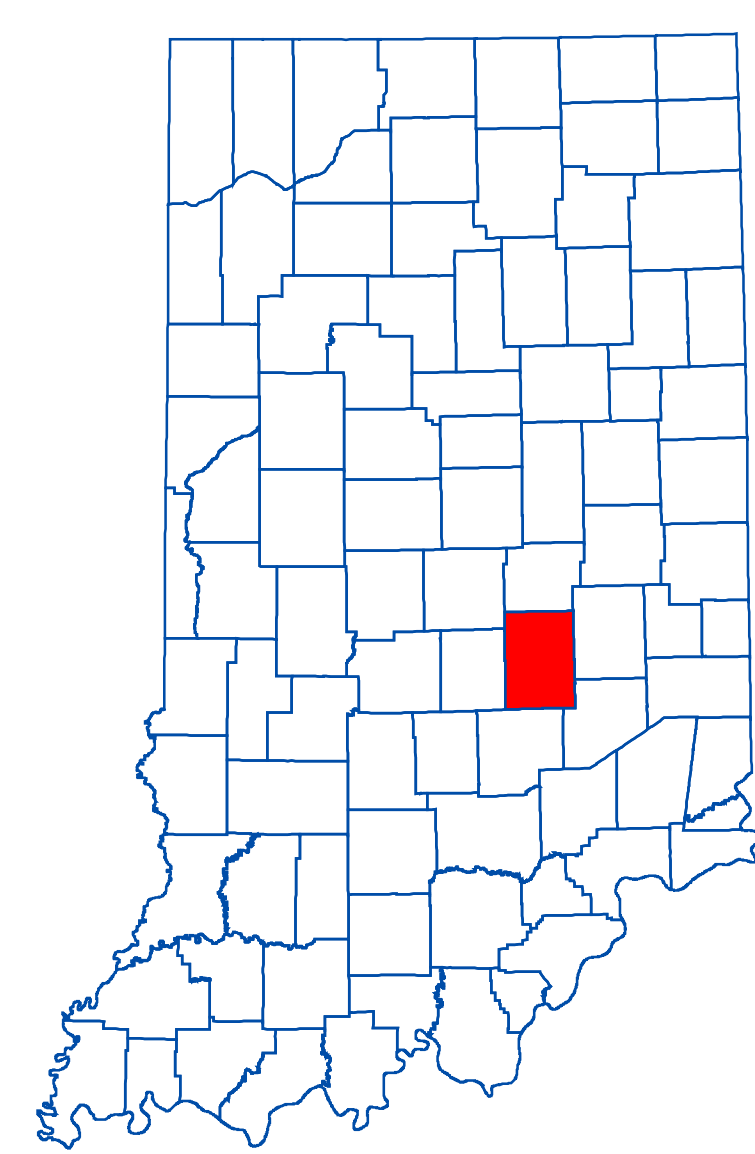
White River and Tributaries Outwash Aquifer Subsystem

The White River and Tributaries Outwash Aquifer Subsystem is mapped along portions of the Flatrock River and Slick Creek in the southwestern part of Shelby County and also in a small area just north of Morristown in the floodplain of the Big Blue River at the Hancock County line.

Total thickness of unconsolidated deposits overlying bedrock ranges from about 50 to 100 feet. Few wells utilizing this system in Shelby County have been reported. However, in neighboring Johnson and Bartholomew Counties, the White River and Tributaries Aquifer Subsystem 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 20 feet below surface. In Johnson and Bartholomew Counties, three high-capacity facilities utilize this aquifer system with reported capacities from 100 to 1000 gpm. Thus, it is expected that the White River and Tributaries Aquifer Subsystem also has similar aquifer characteristics and comparable ground-water potential in Shelby County.

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.

Location Map



EXPLANATION

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



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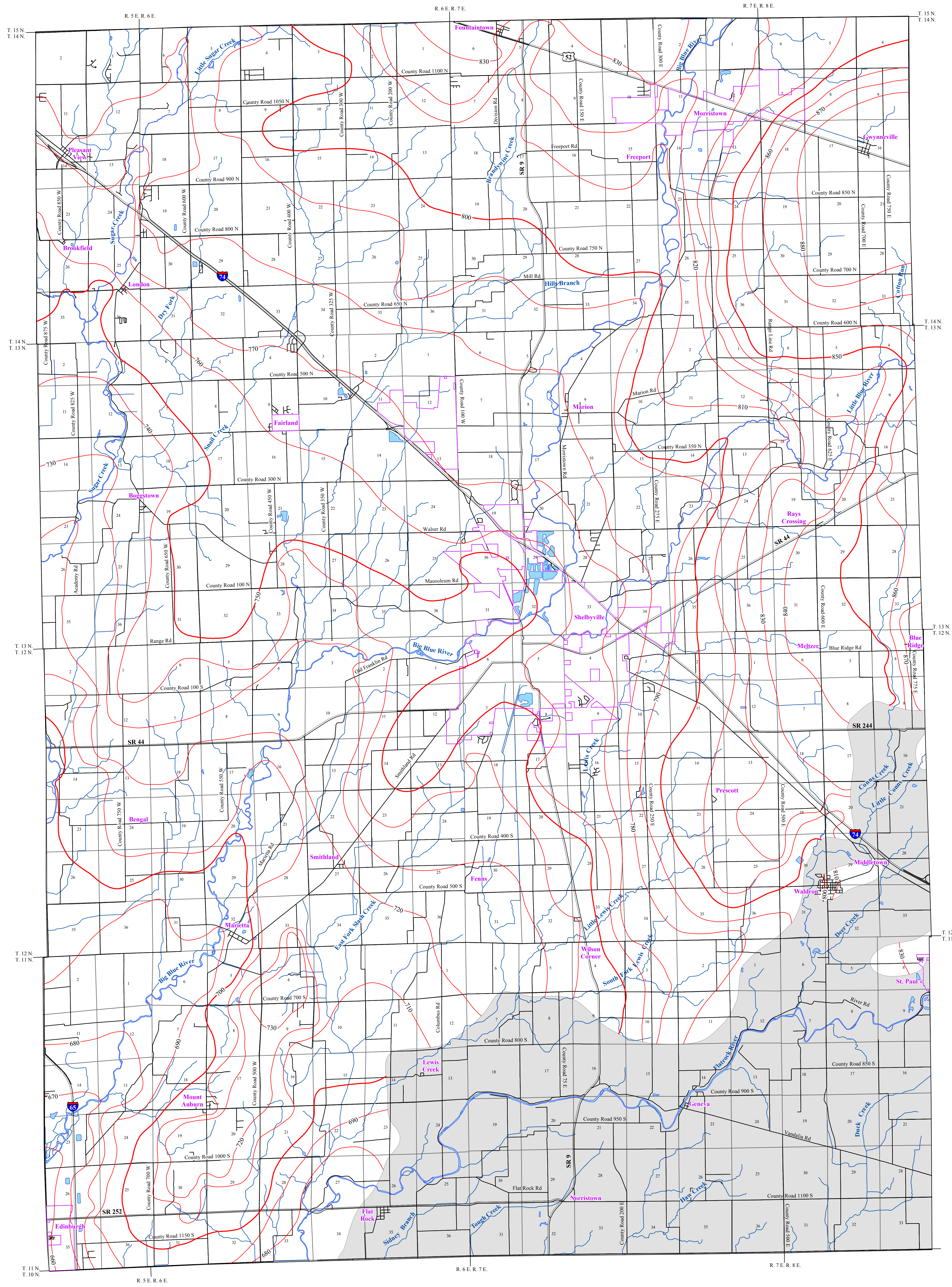
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Unconsolidated Aquifer Systems of Shelby County, Indiana

by
Gregory P. Schrader
Division of Water, Resource Assessment Section

October 2005

POTENTIOMETRIC SURFACE MAP OF THE UNCONSOLIDATED AQUIFERS OF SHELBY COUNTY, INDIANA



Shelby County, Indiana is located in the central portion of the state and is situated within the East Fork White River Drainage Basin.

The Unconsolidated Potentiometric Surface Map (PSM) of the unconsolidated aquifers of Shelby County was mapped by contouring the elevations of approximately 1,300 static water-levels reported on well records received primarily over a 50 year period. These wells are completed in aquifers at various depths and typically under confined conditions (bounded by impermeable layers above and below the water bearing formation). However, some wells were completed under unconfined (not bounded by impermeable layers) settings. The potentiometric surface is a measure of the pressure on water in a water bearing formation. Water in an unconfined aquifer is at atmospheric pressure and will not rise in a well above the top of the water bearing formation, in contrast to water in a confined aquifer which is under hydrostatic pressure and will rise in a well above the top of the water bearing formation.

Portions of Shelby County were not mapped due to a lack of water well data and/or limited water bearing deposits. These areas are generally considered to have limited aquifer resources leaving it difficult to represent accurate PSM elevations (Schrader 2005).

Static water-level measurements in individual wells used to construct county PSM's are indicative of the water-level at the time of well completion. The groundwater level within an aquifer constantly fluctuates in response to rainfall, evapotranspiration, groundwater movement, and pumping. Therefore, measured static water-levels may differ due to local or seasonal variations in measured static water-levels. Because fluctuations in groundwater are typically small, static water-levels can be used to construct a generalized PSM. Groundwater flow is naturally from areas of recharge toward areas of discharge. As a general rule, but certainly not always, groundwater flow approximates the overlying topography and intersects the land surface at major streams.

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Unconsolidated static water levels in Shelby County range from a high of approximately 900 feet mean sea level (msl) in the east-central region of the county, to a low of about 640 feet msl in the southwest portion of the county. Generalized groundwater flow direction for most of Shelby County is towards major drainage relevant to the East Fork White River Basin. Therefore, groundwater flow is generally southwest toward Big Blue River and Flatrock River.

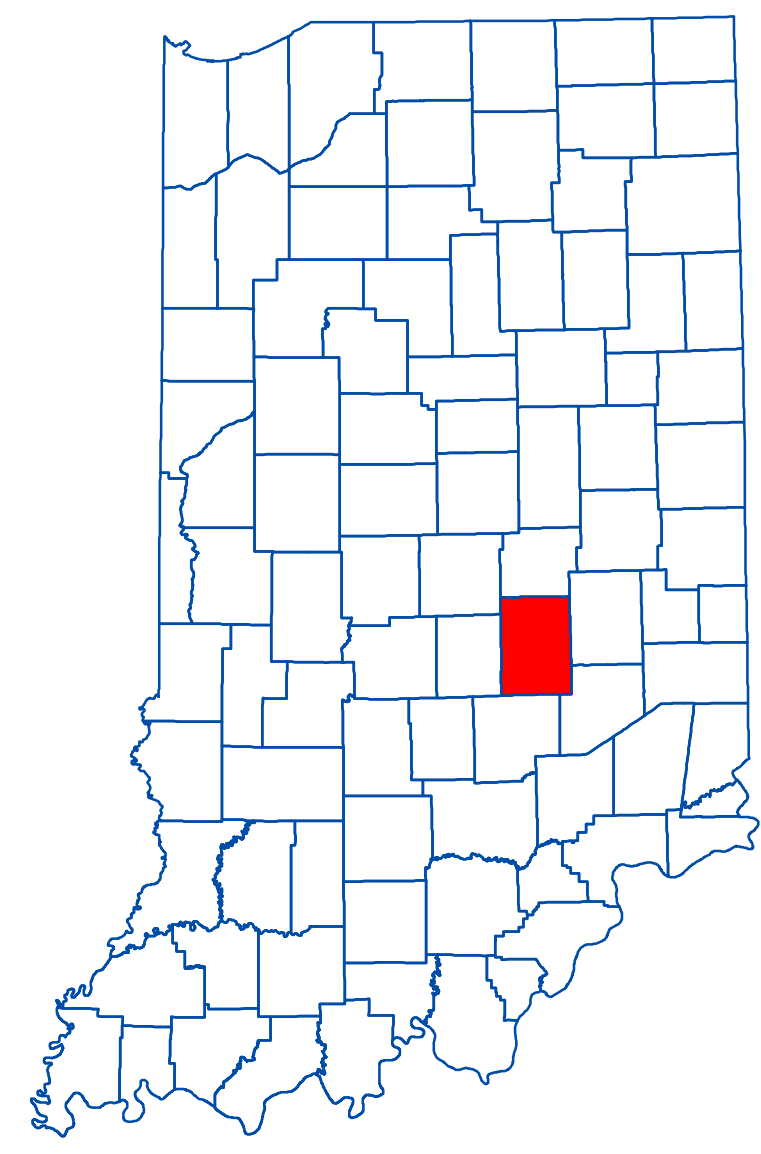
The county PSM can be used to define the regional groundwater flow path and to identify significant areas of groundwater recharge and discharge. County PSM's represent overall regional characteristics and are not intended to be a substitute for site-specific studies.

Schrader, 2005. Unconsolidated Aquifer Systems of Shelby County, Indiana. Indiana Department of Natural Resources, Division of Water, Aquifer System Map 19-A.

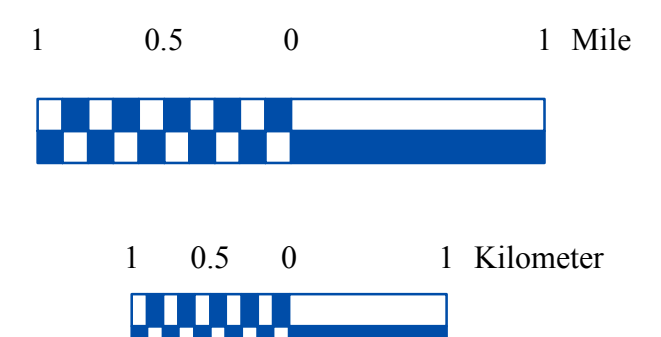
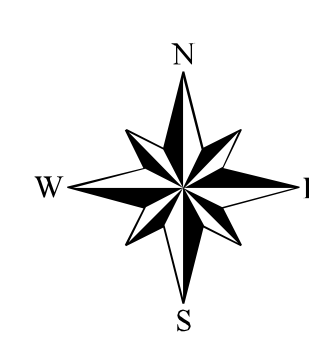
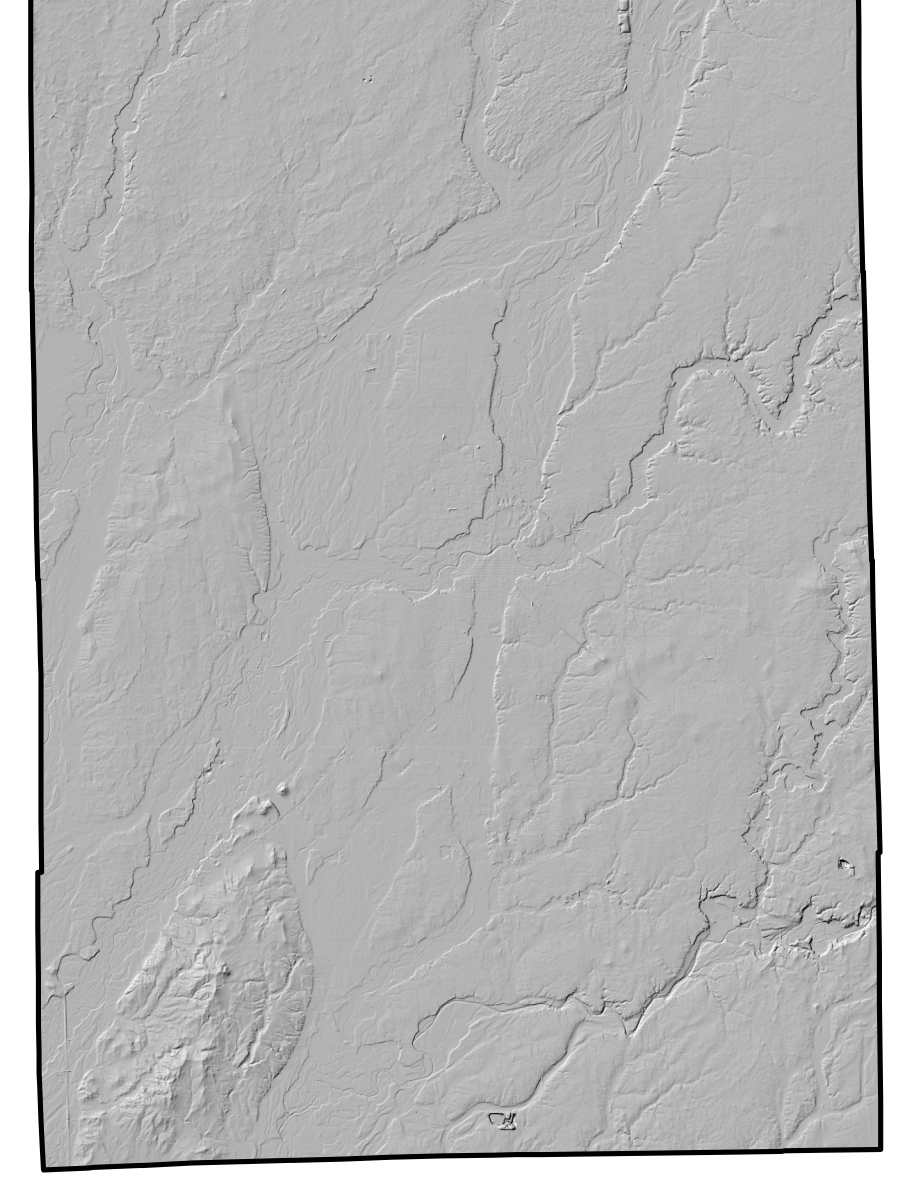
EXPLANATION

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- Stream
- County Road
- State Road & US Highway
- Interstate
- Municipal Boundary
- Lake & River
- No Aquifer Material/ Limited Data

Location Map



Hillshade Map of Shelby County, Indiana



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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. Draft road shapefiles, System 1 and System 2 (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. Hydrography, Streams (NHID) (line shapefile, 20081218), Rivers (NHID) (polygon shapefile, 20081218), Lakes (NHID) (polygon shapefile, 20081218) was from the U.S. Geological Survey and the U.S. Environmental Protection Agency and based on a 1:24,000 scale. County Hillshade image was from the U.S. Geological Survey National Elevation Dataset (raster image, 20100324). No Aquifer Material and Limited Data (polygon shapefile) was based on the Unconsolidated Aquifer Systems of Shelby County, Indiana (polygon shapefile, Schrader, 2005). Potentiometric Surface Map of the Unconsolidated Aquifers of Shelby County, Indiana (line shapefiles, Scott, 2012) was based on a 1:24,000 scale.

Potentiometric Surface Map of the Unconsolidated Aquifers of Shelby County, Indiana

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Shelby County

