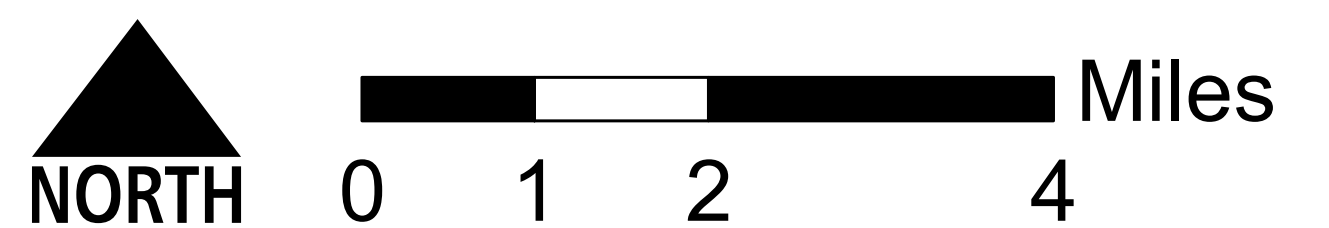
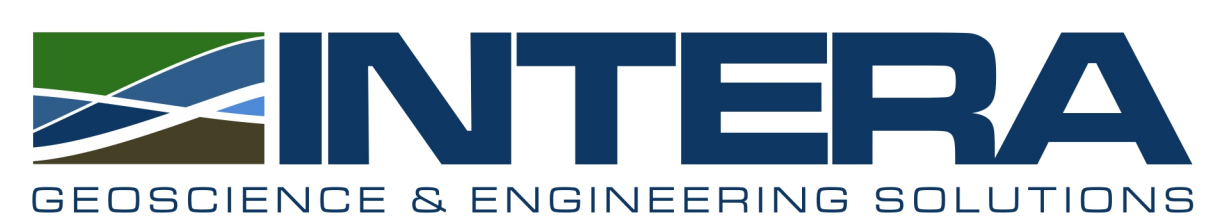


Water Resources and Use in Monroe County

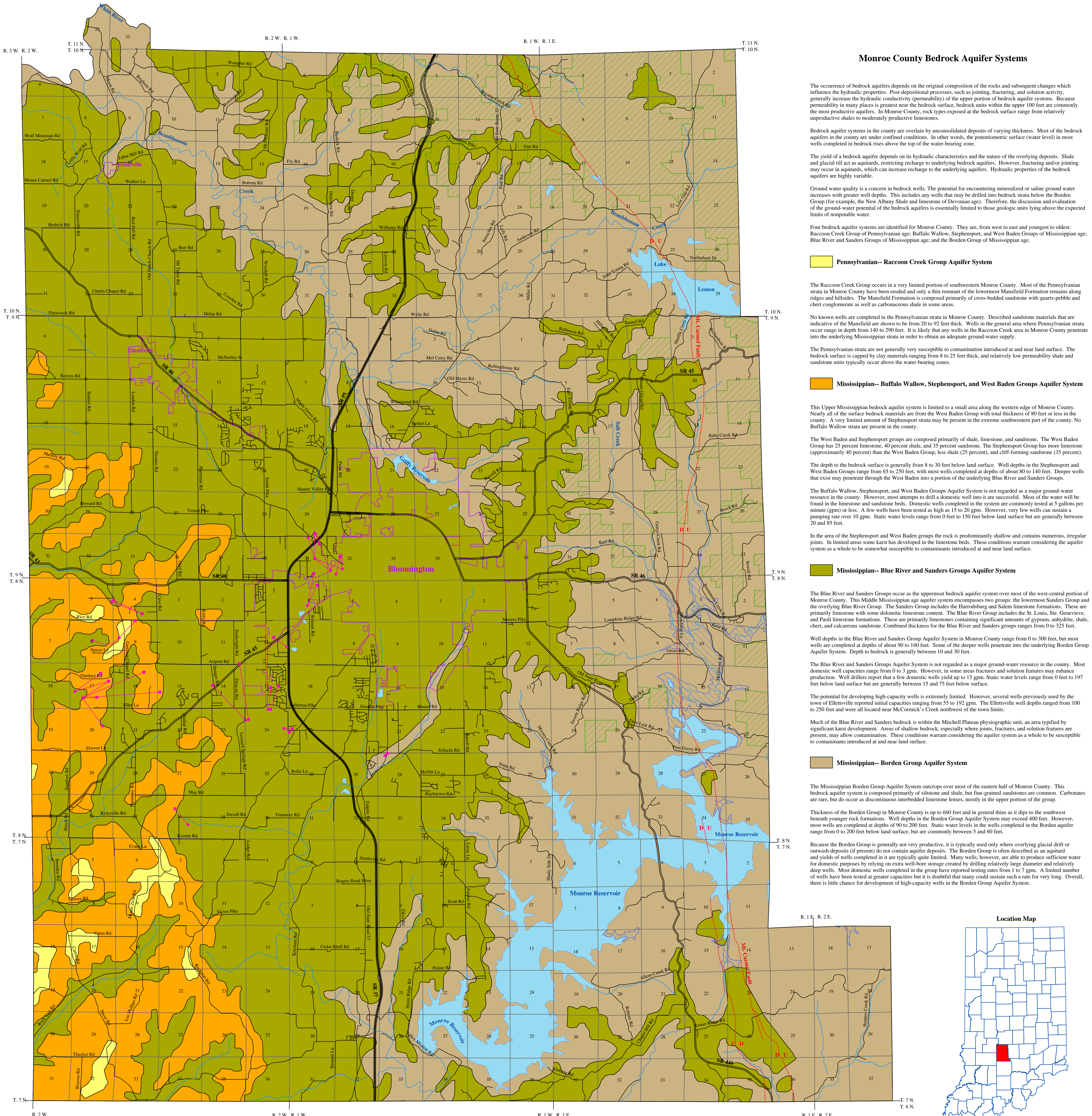
Data Sources: U.S. Geological Survey and Indiana Department of Natural Resources

Withdrawal Location		River
WELL	INTAKE	7Q2 Flow (MGD)
●	▼	<10 MGD
●	▼	10 - 50 MGD
●	▼	50 - 100 MGD
●	▼	100 - 500 MGD
●	▼	> 500 MGD

■	Major Lakes
—	Interstate
□	County
⊗	City



BEDROCK AQUIFER SYSTEMS OF MONROE COUNTY, INDIANA



Monroe County Bedrock Aquifer Systems

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 in many places is greatest near the bedrock surface, bedrock units within the upper 100 feet are commonly the most productive aquifers. In Monroe County, rock types exposed at the bedrock surface range from relatively unproductive shales to moderately productive limestones.

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

Ground water quality is a concern in bedrock wells. The potential for encountering mineralized or saline ground water increases with greater well depths. This includes any wells that may be drilled into bedrock strata below the Borden Group (for example, the New Albany Shale and limestone of Devonian age). Therefore, the discussion and evaluation of the ground-water potential of the bedrock aquifer is essentially limited to those geologic units lying above the expected limits of nonpotable water.

Four bedrock aquifer systems are identified for Monroe County. They are, from west to east and youngest to oldest: Raccoon Creek Group of Pennsylvanian age; Buffalo Wallow, Stephensport, and West Baden Groups of Mississippian age; Blue River and Sanders Groups of Mississippian age; and the Borden Group of Mississippian age.

Pennsylvanian-- Raccoon Creek Group Aquifer System

The Raccoon Creek Group occurs in a very limited portion of southwestern Monroe County. Most of the Pennsylvanian strata in Monroe County have been eroded and only this remnant of the lowermost Mansfield Formation remains along ridges and hillsides. The Mansfield Formation is composed primarily of cross-bedded sandstone with quartz-pebble and chert conglomerate as well as carbonaceous shale in some areas.

No known wells are completed in the Pennsylvanian strata in Monroe County. Described sandstone materials that are indicative of the Mansfield are shown to be from 20 to 92 feet thick. Wells in the general area where Pennsylvanian strata occur range in depth from 140 to 290 feet. It is likely that any wells in the Raccoon Creek area in Monroe County penetrate into the underlying Mississippian strata in order to obtain an adequate ground-water supply.

The Pennsylvanian strata are not generally very susceptible to contamination introduced at and near land surface. The bedrock surface is capped by clay materials ranging from 8 to 25 feet thick, and relatively low permeability shale and sandstone units typically occur above the water-bearing zones.

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

This Upper Mississippian bedrock aquifer system is limited to a small area along the western edge of Monroe County. Nearly all of the surface bedrock materials are from the West Baden Group with total thickness of 80 feet or less in the county. A very limited amount of Stephensport strata may be present in the extreme southwestern part of the county. No Buffalo Wallow strata are present in the county.

The West Baden and Stephensport groups are composed primarily of shale, limestone, and sandstone. The West Baden Group has 25 percent limestone, 40 percent shale, and 35 percent sandstone. The Stephensport Group has more limestone (approximately 40 percent) than the West Baden Group, less shale (25 percent), and cliff-forming sandstone (35 percent).

The depth to the bedrock surface is generally from 8 to 30 feet below land surface. Well depths in the Stephensport and West Baden Groups range from 65 to 250 feet, with most wells completed at depths of about 80 to 140 feet. Deeper wells that exist may penetrate through the West Baden into a portion of the underlying Blue River and Sanders Groups.

The Buffalo Wallow, Stephensport, and West Baden Groups Aquifer System is not regarded as a major ground-water resource in the county. However, most attempts to drill a domestic well into it are successful. Most of the water will be found in the limestone with some dolomitic limestone content. Domestic wells completed in the system are commonly tested at 5 gallons per minute (gpm) or less. A few wells have been tested as high as 15 to 20 gpm. However, very few wells can sustain a pumping rate over 10 gpm. Static water levels range from 0 feet to 150 feet below land surface but are generally between 20 and 85 feet.

In the area of the Stephensport and West Baden groups the rock is predominantly shallow and contains numerous, irregular joints. In limited areas some karst has developed in the limestone beds. These conditions warrant considering the aquifer system as a whole to be somewhat susceptible to contaminants introduced at and near land surface.

Mississippian-- Blue River and Sanders Groups Aquifer System

The Blue River and Sanders Groups occur as the uppermost bedrock aquifer system over most of the west-central portion of Monroe County. This Middle Mississippian age aquifer system encompasses two groups; the lowermost Sanders Group and the overlying Blue River Group. The Sanders Group includes the Harrodsburg and Salem limestone formations. These are primarily limestone with some dolomitic limestone content. The Blue River Group includes the St. Louis, Ste. Genevieve, and Paoli limestone formations. These are primarily limestones containing significant amounts of gypsum, anhydrite, shale, chert, and calcareous sandstone. Combined thickness for the Blue River and Sanders groups ranges from 0 to 325 feet.

Well depths in the Blue River and Sanders Group Aquifer System in Monroe County range from 0 to 300 feet, but most wells are completed at depths of about 90 to 160 feet. Some of the deeper wells penetrate into the underlying Borden Group Aquifer System. Depth to bedrock is generally between 10 and 30 feet.

The Blue River and Sanders Groups Aquifer System is not regarded as a major ground-water resource in the county. Most domestic well capacities range from 0 to 3 gpm. However, in some areas fractures and solution features may enhance production. Well drillers report that a few domestic wells yield up to 15 gpm. Static water levels range from 0 feet to 197 feet below land surface but are generally between 15 and 75 feet below surface.

The potential for developing high-capacity wells is extremely limited. However, several wells previously used by the town of Ellettsville reported initial capacities ranging from 55 to 192 gpm. The Ellettsville well depths ranged from 100 to 250 feet and were all located near McCormick's Creek northwest of the town limits.

Much of the Blue River and Sanders bedrock is within the Mitchell Plateau physiographic unit, an area typified by significant karst development. Areas of shallow bedrock, especially where joints, fractures, and solution features are present, may allow contamination. These conditions warrant considering the aquifer system as a whole to be susceptible to contaminants introduced at and near land surface.

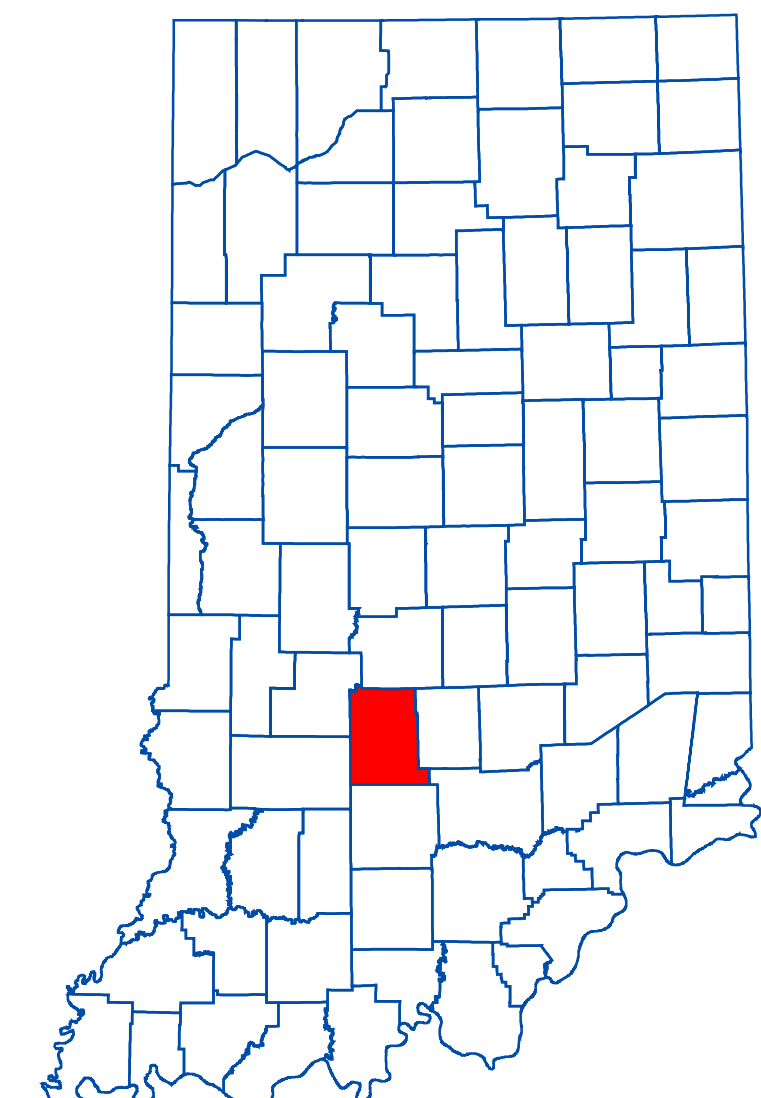
Mississippian-- Borden Group Aquifer System

The Mississippian Borden Group Aquifer System outcrops over most of the eastern half of Monroe County. This bedrock aquifer system is composed primarily 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.

Thickness of the Borden Group in Monroe County is up to 660 feet and in general thins as it dips to the southwest beneath younger rock formations. Well depths in the Borden Group Aquifer System may exceed 400 feet. However, most wells are completed at depths of 90 to 200 feet. Static water levels in the wells completed in the Borden aquifer range from 0 to 200 feet below land surface, but are commonly between 5 and 60 feet.

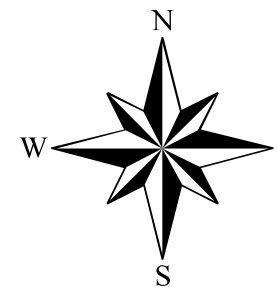
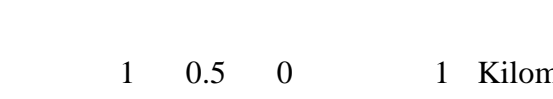
Because the Borden Group is generally not very productive, it is typically used only where overlying glacial drift or outwash deposits (if present) do not contain aquifer deposits. The Borden Group is often described as an aquiclude and yields of wells completed in it are typically quite limited. Many 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. Most domestic wells completed in the group have reported testing rates from 1 to 7 gpm. A limited number of wells have been tested at greater capacities but it is doubtful that many could sustain such a rate for very long. Overall, there is little chance for development of high-capacity wells in the Borden Group Aquifer System.

Location Map



EXPLANATION

- Input Karst Dye Test Point
- Output Karst Dye Test Point
- Karst Dye Trace
- Mt. Carmel Fault Line
- County Road
- State Road & US Highway
- Stream
- Lake & River
- Land Subject to Inundation
- Municipal Boundary
- Morgan-Monroe State Forest



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.

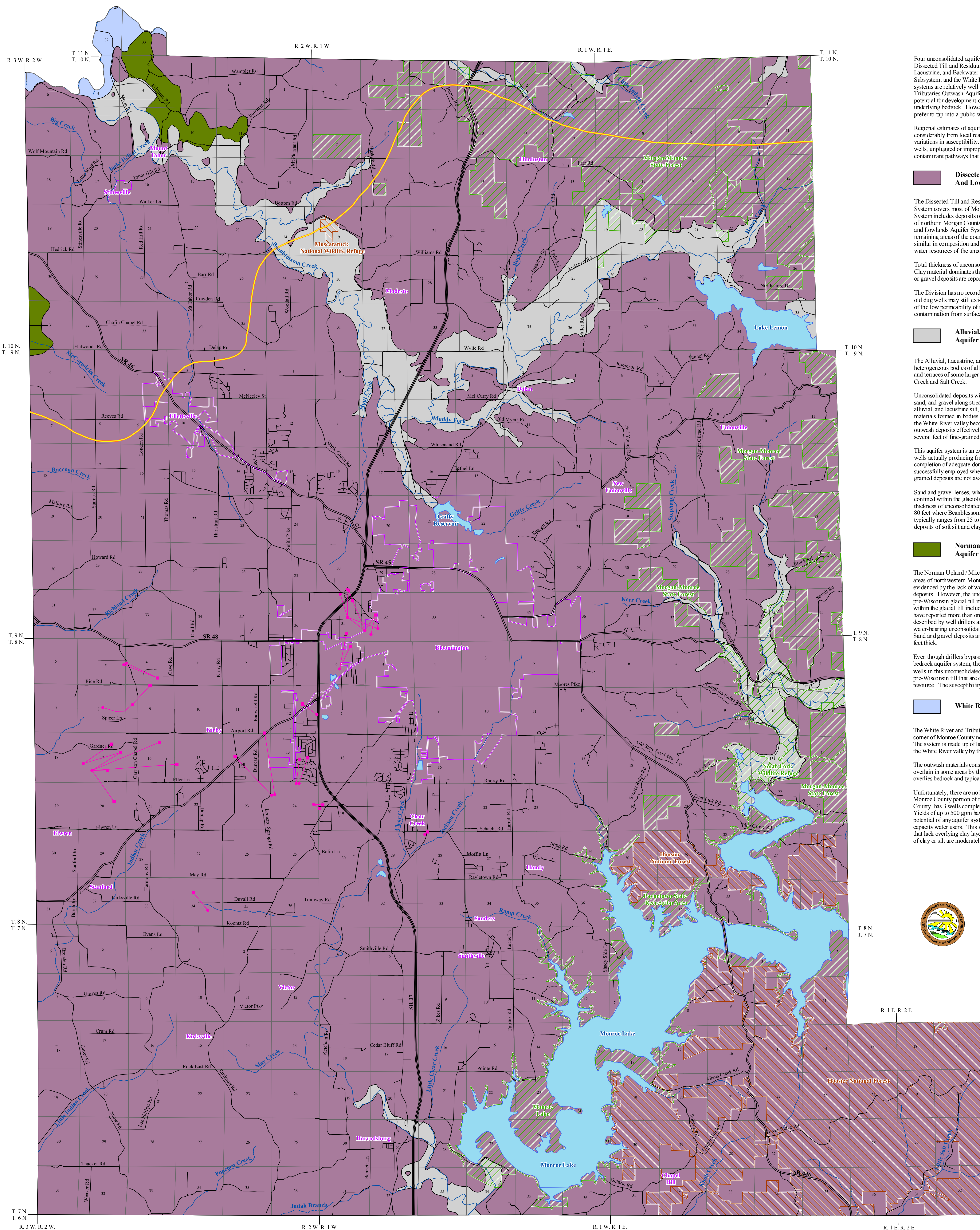
This map was created from several existing shapefiles. Township and Range Lines of Indiana (line shapefile, Land Survey Lines of Indiana (polygon shapefile, 20030621), and County Boundaries of Indiana (polygon shapefile, 20050621) were all from the Indiana Geological Survey and based on a 1:24,000 scale, except the Bedrock Geology of Southwestern Indiana (polygon shapefile, 2001124), which was at a 1:500,000 scale. Structural Features of Indiana (line shapefile, 20020718) was also from the Indiana Geological Survey, but based on various scales. Draft road shapefiles, System1 and System2 (line shapefiles, 2003), were from the Indiana Department of Transportation and based on a 1:24,000 scale. City Areas in Southwestern Indiana (polygon shapefile, 1999) was from ESRI and based on a 1:100,000 scale. Stream27 (line shapefile, 20000420) was from the Center for Advanced Applications in GIS at Purdue University. Managed Areas 96 (polygon shapefile, various dates) was from the IDNR and based on an unknown scale.

Bedrock Aquifer Systems of Monroe County, Indiana

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

July 2003

UNCONSOLIDATED AQUIFER SYSTEMS OF MONROE COUNTY, INDIANA



Four unconsolidated aquifer systems have been mapped in Monroe County: the Dissected Till and Residual / Unglacial Southern Hills and Lowlands Aquifer System, the Alluvial, Lacustrine, and Backwater Deposits Aquifer System, the Norman Upland / Mitchell Plateau Till Aquifer Subsystem, and the White River and Tributaries Outwash. Boundaries between the systems are relatively well defined. With the exception of the White River and Tributaries Outwash Aquifer System, unconsolidated aquifers in the county have limited potential for development of successful water wells. Drillers prefer to try a well in the underlying bedrock. However, that too is relatively limited, and many county residents prefer to tap into a public water supply system serving much of the county.

Regional estimates of aquifer susceptibility to surface contamination can differ considerably from local reality. Variations within geologic environments can cause large variations in susceptibility. Also, 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 Residual / Unglacial Southern Hills and Lowlands Aquifer System

The Dissected Till and Residual / Unglacial Southern Hills and Lowlands Aquifer System covers most of Monroe County. The Dissected Till and Residual Aquifer System includes deposits of pre-Wisconsin glacial drift within a two to three mile fringe of northern Morgan County. Unconsolidated deposits of the Unglacial Southern Hills and Lowlands Aquifer System include weathered bedrock residuum in most of the remaining areas of the county. The two systems are mapped the same because they are similar in composition and aquifer characteristics. They are the most limited groundwater resources of the unconsolidated aquifer systems in Monroe County.

Total thickness of unconsolidated deposits overlying bedrock is commonly 6 to 25 feet. Clay material dominates this unconsolidated aquifer system, however, discontinuous sand or gravel deposits are reported. These deposits are commonly 1 to 3 feet thick.

The Division has no record of drilled wells actually producing from this system. A few old dug wells may still exist in the county, but their yields would be very low. Because of the low permeability of the surface materials, this 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 White River. These include Bear Blossom Creek and Salt Creek.

Unconsolidated deposits within the system include Wisconsin and Holocene (Recent) silt, sand, and gravel along streams and terraces as well as pre-Wisconsin colluvial, alluvial, and lacustrine silt, clay, and sand. The lacustrine deposits are older lake materials formed in bodies of relatively stagnant water. These deposits are attributed to the White River valley becoming choked with outwash from retreating glaciers. The outwash deposits effectively dammed the tributary streams, thus creating lakes in which several feet of fine-grained glaciolacustrine deposits accumulated.

This aquifer system is an extremely limited resource and the Division has no records of wells actually producing from these deposits. The potential does exist, however, for completion of adequate domestic wells. Large-diameter bucket-rig wells are often successfully employed when other means of extracting seepage from limited or fine-grained deposits are not available.

Sand and gravel lenses, when present, are commonly less than 5 feet thick and may be confined within the glaciolacustrine deposits or directly overlie bedrock. The total thickness of unconsolidated materials overlying bedrock in this system can be as much as 80 feet where Bear Blossom Creek joins the White River. However, the thickness typically ranges from 25 to 40 feet. This aquifer system is generally marked by surface deposits of silt and clay that have low susceptibility to surface contamination.

Norman Upland / Mitchell Plateau Till Aquifer Subsystem

The Norman Upland / Mitchell Plateau Till Aquifer Subsystem is mapped along two areas of northwestern Monroe County. This aquifer system is a limited resource, as evidenced by the lack of wells actually producing from the available unconsolidated deposits. However, the unconsolidated deposits overlying bedrock consist of dominantly pre-Wisconsin glacial till materials up to 195 feet thick. Potential aquifer materials within the glacial till include discontinuous mineral sand and gravel units. Also, drillers have reported more than one sand and gravel unit in deeper wells. These are sometimes described by well drillers as a mixture of "muck, sand, and gravel." Drillers often note water-bearing unconsolidated deposits, even though they complete the wells in bedrock. Sand and gravel deposits are reported up to 10 feet thick, or more, but are typically 3 to 5 feet thick.

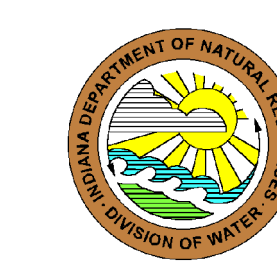
Even though drillers bypass the unconsolidated deposits, preferring the underlying bedrock aquifer system, the potential certainly exists for completion of adequate domestic wells in this unconsolidated aquifer system. This aquifer system has thick deposits of pre-Wisconsin till that are dominantly clay and loam materials overlying the aquifer resource. The susceptibility to contamination is therefore low.

White River and Tributaries Outwash Aquifer System

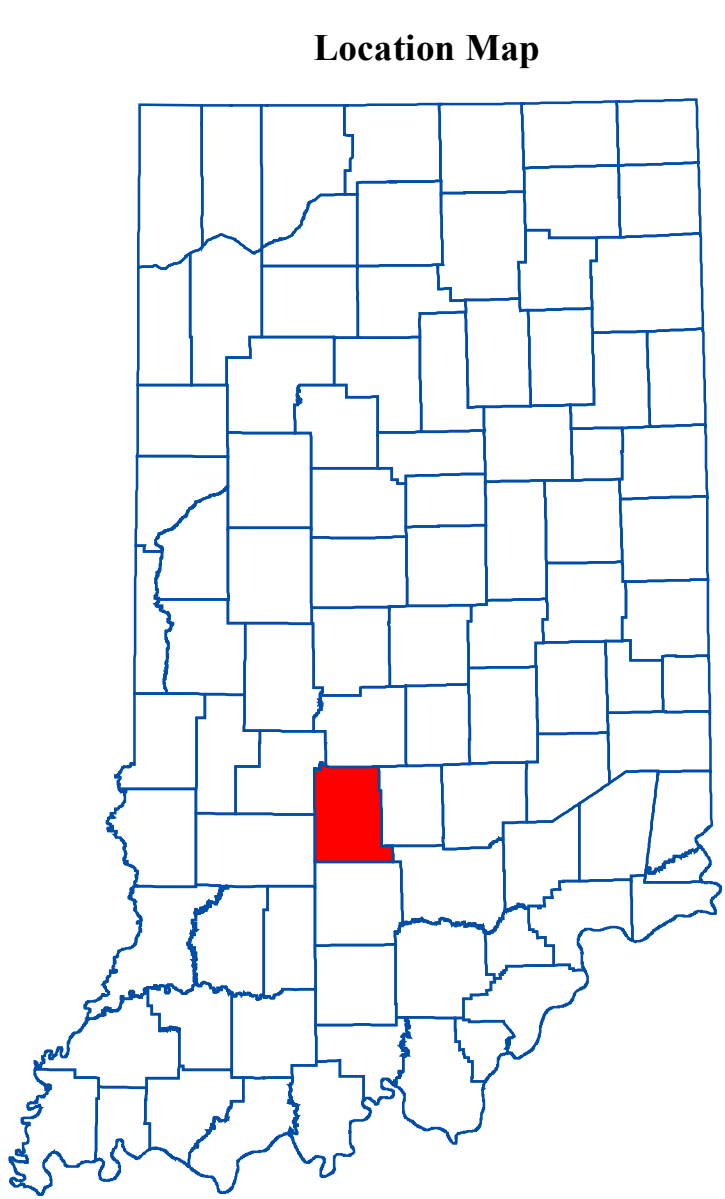
The White River and Tributaries Outwash Aquifer System is located in the northwest corner of Monroe County near the confluence of White River and Bear Blossom Creek. The system is made up of large volumes of outwash materials that were deposited within the White River valley by the retreating continental ice sheets.

The outwash materials consist predominantly of sand and gravel deposits that may be overlain in some areas by thin clay and/or silt materials. This unconsolidated aquifer overlies bedrock and typically ranges from 70 feet to 90 feet in thickness.

Unfortunately, there are no known domestic or high-capacity wells completed in the Monroe County portion of the system. However, the town of Gosport, located in Owen County, has 3 wells completed in the aquifer system at depths of 50, 75, and 90 feet. Yields of up to 500 gpm have been reported. This aquifer system has the greatest potential of any aquifer system in Monroe County and can meet the needs of high-capacity water users. This aquifer system is highly susceptible to contamination in areas that lack overlying clay layers. Areas within the system that are overlain by thick layers of clay or silt are moderately susceptible to surface contamination.

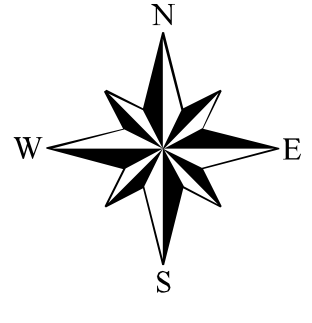
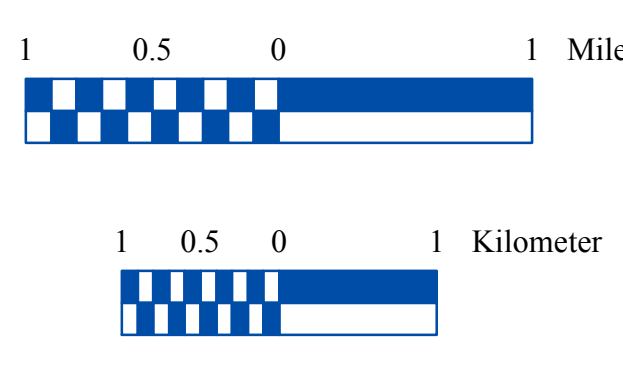


INDIANA DEPARTMENT OF NATURAL RESOURCES



EXPLANATION

- Input Karst Dye Test Point
- Output Karst Dye Test Point
- Karst Dye Trace
- State Road & US Highway
- Stream
- Approximate Southern Limit of Older Glacial Deposits
- Municipal Boundary
- DNR Managed Lands
- Federal Managed Lands
- 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: Township and Range Lines of Indiana (line shapefile, 20020621), Land Survey Lines of Indiana (polygon shapefile, 20020621), County Boundaries of Indiana (polygon shapefile, 20050621), Selected Subsurface Dye Traces in Parts of Southern Indiana (line shapefile, 20000225), and Input and Detection Points for Selected Subsurface Dye Traces in Parts of Southern Indiana (point shapefile, 2001124) were all from the Indiana Geological Survey and based on a 1:24,000 scale, except for the Pre-Wisconsin Glacial Limit (polygon shapefile, 20100510) which is at a 1:500,000 scale. Structural Features of Indiana (line shapefile, 20020718) was also from the Indiana Geological Survey, but based on various scales. Draft road shapefiles, System1 and System2 (line shapefiles, 2003) were from the Indiana Department of Transportation and based on a 1:24,000 scale. City Areas in Southwest Indiana (polygon shapefile, 1999) was from ESRI and based on a 1:100,000 scale. Stream27 (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, 2003, Modified 2010) was based on a 1:24,000 scale.

Unconsolidated Aquifer Systems of Monroe County, Indiana

by
 Randal D. Maier
 Division of Water, Resource Assessment Section
 July 2003

Monroe County

