

# **Bedrock Aquifer Systems of Decatur County, Indiana**

by

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March 2006

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 Decatur 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 Decatur County. They are, from west to east and younger to older: the Silurian and Devonian Carbonates and the Maquoketa Group of Ordovician age. Bedrock aquifers are not highly productive in this county. However, bedrock wells represent about 75% 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.

## **Silurian and Devonian Carbonates Aquifer System**

In Decatur 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 much of the eastern half of the county and in several 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 Decatur County ranges from 0 to about 125 feet.

Wells completed in 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 wells utilizing this system in Decatur County have reported depths ranging from 19 to 265 feet, but are commonly 50 to 100 feet deep. The amount of rock penetrated in this system typically ranges from 12 to 45 feet, although many of the deeper wells also reach the upper portion of the underlying Maquoketa Group. Typical yields for domestic wells range from 4 to 20 gallons per minute (gpm) and static water levels are generally 1 to 35 feet below land surface. However, several dry holes have been reported.

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 Carbonates Aquifer System is moderately susceptible where overlying clay-rich till and residuum are thin or absent.

### **Ordovician -- Maquoketa Group Aquifer System**

The outcrop/subcrop area of this aquifer system is limited to the deeply incised stream valleys (Sand Creek, Cobbs Fork, and Lost Fork) in south-central Decatur County and (Salt Creek, Tub Creek, and Vernon Fork Muscatatuck River) in the southeastern part of the county. The Maquoketa Group consists mostly of shales with interbedded limestone units. Although this system is approximately 700 to 850 feet thick in the county, typically little more than the top 100 feet is used for water production.

Wells completed in this system are generally capable of meeting the needs of domestic users in this county. Nearly 80% of the wells utilizing the Maquoketa Group Aquifer System penetrate the overlying thin eroded Silurian and Devonian Carbonates. Some wells completed in the Maquoketa Group Aquifer System are open to and receive some water from the Silurian and Devonian Carbonates Aquifer System. Wells utilizing the Maquoketa Group Aquifer System in Decatur County have reported depths ranging from 28 to 265 feet, but are commonly 85 to 130 feet deep. The amount of rock penetrated in this system typically ranges from 55 to 95 feet. Typical yields for domestic wells range from 1.5 to 10 gpm and static water levels are commonly 12 to 40 feet below land surface. However, several dry holes have been reported.

Except in areas of karst development or where overlying clay-rich till and residuum are thin or absent, this aquifer system is not very susceptible to contamination from the land surface. In this system, karst development is predominately confined to the outcrop/subcrop area of the Whitewater Formation, the uppermost formation in this aquifer system.

## **Registered Significant Ground-Water Withdrawal Facilities**

There are 2 registered significant ground-water withdrawal facilities (total of 9 wells) using bedrock aquifers in the county. All of these wells tap the Silurian and Devonian Carbonates Aquifer System including one well that also has a contribution from the Maquoketa Group Aquifer System. Reported capacities for individual wells are 6 to 250 gpm. Refer to Table 1 for some details on the wells and to the map for the facility location.

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