

Bedrock Aquifer Systems of Lake County, Indiana

by
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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.

Two bedrock aquifer systems are identified for Lake County: the Devonian and Mississippian age Coldwater, Ellsworth and Antrim Shales, and the Silurian and Devonian Carbonates. Moderately productive limestone subcrops throughout the northern, western, and southern portions of the county, and unproductive shales subcrop over the east-central section of the county. Bedrock aquifer systems in Lake County are overlain by unconsolidated deposits of varying thickness ranging from about 50 to over 200 feet throughout the county. Major sand and gravel aquifers occur in these thick unconsolidated deposits overlying the bedrock.

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.

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.

Devonian and Mississippian -- Coldwater, Ellsworth and Antrim Shales Aquifer System

The Coldwater, Ellsworth and Antrim Shales Aquifer System is present at the bedrock surface in the east-central portion of Lake County. This system is generally not utilized as a source of water in the county because of the typically low permeability of shale, and unconsolidated aquifers are commonly abundant in the overlying deposits. However, the Coldwater, Ellsworth and Antrim Shales is used as the primary source of water in a few isolated areas in Lake County. These locations lie to the immediate north and north-east of the town of Crown Point, where the unconsolidated deposits do not contain any significant aquifers. In some instances, wells are

completed in the underlying carbonate rocks in areas where the thickness of the shales are relatively thin. However, the water may be of poor quality.

Water wells utilizing the Coldwater, Ellsworth and Antrim Shales Aquifer System penetrate approximately 100 to 150 feet of unconsolidated material, and are completed into more than 50 feet of shale. However, only the upper 25 feet of the shale has typically been made permeable due to post-Devonian weathering, jointing and fracturing. Static water levels in the shale range from 40 to 80 feet below the surface. The Coldwater, Ellsworth and Antrim Shales Aquifer System is capable of supplying some domestic users requiring less than 10 gallons per minute (gpm). There are no registered significant groundwater withdrawal facilities in this system.

Since the permeability of shale materials is considered low and the overlying unconsolidated deposits are relatively thick, this bedrock system is not very susceptible to contamination introduced at or near the surface.

Silurian and Devonian Carbonates Aquifer System

The Silurian and Devonian Carbonates Aquifer System subcrops throughout Lake County except in the east-central portion of the county. It is the principle bedrock aquifer and the only one capable of supporting high-capacity pumpage in the county.

In Lake County the Silurian and Devonian Carbonates Aquifer System is overlain in most places by about 50 to more than 200 feet of unconsolidated material. The majority of domestic water wells that penetrate the system are completed in the upper 15 to 100 feet of bedrock. Deep high-capacity wells commonly penetrate 200 to 450 feet of carbonate rock, and some wells have been reported to penetrate up to 550 feet of bedrock. In some areas near the contact between the Coldwater, Ellsworth and Antrim Shales Aquifer System, and the Silurian and Devonian carbonates, wells are drilled through the shales and into the more productive underlying carbonate rocks. Because the overlying shales inhibit recharge, these wells are less productive than wells completed in carbonates not overlain by shale.

Water wells are drilled to an average depth of about 230 feet and static water levels range from flowing to 117 feet below the surface; however, water levels usually are between 10 to 40 feet. Only a few dry holes have been reported in this aquifer system. Most domestic wells can be expected to produce between 10 and 30 gpm with yields ranging from 8 to 200 gpm. There are 22 registered significant groundwater withdrawal facilities (36 wells) in this system. Reported yields range from 87 to 1700 gpm. Uses for these facilities are public supply and irrigation.

The Silurian and Devonian Carbonates Aquifer System has a low susceptibility to surface contamination because the overlying unconsolidated deposits are relatively thick.

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