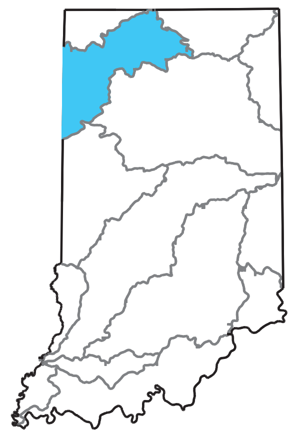


# KANKAKEE RIVER BASIN

By Joseph M. Fenelon

## General Description

The Kankakee River basin, located in northwestern Indiana, is the sixth largest (2,989 $mi^2$) of the 12 water-management basins in the State. The basin includes most of Newton, Jasper and Starke Counties and one-half to two-thirds of Lake, Porter, LaPorte, St. Joseph, Marshall and Benton Counties (fig. 24). Most of the towns in the basin are farming communities; the largest cities are LaPorte, Plymouth, Knox, and Rensselaer.

### Previous Studies

Preliminary reports of the ground-water resources have been published for all of the counties in the Kankakee River basin except Benton County (Rosenshein, 1961; 1962; Rosenshein and Hunn, 1962a; 1962b; 1964a; 1964b; 1964c; 1964d). The reports include preliminary evaluations of the ground-water resources, and tabulated well records for about 6,500 wells, including lithologic descriptions for about 2,500 wells and water-quality data from about 2,000 wells. Approximately 40 percent of the well records are from wells in the Kankakee River basin. The principal aquifers in Lake, Porter, LaPorte, and St. Joseph Counties were described by Rosenshein (1963), Rosenshein and Hunn (1968a; 1968b), Hunn and Reussow (1968), and Hunn and Rosenshein (1969). These authors described and mapped the geometry and potentiometric surfaces of the major aquifers, expected well yields, and general water quality. They also estimated hydraulic properties for the aquifers and associated confining units, and they determined sources and amounts of recharge to and discharge from the aquifers.

The geologic framework of the aquifers in the Valparaiso Moraine and the Kankakee River Lowland is discussed in Fraser and Bleuer (1991a; 1991b). The reports discuss the geology of the unconsolidated deposits and the principal aquifers throughout much of the northwestern part of the Kankakee River basin.

The western one-half of the basin was further studied by other authors. Hartke and others (1975) described the aquifers in Lake and Porter Counties. They summarized ground-water use and the potential for future use. They also qualitatively mapped the potential for aquifer contamination. The effects of ground-water withdrawals for irrigation on the ground-water system in Newton and Jasper Counties were described in several reports (Bergeron, 1981; Basch and Funkhouser, 1985; Arihood, in press).

A report on the water and land resources of the Kankakee River basin includes information on the general ground-water availability, ground-water flow, bedrock elevation, and the geometry and areal extent of the primary aquifers (State of Indiana and others, 1976). A comprehensive report on the water resources of the Kankakee River basin prepared by the Indiana Department of Natural Resources (1990) includes much of the same type of information as the 1976 report, but in more detail. In addition, information on ground-water use and ground-water quality is presented.

General descriptions of the aquifers in the Kankakee River basin have been reported by Harrell (1935) and Clark (1980) who described the major aquifers and the ground-water availability in the area.

### Physiography

The Kankakee River basin lies primarily within the Northern Moraine and Lake Region, which includes the Valparaiso Morainal Area, the Kankakee Outwash and Lacustrine Plain, and the Steuben Morainal Lake Area; the southwestern part of the basin lies within the Tipton Till Plain (figs. 2 and 25).

The Valparaiso Morainal Area, in the northwestern part of the basin, is composed of an arc-shaped end moraine complex that parallels the southern shore of Lake Michigan from Illinois through northwestern Indiana into Michigan. The morainal complex marks a terminal position of the Lake Michigan ice lobe (Bretz, 1955, p. 106-108) and separates the Kankakee River basin from the Lake Michigan basin to the north. Elevations in the morainal complex generally range from 700 to 800 ft above sea level west of Valparaiso, Ind. (fig. 12) and 800 to 950 ft above sea level along the crest of the moraine east of Valparaiso. The western end of the complex is wide and gently undulating. It contains till ridges on the top of the complex and outwash sands on the southern flank that extend northward beneath the moraine (see Fraser and Bleuer, 1991b). East of Valparaiso, only a thin part of the Valparaiso Morainal Area near the crest of the morainal complex lies within the basin.

The Kankakee Outwash and Lacustrine Plain lies south and southeast of the Valparaiso Morainal Area and covers about two-thirds of the basin. It is a broad, flat, and poorly drained area that is primarily covered by glacial outwash, dune sand, alluvial deposits, and lake sand. The southwestern boundary encompasses the Iroquois Moraine of Wisconsinan age (fig. 25).

The Steuben Morainal Lake Area occupies southern St. Joseph County and most of Marshall County in the far eastern part of the basin. The part of the Steuben Morainal Lake area within the basin consists of gently undulating till plains created by the western advance of the Huron-Erie and Saginaw Lobes of the Wisconsinan ice sheet and the eastern advance of the Lake Michigan Lobe (Gray, 1989) (fig. 8).

The Tipton Till Plain extends throughout central Indiana and occupies a small part of the Kankakee River basin in Benton County and extreme southern Newton and Jasper Counties. It is bounded by the Kankakee Outwash Plain on the north side and is a nearly flat to gently undulating Wisconsinan till plain.

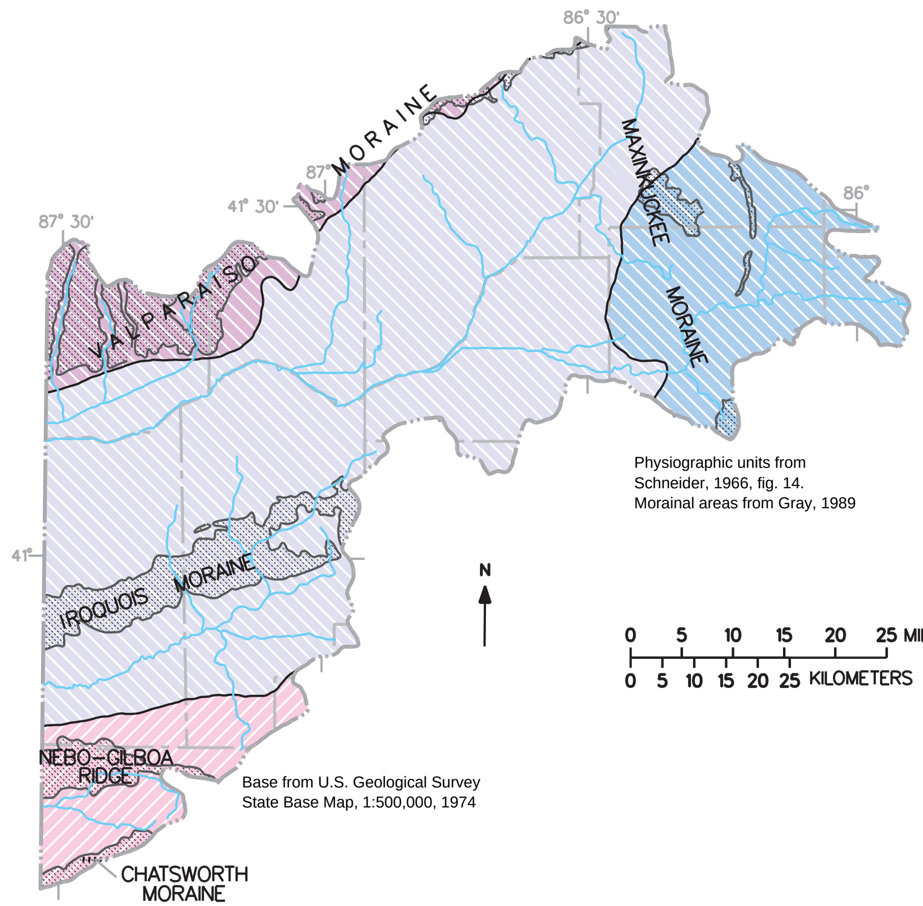
### Surface-Water Hydrology

The Kankakee River drains 5,165 $mi^2$ in northeastern Illinois and northwestern Indiana (State of Indiana and others, 1976, p. III-1). Within Indiana, the Kankakee River basin has an area of 2,989 $mi^2$ (Hoggatt, 1975). The Kankakee River begins in northwestern St. Joseph County and flows southwest for about 80 mi before reaching Illinois (fig. 24). Before development of the area, the Kankakee River was a large, meandering river surrounded by marshes. Now the river in Indiana is ditched, has a gradient of about 1 ft/mi, and has been shortened to about one-third of its natural stream length (State of Indiana and others, 1976, p. III-24).

Most of the northern part of the basin is bounded by the Valparaiso Moraine (fig. 25), which forms a major divide separating drainage to the Mississippi River from drainage to the St. Lawrence River. The major northern tributaries of the Kankakee River, which flow from the Valparaiso Moraine, are the Little Kankakee River, Crooked Creek, and Singleton Ditch. Major tributaries to the south are Pine Creek, the Yellow River, and the Iroquois River (fig. 24). The Iroquois River drains about one-fourth of the basin (843 $mi^2$ in Indiana) and joins the Kankakee River in Illinois. The Yellow River has a drainage area of 439 $mi^2$, all within Indiana (State of Indiana and others, 1976, p. III-24). In all, there are more than 30 tributaries to the Kankakee River, many of them ditch systems.

Lakes occupy about 16 $mi^2$ of the basin, less than 1 percent of the surface area. Three lakes have areas of about 2 $mi^2$ and five lakes have areas of 0.5 to 1.5 $mi^2$ (State of Indiana and others, 1976, p. III-26).


**Figure 24**. Location of section lines and wells plotted in the Kankakee River basin.



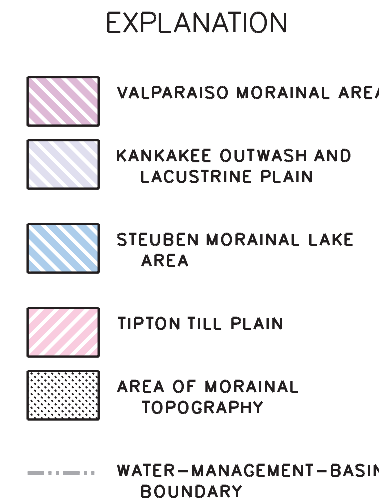




**Figure 25**. Physiographic units and moraines in the Kankakee River basin.

## Geology

### Bedrock Deposits

The major structural feature in the Kankakee River basin is the Kankakee Arch, a northern extension of the Cincinnati Arch, which trends northwest to southeast (fig. 4). The rocks on the north side of the Kankakee Arch dip northeast toward the Michigan Basin, whereas the rocks on the south side dip southwest toward the Illinois Basin. Within the Kankakee River basin, the rocks on both sides of the arch dip approximately 10 to 20 ft/mi. Rocks beneath large areas of Lake, Jasper, and Pulaski Counties, however, are on the crest of the arch and are nearly flat lying.

More than 4,000 ft of gently dipping sedimentary bedrock overlies Precambrian granitic bedrock (Rosenshein and Hunn, 1968a, p. 7; Hartke and others, 1975, p. 4). Approximately 3,500 ft of the sedimentary bedrock is of Cambrian and Ordovician age. The uppermost Ordovician rocks, collectively called the Maquoketa Group, consist of 200 to 300 ft of shale and minor limestone (Gray, 1972, p. 4-6) at depths of 600 to 1,000 ft below land surface.

Overlying the Maquoketa Group are Silurian rocks exposed at the bedrock surface in the northwestern part of the Kankakee River basin and Silurian, Devonian, and Mississippian rocks exposed at the bedrock surface in much of the rest of the basin (fig. 26). The Silurian rocks are composed of 400 to 600 ft of dolomite and some limestone (Hartke and others, 1975, p. 4) and consist of a wide range of carbonate rocks ranging from shaley to pure and fine to coarse-grained carbonate rocks; the lower 40 to 50 feet is very cherty (Shaver and others, 1986). The Silurian rocks compose the Sexton Creek Limestone, the Salamonie Dolomite, and the Salina Group. The Salina Group includes units consisting of reef facies and attains thicknesses of 400 ft in Lake and Newton Counties (Shaver and others, 1986, p. 134).

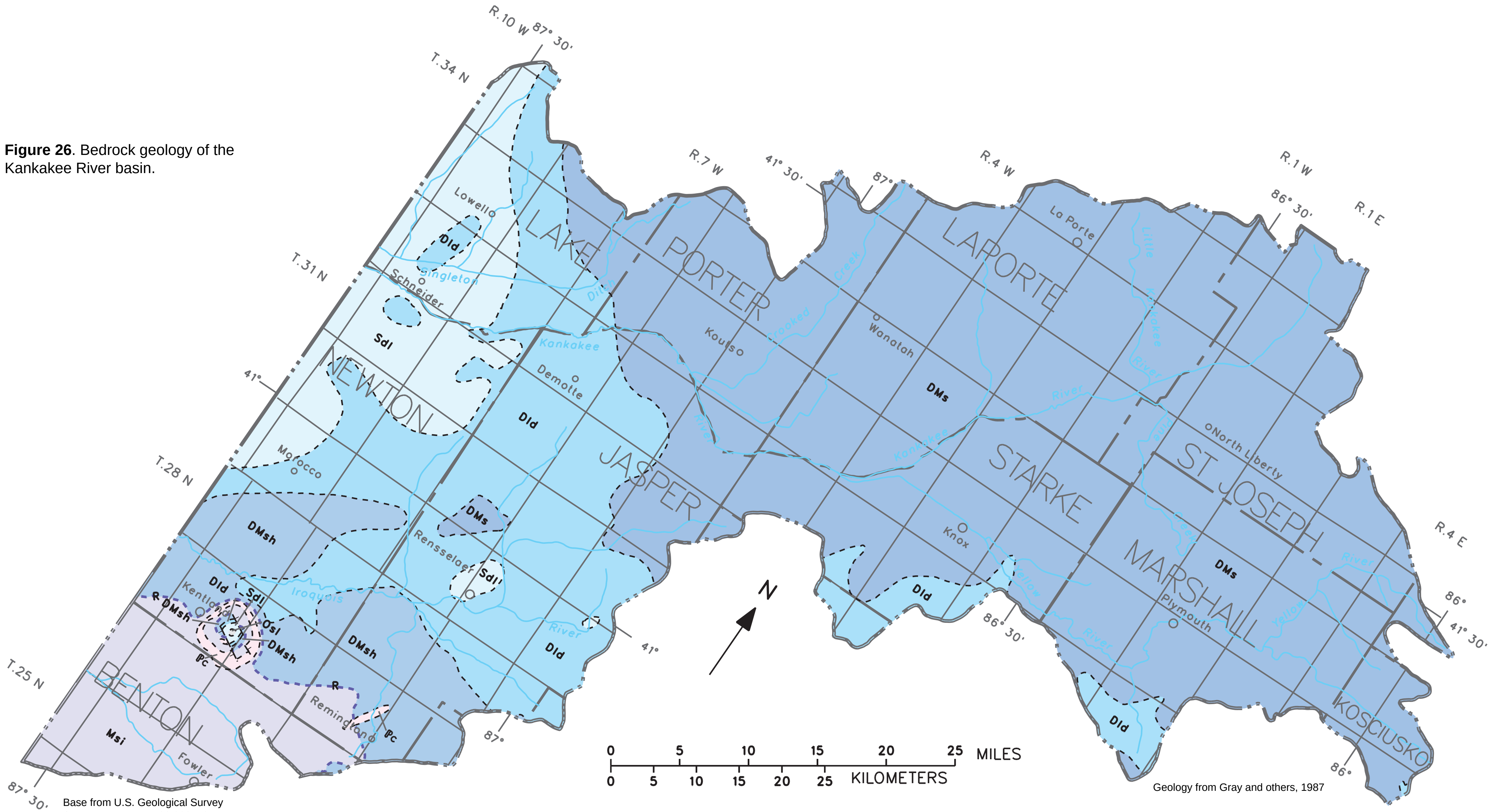
The Devonian and Mississippian rocks consist of several hundred feet of dolomite and limestone overlain by shale; these rocks compose the Muscatatuck Group and the New Albany Shale or the Antrim and Ellsworth Shales. The Muscatatuck Group overlies the Silurian rocks and attains thicknesses of as much as 200 ft (Shaver, 1974, p. 5). The Group is composed of a wide variety of impure to pure and fine to coarse-grained dolomite and limestone, and, in places, it contains anhydrite and gypsum in its lower part (Shaver and others, 1986, p. 99). Overlying the Devonian carbonate rocks in the northeastern part of the basin is the Antrim Shale, a brownish-black, noncalcareous shale (Shaver and others, 1986, p. 5). The Ellsworth Shale overlies the Antrim Shale and is of Devonian and Mississippian age. The Ellsworth Shale is a grayish-green shale that contains limestone or dolomite lenses in its upper part and alternating beds of grayish-green and brownish-black shale in its lower part (Shaver and others, 1986, p. 42). In the southwestern part of the basin, the New Albany Shale, which correlates with and is similar in lithology to the Antrim and Ellsworth Shales, overlies the Devonian carbonate rocks (Shaver and others, 1986, p. 101).

In the southwestern part of the basin, the Devonian and Mississippian shales are overlain by the Rockford Limestone and Borden Group of Mississippian age (Gray and others, 1987). The Rockford Limestone consists of 2 to 20 ft of gray clayey limestone and underlies 485 to 800 ft of gray clayey siltstone and shale known as the Borden Group (Shaver and others, 1986, p. 17-18).

A small (5 $mi^2$) complexly deformed structure known as the Kentland anomaly or dome is near Kentland, Ind. in southern Newton County (fig. 26). This structure consists of steeply dipping Ordovician and Silurian rocks that have been uplifted approximately 2,000 ft. Adjacent to the area are relatively flat-lying Mississippian and Pennsylvanian rocks. Meteorite impact, volcanism, and faulting have been proposed as explanations of the anomaly (Gutschick, 1976).

The bedrock surface is a preglacial erosional feature that has been further scoured by glacial erosion. Several preglacial bedrock-valley systems are buried beneath glacial deposits (Bleuer, 1989) (fig. 7). The Silurian and Devonian carbonate rocks exposed at the bedrock surface contain significant fractures and solution features in the upper 100 to 200 ft of the bedrock (Rosenshein and Hunn, 1968a, p. 10; Hartke and others, 1975, p. 4; Bergeron, 1981, p. 15; Basch and Funkhouser, 1985, p. 33).

**Figure 26**. Bedrock geology of the Kankakee River basin.




## EXPLANATION

- **Pc** — PENNSYLVANIAN COMPLEXLY INTERBEDDED SHALE AND SANDSTONE, WITH THIN BEDS OF LIMESTONE AND COAL-- Composed of the Racoon Creek Group
- **Msi** — MISSISSIPPIAN SILTSTONE AND SHALE WITH MINOR SANDSTONE AND DISCONTINUOUS LIMESTONE-- Composed of the Borden Group
- **R** — ROCKFORD LIMESTONE
- **DMsh** — DEVONIAN AND MISSISSIPPIAN SHALE-- Composed of the New Albany Shale
- **DMs** — DEVONIAN AND MISSISSIPPIAN SHALE-- Composed of the Antrim and Ellsworth Shales
- **Dld** — DEVONIAN LIMESTONE AND DOLOMITE-- Composed of the Muscatatuck Group
- **Sdl** — SILURIAN DOLOMITE AND LIMESTONE-- Composed of the Wabash Formation. Louisville Limestone through Sexton Creek Limestone in Kentland area
- **Osl** — ORDOVICIAN SHALE AND LIMESTONE-- Composed of the Maquoketa Group to the upper part of the Knox Supergroup
- NORMAL FAULT-- Hachures on downthrown side. Dashed where approximately located
- GEOLOGIC CONTACT-- Dashed where approximately located
- WATER-MANAGEMENT-BASIN BOUNDARY

### Unconsolidated Deposits

The unconsolidated deposits in the Kankakee River basin are largely the result of glacial, glaciofluvial, lake, wetland, and wind-blown sedimentation. They consist of clay, silt, and sandy loam tills; sand and gravel outwash; sand dunes; sand, silt and clay lake deposits; and peat. Thicknesses of unconsolidated deposits range from less than 50 ft in the western one-half of the basin to about 350 ft at the northern basin divide near Laporte, Ind. (fig. 27).

Glaciers advanced through the Kankakee River basin a number of times before Wisconsinan time. Most of what is preserved, however, is a result of the last several advances. During the Wisconsinan Age, ice actively advanced through the basin and eroded or overrode most of the older glacial deposits (fig. 8).

The Lake Michigan ice lobe overrode most of the Kankakee River basin as it advanced south of the basin. Where the eastern edge of the ice stalled at a till upland on the east side of the basin in central Marshall and St. Joseph Counties, it formed the Maxinkuckee Moraine (fig. 25), which has been interpreted as an outwash fan head (Bleuer and Melhorn, 1989, p. 44). Two other ice lobes were also active in northwestern Indiana at this time. The Saginaw Lobe advanced southwest into eastern Marshall and St. Joseph Counties. It sat in a lowland east of the Maxinkuckee Moraine and deposited till in the eastern part of the Kankakee River basin (Gray, 1989). The third lobe, the Huron-Erie Lobe, advanced west into Indiana, south of the Saginaw Lobe and east of the Lake Michigan Lobe.

As the Lake Michigan Lobe receded, it formed the till-cored Iroquois Moraine (fig. 25) and a proglacial lake that covered a large area of the Kankakee River basin between the ice to the north and the Iroquois Moraine to the south (Fraser and Bleuer, 1991b, p. 5). Lake muds, in excess of 30 ft, were deposited in the lake, and basal and ablation tills were later deposited over the muds (Fraser and Bleuer, 1991, p.5; Gray, 1989).

After the Lake Michigan Lobe receded, the Huron-Erie Lobe advanced west across the southern half of the basin, overriding the Iroquois Moraine and depositing thin (10 to 30 ft) tills in Benton and southern Newton and Jasper Counties (Gray, 1989).

The Lake Michigan Lobe retreated to a bedrock high on the northern edge of the Kankakee River basin, where it formed the Valparaiso Moraine (fig. 25). The upper part of the moraine is dominantly till on the western side, but it contains progressively more sand to the east until it becomes primarily a giant outwash fan head in LaPorte County.

While the ice was forming the Valparaiso Moraine, large volumes of outwash were deposited in a 5- to 15-mile wide band from the southern edge of the moraine to south of the Kankakee River. South of the river, large areas of the outwash were reworked by wind to form extensive dune sand deposits. Also deposited in the lowland between the Valparaiso, Iroquois, and Maxinkuckee Moraines were small areas of lake sand and clay. The sandy sediments overlie till, lake muds, or bedrock throughout much of the basin. The sand extends north into Lake and Porter Counties beneath the till and ice-contact stratified deposits of the Valparaiso Moraine. In central Newton and Jasper Counties, the sand pinches out on the till of the Iroquois Moraine. In western Marshall County and southern St. Joseph County, it terminates in the till and ice-contact stratified deposits of the Maxinkuckee Moraine.

## Aquifer Types

Nine hydrogeologic sections (3A–3A′ to 3I–3I′) were produced for this atlas to show the general hydrostratigraphy of the Kankakee River basin (fig. 28). Seven of the sections are oriented from south to north; two are oriented from west to east (fig. 24). A total of 490 well logs were used to produce the sections; 72 well logs are from test holes that are unrelated to water use. The average density of logged wells plotted along the section line is 1.4 wells per mile. Several maps of Indiana were used to produce the sections including bedrock topography (Gray, 1982), surficial geology (Gray, 1989), bedrock geology (Gray and others, 1987), and structure on the base of the New Albany Shale (Bassett and Hasenmueller, 1979).

Adequate supplies of ground-water for domestic use can be found throughout the Kankakee River basin. Unconsolidated sands and gravels and Silurian and Devonian carbonate bedrock are the most productive aquifers. The primary unconsolidated aquifers are surficial sands in the central part of the basin and buried sands and gravels in the northern and eastern parts of the basin. The carbonate bedrock aquifer underlies the entire basin, but is only important as a source of water in the western one-half of the basin. Other locally important unconsolidated aquifers are discontinuous surficial sands and gravels in the three morainal areas and discontinuous buried sands in the southwestern part of the basin. An upper weathered-bedrock aquifer composed of limestone, shale, and minor amounts of sandstone is sometimes used in the southwestern part of the basin. Table 5 summarizes characteristics of the six aquifer types mapped in figure 29.

### Unconsolidated Aquifers

#### Surficial Sand and Gravel Aquifer

A surficial sand and gravel aquifer covers about one-half of the basin (fig. 29) and is shown in the central part of sections 3A–3A′, 3B–3B′, and 3I–3I′, most of sections 3C–3C′ and 3D–3D′, and the northern part of section 3E–3E′ (fig. 28). It extends along a 15- to 25-mile wide band that trends east-northeast along the Kankakee River from Illinois to Michigan. It is bounded by the Valparaiso Moraine on the north, the Iroquois Moraine on the south, and the Maxinkuckee Moraine on the east (fig. 25). The aquifer, which is underlain by clay that can be more than 100 ft thick in some places, locally overlies bedrock, as shown in the central part of section 3C–3C′ and small areas of sections 3B–3B′ and 3I–3I′ (fig. 28).

The northern two-thirds of the surficial sand and gravel aquifer is composed of outwash that lies adjacent to and south of the Valparaiso Moraine. The southern one-third of the aquifer is composed of a mantle of dune sand over outwash. The dune sand is mostly reworked outwash sand at higher elevations than the adjacent outwash. The surficial sand and gravel aquifer also includes small areas of lake sand and alluvial material along the central parts of the Kankakee and Yellow Rivers. The aquifer material is mostly sand to the southwest and sand and gravel to the northeast (State of Indiana and others, 1976, p. III-28).

The surficial aquifer is unconfined and is recharged primarily from direct precipitation. Some recharge also comes from ground-water flow from the bedrock (Hartke and others, 1975, p. 30) and from the buried sand and gravel beneath the Valparaiso Moraine. The hydraulic connection between the surficial and buried sand and gravel aquifers can be seen in T. 33 N. of section 3B–3B′ and T. 36 N. of section 3C–3C′ (fig. 28). Most of the ground water flows from topographically high areas and discharges to the rivers and ditches at lower elevations (Bergeron, 1981, p. 21). The Kankakee, Iroquois, and Yellow Rivers function as the major regional discharge areas for the basin (State of Indiana and others, 1976, plate 10).

Depths to the water table range from 0 to more than 50 ft below land surface, but are generally 10 to 20 ft. Water levels in the aquifer fluctuate about 5 ft/yr because of variations in natural recharge and discharge (Arihood, in press); levels are highest in the early spring and the lowest in the summer (Bergeron, 1981, p. 23; Arihood, in press). Pumping of the bedrock aquifer for irrigation causes little noticeable effect on water levels in the surficial aquifer (Basch and Funkhouser, 1985, p. 31-33).

The saturated thickness of the surficial aquifer typically ranges from 20 to 50 ft in the southwestern part of the basin and from 50 to 100 ft in the northeastern part (State of Indiana, 1976, plate 11). Locally, the saturated thickness exceeds 150 ft, as shown in T. 37 N. of section 3D–3D′ (fig. 28). Ground-water yields from the surficial aquifer can be as great as 2,000 gal/min but are commonly much less. Generally, a properly constructed well can be expected to produce between 200 and 600 gal/min (Hartke and others, 1975, p. 30; Clark, 1980).

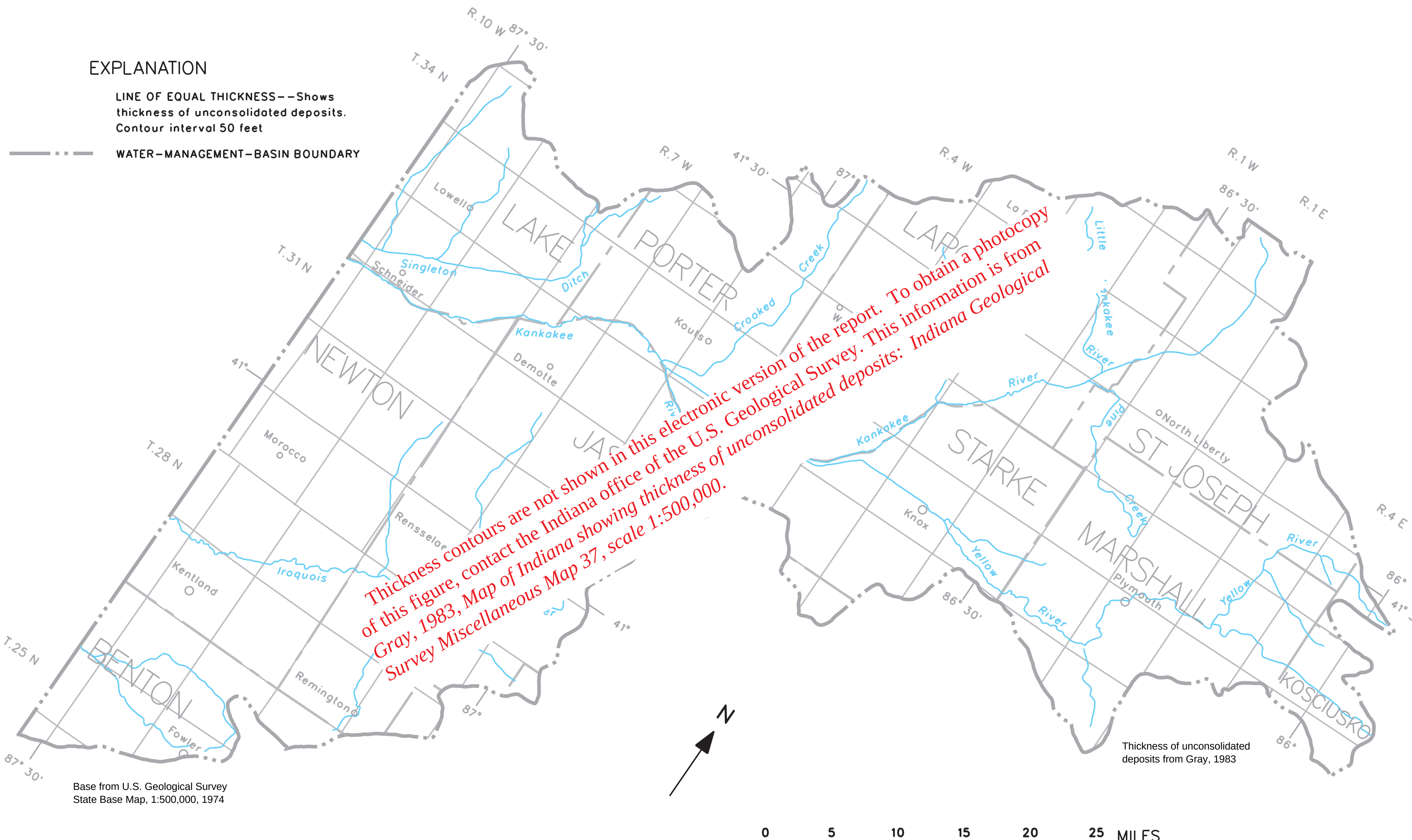



**Figure 27**. Thickness of unconsolidated deposits in the Kankakee River basin.

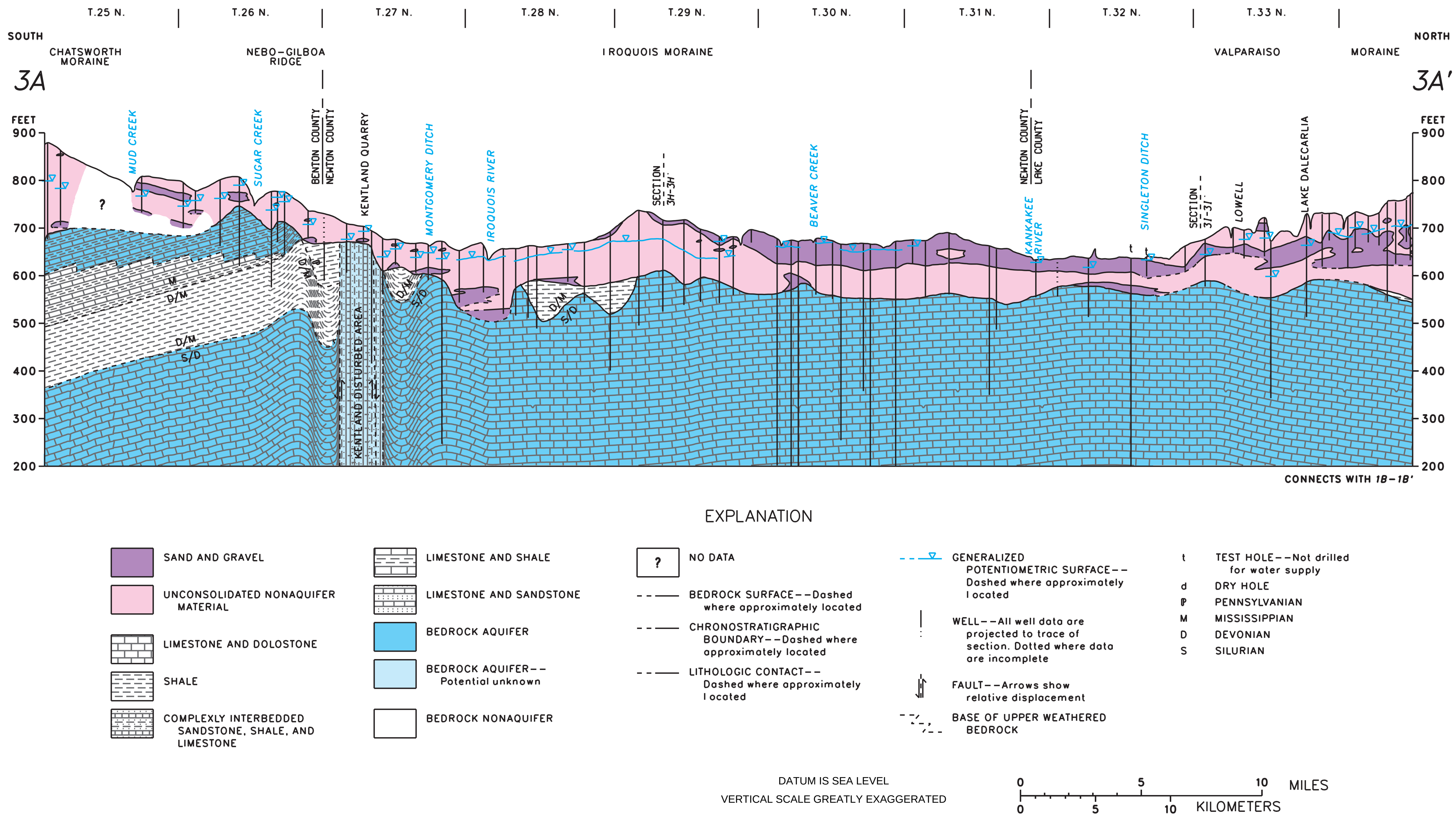



**Figure 28**. Hydrogeologic sections *3A–3A′* to *3I–3I′* of the Kankakee River basin.

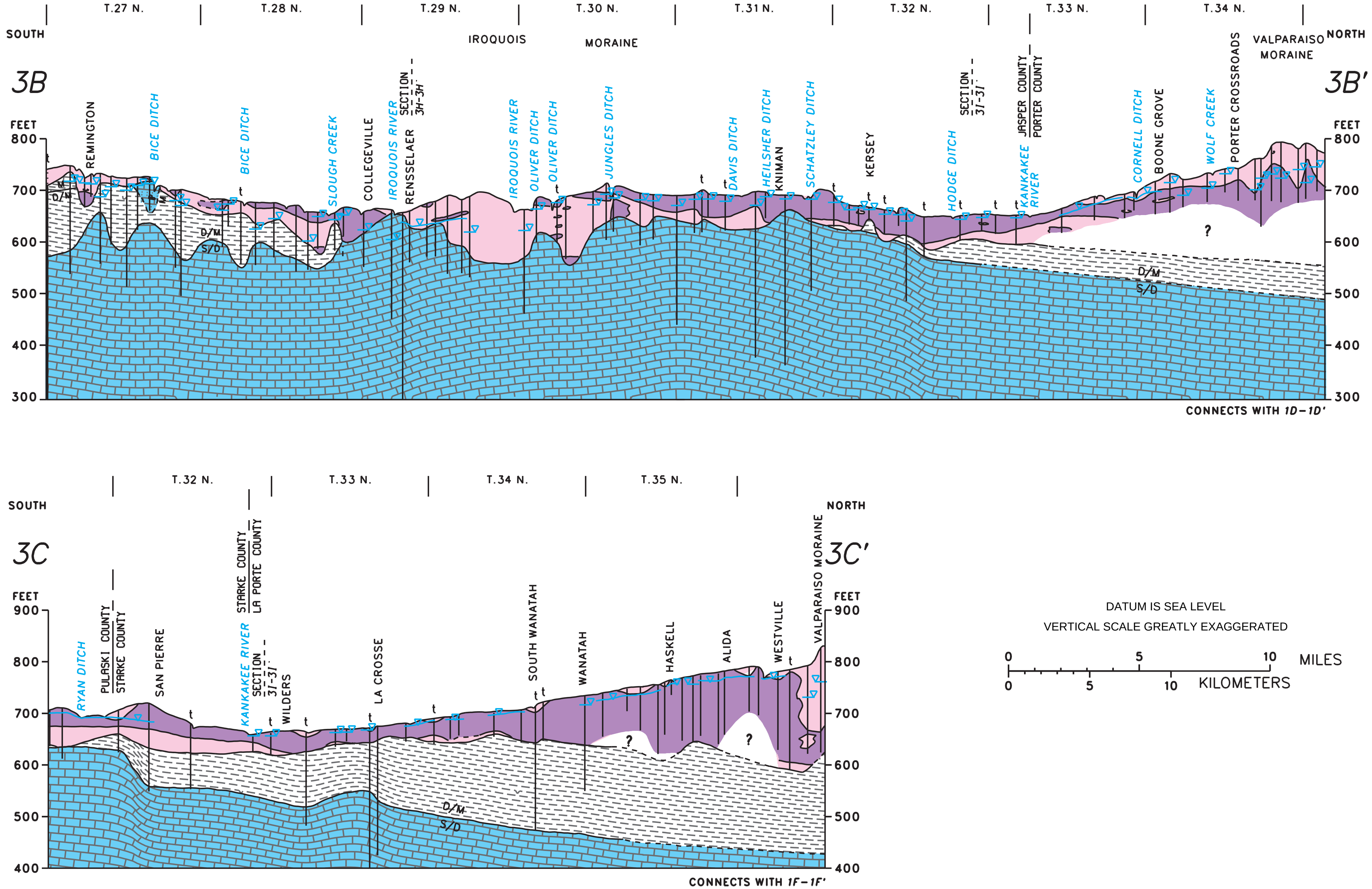
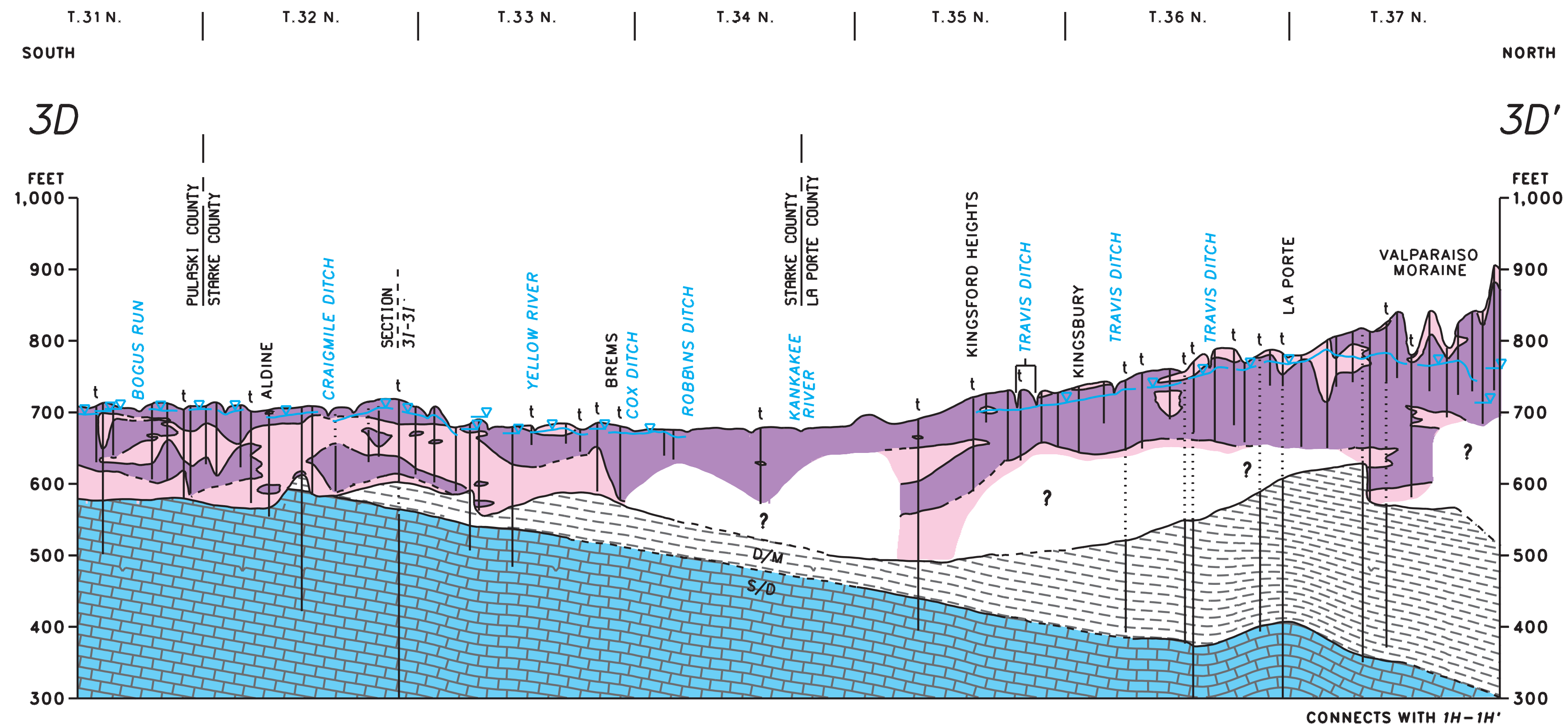
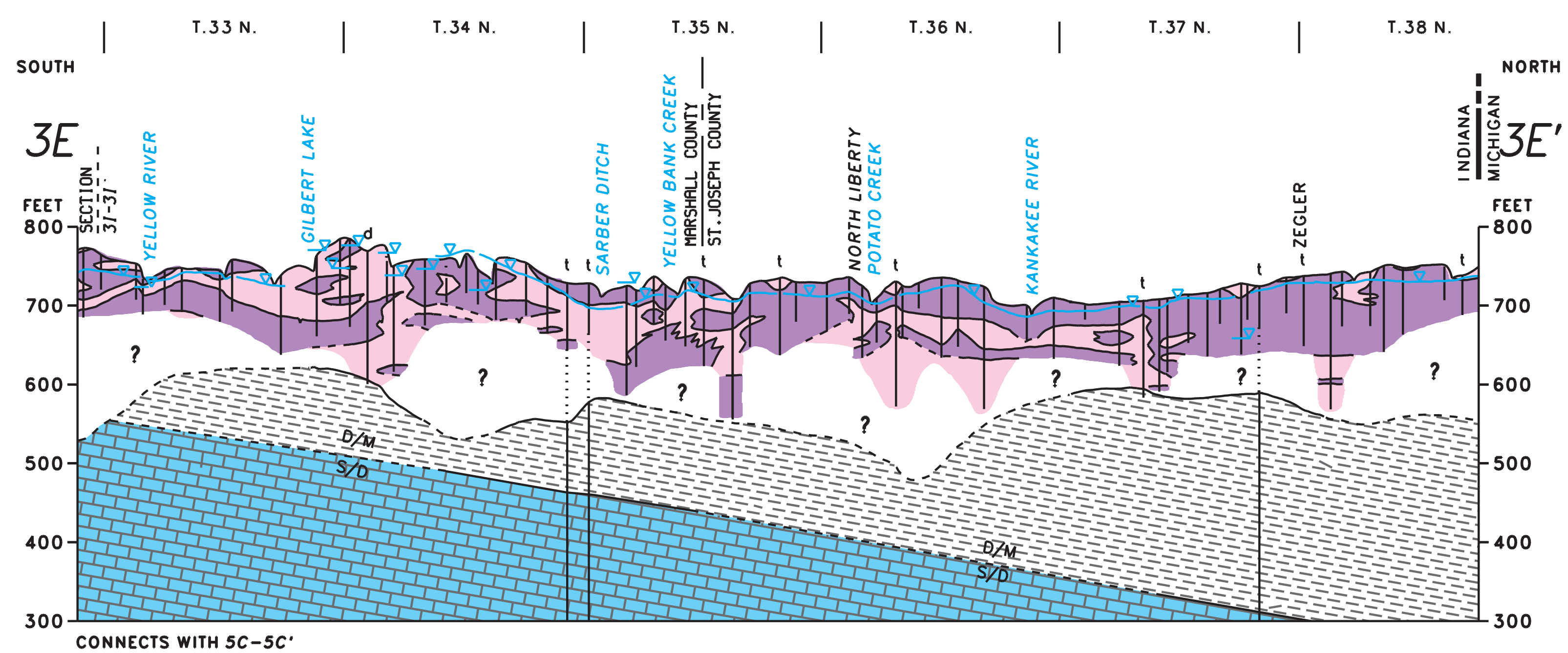



**Figure 28**. Hydrogeologic sections *3A–3A′* to *3I–3I′* of the Kankakee River basin—Continued.



T.31 N.
T.32 N.
T.33 N.
T.34 N.
T.35 N.
T.36 N.
T.37 N.
SOUTH
NORTH
3D
3D′
FEET
1,000
900
800
700
600
500
400
300
PULASKI COUNTY
STARKE COUNTY
BOGUS RUN
ALDINE
CRAIGMILE DITCH
SECTION 3I-3I′
YELLOW RIVER
BREMS
COX DITCH
ROBBINS DITCH
STARKE COUNTY
LA PORTE COUNTY
KANKAKEE RIVER
KINGSFORD HEIGHTS
TRAVIS DITCH
KINGSBURY
TRAVIS DITCH
TRAVIS DITCH
LA PORTE
VALPARAISO MORAINE
D/M
S/D
CONNECTS WITH 1H–1H′

T.33 N.
T.34 N.
T.35 N.
T.36 N.
T.37 N.
T.38 N.
SOUTH
NORTH
3E
3E′
FEET
800
700
600
500
400
300
SECTION 3I-3I′
YELLOW RIVER
GILBERT LAKE
SARBER DITCH
YELLOW BANK CREEK
MARSHALL COUNTY
ST. JOSEPH COUNTY
NORTH LIBERTY
POTATO CREEK
KANKAKEE RIVER
ZEGLER
INDIANA
MICHIGAN
D/M
S/D
D/M
S/D
CONNECTS WITH 5C–5C′

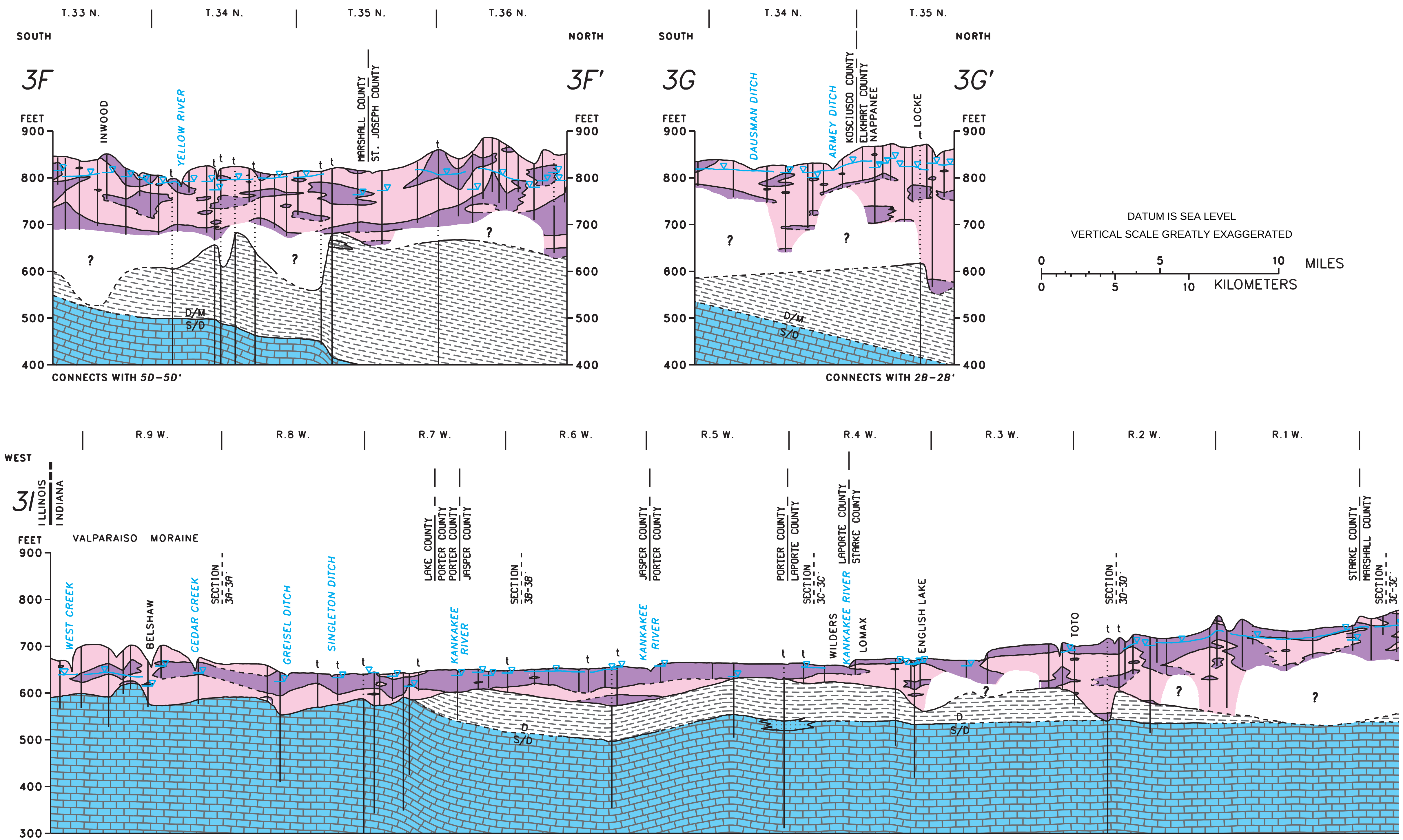
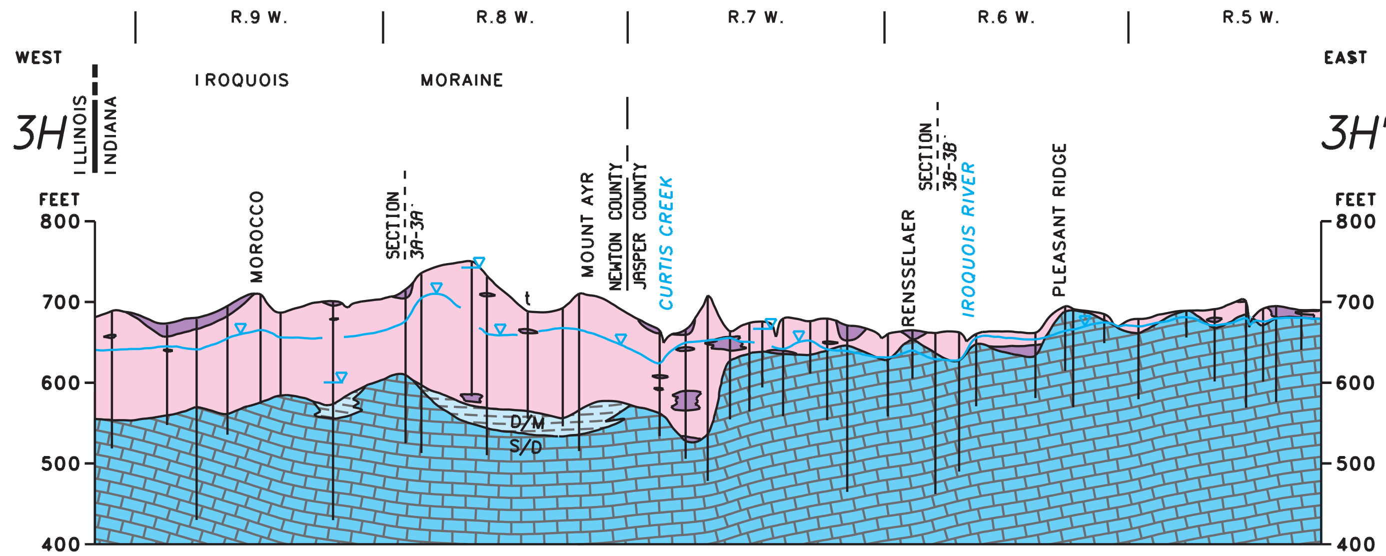
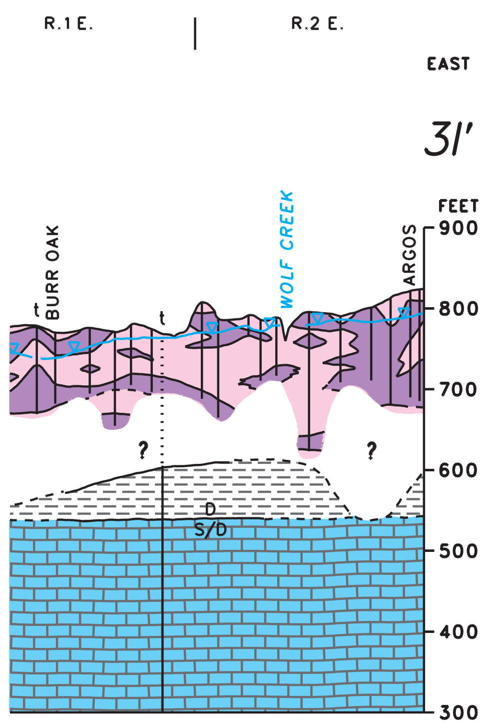



**Figure 28**. Hydrogeologic sections *3A–3A′* to *3I–3I′* of the Kankakee River basin—Continued.




#### Discontinuous Surficial Sand and Gravel Aquifers

Discontinuous surficial sand and gravel aquifers are found in the eastern part of the basin (fig. 29) and are shown in the southern part of section 3E–3E′, most of section 3F–3F′, and the eastern part of section 3I–3I′ (fig. 28). Most of the aquifers are located in the Maxinkuckee and Valparaiso morainal areas and are a part of a complex mixture of ice-contact stratified drift, outwash, and till. Individual aquifers range from a few feet to 100 ft in thickness. The discontinuous surficial sand and gravel is usually not used as a water supply, because it is commonly unsaturated or located above buried sand and gravel aquifers.

#### Buried Sand and Gravel Aquifers

Buried sand and gravel aquifers are present in more than one-quarter of the basin and are shown in three areas of figure 29. A major aquifer is in the northern part of the basin, a second smaller area of buried aquifers is in the southwestern part of the basin, and a third area of buried aquifers, discussed in the following section entitled "Discontinuous Buried Sand and Gravel Aquifers" is in the eastern part of the basin.

The northern buried sand and gravel aquifer is part of the Valparaiso Moraine and can best be seen in the northern parts of sections 3A–3A′ and 3B–3B′ (fig. 28). The sand and gravel form a single, partially confined aquifer (25 to 100 ft thick) that is buried beneath about 20 to 50 ft of clay till. The aquifer probably overlies clay throughout much of its extent in the Kankakee River basin, although in some areas, such as section 3B–3B′ (fig. 28), no information is available as to what underlies the sand and gravel.

The northern buried aquifer is recharged through the overlying till. The buried aquifer discharges to the surficial aquifer where they are hydraulically connected, as well as to the land surface through the overlying till or to the bedrock through the underlying till (Rosenshein and Hunn, 1968b). Water depths are generally 20 to 50 ft below land surface; the deeper water levels are to the north, near the crest of the moraine. Yields from the aquifer are generally 10 to 100 gal/min, but yields exceed 1,000 gal/min in places.

A second area of buried sand and gravel aquifer is the southwestern part of the basin beneath the Iroquois River in a buried bedrock valley. The aquifer, present beneath the river in section 3A–3A′ (fig. 28), has a thickness that ranges from several feet to about 70 ft and averages 25 ft. The aquifer directly overlies bedrock and is buried beneath 20 to 100 ft of clay. Recharge to the aquifer is primarily from the underlying bedrock, and discharge is through the overlying clay to the Iroquois River (Bergeron, 1981, p. 15-22).

#### Discontinuous Buried Sand and Gravel Aquifers

Most of the eastern part of the basin contains discontinuous buried sand and gravel aquifers. Buried aquifers that are continuous for 5 to 10 mi along a section line, such as those shown in the southern part of section 3E–3E′ and in section 3F–3F′ (fig. 28), were mapped as "buried sand and gravel aquifer" (fig. 29). Discontinuous buried sand and gravel aquifer was mapped to the east and west of this area where the aquifers are laterally continuous for only 1 to 5 mi. These discontinuous aquifers are a significant source of ground water. In general, the areas of "buried" and "discontinuous buried" aquifers in the eastern part of the basin differ little in their water-bearing capacity.

Throughout the eastern part of the basin, the "buried" and "discontinuous buried" aquifers are common; a domestic water supply generally can be found within 150 ft of the land surface (see southern part of sections 3D–3D′ and 3E–3E′, sections 3F–3F′ and 3G–3G′, and eastern part of section 3I–3I′; fig. 28). Multiple buried sand and gravel aquifers are common; individual aquifer thicknesses range from 5 to 50 ft. Well depths are generally 50 to 150 ft; a few wells in the far eastern part of the basin are deeper than 150 ft. Ground-water yields from these aquifers are generally 10 to 500 gal/min but are greater than 1,000 gal/min in some areas.

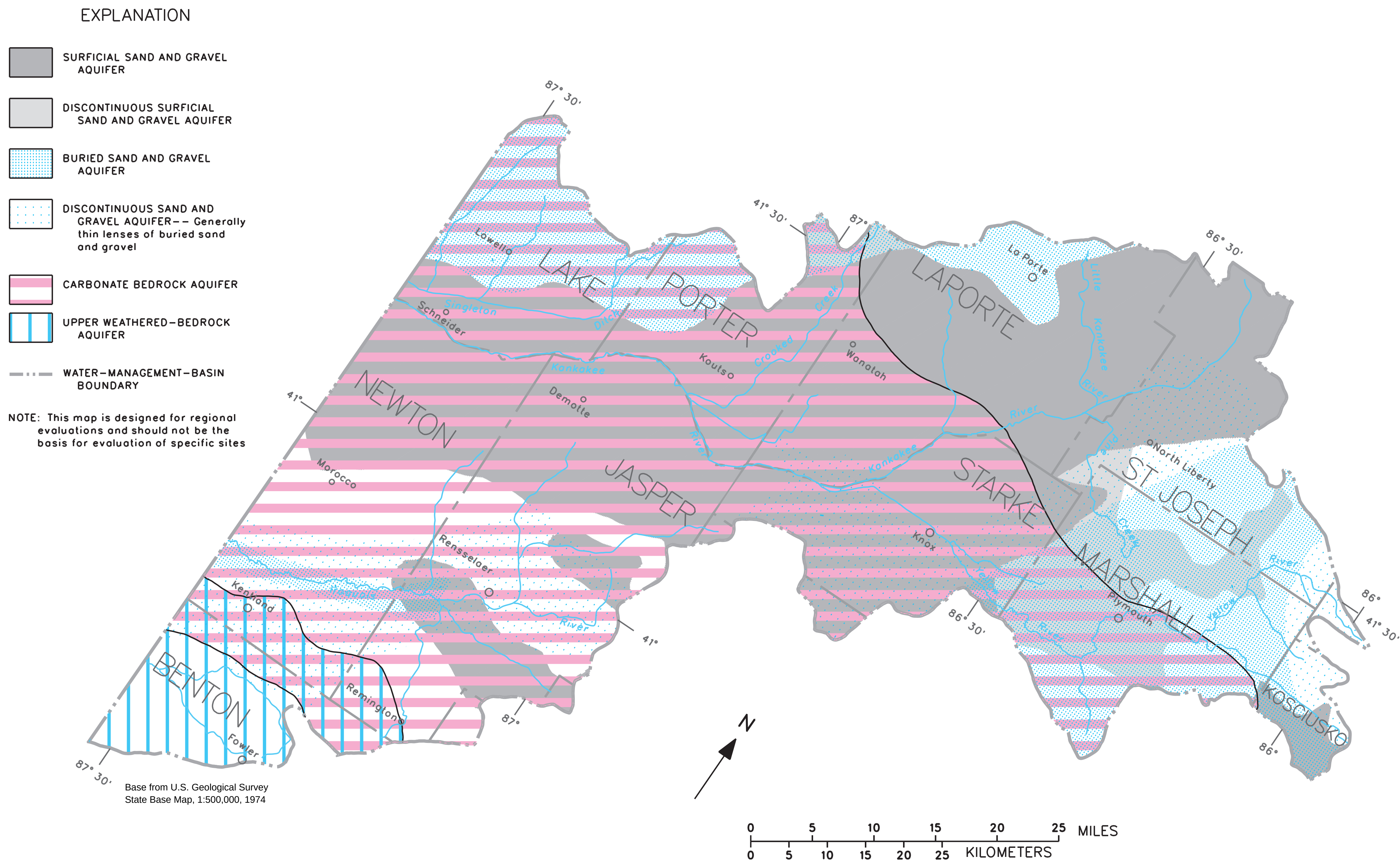



**Figure 29**. Extent of aquifer types in the Kankakee River basin.

**Table 5**. Characteristics of aquifer types in the Kankakee River basin
[>, greater than; <, less than; locations of aquifer types shown in fig. 29]

| Aquifer type | Thickness (feet) | Range of yield (gallons per minute) | Common name(s) |
|---|---|---|---|
| Surficial sand and gravel | 0- 175 | [1,2,3,4]10- 2,000 | Kankakee aquifer[4,5]; Unit 3[1,2,3]; Kankakee and Valparaiso Outwash Apron Aquifer Systems[6] |
| Buried sand and gravel | 5- 100 | [1,3,4]10- >1,000 | Valparaiso aquifer[5]; Unit 3 [1,2,3]; Valparaiso Moraine, Maxinkuckee Moraine, and Nappanee Aquifer Systems[6] |
| Discontinuous surficial sand and gravel | 10- 100 | No data | Maxinkuckee Moraine Aquifer System[6] |
| Discontinuous buried sand and gravel | 2- 50 | 5- 1,000 | Unit 3[3]; Iroquois Basin and Eolian Sands Aquifer Systems[6] |
| Carbonate bedrock | 500- 800 | 5- 2,000 | Silurian-Devonian carbonate aquifer; Sexton Creek Limestone, Salamonie Dolomite, Salina Group, and Muscatatuck Group[7] |
| Upper weathered bedrock | 50- 125 | <1- 20 | Mississippian Borden Group[7] |

[1]Rosenshein and Hunn, 1968a.
[2]Rosenshein and Hunn, 1968b.
[3]Hunn and Rosenshein, 1969.
[4]State of Indiana and others, 1976.
[5]Hartke and others, 1975.
[6]Indiana Department of Natural Resources, 1990.
[7]Shaver and others, 1986.

An area of discontinuous buried aquifers in the southwestern part of the basin is within, and south of, the Iroquois Moraine (fig. 29). These aquifers can be seen in the southern parts of sections 3A–3A′ and 3B–3B′ and in the eastern part of section 3H–3H′ (fig. 28). The aquifers are smaller and less abundant than the buried discontinuous sand and gravel aquifers in the eastern part of the basin. Individual aquifers typically are thin (2 to 15 ft) and cover less than 1 $mi^2$. They are recharged from the surrounding clay material and are tapped for water supplies if no better aquifers are available (such as in section 3A–3A′, fig. 28). Yields from these intratill aquifers range from 5 to 50 gal/min but are commonly 10 to 20 gal/min. Depths to the aquifers can exceed 150 ft but are generally 50 to 100 ft.

## Bedrock Aquifers

### Carbonate Bedrock Aquifer

Silurian and Devonian carbonate bedrock, consisting mostly of dolomite and limestone, forms the principal bedrock aquifer in the Kankakee River basin. Although it is present throughout the basin, it is mostly used as a water supply in the western part of the basin (fig. 29; sections 3A–3A′, 3B–3B′, 3H–3H′, and 3I–3I′, and the southern parts of 3C–3C′ and 3D–3D′, fig. 28). The carbonate bedrock is found at the bedrock surface in most of Lake, Newton, and Jasper Counties. In the remaining parts of the basin, it is covered by as much as 300 ft of shale in addition to 100 to 300 ft of overlying unconsolidated deposits (fig. 27). Carbonate bedrock is shown at land surface in parts of section 3H–3H′ (fig. 28) but it is more than 500 ft below land surface in the northern parts of sections 3D–3D′ and 3F–3F′ (fig. 28).

The carbonate bedrock aquifer is generally 500 to 600 ft thick except in the northeastern part of the basin, where it attains a thickness of 800 ft. The upper part of the aquifer is highly permeable because of the enlargement of fractures, joints, and bedding planes by pre-Pleistocene weathering. The density of the fractures and joints decreases with depth (Bergeron, 1981, p. 15). The carbonate bedrock aquifer also includes reef structures within the Silurian rocks that can be highly fractured (Ault and others, 1976). These fractures are excellent conduits for ground water.

Most domestic wells penetrate only the upper 10 to 150 ft of the carbonate bedrock, as shown in section 3H–3H′ and the southern part of section 3B–3B′ (fig. 28). Many high-capacity irrigation, industrial, and municipal wells have been completed in the carbonate bedrock in Newton and Jasper Counties between the Kankakee and Iroquois Rivers. Most of the high-capacity wells are used to irrigate crops grown in the Kankakee outwash and surficial dune sands, such as those shown in the central part of section 3A–3A′ (fig. 28). The high-capacity wells generally penetrate more than 200 ft of carbonate bedrock; a few penetrate more than 500 ft.

In the northeastern and extreme southwestern parts of the basin, the carbonate bedrock aquifer is not used because of the availability of water in the unconsolidated aquifers, the greater depth to the carbonate bedrock aquifer, and potentially high concentration of dissolved solids in the water (Rosenshein and Hunn, 1968b, p. 5). The boundary of the carbonate bedrock aquifer is mapped where the top of the carbonate bedrock aquifer is generally greater than 300 ft below land surface (fig. 29), but this boundary does not necessarily separate the usable from the unusable parts of the aquifer. The aquifer is generally not used where more than 200 ft of unconsolidated material and(or) shale cover it, and it is rarely used where more than 300 ft of material cover it, because of the reasons given above.

Devonian and Mississippian shales and the lower till unit confine the upper surface of the carbonate bedrock aquifer throughout most of the basin. The shales are potential sources of small quantities of water (Rosenshein and Hunn, 1968a; 1968b; Arihood, in press). At depths of greater than 600 ft, the lower carbonate bedrock surface is underlain by 200 to 250 ft of shale interbedded with some limestone (Gray, 1972). Recharge to the carbonate bedrock aquifer is mostly from the till and upper shale, and discharge is to the major rivers in the basin (Arihood, in press). Well yields are generally 5 to 50 gal/min, although high-capacity wells can produce as much as 1,500 to 2,000 gal/min (Basch and Funkhouser, 1985, p. 34). During the irrigation season, water levels in the bedrock are lowered 5 to 80 ft by pumping (Arihood, in press), but most wells are able to recover fully before the beginning of the next season.

### Upper Weathered-Bedrock Aquifer

Mississippian limestone, siltstone, and shale are found at the bedrock surface in the southwestern part of the basin in Benton County (fig. 29). As much as 200 ft of the Mississippian bedrock is shown in the southern part of section 3A–3A′ (fig. 28). Water wells in the section penetrate 10 to 125 ft of the upper part of the bedrock. The upper weathered bedrock, where permeability has probably been enhanced due to preglacial weathering, is shown as “aquifer.” In general, the Mississippian bedrock is a poor water producer. Yields from wells into the Mississippian bedrock shown in section 3A–3A′ (fig. 28) range from less than 1 to 20 gal/min.

## Summary


The Kankakee River basin includes 2,989 $mi^2$ in northwestern Indiana. The basin is bounded by morainal areas and till on the north, southwest, and east; a wide band of surficial outwash and dune sands crosses the central part of the basin.

Six aquifer types were delineated in the Kankakee River basin. Unconsolidated sands and gravels and Silurian and Devonian carbonate bedrock are the most productive aquifers in the Kankakee River basin. One of the primary unconsolidated aquifers is composed of surficial sands in the central part of the basin. The saturated thickness of the sands ranges from 20 to 100 ft, and well yields range from 10 to 2,000 gal/min. Two additional areas of productive unconsolidated aquifers are in the northern and eastern parts of the basin where buried continuous and discontinuous sands and gravels are present. The northern buried aquifer, located beneath the Valparaiso Moraine, forms a single, partially confined aquifer that is 25 to 100 ft thick. It is buried beneath 20 to 50 ft of clay till and overlies a basal till. The eastern buried continuous and discontinuous aquifers are the main source of ground water for the eastern part of the basin. Sufficient supplies of ground water for domestic use are commonly found within 150 ft of land surface. The buried aquifers can supply from 10 to more than 1,000 gal/min of ground water. Other locally important unconsolidated aquifers are discontinuous surficial sands and gravels in morainal areas and discontinuous buried sands in the southwestern part of the basin.

The carbonate bedrock aquifer underlies the entire basin but is only important as a source of water in the western one-half of the basin, where it is near or at the bedrock surface. Most domestic wells penetrate only the upper 10 to 150 ft of the carbonate rocks, whereas high-capacity wells penetrate from 200 to more than 500 ft of the carbonate bedrock aquifer. Yields are usually sufficient for domestic use, and they can be as great as 2,000 gal/min. Another bedrock aquifer composed of an upper weathered zone of various lithologies is used for a water supply in some areas of the southwestern part of the basin.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