UNCONSOLIDATED AQUIFER SYSTEMS OF CRAWFORD COUNTY, INDIANA

Three unconsolidated aquifer systems have been mapped in Crawford County: the Unglaciated Southern Hills and Lowlands; the Alluvial, Lacustrine, and Backwater Deposits; and the Ohio River Outwash. The first aquifer system consists primarily of thin, eroded residuum (a product of bedrock weathering). The next two systems comprise sediments primarily deposited by, or resulting from, glaciers, glacial meltwaters, and post-glacial precipitation events. Boundaries of these aquifer systems are in many places gradational and individual aquifers may extend across aquifer system boundaries.

The vast majority of the county has 15 feet or less of unconsolidated material overlying bedrock. In the southern portion of the county there are several valleys tributary to the Ohio River that contain alluvium and fine-grained lacustrine deposits for which the thickness may exceed 60 feet. Farther north (upstream) these valleys may have isolated areas in which the thickness may approach 25 feet. However, these upstream areas are small and are not individually mapped. In contrast, a thick sand and gravel aquifer occurs in the main valley of the Ohio River.

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.

Unglaciated Southern Hills and Lowlands Aquifer System

The Unglaciated Southern Hills and Lowlands Aquifer System, which covers most of Crawford County, has the most limited ground-water resources of the unconsolidated aquifer systems in the county. Unconsolidated materials of the Unglaciated Southern Hills and Lowlands Aquifer System consist of thin, eroded bedrock residuum in most of the county. The residuum has a high clay content and is typically less than 15 feet thick, including minor amounts of loess. Total thickness of the aquifer system in Crawford County commonly ranges from about 5 to 25 feet. Some smaller stream valleys are also mapped in this system. These may include a few feet of colluvium, alluvium, and lacustrine silt and clay. In those valleys a thin sand layer, generally less than 5 feet thick, may be encountered in places.

Because the unconsolidated materials covering the bedrock are so thin in most places, the aquifer elevations closely match the elevation of the bedrock surface. Therefore, the highest aquifer elevations are in the northeastern part of the county and the lowest elevations are in the southern part of the county along the Ohio River.

The Division of Water has no records of any water supply wells completed in this aquifer system in Crawford County. Expected yields would range from 0 to 2 gallons per minute (gpm); however, dry holes would be most commonly expected. In a few places large-diameter bored (bucket-rig) wells could potentially produce water from weathered bedrock on broad ridge tops or from thin sands within the predominantly clay and silt materials in valley bottoms.

Because of the low permeability of the 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 composed of unconsolidated deposits in valleys tributary to the Ohio River. The unconsolidated deposits in this aquifer system come from two sources. One source is alluvium deposited by the stream along with colluvium eroded from the valley 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 Ohio 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. They can occur up to an elevation of about 450 feet mean sea level (m.s.l.) in the county.

Because the Blue River, Little Blue River, and their tributaries never carried outwash from melting glaciers, it is doubtful that these valleys have the potential for more than domestic wells. Well data are very sparse, but very little alluvial material is expected in the narrow bedrock-walled valleys.

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. Sand and gravel lenses, where present, are commonly less than 5 feet thick and are confined within the glaciolacustrine deposits, or directly overlie bedrock. Large-diameter bored (bucket-rig) wells are employed where other means of extracting seepage from the fine-grained deposits are not available. Wells that penetrate this system commonly have depths that range from 20 to 60 feet. Static water levels in wells penetrating the aquifer system are typically less than 25 feet below the land surface. Yields from domestic wells range from 0 (dry holes) to 5 gpm. Overall, prospects of completing high-capacity wells in this aquifer system are very poor.

This aquifer system is marked by thick deposits of soft silt and clay that have low susceptibility to surface contamination.

Ohio River Outwash Aquifer System

In Indiana, the Ohio River Outwash Aquifer System occupies primarily the existing main valley of the Ohio River. In Crawford County, the Ohio River valley is the only valley that carried outwash from the melting glaciers far to the north and east.

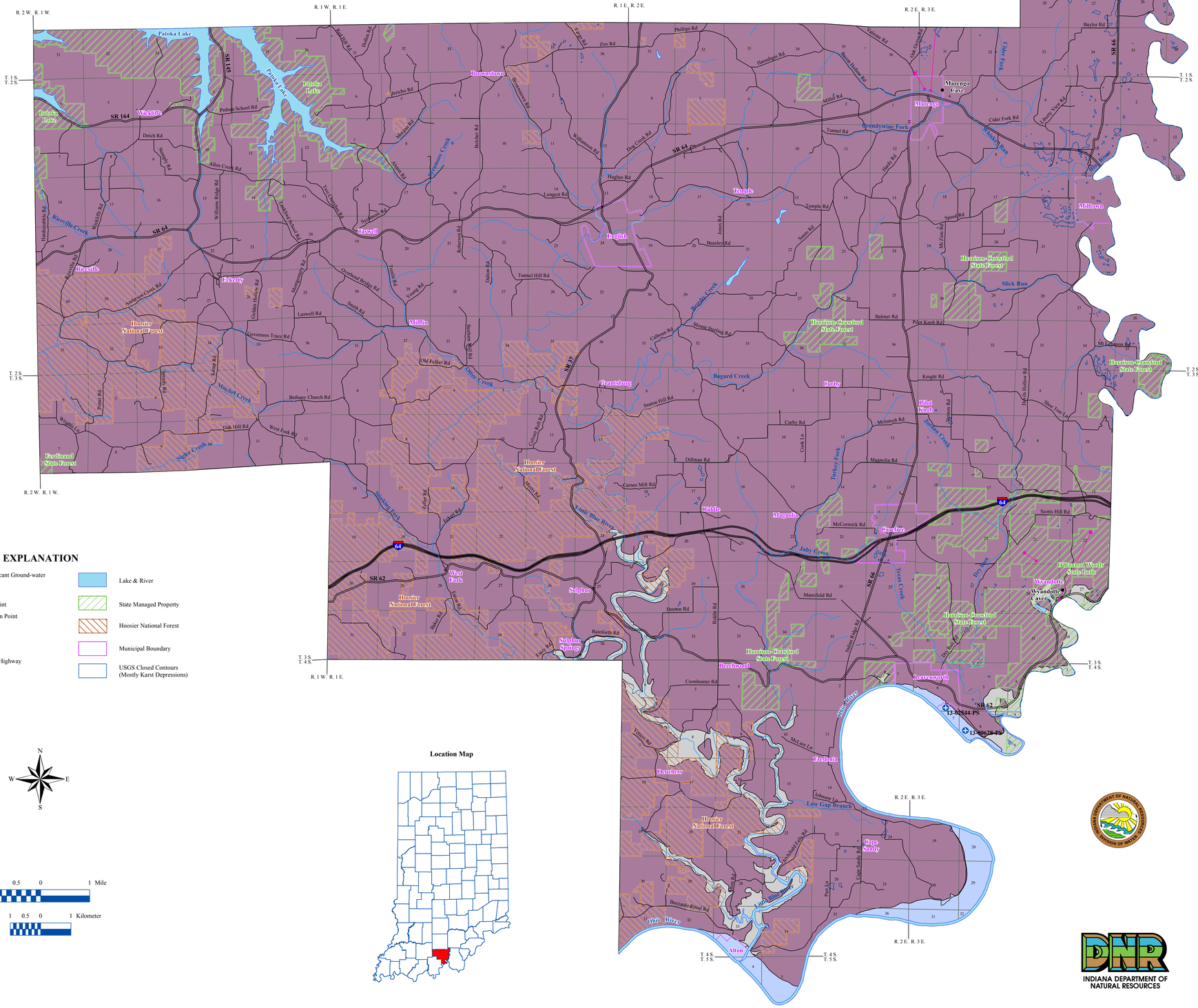
The system contains large volumes of sand and gravel that fill the main river valley. As the glaciers melted, the sediment contained within them was delivered to the Ohio River in quantities too large for the stream to transport. As a result, the increased sediment load was stored in the valleys as vertical and lateral accretionary deposits. As long as the retreating glaciers continued to provide sediment in quantities too large for the stream to transport, the valley continued to be filled.

The unconsolidated deposits of the Ohio River Outwash Aquifer System range from less than 20 feet at the edge of the valley to more than 100 feet in thickness. This aquifer system, with its thick sand and gravel, contrasts sharply with the adjacent aquifer systems, which show little or no sand or gravel. However, not all of the sand and gravel is saturated with water. Saturated sand and gravel (aquifer) thickness of the Ohio River Outwash Aquifer System ranges from about 10 to 80 feet, but most of the system has an aquifer thickness between 40 and 70 feet. Static water levels typically range from about 30 to 55 feet below land surface. Because water levels are generally near the base of overlying fine-grained clay, silt, or muddy sand the aquifer could be under confined or unconfined conditions.

The elevation of the modern Ohio River floodplain is approximately 420 feet m.s.l. upstream where the river enters Crawford County and approximately 410 feet m.s.l. downstream where it leaves the county. Accurate elevations of the top and bottom of the aquifer itself are hard to determine because there are not many records available for wells completed in the aquifer. However, several records do show 20 to 55 feet of clay or muddy sand and silt above the aquifer. The bottom elevation of the aquifer is expected to range from about 275 to 300 feet m.s.l. in that part of the valley where the depth to bedrock is greatest.

The Ohio River Outwash Aquifer System is by far the most productive aquifer system in the county and has the potential to consistently meet the needs of high-capacity water users. Well yields of 500 to greater than 1300 gpm have been obtained from this aquifer system.

This aquifer system is highly susceptible to contamination in areas that lack overlying clay layers. Areas within the system that are overlain by thick layers of clay or silt are moderately susceptible to surface contamination.



EXPLANATION

- Registered Significant Ground-water Withdrawal Well
- Commercial Cave
- Dye Test Input Point
- Dye Test Detection Point
- Karst Dye Trace
- County Road
- Stream
- State Road & US Highway
- Interstate
- Lake & River
- State Managed Property
- Hoosier National Forest
- Municipal Boundary
- USGS Closed Contours (Mostly Karst Depressions)

N
W E
S

1 0.5 0 1 Mile

1 0.5 0 1 Kilometer

Location Map

INDIANA DEPARTMENT OF NATURAL RESOURCES

Map generated by Jennifer Mc Millan
IDNR, Division of Water, Resource Assessment Section
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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, 20050621), Selected Subsurface Dye Traces in Parts of Southern Indiana (line shapefile, 20000225), and Input and Detection Points for Selected Subsurface Dye Traces in Parts of Southern Indiana (point shapefile, 20001124) were all from the Indiana Geological Survey 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. Draft road shapefiles, System1 and System2 (line shapefiles, 2003), were from the Indiana Department of Transportation and based on a 1:24,000 scale. Managed Areas 96 (polygon shapefile, various dates) was from IDNR. Large-scale DLG Hypsography data (line shapefile, various dates) was from the US Geological Survey and based on a 1:24,000 scale. Unconsolidated Aquifer Systems coverage (Grove, 2003) was based on a 1:24,000 scale.

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