

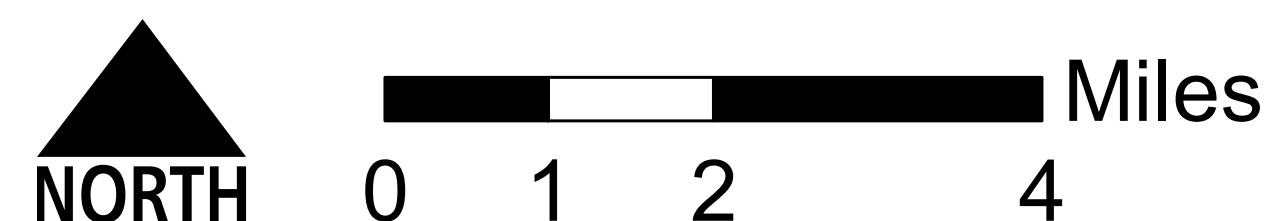
Water Resources and Use in St. Joseph County

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

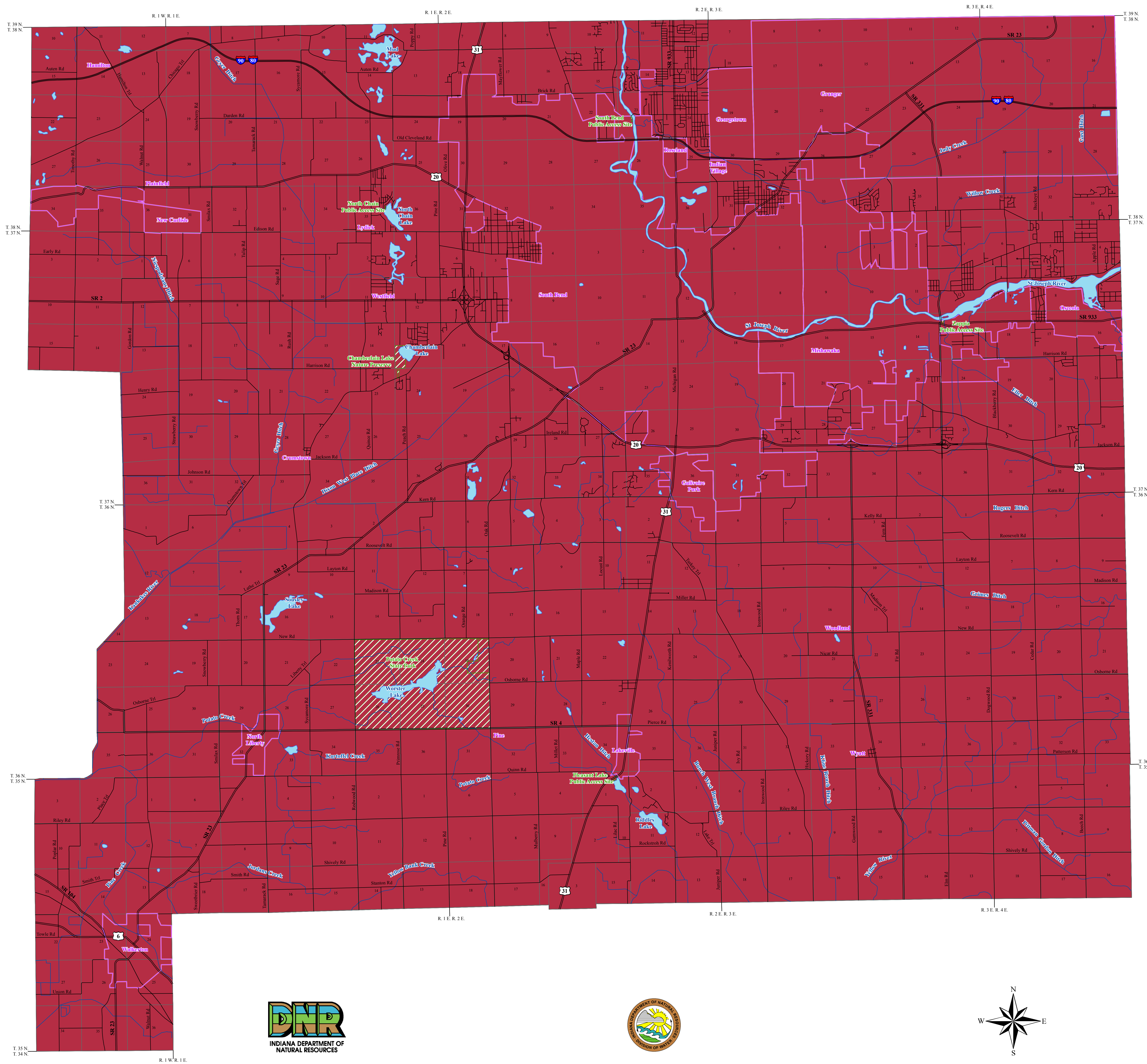
- #### Withdrawal Location
- | WELL INTAKE | Symbol | Category |
|---------------|---------------|---------------|
| Energy/Mining | Red circle | Energy/Mining |
| Industry | Orange circle | Industry |
| Irrigation | Green circle | Irrigation |
| Misc. | Yellow circle | Misc. |
| Public Supply | Blue circle | Public Supply |
| Rural Use | Purple circle | Rural Use |

- #### River
- | 7Q2 Flow (MGD) | Line Style |
|----------------|-----------------------------------|
| < 10 MGD | Thin blue line |
| 10 - 50 MGD | Medium blue line |
| 50 - 100 MGD | Thick blue line |
| 100 - 500 MGD | Very thick blue line |
| > 500 MGD | Thick blue line with white border |

- | | |
|---------------------|-------------|
| Blue square | Major Lakes |
| Red line | Interstate |
| White dashed line | County |
| White square with X | City |



BEDROCK AQUIFER SYSTEMS OF ST. JOSEPH 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 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.

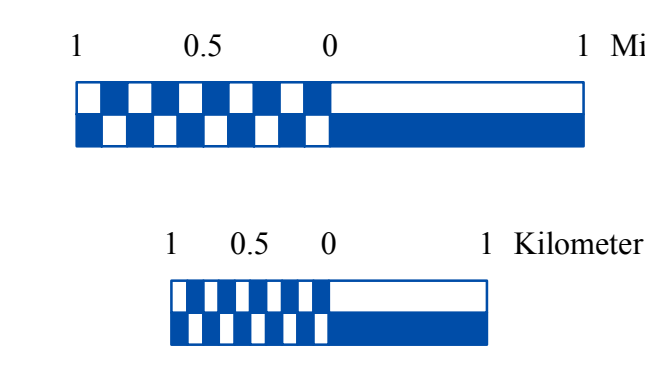
Devonian and Mississippian – Coldwater, Ellsworth, and Antrim Shales Aquifer System

One bedrock aquifer system is identified for St. Joseph County: the Devonian and Mississippian age Coldwater, Ellsworth, and Antrim Shales. The Coldwater, Ellsworth, and Antrim Shales Aquifer System is about 300 feet thick and subsists throughout St. Joseph County. These shales are commonly considered an aquitard; therefore, the system is an extremely limited groundwater resource.

St. Joseph County has a complex glacial history and was subjected to multiple glacial advances from the north and northeast resulting in thick glacial deposits that overlie the bedrock surface and completely covers the county. This aquifer system consists in ascending order of the Coldwater, Ellsworth, and Antrim Shales. However, in St. Joseph County only the Ellsworth and Antrim Shales are present. The Ellsworth Shales consist primarily of gray-green shale with limestone or dolomite lenses in the upper part and alternating beds of gray-green shale and black-brown shale in the lower part. The underlying Antrim Shales consist of brown to black non-calcareous shale in the upper part and black to brown non-calcareous shale with calcareous shale, limestone, and sandstone present in the lower part of the unit. This system is overlain by unconsolidated deposits ranging in thickness from 150 feet in the northeast and western portion of the county to over 300 feet in the northwestern portion of the county.

A few wells have been completed in this aquifer system and are capable of meeting the needs of some domestic users in St. Joseph County. Domestic well yields are commonly less than 5 gallons per minute with a few dry holes (pumped) reported. Well depths range from 45 to 140 feet deep and static water levels typically range from 5 to 50 feet below the land surface. The amount of rock penetrated in this system ranges from 30 to 60 feet. There are no registered significant groundwater withdrawal facilities using the Coldwater, Ellsworth, and Antrim Shales Aquifer System in St. Joseph County.

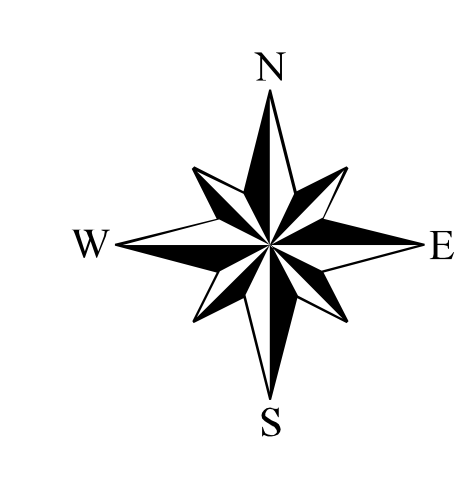
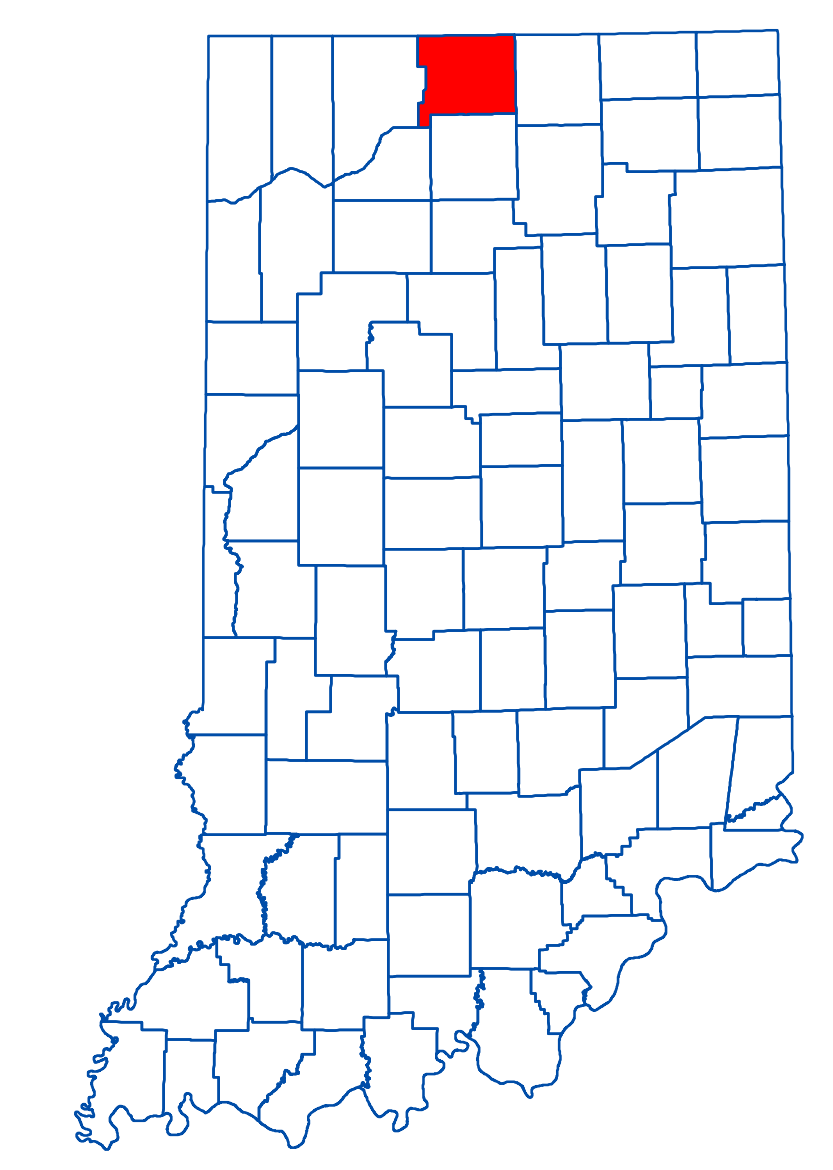
Since the permeability of shale materials is considered low and the overlying unconsolidated deposits are thick, susceptibility to contamination introduced at or near the surface is low.



EXPLANATION

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

Location Map



Map Use and Disclaimer Statement

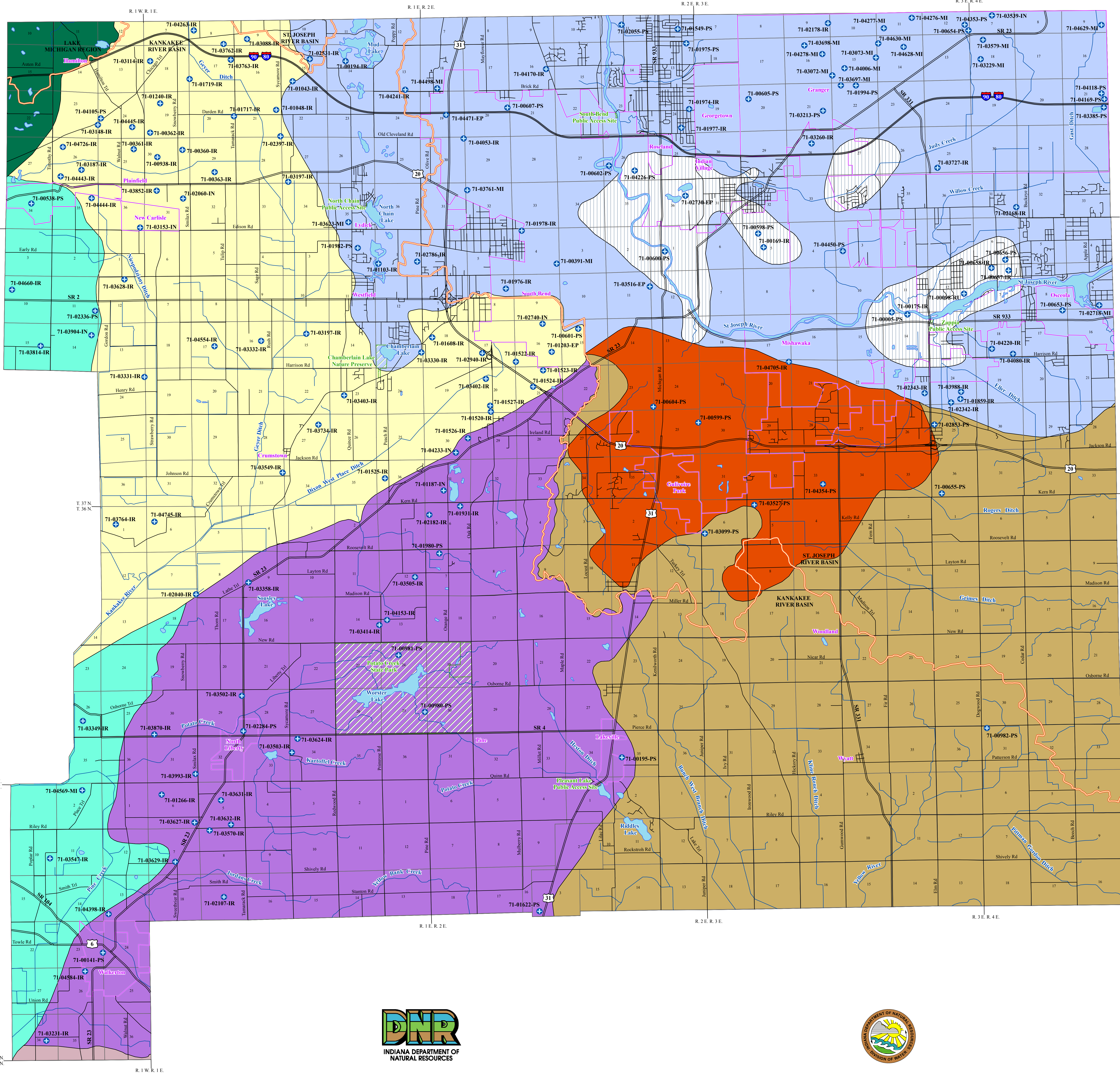
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Bedrock Aquifer Systems of St. Joseph County, Indiana

by
Division of Water
1987, 1990, 1994

UNCONSOLIDATED AQUIFER SYSTEMS OF ST. JOSEPH COUNTY, INDIANA



The following is a summary of the availability of groundwater in St. Joseph County and was derived from the Indiana Department of Natural Resources 1997 publication Water Resource Availability in the St. Joseph River Basin, Indiana, the Indiana Department of Natural Resources 1990 publication Water Resource Availability in the Kankakee River Basin, Indiana, and the Indiana Department of Natural Resources 1994 publication Water Resource Availability in the Lake Michigan Region, Indiana. Each report describes the availability, distribution, quality, and use of groundwater and surface water in the St. Joseph River Basin, the Kankakee River Basin, and the Lake Michigan Region. The full reports can be viewed and downloaded at <http://www.in.gov/dnr/water>.

Unconsolidated deposits of glacial sands and gravels are the principle source of groundwater in St. Joseph County. Eight unconsolidated aquifer systems have been mapped and defined on the basis of geologic environments and aquifer characteristics. They are: the Nappanee Aquifer System, the Hilltop Aquifer System, the Eolian Sands Aquifer System, the Valparaiso Moraine Aquifer System, the Kankakee Aquifer System, the Valparaiso Outwash Apron Aquifer System, and the St. Joseph Aquifer System and Tributary Valleys. Due to the availability of prolific unconsolidated aquifer systems and the extreme limitations of shale materials, the underlying bedrock is generally not used as an aquifer resource.

Nappanee Aquifer System
This aquifer system is composed of interbedded medium to coarse sand and gravel zones contained within a thick till sequence. The individual layers of sand and gravel range from 3 to 10 feet in thickness. Individual aquifers thicken locally to 30 feet or more but are seldom more than one to two square miles in area. It is not uncommon to have two or more of the aquifer units at an approximate elevation of 750 feet mean sea level (msl). This aquifer system is present under the glacial till plain in eastern St. Joseph County. This is an area of moderate to good groundwater availability (50 to 600 gallons per minute (gpm)).

There are 4 registered significant groundwater withdrawal facilities (6 wells) with yields from 50 to 250 gpm. This system, where surface sand and gravel is present, is only slightly susceptible to contamination.

Hilltop Aquifer System
In St. Joseph County the Hilltop Aquifer System is located in a small area southeast of South Bend. To the north, the St. Joseph Aquifer System (outwash valley) forms a distinct topographic contrast with the Hilltop Aquifer System which occurs at a higher elevation. The south, east, and west boundaries of the Hilltop Aquifer System represent a gradual change from the sand and gravel rich Hilltop Aquifer System deposits, to clay-rich deposits typical of the Nappanee Aquifer System. A poorly defined band of surface sands and gravels, often more than 100 feet thick, extends north and south through the middle of the system. Clay till units thicken to the east and west; however, they seldom exceed 40 feet in thickness. Many wells located in the northern third of the system are completed in a sand and gravel unit that is 10 to 30 feet thick and is found at an elevation of 720 to 690 feet msl, virtually matching the elevation range of the St. Joseph surface sands and gravels complex immediately to the north. Continuity of the various units becomes erratic southward. Wells in the south half of the system are typically completed in thick sand and gravel units ranging in elevation from approximately 730 to 670 feet msl. State water levels are relatively deep in the Hilltop Aquifer System ranging from 40 to 60 feet below ground surface. Domestic wells generally yield 10 to 40 gpm.

In most areas of the Hilltop Aquifer System, high-capacity wells can be expected to yield 50 to 250 gpm. There are 5 registered significant groundwater withdrawal facilities (8 wells) with yields reported up to 2000 gpm. The surficial sand deposits are highly susceptible to contamination, but the intratill deposits are only slightly susceptible.

Eolian Sands Aquifer System
The Eolian Sands Aquifer System occurs in the southwestern tip of St. Joseph County. This aquifer system is a drift complex which contains intratill lenses of sand and gravel and a characteristic blanket of windblown sand on the surface. Aquifers within this system include surficial sands, and intratill sand and gravel lenses. The aquifer units vary in thickness from 4 to 72 feet, but most wells produce from aquifers 10 to 30 feet thick. Well depths range from 24 to 211 feet, but most wells are between 5 and 120 feet deep. State water levels throughout the system range from 0 to 48 feet; however, most state water levels are between 5 and 20 feet deep. High capacity wells in nearby counties have produced up to 1200 gpm, but expected yields range from 100 to 600 gpm.

There are no registered significant groundwater withdrawal facilities utilizing this system in St. Joseph County. The surficial sand deposits are highly susceptible to contamination, but the intratill deposits are only slightly susceptible.

Maxinkuckee Moraine Aquifer System
This aquifer system is a complex mixture of thin intratill sand and gravel units within a thick till deposit and in places, locally thick, coarse grained surficial deposits. Most of the aquifer are between 3 and 15 feet thick. Well depths range from 26 to 273 feet; however, most wells are 50 to 150 feet deep. Wells less than 40 feet deep typically are completed in surficial sand and gravel deposits. State water levels range from 0 to 90 feet deep, but in most areas are 10 to 50 feet deep. Domestic wells may produce from 4 to 80 gpm, although yields of 10 to 25 gpm are most common.

There are 32 registered significant groundwater withdrawal facilities (43 wells) with high-capacity yields from 70 to 2200 gpm. The aquifer system is moderately to highly susceptible to surface contamination.

Valparaiso Moraine Aquifer System
This aquifer system, which forms the southern slope of the Valparaiso Moraine, is a deposit of fine to medium grained sand interbedded with gravel rich zones and clay lenses. Shale rich gravel lenses are scattered throughout the system. The outwash apron occurs in the southwestern corner and the northeastern edge of St. Joseph County.

Most wells are completed in the upper aquifer unit and have depths ranging from 30 feet to more than 100 feet. The wells completed in the lower aquifer unit typically exceed 50 feet deep and may be more than 150 feet deep. The depth to the static water level typically is less than 20 feet deep, but at higher surface elevations, depths may exceed 40 feet. Yields in the upper and lower aquifer units are similar, ranging from 15 to 60 gpm for domestic wells.

There are 8 registered significant groundwater withdrawal facilities (16 wells) with yields from 10 to 1200 gpm. Because there is no clay rich cap, the aquifer system is highly susceptible to surface contamination.

Valparaiso Outwash Apron Aquifer System
This aquifer system, which forms the southern slope of the Valparaiso Moraine, is a deposit of fine to medium grained sand interbedded with gravel rich zones and clay lenses. Shale rich gravel lenses are scattered throughout the system. The outwash apron occurs in the southwestern corner and the northeastern edge of St. Joseph County.

Most wells are completed in the upper aquifer unit and have depths ranging from 30 feet to more than 100 feet. The wells completed in the lower aquifer unit typically exceed 50 feet deep and may be more than 150 feet deep. The depth to the static water level typically is less than 20 feet deep, but at higher surface elevations, depths may exceed 40 feet. Yields in the upper and lower aquifer units are similar, ranging from 15 to 60 gpm for domestic wells.

There are 8 registered significant groundwater withdrawal facilities (16 wells) with yields from 10 to 1200 gpm. Because there is no clay rich cap, the aquifer system is highly susceptible to surface contamination.

Kankakee Aquifer System
The Kankakee Aquifer System is an unconfined deposit of well-sorted fine to medium grained sand, which is interbedded with gravel lenses in the tributary valleys. In places the aquifer system thickness ranges from less than 20 feet where the unit overlies bedrock highs to more than 150 feet in tributary valleys. However, the thickness is about 30 feet in most areas.

Static water levels are shallow in the Kankakee River floodplain, and are usually less than 20 feet deep. Wells typically are shallow, and few exceed depths of 50 feet. In the tributary valleys, however, the depth to the water table may exceed 50 feet and well depths may exceed 150 feet. Domestic wells usually produce from 15 to 50 gpm.

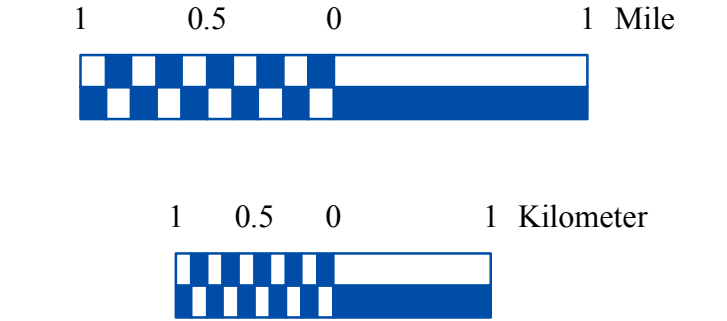
There are 52 registered significant groundwater withdrawal facilities (87 wells) with high-capacity yields from 100 to 2500 gpm. Due to the absence of clay deposits, the aquifer system is highly susceptible to groundwater contamination. There are 62 registered significant groundwater withdrawal facilities (134 wells) with yields from 7 to 2000 gpm.

The Tributary Valleys Aquifer System is similar to the main stem St. Joseph Aquifer System, but often contains coarser outwash deposits. This unit is underlain by a thick clay/mud which in turn is underlain by a sand and gravel aquifer ranging up to 50 feet in thickness. The deeper aquifers are utilized by many industrial concerns. This area exhibits good to excellent groundwater availability (100 to 1000 gpm). The surficial sand and gravel deposits of this system are highly susceptible to contamination and the deeper aquifers are slightly susceptible.

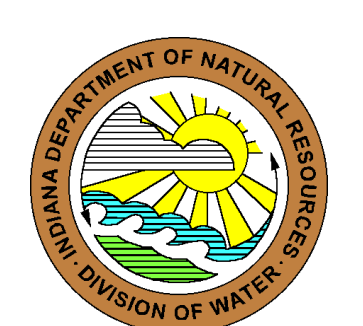
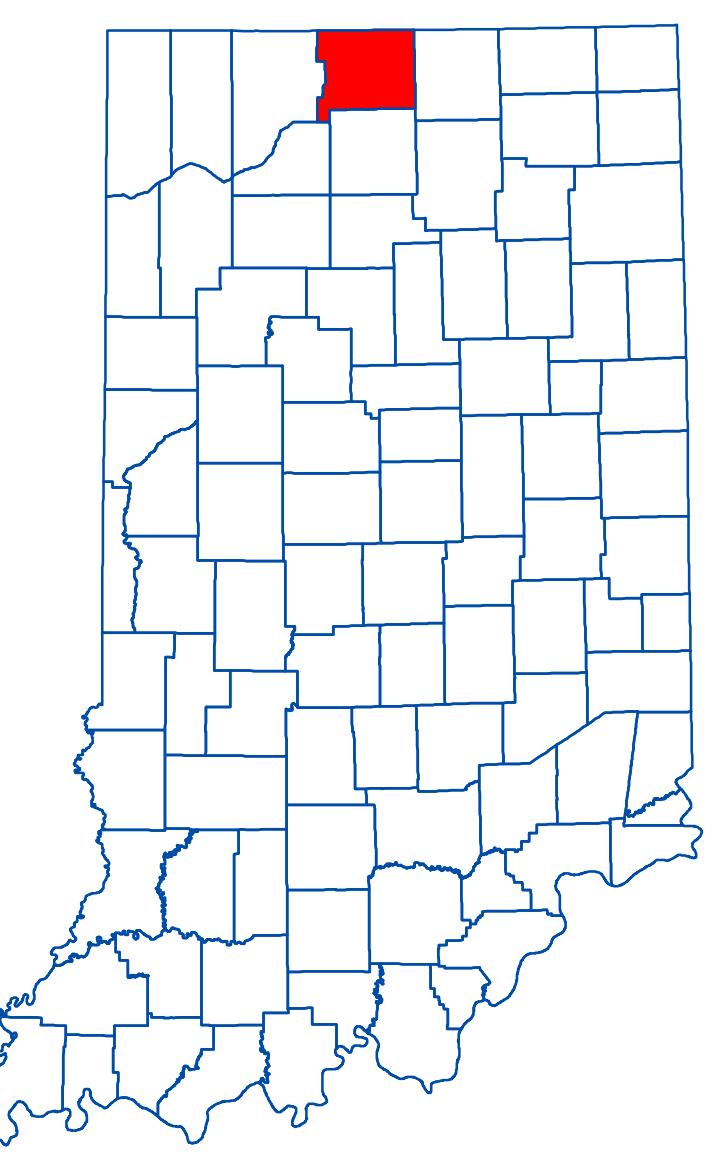
In northeastern St. Joseph County around South Bend, this area is contained within the St. Joseph Aquifer System and is composed of surficial sand and gravel above a moderately thick (20 to 100 feet) clay/glacial till zone which is underlain by a sand and gravel aquifer that is extensively used by industrial and municipal wells in the southern South Bend area. The lower sand and gravel unit ranges in thickness from 20 to 50 feet, and contains localized zones of coarse sand and gravel. This is an area of major groundwater availability (500 to 1500 gpm). There are 11 registered significant groundwater withdrawal facilities (16 wells) with yields from 90 to 2500 gpm. The aquifer is moderately to highly susceptible to groundwater contamination.

EXPLANATION

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



Location Map



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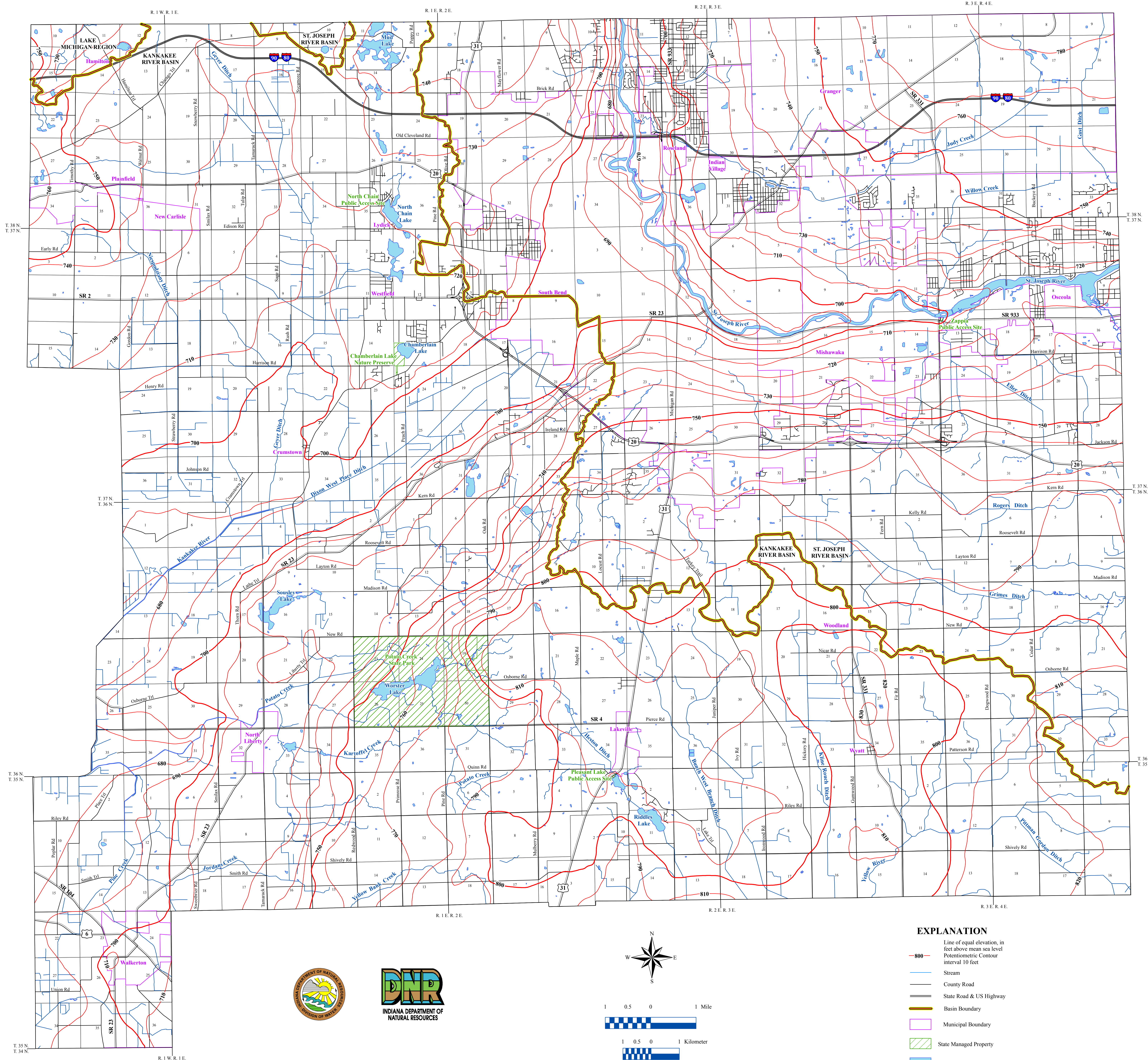
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Unconsolidated Aquifer Systems of St. Joseph County, Indiana

by
Division of Water
1987, 1990, 1994

POTENTIOMETRIC SURFACE MAP OF THE UNCONSOLIDATED AQUIFERS OF ST. JOSEPH COUNTY, INDIANA



St. Joseph County, Indiana is located in the north-central portion of the state and is situated within three major drainage basins. Much of the county is split between two basins with the northeast region within the St. Joseph River Basin and the western and southern part within the Kankakee River Basin. A small portion of the northwest corner is within the Lake Michigan Basin.

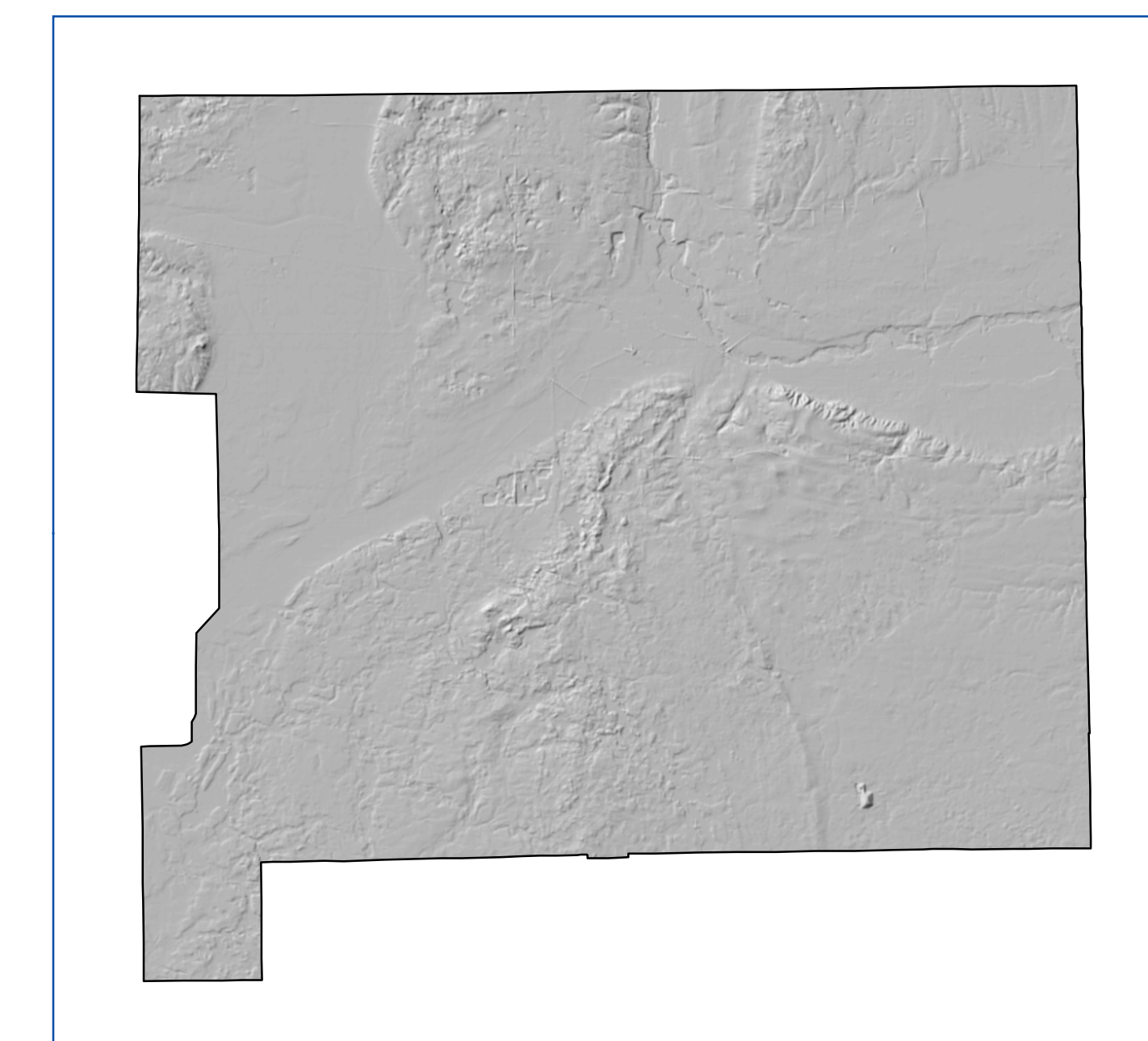
The generalized unconsolidated potentiometric surface map contour elevations represent lines of equal elevation to which groundwater levels will rise in wells. State water level measurements in individual wells used to construct the potentiometric surface map are indicative of the water level at the time of well completion. Therefore, current site specific conditions may differ due to local or seasonal variations in measured static water levels.

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.

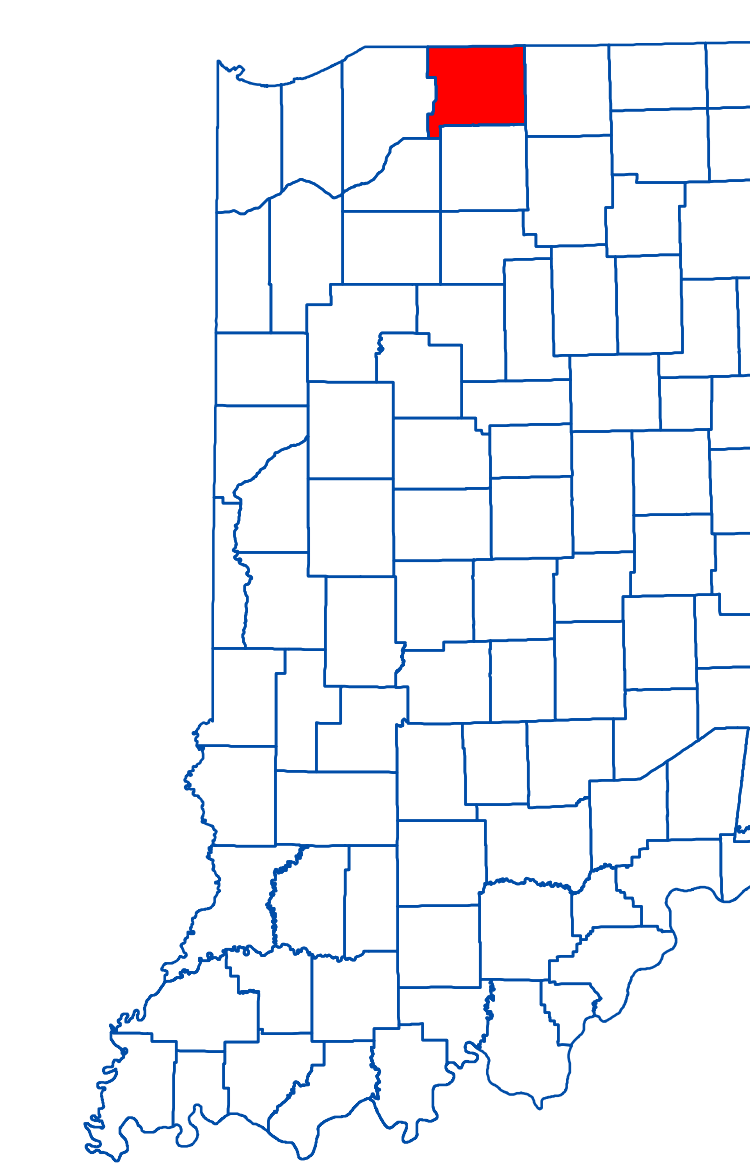
In St. Joseph County wells depths 100 feet or less were a priority in mapping the potentiometric surface. However, deeper wells were used in areas where data was sparse. There are approximately 23,875 water well records in the county of which, 7058 (30%) are located. Approximately 4,777 (20% of the total) are within the priority depth range of 100 feet or less. Potentiometric surface contour elevations range from a high of 830 feet mean sea level (msl) in the central southeast region of the county, to a low of 670 feet msl along the St. Joseph River in the north-central part of the county. Generalized groundwater flow direction for most of St. Joseph County is towards major drainage relevant to the basin. Therefore, in the St. Joseph River Basin, groundwater flow is towards the St. Joseph River and in the Kankakee River Basin groundwater flow is towards the Kankakee River. Regionally, however, groundwater flow is north for the St. Joseph River Basin and southwest for the Kankakee River Basin. For the Lake Michigan Basin, however, general groundwater flow reflects a more local trend towards the north-northeast but regionally would likely reflect a more north-northwest trend.

Much of the north and west part of St. Joseph County include outwash plain and valley train sediments at the surface. Therefore, most of the potentiometric surface for this part of the county is generally under unconfined or semi-confined conditions. However, portions of southeast St. Joseph County include ground and coal measure sediments at the surface. Therefore, the potentiometric surface to the southeast is more commonly considered under confined conditions.

Hillshade Map of St. Joseph County, Indiana

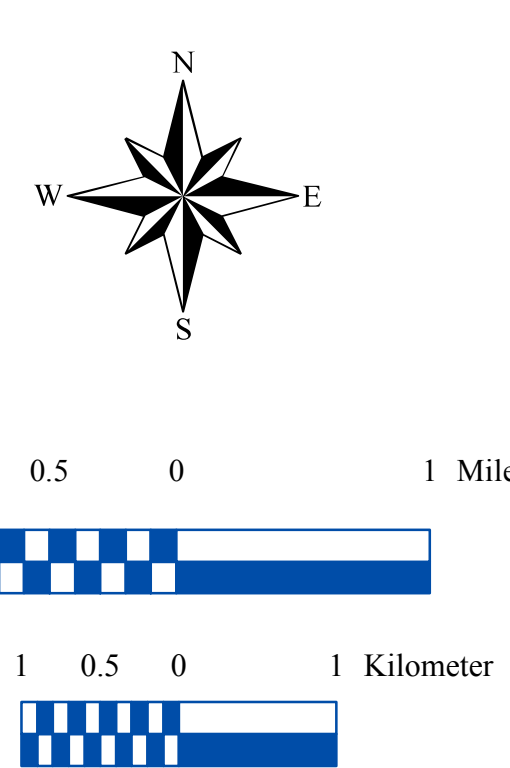


Location Map



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



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Potentiometric Surface Map of the Unconsolidated Aquifers of St. Joseph County, Indiana
by
Randal D. Maier
Division of Water, Resource Assessment Section

December 2011

St. Joseph County

