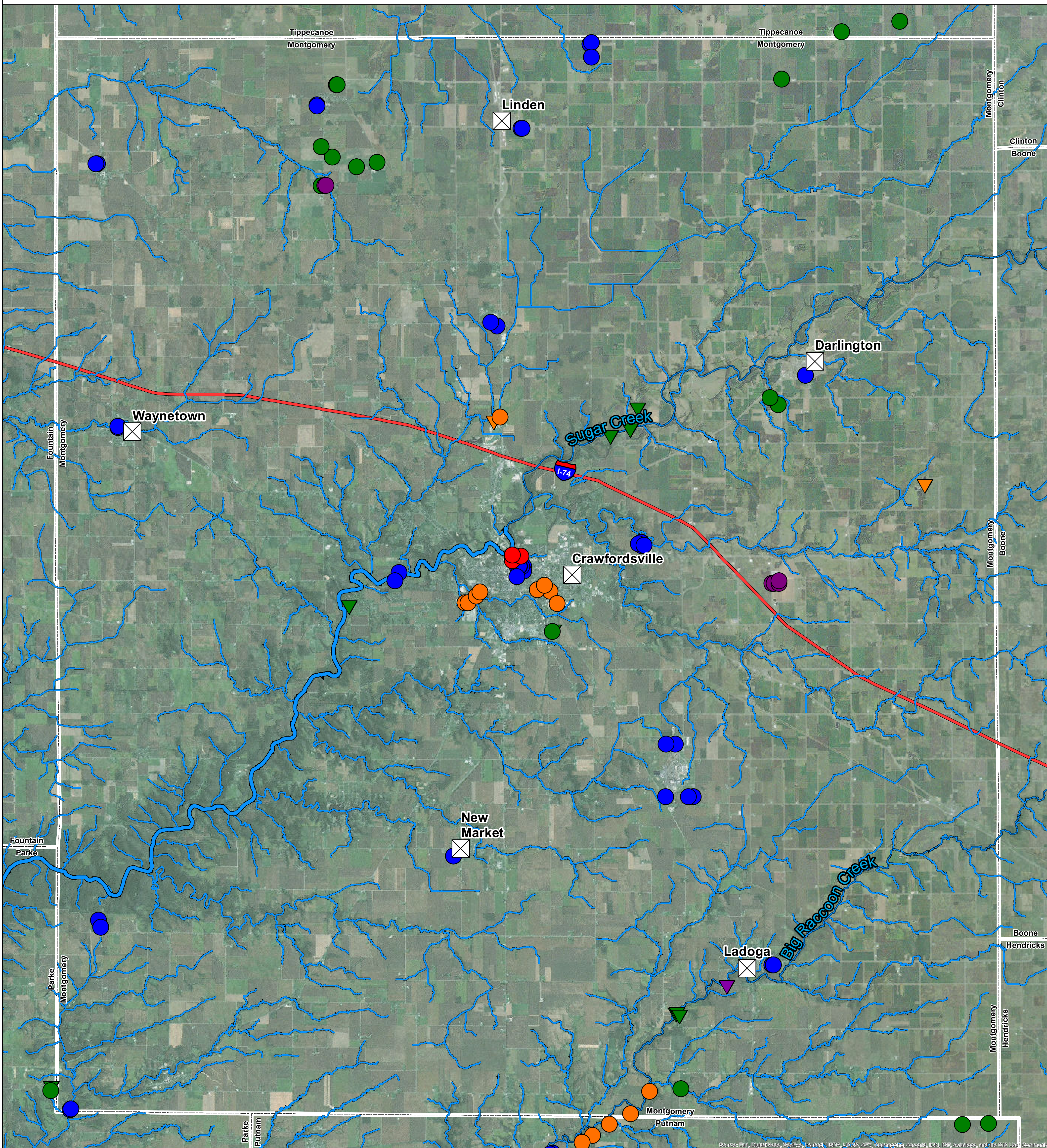
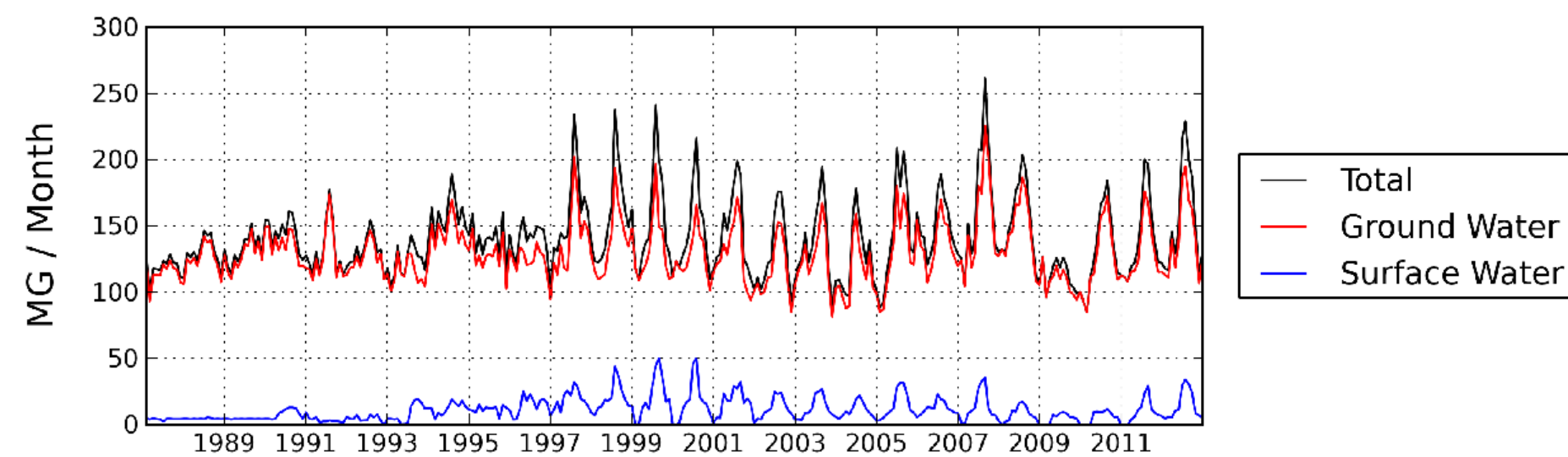
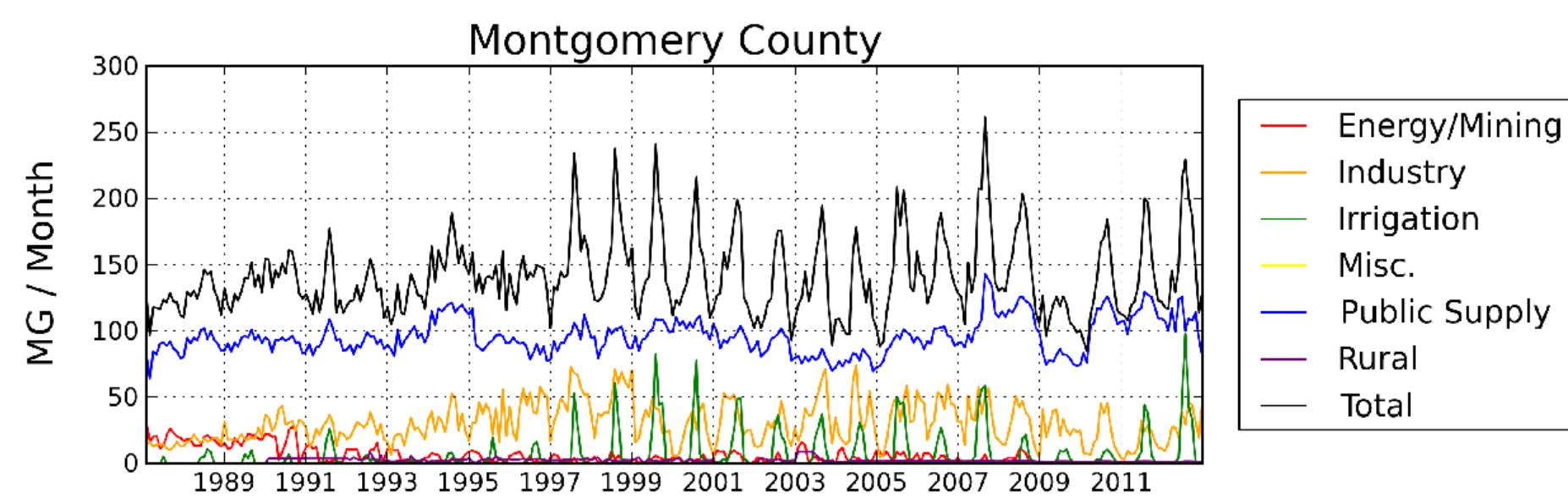


Average Daily Use: 5.2 MGD



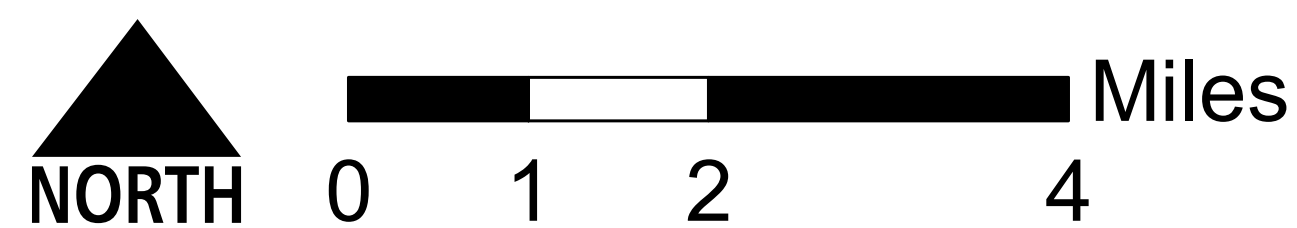
Water Resources and Use in Montgomery County

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

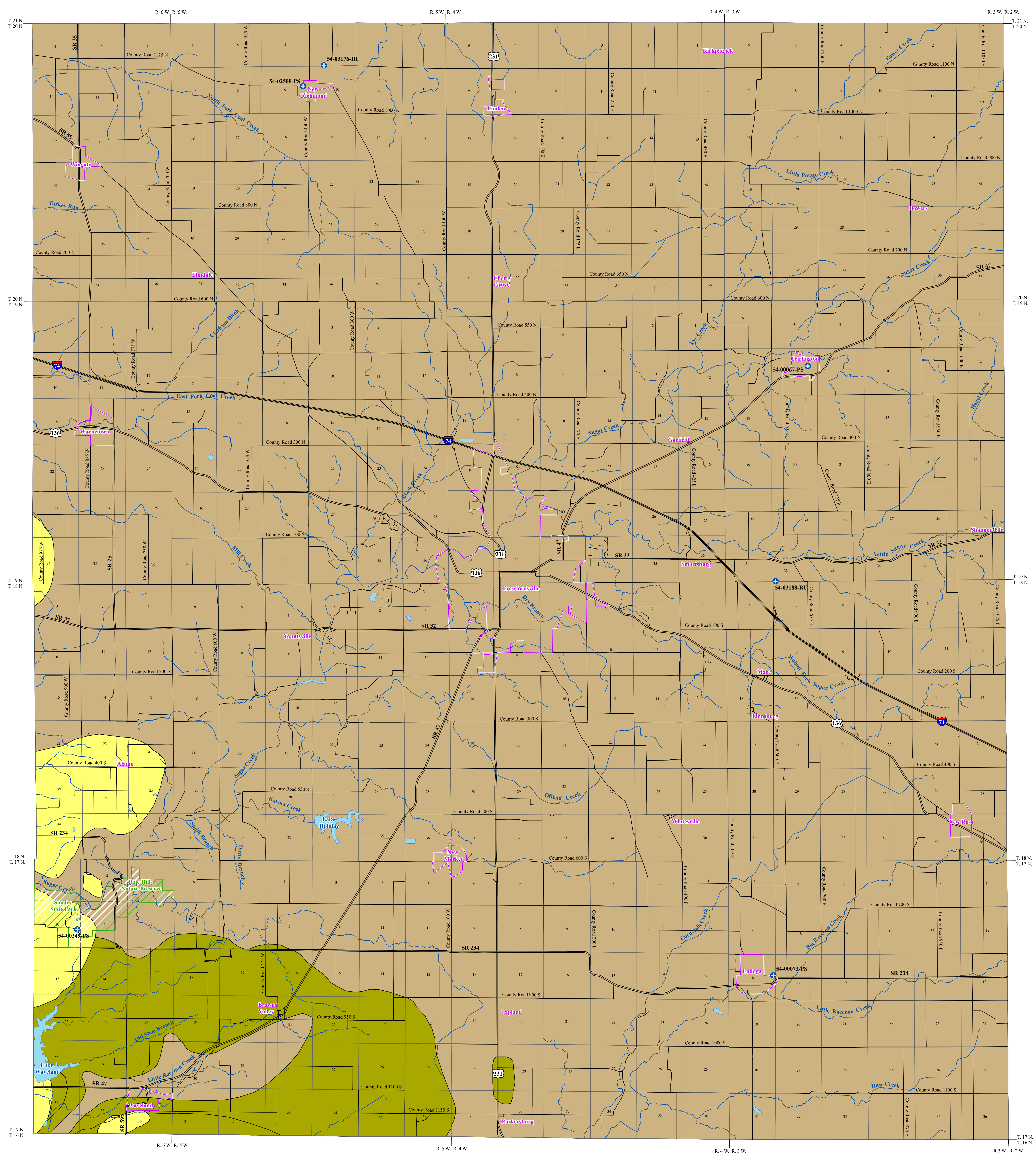
- | Withdrawal Location | |
|---------------------------------------|---|
| WELL | INTAKE |
| ● | ▼ Energy/Mining |
| ● | ▼ Industry |
| ● | ▼ Irrigation |
| ● | ▼ Misc. |
| ● | ▼ Public Supply |
| ● | ▼ Rural Use |

- | River | 7Q2 Flow (MGD) |
|--|----------------|
| — | <10 MGD |
| — | 10 - 50 MGD |
| — | 50 - 100 MGD |
| — | 100 - 500 MGD |
| — | > 500 MGD |

- Major Lakes
- Interstate
- County
- X City



BEDROCK AQUIFER SYSTEMS OF MONTGOMERY COUNTY, INDIANA



The occurrence of bedrock aquifers depends on the original composition of the geologic material 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 ranging from outcropping to over 400 feet thick northwest of Kirkpatrick where a deep narrow buried bedrock valley exists the county. Bedrock is at or near the surface in many places along Sugar Creek and its tributaries, and also Big Racon Creek. Bedrock is typically less than 100 feet deep in much of the county.

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. 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.

Three bedrock aquifer systems are identified for Montgomery County. They are, from youngest to oldest: the Racoon Creek Group of Pennsylvanian age, the Blue River and Sanders Group of Mississippian age, and the Borden Group of Mississippian age. Bedrock wells represent a little more than half of all wells completed in the 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.

Pennsylvanian - Racoon Creek Group Aquifer System

The Racoon Creek Group Aquifer System outcrops/subcrops primarily in portions of southwestern Montgomery County. This bedrock aquifer system consists of mostly sandstone and shale with minor amounts of mudstone, coal, and limestone. The basal formation of the Racoon Creek Group, the Mansfield Formation, rests unconformably on Mississippian rocks. The Pennsylvanian-Mississippian crossional 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 is typically less than 100 feet. The few wells in this system are completed at depths ranging from 45 to 147 feet. The amount of rock penetrated by wells varies from 26 to 111 feet. Reported static water levels range from 9 to 31 feet below the surface. There is one registered significant groundwater withdrawal facility (2 wells) that penetrates this system. These wells primarily utilize the Mansfield Formation. The facility is used for public water supply and the wells have reported capacities of 58 and 83 gallons per minute (gpm). This system is not very susceptible to contamination from the land surface because of thick, low-permeability strata above water-bearing zones. However, the system is moderately susceptible to contamination from the land surface where the unconsolidated deposits are thin.

Mississippi - Blue River and Sanders Groups Aquifer System

The area of the Blue River and Sanders Groups Aquifer System in Montgomery County is located in the southwestern corner of the county. The rocks of this system primarily consist of limestone and dolomite, but they contain significant amounts of gypsum, anhydrite, shale, chert, and calcareous sandstone in places.

The depth to the bedrock surface is typically between 20 and 120 feet. Wells in this system are completed at depths ranging from 55 to 175 feet with reported static water levels ranging from 6 to 60 feet below the surface. The amount of rock penetrated by wells varies from 10 to as much as 115 feet. This aquifer system in Montgomery County is considered moderately susceptible to contamination from the land surface because of the shallow rock. Where the unconsolidated deposits are thicker the susceptibility to contamination is lower.

Mississippi - Borden Group Aquifer System

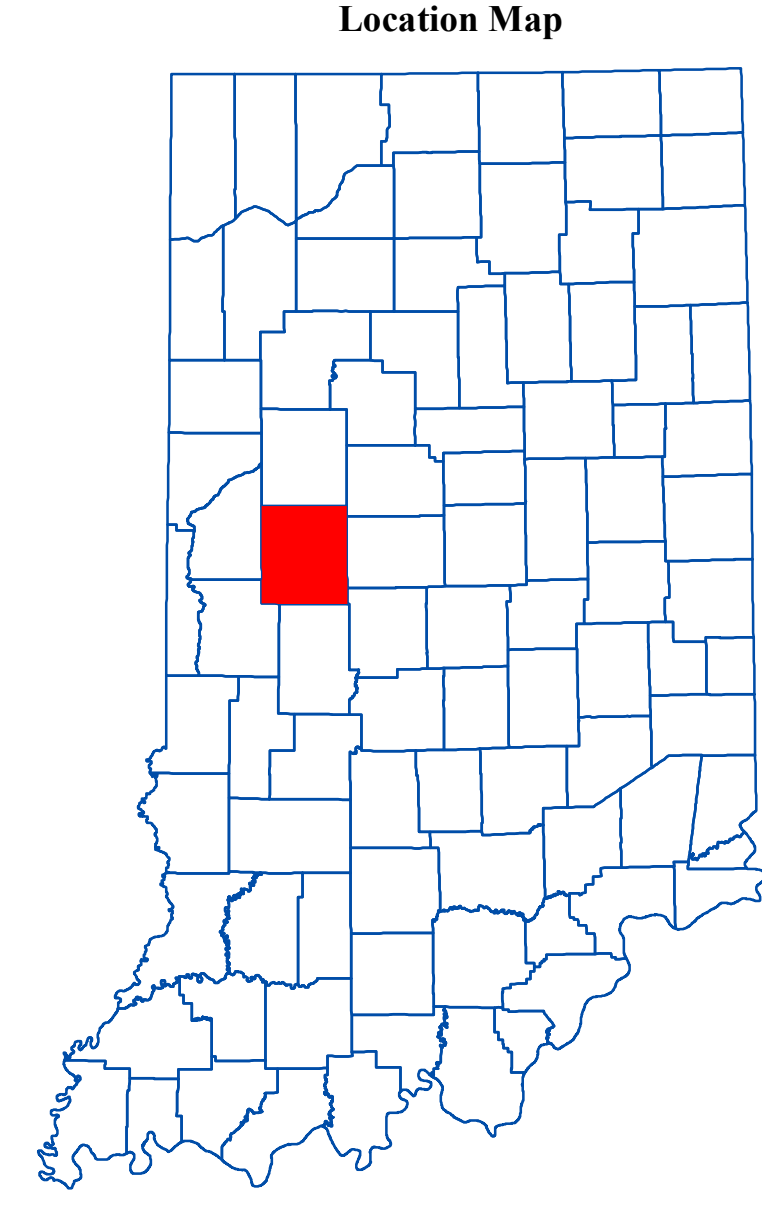
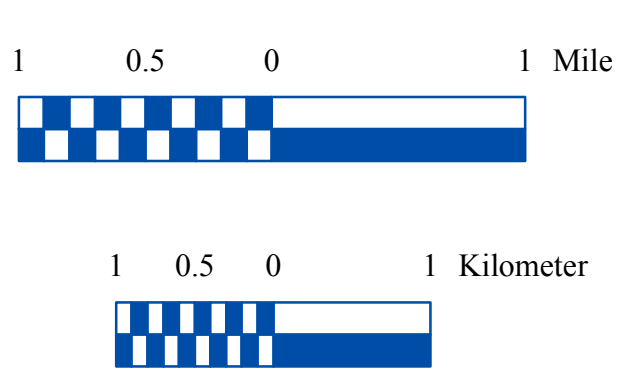
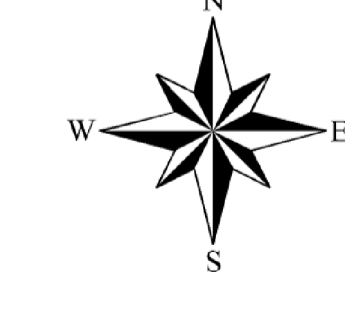
The Mississippian age Borden Group outcrops/subcrops throughout most of the county. This bedrock aquifer system is composed mostly of siltstone and shale, but fine-grained sandstones are common. Carbonates are rare, but do occur as discontinuous, interbedded limestone lenses, mostly in the upper portion of the group. Depth to bedrock in the Borden Group in Montgomery County ranges from outcropping along Sugar Creek, to over 400 feet deep northwest of Kirkpatrick.

Because this system is generally not very productive, it is typically used only where overlying deposits do not contain aquifer material. The Borden Group is often described as an aquitard, and well yields are typically quite limited. A few of the domestic wells penetrate through the shale and siltstone in favor of the underlying Silturian and Devonian Carbonates that are generally more productive. Reported depths commonly range from 60 to 120 feet deep. The amount of rock penetrated in this system generally ranges from 15 to 55 feet. The typical domestic well in the outcrop/subcrop area produces less than 15 gpm. Many dry holes have been reported in this system. Static water levels commonly range from 10 to 40 feet below the land surface. There are five registered significant groundwater withdrawal facilities (8 wells) that penetrate this system with reported capacities between 60 and 225 gpm. However, it is likely these wells have encountered a fractured area and are receiving water from the unconsolidated deposits on top of the bedrock, or are utilizing underlying Silturian and Devonian Carbonates. The facilities are used for public water supply, irrigation and rural uses.

The Borden Group is composed of primarily fine-grained materials that limit the movement of groundwater to fractures, joints, and along the bedrock surface. Where bedrock is shallow, risk to contamination from the surface or near surface sources is high. Where the overlying sediment consists of thick fine-grained clay materials, the Borden Group Aquifer System in Montgomery County is at low risk to contamination from the surface or near surface sources.

EXPLANATION

- Registered Significant Groundwater Withdrawal Facility
- Stream
- County Road
- State Road & US Highway
- Interstate
- Municipal Boundary
- State Managed Property
- Lake & River



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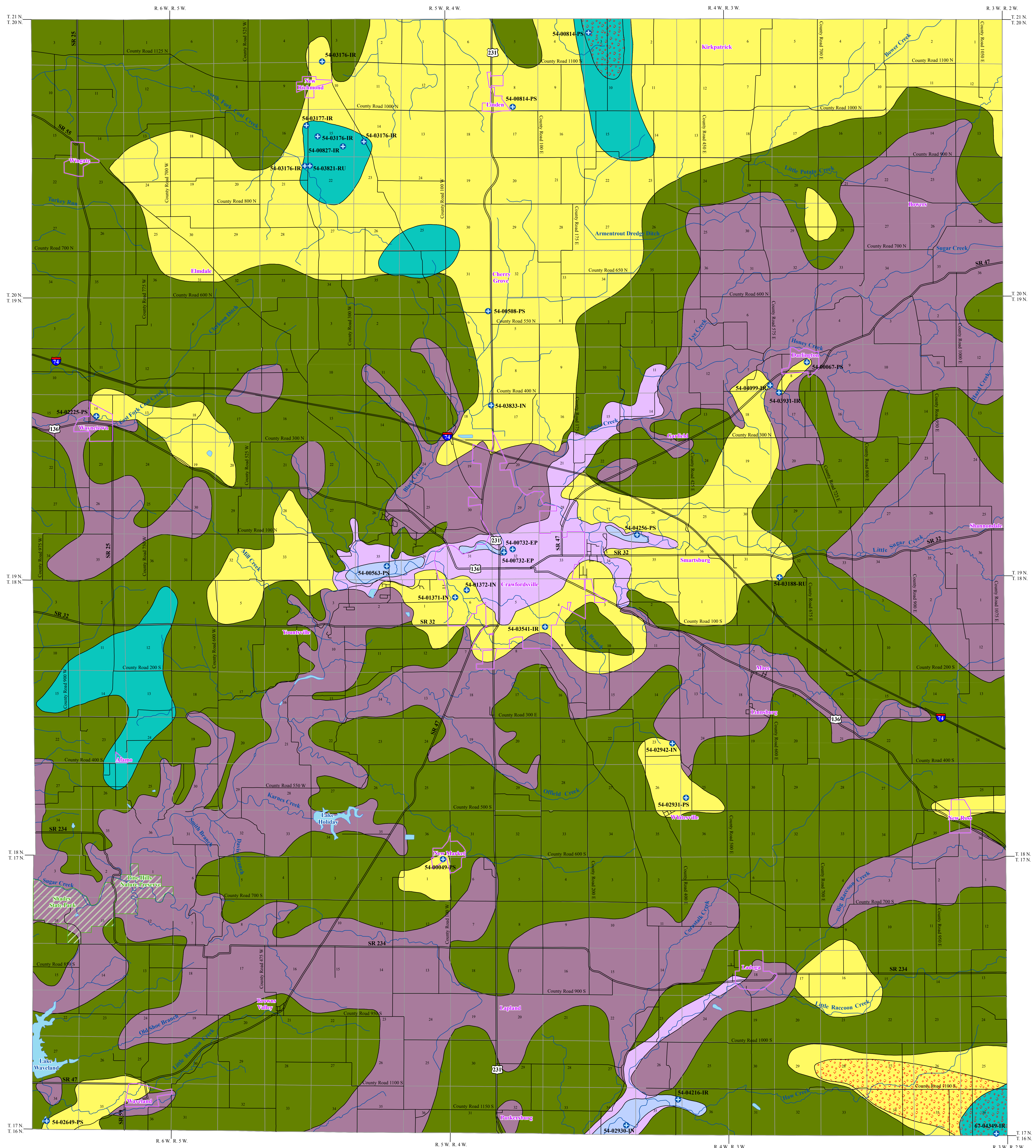
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This map was created from several existing shapefiles. Township and Range Lines of Indiana (line shapefile, 20020621), Land Survey Lines of Indiana (polygon shapefile, 20020621) and County Boundaries of Indiana (polygon shapefile, 20020621) were all from the Indiana Geological Survey and based on a 1:24,000 scale, 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 Montgomery County, Indiana

by
Glenn E. Grove
Division of Water, Resource Assessment Section
September 2009

UNCONSOLIDATED AQUIFER SYSTEMS OF MONTGOMERY COUNTY, INDIANA



The unconsolidated aquifer systems of Montgomery County are composed of sediments deposited by, or resulting from, a complicated sequence of glacial, glacial meltwaters, and post-glacial precipitation events. Six unconsolidated aquifer systems have been mapped in Montgomery County: the Tipton Till, the Central Wabash Valley/Tipton Till Subsystem, the Central Wabash Valley/Tipton Complex, the Wabash River and Tributaries Outwash System, and the Wabash River and Tributaries Outwash Subsystem. Because of the complicated glacial geology, boundaries of the aquifer systems in this county are commonly gradational and individual aquifers may extend across aquifer system boundaries.

The thickness of unconsolidated deposits in Montgomery County is quite variable, due to the deposition of glacial material over an uneven bedrock surface. Unconsolidated deposits are typically less than 100 feet deep in much of the county. However, in places, bedrock is at or near the surface along Sugar Creek and its tributaries, and Big Raccoon Creek. The thickest unconsolidated deposits are about 400 feet thick where a deep narrow buried bedrock valley exists the county northwest of Kirkpatrick. Another narrow buried bedrock valley is present along the southeast corner of the county with up to 250 feet of unconsolidated deposits in a few places.

Regional estimates of aquifer susceptibility to contamination from the surface can differ considerably due to a wide range of variations within geologic environments. 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.

Tipton Till Aquifer System

In Montgomery County, the Tipton Till Aquifer System consists of areas where the unconsolidated material is predominantly thin till overlying bedrock. Along some of the major streams, this system also includes thin alluvium, and surficial sand and gravel outwash deposits overlying shallow bedrock. This system in Montgomery County is primarily mapped along the major streams including Big Raccoon Creek, Coal Creek, Sugar Creek and many of its tributaries. Total thickness of the Tipton Till Aquifer System generally ranges from about 10 to 50 feet. This system has the most limited groundwater resources of the unconsolidated aquifer systems in the county.

There is little potential for groundwater production in this system in Montgomery County. The system is commonly bypassed and most wells are completed in the underlying bedrock. Potential aquifers within this system include thin isolated sand and/or gravel layers, and surficial sand and gravel outwash or alluvium. Very few of the reported wells penetrating this aquifer system in the county are completed in unconsolidated materials. In this county the depth of the few wells completed in the Tipton Till Aquifer System range from 32 to 50 feet deep with static water levels ranging between 5 and 20 feet below the surface. Most of the wells have reported capacities of less than 10 gallons per minute (gpm).

This system is generally not very susceptible to contamination from surface sources because of the low permeability of the near-surface materials. However, there are areas where protective clay layers are thin or absent. These areas are very susceptible to contamination.

Tipton Till Aquifer System

The Tipton Till Aquifer System primarily consists of glacial till with intertill sand and gravel layers. In Montgomery County, this aquifer system ranges in thickness from about 50 feet to 250 feet. However, the sand and gravel aquifers in this system tend to be thin and discontinuous.

Wells completed in this system are capable of meeting the needs of most domestic and some high-capacity users in Montgomery County. Saturated aquifer materials include sand and gravel deposits that are commonly 5 to 15 feet thick and are generally overlain by 35 to 90 feet of till. Wells producing from this aquifer system are typically 55 to 110 feet deep. Domestic well capacities are commonly 10 to 20 gpm with static water levels generally ranging from 15 to 60 feet below the surface. There are 16 registered significant groundwater withdrawal facilities (28 wells) using the Tipton Till Aquifer System and most of these facilities are used for public supply and industry. The reported pumping rates range from 10 to 543 gpm.

A small area of the Tipton Till Aquifer System overlies a buried bedrock valley in the southeastern part of the county. The total unconsolidated thickness generally exceeds 200 feet in this area. Only one reported well utilizes the deeper aquifer within the buried bedrock valley. The aquifer utilized by this well is reported to be 10 feet thick and the reported yield is 20 gpm.

The Tipton Till Aquifer System typically has a low susceptibility to surface contamination because intertill sand and gravel units are moderately overlain by thick glacial till. Shallow wells completed in this system are moderately susceptible to contamination.

Central Wabash Valley/Tipton Till Aquifer Subsystem

The Central Wabash Valley/Tipton Till Aquifer Subsystem is mapped throughout the county. The subsystem is mapped similar to that of the Tipton Till Aquifer System. However, potential aquifer materials are generally thinner and potential yields are less in the subsystem.

The unconsolidated deposits typically range from 50 feet to 130 feet thick for the subsystem in this county. However, the depth to bedrock is generally less than 100 feet. Potential aquifer materials include thin, discontinuous intertill sand and gravel deposits. Where present, these deposits are typically capped by till that is commonly 40 to 60 feet thick. There are no registered significant groundwater withdrawal facilities utilizing this system.

About half of the wells started in this subsystem in Montgomery County are completed in the underlying bedrock aquifer system. However, the Central Wabash Valley/Tipton Till Aquifer Subsystem is capable of meeting the needs of some domestic users in the county. The wells producing from this subsystem are completed at depths ranging from 50 to 100 feet. Intertill sand and gravel aquifer materials are typically less than 5 feet thick. Domestic well yields are commonly 5 to 10 gpm and static water levels are generally 10 to 35 feet below the surface.

This subsystem is generally not very susceptible to surface contamination because intertill sand and gravel units are overlain by thick till deposits. Wells producing from shallow aquifers are moderately to highly susceptible to contamination.

Central Wabash Valley/Tipton Complex Aquifer System

The Central Wabash Valley/Tipton Complex Aquifer System is mapped in a few areas of Montgomery County and is characterized by unconsolidated deposits that are quite variable in materials and thickness. The aquifers are typically overlain by thick clay layers. The aquifers are highly variable in depth and lateral extent and include single or multiple intertill sand and gravel layers. The total thickness of unconsolidated deposits range from about 50 feet to over 400 feet.

The deeper more prolific aquifers of this system are capable of meeting the needs of domestic and some high-capacity users in Montgomery County. Saturated aquifer materials in the Central Wabash Valley/Tipton Complex Aquifer System are generally 15 to 40 feet thick. Wells in this system are typically completed at depths ranging from 70 to 110 feet. Domestic well yields are commonly 10 to 40 gpm and static water levels are generally 20 to 50 feet below the surface. There are four registered significant groundwater withdrawal facilities (7 wells) using this system. These facilities are used for irrigation. The reported yield for the high-capacity wells ranges from 85 to 740 gpm.

Northwest of Kirkpatrick, a portion of this system overlies the Lafayette (Teays) Bedrock Valley System with a total thickness of unconsolidated deposits of around 400 feet. The deeper portion of the buried bedrock valley is filled with thick sand and gravel deposits. A test well reported over 50 feet of sand and gravel above the bedrock valley. Another small area of this system is located in the southeastern corner of the county and overlies a smaller buried bedrock valley with a total thickness of unconsolidated deposits around 225 feet, with reported sand and gravel thickness of around 35 feet. There are two registered significant groundwater withdrawal facilities (2 wells) using this system which is used for public water supply and irrigation. Reported pumping rates range from 800 to 1100 gpm.

The Central Wabash Valley/Tipton Complex Aquifer System is not very susceptible to contamination where overlain by thick clay deposits. However, in some areas where surficial clay deposits are thin or lacking, the shallow aquifer, if present, is at moderate to high risk.

Wabash River and Tributaries Outwash Aquifer System

The Wabash River and Tributaries Outwash Aquifer System is mapped in a few places along Sugar Creek around Crawfordsville and Big Raccoon Creek southwest of Ladoga. This system includes thick glacial outwash sands and gravels capped by recent alluvial deposits. The total thickness of unconsolidated deposits in this system ranges from 30 feet to over 150 feet.

This aquifer system is capable of meeting the needs of domestic and high-capacity users in Montgomery County. The few wells utilizing the Wabash River and Tributaries Outwash Aquifer System are completed at depths ranging from 29 to 141 feet with saturated sand and gravel aquifer materials commonly 10 to 40 feet thick. Static water levels range from flowing to 27 feet below the surface. In Montgomery County, there are five registered significant groundwater withdrawal facilities (2 wells) in this system. The main uses for these facilities are public water supply and energy production. Reported capacities for these wells range from 100 to 800 gpm in Montgomery County.

This system is highly susceptible to surface contamination where sand and gravel deposits are near the surface and have little or no clay deposits. However, areas that have overlying thick clay deposits are moderately susceptible to contamination.

Wabash River and Tributaries Outwash Aquifer Subsystem

The Wabash River and Tributaries Outwash Aquifer Subsystem is mapped along Sugar Creek around Crawfordsville and Big Raccoon Creek southwest of Ladoga. In places, sand and gravel from the melting glaciers (outwash) were deposited in the stream valleys. The subsystem is mapped similar to the Wabash River and Tributaries Outwash Aquifer System. However, potential aquifer materials are generally thinner, with thicker overlying silt and/or clay materials, and potential yields are less in the subsystem than in the system. The total thickness of unconsolidated deposits in this system ranges from about 30 feet to over 150 feet. The aquifer materials in this system are generally overlain by 10 to 35 feet of silt and/or clay. However, in many places, this layer is missing and unsaturated sand and gravel deposits lie above the productive aquifer.

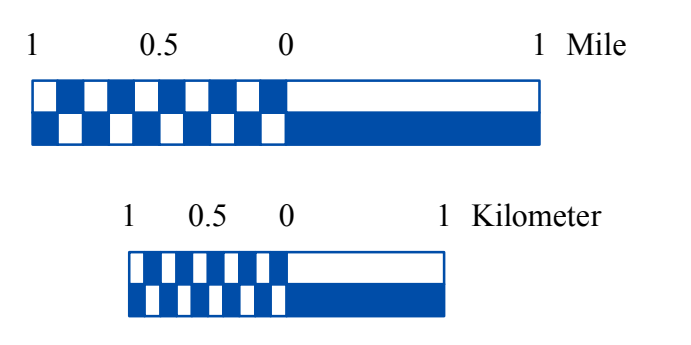
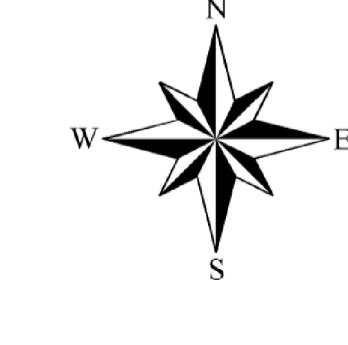
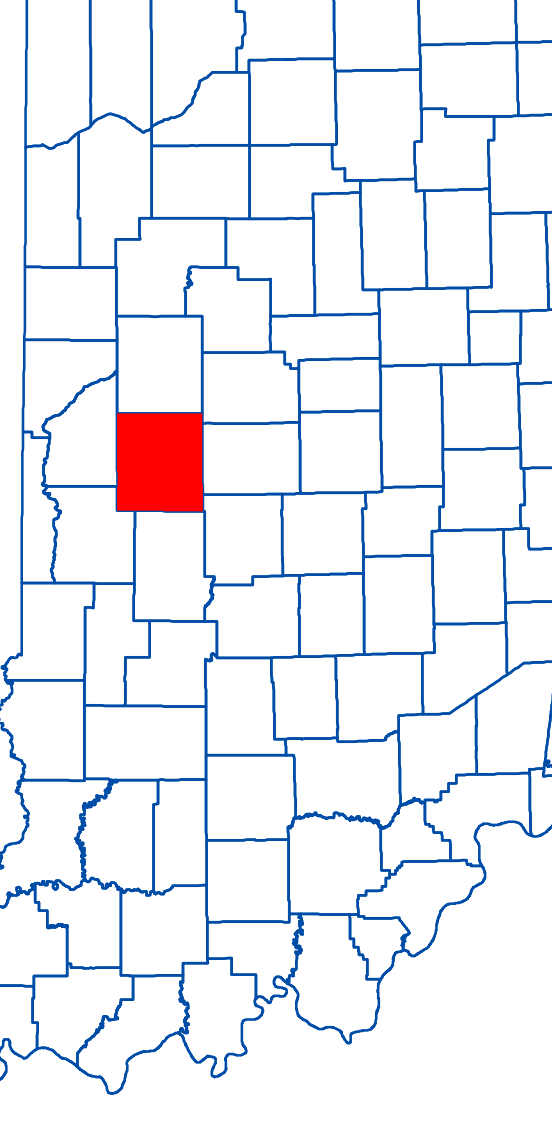
The Wabash River and Tributaries Outwash Aquifer Subsystem has the potential to meet the needs of domestic and some high-capacity users. The wells in this system are completed at depths commonly ranging from 40 to 85 feet. Saturated aquifer materials include sand and gravel deposits that are commonly 15 to 25 feet thick. Domestic well yields typically range from 10 to 20 gpm with static water levels generally ranging from flowing to 45 feet below the surface. There is only one registered significant groundwater withdrawal facility with one well in this system. The reported capacity for this well is 100 gpm and the well is used for energy production.

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

EXPLANATION

- Registered Significant Groundwater Withdrawal Facility
- Stream
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- Lake & River

Location Map



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Unconsolidated Aquifer Systems of Montgomery County, Indiana

by
Glenn E. Grove
Division of Water, Resource Assessment Section
September 2009

Montgomery County

