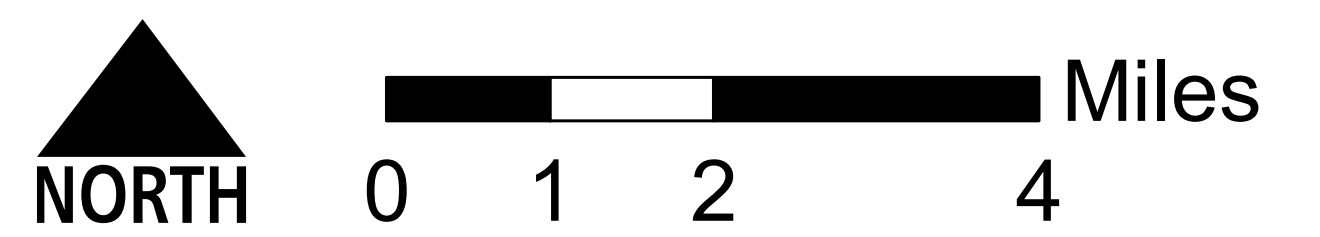
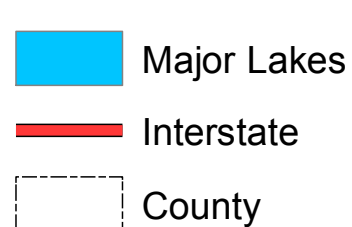
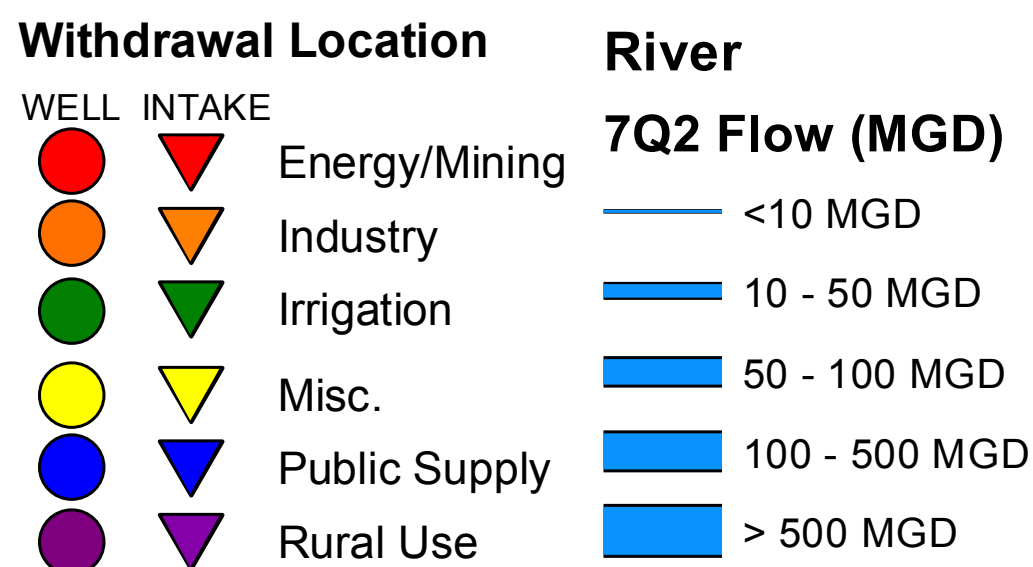
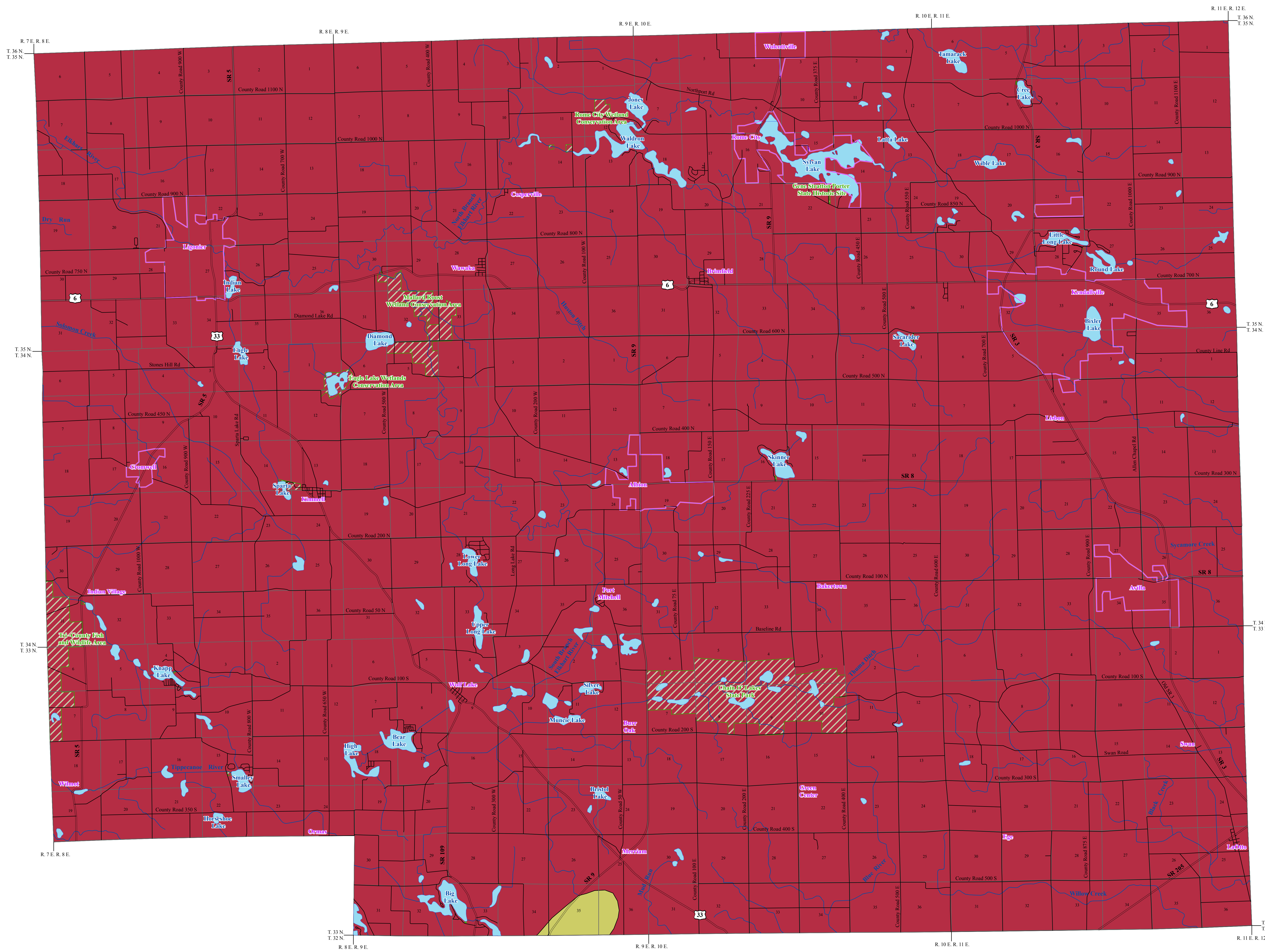


# Water Resources and Use in Noble County

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



# BEDROCK AQUIFER SYSTEMS OF NOBLE COUNTY, INDIANA



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.

The bedrock aquifer systems in Noble County are overlain by unconsolidated deposits of varying thickness, ranging from around 200 feet to more than 450 feet. The unconsolidated thickness is typically greater than 300 feet in the county. The bedrock aquifers, therefore, 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 formation.

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 jointing may occur in aquitards, which can increase recharge to the underlying aquifers. Hydraulic properties of the bedrock aquifers are highly variable.

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.

Two bedrock aquifer systems are identified for Noble County. They are, from youngest to older: the Devonian and Mississippian Coldwater, Ellsworth and Antrim Shales; and the Silurian and Devonian Carbonates.

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

The subcrop area for this system covers nearly all of Noble County, except for a small area south of Merriam where the system has been eroded away. The Coldwater, Ellsworth and Antrim Shales Aquifer System is overlain by between 200 and 450 feet of unconsolidated deposits. This system is generally less than 100 feet thick in Noble County, however, it reaches a thickness of approximately 250 feet along the northeastern corner of the county.

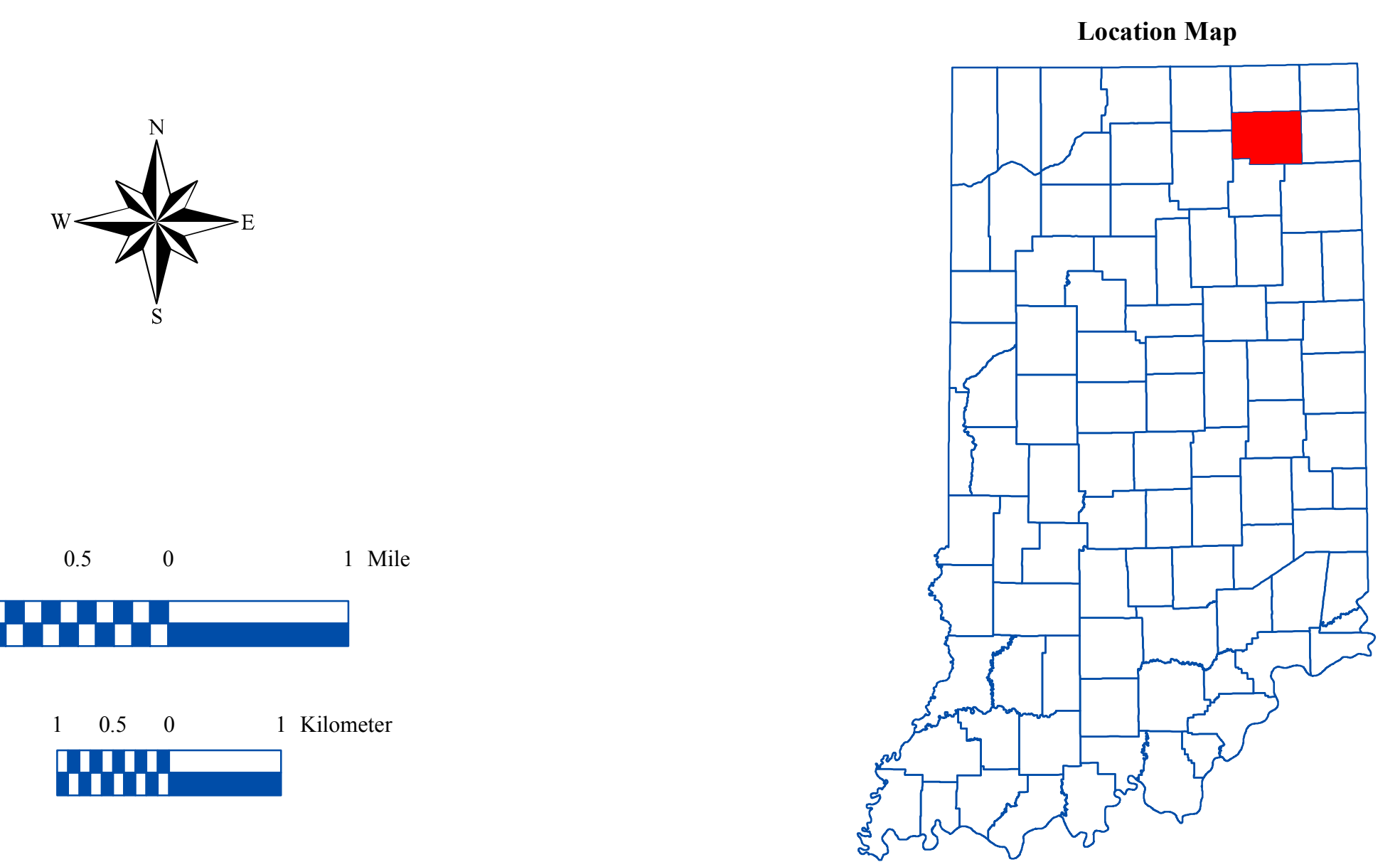
In Noble County the Coldwater Shale and Ellsworth Shale subcrop in the northern third of the county while the Antrim Shale subcrops in the southern two-thirds. The Coldwater is typically described as greenish to bluish shales, the Antrim Shale in Indiana is described as greenish-black shale and the Ellsworth is described as greenish-gray shale. These shales are commonly considered an aquitard; therefore, the system is an extremely limited ground-water resource. However, in some places the lower portion of the aquifer unit may contain some limestone.

Due to the availability of ground water in the overlying unconsolidated aquifers no reported wells have been completed in the Coldwater, Ellsworth and Antrim Shales Aquifer System in Noble County. Because the permeability of shale materials is considered low and the overlying unconsolidated deposits are thick, susceptibility to contamination introduced at or near the surface is low.

**Silurian and Devonian Carbonates Aquifer System**

The Silurian and Devonian Carbonates Aquifer System subcrops in a small area south of Merriam along the southern county line. In Noble County the only unit that subcrops in this aquifer system is the Muscatuck Group of middle Devonian age. Total thickness of this aquifer system exceeds 870 feet in places. Depth to bedrock in this system ranges from around 350 to more than 400 feet.

Due to the availability of the overlying unconsolidated resources very few wells have been completed in the Silurian and Devonian Carbonates Aquifer System. The reported domestic wells utilizing this system in Noble County have depths ranging from 402 to 444 feet deep. The amount of rock penetrated in this system varies from 17 to about 25 feet. Domestic well yields range from 10 to 55 gallons per minute. Static water levels are between 72 to 100 feet below the land surface. In Noble County the Silurian and Devonian Carbonates Aquifer System has a low susceptibility to surface contamination because thick clay deposits overlie the system.



**EXPLANATION**

- Stream
- County Road
- State Road & US Highway
- Municipal Boundary
- State Managed Property
- Lake & River

**DNR**  
INDIANA DEPARTMENT OF NATURAL RESOURCES

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**Bedrock Aquifer Systems of Noble County, Indiana**

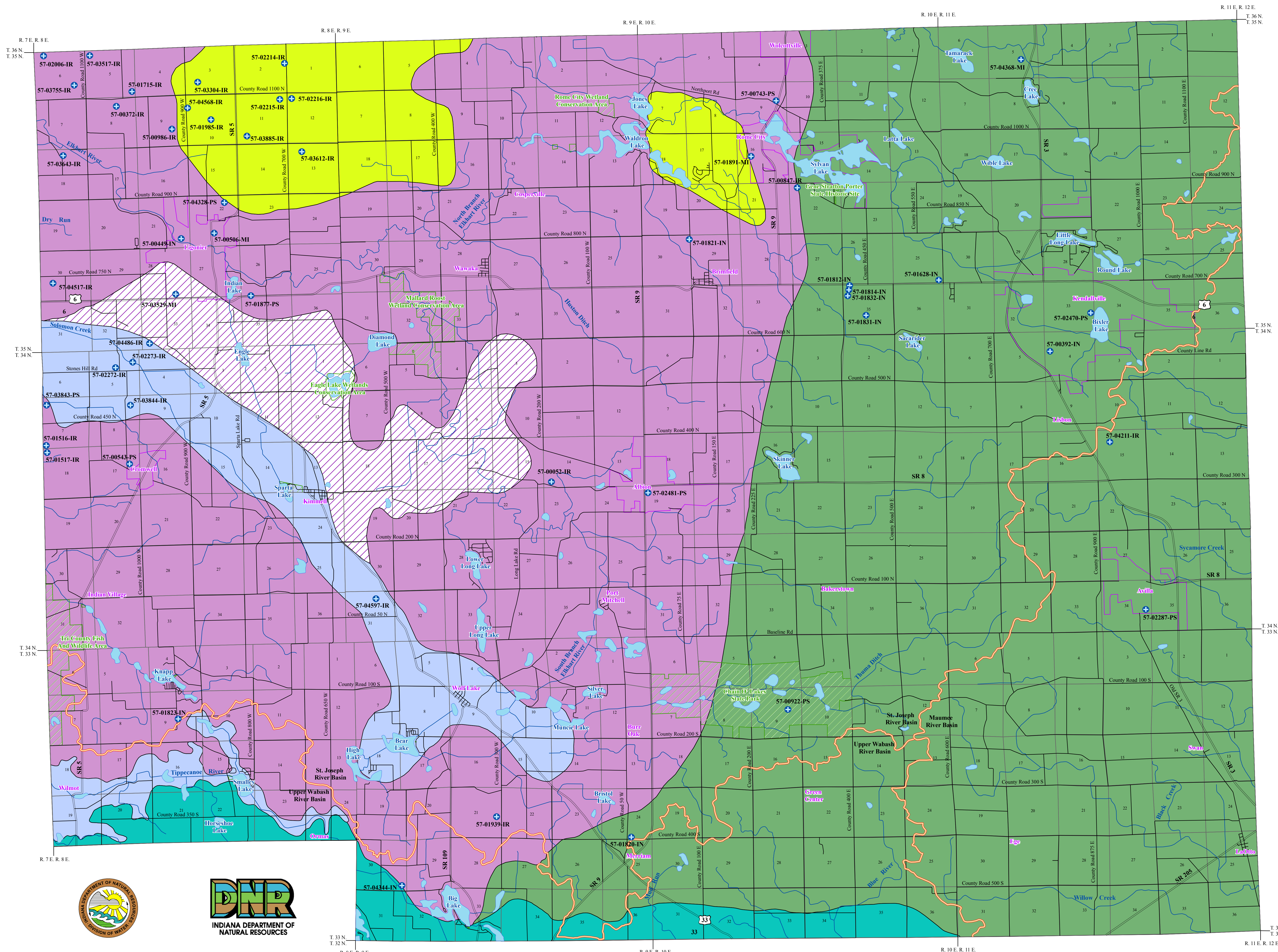
by  
Glenn E. Grove  
Division of Water, Resource Assessment Section

September 2008

# UNCONSOLIDATED AQUIFER SYSTEMS OF NOBLE COUNTY, INDIANA

Michelle E. Daniels, Jr., Governor  
Department of Natural Resources  
Robert E. Carter, Jr., Director

Aquifer Systems Map 50-A



Six unconsolidated aquifer systems have been mapped in Noble County: the Kendallville; the Topoka; the Natural Lakes and Moraines; the Natural Lakes and Moraines Subsystem; the Auburn/Warsaw Complex; and the St. Joseph and Tributary Valleys/Wabash River and Tributaries Outwash. The northern two-thirds of the county has been previously described and mapped in two previously published regional basin study reports (Water Resource Availability in the St. Joseph River Basin, Indiana, 1987 and Water Resource Availability in the Maumee River Basin, Indiana, 1996). The Topoka Aquifer System and the Natural Lakes and Moraines Subsystem were not mapped as part of the new county scale mapping. However, a brief description of these aquifer systems is included from the previously mentioned basin studies. For more detailed descriptions of these systems refer to the Water Resource Availability in the St. Joseph River Basin, Indiana, 1987.

Noble County has a very complex glacial history as it was subjected to multiple glacial advances from the north, northeast and east. The county lies in an interlobe area that was affected by the Saginaw lobe and Huron-Erie lobes. The dynamic interaction of the lobes resulted in a complex overlap and cross-cutting of glacial terraces. The resulting glacial landscape includes moraines, ground moraine, outwash, tunnel valleys (subglacial drainage channels) and outwash plains. Because of the complicated glacial geology, boundaries of the aquifer systems in this county are commonly gradational, and individual aquifers may extend across aquifer system boundaries.

The thickness of unconsolidated sediments in Noble County is quite variable, ranging from around 200 feet in the southeastern portion of the county, to more than 450 feet in the northeastern part of the county. In Noble County, unconsolidated deposits are commonly 300 to 400 feet thick. Almost all the domestic wells are completed in unconsolidated deposits in the county.

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.

## Kendallville Aquifer System

The Kendallville Aquifer System is mapped primarily in the eastern third of the county and consists primarily of thick clay with intratill sand and gravel layers. In Noble County, this system generally has multiple layers of intratill sand and gravel of various thickness and lateral extent. The main aquifer deposits are typically deeper, thicker, and more continuous than the shallower sand and gravel layers in this system.

This system is generally capable of meeting the needs of most domestic and some high-capacity users. Wells produced from the Kendallville Aquifer System commonly range from 70 to 150 feet deep with a few wells over 300 feet deep. Domestic well capacities are commonly 15 to 50 gallons per minute (gpm) and static water levels typically range from 15 to 65 feet below the surface with a few flowing wells reported. There are 12 registered significant ground-water withdrawal facilities (22 wells) with reported yields for high-capacity wells ranging from 120 to 1500 gpm. The Kendallville Aquifer System has a low susceptibility to surface contamination because intratill sand and gravel units are commonly separated from the surface by thick till layers.

## Topoka Aquifer System

The Topoka Aquifer System is located in two separate areas. The northern most occurrence of this system is just south of Topoka in LaGrange County, and extends southward into Noble County just north of Logansport. The other occurrence of the Topoka Aquifer System covers approximately five square miles in north central Noble County west of Rome City. This system consists of up to 126 feet of near-surface sand and gravel that overlies till. The till sequence that underlies this near-surface sand and gravel consists of clay units alternating with up to four separate sand and gravel layers. In most areas of this system, however, there is only one (0 to 60 feet thick) sand and gravel zone at depth. The majority of existing wells in these regions utilize the more continuous deeper sand and gravel aquifer rather than the near-surface aquifer. In areas where there is more than one aquifer present, the minor aquifers are only locally continuous. Eight registered significant ground-water withdrawal facilities (11 wells) are in the Topoka Aquifer System in Noble County. Reported yields for high-capacity wells in this aquifer system range from 25 to 1200 gpm. The surficial sand and gravel deposits are highly susceptible to contamination and the deeper aquifers are a slightly susceptible.

## Natural Lakes and Moraines Aquifer System

The Natural Lakes and Moraines Aquifer System in Noble County is mapped over much of the western half of the county and is a complex aquifer system typically with multiple intratill sand and gravel seams. In this county, the Natural Lakes and Moraines Aquifer System normally contains at least two potential sand and gravel aquifers, one near the surface, the other at depth. In places, the near-surface aquifer is absent and surficial clays over 80 feet thick are present. A few localized surficial sand and gravel deposits are reported and range from 15 to 40 feet thick; however, the static water levels are commonly deep and these deposits are seldom used. The total thickness of unconsolidated deposits in this system in Noble County ranges from about 300 to over 400 feet.

This system is capable of meeting the needs of domestic and most high-capacity users in Noble County. Wells completed in this aquifer system range in depth from 20 to over 400 feet deep. However, typical well depths range from 65 to 145 feet deep. The primary aquifer is generally between 15 and 25 feet thick and is typically covered by a thick till cap. Domestic well yields are commonly 10 to 60 gpm and static water levels are typically 15 to 60 feet below the surface. There are 26 registered significant ground-water withdrawal facilities (37 wells) utilizing this system with reported yields up to 1400 gpm for individual wells.

The Natural Lakes and Moraines Aquifer System is generally not very susceptible to surface contamination because thick clay deposits overlie intratill sand and gravel seams. Wells producing from shallow aquifers are moderately to highly susceptible to contamination.

## Natural Lakes and Moraines Aquifer Subsystem

The Natural Lakes and Moraines Aquifer Subsystem in Noble County is primarily mapped in the west-central part of the county where a relatively thin layer of outwash overlies moraine topography. This subsystem is typically transitional between the large outwash areas in the west-central portion of the county and the Natural Lakes and Moraines Aquifer System. The subsystem is a complex sequence of glacial deposits ranging in thickness from around 300 feet to over 400 feet. It generally consists of continuous surficial sand and gravel deposits that vary in thickness from 20 to over 120 feet thick but are commonly 25 to 45 feet thick. Below the surficial sand and gravel deposits, thick clays predominate. Most areas have two or more intratill sand and gravel aquifers. The deeper sand and gravel deposits tend to be thicker and more continuous and are commonly between 10 and 30 feet thick. Most wells are completed in the deeper aquifers. However, some wells use the surficial sand and gravel deposits.

This subsystem is capable of meeting the needs of domestic and most high-capacity users in Noble County. Wells completed in this aquifer system range in depth from 22 to 235 feet deep. However, the wells are generally 50 to 110 feet deep. Domestic well yields are commonly 20 to 60 gpm and static water levels are typically 10 to 55 feet below the surface. There is one registered significant ground-water withdrawal facilities (1 well) utilizing the Natural Lakes and Moraines Aquifer Subsystem with a reported well yield of 1500 gpm.

Wells that utilize the surficial sand and gravel in this subsystem are highly susceptible to contamination. However, wells that produce from the deeper aquifers in the Natural Lakes and Moraines Aquifer Subsystem are generally not very susceptible to surface contamination because thick clay deposits overlie intratill sand and gravel seams.

## Auburn/Warsaw Complex Aquifer System

The Auburn/Warsaw Complex Aquifer System is mapped along the southern portions of Noble County. Unconsolidated deposits in general are more than 300 feet thick in this system. This aquifer system is characterized by deposits that are quite variable in materials and thickness. A thick till commonly overlies the sand and gravel aquifer deposits. This system generally has multiple layers of intratill sand and gravel of various thickness and lateral extent. The main aquifer deposits are typically deeper, thicker, and more continuous than the shallower sand and gravel layers in this system.

This system is capable of meeting the needs of domestic and some high-capacity users in Noble County. Wells in this system are typically completed at depths of 85 to 215 feet. Domestic well yields are commonly 10 to 30 gpm and static water levels are generally 20 to 70 feet below the surface. The Auburn/Warsaw Complex Aquifer System is not very susceptible to contamination because thick clay deposits overlie the aquifer materials.

## St. Joseph and Tributary Valleys/Wabash River and Tributaries Outwash Aquifer System

The St. Joseph and Tributary Valleys/Wabash River and Tributaries Outwash Aquifer System is mapped along the Tippecanoe River and some tributaries of the St. Joseph River along the west-central and southwest portions of Noble County. Large amounts of outwash sand and gravel from the melting glaciers were deposited in stream valleys making this the most productive aquifer system in the county. The coarser sediments tend to be deeper while the finer sands were generally deposited higher in the sequence as the ice front receded. The total unconsolidated thickness of this system exceeds 350 feet with over 90 feet of continuous sand and gravel deposits at the surface in some areas. However, the outwash is typically 35 to 65 feet thick with the thickness of saturated sands and gravels commonly ranging from 25 to 55 feet. In some areas 20 to 40 feet of sandy clay or silt lies at the surface or below the surficial sand and gravels.

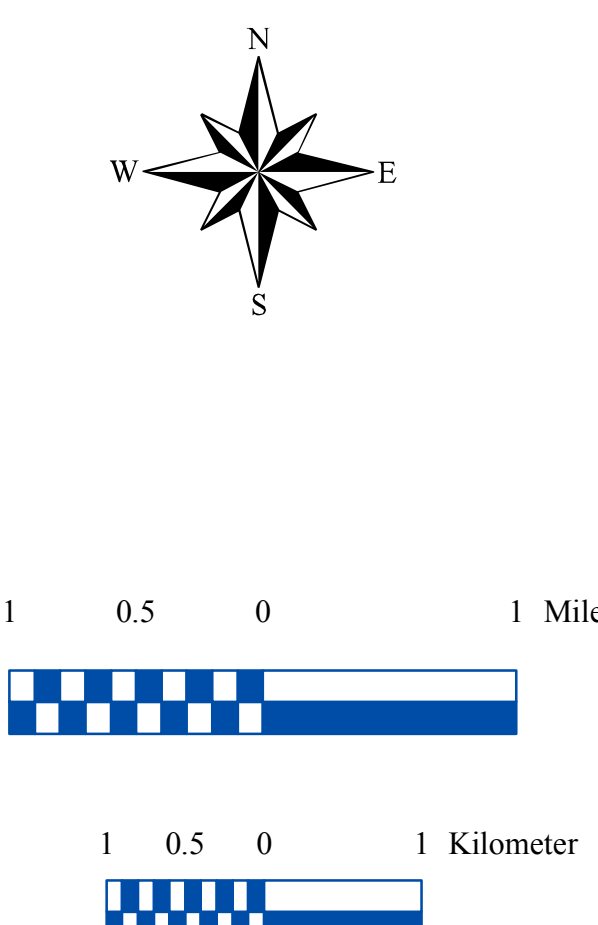
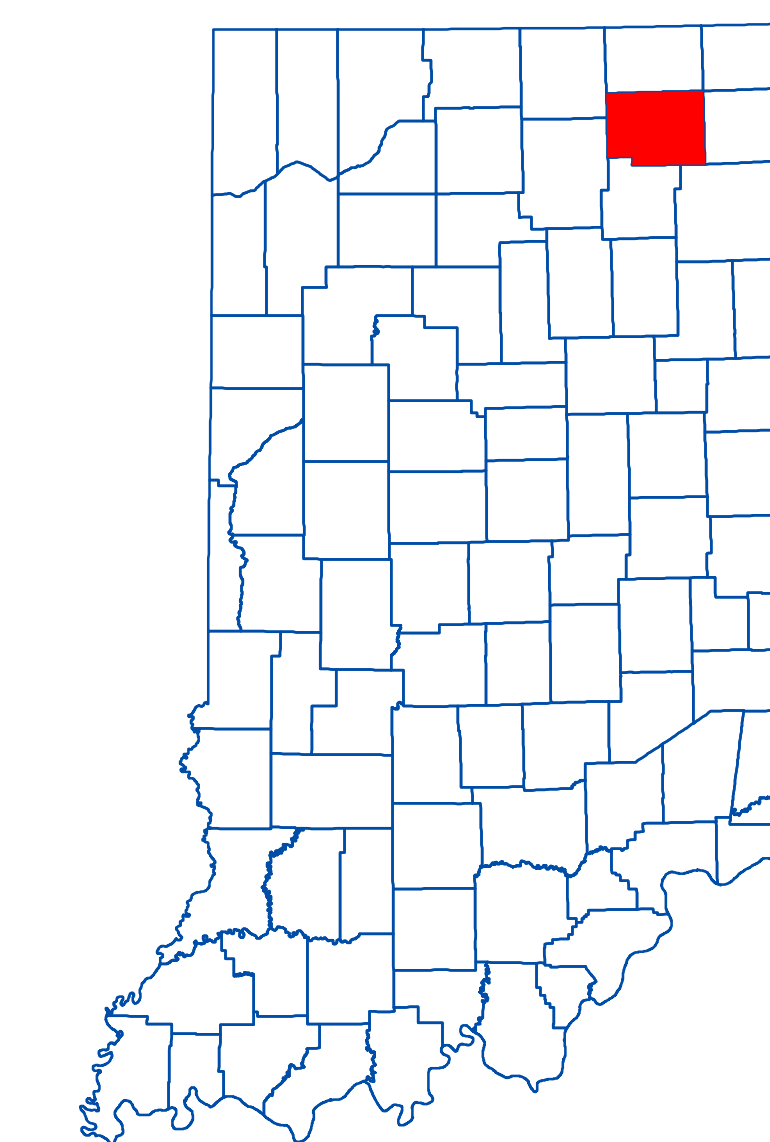
These sand and gravel deposits have adequate potential for domestic and most high-capacity users. Well depths are typically 50 to 90 feet. Domestic well yields are commonly 15 to 60 gpm and static water levels are generally 15 to 30 feet below the surface. Five registered significant ground-water withdrawal facilities (7 wells) are in the St. Joseph and Tributary Valleys/Wabash River and Tributaries Outwash Aquifer System in Noble County. Reported yields for high-capacity wells in this aquifer system range from 450 to 1200 gpm.

This aquifer system is highly susceptible to contamination from surface sources in areas that lack overlying clay layers. The system is only moderately susceptible where it is overlain by relatively thick clay or silt deposits.

## EXPLANATION

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

## Location Map



## Map Use and Disclaimer Statement

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## Unconsolidated Aquifer Systems of Noble County, Indiana

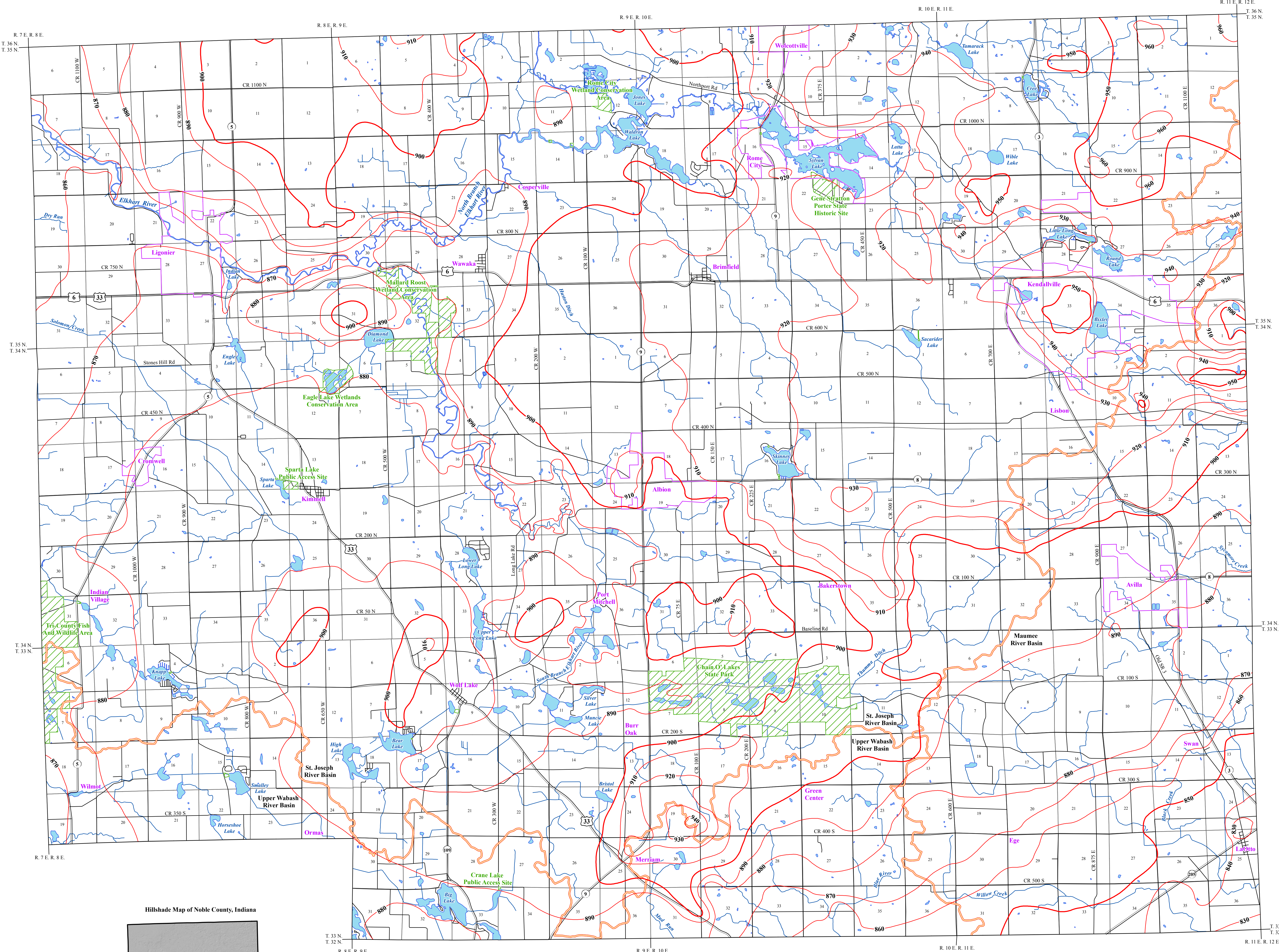
by  
Glenn E. Grove  
Division of Water, Resource Assessment Section

September 2008



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

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



Noble County, Indiana is located in the northeastern portion of the state and is situated within three major drainage basins. The east-central and southeast portions of the county are located within the Maumee River Basin, the southwest and south-central portions of the county are located within the Upper Wabash River Basin, and the remaining portions of the county are located within the St. Joseph River Basin.

Coordinate locations of water well records were physically obtained in the field, determined through address geocoding, or reported on water well records. Elevation data were either obtained from topographic maps or a digital elevation model (DEM). Elevation and location quality control quality assurance procedures were utilized to refine or remove data where errors were readily apparent.

The Potentiometric Surface Map (PSM) of the Unconsolidated Aquifers of Noble County was mapped by contouring the elevations of approximately 2900 single measurement static water-levels reported on water well records. The potentiometric surface is a measure of the pressure on water in a water bearing formation. 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), although a few wells are completed under unconfined (water table) settings. Water in an unconfined aquifer (not bounded by an impermeable layer above) 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 which 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 potentiometric surface maps 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, current site specific conditions may differ due to local or seasonal variations in measured static water-levels. Because fluctuations in groundwater are generally small, static water-levels can be used to approximate regional groundwater flow direction. 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.

The objective in creating county PSMs is to map static water-levels in the upper 100 feet of unconsolidated materials. If an area of the county has few located wells in the zero to 100 feet interval, then the static water-levels in wells completed between 100 to 200 feet, if available, are used to complement the mapping.

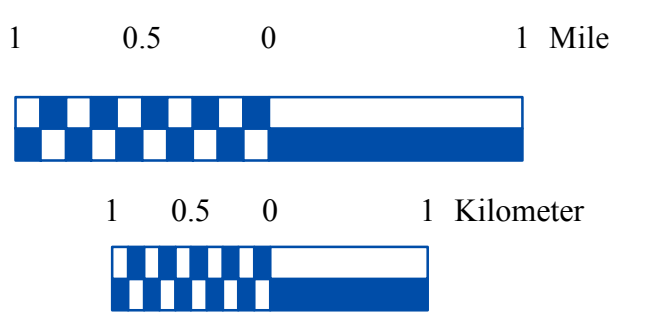
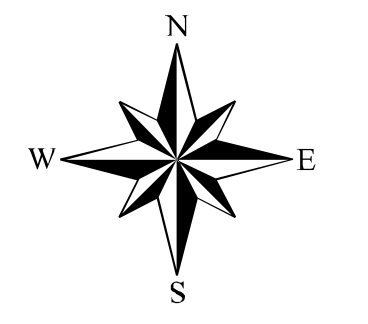
Within the Maumee River Basin in Noble County the potentiometric surface elevations range from a high of 1004 feet mean sea level in the east-central part of the county, to a low 824 feet in the southeast part of the county. Generalized groundwater flow direction within the Maumee River Basin, therefore, appears to be toward the southeast. Within the Upper Wabash River Basin the potentiometric surface elevations range from a high of 911 feet along the basin boundary, to a low of 846 feet in the southern part of the county. Generalized groundwater flow direction within the Upper Wabash River Basin, therefore, appears to be from the north to the south. Within the St. Joseph River Basin the potentiometric surface elevations range from a high 983 feet in the northeast part of the county, to a low of 856 feet in the northwest part of the county. Generalized groundwater flow direction within the St. Joseph River Basin, therefore, appears to be from the east to the west.

Saturated thickness of the water bearing formations in Noble County average about 20 feet thick, and are composed predominantly of sand and gravel. Approximately 80 percent of the wells in Noble County are estimated to be under confined or semi-confined conditions. A Bedrock PSM was not constructed for Noble County due to the relatively small number of wells utilizing the bedrock.

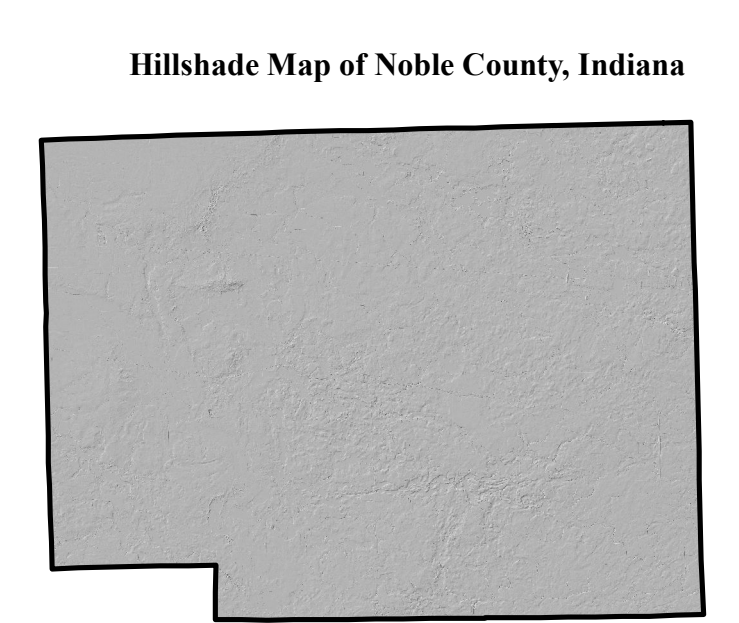
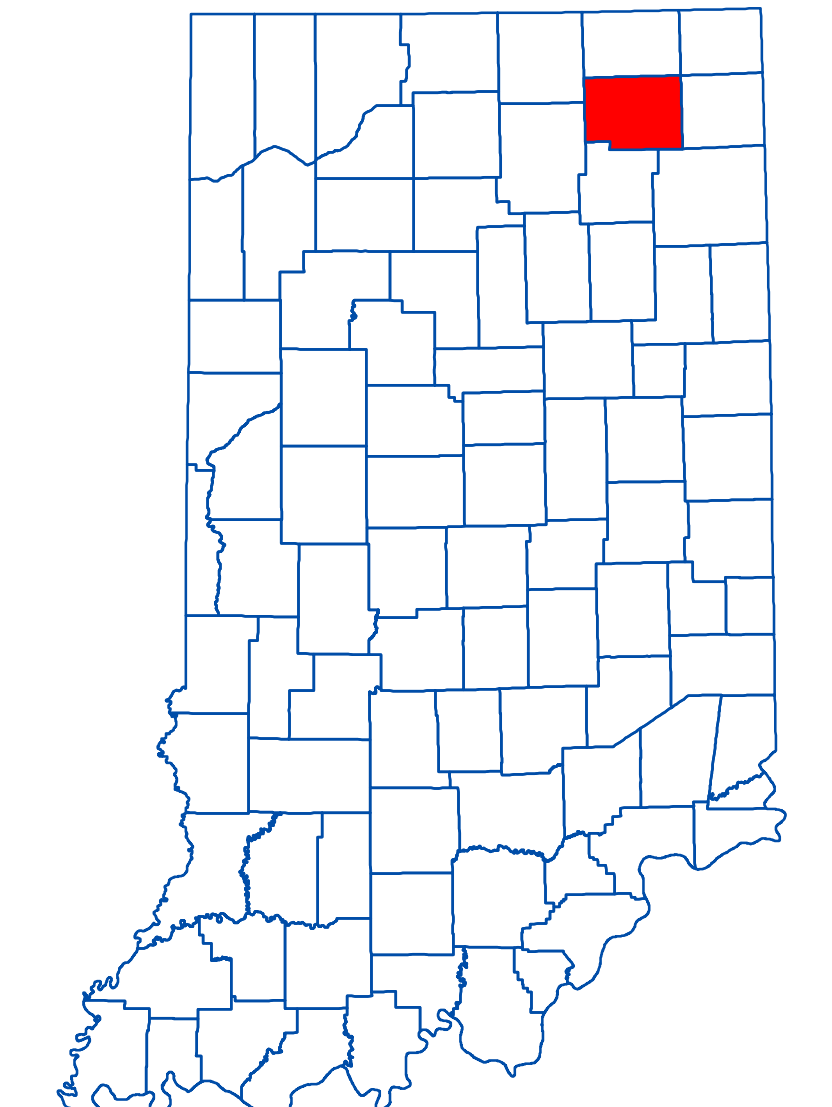
The county PSM can be used to define the regional groundwater flow path and to identify significant areas of groundwater recharge and discharge. However, due to the complex glacial geology, especially around lakes the local groundwater flow may differ from the regional groundwater flow that is indicated by the PSM.

### EXPLANATION

- 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



### Location Map



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### Potentiometric Surface Map of the Unconsolidated Aquifers of Noble County, Indiana

by  
Robert A. Scott  
Division of Water, Resource Assessment Section

September 2011

# Noble County

