Unconsolidated Aquifer Systems of Gibson County, Indiana

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Ten unconsolidated aquifer systems have been mapped in Gibson County: the Dissected Till and Residuum / Unglaciated Southern Hills and Lowlands; the Alluvial, Lacustrine, and Backwater Deposits; the Buried Valley; the Wabash Lowland Till; Wabash Lowland Till Subsystem; the Wabash River and Tributaries Outwash; the Wabash River and Tributaries Outwash Subsystem; the White River and Tributaries Outwash; the White River and Tributaries Outwash Subsystem; and the Coal Mine Spoil. The first nine aquifer systems comprise sediments that were deposited by (or resulted from) glaciers and their meltwaters, or are thin, eroded residuum (a product of bedrock weathering). Boundaries of these aquifer systems are often gradational and individual aquifers may extend across aquifer system boundaries. The Coal Mine Spoil Aquifer System is man-made and the larger area boundaries are well defined.

The thickness of unconsolidated sediments in Gibson County is quite variable. In much of the eastern part of the county the unconsolidated materials overlying bedrock are less than 30 feet thick. However, along the northwestern county boundary, particularly in the floodplains of the Wabash and White Rivers, the thickness of unconsolidated deposits commonly ranges from 90 to 130 feet. A maximum thickness of nearly 250 feet occurs in a very small area about two miles northeast of Owensville, where sequences of glacial outwash, till, lacustrine, and loess deposits have been stacked above the deepest part of a buried bedrock valley. Sand and gravel aquifers occur within the thicker unconsolidated materials, especially in the main valleys of the Wabash and White Rivers.

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.

Dissected Till and Residuum / Unglaciated Southern Hills and Lowlands Aquifer System

The Dissected Till and Residuum / Unglaciated Southern Hills and Lowlands Aquifer System, which covers about 40 percent of Gibson County, has the most limited groundwater resources of the unconsolidated aquifer systems in the county. Unconsolidated materials of this aquifer system predominantly consist of thin, eroded bedrock residuum and (in the glaciated area to the north and west) pre-Wisconsin tills. In many parts of the county, these deposits are capped with lacustrine silt and clay and Wisconsin loess. Thin Wisconsin dune sands are also present in this

system near the Wabash River outwash. Total thickness of this system in Gibson County typically ranges from about 15 to 40 feet.

There is little potential for water production in the Dissected Till and Residuum / Unglaciated Southern Hills and Lowlands Aquifer System in Gibson County. Over 95 percent of wells penetrating this unconsolidated aquifer system in the county are developed in the underlying bedrock. However, in places large-diameter bored (bucket-rig) wells may produce water from thin sands within the predominantly clay and silt materials of this aquifer system. The Dissected Till and Residuum / Unglaciated Southern Hills and Lowlands Aquifer System is transected by the Alluvial, Lacustrine, and Backwater Deposits Aquifer System, the Buried Valley Aquifer System, the Wabash Lowland Till Aquifer System, and the Wabash Lowland Till Aquifer Subsystem. The boundaries between these systems are transitional in many areas of the county. Because of the generally low permeability of the near-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 deposits in the valleys of tributaries to the White, Wabash, and Ohio Rivers. The unconsolidated deposits in this aquifer system come from two sources. The first source is alluvium deposited by the stream along with colluvium eroded from the valleys walls and upland areas. The second source is glaciolacustrine deposits that were formed in bodies of relatively stagnant lake water, and are marked by soft silt and clay. These lake deposits were formed when the major valleys of the Wabash River and the White River were choked with coarser material carried by glacial meltwater. Thick deposits of this material effectively dammed tributary streams, creating lakes. Thick deposits of silt, sometimes called “slackwater clay,” mark the former locations of these glacial lakes. These lacustrine deposits are often noted on Quaternary geology maps and soil maps.

The total thickness of unconsolidated deposits (mostly clay and silt) in this aquifer system varies considerably, from less than 10 feet to more than 90 feet. However, the thickness of permeable sand or gravel zones is typically less than 15 feet. The overall scarcity of productive zones of sand and gravel in this aquifer system is apparent from the number of water wells completed in the underlying bedrock aquifers. Very little data are available, and dry holes have been reported. However, it is expected that many wells drilled in this system (especially bucket-rig wells) may yield sufficient water for domestic needs.

This aquifer system is marked by thick deposits of soft silt and clay that have low susceptibility to surface contamination. One exception is a small area in the Wabash River floodplain in which thin outwash, alluvium, and wind-blown sand overlie shallow bedrock. This area would be highly susceptible to surface contamination.

Buried Valley Aquifer System

The Buried Valley Aquifer System consists of aquifer materials deposited in pre-glacial bedrock valleys. During valley development, layers of bedrock were eroded to create valleys that were subsequently filled with unconsolidated glacial sediment of variable thickness. Although there are additional buried bedrock valleys in Gibson County, only the larger buried valleys that contain significant water-bearing sediments have been included as mapped units of the Buried Valley Aquifer System.

There is only one main buried bedrock valley located in Gibson County. It cuts as deeply as about 130 feet into Pennsylvanian (McLeansboro Group) bedrock. It enters the county at the southern county line about seven miles southwest of Owensville, or about two miles north of Poseyville in Posey County, and trends northwest toward the Wabash River valley. The only wells penetrating this aquifer system in Gibson County were completed in the underlying bedrock. Although potential is limited in many places due to the fine-grained, commonly dirty nature of the water-bearing sand and gravel units, a few high-capacity wells producing over 200 gpm have utilized this aquifer system just across the county line in Poseyville.

The Buried Valley Aquifer System has a low susceptibility to surface contamination because tills and lacustrine silts and clays generally overlie outwash sediments occurring within the bedrock valleys. Although lenses of outwash sand and gravel may occur within the tills, the predominance of fine-grained sediments above the bedrock valleys limits the migration of contaminants from surface sources to the deep aquifers.

Wabash Lowland Till Aquifer System

The Wabash Lowland Till Aquifer System is mapped in a small area in central Gibson County. The unconsolidated deposits overlying bedrock consist of dominantly pre-Wisconsin glacial materials that range in thickness from 30 to more than 165 feet. Loess and eolian sands of Wisconsin age overlie the till across much of this system. In places, this system is also covered by younger lacustrine deposits.

This aquifer system is capable of meeting the needs of domestic and some high-capacity users in Gibson County. Wells in the Wabash Lowland Till Aquifer System are completed at depths ranging from 38 to 178 feet, although well depths ranging from 50 to 70 feet are most common. Potential aquifer materials within the glacial till include discontinuous intertill sand and gravel units. In places, these units are described by well drillers as a mixture of: muck, sand, and gravel, dirty sand, or sanded clay. In Gibson County, however, the aquifer materials within this system tend to be described as: quicksand, sand, or sand and gravel, which typically range from 10 to 35 feet thick capped with 20 to 50 feet of clay. Domestic well yields are typically 8 to 28 gpm and static water levels range from 4 to 30 feet below the land surface. There are 3 registered significant groundwater withdrawal facilities (14 wells) using the Wabash Lowland Till Aquifer System. The reported yields for the high-capacity wells range from 30 to 300 gpm.

The Wabash Lowland Till Aquifer System has a low susceptibility to surface contamination because intertill sand and gravel units are generally separated from the surface by till layers within the system.

Wabash Lowland Till Aquifer Subsystem

The Wabash Lowland Till Aquifer Subsystem is mapped in four areas in central Gibson County. The subsystem is mapped similar to the Wabash Lowland Till Aquifer System. However, potential aquifer materials are generally thinner and potential yields are less in the subsystem.

About 58 percent of wells started in this subsystem in Gibson County are completed in the underlying bedrock aquifer system. Potential aquifer materials include discontinuous intertill sand and gravel deposits. These intertill sand and gravel aquifer materials range from 12 to 38 feet thick and are capped with 15 to 75 feet of clay. The wells producing from this subsystem are typically completed at depths ranging from about 55 to 140 feet. Domestic well yields are generally 2 to 12 gpm and static water levels range from 10 to 40 feet below the surface. There are no registered significant groundwater withdrawal facilities using the Wabash Lowland Till Aquifer Subsystem.

This subsystem is generally not very susceptible to surface contamination because intertill sand and gravel units are overlain by thick till deposits. Wells producing from shallow aquifers are moderately to highly susceptible to contamination.

Wabash River and Tributaries Outwash Aquifer System / White River and Tributaries Outwash System

In Indiana the Wabash River and Tributaries Outwash Aquifer System occupies the valleys of the Wabash River and its major tributaries. Although the White River is a major tributary of the Wabash River, within the drainage basin of the White River this system is called the White River and Tributaries Outwash Aquifer System.

These systems contain large volumes of sand and gravel that fill the main river valleys. As the glaciers melted (far upstream), the sediment contained within them was delivered to the Wabash and White Rivers in quantities too large for the streams to transport. As a result, the increased sediment load was stored in the valley as vertical and lateral accretionary deposits. As long as the retreating glaciers continued to provide sediment in quantities too large for the streams to transport, the main valleys continued to be filled. This valley-filling process formed the most prolific aquifer systems in the county.

The unconsolidated deposits (mostly sand and gravel) of these systems in Gibson County are known to be up to 150 feet thick. In many places a clay layer, commonly under 15 feet thick, lies above the sand and gravel. Most of the sand and gravel is saturated, because the groundwater level is typically 5 to 15 feet below the land surface. Wells completed in these

systems are commonly 40 to 85 feet deep and typically only penetrate 30 to 70 feet of saturated aquifer materials. However, in places the total saturated aquifer thickness may exceed 150 feet

The elevation of the modern White River floodplain is approximately 405 feet above mean sea level (msl) upstream where the river enters Gibson County and approximately 390 feet msl downstream at its confluence with the Wabash River. The elevation of the floodplain where the Wabash River leaves the county is approximately 375 feet msl.

These aquifer systems are by far the most productive in Gibson County and have the potential to consistently meet the needs of high-capacity water users. There are 15 significant groundwater withdrawal facilities (43 wells) using the Wabash River and Tributaries Outwash Aquifer and White River and Tributaries Outwash Aquifer Systems. Typical production for high-capacity wells in these aquifer systems ranges from 600 to 1,050 gpm.

These aquifer systems are highly susceptible to contamination from surface sources in areas that lack overlying clay layers. However, where these systems are overlain by thick layers of clay or silt they are only moderately susceptible to surface contamination.

Wabash River and Tributaries Outwash Aquifer Subsystem / White River and Tributaries Outwash Subsystem

These aquifer systems (subsystems) are generally located adjacent to and parallel to the Wabash or White River and Tributaries Outwash Aquifer Systems. They typically occupy a higher topographic position and have considerably thinner (typically 12 to 35 feet thick) sand and gravel units than the main outwash aquifer systems. Commonly the sand and gravel is covered by a layer of clay, till, lacustrine, or loess deposits with a typical thickness ranging from 10 to 35 feet.

Although not nearly as productive as their respective outwash systems, domestic wells completed in these subsystems typically yield 5 to 20 gpm. There are also 2 significant groundwater withdrawal facilities (2 wells) using the Wabash River and Tributaries Outwash Aquifer and White River and Tributaries Outwash Aquifer Subsystems in Gibson County. High-capacity wells in these aquifer systems have been tested at rates ranging from 100 to 250 gpm.

In general, these subsystems are moderately to highly susceptible to surface contamination. Although the overlying silt, clay, or till may provide some protection to the confined portions of these subsystems, in places such protection does not exist.

Coal Mine Spoil Aquifer System

The Coal Mine Spoil Aquifer System covers only about 2 percent of Gibson County primarily because the coal seams (within the Carbondale Group of Pennsylvanian age) are shallow enough to be economically surface mined only in a small area in the eastern part 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 contain considerable amounts of groundwater.

The quality of groundwater in this system is generally 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. In this county, this aquifer system has limited aquifer potential because its areal extent is discontinuous and small.

Very 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.

Registered Significant Groundwater Withdrawal Facilities

There are 20 registered groundwater withdrawal facilities (total of 59 wells) using unconsolidated aquifers in the county. Most of these facilities utilize the Wabash or White River and Tributaries Outwash Aquifer Systems (15 facilities, 43 wells). However, some facilities use the Wabash River and Tributaries Outwash Aquifer Subsystem (2 facilities, 2 wells) and the Wabash Lowland Till Aquifer System (3 facilities, 14 wells). Dominant uses for these facilities are irrigation, public water supply, and energy production.

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