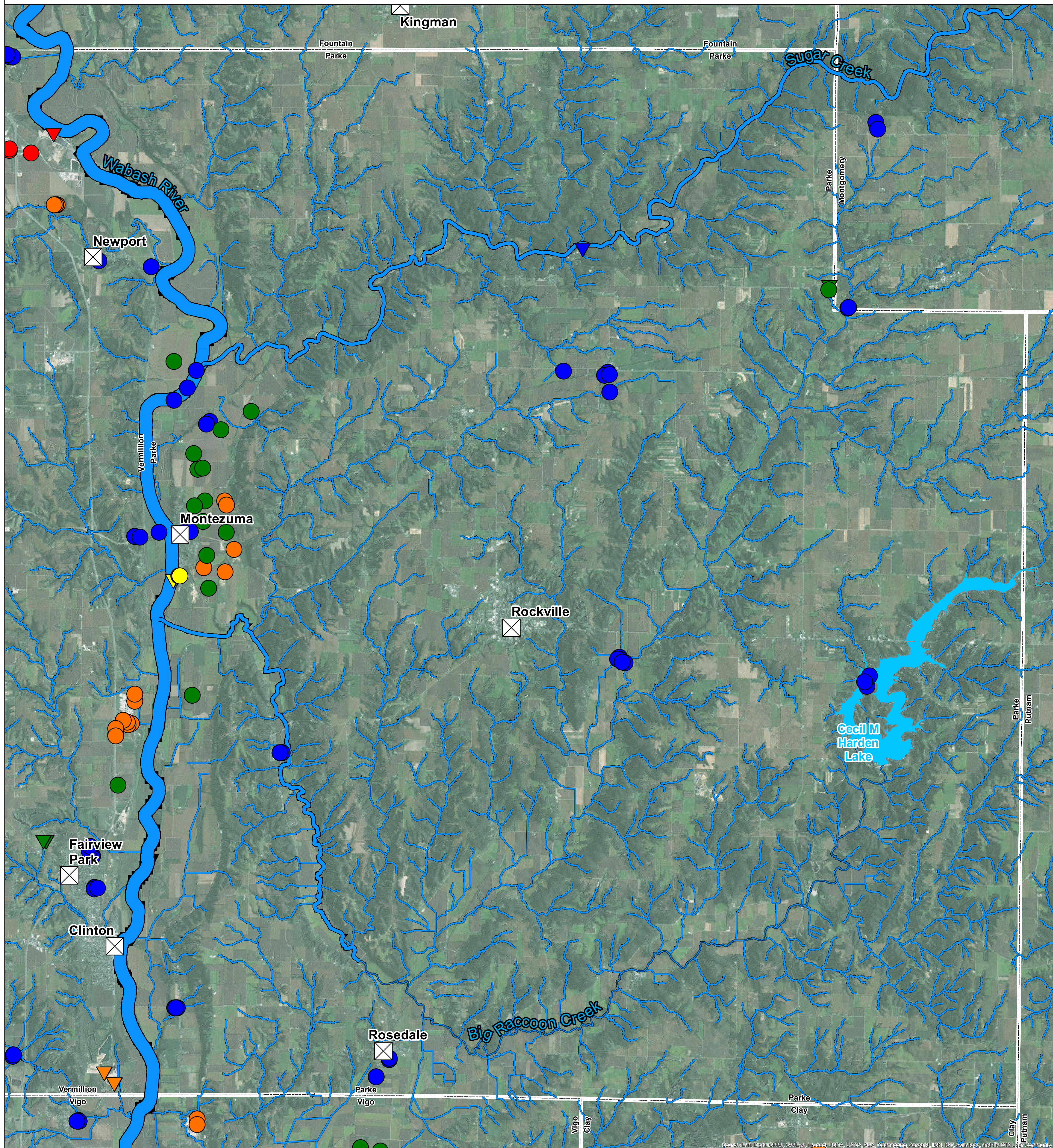
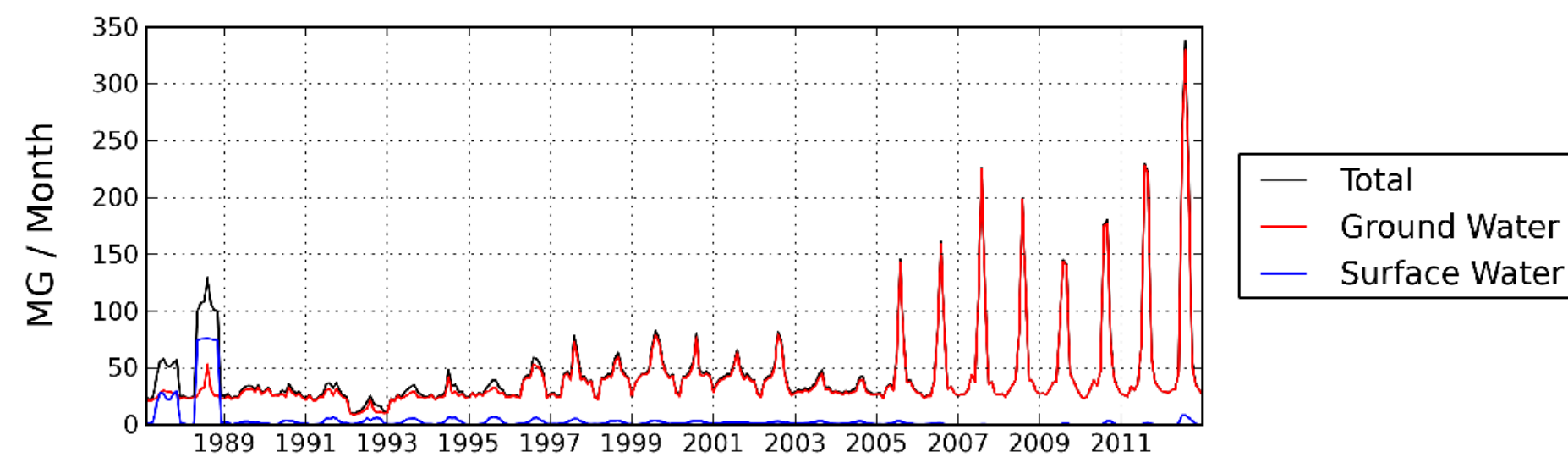
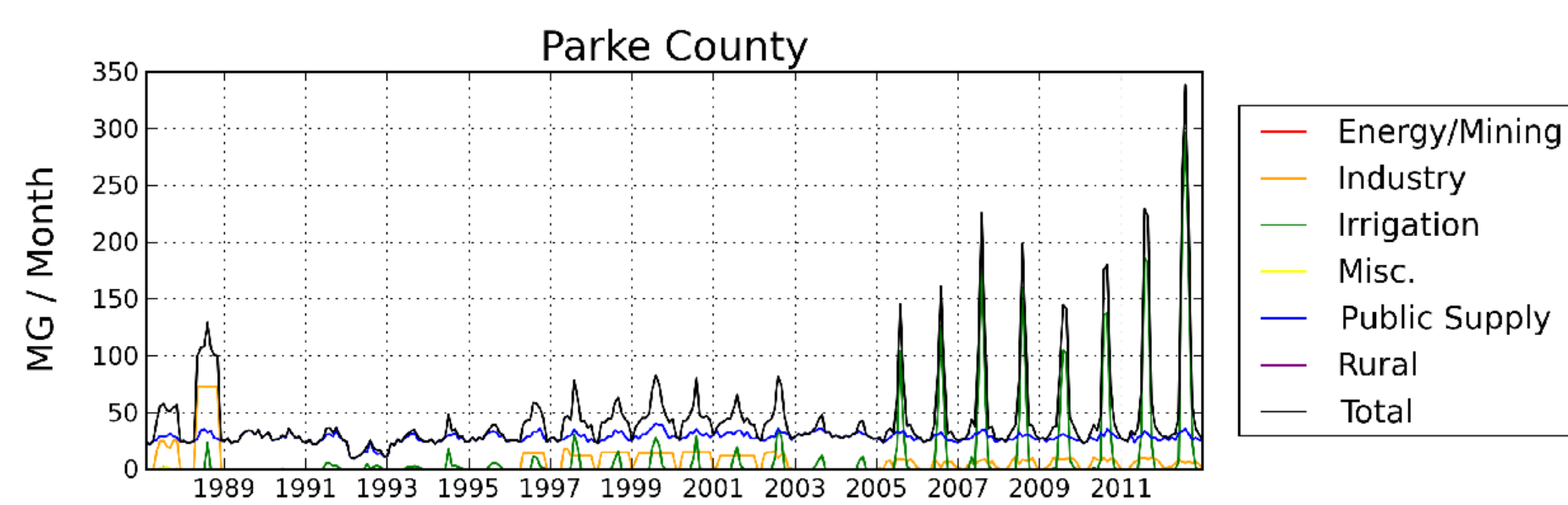


Average Daily Use: 3.1 MGD



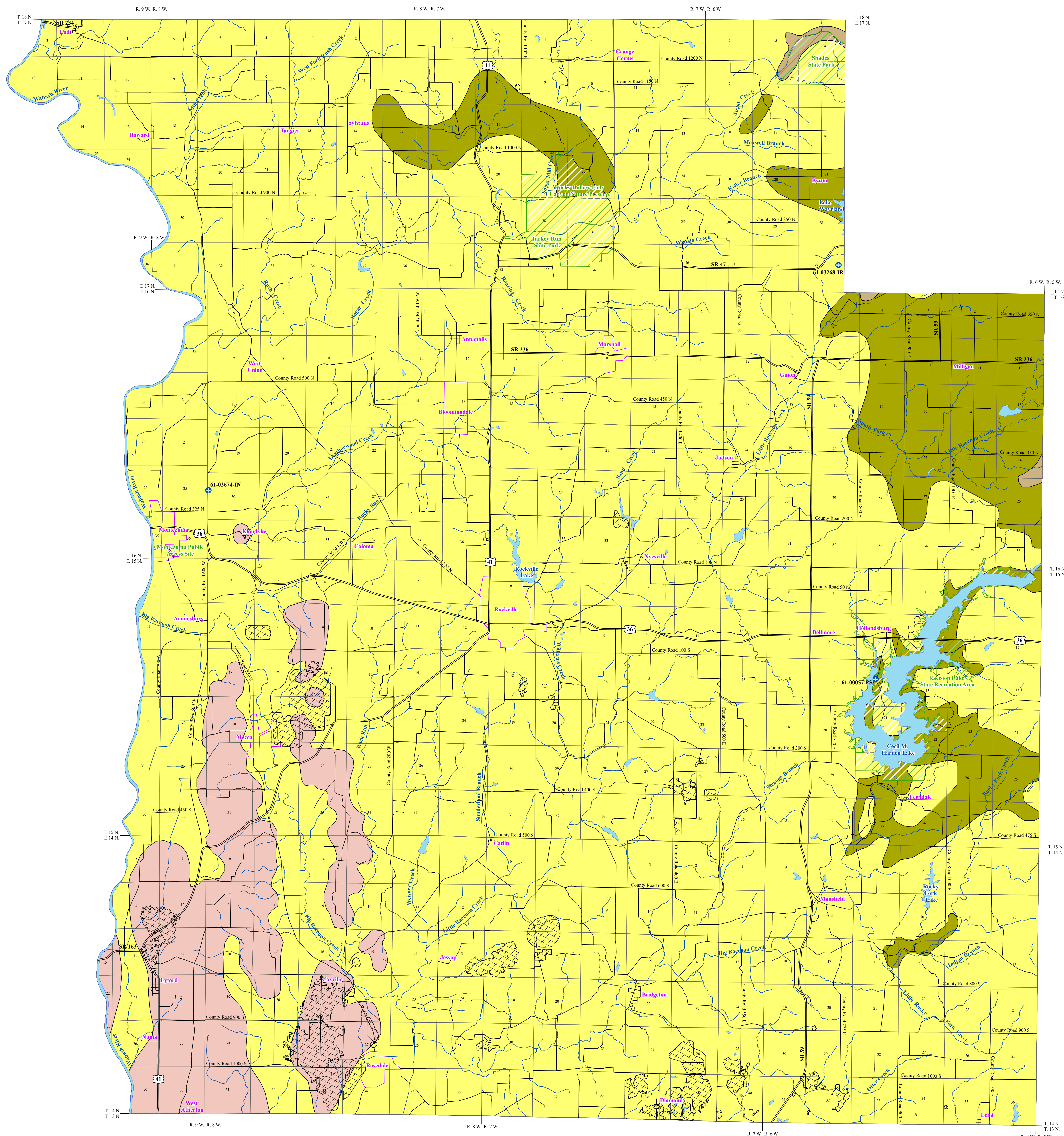
Water Resources and Use in Parke County

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	INTERA GEOSCIENCE & ENGINEERING SOLUTIONS
Interstate	
County	
City	
	Miles
	0 1 2 4

BEDROCK AQUIFER SYSTEMS OF PARKE 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.

Unconsolidated deposits of varying thickness overlie bedrock aquifer systems in Parke County. Total thickness ranges from less than one foot where bedrock is shallow or outcrops along sections of tributaries to the Wabash River, to an estimated 250 feet in the southwestern portion of the county. 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 formation.

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.

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

Four bedrock aquifer systems are identified for Parke County. They are the Pennsylvanian Carbondale Group, the Pennsylvanian Racoon Creek Group, the Mississippi Blue River and Sanders Groups, and the Mississippi Borden Group.

Pennsylvanian - Carbondale Group Aquifer System

The Carbondale Group Aquifer System outcrop/subcrop area is limited to the southwestern part of Parke County. Bedrock deposits include mostly shale and sandstone with some limestone and coal. Estimated thickness of the Carbondale Group in Parke County ranges from less than one foot, where it is in contact with the underlying Racoon Creek Group, to about 350 feet.

Few wells are completed in the Carbondale Group Aquifer System. Depth to the bedrock surface generally ranges from 5 to 189 feet below surface. Total well depth ranges from about 38 to 350 feet. The amount of rock penetrated ranges from 11 to 270 feet. The Carbondale Group is considered a minor groundwater source with domestic wells ranging from 1 to 6 gallons per minute (gpm) in Parke County. Some dry holes have been reported. Static water levels range from 14 to 130 feet below the land surface.

In areas where overlying clay materials are present, the Carbondale Group Aquifer System is at low risk to contamination. However, in some areas fine sand, gravel and silt materials directly overlie the bedrock surface. These areas are at moderate to high risk from surface contamination.

Pennsylvanian - Racoon Creek Group Aquifer System

The Racoon Creek Group Aquifer System outcrop/subcrop area occurs throughout most of Parke County. Bedrock 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 Racoon Creek Group is generally considered a limited groundwater resource. However, the Mansfield Formation is considered a moderately dependable source of groundwater. Depth to bedrock ranges from 25 to 90 feet. Wells completed in the Racoon Creek Group are typically 95 to 190 feet deep with 35 to 130 feet of penetration into the bedrock. Domestic well capacities range from 3 to 17 gpm with static water levels of 20 to 75 feet below surface. Greater capacities have been reported in isolated areas. There is one registered significant groundwater withdrawal facility (one well) with a reported capacity of 140 gpm. However, greater yields are commonly associated with significant to complete drawdown.

Clay materials that overlie bedrock are generally thick. These areas are considered at low risk to contamination. However, in some areas outwash, alluvial, and lacustrine sands directly overlie the bedrock surface. These areas are at moderate to high risk from surface contamination.

Mississippi - Blue River and Sanders Groups Aquifer System

The Blue River and Sanders Groups Aquifer System is present over portions of north-central and eastern Parke County. The Sanders Group includes primarily limestone with some dolomitic limestone content. The overlying Blue River Group includes mostly limestones containing significant amounts of gypsum, anhydrite, shale, chert, and calcareous sandstone.

The Blue River and Sanders Groups Aquifer System is not regarded as a major groundwater resource. Well depths in Parke County range from 90 to 190 feet. Depth to bedrock is generally between 15 and 80 feet below land surface. Domestic well capacities range from 2 to 18 gpm with reported static water levels that range from 20 feet to 65 feet below surface. Greater capacities have been reported in isolated areas. However, higher yields are commonly associated with significant to complete drawdown.

In areas where overlying clay materials are present, the Blue River and Sanders Groups Aquifer System is at low risk to contamination. However, in some areas outwash, alluvial, and lacustrine sands directly overlie the bedrock surface. These areas are at moderate to high risk from surface contamination.

Mississippi - Borden Group Aquifer System

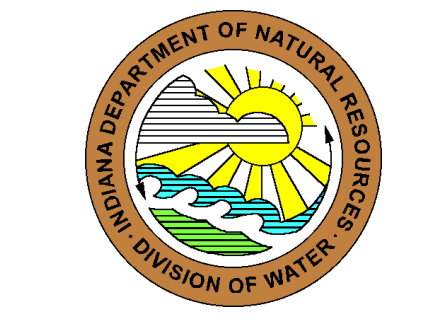
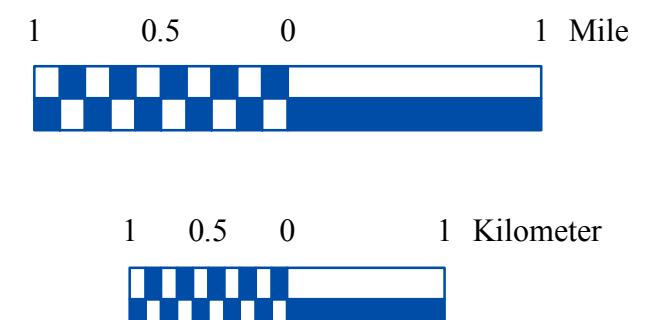
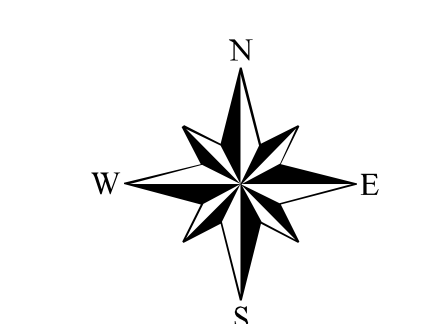
The Borden Group Aquifer System outcrop/subcrop area is limited to extremely small portions of northeastern Parke County. This bedrock aquifer system is composed of siltstone and shale, but fine-grained sandstones are also common. Although carbonates are rare, discontinuous interbedded limestone lenses are present, mainly in the upper portion of the group. Thickness of the Borden Group in Parke County is estimated up to 700 feet.

There is little well information available on the Borden Group in Parke County; however, there is one known well completed in the Borden Group subcrop area. The total well depth is 200 feet with bedrock encountered at 55 feet. The reported well yield is 2 gpm with a static water level of 68 feet below surface.

The Borden Group is composed primarily of fine-grained materials that limit the movement of groundwater and is overlain with thick clay materials. The Borden Group Aquifer System, therefore, is at low risk to contamination from the surface or near surface. However, to the northeast along Sugar Creek bedrock is shallow and may be fractured. Therefore, these areas are at moderate to high risk from surface contamination.

Underground Mine Areas

In Parke County various underground coal seams have been removed by underground mining methods. In underground mines, approximately 50 percent of the coal seam was typically removed leaving the potential for storage of substantial amounts of water in the larger mines. Although the Division has no records of wells drilled into these mines, yields of a few hundred gpm may be possible. A limitation on use of the water could be its more mineralized nature.



EXPLANATION

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

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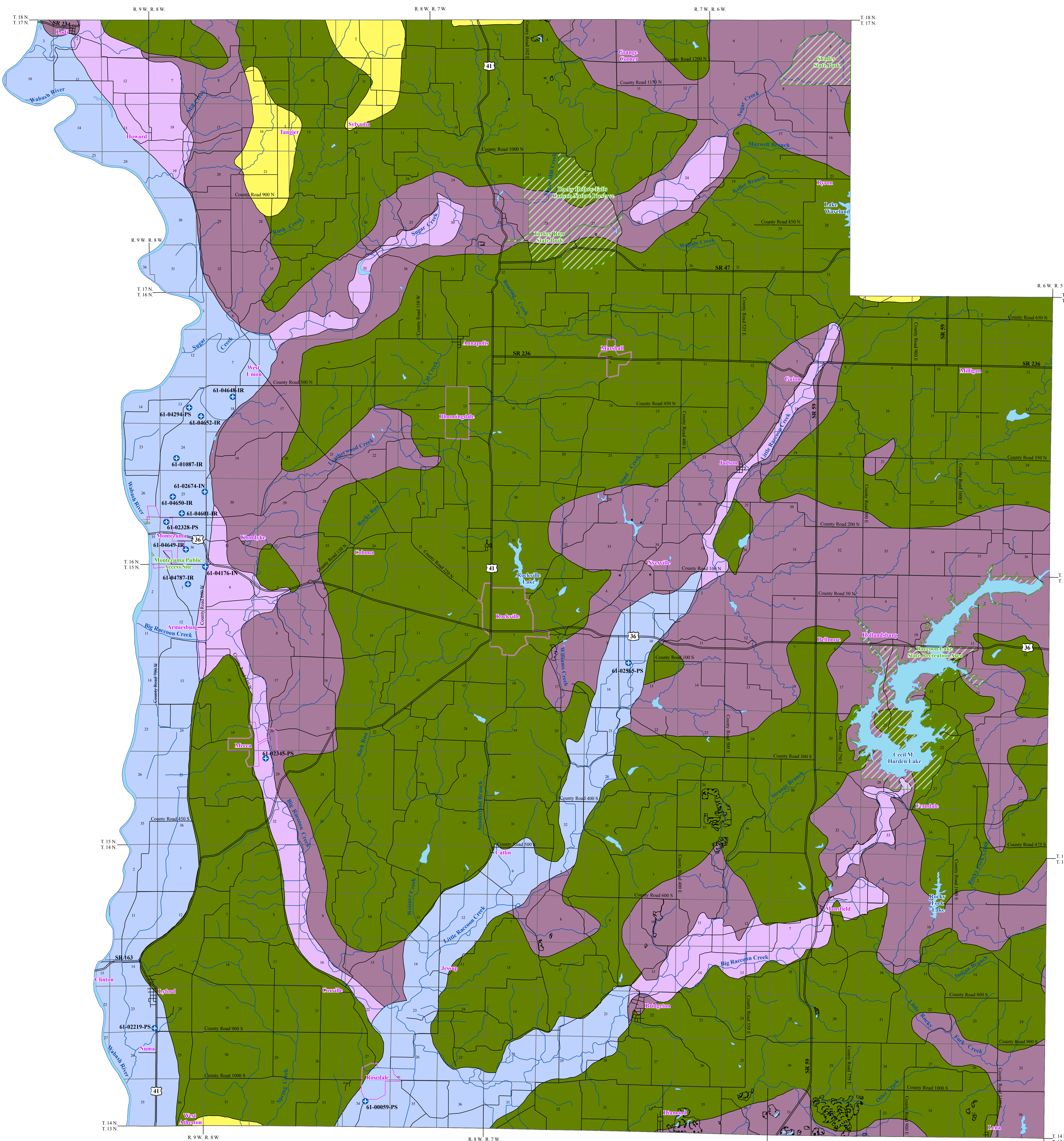
This map was created from several existing shapefiles. Township and Range Lines of Indiana (line shapefile, 20020621), Land Survey Lines of Indiana (polygon shapefile, 20020621) County Boundaries of Indiana (polygon shapefile, 20020621), and Underground Coal Mines (polygon shapefile, 20001231), were 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 Parke County, Indiana

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

December 2009

UNCONSOLIDATED AQUIFER SYSTEMS OF PARKE COUNTY, INDIANA



Six unconsolidated aquifer systems have been mapped in Parke County: the Till Veneer; the Tipton / Central Wabash Valley / Wabash Lowland Till; the Tipton / Central Wabash Valley / Wabash Lowland Till Subsystem; the Wabash River and Tributaries Outwash; the Wabash River and Tributaries Outwash Subsystem; and the Coal Mine Spoil. Boundaries of all aquifer systems described are commonly gradational, and individual aquifers may extend across aquifer system boundaries.

Thicknesses of unconsolidated sediments that overlie bedrock are quite variable in Parke County. Total thickness ranges from less than one foot where bedrock is shallow or outcrops along sections of tributaries to the Wabash River, to an estimated 250 feet in the southwestern portion of the county.

Regional estimates of aquifer susceptibility to contamination from the surface can differ considerably from local reality. Variations within geologic environments can cause variation in susceptibility to surface contamination. In addition, man-made structures such as poorly constructed water wells, unplugged or improperly abandoned wells, and open excavations, can provide contaminant pathways that bypass the naturally protective clays.

Till Veneer Aquifer System

The Till Veneer Aquifer System is mapped throughout much of Parke County, especially along Sugar Creek, Big Raccoon Creek and portions of smaller tributaries. The system consists of thin till, generally less than 50 feet thick, which directly overlies an uneven bedrock surface. Along some of the major streams this system may include thin alluvium and surficial sands and gravels that directly overlie the bedrock surface.

There is little potential for groundwater production in this system in Parke County. Nearly all wells drilled in areas mapped as Till Veneer bypass the unconsolidated deposits in favor of the underlying bedrock aquifer system. However, potential aquifer deposits include thin, isolated sands and/or gravels with yields less than 5 gallons per minute (gpm).

This aquifer system is generally not very susceptible to surface contamination because intertill sand and gravel units are overlain by till deposits. However, some areas have surface sands and gravels or thin to no clay deposits above the aquifer resource. These areas are considered at moderate to high risk to contamination.

Tipton / Central Wabash Valley / Wabash Lowland Till Aquifer System

The Tipton / Central Wabash Valley / Wabash Lowland Till Aquifer System is mapped along small portions of southwestern and northern Parke County. The system typically consists of thick clay with discontinuous intertill sands and gravels. The discontinuous sands and gravels, where present, are generally less than 10 feet thick and are often noted as "dry". Well depths range from 90 to 160 feet. Aquifer sands and gravels generally range from 1 to 15 feet thick and are capped by 80 to 157 feet of clay.

This system is capable of meeting the needs of domestic and some high-capacity users. However, some higher yield wells have significant drawdown. Domestic well yields are generally from 4 to 65 gpm with static water levels that range from 16 to 50 feet below surface. There are no registered significant groundwater withdrawal facilities. This system is generally not very susceptible to surface contamination because sand and gravel units are overlain by thick till deposits.

Tipton / Central Wabash Valley / Wabash Lowland Till Aquifer Subsystem

The Tipton / Central Wabash Valley / Wabash Lowland Till Aquifer Subsystem is mapped throughout most of Parke County. The subsystem is mapped similar to that of the Tipton / Central Wabash Valley / Wabash Lowland Till Aquifer System. However, potential aquifer materials are thinner and potential yield is less in the subsystem than in the system.

In Parke County approximately 75 percent of the wells drilled in areas mapped as till subsystem are completed in the underlying bedrock aquifer system. However, the subsystem has the potential of meeting the needs of some domestic users. Well depths typically range from 55 to 130 feet. Potential aquifer materials include sand and gravel deposits that generally range from 2 to 10 feet thick and are capped by 45 to 115 feet of till with, in places, intertill sands and gravels. Where present, the intertill sands and gravels are generally less than 10 feet thick and are often noted as "dry". The few wells that utilize the available sand and gravel deposits have yields that range from 5 to 15 gpm with static water levels of 15 to 65 feet below surface. Most wells with yields greater than 10 gpm are associated with significant drawdown. Many wells with deeper static water levels have limited available drawdown.

This aquifer subsystem is generally not very susceptible to surface contamination because intertill sand and gravel units are overlain by thick till deposits. However, some areas have surface sands and gravels or thin to no clay deposits above the aquifer resource. These areas are considered at moderate to high risk to contamination.

Wabash River and Tributaries Outwash Aquifer System

The Wabash River and Tributaries Outwash Aquifer System includes thick glacial outwash sands and gravels capped by recent alluvial deposits. The system is mapped primarily along the Wabash River and portions of Big Raccoon and Little Raccoon creeks.

Wells completed in the Wabash River and Tributaries Outwash Aquifer System range from 30 to 140 feet but are typically 45 to 90 feet in depth. In places, the outwash aquifer deposits are up to 110 feet of continuous sands and gravels and may be capped by thin alluvial silt and clay materials that are generally 15 feet thick or less. The Wabash River and Tributaries Outwash Aquifer System is capable of meeting the needs of domestic and high-capacity users. Domestic well capacities range from 5 to 50 gpm with static water levels of 8 to 50 feet below ground surface. There are 13 registered significant groundwater withdrawal facilities (27 wells) with capacities that range from 100 to 1500 gpm.

Areas that lack overlying clay deposits are highly susceptible to contamination. However, where overlying clay or silt deposits are present the system is moderately susceptible to surface contamination.

Wabash River and Tributaries Outwash Aquifer Subsystem

The Wabash River and Tributaries Outwash Aquifer Subsystem is mapped along the northwestern fringe of the Wabash River and along portions of Sugar, Big Raccoon and Little Raccoon creeks. The subsystem is mapped similar to the Wabash River and Tributaries Outwash Aquifer System. However, potential aquifer materials are thinner, overlying silt or clay materials are generally thicker and potential yield is less in the subsystem than in the system.

There are a limited number of wells completed in the Wabash River and Tributaries Outwash Aquifer Subsystem in Parke County. Well depths generally range from less than 30 to 190 feet. In places aquifer materials are up to 130 feet of continuous sand and gravel. However, in some areas the upper portion of the total aquifer sequence of sands and gravels are reported as "dry". The subsystem is capable of meeting the needs of domestic and some high-capacity users. Domestic well capacities range from 5 to 40 gpm with static water levels of 8 to 111 feet below ground surface. There is one registered significant groundwater withdrawal facility (2 wells) with capacities for both wells reported at 240 gpm.

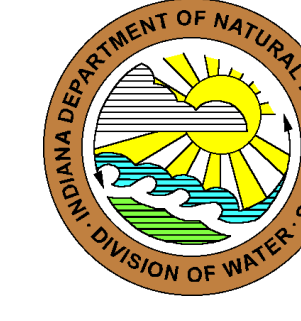
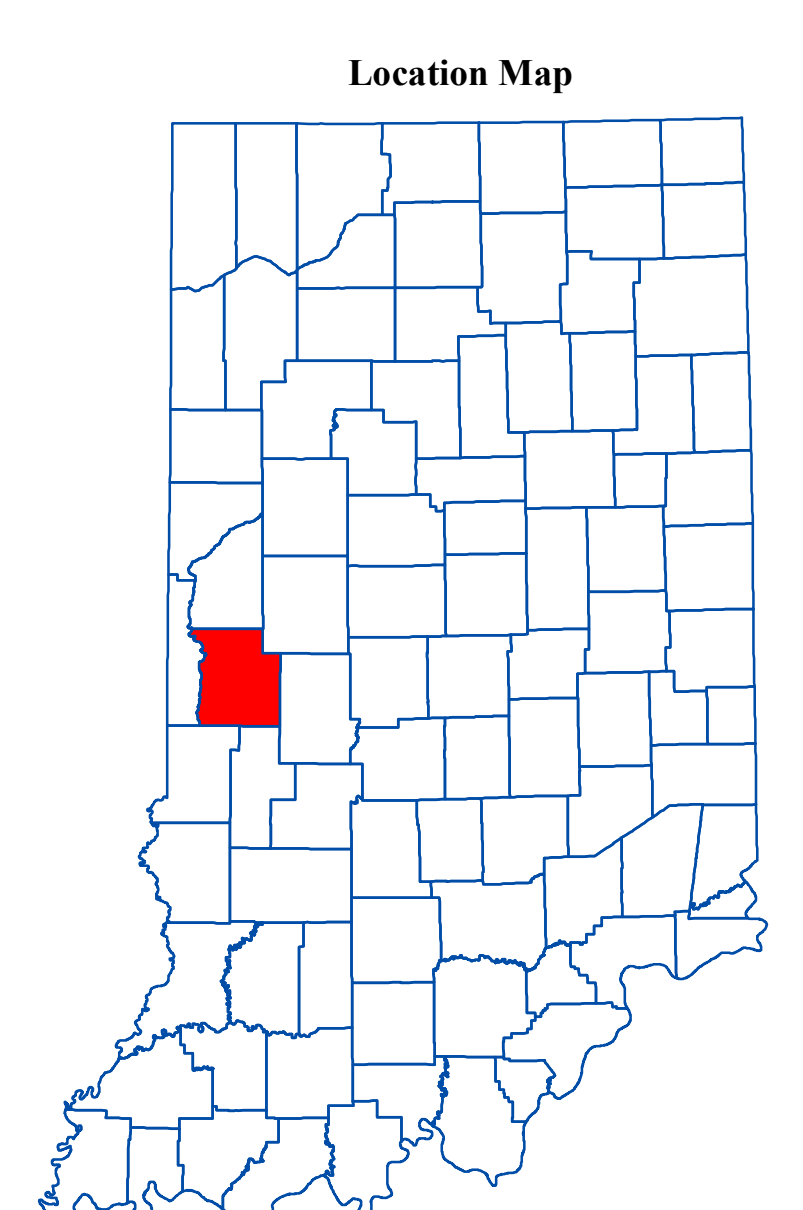
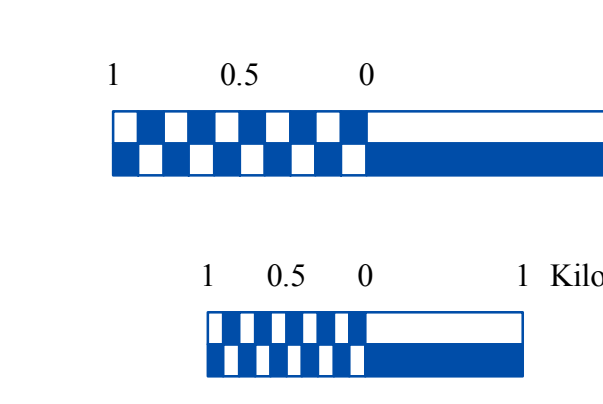
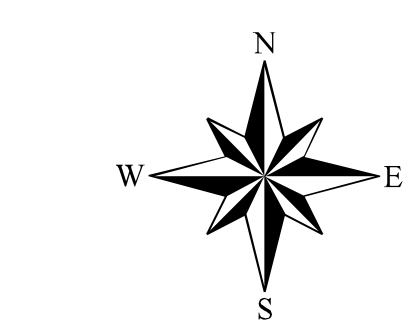
Areas that lack overlying clay deposits are highly susceptible to contamination. However, where overlying clay or silt deposits are present the system is moderately susceptible to surface contamination.

Coal Mine Spoil Aquifer System

The Coal Mine Spoil Aquifer System is present mainly in the southeastern portion of Parke County as well as a few small isolated areas in the central and north-central parts of the county. This aquifer system was formed during the process of mining coal by surface-mining methods. The overburden was typically broken up by blasting and moved aside to uncover the desired coal seam. The overburden, most of which was originally solid rock, became a heterogeneous mixture of particles ranging in size from clay, silt, and sand up to gravel, slabs, and boulders. Where extensive, these spoil areas may contain considerable amounts of groundwater.

In Parke County, there are no reported wells producing from the Coal Mine Spoil Aquifer System. Information from surface coal mine areas in other counties indicate that the quality of groundwater in this system is probably much poorer than that in the overburden before mining took place. Typically a significant increase in total dissolved solids, especially calcium, magnesium, bicarbonate, and sulfate occurs. High iron, and in places low pH, can severely limit potential uses of groundwater from this system.

Generally, it is expected that aquifers in old coal mine spoil that was not graded and capped with compacted soil are highly susceptible to contaminants introduced at the surface. However, spoil aquifers in areas benefiting from modern reclamation methods are likely to be only moderately susceptible.



EXPLANATION

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

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Unconsolidated Aquifer Systems of Parke County, Indiana

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

December 2009

Parke County

