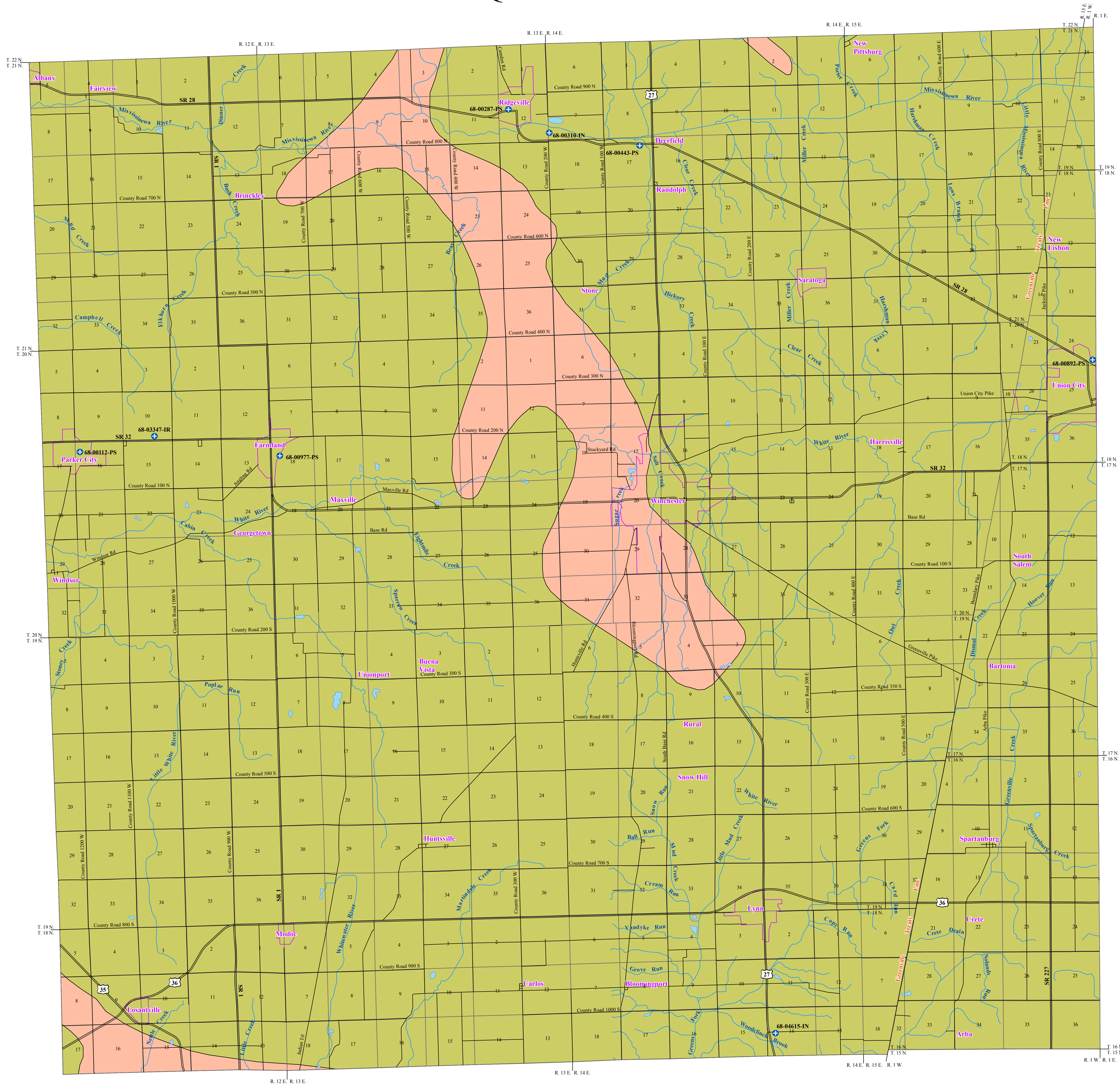




# BEDROCK AQUIFER SYSTEMS OF RANDOLPH COUNTY, INDIANA



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 greater near the bedrock surface, bedrock units within the upper 100 feet are commonly the most productive aquifers. In Randolph County, rock types exposed at the bedrock surface include moderately productive limestones and dolomites with varying amounts of interbedded shale, and unproductive shales with interbedded limestone.

Bedrock aquifer systems in Randolph County are overlain by unconsolidated deposits of varying thickness, ranging from less than one foot to approximately 300 feet. Most of the bedrock aquifers in the county are under confined conditions. In other words, the potentiometric surface (water level) in most wells completed in bedrock rises above the top of the water-bearing zone.

The yield of a bedrock aquifer depends on its hydraulic characteristics and the nature of the overlying deposits. Shale and clay act as 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 extremely variable.

Two bedrock aquifer systems are identified for Randolph County. They are, from younger to older, the Silurian and Devonian Carbonates, and the Maquoketa Group of Ordovician age. Bedrock aquifers are fairly productive in this county. Bedrock wells represent about one-third of all wells completed in Randolph County.

The susceptibility of bedrock aquifer systems to surface contamination is largely dependent on the type and thickness of the overlying sediments. However, because bedrock aquifer systems may have complex fracturing systems, once a contaminant has been introduced into a bedrock aquifer system, it will be difficult to track and remediate.

- Silurian and Devonian Carbonates Aquifer System
- Ordovician - Maquoketa Group Aquifer System

In Randolph County, the younger Devonian age carbonates are not present and this aquifer system consists only of Silurian age carbonates. The Silurian and Devonian Carbonates Aquifer System outcrops/subcrops throughout much of Randolph County. The total thickness of this system in the county ranges from 0 to about 200 feet.

In Randolph County, wells penetrating the Silurian and Devonian Carbonates Aquifer System have reported depths ranging from 35 to 380 feet, but are commonly 100 to 180 feet deep. The amount of rock penetrated in this system typically ranges from 20 to 70 feet, although many of the deeper wells also reach the upper portion of the underlying Maquoketa Group.

Wells utilizing the Silurian and Devonian Carbonates Aquifer System are generally capable of meeting the needs of domestic users and some high-capacity users in this county. Domestic well yields commonly range from 10 to 35 gallons per minute (gpm). Static water levels typically range from 15 to 35 feet below the land surface. A few flowing wells have been reported for this bedrock aquifer system in the county. There are 8 registered significant ground-water withdrawal facilities (12 wells) utilizing the Silurian and Devonian Carbonates Aquifer System in Randolph County. Reported yields range from 50 to 600 gpm. High-capacity wells depth range from approximately 40 to 400 feet below the land surface. Several of the high-capacity wells have contributions from both the Silurian and Devonian Carbonates Aquifer System and the underlying Maquoketa Group Aquifer System.

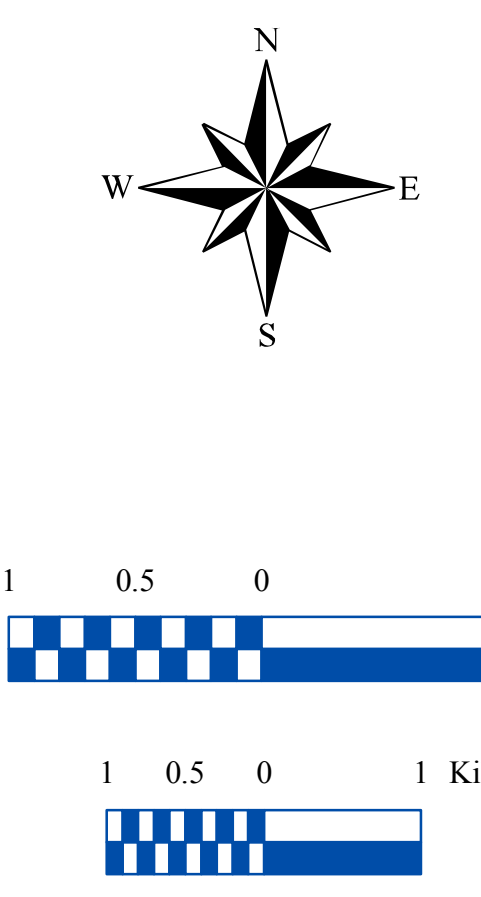
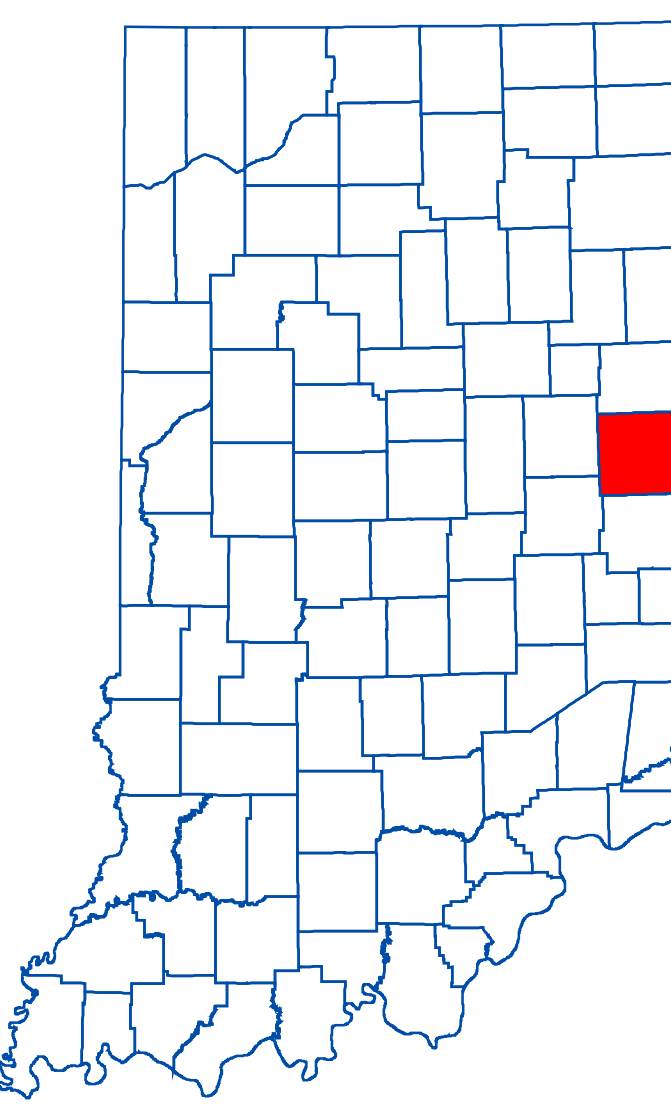
This aquifer system is generally not very susceptible to surface contamination due to thick clay deposits over most of the county. However, solution features (caves) are described in a few well records suggesting minor karst development and there are localized areas, especially near the White River and the Mississauga River, where the bedrock surface is shallow or exposed. These areas, therefore, are at moderate to high risk to contamination.

The outcrop/subcrop area of this aquifer system is limited to the three main bedrock valleys in this county. The Maquoketa Group consists mostly of shales with interbedded limestone units. Although the Maquoketa Group Aquifer System is approximately 800 to 900 feet thick in the county, typically little more than the top 100 feet is used for water production.

In Randolph County, some wells completed in the Maquoketa Group Aquifer System are open to and receive some water from the Silurian and Devonian Carbonates Aquifer System. However, wells completed solely in the Maquoketa Group Aquifer System are generally capable of meeting the needs of domestic users in this county. Wells exclusively utilizing the Maquoketa Group Aquifer System in Randolph County have reported depths ranging from 79 to 423 feet, but are commonly 120 to 300 feet deep. The amount of rock penetrated in this system typically ranges from 20 to 80 feet. Yields for domestic wells generally range from 10 to 30 gpm and static water levels are commonly 10 to 25 feet below the land surface.

The Maquoketa Group Aquifer System is generally not very susceptible to contamination from the land surface because thick layers of clay-rich material overlie the bedrock.

Location Map



### EXPLANATION

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



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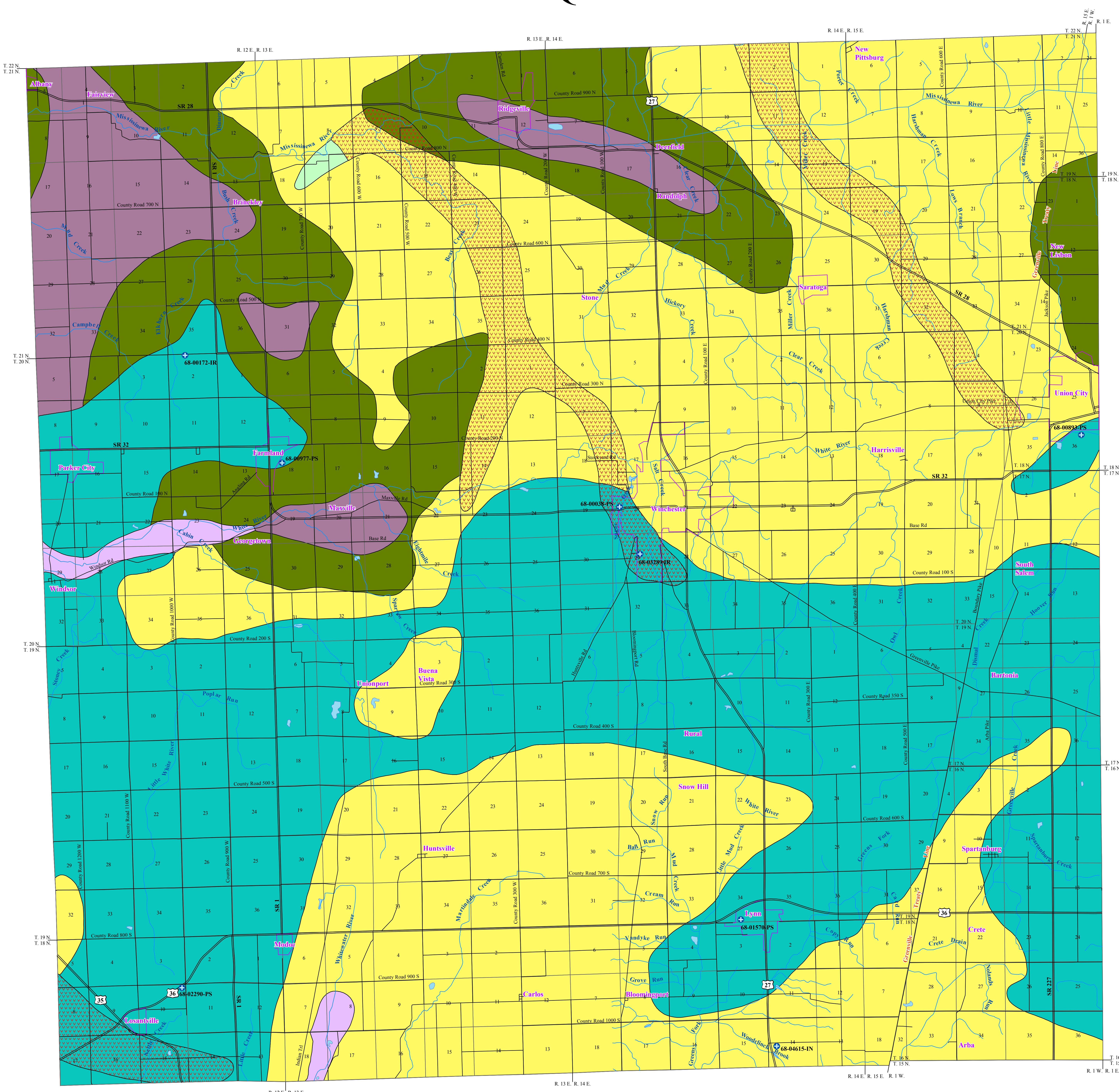
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### Bedrock Aquifer Systems of Randolph County, Indiana

by  
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Division of Water, Resource Assessment Section

December 2006

# UNCONSOLIDATED AQUIFER SYSTEMS OF RANDOLPH COUNTY, INDIANA



Ten unconsolidated aquifer systems have been mapped in Randolph County: the Till Veneer, the New Castle Till, the Bluffton Till, the New Castle Till Subsystem, the Bluffton Till Subsystem, the New Castle Complex, the Bluffton Complex, the Buried Valley, the White River and Tributaries Outwash Subsystem, and the Whitewater River Valley Outwash Subsystem. These systems comprise sediments deposited by, or resulting from, glaciers, 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 deposits in Randolph County is quite variable, ranging from less than one foot to approximately 300 feet. However, the depth to bedrock throughout much of the county generally ranges from about 50 to 150 feet. The thickest unconsolidated deposits in the county are generally associated with bedrock valleys that were subsequently filled with glacial sediment.

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.

There is little potential for ground water production in the Till Veneer Aquifer System in Randolph County. Wells in the mapped area are completed in the underlying bedrock and there are no reported wells that produce from the Till Veneer Aquifer System. Potential aquifer units within this system include thin isolated sand and/or gravel layers. Large-diameter bored (bucket rig) wells may be successful in producing water from these thin seams of coarse-grained material to meet the needs of some domestic users.

This system is not very susceptible to contamination from surface sources because of the low permeability of the near-surface materials. However, there are areas where bedrock is extremely shallow. These areas are moderately susceptible to contamination.

In Randolph County, the New Castle Till Aquifer System and Bluffton Till Aquifer System are mapped as one system because the aquifer characteristics are similar. These aquifer systems are composed primarily of glacial tills that are separated by intertill sand and gravel aquifers of limited thickness and extent. Unconsolidated deposits range in thickness from less than 50 feet to 250 feet, but are typically 80 to 150 feet thick. Potential aquifer materials include sands and gravels that are commonly 5 feet thick.

In places, the New Castle Till Aquifer System and Bluffton Till Aquifer System overlie deep bedrock valleys. However, in Randolph County, there is little known unconsolidated aquifer potential in the valleys below these systems.

Wells completed in the New Castle Till Aquifer System / Bluffton Till Aquifer System are capable of meeting the needs of most domestic users and some high-capacity users in Randolph County, although approximately 45 percent of wells started in these systems utilize the underlying bedrock aquifer. Reported well depths in the New Castle Till Aquifer System / Bluffton Till Aquifer System range from 30 to 230 feet, but are typically between 50 and 110 feet. Domestic well capacities are commonly 10 to 50 gallons per minute (gpm). Static water levels generally range from 15 to 40 feet below the surface with some reports of flowing wells.

The New Castle Till Aquifer System and Bluffton Till Aquifer System generally have a low susceptibility to surface contamination because intertill sand and gravel units are commonly overlain by thick glacial till. Shallow wells completed in these systems are moderately susceptible to contamination.

Areas where unconsolidated materials generally exceed 50 feet in thickness, yet have little aquifer potential, are mapped as New Castle Till Aquifer Subsystem / Bluffton Till Aquifer Subsystem in Randolph County. Potential aquifer materials include thin, discontinuous, intertill sand and gravel deposits that range in thickness from 2 to 8 feet and are capped by till, which is commonly 20 to 40 feet thick.

In places, these subsystems overlie deep bedrock valleys. However, in Randolph County, there is little evidence for unconsolidated aquifer potential in the valleys below the subsystems.

Approximately 94 percent of wells in the New Castle Till Aquifer Subsystem and Bluffton Till Aquifer Subsystem in Randolph County utilize the underlying bedrock aquifer system. However, these subsystems are capable of meeting the needs of some domestic users in the county. Wells completed in the New Castle Till Aquifer Subsystem and Bluffton Till Aquifer Subsystem in Randolph County are typically 35 to 70 feet deep. Domestic well yields are commonly 10 to 20 gpm. Static water levels are typically 10 to 20 feet below the land surface.

The subsystems are generally not very susceptible to surface contamination because intertill sand and gravel units are overlain by thick till deposits.

## New Castle Complex Aquifer System / Bluffton Complex Aquifer System

The New Castle Complex Aquifer System and Bluffton Complex Aquifer System are mapped as one system because they have similar aquifer characteristics. In Randolph County, these systems are mapped over an extensive area. The New Castle Complex Aquifer System and Bluffton Complex Aquifer System are characterized by unconsolidated deposits which can be quite variable in materials and thickness. Aquifers within the systems range from thin to thick and from single to multiple intertill sands and gravels. The aquifers are highly variable in depth and lateral extent and are typically confined by clay. The total thickness of unconsolidated deposits can be in excess of 250 feet in places.

In places, the New Castle Complex Aquifer System and Bluffton Complex Aquifer System overlie deep bedrock valleys. However, in Randolph County, there is little known unconsolidated aquifer potential in the valleys below these systems.

Well depths in the New Castle Complex Aquifer System and Bluffton Complex Aquifer System range from 25 to 240 feet although wells are typically completed at depths ranging from 50 to 100 feet. Most wells are completed below the shallow sand and gravel deposits (if present), which generally range in thickness from 1 to 10 feet. A till cap of variable thickness commonly separates upper and lower aquifers. Aquifers utilized in the New Castle Complex Aquifer System and Bluffton Complex Aquifer System range in thickness from 2 to 65 feet but are commonly 5 to 15 feet thick.

These systems are capable of meeting the needs of domestic and some high-capacity users. Typical domestic yields range from 10 to 50 gpm. Static water levels generally range from 10 to 35 feet below the surface with some reports of flowing wells. There are 7 registered significant ground-water withdrawal facilities (21 wells). Reported high-capacity pumping rates commonly range from 80 to 350 gpm.

The New Castle Complex Aquifer System and Bluffton Complex Aquifer System are not very susceptible to contamination where overlain by thick clay deposits. However, in some areas where surficial clay deposits are thin, the shallow aquifer, if present, is at moderate to high risk.

## Buried Valley Aquifer System

In Randolph County, the Buried Valley Aquifer System consists of glacial materials deposited in bedrock valleys. The system is mapped in a small area of the northwestern portion of the county. Although there are additional buried bedrock valleys in Randolph County, only the larger buried valleys that contain water-bearing sediments at depth have been included as mapped units of the Buried Valley Aquifer System.

Unconsolidated deposits overlying bedrock in the Buried Valley Aquifer System are nearly 200 feet thick in places. Typical deposits include clay with multiple intertill sands and gravels. The few wells completed in the Buried Valley Aquifer System produce at depths of 90 to greater than 150 feet. Aquifer materials include sand and gravel deposits that are generally 5 to 15 feet thick.

This aquifer system has the potential to meet the needs of domestic users. Domestic well yields range from 15 to 60 gpm. Static water levels are typically about 15 feet below the surface. There are no registered significant ground-water withdrawal facilities in this system in Randolph County.

The Buried Valley Aquifer System is generally not very susceptible to surface contamination. Thick clay deposits overlie the aquifer units and inhibit the downward migration of contaminants.

## White River and Tributaries Outwash Aquifer Subsystem / Whitewater River Valley Outwash Aquifer Subsystem

The White River and Tributaries Outwash Aquifer Subsystem is mapped along portions of the White River floodplain in west-central Randolph County. The Whitewater River Valley Outwash Aquifer Subsystem is mapped along a portion of the main valley of the Whitewater River. Sand and gravel fill from the melting glaciers (outwash) were deposited in places in these valleys.

Few wells have been reported to utilize these aquifer subsystems. Well depths typically range from 50 to 80 feet. Sand and gravel aquifer deposits within these subsystems are commonly 5 to 30 feet thick. In general, the sand and gravel aquifer is capped by clay 20 to 30 feet thick, however, the clay cap is missing in places. Static water levels typically range from 10 to 30 feet below the surface. The White River and Tributaries Outwash Aquifer Subsystem and Whitewater River Valley Outwash Aquifer Subsystem have the potential to meet the needs of domestic and some high-capacity users. However, there are no registered significant ground-water withdrawal facilities in Randolph County in these subsystems.

The White River and Tributaries Outwash Aquifer Subsystem and Whitewater River Valley Outwash Aquifer Subsystem are highly susceptible to contamination from surface sources in areas that lack overlying clay layers. Where clay and silt deposits overlie the aquifer units, these systems are moderately susceptible to surface contamination.

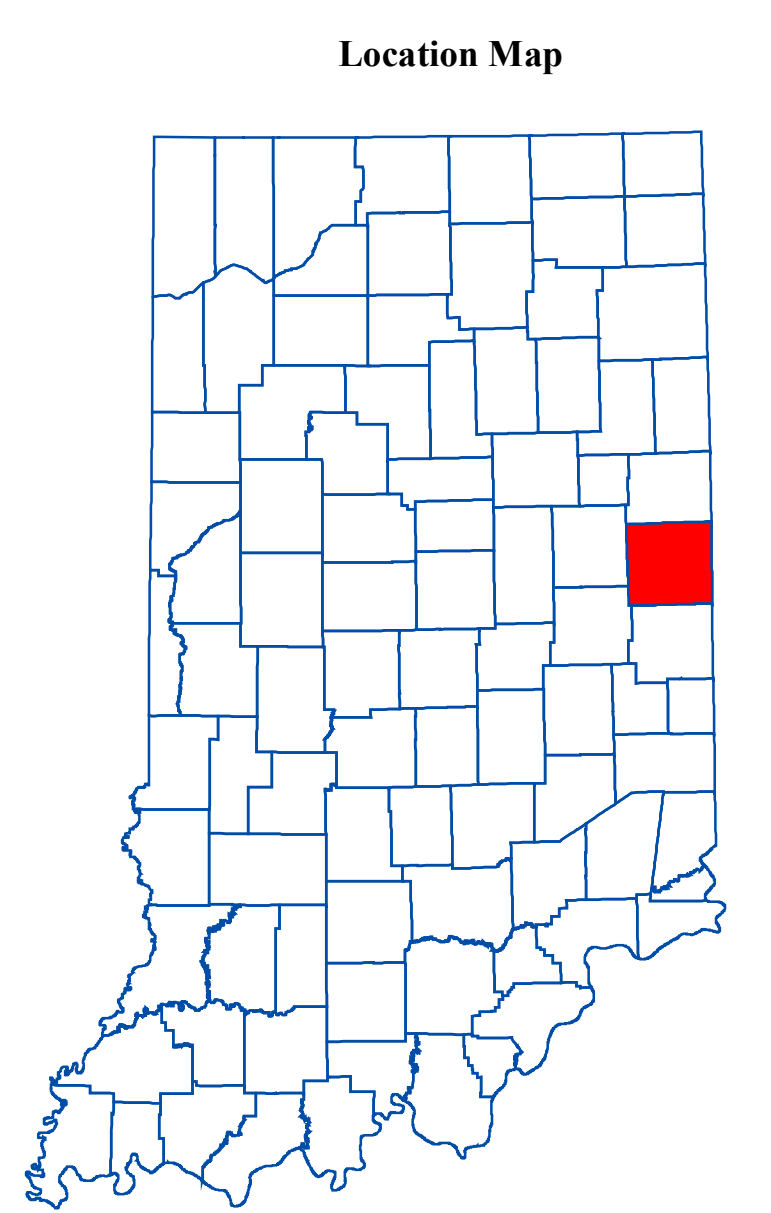
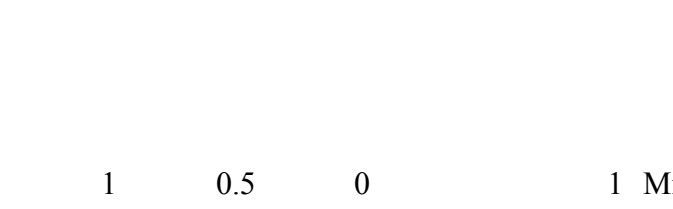
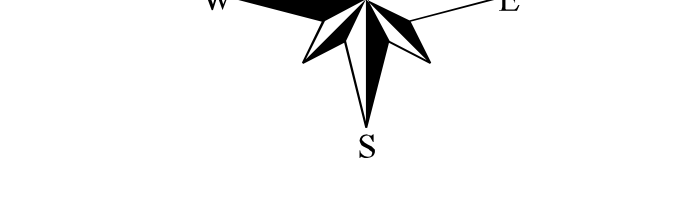
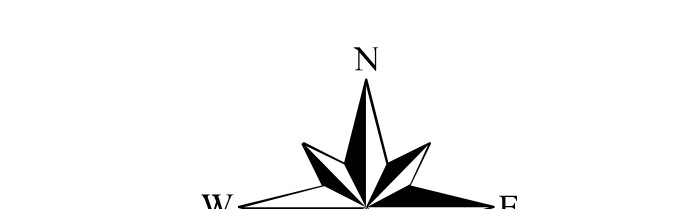
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In places, these subsystems overlie deep bedrock valleys. However, in Randolph County, there is little evidence for unconsolidated aquifer potential in the valleys below the subsystems.

Approximately 94 percent of wells in the New Castle Till Aquifer Subsystem and Bluffton Till Aquifer Subsystem in Randolph County utilize the underlying bedrock aquifer system. However, these subsystems are capable of meeting the needs of some domestic users in the county. Wells completed in the New Castle Till Aquifer Subsystem and Bluffton Till Aquifer Subsystem in Randolph County are typically 35 to 70 feet deep. Domestic well yields are commonly 10 to 20 gpm. Static water levels are typically 10 to 20 feet below the land surface.

The subsystems are generally not very susceptible to surface contamination because intertill sand and gravel units are overlain by thick till deposits.



## EXPLANATION

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### Unconsolidated Aquifer Systems of Randolph County, Indiana

by  
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Division of Water, Resource Assessment Section  
December 2006

Map generated by Andrew G. Dankman, Joseph L. Phillips and Jennifer K. McMillan  
DNR, Division of Water, Resource Assessment Section

# Randolph County

