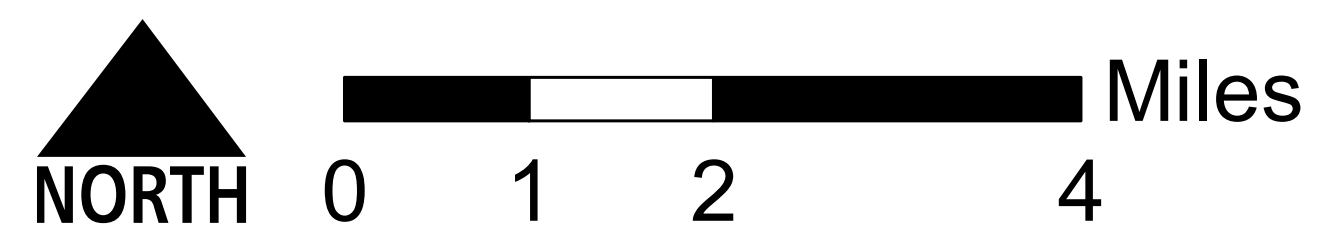
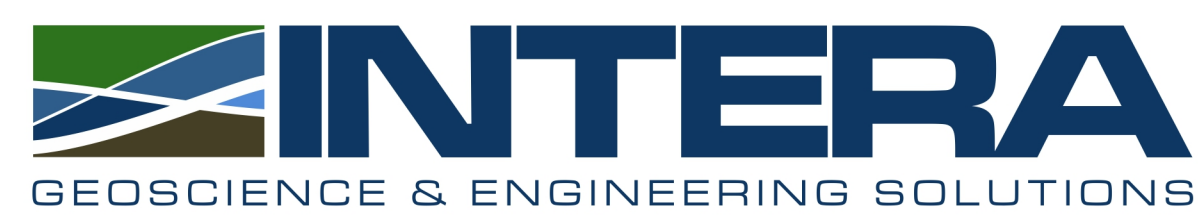
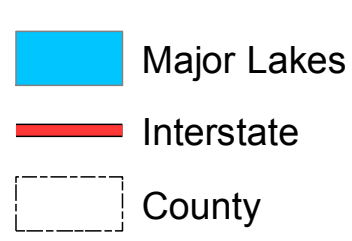
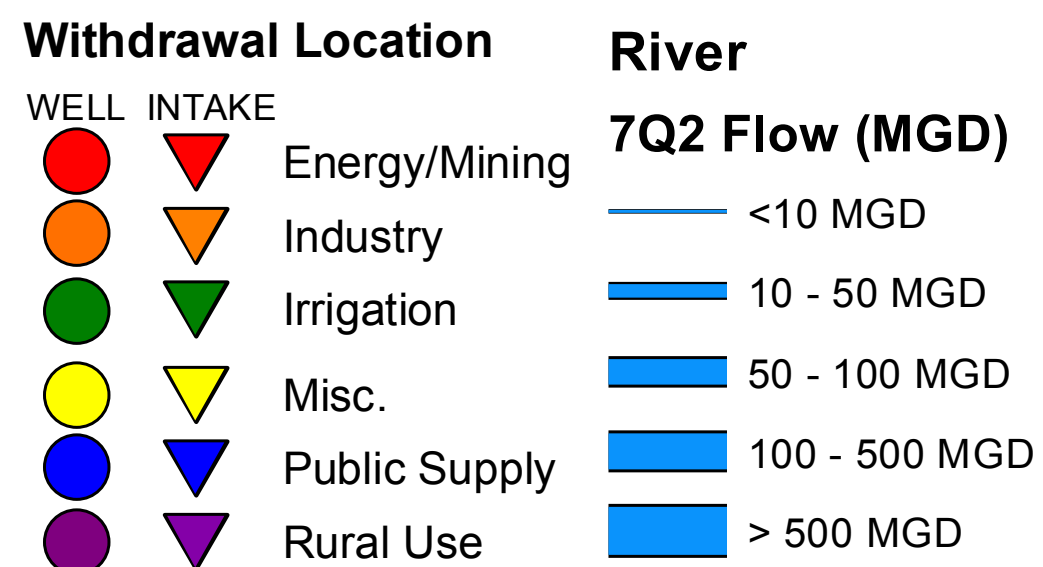


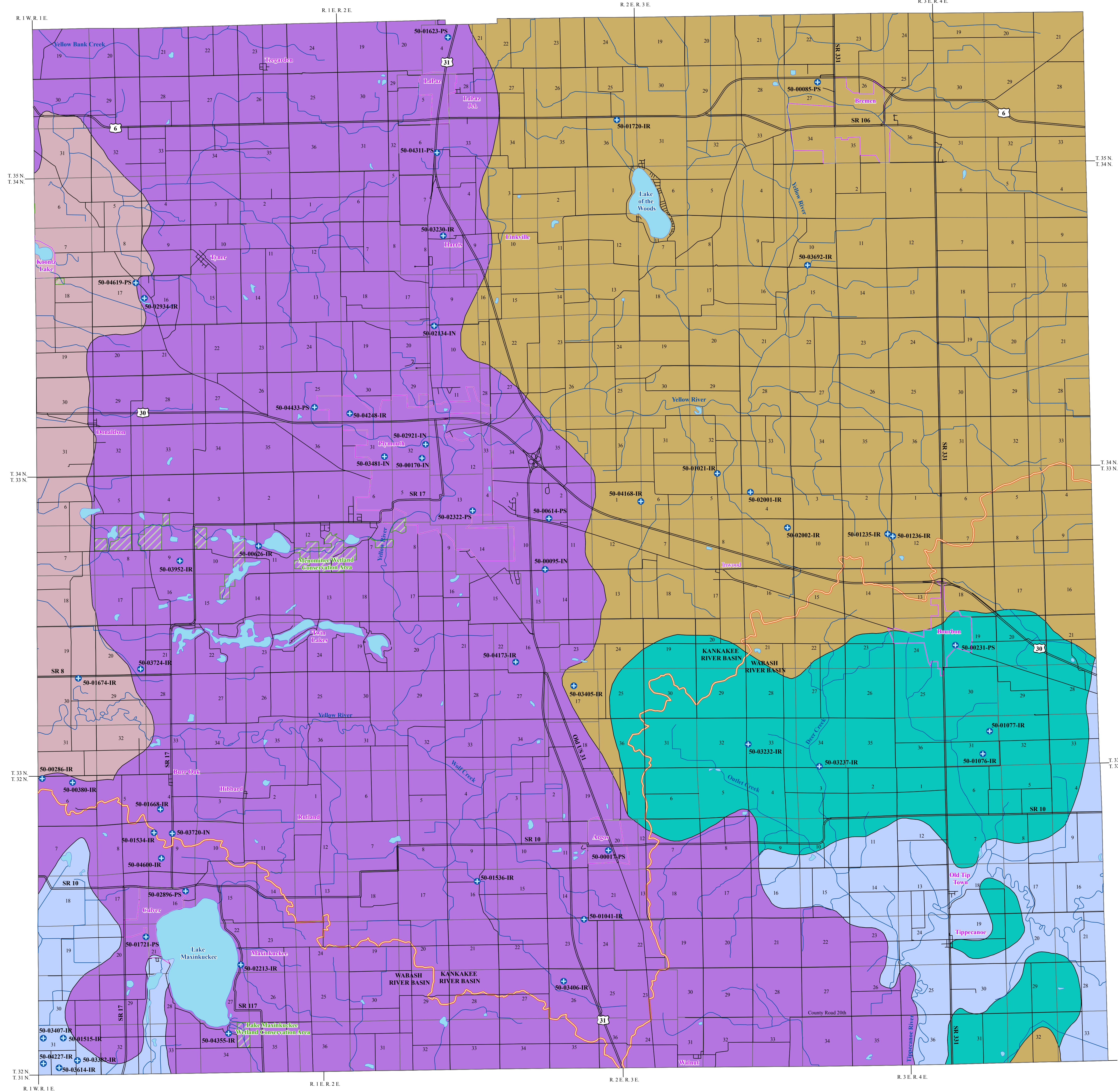
# Water Resources and Use in Marshall County

Data Sources: U.S. Geological Survey and Indiana Department of Natural Resources





# UNCONSOLIDATED AQUIFER SYSTEMS OF MARSHALL COUNTY, INDIANA



Five unconsolidated aquifer systems have been mapped in Marshall County: the Nappanee; the Eolian Sands; the Maxinkuckee Moraine; the Warsaw / Plymouth Complex; and the Wabash River and Tributaries Outwash System. Characteristics of the first three aquifer systems have been described and mapped as part of two previously published regional basin study reports: Water Resource Availability in the St. Joseph River Basin, Indiana, IDNR, 1987 and Water Resource Availability in the Kankakee River Basin, Indiana, IDNR, 1990. Although characteristics and descriptions of the basin study aquifer systems are generalized over large portions of northern Indiana, the descriptions of the aquifer systems have been modified here to accommodate the individuality of Marshall County. Boundaries of all aquifer systems described are commonly gradational, and individual aquifers may extend across aquifer system boundaries.

Pre-Wisconsin and Wisconsin glacial sediments completely cover Marshall County. Thicknesses of unconsolidated sediments that overlie bedrock are quite variable ranging from approximately 100 feet, to as much as 170 feet.

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, untagged or improperly abandoned wells, and open excavations, can provide contaminant pathways that bypass the naturally protective clays.

### Nappanee Aquifer System

In Marshall County, the Nappanee Aquifer System is mapped along most of the northeastern part of the county and a small area to the southeast. This system typically consists of thick clay with intertill sands and gravels. The aquifer materials are typically overlain by 20 to 70 feet of continuous clay.

The Nappanee Aquifer System is capable of meeting the needs of domestic and some high-capacity users. Well depths range from 55 to 120 feet below surface. Aquifer sands and gravels are generally 5 to 10 feet thick. The intertill sand and gravel deposits range from 2 to 15 feet thick and appear to be more consistent in the northern part of the county.

Domestic well capacities commonly range from 10 to 30 gallons per minute (gpm) with static water levels from 7 to 30 feet below surface. There are 10 registered significant ground-water withdrawal facilities (18 wells) in the Nappanee Aquifer System in Marshall County. Reported yields range from 100 to 800 gpm.

This aquifer system is generally not very susceptible to surface contamination because intertill sand and gravel units are overlain by thick till deposits. However, some areas have surface sands and gravels with thinner underlying clay above the aquifer resource. These areas are considered moderately susceptible to contamination.

### Eolian Sands Aquifer System

The Eolian Sands Aquifer System in Marshall County is mapped along part of the western edge of the county. In places, characteristics of this system generally involve windblown (eolian) sands at the surface with thick clay beneath that separates the surface deposits from the deeper aquifer resource. However, in some places the clays are not present. Clay thickness is typically 10 to 150 feet with the surface sand and gravels ranging from 10 to 60 feet thick. Wells completed in the Eolian Sands Aquifer System are generally 35 to 80 feet but wells as deep as 180 feet have been reported. Aquifer thickness ranges from 5 to 45 feet.

This system is capable of meeting the needs of domestic and some high-capacity users. Domestic well capacities are commonly 10 to 60 gpm. Static water levels range from 5 to 35 feet below surface. There are 2 registered significant ground-water withdrawal facilities (1 wells) utilizing this system with reported yields ranging from 90 to 500 gpm. However, large drawdowns are associated with the higher capacity wells.

This aquifer system is generally not very susceptible to surface contamination because intertill sand and gravel units are overlain by thick till deposits. However, areas where overlying clays are thin or absent are at moderate to high risk of contamination.

### Maxinkuckee Moraine Aquifer System

The Maxinkuckee Moraine Aquifer System is mapped throughout most of the western half of Marshall County. Unconsolidated deposits are associated with a large moraine complex with varying characteristics that involve discontinuous and isolated surficial sands and gravels, thick till sequences with discontinuous intertill sands and gravels as well as deeper aquifer sands and gravels of varying thickness.

Most wells completed in the Maxinkuckee Moraine Aquifer System produce from the deeper sand and gravel deposits. However, a few wells are completed in the shallow sands and gravels. Well depths range from 25 to 275 feet but are commonly 55 to 120 feet. Typical aquifer thickness is from 0 to 10 feet; however, in places aquifer deposits may be significantly greater. The aquifer deposits are typically capped by 20 to 70 feet of clay with intertill sand and gravel layers that are 5 to 20 feet thick.

The Maxinkuckee Moraine Aquifer System is capable of meeting the needs of domestic and high-capacity users. Typical domestic yields range from 10 to 15 gpm with static water levels commonly 10 to 30 feet below surface. There are 31 registered significant ground-water withdrawal facilities (49 wells) with reported yields that range from 70 to 278 gpm.

This aquifer system is generally not very susceptible to surface contamination because intertill sand and gravel units are overlain by thick till deposits. However, wells that utilize the shallow sands and gravels are at moderate to high risk to surface contamination.

### Warsaw / Plymouth Complex Aquifer System

The Warsaw / Plymouth Complex Aquifer System is mapped in portions of the southeast part of Marshall County. Several glacial advances resulted in a complex sequence of multiple, stacked, till and outwash units that are quite variable in position and thickness. Characteristics of this system include either surface sands and gravels commonly not used as a aquifer resource that overlie a thick till with intertill sands and gravels above a primary aquifer unit, or a thick clay cap with intertill sands and gravels that is underlain by an aquifer unit.

Well depths are commonly 45 to 135 feet. In places the system exhibits multiple sand and gravel deposits above the primary aquifer resource that are also a potential source of ground-water. The sand and gravel deposits vary from thin to massive and are typically discontinuous and overlain by a thick till. Total accumulative unconsolidated thickness above the aquifer units are generally 20 to 105 feet. Individually, the discontinuous sands and gravels are typically 5 to 25 feet thick and the deeper, more productive aquifer deposits are 8 to 35 feet thick.

The Warsaw / Plymouth Complex Aquifer System is capable of meeting the needs of domestic and some high-capacity users. Typical domestic yields range from 10 to 45 gpm. Static water levels commonly range from 10 to 35 feet below surface with some flowing wells reported. There are 5 registered significant ground-water withdrawal facilities (7 wells) with reported yields that range from 250 to 900 gpm.

This aquifer system is not very susceptible to contamination where thick clay deposits overlie aquifer materials. However, in places clay deposits are thin or not present. These areas are at moderate to high risk to surface contamination.

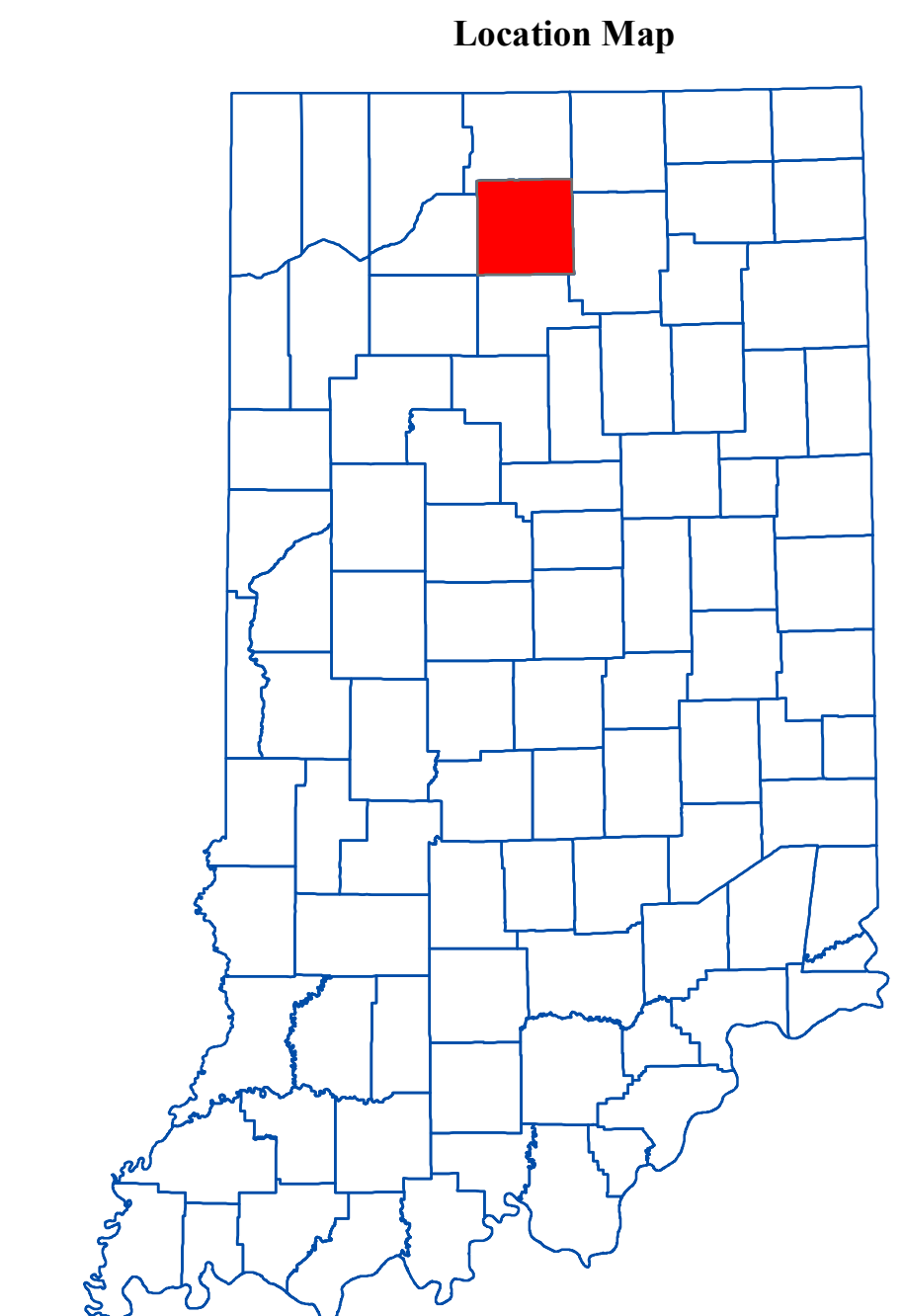
### Wabash River and Tributaries Outwash Aquifer System

In Marshall County the Wabash River and Tributaries Outwash Aquifer System is mapped along the southeastern and southwestern edges of the county. The system is made up of thick, glacially derived outwash deposits along with recent alluvial deposits that cap the outwash deposits.

Few wells are completed in this system in Marshall County. Well depths range from 30 to 110 feet below surface with up to 180 feet of continuous sand and gravel. However, well depths are generally 50 to 80 feet. In places, aquifer materials are capped by silt or sandy clay ranging from less than 10 to 35 feet thick. In addition, aquifer sand and gravel deposits may include discontinuous clay, sandy clay or gravelly clay deposits 1 to 40 feet thick.

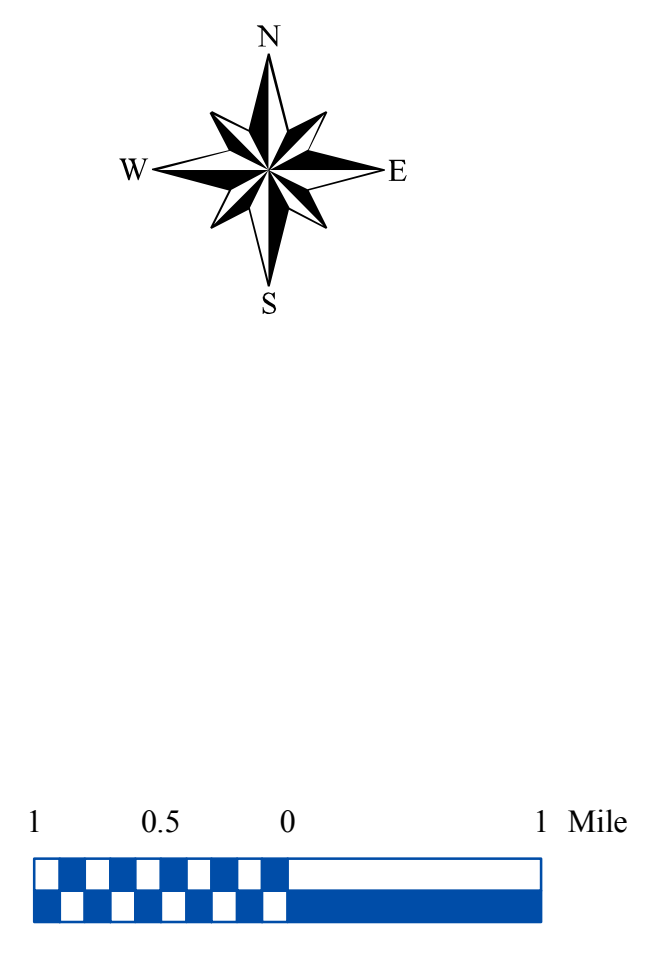
The Wabash River and Tributaries Outwash Aquifer System is capable of meeting the needs of domestic and some high-capacity users. Domestic wells are commonly 10 to 40 gpm. Static water levels are commonly 4 to 15 feet below surface with some flowing wells reported. There are 5 registered significant ground-water withdrawal facilities (5 wells) in the outwash system in Marshall County. Well yields range from 350 to 800 gpm.

Areas that lack overlying clay or silt deposits are highly susceptible to contamination. However, where overlying clay or silt deposits are present the system is moderately susceptible to surface contamination.



### EXPLANATION

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



### Map Use and Disclaimer Statement

We request that the following agency be acknowledged in products derived from this map. Indiana Department of Natural Resources, Division of Water.

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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), and County Boundaries of Indiana (polygon shapefile, 20020621), were all from the Indiana Geological Survey and based on a 1:24,000 scale. Draft road shapefiles, System1 and System2 (line shapefiles, 2003), were from the Indiana Department of Transportation and based on a 1:24,000 scale. Populated Areas in Indiana 2000 (point shapefile, 20021000) was from the U.S. Census Bureau and based on a 1:100,000 scale. Stream27 (line shapefile, 20000420) was from the Center for Advanced Applications in GIS at Purdue University. Managed Areas 96 (polygon shapefile, various dates) was from DNR. Unconsolidated aquifer systems coverage (Maier, 2008) was based on a 1:24,000 scale.

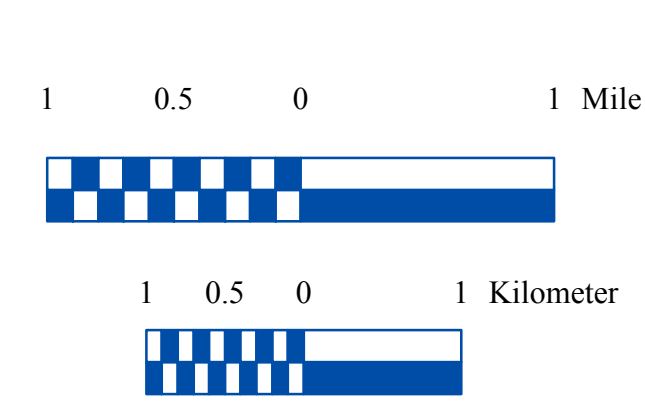
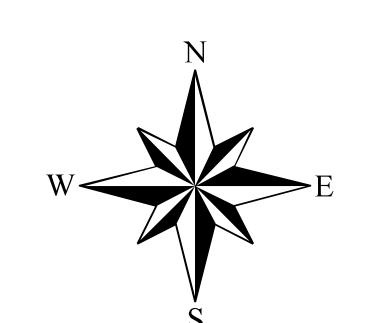
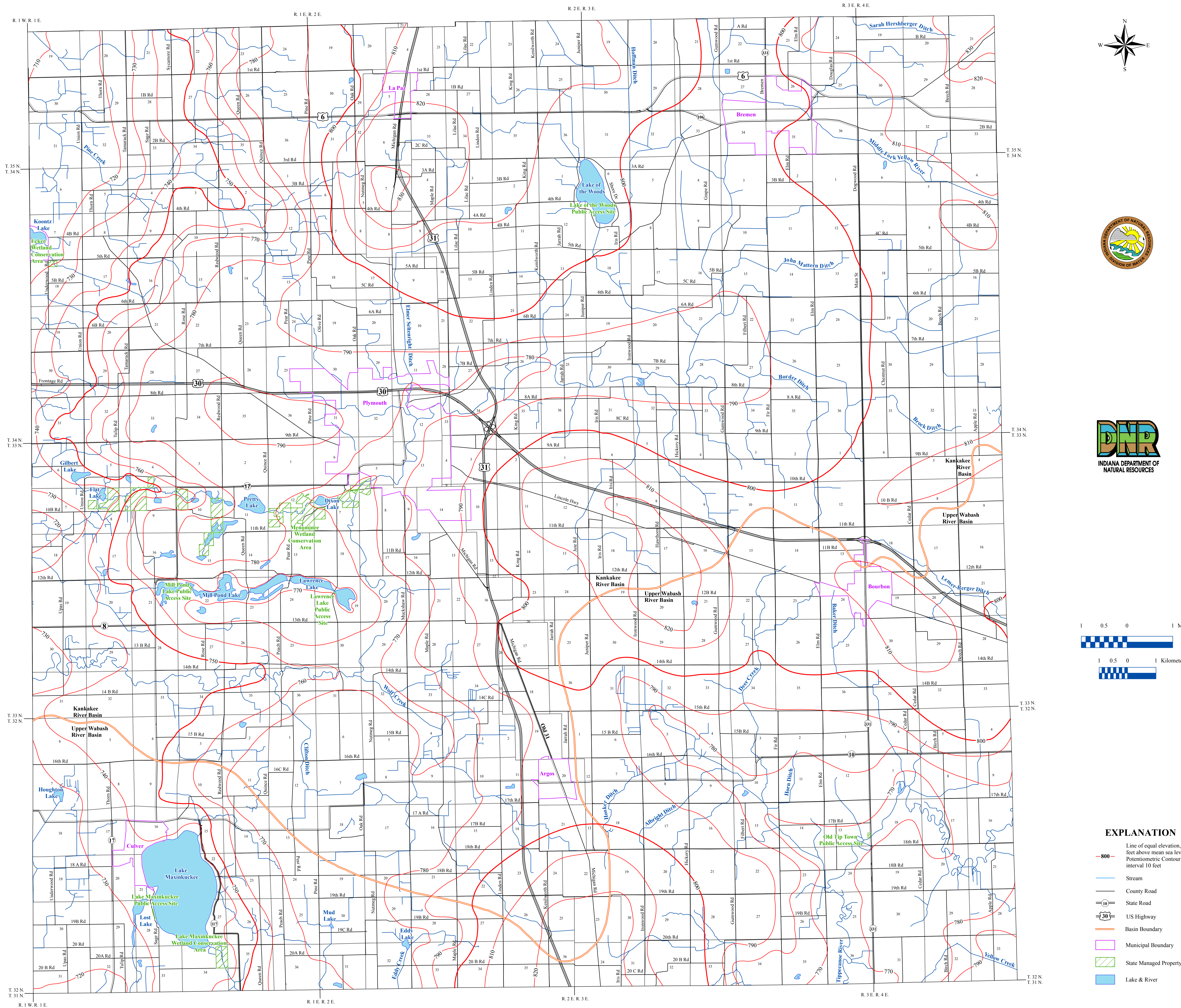
### Unconsolidated Aquifer Systems of Marshall County, Indiana

by  
Randall D. Maier  
Division of Water, Resource Assessment Section

April 2008

Map generated by Scott H. Dean  
DNR, Division of Water, Resource Assessment Section

# POTENTIOMETRIC SURFACE MAP OF THE UNCONSOLIDATED AQUIFERS OF MARSHALL COUNTY, INDIANA



**EXPLANATION**

- 800 — Line of equal elevation, in feet above mean sea level
- Potentiometric Contour interval 10 feet
- Stream
- County Road
- State Road
- US Highway
- Basin Boundary
- Municipal Boundary
- State Managed Property
- Lake & River

Marshall County, Indiana is located in the north-central section of the state. The southwestern and southeastern portions of the county are situated within the Upper Wabash River Basin with the remaining parts located in the Kankakee River Basin.

The Potentiometric Surface Map (PSM) of the unconsolidated aquifers of Marshall County was mapped by contouring the elevations of approximately 2000 static water-levels reported on well records received primarily over a 50 year period. These wells are completed in aquifers at various depths, and typically, under confined conditions (bounded by impermeable layers above and below the water bearing formation). However, some wells were completed under unconfined (not bounded by impermeable layers) settings. The potentiometric surface is a measure of the pressure on water in a water bearing formation. Water in an unconfined aquifer is at atmospheric pressure and will not rise in a well above the top of the water bearing formation. In contrast to water in a confined aquifer that is under hydrostatic pressure and will rise in a well above the top of the water bearing formation.

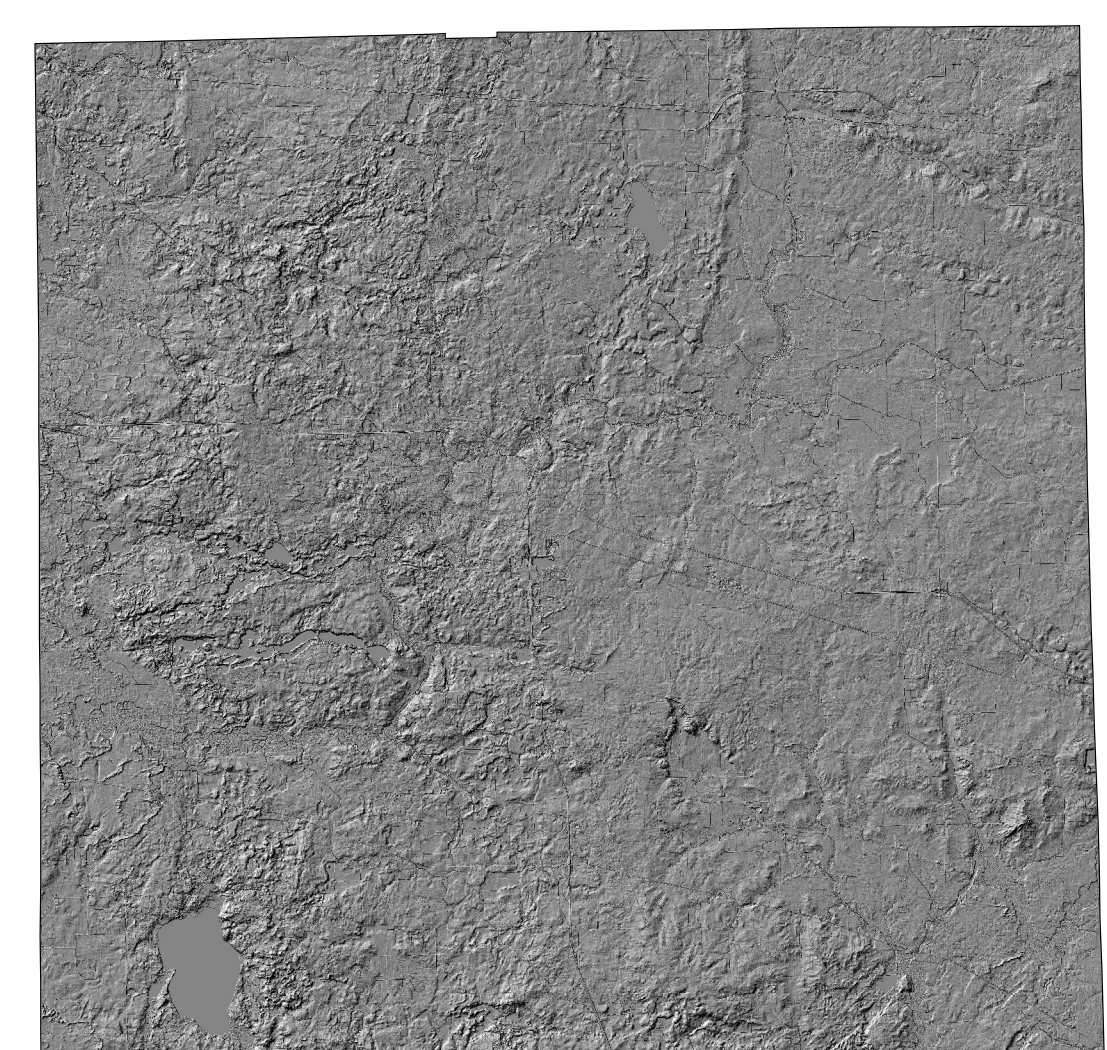
Static water-level measurements in individual wells used to construct county PSM's are indicative of the water-level at the time of well completion. The groundwater level within an aquifer constantly fluctuates in response to rainfall, evapotranspiration, groundwater movement, and groundwater pumping. Therefore, measured static water-levels in an area may differ due to local or seasonal variations. Because fluctuations in groundwater are typically small, static water-levels can be used to construct a generalized PSM. Groundwater flow is naturally from areas of recharge toward areas of discharge. As a general rule, but certainly not always, groundwater flow approximates the overlying topography and intersects the land surface at major streams.

Universal Transverse Mercator (UTM) coordinates for the water wells were either physically obtained in the field, determined through address geocoding, or reported on water well records; however, the location of the majority of the water well records used to make the PSM were not field verified. Elevation data were either obtained from topographic maps or a digital elevation model. Quality control/quality assurance procedures were utilized to refine or remove data where errors were readily apparent.

Unconsolidated potentiometric surface contours in Marshall County range from a high of 830 feet mean sea level (msl) in the northeastern section of the county, to a low of 710 feet msl in the far western portion. Groundwater flow direction in the Kankakee River Basin is to the west toward the Kankakee River, and generally south toward the Tippecanoe River within the Upper Wabash River Basin.

The county PSM can be used to define the regional groundwater flow path and to identify significant areas of groundwater recharge and discharge. County PSM's represent overall regional characteristics and are not intended to be a substitute for site-specific studies.

Hillshade Map of Marshall County, Indiana



Vertical Exaggeration = 5x

Location Map



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**Potentiometric Surface Map of the Unconsolidated Aquifers of Marshall County, Indiana**  
by  
Glenn Grove  
Division of Water, Resource Assessment Section

May 2013

# Marshall County

