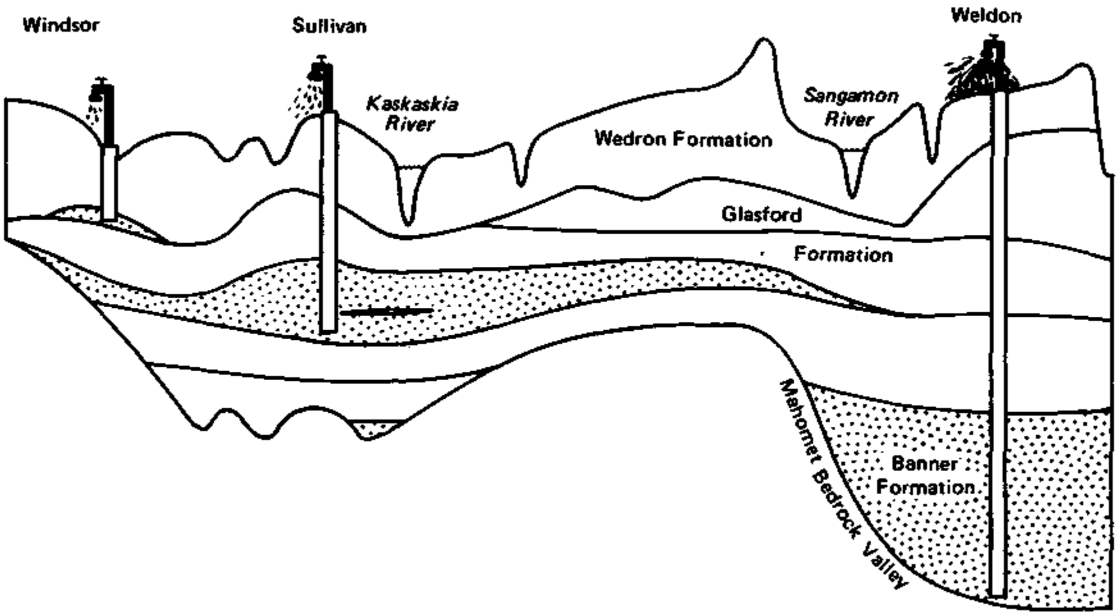
Cooperative Groundwater Report 8

HYDROGEOLOGIC EVALUATION OF SAND AND GRAVEL AQUIFERS FOR MUNICIPAL GROUNDWATER SUPPLIES IN EAST-CENTRAL ILLINOIS



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and Adrian P. Visocky

Illinois Department of Energy and Natural Resources

State Geological Survey Division
State Water Survey Division

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HYDROGEOLOGIC EVALUATION OF SAND AND GRAVEL AQUIFERS FOR MUNICIPAL GROUNDWATER SUPPLIES IN EAST-CENTRAL ILLINOIS

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Division of Water Resources, Frank Kudrna, Director.

June 1982

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HYDROGEOLOGIC EVALUATION OF SAND AND GRAVEL AQUIFERS FOR MUNICIPAL GROUNDWATER SUPPLIES IN EAST-CENTRAL ILLINOIS

ABSTRACT

Glacial sand and gravel aquifers have been identified stratigraphically and mapped in a 50- by 80-mile rectangular area of east-central Illinois. Located within the area are several water-short communities as well as the cities of Danville, Champaign, Urbana, Decatur, Shelbyville, Mattoon, Charleston, and Paris. An evaluation of all existing subsurface data, including data from 14 test holes and 7 test wells drilled for this study, indicates that only slightly more than half this region is underlain by aquifers with a potential for yielding municipal groundwater supplies.

The principal aquifer is the Mahomet Sand, a basal pre-Illinoian Banner Formation aquifer partially filling the buried Mahomet Bedrock Valley located generally west of Champaign. The Mahomet Sand is more than 100 feet thick in many locations and averages just under 10 miles wide over its approximately 30-mile length within east-central Illinois. Yields of individual wells from the aquifer are as high as 3500 gpm. Elsewhere in the region, small, thin aquifers occur within the Banner Formation.

The Glasford Formation (Illinoian) overlies the Banner and contains extensive sand and gravel aquifers, mainly at its base, throughout the western and northern parts of the region. Although Glasford aquifers are second in significance to the Mahomet Sand, primarily because they are thinner and cover less area, the largest of these may still yield up to 1000 gpm in local situations.

A basal Wedron Formation (Wisconsinan) aquifer has been mapped in numerous, small scattered areas; wells at some of these locations yield up to 500 gpm. Similar yields are also obtained from some areas of the surficial Henry Formation, which is present as narrow fills of the principal river valleys and a narrow, discontinuous plain just outside the margin of the Wedron Formation.

Scattered aquifers have been documented throughout the region; however, there are probably no widespread, highly productive aquifers remaining to be identified.

Hydraulic conductivities are highly variable in the shallower deposits, even within well fields, but become uniformly greater with depth. Storage coefficients reflect artesian conditions in the Mahomet Sand as well as other Banner Formation aquifers; in the shallower units, conditions range from artesian to water table. Water quality does not differ substantially from formation to formation and is generally of good quality for municipal use.

Aquifers in east-central Illinois are unevenly distributed. All major aquifers, including the Mahomet Sand, are concentrated in the western half of the region. In the eastern half, the limited size and thickness of the aquifers restrict current and future development of public groundwater supplies. Communities with insufficient or marginal water supplies must assess the costs of prospecting for local sources in relation to the costs of acquiring access to the nearest dependable, productive aquifer. Cooperation between communities would contribute to the economical, efficient exploration for and development of available resources. Finally, further study and evaluation of the principal aquifers, particularly of the underdeveloped Mahomet Sand, is necessary to determine their maximum potential and promote responsible development and management.

ACKNOWLEDGMENTS

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Keros Cartwright, Head of the Hydrogeology and Geophysics Section of the State Geological Survey, and Richard J. Schicht, Assistant Chief for Research and Services of the State Water Survey, provided general direction and technical review during the preparation of this report. James P. Gibb, Head of the Groundwater Section of the State Water Survey, also reviewed the manuscript and critiqued the hydrologic portions. Ann C. Sternberg contributed significantly to the compilation and evaluation of the basic geologic data used for the study. W. Hilton Johnson, Department of Geology, University of Illinois, and H. D. Glass, State Geological Survey, provided data and suggestions for stratigraphic interpretations and correlations. Philip C. Reed, Michael L. Sargent, and Kemal Piskin, State Geological Survey, aided in the geophysical loggings and sampling of the test holes and wells.

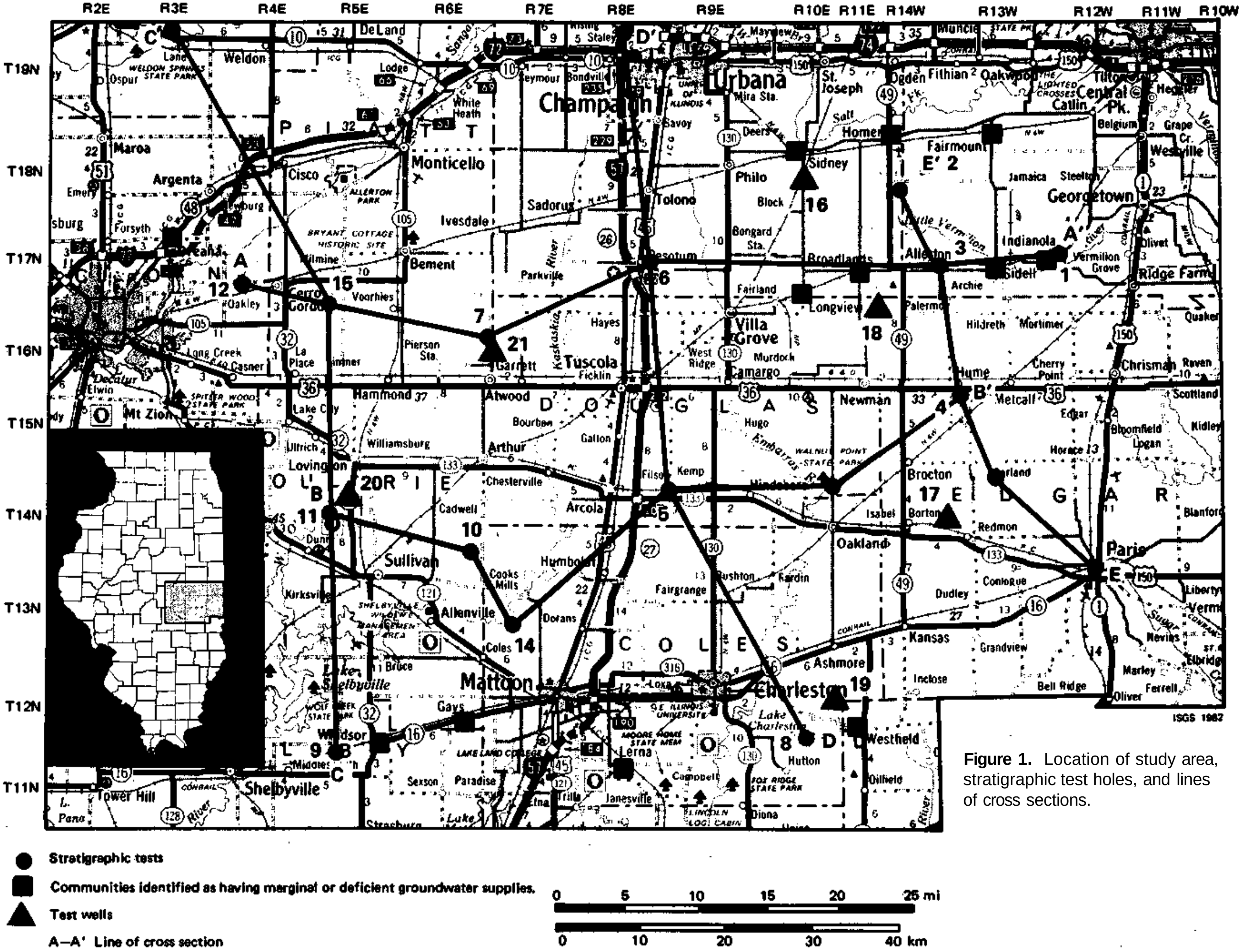

Figure 1. Location of study area, stratigraphic test holes, and lines of cross sections.

INTRODUCTION

Numerous communities throughout Illinois experienced water supply problems when drought conditions developed in 1976 and continued into 1978. In response to these problems, the Illinois Department of Transportation, Division of Water Resources, cooperating with the Illinois State Water Survey and the Illinois State Geological Survey, began an assessment of public groundwater supplies. The first phase of this assessment focused on communities that are situated outside of the six-county Chicago metropolitan area and are dependent upon groundwater as a source of supply. A preliminary appraisal indicated that at least 39 communities have marginal or deficient supplies in terms of present demands (Visocky et al., 1978; Poole and Heigold, 1981).

A preliminary study for 24 of these communities provided some information on the potential for developing additional groundwater supplies in the immediate vicinity of each community. In many cases the potential appeared limited. In some cases, data was insufficient or areas suggested as favorable by resistivity surveys or previous studies were not investigated.

The second phase of the assessment attempted to locate suitable areas to explore for sources of supplementary groundwater—for each community. Because of the magnitude of the problem, however, it was decided that regional assessment rather than the detailed investigation of individual communities would be a more profitable procedure. Since ten of the communities initially identified were clustered in a 50-by 80-mile region of east-central Illinois with generally similar geologic conditions (fig. 1), a regional mapping program, including subsurface investigation, was undertaken. Such regional investigations require evaluation of existing subsurface data supplemented, where needed, by controlled drilling, sampling, and hydrologic testing to identify, characterize, and map the extent of significant aquifers in the region.

In the portion of east-central Illinois chosen for this aquifer evaluation program, most aquifers occur within the glacial deposits. The aquifer systems supplying groundwater consist of sand and gravel deposits present at distinct stratigraphic positions or horizons within the glacial sequence and are of mappable thickness and areal extent.

Therefore, in order to define each sand and gravel aquifer, the glacial deposits were studied to delineate each geologic unit and to stratigraphically place each aquifer in its correct position within the stratigraphic framework. Previously acquired hydrologic data and those obtained by field testing for this study were then correlated with the correct aquifer. Such an approach allows for the delineation of each sand and gravel deposit as a distinct hydrogeologic unit thereby allowing for mapping of the areal distributions, depth, thickness, and hydrogeologic characteristics. Once the distribution and water-yielding character of each aquifer has been established, the areal relationship to each community will determine the long-term availability of groundwater for each community.

Previous Studies

Since the bedrock of east-central Illinois has a very limited potential for development of municipal groundwater supplies, recent geologic and hydrologic studies related to groundwater availablity have focused on the glacial deposits (Foster, 1953). Studies by Horberg (1945,1950,1953) and later by Piskin and Bergstrom (1975) provided some of the hydrogeologic background for later studies by establishing the regional character of bedrock topography and the thickness of overlying glacial deposits. One of the most significant of Horberg's contributions was the definition of the Mahomet Sand Member and its recognition as a major aquifer in east-central Illinois.

Following the early work of Horberg, there have been a number of local and regional hydrogeologic studies of east-central Illinois. These include regional studies summarizing general groundwater conditions (Selkregg, Prior, and Kempton, 1957; and Selkregg and Kempton, 1958), a regional study focusing on the Mahomet Valley aquifers (Stephenson, 1967), and studies covering portions of the east-central Illinois area (Foster, 1952; Foster and Buhle, 1951; Hackett, 1956; Cartwright and Kraatz, 1967; Bergstrom et al., 1976; and Hunt and Kempton, 1977). Summaries of the geologic aspects of this current study were presented by Morse et al. (1980) and Kempton et al. (1980).

Hydrologic studies include evaluation of the Mahomet Valley aquifers by Visocky and Schicht (1969) and the study of Champaign County by Smith (1950). Specific data on public groundwater supplies have been provided by Hanson (1950) and Woller (1975). Detailed assessments of selected groundwater supplies were made by Visocky et al. (1978) and Wehrmann et al. (1980).

Methods of Study

Geologic methods

All available data were evaluated, and those relevant to the thickness and character of the glacial deposits were plotted on topographic quadrangle maps and on 1:125,000 base maps. Water well logs provided the bulk of the information, supplemented by data from about 25 geophysical logs of water wells. Logs of coal, oil, and gas tests were available, including a significant number of downhole geophysical logs (electrical and natural gamma). In addition, logs, engineering data, and representative samples yielding material descriptions and grain size, clay mineral, and carbonate data were obtained from about 60 engineering foundation borings throughout the area. Also, information was derived from the study of samples from about 50 water wells.

A controlled drilling program was conducted to collect samples and stratigraphic data in areas where information was inadequate. Fourteen borings were made using a rotary rig (fig. 1, borings 1-12, 14, and 15). Split spoon (core) samples were taken at regular intervals in some borings and at selected intervals in the remainder. In all borings, cuttings were collected at 5-foot intervals. A field description was made of each sample, and when possible, a penetrometer test was performed on spoon samples. Upon completion of each boring, a natural gamma ray log was made. Electric logs were run on four borings. Samples were taken to the Illinois State Geological Survey laboratories for further description and testing. Grain size, carbonate, and clay mineral analyses were made on spoon samples. Results of these analyses as well as data from the selected engineering foundation test borings used in this study are on open file at the State Geological Survey. The location, total depth, and aquifer(s) encountered for each control boring are given in Appendix 3.

Data from all logs were recorded on the base map, including the elevation and thickness of each sand and gravel unit and soil horizon. Information from the control borings was added to the base map, and several cross sections were made. In addition, cross sections were made from downhole geophysical logs correlated with selected descriptive logs and laboratory data. From this information the stratigraphic position of the aquifer units was determined.

Hydrologic methods

Hydrologic information from the State Water Survey files included well-production test data from 107 municipal, industrial, state-owned, institutional, and privately owned wells in the study area. Test data were analyzed for hydraulic properties of aquifers such as transmissivity and hydraulic conductivity. Where observation-well data were available, storage coefficients were also determined. In addition, the analysis of specific-capacity data for another 197 wells provided estimates of transmissivity and hydraulic conductivity at those sites.

In an attempt to determine hydraulic properties and assess production capability at particular sites near water-short communities, seven test wells were drilled. At three of the sites, the permeable material was thick enough to set a screen and conduct a production test. At one site the sand, although sufficiently thick, was too fine to set screen. Data for the seven test wells are included in Appendix 3 (DAA-16 through DAA-22), and well locations are shown in figure 1.

GEOLOGIC CONTROLS OF GROUNDWATER AVAILABILITY

General Principles

An aquifer is a body of earth materials that will yield sufficient quantities of groundwater to some type of well. Nearly all geologic materials will transmit water, but at vastly different rates depending on the type of material (for example, clay versus gravel). The amount of water available from an aquifer during a given period of time depends not only on the rates at which materials transmit water, but also on the dimensions of the body of water-yielding materials as well as the amount and rate of recharge to that body of materials.

A knowledge of the geometry of an aquifer is important for determining its hydrologic properties, and therefore, whether or not it will yield the required amount of groundwater for a particular use in a given area. For this study, 5 feet of sand and gravel was used as a minimum thickness for consideration as a potential municipal aquifer. Only areas with 5 feet or more of sand and gravel were mapped. Obviously, the thicker and more extensive the sand and gravel, the greater its significance as a potential source of a municipal groundwater supply.

The availability of groundwater is therefore controlled by the nature and arrangement of the various earth materials beneath the surface. Any groundwater supply, whether for small domestic needs or for the large requirements of a city or industry, can be obtained only where aquifers capable of yielding the desired amounts of water are present. Because geologic conditions differ, groundwater is readily available in some areas and difficult to obtain in others. Consequently, the proper development of the groundwater resources in any area is greatly assisted by information on the distribution and character of the aquifers that may be present.

Geologic Framework of East-Central Illinois

Bedrock geology

The bedrock formations in east-central Illinois (fig. 2) consist of a succession of sedimentary rocks several thousand feet thick, including sandstone, limestone, dolomite, shale, and coal. These sedimentary rocks were warped and tilted to form the Illinois Basin centered in southeastern Illinois and an arch-like structure, the La Salle Anticlinal Belt, which trends north-south through the approximate center of the study region.

Whereas the older, generally deeper rocks of east-central Illinois are, for the most part, composed of limestone, dolomite, and sandstone (frequently water yielding), the younger rocks that are at or within a few hundred feet of the bedrock surface are composed largely of nonwater-yielding shale interbedded with a few, relatively thin layers of sandstone, limestone, and coal. Only along the trace of the La Salle Anticlinal Belt do the older, more permeable rocks reach near or to the bedrock surface. In addition, below depths of 200 to 400 feet, the water is generally too highly mineralized to be of use, both in the younger and older rocks. Therefore, groundwater resources are extremely limited in the shallow bedrock and normally available only in small quantities where permeable sandstone or fractured

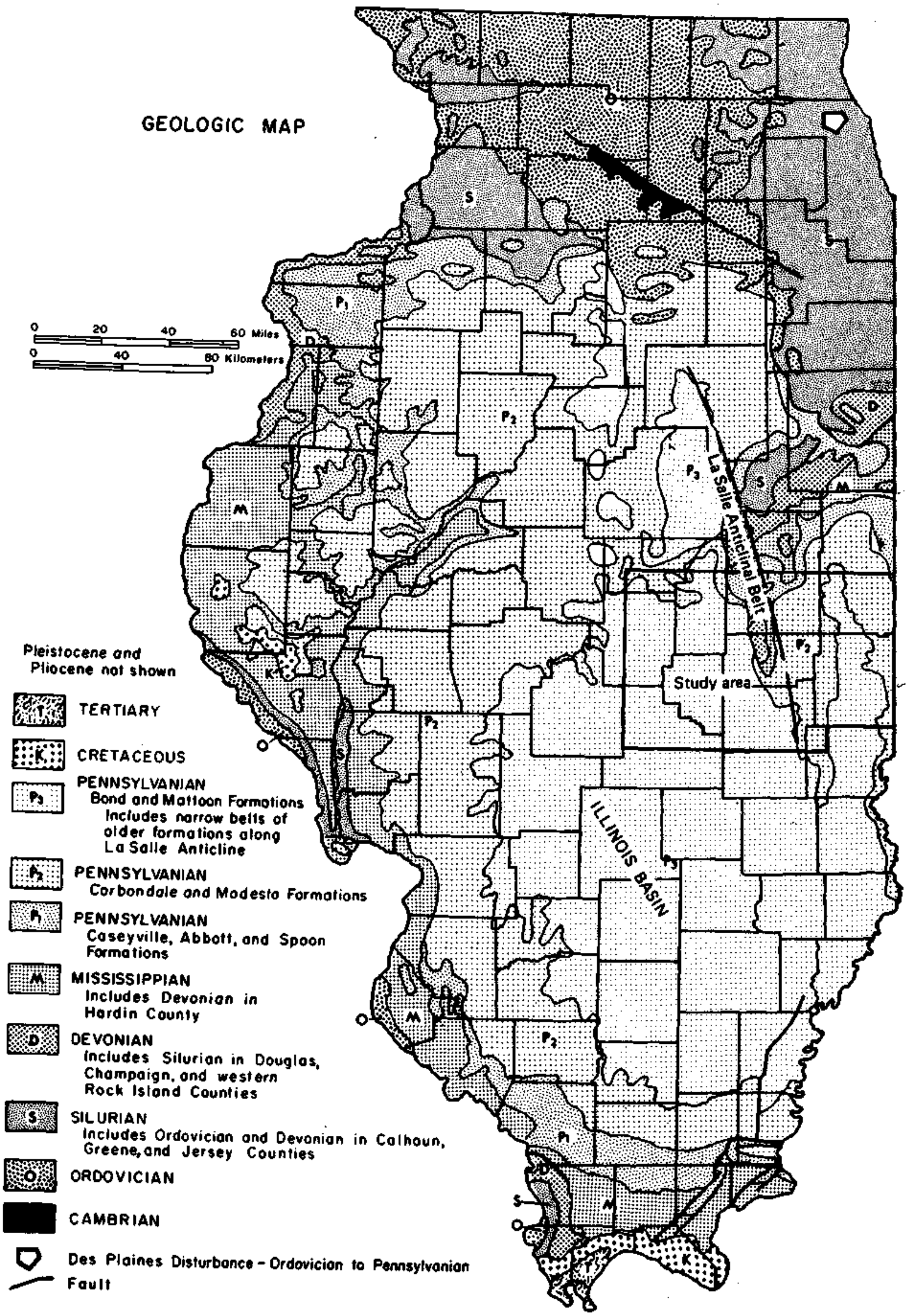

Figure 2. Bedrock geologic map of Illinois showing area of study, Illinois Basin, and La Salle Anticlinal Belt axis (modified from Willman and Frye, 1970).

limestone is encountered. Because several communities have utilized the shallow bedrock in areas lacking sand and gravel aquifers, it must still be considered as a source of small local supplies where conditions are favorable.

Bedrock topography

Following deposition of the youngest rocks in the area, the upper part of the bedrock was eroded deeply. The first regional maps of the bedrock surface prepared by Horberg (1945, 1950) showed that a well-developed drainage system existed before the continental glaciers spread debris across the surface. Figure 3 is a revision of the east-central Illinois portion of Horberg's maps based on data currently available.

Since many of the major bedrock valleys mapped in Illinois were thought to contain sand and gravel as a significant part of the fill of these valleys, great emphasis has been placed on the study of these valleys as potential sources of large groundwater supplies. It has been shown subsequently that not all bedrock valleys contain significant aquifers; however, the configuration of the bedrock surface still appears to be one of the controlling factors in the occurrence of sand and gravel aquifers within the overlying glacial deposits.

The principal bedrock valleys in east-central Illinois are the Mahomet, Middletown, and Pesotum Valleys (fig. 3); the latter two are tributaries to the Mahomet. Other smaller bedrock valleys are tributary to these valleys, or separate systems tributary to other major bedrock valleys to the southeast or southwest of east-central Illinois. The position of the confluence of the Pesotum Valley with the Mahomet Valley has been changed to south-central Champaign County on the revised map. Other changes from Horberg's map are generally less significant.

Pleistocene (glacial) geology

The glacial deposits covering the bedrock surface in east-central Illinois range in thickness from a few feet to more than 400 feet (fig. 4). Bedrock is exposed in a number of areas, particularly in Vermilion, Moultrie, and Coles Counties, either as natural exposures along stream valleys or in strip mines, pits, and quarries. The thickest drift is found generally over bedrock valleys such as the Mahomet, Pesotum, and Middletown Valleys, although the drift averages more than 150 feet thick throughout the region.

The glacial drift deposited by many pulses of the continental glaciers that entered east -central Illinois is composed principally of glacial till, which is a mixture of clay, silt, sand, gravel, and scattered boulders. The deposits of meltwater streams that flowed from glaciers during warm periods are commonly called outwash. Sand and gravel outwash is thus glacial debris from which much of the silt and clay have been washed.

Glacial tills are generally widespread blanket deposits of individual glaciers. The till deposited by each glacier has similar physical and mineralogical properties throughout its extent. Although many tills have similar properties, each till sheet can usually be distinguished by a specific set of properties or by its relation to other identifiable underlying or overlying materials; therefore, its distribution can be mapped.

Glacial outwash is debris deposited by meltwater on the surface of the ice, in crevasses in the ice, in channels below the ice, or along or beyond the margin of the ice. If outwash is deposited along the margin of the ice, the deposits are called outwash plains. Valley trains result from outwash deposited downvalley from the ice, and ice contact deposits are associated directly with the ice. Debris that collects on the surface of a melting glacier is also called ablation drift and may consist of both till and water-laid materials. Such deposits have been recognized from the study of present glaciers and by mapping the surficial deposits of glaciated regions such as east-central Illinois.

A glacial till can be expected to be present over much of the area covered by the glacier that deposited it; however, the occurrence of a buried sand and gravel is usually less widespread and less predictable. Outwash plains are generally extensive. Other types of outwash deposits are more restricted areally, having formed in long, narrow channels or in mounds and ridges of limited size and distribution.

High energy meltwater streams flowing from a glacier can carry and deposit very coarse gravel and sand. Conversely, low energy streams flowing from a glacier transport relatively fine-textured materials, such as sand and silt, much of which is deposited as fine-textured outwash. Glacial meltwater normally carries fine silt and clay great distances beyond the glacier. Occasionally these sediments are trapped in depressions behind the glacier, or behind rapidly accumulating outwash, and are deposited as fine-textured lake sediments (Frazer and Steinmetz, 1971).

All the conditions described above apparently occurred in east-central Illinois throughout the succession of glacial deposits. Although the thicker and more extensive subsurface outwash materials of various types have been identified and mapped (especially the Mahomet Sand), many of the thinner and less extensive sand and gravel deposits have been identified only in specific localities or from individual well records. The distribution of the surficial materials is now well known (Lineback, 1979).

STRATIGRAPHY AND DISTRIBUTION OF SAND AND GRAVEL AQUIFERS

General Stratigraphic Relationships

To adequately map and characterize the sand and gravel aquifers within the glacial drift, it is necessary to determine their proper stratigraphic position. Although the glacial deposits have been studied for many years, only within the last thirty years have the subsurface deposits been investigated in the systematic fashion that allows this to

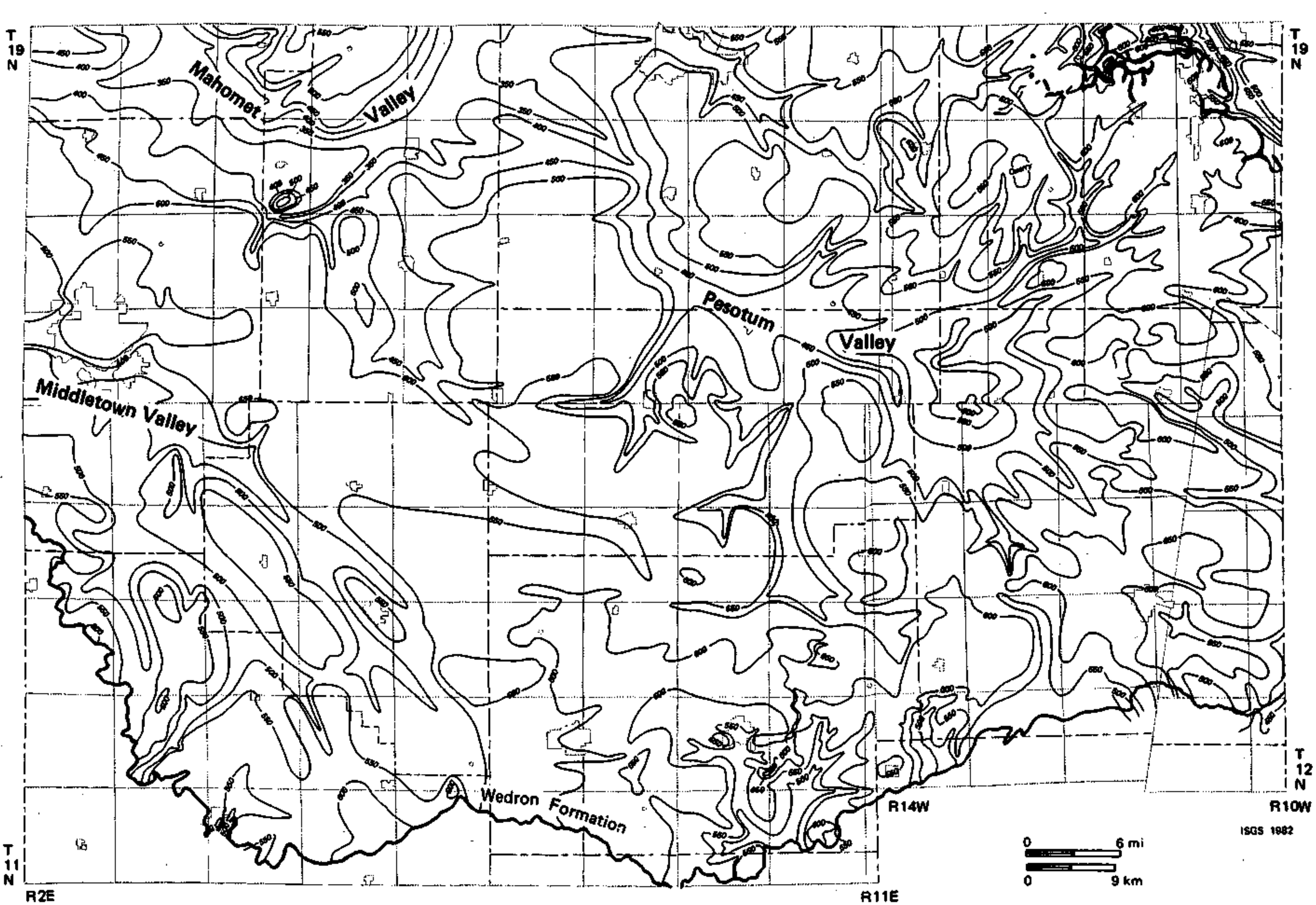

Figure 3. Bedrock topography.

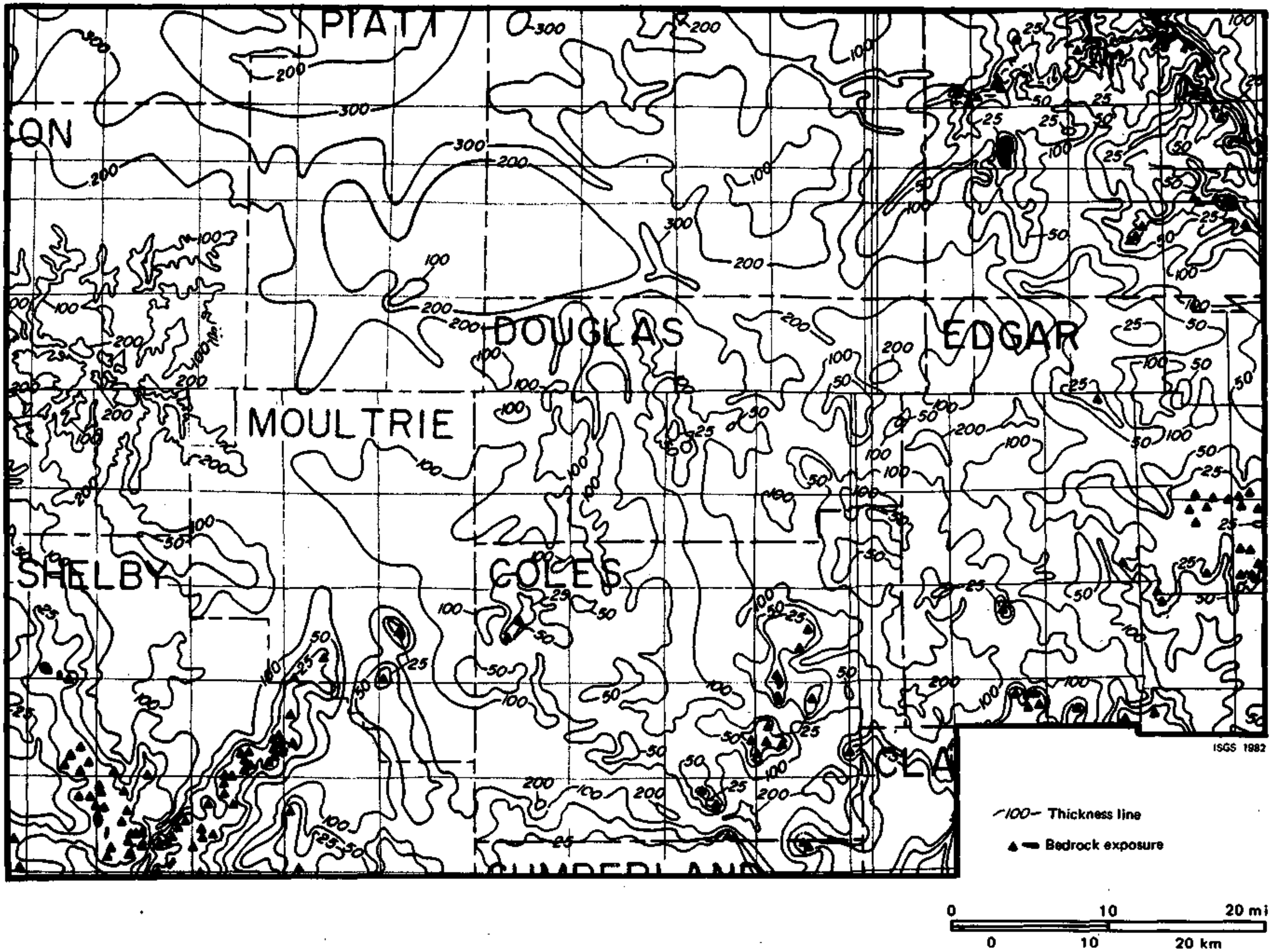

Figure 4. Drift thickness (from Piskin and Bergstrom, 1975):

be accomplished. The earliest subsurface studies (Horberg, 1945, 1953) provided the impetus for additional studies (Stephenson, 1967; Visocky and Schicht, 1969) in east-central Illinois and elsewhere (Kempton, 1963). Recent studies (Willman and Frye, 1970; Jacobs and Lineback, 1969; Johnson, 1971; Johnson et al., 1971, 1972; and Ford, 1974) have provided the stratigraphic basis for classifying the glacial deposits of east-central Illinois.

Figure 5 summarizes the current classification of the glacial deposits in east-central Illinois, and figure 6 shows the distribution of the surface tills. The probable position of each aquifer unit with respect to other aquifer and nonaquifer units is emphasized in figure 5. Although the rock-stratigraphic and time-stratigraphic units shown are those currently used at the Illinois State Geological Survey, it should be noted that recent and current studies in Illinois have yielded significant new data suggesting the probable need for future revisions of certain portions of the classifications, particularly the pre-Illinoian units.

Currently, the glacial deposits of east-central Illinois are assigned to three stages of continental glaciation: Kansan, Illinoian, and Wisconsinan. The deposits are also assigned to three formations: the Banner Formation (Kansan), the Glasford Formation (Illinoian), and the Wedron Formation (Wisconsinan). Each formation includes several members composed mainly of glacial till, glacial till and associated outwash, or outwash.

It has been demonstrated that each of the tills has distinctive physical and mineralogical properties; therefore, the determination of these properties by descriptive and laboratory analysis of representative samples provides data to identify, correlate, and map tills regionally. Since the physical characteristics of sand and gravel deposits vary greatly, it is normally difficult to correlate them from area to area without having an established framework of the tills to which they can be related. Clay mineral data may aid in relating a particular outwash to either the till above or below it.

One of the most helpful ways to delineate a succession of several tills is to establish the position of soils or other organic debris that formed during ice-free conditions. The Robein Silt (figs. 5, 7, and 8), which developed on the surface of Glasford Formation tills, generally provides an excellent marker horizon. Although the organic debris does not form a continuous blanket, it occurs frequently enough to permit contouring of the Glasford surface (fig. 7). Similar horizons occur at other positions, frequently on the surface of Banner Formation tills.

The aquifer maps (figs. 9-11) prepared for this study represent stratigraphic and mapping judgments based on the data available. During the course of the study, however, significant insight was gained on the regional stratigraphy, which should result in more precise mapping in the future. Also, this preliminary outlining of areas where potential aquifers may be present provides the focus for more detailed studies.

The specific aquifer maps (figs. 9-11) were developed by plotting thickness, elevation of the top, and depth to the top for each sand and gravel deposit reported in the log of each well or test hole. Also, the elevations of marker horizons such as organic zones were recorded. Once the till stratigraphy was established from control data, the aquifers were assigned a stratigraphic position determined by the nearest control well. Since relatively large quantities of data were available to define the top of the Robein Silt (fig. 7), which directly overlies the Glasford Formation, separation of the Wedron and Glasford Formations presented no significant regional problem. Since the amount of available data decreased with depth, it was not always clear which unit related to a given sand and gravel deposit in the lower part of the sequence. It became a matter of judgment, based on the evidence, whether to stratigraphically locate some aquifers within the Glasford or the Banner Formation.

The aquifer maps included in this report (figs. 9-11) are modified from 1:125,000 scale maps that show the depth to and thickness of sand and gravel penetrated for each recorded well in the outlined area. (A blue-line copy of these maps at the original scale is available at cost from the Illinois State Geological Survey.) With the exception of the well-defined Mahomet Sand Member (Banner Formation), the outlined areas suggest the best possibilities for locating sand and gravel. As a rule, any till or sand and gravel unit may be locally absent, either due to erosion or nondeposition, even though it is generally present within the area. Furthermore, outwash deposits are frequently variable, both vertically and horizontally (areally). It is not uncommon for outwash to range vertically from coarse sand and gravel at the base to fine sand and silt at the top (or vice versa). The same variation may take place horizontally even within a few tens of feet. Thus the maps prepared for this study must be considered probability maps.

This study indicates that significant aquifers are situated in several stratigraphic positions (figs. 5 and 8). The lowermost stratigraphically and most important regionally, the Mahomet Sand, occurs within the Banner Formation (fig. 9). Minor aquifers also occur locally within the Banner Formation but not necessarily at the same stratigraphic position. Within the Glasford Formation (fig. 10), possibly two aquifers are present. The lower aquifer at or near the base of the formation is a proglacial outwash related to the Vandalia Till Member. The upper aquifer, apparently restricted to the northwestern quarter of the area, is at the base of the Radnor Till Member and directly above the Vandalia Till Member. There is also some suggestion of an intra-Radnor outwash; and occasionally, a minor outwash is found at the top of the Radnor Till Member. The sand and gravel at the base of the Vandalia Till is the most significant aquifer aside from the Mahomet Sand. The principal aquifer within the Wedron Formation (fig. 11) is located at the base of the formation as a proglacial outwash of the Fairgrange (or Oakland) Till Member;

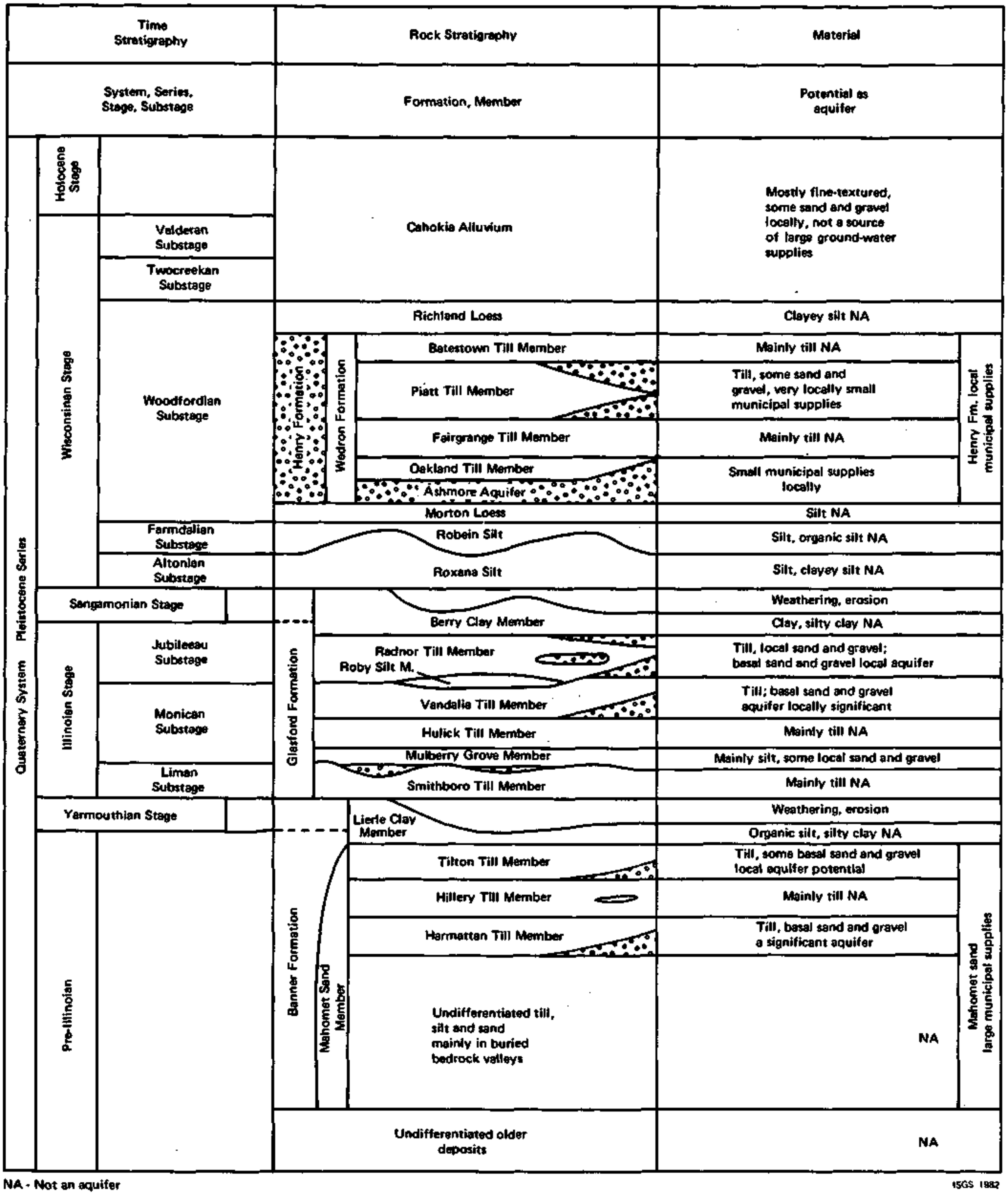

Figure 5. Stratigraphy of glacial and related deposits and their potential as aquifers.

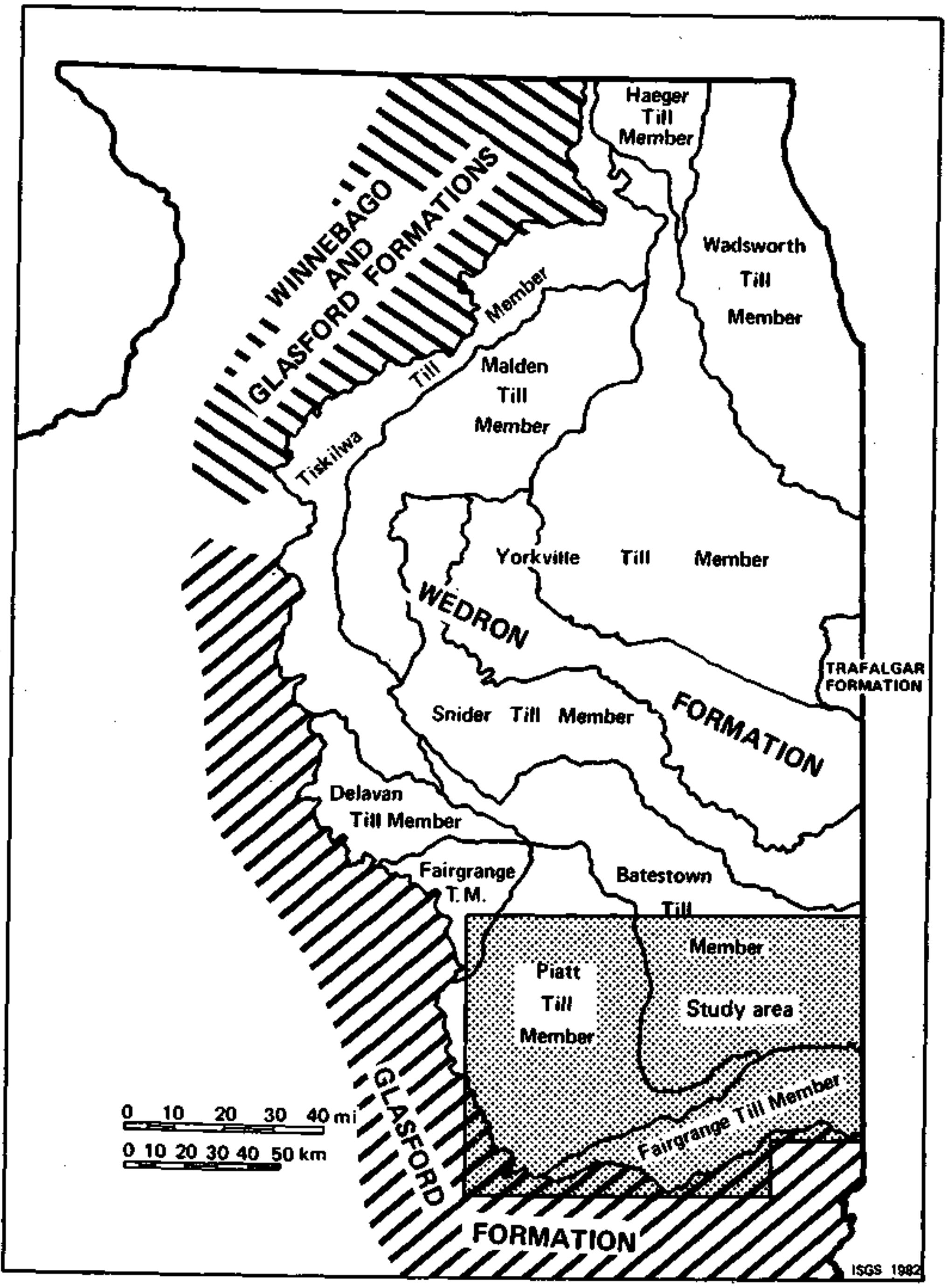

Figure 6. Areal distribution of the surficial till formations and members of Illinois (after Lineback, 1979).

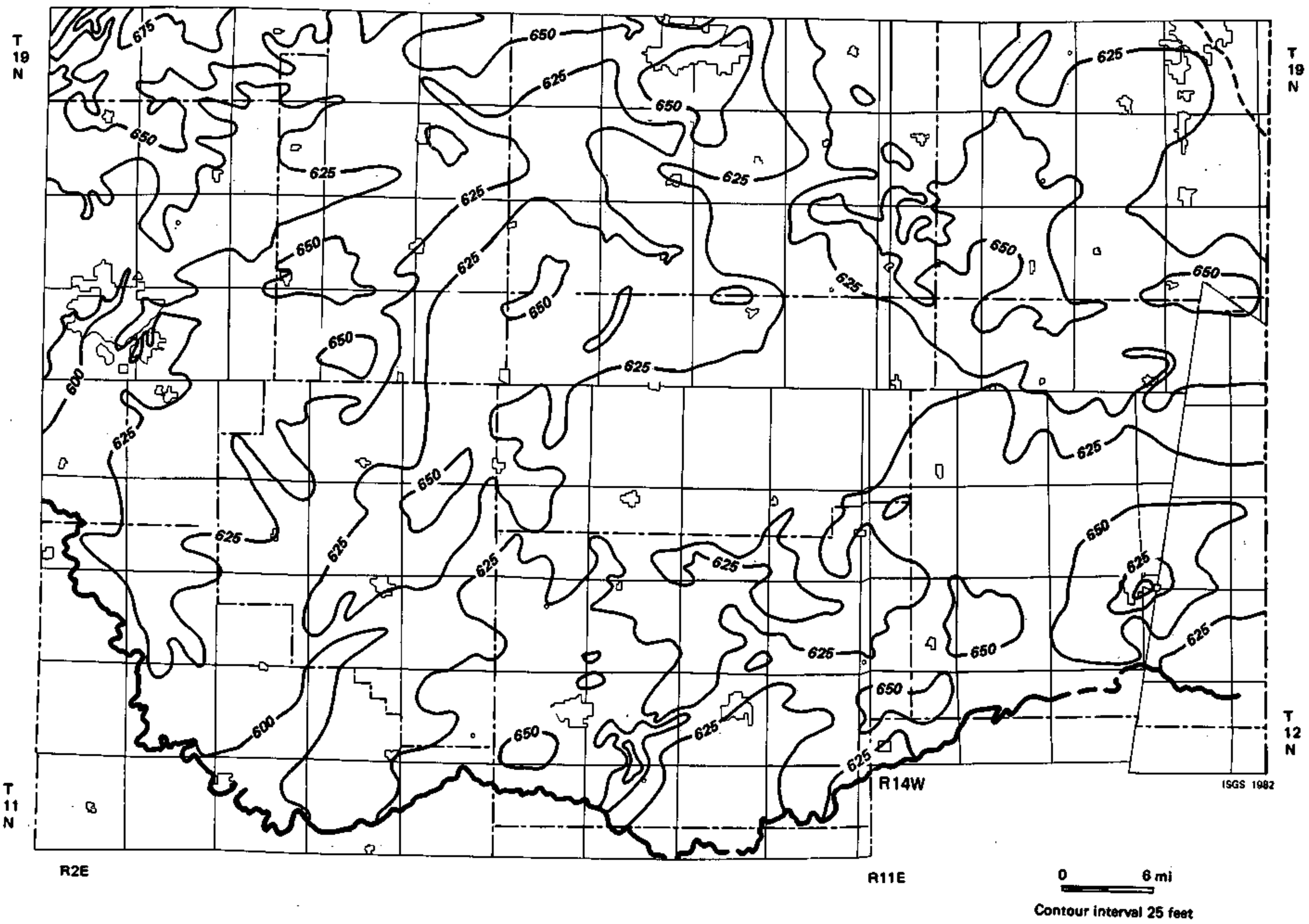

Figure 7. Elevation top of Robein Silt.

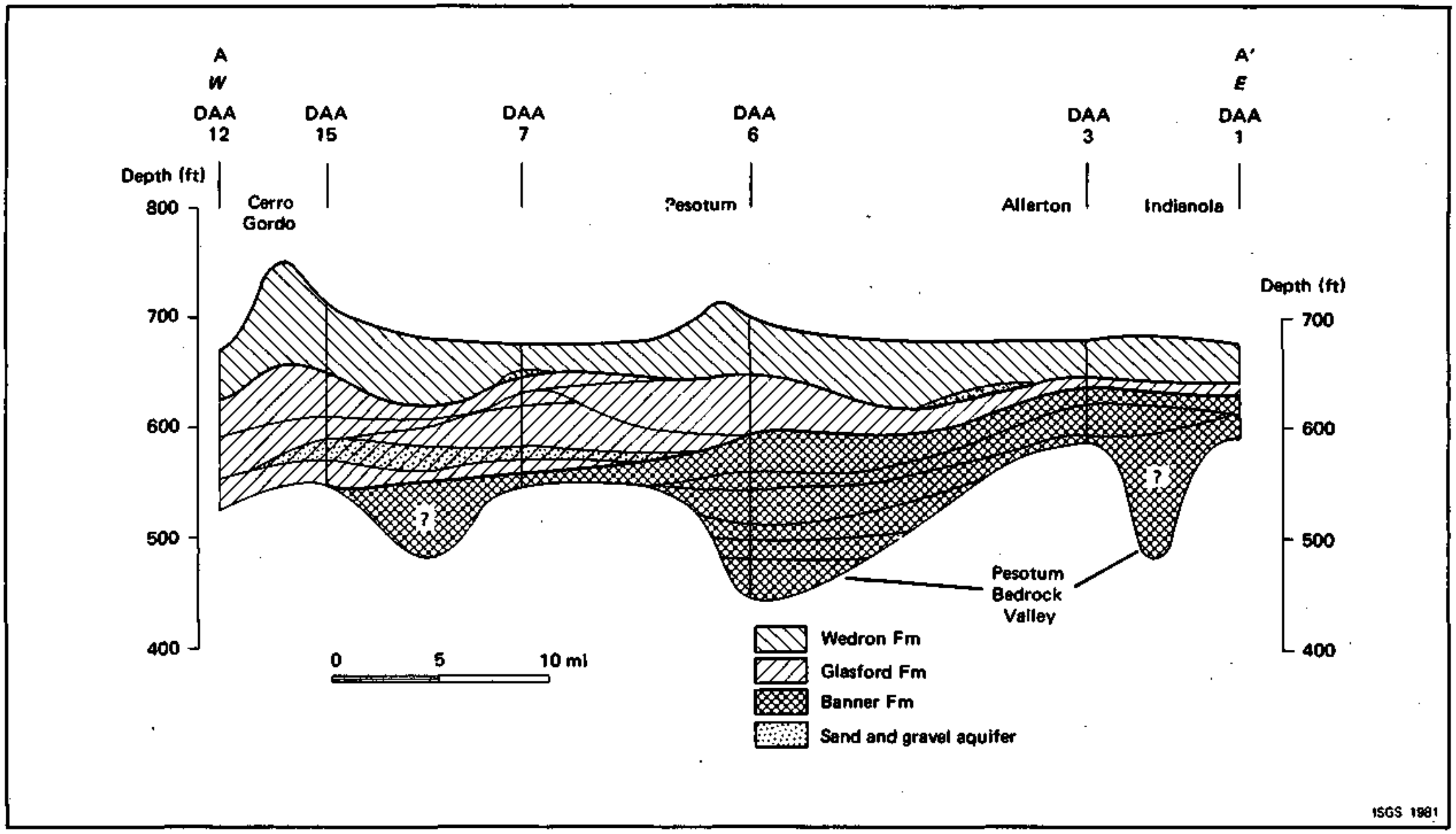

Figure 8a. AA' northern W—E cross section, Macon to Vermilion Counties.

Figure 8. Generalized regional cross sections. Lines of cross sections are shown on figure 1. (Vertical scale is greatly exaggerated.) Lines within formations represent breaks between stratigraphic units, indicating the presence of subsidiary nonaquifer units.

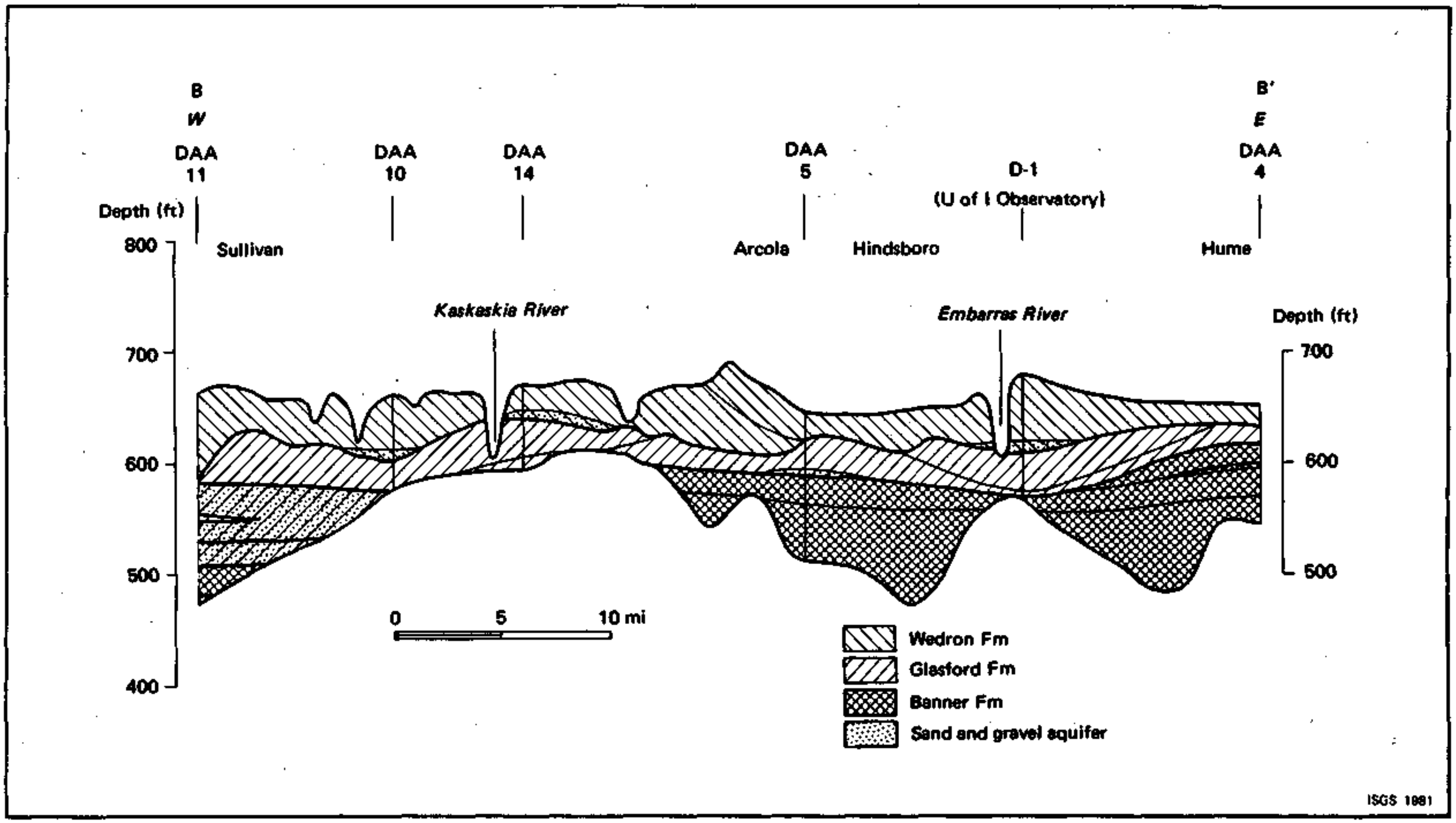

Figure 8b. BB' southern W—E cross section, Moultrie to Edgar Counties.

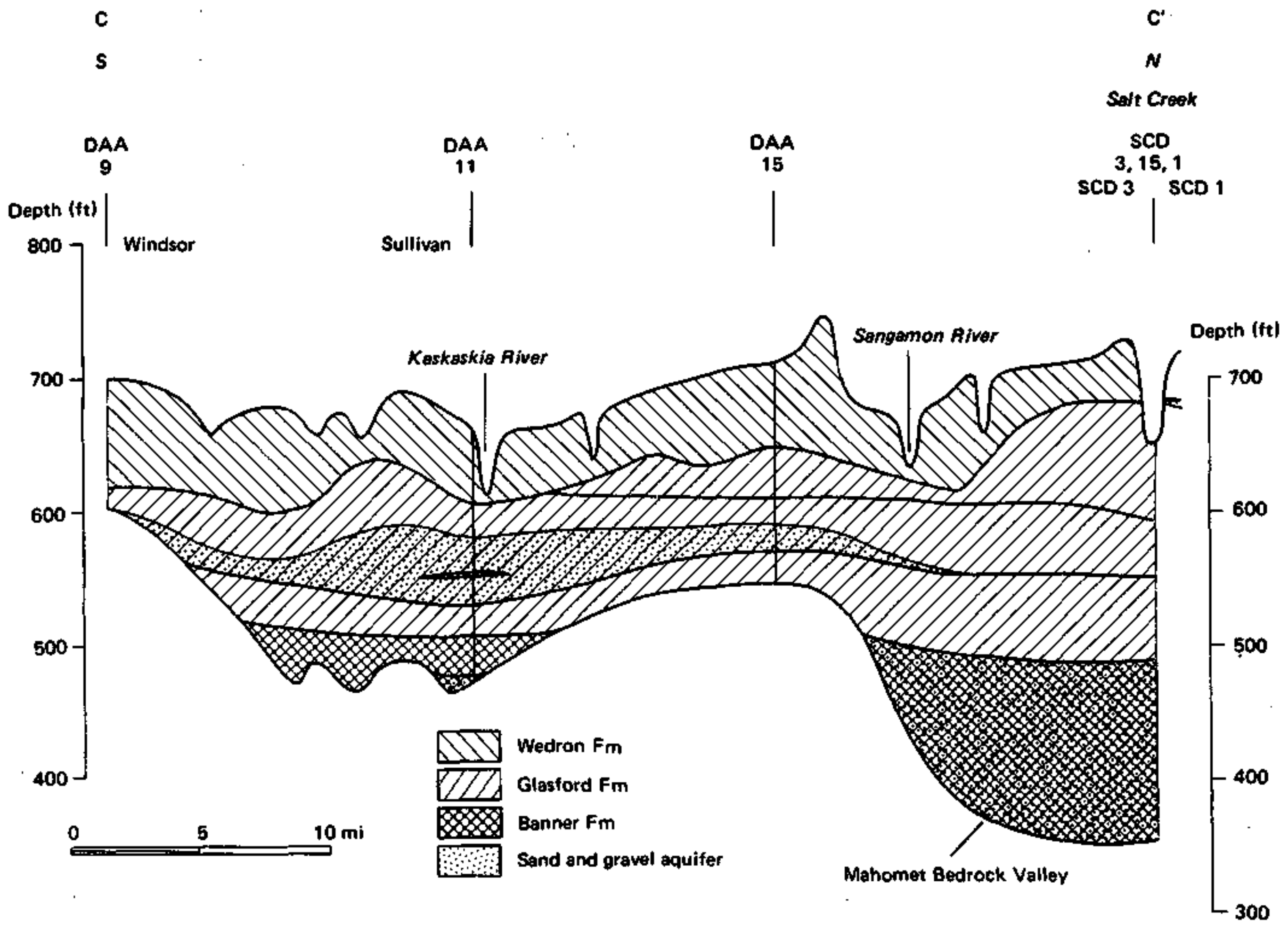

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Figure 8c. CC western S—N cross section, Shelby to De Witt Counties.

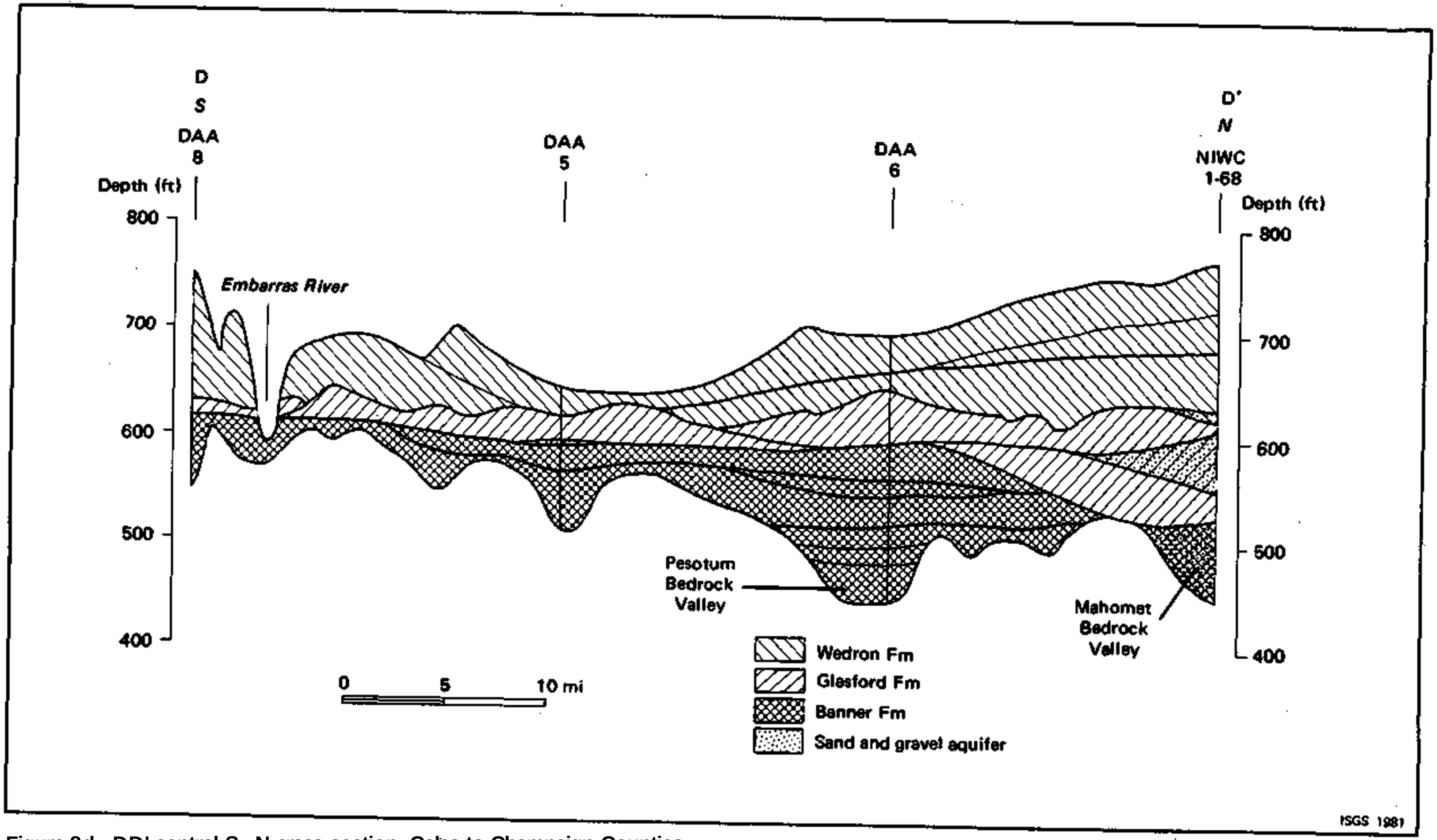

Figure 8d. DD' central S—N cross section, Coles to Champaign Counties.

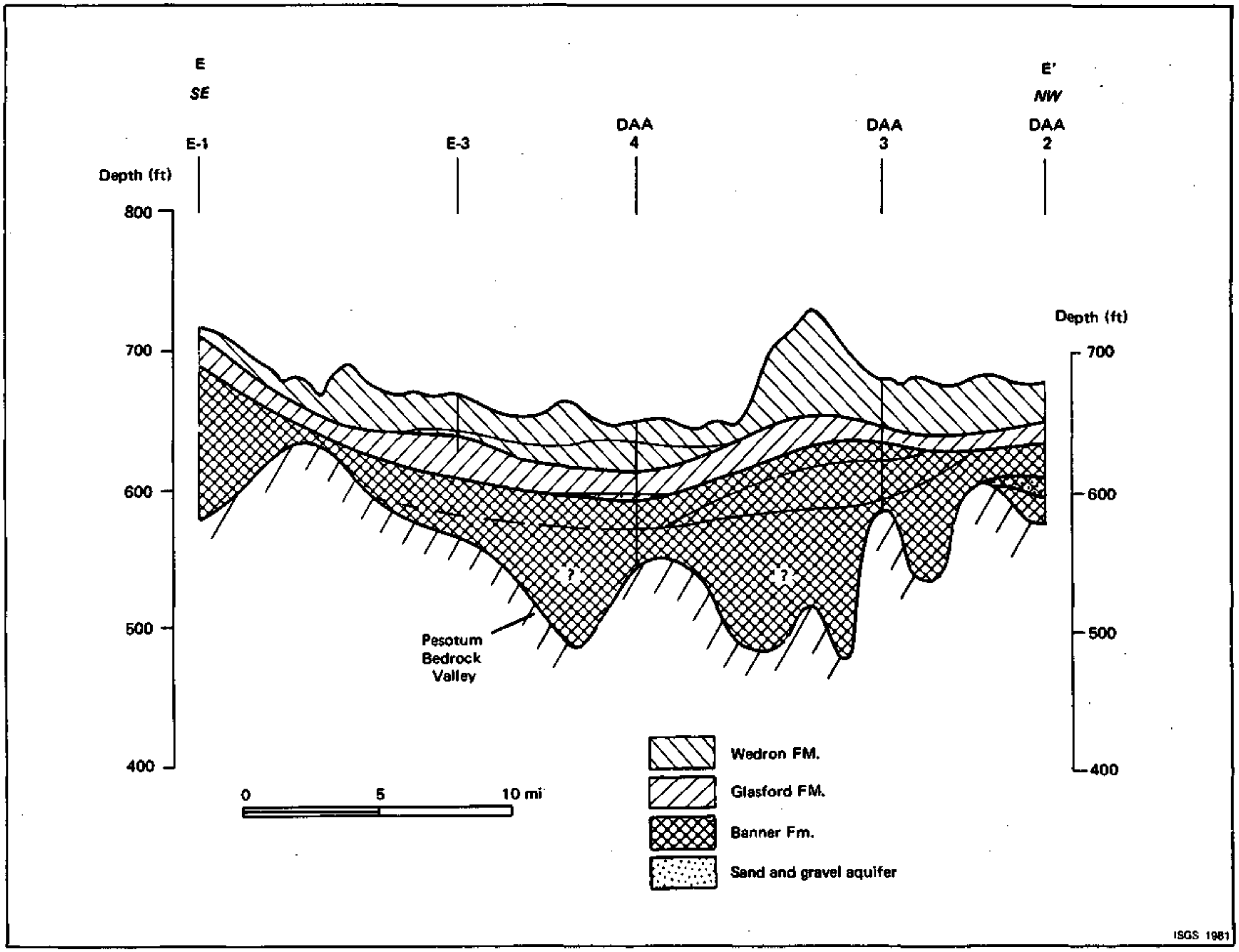

Figure 8e. EE' eastern S-N cross section, Edgar to Champaign Counties.

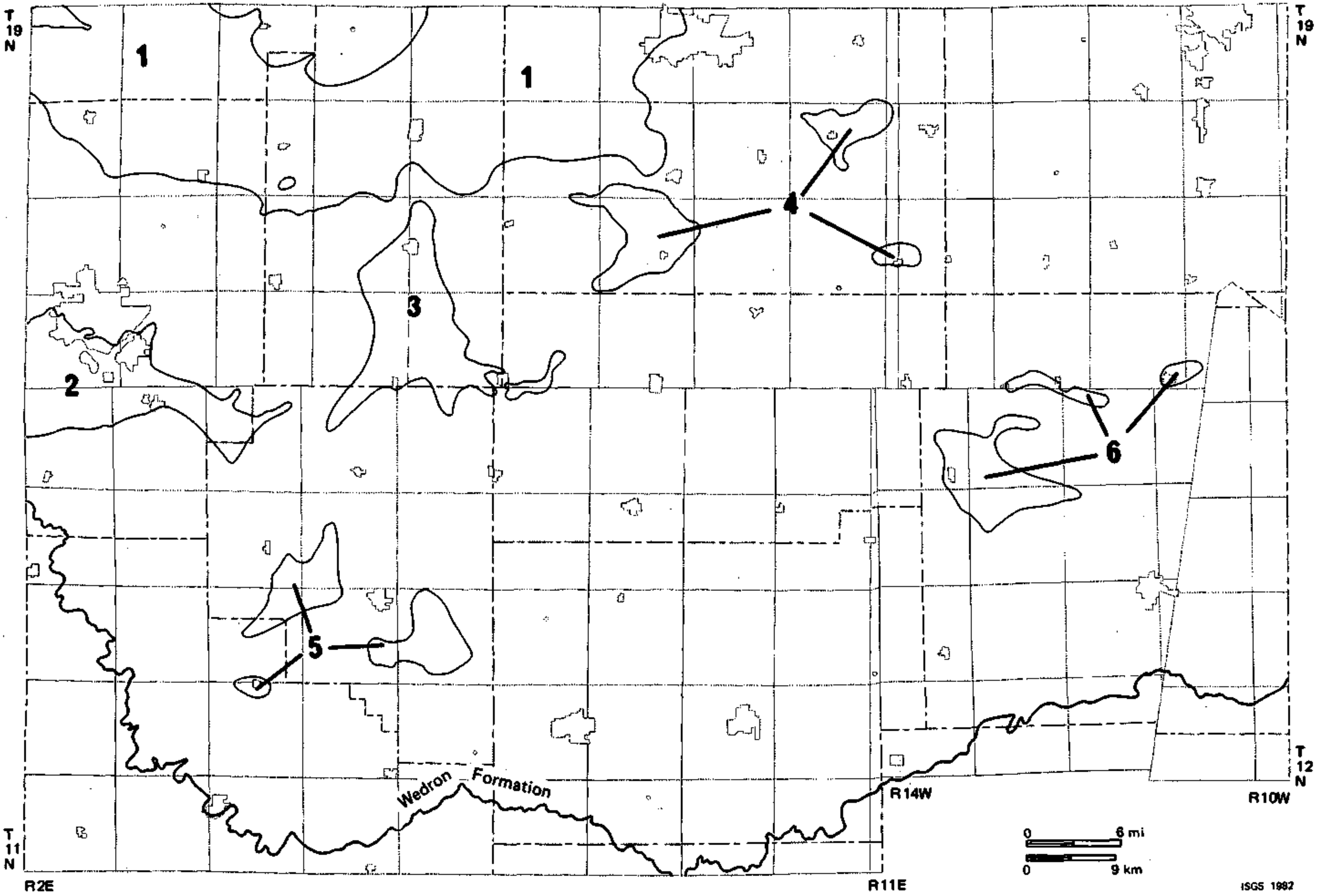

Figure 9. Banner Formation aquifers.

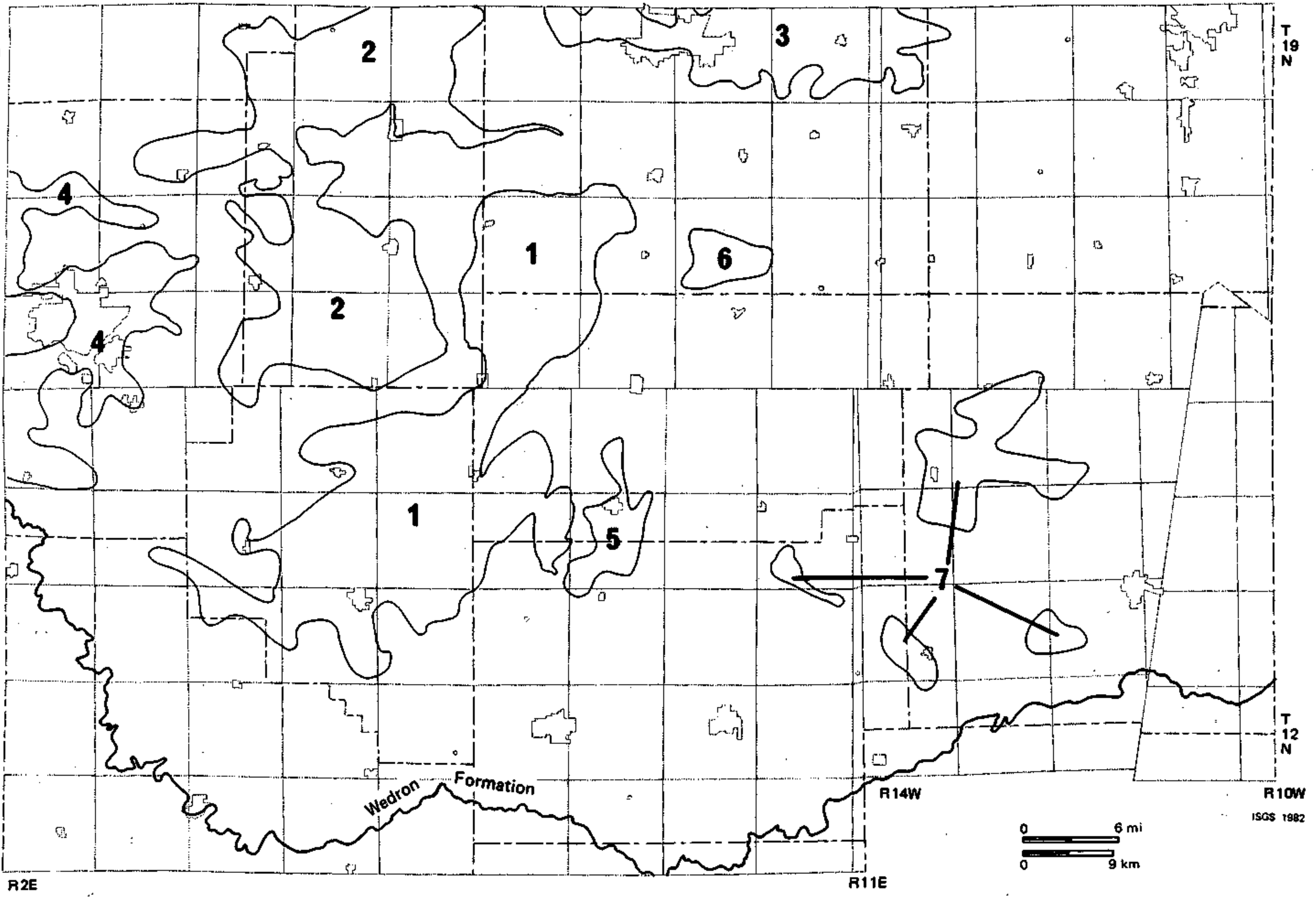

Figure 10. Glasford Formation aquifers.

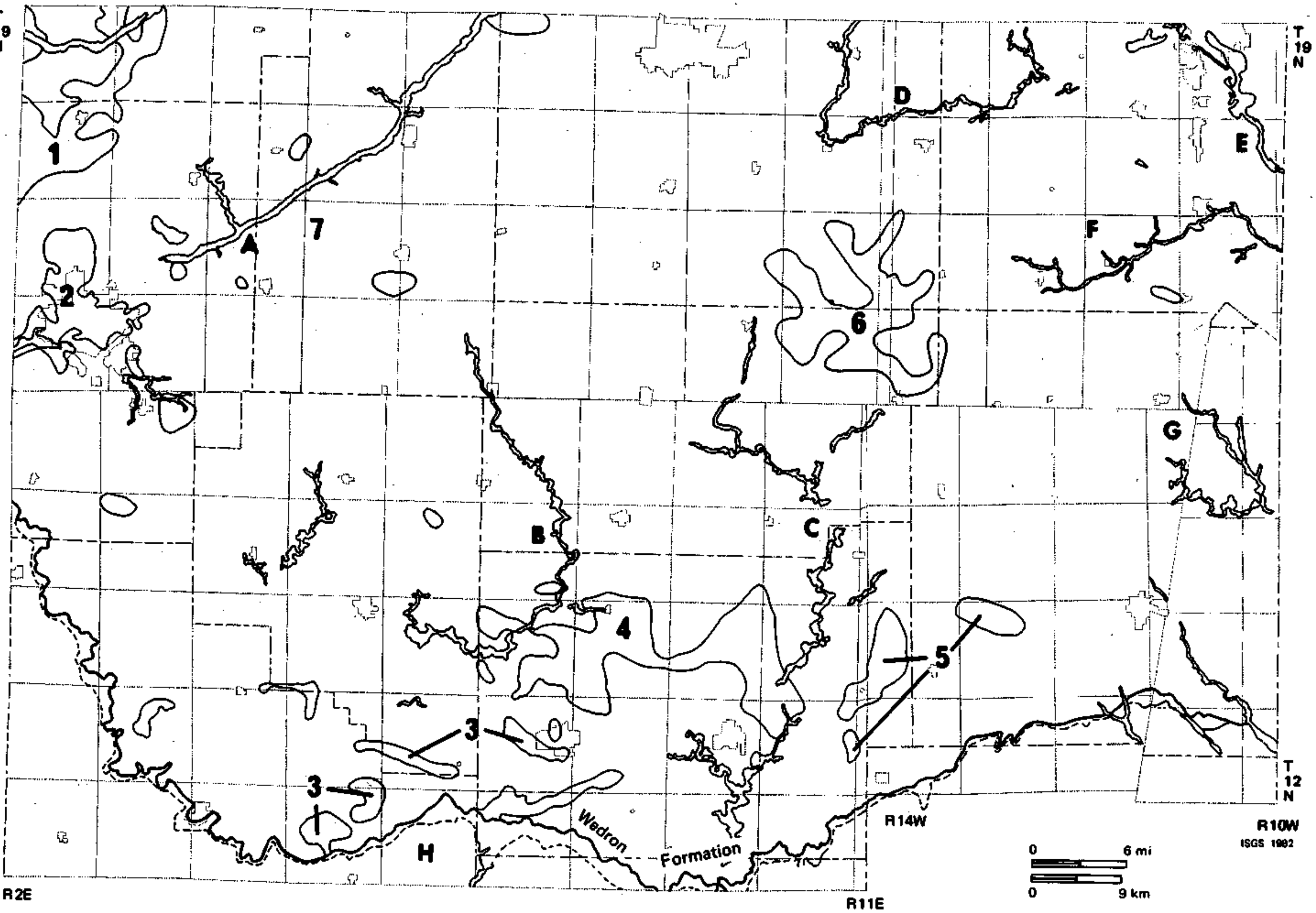

Figure 11. Aquifers in the Wedron Formation (map areas 1-7) and the Henry Formation (map areas A-H).

this outwash has been formally named the Ashmore Aquifer. The Ashmore occurs locally throughout east-central Illinois and is readily identified by its position directly above the Robein Silt. Also, local sand and gravel deposits thick enough to be utilized as an aquifer occur within or at the base of the Piatt Till Member. However, only one municipal well field (Cerro Gordo) is known to be finished in sand and gravel at this stratigraphic position.

Of some local importance is the occurrence of sand and gravel as valley-train outwash assigned to the Henry Formation (fig. 11) within the valleys of several rivers and streams that cross the region and run along the margin of the Wedron Formation. Normally these deposits are quite thin and narrow; locally, they may be 30 feet or thicker and up to 1 mile wide. As they have the advantage of being in discharge areas, wells developed in these deposits may also be pumped at a rate that will induce some recharge from nearby streams.

Stratigraphic and Areal Distribution

Banner Formation aquifers

The Banner Formation contains the most significant aquifer in east-central Illinois, the Mahomet Sand Member (fig. 9, map area 1). The Mahomet Sand is a thick extensive valley train deposit that fills the deeper parts of the Mahomet Bedrock Valley in the northwestern part of the study area (figs. 5, 8c, and 8d). It can generally be expected to fill the Mahomet Valley to an elevation averaging 500 feet and ranging from about 520 feet locally in central Champaign County to between 480 and 500 feet in De Witt County. Local variations are probably due either to surface erosion from overriding glaciers or to postdepositional stream erosion.

Since the top of the Mahomet Sand is at an elevation of approximately 500 feet, a reasonably accurate mapping of the bedrock topography (fig. 3) allows for preparing a rather accurate map of the areal extent of the unit, particularly where verified by logs of wells drilled along the margins. On this basis, the deposit may reach a maximum width of nearly 12 miles in Champaign and De Witt Counties, and a minimum of slightly more than 7 miles in central Piatt County. The average width of the unit is probably just under 10 miles in the study area.

In places where the bottom of the Mahomet Valley is below an elevation of 350 feet, the Mahomet Sand is often more than 150 feet thick. Where the surface of the unit has been eroded, the thickness will be less. Obviously, the Mahomet Sand thins toward the margins of the valley. Detailed maps of the thickness, elevation of the top, and extent of the unit in De Witt County are shown in Hunt and Kempton (1977).

One other factor affects the potential of the Mahomet Sand as an aquifer, particularly along the margins. While the deposit is primarily composed of clean sand and gravel with only minor amounts of fines (silt and clay), the unit frequently grades into sand and silty sand near the top (Horberg, 1953). This finer, upper portion ranges up to 50 feet thick, although only the upper 10 to 25 feet may be silty. Therefore, along the margins where the unit measures 50 feet thick or less, the water-yielding potential may be greatly reduced.

Bedrock valleys tributary to the Mahomet Valley do not appear to contain significant sand and gravel aquifers related to the Mahomet Sand. Rather, these valleys contain fine-textured water-laid sediments formed in lakes ponded by the aggrading outwash blocking their confluence with the Mahomet Valley. Consequently, the Mahomet Sand is confined to the main part of the Mahomet Valley.

The distribution of Banner Formation aquifers throughout the remainder of the region is quite restricted (fig. 9). Although several small areas are mapped (fig. 9, map areas 2-6), there is generally little information to provide firm stratigraphic positioning or to adequately define their boundaries. Map areas 2, 3, and 5 of figure 9 may include portions of the overlying Glasford Formation aquifers. Map areas 4 and 6 (fig. 9) are probably within the Banner Formation, but their precise stratigraphic position is not clearly established. Scattered throughout the area are wells finished in sand and gravel, particularly within the eastern half of the study area; however, the sand and gravel is generally thin and the aquifers do not appear to be extensive.

Glasford Formation aquifers

Aquifers of the Glasford Formation have been identified in two or more stratigraphic positions (fig. 5). The principal and deepest of these is at the base of the Vandalia Till Member, which is also the base of the Glasford Formation over much of the study area. A shallower intra-Glasford aquifer in north-central Moultrie County and central Macon County is present between the Radnor and Vandalia Till Members (Burris, Morse, and Naymik, 1981). In southwestern Piatt County, limited data indicate the possibility of a localized shallow Glasford aquifer.

The top of the principal aquifer in the western half of the region has been encountered at elevations ranging from about 570 feet to above 635 feet, perhaps due to the variable surface of a single stratigraphic unit. However, in a few well logs, two distinct sand units were recorded within this range of elevation. A cluster of these wells is in northeastern Moultrie County. Although many of the wells that end in sand at the higher elevations are not deep enough to indicate whether or not a second aquifer exists, it is probable that a substantial portion of the area mapped for aquifer potential in the Glasford Formation contains more than one aquifer. Reported thickness of Glasford aquifers in the study area varies from less than 5 feet to greater than 60 feet, suggesting that some of the areas of greater thickness may be a result of one sand and gravel unit deposited directly over another.

The elevation of the Glasford aquifer in Macon County (fig. 10, map area 4) decreases to the south where it overlaps an area mapped as a Banner Formation aquifer. Also a few logs report that sand and gravel up to 60 feet thick is continuous from the base of the Wedron Formation to bedrock. Since stratigraphic data are sparse, there is some question as to exactly where the boundaries of the Banner, Glasford, and Wedron Formation aquifers should be. This overlap of mapped units will have to be resolved with additional data and further study of the area.

Two large, irregular map areas of the Glasford aquifer occupy much of Moultrie and Piatt Counties as well as parts of surrounding counties (fig. 10, map areas 1 and 2). Again, data was insufficient to determine precise boundaries. In fact, these two areas may be connected. The significance of the Glasford aquifer in the northwestern part of the region (fig. 10, map area 2) may not be as great where it overlies the Mahomet Sand, although it provides water for domestic wells. In the rest of the western half of the study area, the Glasford aquifer is a major aquifer, second only to the Mahomet Sand.

In most of *the* eastern half of the region (fig. 10, map areas 6 and 7), the Glasford Formation is thin. Glasford aquifers of mappable size do not exist except in small, isolated patches with poorly defined boundaries. The elevation of the top of the aquifer is generally higher in this half of the study area, ranging from about 600 feet to about 650 feet in Edgar County. Thickness is variable but averages about 10 feet.

In Champaign County, east of Urbana (fig. 10, map area 3), many wells penetrate sand and gravel as thick as 15 to 30 feet or more. The aquifer in this area is the source of municipal supplies. However, texture is quite variable, ranging from mainly coarse sand and gravel in the western half of area 3 to fine-textured sand and gravel to sand in the eastern part. It is locally more than 70 feet thick in the western half of map area 3.

Wedron Formation aquifers

Although the Wedron Formation is locally more than 150 feet thick and averages about 60 feet thick, the distribution of sand and gravel aquifers is quite limited within it. The principal aquifer is the Ashmore (fig. 5) situated at the base of the Wedron in scattered locations throughout the region (figs. 8 and 11). The Ashmore Aquifer is a tabular outwash sand and gravel generally averaging about 10 feet thick; however, it has been reported to be 50 feet thick at some sites. In some places, the Ashmore may be a fine silty sand, and in others, a relatively coarse gravel and sand.

In map areas 1-7 (fig. 11), the Ashmore is well developed. Although it is present at other locations scattered throughout the region, the data is insufficient and/or the area is too small or uncertain to map. Small municipal or commercial-industrial groundwater supplies are obtained from the Ashmore in most areas outlined on figure 11.

Surficial aquifers

The Henry Formation, also shown on figure 11 in map areas A-H, consists of surficial sand and gravel that is found mainly as relatively narrow deposits in many of the present stream valleys (map areas A-G) or as a rather narrow, discontinuous outwash plain formed at the margin of the Wedron Formation (map area H). Modern stream alluvium (Cahokia Alluvium, fig. 8) normally overlies the Henry Formation within the floodplain of depositing streams but was not distinguished from the Henry for this study. The alluvium may be composed of redeposited sand and gravel of the Henry Formation, although generally its principal components are silt and sand. All areas are quite variable in thickness, ranging from a few feet to 50 feet thick.

The Henry Formation is thickest and best developed along river valleys. Wells developed in it are relatively shallow and have the advantage of being in a regional discharge area while at the same time providing the potential for induced recharge from the nearby stream.

Summary of Aquifer Distribution

Figure 12 summarizes the distribution of all sand and gravel aquifers that have been mapped in the region studied. The dark shading represents the areal distribution of the Mahomet Sand whereas the light shading represents the areal distribution of all other significant sand and gravel, except for the Henry Formation aquifers. These were not shown on figure 12 because of scale limitations but are shown on figure 11.

A brief inspection of figure 12 shows that the most extensive aquifers are concentrated in the western half of the region studied. Of these, the Mahomet Sand is by far the most predictable and significant; however, smaller areas mapped for aquifer potential have local importance. In fact, a sizeable portion of the land underlain by the Mahomet Sand contains shallower aquifers as well (figs. 10 and 11). In the eastern half of the region, the Banner Formation comprises a high percentage of the local drift, although Banner Formation aquifers are rare. The aquifer potential of the relatively thin Glasford and Wedron Formations is also limited. This combination of circumstances accounts for the infrequent occurrence of sand and gravel aquifers in the eastern part of the region.

The larger aquifer areas, in addition to the Mahomet Sand, are generally expected to be continuous, and therefore predictable. However, local variation in thickness and texture is not as yet predictable. The presence of a suitable aquifer at any given site within areas mapped for potential aquifers must be verified by additional data (resistivity survey, test drilling) prior to planning or developing a well or well fields.

There is a significant distinction between map areas labeled L and N on figure 12. Areas designated asN (no sand and gravel aquifers reported) were determined primarily

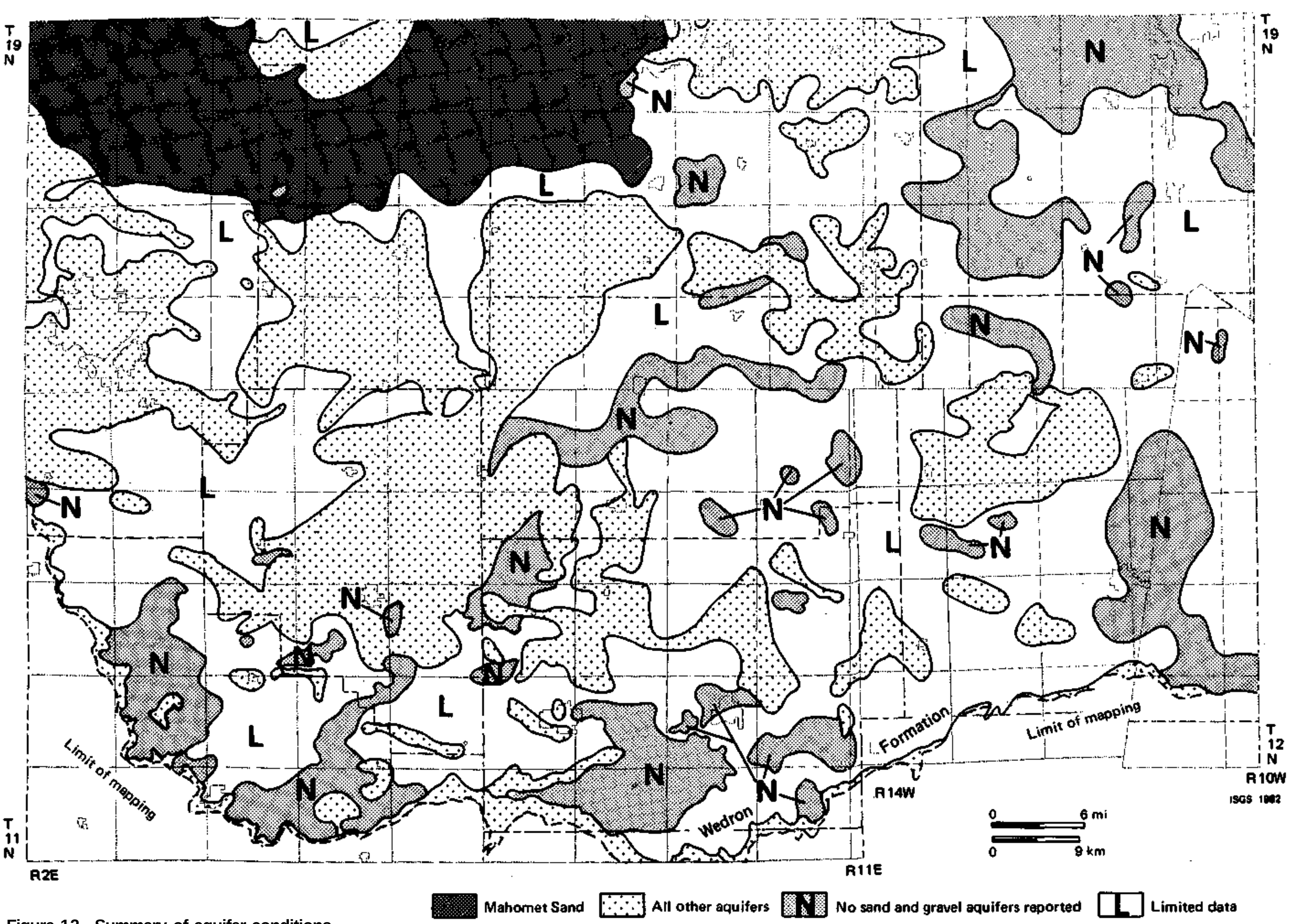

Figure 12. Summary of aquifer conditions.

on the basis of available well logs: If several wells clustered within a specific locality encountered no sand and gravel deposits more than 5 feet thick, the area was outlined as N. Other factors, such as thin drift, bedrock outcrops, quarries, and strip mines have been included in the N category, if well data provided verification. These areas, therefore, have the least probability of containing aquifers capable of yielding municipal groundwater supplies.

In map areas labeled L (fig. 12), well data are sparse, and there is no clear cut evidence to determine whether significant aquifers are present at any stratigraphic position. Extrapolation of mapped aquifer or nonaquifer boundaries beyond the areas established by substantial data could be misleading. Areas labeled L, while not expected to contain extensive and significant aquifers, have greater potential than N areas. Communities or other users of large groundwater supplies should carefully evaluate their current situation prior to exploring for new or supplementary groundwater supplies in areas labeled L, and particularly, in areas labeled N. If located near mapped aquifers, consideration should be given to exploration in these areas first. Finally, communities located near the mapped boundary of the Mahomet Sand and within economic water transport distance may wish to consider developing wells in that aquifer if their present supply is marginal, even where located over or near other mapped aquifers. In the future, however, as competition for water from the Mahomet Sand grows, the exploration for local sources may become more desirable.

HYDROLOGIC APPRAISAL OF AQUIFERS

While much can be determined about an aquifer from a strictly geologic appraisal of its stratigraphic position, boundaries, and physical characteristics, a knowledge of the hydraulic properties of an aquifer system is necessary to provide more specific information on the amount of water available from the system. Ultimately, combination of geologic and hydrologic appraisals of the aquifer will provide the best estimate of an aquifer's performance.

Hydraulic Properties

In the study area, the principal hydraulic properties influencing well fields, particularly the water-level response to pumpage, are the hydraulic conductivity, the transmissivity, and the storage coefficient. In some locations, such as the Banner and Glasford Formation aquifers at Champaign-Urbana and the Glasford Formation aquifer at St. Joseph, the vertical hydraulic conductivity of the confining beds also plays an important role.

The capacity of a material to transmit groundwater is expressed by the transmissivity, T, which is defined as the rate of water flowing through a vertical strip of the aquifer; the vertical strip is of unit width and extends the full saturated thickness of the aquifer under a unit hydraulic gradient at the prevailing temperature of the water. Transmissivity is calculated by multiplying the saturated thickness, m, of the aquifer by the hydraulic conductivity, K, defined as the rate of water flowing through a unit cross-sectional area of the aquifer under a unit hydraulic gradient at the prevailing temperature of the water.

The storage properties are expressed by the storage coefficient, S, which is defined as the volume of water released from or taken into storage per unit surface area of the aquifer per unit change in head normal to that surface. For a confined or artesian aquifer, in which water levels rise above the top of the aquifer in wells penetrating the aquifer, water released from or taken into storage is attributed solely to compressibility properties of the aquifer and water. Such coefficents are usually very small (generally 10^{-5} to 10^{-3}). On the other hand, for unconfined or water-table aquifers, in which water levels in wells represent the top of the saturated thickness of the aquifer, water released from or taken into storage is attributed almost entirely to gravity drainage or refilling of the zone through which the change of the water table takes place. A small portion of the water volume change results from compressibility of the aquifer and water, as in the artesian case, but this volume is proportionately insignificant. The storage coefficient in water-table aquifers is often referred to as the specific yield, and typically ranges in value from about 0.05 to 0.3.

The rate of vertical leakage of groundwater through a confining bed in response to a given vertical hydraulic gradient is dependent upon the vertical hydraulic conductivity of the confining bed, K In cases where the confining bed is not well defined or is unknown, the ratio K'/m' (where m' is the thickness of the confining bed) is used. This ratio, termed the leakage coefficient by Hantush (1956), is defined as the quantity of water that crosses a unit area of the interface between an aquifer and its confining bed divided by the head loss across the confining bed.

Aquifer tests

The hydraulic properties of aquifers and confining beds may be determined by means of aquifer tests wherein the effect of pumping a well at a known constant rate is measured in the pumped well and in observation wells penetrating the aquifer. Graphs of drawdown versus time or drawdown versus distance from the pumped well are used to solve formulas that express the relation of the hydraulic properties of an aquifer and its confining bed, if present, to the lowering of water levels (drawdown) in the vicinity of a pumping well. Graphic analysis may utilize the leaky artesian formula (Hantush and Jacob, 1955), the nonequilibrium formula (Theis, 1935), or the modified nonequilibrium formula (Cooper and Jacob, 1946). Type-curve and straight-line methods for graphic analysis were described by Walton (1962). Test data collected under water-table conditions may be analyzed by methods devised by Boulton (1963) and described by Prickett (1965). Where hydrogeologic boundaries are

TABLE 1. SUMMARY OF LEAKAGE COEFFICIENTS AND VERTICAL HYDRAULIC CONDUCTIVITY IN STUDY AREA

County and well number	Aquifer†	Leakage coefficient (gpd/ft^3)	Confining bed	Confining layer thickness (ft)	Vertical hydraulic conductivity (gpd/ft^2)
CHM					
19N8E					
5.1gl	Ban (M)	0.00509	"Hardpan"?	35	0.178
18.3d	Ban(M)	0.0061	"Sandy clay"	35	0.214
18.4d	Ban (M)	0.00836	"Dirty sand and gravel"	50	0.42
19N10E					
14.6h	Glas	0.001	Till	35	0.035
PIA					
18N5E					
30.7a	Ban (M)	0.00111	"Clay"	75	0.083

† Ban (M) = Banner Formation, Mahomet Sand Member
Glas - Glasford Formation

known to exist, their effect on drawdowns can be determined by means of image-well theory described by Ferris (1959).

Controlled aquifer tests in glacial drift aquifers have been made at 107 sites in the study area since 1949. Tests involving only the pumped well were made at 62 of the sites. The effects of leakage were negligible during most of these tests, and analysis was limited to the use of nonleaky or modified nonequilibrium formulas. The storage coefficient was not determined from pumped well data, since considerable error is involved in estimating the effective radius of the well. The results of the test analyses involving nonleaky methods are listed in Appendix 1. Leakage parameters determined from five tests are summarized in table 1.

Walton (1965) summarized coefficients of vertical hydraulic conductivity (K') for confining layers of glacial drift and bedrock in several areas of northeastern, central, and western Illinois. Coefficients were computed from aquifer tests, flow-net analyses, and model-aquifer analyses. Walton found that values of K' for drift deposits consisting largely of sand and gravel exceeded 1.0 gpd/sq ft and averaged 1.31 gpd/sq ft. As the clay content increased, values of K' decreased, averaging 0.25 gpd/sq ft when considerable sand and gravel was present and 0.03 gpd/sq ft when little sand and gravel was present. No similar attempt was made in this report to correlate K' values with confining bed lithology. Walton's findings are given in table 2.

TABLE 2. SUMMARY OF LEAKAGE COEFFICIENTS AND VERTICAL HYDRAULIC CONDUCTIVITY IN ILLINOIS (FROM WALTON. 1965)

Lithology	Leakage coefficient (gpd/cu ft) range	Vertical hydraulic conductivity (gpd/sq ft) range	average
Drift, sand and gravel, some clay and silt	0.034 to 0.23	1.02 to 1.60	1.31
Drift, clay and silt with considerable sand and gravel	0.0061 to 0.052	0.10 to 0.63	0.25
Drift, clay and silt with some sand and gravel	0.000083 to 0.005	0.01 to 0.08	0.03
Drift, clay and silt with some sand and gravel and dolomite	0.000045 to 0.00032	0.005 to 0.011	0.008
Drift, clay and silt with some sand and gravel and shaly dolomite	0.000051	0.005	0.005
Dolomite shale	0.00000025	0.00005	0.00005

Specific capacity analyses

One means of expressing the yield of a well is by use of the term specific capacity, defined as the yield of the well in gallons per minute per foot of drawdown for a given pumping period and discharge rate. Walton (1962) showed that the Theis nonequilibrium formula can be expressed in terms of the theoretical specific capacity of a well discharging at a constant rate in a homogeneous, isotropic, areally infinite, nonleaky aquifer.

The theoretical specific capacity of the well varies with the radius of the well and the pumping period. For instance, a 30-inch diameter well has a specific capacity about 13 percent greater than that of a 12-inch diameter well. The theoretical specific capacity decreases with the length of the pumping period, since drawdown continuously increases with time.

Since drawdown is greater in wells that do not completely penetrate an aquifer than in fully penetrating wells, drawdown data must be corrected for the effects of partial penetration using methods described by Butler (1957). Under water-table conditions, observed drawdown must also be adjusted to account for the decrease in saturated thickness. A correction formula proposed by Jacob (1944) can be applied in such cases.

Finally, head losses within the well, known as well losses, must be accounted for before drawdown data can be used in the specific capacity formula to estimate hydraulic properties. Jacob (1946) and Rorbaugh (1953) described graphic methods to compute the well-loss coefficient from data collected during a step-drawdown test in which the well is operated during several successive and equal time periods at constant fractions of full capacity.

Specific capacity data collected during production tests of 194 wells are also summarized in Appendix 1, along with the aquifer test data. The theoretical specific capacity was estimated by correcting the observed specific capacity, as necessary, for well loss, dewatering, and partial penetration. The transmissivity was then obtained from the relationship between transmissivity and specific capacity determined by the modified nonequilibrium formula (Walton, 1962). To solve this formula, the storage coefficient must be assumed, depending upon whether a water-table or artesian aquifer is being tested. Because of the imprecise nature of all the above data corrections, transmissivities and hydraulic conductivities derived from specific capacities are considered only approximations. If the saturated thickness is also uncertain, the resulting value of hydraulic conductivity can be unusually low. Such values were not included in Appendix 1.

Summary of hydraulic properties

Table 3 gives ranges of the transmissivity, hydraulic conductivity, and storage coefficient as determined from aquifer tests in glacial drift aquifers within the study area. Specific-capacity data are also summarized in table 3;

TABLE 3. SUMMARY OF AQUIFER-TEST AND SPECIFIC-CAPACITY DATA

	Aquifer tests				Specific-capacity data			
	Transmissivities *(gpd/ft)*	Hydraulic conductivities *(gpd/sq ft)*		Storage coefficients	Unadjusted specific capacities *(gpm/ft)*	Transmissivities *(gpd/ft)*	Hydraulic conductivities *(gpd/sq ft)*	
	range	range	median	range	range	range	range	median
Henry Fm	825-256,000	206-6,400	775	0.00049-0.1	3.1-66.2	8,100-115,000	550-7,200	2,375
Ashmore outwash	990-30,800	400-2,350	1,298	0.00018-0.0068	0.4-26.3	270-38,000	45-4,250	790
Glasford Fm	1,146-233,000	112-4,660	885	0.00001-0.11	0.4-110	270-298,000	120-9,600	750
Mahomet Sand (Banner Fm)	70,800-325,000	1,840-4,780	2,920	0.0001-0.0023	2.0-207	4,700-710,000	160-7,750	3,025
Other aquifers (Banner Fm)	950-117,500	120-2,650	905	0.00013-0.0018	0.2-40.0	300-98,000	80-5,000	480

ranges are given for unadjusted (observed) specific capacities, transmissivities, and hydraulic conductivities.

Several features appear to characterize the hydraulic properties in the various formations. Hydraulic conductivites are highly variable in the shallower deposits even within well fields, but they tend to be less variable with depth. Also, hydraulic conductivites increase in the deeper Mahomet Sand. Storage coefficients in the Wedron/Henry and Glasford Formations vary in magnitude from artesian to water-table values, whereas the more deeply buried Banner Formation and Mahomet Sand remain under artesian conditions, as reflected in their artesian storage coefficients.

Appraisal of Aquifers

Phase 1 of an assessment of public groundwater supplies outside of the six-county Chicago metropolitan area (Visocky et al., 1978) found that many communities had supplies considered either marginal or deficient at that time; eight of these are in the study area. Forty-nine communities in the study area had adequate supplies (table 4). In order to assess the groundwater availability and provide a base for future planning, an appraisal of the production rates was made for each aquifer system.

Banner Formation

Sixteen municipalities tap Banner deposits as their sole source of water, and five others obtain at least a portion of their water from the Banner. With the exception of Oakwood (Vermilion County) and Broadlands (Champaign County), which combines Ashmore and Banner sources, all of the Banner or Banner-combination supplies in the study area are adequate. Present withdrawals range from 15,000 gpd at Camargo (Douglas County) to over 15 mgd at Champaign-Urbana. Champaign-Urbana is supplied chiefly from the Mahomet Sand Member. The largest supply furnished by Banner deposits other than the Mahomet Sand is at Sullivan (600,000 gpd). Individual pumping rates range from 6 to 1,050 gpm, and go as high as 3,500 gpm in the Mahomet Sand. In the study area, the Mahomet Sand is certainly the most productive and dependable source of groundwater supplies.

Glasford Formation

Twenty-two communities obtain their water from Glasford aquifers, and three others obtain a portion of their supply from these deposits. The supplies at all but three (Homer, Hindsboro, and Oreana were marginal) were assessed as adequate. Withdrawals range from 10,000 gpd at Redmon (Edgar County) to 200,000 gpd at Arthur (Douglas County), while pumping rates from wells range from 5 to 1,000 gpm. In terms of production capability, the Glasford Formation contains the second most important aquifer in the study area.

Wedron Formation

Ten public groundwater supplies are derived wholly from Wedron deposits, principally from the Ashmore Aquifer. At four other communities, supplies come from combined sources. As mentioned previously, the combined supply at Broadlands as well as at Windsor (Shelby County) was determined to be marginal, and the supply at Lerna (Coles County) was assessed as deficient. All other supplies are adequate. Present withdrawals range from 4,500 gpd at Vermilion (Edgar County) to 107,500 gpd at Windsor. Ridge Farm (Vermilion County) and Newman (Douglas County) pump 114,000 gpd from combined supplies, which include Wedron deposits. Well yields range from less than 10 to 485 gpm in Wedron deposits.

Henry Formation

Only three communities obtain water from Henry Formation deposits. The supply at Indianola (Vermilion County), currently averaging 18,000 gpd in withdrawals, is considered adequate; when withdrawals were higher, it was marginal. The supply at Sidell (Vermilion County) averages 35,000 gpd and is considered adequate. Shelbyville also has a sufficient supply with an average 850,000 gpd. Well yields from the Henry Formation aquifers vary from 25 to 550 gpm.

Summary of Test Well Program

Seven test wells were drilled from the purpose of evaluating Banner, Glasford, and Ashmore deposits in the study area (wells DAA 16-22, fig. 1, and Appendix 3). Two wells, DAA 16 (CHM 18N10E-22.8f) and DAA 17 (EDG 14N 13W-18.1a), encountered Banner deposits; however, the material encountered was suitable for setting screen and testing only at the first site. In well DAA 16, 5 feet of #25-slot (0.025-in.) screen was set between 127 and 132 feet, and a 3-hour production test was conducted May 5, 1980. Pumpage was held at a constant rate of 45 gpm, and at the end of 3 hours, the observed drawdown was 7.49 feet from a nonpumping level of 8.48 feet below land surface. Graphic analysis of time-drawdown data from the test determined the aquifer transmissivity and hydraulic conductivity to be 22,400 gpd/ft and 1,318 gpd/ft^2, respectively, based on a saturated thickness of 17 feet. The data also revealed the presence of barrier boundaries that limit the areal extent of the aquifer and limit its development. It was estimated that on a long-term, continuous basis the well was capable of supplying 20 gpm.

Two wells, DAA 18 (DGL 16N14W-6.6a) and DAA 19 (COL 12N11E-18.4e), were drilled to test the Ashmore Aquifer. The Ashmore was absent in the first well, and drilling continued to a depth of 60 feet, where 6 feet of the Glasford Formation aquifer was encountered; the materials sampled were not considered suitable for testing. At the Coles County site 3 feet of Ashmore was found at

TABLE 4. ASSESSMENT OF SAND AND GRAVEL AQUIFERS

Muncipality	Aquifer†	Average pumpage *(gpd)*	Assessment*
Champaign County			
Broadlands	Ash/Ban	21,000	M
Champaign-Urbana	Ban (M)/Glas	15.02 MGD	A
Homer	Glas	118,000	M
Ivesdale	Glas	24,700	A
Longview	Ash	21,000	A
Ogden	Glas	61,000	A
Pesotum	Ban	45,000	A
Sadorus	Ban	22,000	A
Sidney	Glas	55,600	A
St. Joseph	Glas	180,000	A
Tolono	Ban	167,700	A
Clark County			
Westfield	Ash	50,000	A
Coles County			
Ashmore	Ash	65,000	A
Lerna	Wed	18,600	D
Douglas County			
Arcola	Glas	190,000	A
Arthur	Glas	200,000	A
Atwood	Glas	122,000	A
Camargo	Ban	15,000	A
Hindsboro	Glas	27,000	M
Newman	Ash/Glas/Ban	114,000	A
Edgar County			
Brocton	Ash	35,000	A
Chrisman	Ban	147,000	A
Hume	Glas	35,000	A
Kansas	Ash	63,000	A
Metcalf	Ban	36,000	A
Redman	Glas	10,000	A
Vermilion	Ash	4,500	A
Macon County			
Argenta	Ban (M)	75,000	A
Forsyth	Glas	45,200	A
Long Creek PWD	Glas	139,000	A
Macon	Ban	102,400	A
Maroa	Ban (M)	113,800	A
Oreana	Glas	62,000	M
Moultrie County			
Bethany	Glas	94,700	A
Dalton City	Ash/Glas	35,000	A
Lovington	Glas	85,000	A
Sullivan	Ban	600,000	A
Piatt County			
Bement	Ban	190,000	A
Cerro Gordo	Wed/Ban	95,000	A
Cisco	Glas	28,000	A
Deland	Glas	31,000	A
Hammond	Glas	32,000	A
La Place	Ash	23,000	A
Monticello	Ban (M)	500,000	A
White Heath	Ban (M)	28,000	A

TABLE 4. *continued*

Muncipality	Aquifer†	Average pumpage (gpd)	Assessment*
Shelby County			
Findlay	Ban	90,000	A
Moweaqua	Glas	140,000	A
Shelbyville	Hen	850,000	A
Tower Hill	Glas	24,200	A
Windsor	Ash	107,500	M
Vermilion **County**			
Allerton	Ash	14,000	A
Fairmount	Glas	55,000	A
Fithian	Ban	40,100	A
Indianola	Alluv	18,000	M**
Oakwood	Ban	38,900	M
Ridge Farm	Ash/Ban	113,900	A
Sidell	Hen	35,000	A

† Ash = Ashmore Aquifer, Wedron Formation
Ban = Banner Formation; (M) - Mahomet Member
Glas = Glasford Formation
Hen = Henry Formation (alluvial)
Wed = Wedron Formation

* A = Adequate
D = Deficient
M = Marginal

** Now considered adequate due to reduced demand

a depth of 91 feet, but again, these materials were not considered of suitable value for testing.

Three wells were drilled for the purpose of testing the Glasford Formation. A 120-foot well, DAA20 (MOU 14N5E-17.1g), encountered 35 feet of Glasford aqui-deposits below a depth of 85 feet. The well was finished at a depth of 107 feet with 5 feet of #25-slot (0.025-in.) screen. A 3-hour production test was conducted May 28, 1980, at a constant rate of 60 gpm; and the final drawdown was observed to be 10.06 feet from a nonpumping level of 13.12 feet below land surface. Graphic analysis of time-drawdown data indicated a transmissivity of 14,800 gpd/ft. Due to the uncertain effects of partial penetration and inhomogeneities of materials, an effective saturated thickness (and therefore, hydraulic conductivity) could not be estimated. The effect of at least one barrier boundary was observed in the time-drawdown data; however, the aquifer was judged to be areally extensive enough to support a long-term, continuous pumping rate of 45 to 50 gpm.

A second well, DAA 21, tapping 28 feet of Glasford deposits below a depth of 47 feet, was drilled in Piatt County (PIA 16N5E-12.2b). The well finished with 5 feet of #25-slot (0.025-in.) screen at a depth of 59 feet. A brief production test was conducted May 29, 1980, at a rate of 10 gpm. Pumpage had to be discontinued after 80 minutes of testing because excessive drawdown prevented further drawdown measurements. The final observed drawdown after 70 minutes was 24.36 feet from a nonpumping water level of 18.53 feet below ground. Time-drawdown graphic analysis indicated severe boundary effects (limited areal extent of the aquifer), and no estimate of hydraulic properties was possible. The long-term production capacity of the well was estimated to be only 5,000 gpd.

A third well, DAA 22 (CUM 20N10E-35.3d), encountered fine sand in the Glasford from 35 to 100 feet. An attempt was made to finish the well with 5 feet of #10-slot (0.010-in.) screen from 92 to 97 feet; however, development could not be satisfactorily completed because of the continuous pumping of fine sand.

The results of the well-testing program, along with the summary of hydraulic properties in table 3, serve to emphasize what the geologic investigation had already indicated: the distribution of sand and gravel units within the drift in east-central Illinois is unpredictable—with the exception of the Mahomet Sand and certain Glasford deposits. As their hydraulic properties vary greatly, these sand and gravel units must be thoroughly tested before an estimate of their long-term production potential can be made. Once the major aquifers have been eliminated as feasible water sources for a community (for instance, as too far away to develop economically), the task of locating a nearby dependable groundwater supply becomes increasingly difficult. The results of the current study provide a guide for exploration. Moreover, a test-drilling program is almost a prerequisite of any search for a dependable water supply.

Water Quality

The chemical character of the groundwater in drift aquifers of the study area is known from the analyses of selected water samples from 155 wells (Appendix 2). The analyses were made by the Analytical Laboratory of the State Water Survey as well as by laboratories of the State Environmental Protection Agency. The ranges and mean values of certain chemical constituents are summarized in table 5 from data given in Appendix 2 for mineral analyses of water samples from selected wells in Banner, Glasford, Wedron, and Henry Formation deposits. As shown in table 5, the quality of waters sampled from wells in these formations does not differ substantially from formation to formation. The concentration of iron appears to be somewhat lower in shallow deposits than in deep deposits, whereas chloride and sulfate concentrations are highly variable in all deposits. Although alkalinity appears to increase with depth, hardness and total dissolved minerals vary unpredictably.

TABLE 5. RANGES AND MEAN VALUES OF CERTAIN MINERAL CONSTITUENTS FOR SELECTED WELL WATER SAMPLES (PARTS PER MILLION)

	Iron (Fe)		Chloride (Cl)		Sulfate (SO_4)		Alkalinity (as $CaCO_3$)		Hardness (as $CaCO_3$)		Total dissolved minerals	
	range	mean	range	mean	range	mean	range	mean	range	mean	range	mean
Banner Fm	0.1-9.7	2.6	0-480	54.6	0-242.3	11.9	284-704	428	68-644	288	303-1188	514
Glasford Fm	0.1-12	2.8	0-61	13.9	0-82.5	13.0	220-680	394	128-578	326	246-756	471
Wedron Fm	0-9.7	2.1	0-190	24.9	81-624.9	86.0	212-728	361	200-988	410	377-1470	538
Henry Fm	0.1-2.8	0.9	6-54	17.3	—	—	150-370	296	208-566	334	264-707	405

DISCUSSION AND CONCLUSIONS

The decision to examine the problem of water-short communities through a regional hydrogeologic study of east-central Illinois rather than a detailed study of individual communities appears to have benefited the entire region. It not only has established the magnitude of available water supplies but also has provided some basis for making decisions regarding future groundwater development. While the general distribution and productivity of the Mahomet Sand had been generally known, the distribution and water-yielding characteristics of other aquifers throughout the region had not been defined previously. In addition to providing a basis for understanding the general distribution of aquifers, this study has shown the areas needing futher investigation and established that regional stratigraphic data is a prerequisite for definitive mapping of individual sand and gravel aquifers.

The following conclusions can be drawn from this study:

1. Aquifers in east-central Illinois are unevenly distributed. The principal aquifers are concentrated in the western half of the region, while aquifers of limited extent and thickness, separated by large areas containing no aquifers, occupy the eastern half.

2. The hydraulic conductivity of aquifers is highly variable in the shallow deposits but tends to increase and become uniform with depth. Storage coefficients reflect artesian conditions in the Banner Formation aquifers, including the Mahomet Sand; but they vary from artesian to water table in the shallower units.

3. The Mahomet Sand is by far the most productive and predictable aquifer of the region; but while the aquifer is still underdeveloped, future demands may restrict local development.

4. The Glasford Formation aquifers in the west-central and north-central portions of the region are next in importance to the Mahomet Sand; but in general, they are less productive, and their distribution and thickness is less predictable.

5. Probably no major aquifers remain to be identified, although it is possible that a few aquifers of local significance are still unmapped or that boundaries of mapped aquifers may be extended.

6. Some communities with currently adequate groundwater supplies have not yet pushed the production capability of their aquifers to the limit. In some cases additional or supplemental supplies may be difficult to obtain from the same aquifer system, if the aquifer is of limited potential. In other cases, aquifers may not be as productive as their mapped extent implies.

7. The identification and mapping of individual aquifers have been significantly aided by stratigraphic data obtained from the 14 test holes drilled for the project; however, two particular stratigraphic problems remain that could not be resolved by the available data. First, a better definition of the succession of Glasford Formation deposits in the western half of the region could aid in distinguishing between the two principal aquifers; and second, additional regional control on the Banner Formation could aid in separating Banner from Glasford aquifers locally and provide better characterization of Banner Formation aquifers, particularly in the eastern part of the region.

8. The quality of waters sampled from wells in these aquifers does not differ substantially from formation to formation. Generally, the water is of good quality for municipal use. In some local situations, high concentrations of a few constituents may require special treatment.

RECOMMENDATIONS

The information and insight gained from the study of groundwater conditions in east-central Illinois suggest two sets of recommendations.

First, the identification and mapping of the significant aquifers in east-central Illinois, as well as the data on aquifer productivity, is essential information for communities and other agencies planning to use groundwater resources. This information may be applied in conjunction with any program that estimates future water supply needs, calculates the costs of development and production (including test drilling and pipeline), and evaluates storage, treatment, and distribution systems. Water-short or marginal communities, in particular, need accurate data in order to realistically appraise the situation and consider alternatives. Industrial or commercial interests should be aware of the limitations as well as the possibilities for growth conditional upon groundwater supplies. Moreover, because of the uneven distribution of aquifers in some portions of east-central Illinois, access to such information could promote regional cooperation by enabling two or more communities to look into the possibility of establishing water districts for economical, efficient development and management of the best aquifer available. By sharing costs of exploration and significant segments of pipeline, such communities could collectively secure a more dependable water supply than they could individually.

The second set of recommendations emphasizes the need for additional investigation and accumulation of data. This study and other similar studies, as stated previously, must be considered to be preliminary overviews because extensive extrapolation has been necessary over areas with little or no data available. A detailed study of specific aquifers should focus on locally critical areas, defining the characteristics and boundaries for aquifers of lesser extent and limited productivity (compared to the Mahomet Sand, for example).

High priority for study and evaluation must be given to the Mahomet Sand. Since it is the most productive aquifer in the region, the Mahomet Sand will continue to be the focal point of increasing groundwater development. Therefore, its maximum potential must be determined so that responsible development is possible and current users are protected. A thorough geologic definition followed closely by a hydrologic reevaluation of the entire extent of the Mahomet Sand is strongly recommended.

Finally, regional studies should be undertaken by the State Geological and State Water Surveys for the purpose of identifying and mapping aquifers throughout Illinois. Information similar to that provided by this study for east-central Illinois would provide the necessary foundation for advanced groundwater resource planning and development in other regions of the state.

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AQUIFER TESTS AND SPECIFIC-CAPACITY DATA

County and well number	Owner	Depth *(ft)*	Aquifer	Land surface elevation *(ft above msl)*	Non-pumping water level *(ft)*	Pumping rate *(gpm)*	Observed specific capacity *(gpm/ft)*	Trans-missivity *(gpd/ft)*	Hydraulic conduc-tivity *(gpd/ft²)*	Storage coefficient
CHM (Champaign)										
17N7E										
7.6d(1)	Ivesdale (V)	85	Glas	680	24.1	50	6.8	12,000**	1200	–
17N8E										
6.5h(2)	Sadorus (V)	112	Ban?	693	29.5	58	4.2	7,250**	460	–
6.5h(3)	Sadorus (V)	116	Ban?	690	34.9	50	1.0	3,384**	200	
6.6h(1-63)	Sadorus (V)	114	Ban?	692	33	30	0.5	1,360**	–	–
16.5e(1)	Ill. Div. of Hwys.	125	Ban	690	56.6	50.2	11.0	42,800**	1430	–
22.1d1(1)	Pesotum (V)	190	Ban	710	71.5	81	4.6	14,000*	1400	–
22.1d2(67-1)	Pesotum (V)	190	Ban	711	79.5	77.5	4.7	31,500**	1575	0.0015**
17N11E										
19.2a(1-55)	Broadlands (V)	72	Ash	685	6.5	82	2.9	5,400*	1080	–
19.3a(2)	Broadlands (V)	78	Ash	683	50.0	25	3.8	8,800**	570	–
30(1)	Broadlands (V)	120	Ban	685	16.5	22.3	0.2	360*	90	–
18N7E										
9.1c(1)	ICI U.S., Inc.	132	Ban?	695	45.0	100	6.2	12,000*	428	–
18N8E										
2.2h(2)	U. of Illinois	168	Ban?	748	92	45	6.4	22,000*	880	–
2.4e(1)	U. of Illinois	218	Ban	745	–	231	19.8	117,500**	1680	0.00014**
25	Unity H.S.	150	Glas	730	76.5	42	7.0	12,500*	310	–
25.5d(9)	Tolono (V)	179	Ban	730	102.2	145	10.0	21,100**	910	0.00041**
25.5d(10)	Tolono (V)	181	Ban	725	86.7	121	8.4	14,100†	350	0.00017†
25.6d2(11)	Tolono (V)	180	Ban	730	83	216	9.8	15,600**	650	–
25.8d(12)	Tolono (V)	182	Ban	730	97	190	7.4	7,600*	200	–
25.8f(5)	Tolono (V)	185	Ban	735	76	98	1.6	3,000*	200	–
26.1c1(3)	Tolono (V)	158	Ban	736	64	90	1.7	3,500*	1170	–
26.1c2(4)	Tolono (V)	186	Ban	736	71.8	53	0.6	920*	460	–
18N9E										
22.1h(4)	Philo (V)	26	Wed	730	13.5	57.5	10.5	19,500*	1220	–
22.4f(2)	Philo (V)	44	Wed	710	9.5	65	5.9	10,500*	580	–
22.4f(3)	Philo (V)	29	Wed	700	15.0	50	7.9	6,700*	960	–
23.7g(1)	Philo (V)	81	Ash	730	33	73	2.4	3,800*	760	–

AQUIFER TESTS AND SPECIFIC-CAPACITY DATA-continued

County and well number	Owner	Depth *(ft)*	Aquifer	Land surface elevation *(ft above msl)*	Non-pumping water level *(ft)*	Pumping rate *(gpm)*	Observed specific capacity *(gpm/ft)*	Trans-missivity *(gpd/ft)*	Hydraulic conduc-tivity *(gpd/ft^2)*	Storage coefficient
18N10E										
16.2g(2)	Sidney (V)	59	Glas	665	25	157	21.5	42,000*	2800	–
16.3d(1-74)	Sidney (V)	57	Glas	665	32	12	1.7	3,160**	263	–
16.3g(1)	Sidney (V)	56	Glas	665	22	30	2.6	7,600*	590	–
16.6f(3-76)	Sidney (V)	106	Glas	660	10.3	40	1.6	1,684**	168	–
16.6f(3)	Sidney (V)	53	Glas	660	7.4	56	3.4	7,400	740	–
18N14W										
8.3c(2)	Homer (V)	61	Glas	670	–	65	13	11,000*	1050	–
8.3d(1)	Homer (V)	72	Glas	670	11.0	80	2.9	5,700**	380	–
8.3e(TH3)	Homer (V)	82	Glas	670	15.1	60	1.7	3,425**	342	–
8.4e(3)	Homer (V)	59	Glas	670	28	107	7.6	7,600**	760	–
19N8E										
2.8a(53)	North. Ill. Water C.	289	Ban (M)	755	117.8	1016	115	426,000*	7750	–
3.8c(60)	North. Ill. Water C.	340	Ban (M)	735	158	1150	192	500,000*	4200	–
4.5a(61)	North. Ill. Water C.	297	Ban (M)	740	127	1218	121.8	300,000*	3260	–
5.1g1(49)	North. Ill. Water C.	297	Ban (M)	735	78	1000	37.3	325,000**	3250	0.0001**
5.1g2(55)	North. Ill. Water C.	300	Ban (M)	730	–	900	97.5	415,000*	3190	–
11.7f(1)	Humko Corp.	291	Ban (M)	757	119	928	116	243,000*	4320	–
11.8f(2)	Humko Corp.	277	Ban (M)	750	111	800	114	270,000*	4910	–
12.3c2	S. S. Kresge Co.	180	Glas	742	101.5	100	18.2	64,000*	2670	–
12.3c3	Robeson's	189	Glas	742	118.3	86	7.1	23,000*	–	–
13.1h	Producers Creamery	166	Glas	740	96.6	95	4.9	21,000*	525	–
18.3d(2)	Petro. Chem. Corp.	272	Ban (M)	700	54.7	1767	120	252,000**	3350	0.00031**
18.4b(3)	Petro. Chem. Corp.	272	Ban (M)	700	60.2	1550	114.2	205,000 †	2050	0.0023 †
18.4d(1)	Petro. Chem. Corp.	278	Ban (M)	700	56.0	1683	120.0	236,000**	2840	0.00031**
18.8h(4)	Petro. Chem. Corp.	310	Ban (M)	705	86.0	1400	207	490,000*	4900	–
21.3h	Maynard Lake Rlty.	260	Ban (M)	705	106	709	35.6	140,000*	2860	–
24.4b	Studio Lodge	154	Glas	742	80.3	19	3.7	20,000*	830	–
25.1e(4-46)	U. of Illinois	155	Glas	725	67	67.5	2.9	7,000*	280	–
29.7h	Urb.-Cham. San. Dist.	205	Glas	705	86.5	70	1.0	5,130**	–	–
36.2e	Parkhill's Lake	144	Glas	720	75	27	4.5	17,000*	1890	–
36.6a(T)	U. of Illinois	168	Glas	740	75	248	17.7	50,000*	2000	–
36.6b	Savoy(V)	169	Glas	670	70	248	17.1	74,000*	2470	–
36.7b	Paradise Inn	160	Glas	740	84.0	47	9.4	17,000*	–	–

AQUIFER TESTS AND SPECIFIC-CAPACITY DATA-continued

County and well number	Owner	Depth *(ft)*	Aquifer	Land surface elevation *(ft above msl)*	Non-pumping water level *(ft)*	Pumping rate *(gpm)*	Observed specific capacity *(gpm/ft)*	Trans-missivity *(gpd/ft)*	Hydraulic conduc-tivity *(gpd/ft²)*	Storage coefficient
19N9E										
6.4e1(43)	North. Ill. Water C.	225	Glas	740	146.4	810	48.1	100,000*	1820	–
6.5f1(T)	Swift & Co.	162	Glas	730	109.8	200	12.7	29,000*	760	–
6.5f2(2)	Swift & Co.	162	Glas	730	112.8	295	13.1	26,000*	685	–
6.5f3(3)	Swift & Co.	161	Glas	732	111.4	500	18.3	63,450**	1670	0.00001**
6.7h(1-73)	Swift & Co.	160	Glas	735	111	250	7.8	18,300*	–	–
7.2h(40)	North. Ill. Water C.	212	Glas	750	137.7	610	16.6	72,000*	1310	–
7.3h4(39)	North. Ill. Water C.	216	Glas	750	126	743	41.2	115,000*	2090	–
7.3h5(41)	North. Ill. Water C.	224	Glas	750	149.7	700	71.8	160,000*	2910	–
7.3h6(42)	North. Ill. Water C.	218	Glas	750	139.5	1000	100	200,000*	3640	–
7.3h8(46)	North. Ill. Water C.	241	Glas	750	163.2	400	57.2	156,000*	2740	–
7.3h9(47)	North. Ill. Water C.	217	Glas	750	165	380	12.7	28,000*	510	–
7.4a2(11)	U. of Illinois	160	Glas	740	–	1000	62	117,000*	2660	–
7.4h(34)	North. Ill. Water C.	216	Glas	740	106	388	13.6	39,000*	710	–
7.5h(38)	North. Ill. Water C.	166	Glas	740	111.6	423	9.3	20,000*	364	–
7.8b2(2)	Meadow Gold Dairy	184	Glas	740	122	101	14.4	130,000*	2400	–
7.8g	Coll. Cap & Gown	170	Glas	734	–	33	8.2	14,500*	360	–
7.8g(2)	Coll. Cap & Gown	190	Glas	735	117.0	102	3.1	20,650*	328	–
8.4a	Cinema Theater	151	Glas	710	99.8	49	13.0	25,400*	820	–
14.2e	F. G. Scott	94	Glas	690	27.8	10	0.6	1,050*	150	–
16.1h	Chm. Co. Off. Bldg.	156	Glas	740	81.9	5	2.2	4,890**	375	–
18(4)	U. of Illinois	143	Glas	740	63.9	107	8.0	39,000*	1300	–
18(10)	U. of Illinois	160	Glas	740	106	870	84.5	165,000*	980	–
18.4h2(6)	U. of Illinois	169	Glas	740	–	596	17.1	31,000*	660	–
18.4h3(9)	U. of Illinois	248	Glas	740	–	425	6.2	14,000*	255	–
18.5g	Coed Theater	245	Glas	741	77	36	1.8	4,200*	280	–
18.5h1(7)	U. of Illinois	172	Glas	720	–	423	10.1	17,000*	304	–
21.7g1	Freeman Trailer Park	45	Ash	750	8.9	13.2	0.4	270*	45	–
21.7g2	Freeman Trailer Park	174	Glas	750	99.4	30.5	0.4	650*	163	–
19N10E										
14.6h(1)	St. Joseph (V)	76	Glas	670	10.0	170	18.3	13,000**	810	0.0001**
14.7h(2)	St. Joseph (V)	73	Glas	670	20.7	138	3.7	17,800**	1110	–
15.1e(4)	St. Joseph (V)	82	Glas	665	13.0	125	5.7	11,580**	399	–
15.1g(3)	St. Joseph (V)	72	Glas	675	13	126	4.7	8,100*	2020	–
19N14W										
7.7e	St. of Illinois	180	Glas	680	6.2	30	2.2	3,440**	430	0.00022**
9.7a	Ogden (V)	65	Glas	670	14	54.2	6.4	27,000*	773	–

AQUIFER TESTS AND SPECIFIC-CAPACITY DATA -continued

County and well number	Owner	Depth *(ft)*	Aquifer	Land surface elevation *(ft above msl)*	Non-pumping water level *(ft)*	Pumping rate *(gpm)*	Observed specific capacity *(gpm/ft)*	Trans-missivity *(gpd/ft)*	Hydraulic conduc-tivity *(gpd/ft²)*	Storage coefficient
CLK (Clark)										
12N14W										
20.7d(5)	Westfield (V)	50	Ash	695	0.0	34	–	6,600*	660	–
20.7e(1-75)	Westfield (V)	53	Ash	690	3.7	60	3.5	6,832**	639	0.00026**
COL (Coles)										
11N7E										
8.1c	N.Y.A. Camp	54	Hen	685	28	35	8.2	14,500*	1810	–
18.2e(3)	Mattoon (C)	41	Hen	657	5.5	295	36.9	72,000*	7200	–
18.4e(2)	Mattoon (C)	41	Hen	655	5.5	272	22.6	50,000*	5000	–
18.6a(7)	Mattoon (C)	39	Hen	650	12.5	265	12.5	18,000*	550	–
18.6b	Mattoon (C)	40	Hen	650	12.5	295	15.5	18,000*	2250	–
18.6e(5)	Mattoon (C)	38	Hen	655	12.7	360	38.7	70,000*	2500	–
18.7e1(1)	Mattoon (C)	39	Hen	650	5.2	300	16.8	31,000*	3100	–
18.8a(4)	Mattoon (C)	42	Hen	640	17.2	100	50	45,000*	1410	–
19.6g(1-55)	Mattoon (C)	38	Hen	640	16.9	46.5	5.3	10,000*	590	–
11N8E										
10.4g1(1-58)	Lerna (V)	33	Ash	755	5.5	20	1.3	1,400*	–	–
10.4g2(2-58)	Lerna (V)	34	Ash	755	5.2	25	1.5	2,700*	540	–
11N9E										
13.6f(1-54)	Fox Ridge St. Pk.	159	Ban	680	122.3	8	0.3	400*	–	–
12N7E										
24.4g(7)	Mattoon (C)	56	Ash	705	42	40	5.2	10,000*	1250	–
12N8E										
14.7c(1)	Coles Co. Airport	48	Ash	705	17.9	13.4	0.6	920*	180	–
12N11E										
6.7h(1)	Ashmore (V)	42	Ash	675	22	50	26.3	26,000*	1240	–
6.8h(2)	Ashmore (V)	44	Ash	685	20.3	75	12.6	33,000*	2640	–
13N7E										
10.7c(TH-2)	Cooks Mills	16	Hen	630	7.0	40	6.6	825**	206	0.00049**
25.6d(3)	Cooks Mills	28	Ash	672	6.3	26	6.8	12,160**	1351	0.00018**
25.7d(2)	Cooks Mills	30	Ash	672	5.2	17.5	5.0	20,675**	1798	0.00038**
26.1d(1)	Cooks Mills	33	Ash	672	2.9	12	1.9	7,920**	1320	–

AQUIFER TESTS AND SPECIFIC-CAPACITY DATA -continued

County and well number	Owner	Depth *(ft)*	Aquifer	Land surface elevation *(ft above msl)*	Non-pumping water level *(ft)*	Pumping rate *(gpm)*	Observed specific capacity *(gpm/ft)*	Trans-missivity *(gpd/ft)*	Hydraulic conduc-tivity *(gpd/ft²)*	Storage coefficient
13N8E										
30.4b(7)	Mattoon (C)	42	Ash	693	20	190	12.7	21,000*	1550	–
30.5c(2A)	Mattoon (C)	42	Ash	695	25.9	107	11.9	19,000*	2380	–
30.5d	Mattoon (C)	45	Ash	695	17.5	150	17.7	29,600**	1410	0.00096**
30.5d(1B)	Mattoon (C)	43	Ash	686	10.0	157	14.4	25,900**	1177	–
30.6d(3B)	Mattoon (C)	43	Ash	695	17.5	156	13.7	25,000**	1600	0.0015**
30.6d2(6)	Mattoon (C)	40	Ash	695	15.5	145	12.3	26,400**	1650	0.0028**
30.6d3(7)	Mattoon (C)	43	Ash	695	16	130	15.8	12,700**	850	–
30.6d4(4A)	Mattoon (C)	39	Ash	695	13.6	125	11.1	30,800**	2050	0.0002**
30.6d5(5A)	Mattoon (C)	47	Ash	695	23.5	104	8.8	15,500*	820	–
14N7E										
26.2d(1-63)	Ashland Oil Co.	73	Ban	630	0.6	102	4.2	8,500**	470	–
DGL (Douglas)										
14N7E										
11.7d(2)	Rockome Gardens	70	Glas	650	13.9	69.5	5.0	7,340*	734	–
14N8E										
3.8g(6)	Arcola (C)	119	Glas	668	47.8	125	7.8	18,300**	660	–
4.3d1(1)	Arcola (C)	100	Glas	675	30	25	0.4	270*	–	–
4.3d3(3)	Arcola (C)	100	Glas	675	47.5	87	4.1	3,200*	360	–
4.3e1(4)	Arcola (C)	100	Glas	675	47.5	55	1.3	2,200*	275	–
4.4d(1A)	Arcola (C)	103	Glas	680	–	115	43	4,000*	330	–
4.4e1(2A)	Arcola (C)	122	Glas	675	54	125	8.9	20,700**	770	–
11.6a(11-53)	Arcola (C)	88	Glas	660	15	61	2.6	6,000*	600	–
14N10E										
6.5e(3)	Hindsboro (V)	140	Ban	644	21.1	30	0.8	2,090**	174	–
6.6a(4)	Hindsboro (V)	105	Glas?	650	13.4	30	1.3	1,685**	112	–
6.6b1(1)	Hindsboro (V)	83	Glas?	650	5	30	0.5	3,500*	230	–
6.6b1(1)	Hindsboro (V)	83	Glas?	650	15.7	11.2	0.5	1,500*	208	–
6.6b2(TW2)	Hindsboro (V)	88	Glas?	650	3.6	11.2	1.5	3,700*	250	–
6.6b3(2)	Hindsboro (V)	28	Ash	650	8.2	28.5	2.0	3,520**	–	0.00077**
6.6b3(2)	Hindsboro (V)	28	Ash	650	22.7	7.4	1.5	3,000*	–	–

AQUIFER TESTS AND SPECIFIC-CAPACITY DATA-continued

County and well number	Owner	Depth *(ft)*	Aquifer	Land surface elevation *(ft above msl)*	Non-pumping water level *(ft)*	Pumping rate *(gpm)*	Observed specific capacity *(gpm/ft)*	Trans-missivity *(gpd/ft)*	Hydraulic conduc-tivity *(gpd/ft³)*	Storage coefficient
15N7E										
1.2f	Pan. East. Ppln. Co.	55	Ash	670	0.0	90	2.0	4,300*	720	–
6.3f(TH-17)	Arthur (V)	95	Glas	652	+0.3	400	20.2	39,516**	1147	0.0014**
19.8c(6)	Arthur (V)	84	Glas	659	26.2	100	4.8	7,140**	450	–
19.8e	Arthur (V)	85	Glas	660	13.2	65	3.1	7,150**	330	0.0002**
19.8f(5)	Arthur (V)	81	Glas	660	13.7	100	5.9	13,900**	630	–
30.4d(1)	Arthur (V)	78	Glas	660	21	40	2.5	6,300*	330	–
30.7h1(3)	Arthur (V)	90	Glas	655	11.0	98	7	19,000*	905	–
30.7h2(4)	Arthur (V)	103	Glas	655	18.7	85	7.1	29,000*	1160	–
15N8E										
20.1g(5-75)	Arcola (C)	178	Ban	630	38.1	95	0.7	2,660**	242	0.0018**
31.8e(10)	Arcola (C)	79	Glas	660	13.9	40	3.1	13,700**	1250	0.00044**
15N10E										
35.4d(2-67)	U. of Ill. Opt. Tel.	63	Ash	680	28.4	6	0.4	990**	–	–
36.4e(2)	Dgl. Co. Cons. Area	36	Ash	650	9.6	10	5.5	4,330**	540	–
16N6E										
25.1a	Atwood H.S.	110	Glas	670	14	10	5	10,500*	1050	–
16N7E										
31.8d(T)	Atwood (V)	96	Glas	670	11.5	83	3.5	9,500*	500	–
31.8e1(1)	Atwood (V)	97	Glas	672	11.5	190	5.8	14,000*	740	–
31.8e2(2)	Atwood (V)	96	Glas	672	19	222	7.3	15,500*	740	–
16N9E										
34.1e(1-61)	Camargo (V)	81	Ban	665	4.2	25	1.4	2,400*	–	–
34.4e(3)	Camargo (V)	72	Ban	645	13.2	60	4.4	13,400**	1120	–
16N10E										
4.8h(1)	Longview (V)	50	Ash	660	1.2	62.5	4.5	8,400**	420	0.0013**
16N11E										
31.4h(4)	Newman (C)	58	Glas?	649	10.2	115	21.4	48,000*	3000	–
16N14W										
31.4d2(1)	Newman (C)	127	Ban	648	21.1	27	0.4	500*	–	–
31.7d(2)	Newman (C)	143	Ban	647	2	117	1.3	2,300*	135	–
32.5a(3)	Newman (C)	30	Ash	646	4.5	70	7.4	21,300*	1065	–

AQUIFER TESTS AND SPECIFIC-CAPACITY DATA-continued.

County and well number	Owner	Depth *(ft)*	Aquifer	Land surface elevation *(ft above msl)*	Non-pumping water level *(ft)*	Pumping rate *(gpm)*	Observed specific capacity *(gpm/ft)*	Trans-missivity *(gpd/ft)*	Hydraulic conduc-tivity *(gpd/ft^2)*	Storage coefficient
EDG (Edgar)										
13N11W										
11.2a1(1)	Vermilion (V)	54	Ash	670	10	50	2.2	6,000*	430	–
11.2a2(2)	Vermilion (V)	55	Ash	670	4.4	26	1.3	2,350*	170	–
14N13W										
21.3b	Redmon (V)	74	Glas	680	21.4	30	1.0	1,146**	–	0.11**
21.6a	Redmon (V)	66	Glas	677	12.8	50.5	4.5	3,500**	130	0.0022**
15N14W										
25.4g(1)	Brocton (V)	38	Ash	660	–	60	10	12,500**	1560	–
16N11W										
26.4b	Scottland Consol. Sch.	125	Ban	650	30	49	6.1	19,500*	1950	–
16N12W										
26.1a(5)	Chrisman (C)	92	Ban	625	38.6	349	16.6	53,000**	2650	0.00013**
26.4a1(4)	Chrisman (C)	96	Ban	650	16.2	104	40	80,000*	5000	–
26.4a2(NN)	Chrisman (C)	96	Ban	650	16	250	13.9	35,000*	2330	–
16N13W										
31.3c(1)	Hume (V)	55	Glas?	660	10	130	32.5	70,000*	1520	–
31.3c(2)	Hume (V)	57	Glas?	650	8.0	150	15.2	37,400**	1335	–
MCN (Macon)										
14N2E										
18.8a(1)	Moweaqua (V)	33	Glas	615	13.2	105	26.3	35,000*	1750	–
18.8a(1W)	Moweaqua (V)	34	Glas	618	9.6	60	15.2	59,825**	2663	0.048**
18.8a(13)	Moweaqua (V)	34	Glas	622	12.7	50	31.6	37,000*	1776	–
18.8a(14)	Moweaqua (V)	34	Glas	621	11.3	50	19.1	17,500*	795	–
15N2E										
29.1b1(TW3)	Macon (C)	134	Glas	715	56.3	48	3.2	10,000*	560	–
29.1b2(3)	Macon (C)	128	Glas	715	87.7	100	6.2	10,000*	710	–

AQUIFER TESTS AND SPECIFIC-CAPACITY DATA-continued

County and well number	Owner	Depth *(ft)*	Aquifer	Land surface elevation *(ft above msl)*	Non-pumping water level *(ft)*	Pumping rate *(gpm)*	Observed specific capacity *(gpm/ft)*	Trans-missivity *(gpd/ft)*	Hydraulic conduc-tivity *(gpd/ft²)*	Storage coefficient
16N2E										
9.6f	Bob White Dairy	114	Glas	660	70	7	2.0	3,000*	750	–
11.5g	Decatur Buick Co.	84	Glas	680	58.5	6	3.0	4,750*	800	–
11.6a	Swift & Co.	91	Ash/Glas	680	60	50	20.0	38,000*	3800	–
12.4b	A. E. Staley Co.	59	Ash	675	12.3	485	16.6	37,000*	2640	–
14.7h	Kentland Dairy	65	Ash	670	47.2	25.5	2.8	3,000*	300	–
15.1d	Union Dairy	54	Ash	670	27	30	2.0	3,900*	390	–
15.7h	Polar Ice Co.	100	Glas	670	40	450	45.0	110,000*	3930	–
21.3a	Enterprise School	69	Glas	655	41.1	9.7	5.1	8,700*	970	–
22.5f(TW-10)	Mueller Co.	59	Hen	600	7	195	26.9	70,000*	2190	–
22.5f2	Mueller Co.	59	Hen	600	7	200	13.3	50,000*	1560	–
22.7f(TW-5)	Mueller Co.	41	Hen	600	3.5	52.5	3.2	8,100*	900	–
16N3E										
7.1h	Shellabarger Gr. Co.	95	Glas	675	52	55	12.2	25,800*	680	–
7.1h1(1)	Kellogg & Sons Inc.	97	Glas	675	–	440	110.0	298,000*	9600	–
7.1h2(3)	Kellogg & Sons Inc.	92	Glas	675	–	350	29.2	76,200*	2820	–
16.8f1(1)	Decatur Park Dist.	63	Ash?	670	35	8	0.7	1,300*	220	–
17N2E										
14.7h(1)	Forsyth Grade Sch.	111	Glas	675	20.5	100	3.1	25,400**	1690	–
14.7h(1-79)	Forsyth (V)	116	Glas	673	20	349	13.4	20,957**	1510	0.00014**
14.8h(T1)	Forsyth (V)	104	Glas	670	17.0	113	3.9	9,960**	1110	–
29.2e(1)	Bob Cooper Realty	77	Ash?	690	47.2	36	3.3	15,750**	2100	0.001**
17N3E										
9.2e(1)	Oreana (V)	132	Glas	685	41.2	102	8.9	10,800**	1080	–
9.2e(2)	Oreana (V)	132	Glas	690	49.7	147	8.9	25,000**	960	0.00012**
10.8f(TH-9)	Oreana (V)	136	Glas	689	54.9	210	7.3	20,900**	1300	0.00008**
27.7b(1)	Long Creek PWD	106	Glas	662	50	305	20.9	158,000**	3290	–
27.8b(TW-3)	Long Creek PWD	121	Glas	667	55.6	150	21.2	233,000**	4660	0.00023**
17N4E										
33.8h(3)	Cerro Gordo (V)	27	Wed	690	5.1	50	8.8	16,000*	1280	–
33.8h(4)	Cerro Gordo (V)	25	Wed	691	7.2	30	7.5	13,500*	1350	–
33.8h(5A)	Cerro Gordo (V)	32	Wed	690	8.0	101	12.9	22,500*	2820	–
33.8h(6)	Cerro Gordo (V)	25	Wed	690	13.0	119	16.2	24,400**	2210	–
33.8h(7)	Cerro Gordo (V)	31	Wed	685	16.8	130	40	52,000*	3700	–
18N2E										
2.8b1(2)	Maroa (C)	292	Ban (M)	720	110.6	130	15.1	95,628**	4780	0.00069**
2.8b2(3)	Maroa (C)	290	Ban (M)	720	74	375	46.9	110,000*	5500	–

AQUIFER TESTS AND SPECIFIC-CAPACITY DATA-continued

County and well number	Owner	Depth *(ft)*	Aquifer	Land surface elevation *(ft above msl)*	Non-pumping water level *(ft)*	Pumping rate *(gpm)*	Observed specific capacity *(gpm/ft)*	Trans-missivity *(gpd/ft)*	Hydraulic conduc-tivity *(gpd/ft^2)*	Storage coefficient
18N3E										
4.4a	Maroa Pump Sta.	258	Ban (M)	700	90	35	4.4	15,500*	320	–
26.1a(1)	Argenta (V)	230	Ban (M)	686	64.7	170	15.7	40,000*	2000	–
26.2b(2)	Argenta (V)	251	Ban (M)	685	63	119	21.6	86,300*	1690	–
18N4E										
30.1d(1)	St. of Illinois	230	Ban (M)	682	58.4	38	11.7	130,000*	2600	–
MOU (Moultrie)										
12N6E										
26.4f(3)	Gays (V)	110	Ash	755	77.6	10	1.8	3,100**	450	–
13N5E										
13.4e1	Sullivan C. C.	90	Glas	638	48.2	150	21.7	155,000*	3700	–
13.4e2	Sullivan C. C.	97	Glas	638	48	150	21.4	124,000*	3180	–
23.3g1(N)	Sullivan (C)	129	Ban?	637	58	660	34.7	61,000*	940	–
23.3g2(T4)	Sullivan (C)	120	Ban?	637	56	500	28.6	53,000*	815	–
23.4f(4)	Sullivan (C)	114	Ban?	620	48.4	495	32.7	56,800**	1160	–
23.4g(T3)	Sullivan (C)	91	Glas	632	51	170	42.5	53,000*	1330	–
14N4E										
22.2e1(4)	Bethany (V)	80	Glas	658	50	65	16.3	20,600*	690	–
22.2e2(5)	Bethany (V)	76	Glas	658	27.	35	1.8	20,000*	670	–
22.7d(T8)	Bethany (V)	41	Glas	630	0.0	30	0.8	1,460*	146	–
22.8d(1)	Bethany (V)	77	Glas	630	40	65	4.6	16,800*	460	–
25.5g(1-75)	Dunn Game Mgt. Area	89	Glas	630	15.0	13	10.2	13,200**	734	–
14N5E										
30.8h1(2-63)	Bethany (V)	71	Glas	620	13.8	124	10.8	72,000**	3130	0.00068**
30.8h2(11-63)	Bethany (V)	71	Glas	620	17.0	133	19.3	38,000*	1900	–
15N4E										
29.2c(TW-7)	Dalton City (V)	78	Ash	695	0.4	100	5.1	13,500**	965	–
30.6a	Dalton City (V)	108	Glas	684	15	56	0.7	1,500*	210	–
15N5E										
27.4f(7)	Lovington (V)	108	Glas	675	34.5	300	6.7	11,400**	420	0.0074**
27.5b	Lovington (V)	130	Glas	678	56	125	3.1	7,000*	1000	–

AQUIFER TESTS AND SPECIFIC-CAPACITY DATA-continued

County and well number	Owner	Depth *(ft)*	Aquifer	Land surface elevation *(ft above msl)*	Non-pumping water level *(ft)*	Pumping rate *(gpm)*	Observed specific capacity *(gpm/ft)*	Trans-missivity *(gpd/ft)*	Hydraulic conduc-tivity *(gpd/ft^2)*	Storage coefficient
PIA (Piatt)										
16N4E										
35.4f(1)	La Place (V)	55	Ash	700	4.2	48	4.9	11,700**	1060	–
35.5f(2)	La Place (V)	60	Ash	700	12.2	83	6.0	9,960**	400	–
16N5E										
36.8d1(T2)	Hammond (V)	88	Glas	687	12	95	7.9	21,700*	1550	–
36.8d2(1)	Hammond (V)	87	Glas	687	11	390	8.7	17,000*	1220	–
17N4E										
11.8d(8)	Cerro Gordo (V)	156	Ban?	675	43.1	310	13.8	79,250**	1415	0.0004**
17N5E										
24.2h(1-80)	Bement (V)	143	Glas?	685	35.8	300	12.4	23,000**	1150	0.000053**
17N6E										
19.7g(5)	Bement (V)	139	Ban	685	39	475	11.3	22,000*	730	–
18N4E										
14.8a(1-50)	Cisco (V)	111		687	46.4	51	1.6	2,500*	230	–
14.8b(2-50)	Cisco (V)	113		688	46.3	80	3.7	7,700*	860	–
18N5E										
7.1h(1)	WILL TV	195	Ban (M)	690	64.7	17	2.2	8,000*	470	–
21.1b	U. of Illinois	201	Ban (M)	672	44.8	46	2.3	4,700*	670	–
30.7a(2)	Decatur (C)	252	Ban (M)	640	15	2250	185.5	270,000**	1910	0.00014**
31.7g(1)	Decatur (C)	244	Ban (M)	625	0.4	1655	78	276,000**	1840	0.00023**
18N6E										
6.4f(1)	Camp Cr. Duck Farm	118		662	33.4	70	2.8	5,150*	520	–
7.6a(1)	Monticello (C)	209	Ban (M)	672	32	340	7.4	160,000*	1400	–
7.6b(3)	Monticello (C)	263	Ban (M)	668	34	465	93.0	710,000*	5500	–
7.6b2(4)	Monticello (C)	263	Ban (M)	668	34	1009	80.6	390,000*	5200	–
7.7b3(3)	Viobin Corp.	212	Ban (M)	660	22.2	270	24.8	174,000*	1740	–
7.8a(5)	Viobin Corp.	228	Ban (M)	660	28.1	360	58.0	165,000*	3000	–
19N5E										
9.8b1(1)	Deland (V)	83		705	18	65	1.4	2,950*	370	–
9.8b2(T7)	Deland (V)	84		705	33	45	1.3	2,250*	280	–
9.8b3(4)	Deland (V)	79		705	30.8	20	1.2	1,690**	150	–

AQUIFER TESTS AND SPECIFIC-CAPACITY DATA-continued

County and well number	Owner	Depth *(ft)*	Aquifer	Land surface elevation *(ft above msl)*	Non-pumping water level *(ft)*	Pumping rate *(gpm)*	Observed specific capacity *(gpm/ft)*	Trans-missivity *(gpd/ft)*	Hydraulic conduc-tivity *(gpd/ft²)*	Storage coefficient
19N6E										
22.5b	Ill. Central R.R.	235	Ban (M)	715	49	120	2.0	6,700*	160	–
22.5d(1)	White Heath (V)	233	Ban (M)	705	81.6	75	6.4	70,800**	2400	–
SHL (Shelby)										
11N2E										
23.8e(1-50)	Tower Hill (V)	36	Glas	650	1.7	8.2	0.4	730*	120	–
11N3E										
23.2h(TW2)	Shelbyville (C)	54	Wed?	575	24.0	201	24.1	58,000*	2070	–
26.4h1(1-54)	Shelbyville (C)	51	Hen	560	17	200	33.9	115,000*	3110	–
26.4h2(1-55)	Shelbyville (C)	60	Hen	560	22.1	316	56.4	96,000*	2530	–
26.4h3(2-55)	Shelbyville (C)	58	Hen	560	18.5	550	53.9	115,000*	2950	–
26.4h4(3-55)	Shelbyville (C)	54	Hen	560	15.5	510	66.2	100,000*	2640	–
26.5h(7)	Shelbyville (C)	61	Hen	550	19.8	302	18.4	256,000**	6400	–
35.6a(TW-10)	Shelbyville (C)	61	Hen	550	19.2	440	22.1	118,000**	2950	0.1**
35.6a(6)	Shelbyville (C)	63	Hen	550	18.3	408	14.2	180,000**	4000	–
35.6b(4)	Shelbyville (C)	59	Hen	545	17.6	412	19.7	42,100**	1030	0.1**
11N5E										
12.4h(9)	Windsor (V)	101	Ash	720	79.1	60	22.2	28,250**	1950	0.0068**
12.7h1	Windsor (V)	101	Ash	720	63.5	150	4.2	3,900*	290	–
12.7h2(T6)	Windsor (V)	98	Ash	720	64.5	80	5.3	9,800*	730	–
12.7h3(1-51)	Windsor (V)	98	Ash	720	81.7	26	16.9	34,000*	4250	–
12.7h4(4)	Windsor (V)	100	Ash	720	85.4	35	10.4	18,000*	2250	–
12.7h5(3)	Windsor (V)	100	Ash	720	93.2	26	7.4	16,000*	2000	–
12N4E										
3.8g1(T3)	Findlay (V)	171	Ban	680	96.3	91	22.3	62,000*	1270	–
3.8g2(3)	Findlay (V)	154	Ban	680	96	150	10.5	15,400*	480	–
3.8g3(2)	Findlay (V)	163	Ban	680	103.3	125	20.6	37,900**	900	–
12N5E										
34.5g(5)	Windsor (V)	63	Ash	685	15.0	44	5.0	10,200**	1275	–
34.6f(6)	Windsor (V)	64	Ash	670	21.6	25	3.2	9,440**	2350	–
36.5b(T11)	Windsor (V)	134	Ban	708	24	50	1.2	840*	–	–
36.5c(2)	Windsor (V)	133	Ban	708	30.6	50.5	0.6	300*	–	–

County and well number	Owner	Depth *(ft)*	Aquifer	Land surface elevation *(ft above msl)*	Non-pumping water level *(ft)*	Pumping rate *(gpm)*	Observed specific capacity *(gpm/ft)*	Trans-missivity *(gpd/ft)*	Hydraulic conduc-tivity *(gpd/ft²)*	Storage coefficient
VER (Vermilion)										
17N11W										
31.6g1	Ridge Farm (V)	82	Ash-Glas?	720	32	80	4.2	8,200*	510	–
31.6g2	Ridge Farm (V)	78	Ash-Glas?	720	34	70	3.7	7,500*	750	–
31.7a(3)	Ridge Farm (V)	92	Ban	685	2.2	280	26.7	74,000**	1610	–
17N12W										
17.2d1(5-52)	Indianola	16	Alluv	660	4.0	25.5	3.1	3,920**	390	–
17.2d2(6-52)	Indianola	18	Alluv	660	5.5	30	5.3	5,030**	720	–
17.3b(3)	Indianola	49	Alluv	674	1.6	100	18.6	29,300**	680	–
17N13W										
26.8b(4)	Sidell (V)	69	Hen	655	1.0	118	5.5	20,100**	440	0.00056**
27.6e(3)	Sidell (V)	28	Hen-Ash?	690	10.8	37.6	4.4	7,500**	830	–
17N14W										
27.4e(1)	Allerton (V)	50	Ash	710	13	74	6.2	11,000*	1100	–
18N13W										
4.2c(3)	Fairmount (V)	49	Glas?	660	15.0	65	43.3	10,000**	2500	–
19N11W										
8.3f	Lauhoff Grain Co.	104	Ban?	595	21	1049	26.9	98,000*	1100	–
15.2f	Vermilion Hills Est.	74	Ban?	550	25.4	9.8	1.0	950**	120	–
15.3f	Vermilion Hills Est.	110	Ban?	545	25.0	49	7.3	20,900**	2090	–
19N13W										
7.6e(TW1)	Fithian (V)	97	Ban	660	14.8	20.5	0.7	1,000*	200	–
8.4e(2)	Oakwood (V)	64	Ban	640	45	33	3.3	6,700*	450	–
12.2a(1)	Oakwood (V)	71	Ban	646	11.5	40	1.2	2,200*	110	–
16.6g1	Fithian (V)	36	Glas?	650	13.5	66	5.7	15,800*	930	–
16.6g2(S1)	Fithian (V)	32	Glas?	650	21.0	30	7.2	17,200**	1010	–
19N14W										
10.4e(1-65)	State Highway Dept.	97	Ban	670	7.7	42	5.4	28,000**	760	–
11.4g(1)	St. of Illinois	105	Ban	660	4.8	48	41.4	70,400**	1070	–

* Specific capacity analysis

** Time-drawdown graphical analysis

† Distance-drawdown graphical analysis

CHEMICAL ANALYSES OF WATER FROM SELECTED WELLS

County and well number	Depth *(ft)*	Lab number	Iron Fe *(mg/L)*	Manganese Mn *(mg/L)*	Ammonium NH *(mg/L)*	Fluoride F *(mg/L)*	Nitrate NO$_3$	Chloride Cl	Sulfate SO$_4$	Alkalinity as CaCO$_3$	Hardness as CaCO$_3$ *(mg/L)*	Total dissolved minerals *(mg/L)*	Temperature *(°F)*
CHM (Champaign)													
17N7E													
7.6d(1)	85	* 50857	2.8	0.02	1.8	0.6	0.0	4.8	9.0	405	350	414	–
17N8E													
6.5h(2)	112	*B52803	1.7	0.01	1.7	0.6	0.0	7.0	6.2	405	250	429	–
6.5h(3)	116	211190	1.7	0.01	0.04	0.4	0.8	4.0	–	418	250	451	56
16.5e(1)	125	183696	1.1	0.01	–	0.6	1.1	8.0	–	348	204	368	56
22.1d(1)	190	144573	1.0	0.0	Tr	0.5	7.6	10.0	0.8	404	240	465	57
17N11E													
19.3a(2)	78	206372	1.0	0.03	–	0.7	0.8	4.0	–	350	200	377	55
30 (1)	120	135859	3.7	–	–	0.2	0.7	15.0	–	544	228	551	–
18N7E													
9.1c(1)	132	199023	0.7	0.07	2.5	0.4	1.5	3.0	–	382	248	406	–
18N8E													
2.2h(2)	168	119500	6.3	0.1	17.4	0.1	1.2	3.0	1.0	420	303	426	52
2.4e(1)	218	115437	4.8	–	10.7	0.1	–	2.0	0	504	400	526	55
25	150	144290	2.5	–	8.7	0.3	0.6	4.0	–	458	248	477	–
25.5d(9)	179	162156	5.4	0.12	10.3	0.3	0.6	3.0	2.0	640	391	669	–
25.5d(10)	181	164496	3.5	0.00	5.7	0.3	0.6	8.0	–	536	296	581	54
25.6d(11)	180	197126	3.1	0.03	8.5	0.3	0.9	7.0	0	555	328	576	–
25.8d(12)	182	192796	6.4	0.48	6.2	0.3	–	2.0	–	556	348	590	56
25.8f(5)	185	109850	1.7	0.0	1.0	0.3	1.0	13.0	1.0	488	301	548	–
26.1c(3)	158	116737	5.2	0.0	13.3	0.4	0.5	8.0	1.0	704	434	736	54
26.1c(4)	186	74759	1.0	0.0	0.3	–	1.5	20.0	2.0	416	235	466	–
18N9E													
22.1h(4)	26	*B50321	0.0	0.01	0.0	0.2	13.0	15.0	81.0	227	331	378	–
22.4f(2)	44	*B50320	0.1	0.14	0.0	0.3	1.3	10.0	98.0	276	370	438	–
22.4f(3)	29	*B50319	0.0	0.04	0.4	0.3	17.0	11.0	90.0	216	334	360	–
23.7g(1)	81	99701	0.8	–	–	–	–	7.0	–	308	317	379	52.1
18N10E													
16.2g(2)	59	*B114806	2.5	0.09	4.1	0.5	0.0	20.0	0	396	275	475	–
16.3g(1)	56	189650	1.3	0.09	13.2	0.4	1.1	14.0	–	388	256	446	56
16.6f(3)	53	*B52387	1.4	0.02	1.0	0.6	0.0	8.5	5.0	334	204	353	–
18N14W													
8.3c(2)	61	152174	0.4	Tr	2.3	0.5	0.1	28.0	6.0	400	265	478	–
8.3d(1)	72	116703	1.0	Tr	Tr	0.5	9.1	17.0	20.0	352	263	437	54
8.4e(3)	59	151089	0.9	0.1	–	0.3	8.3	56.0	–	436	300	581	–

CHEMICAL ANALYSES OF WATER FROM SELECTED WELLS-continued

County and well number	Depth *(ft)*	Lab number	Iron Fe *(mg/L)*	Manganese Mn *(mg/L)*	Ammonium NH *(mg/L)*	Fluoride F *(mg/L)*	Nitrate NO_3	Chloride Cl	Sulfate SO_4	Alkalinity as $CaCO_3$	Hardness as $CaCO_3$ *(mg/L)*	Total dissolved minerals *(mg/L)*	Temperature *(°F)*
19N8W													
2.8e(53)	289	142209	0.6	0.1	1.9	0.3	0.3	4.0	4.0	292	261	308	–
3.4a(57)	297	157245	0.5	0.0	1.7	0.3	2.2	1.0	–	316	259	322	–
3.8c(60)	340	186776	1.1	0.00	1.0	0.3	0.3	0	0	312	252	303	–
4.5a(61)	297	196205	0.7	0.04	1.7	0.3	0.0	1.0	0	318	248	315	–
5.1g(49)	297	143102	0.7	Tr	0.7	0.3	1.6	2.0	0	308	259	313	–
11.7f(1)	291	140154	0.2	–	1.2	0.3	–	5.0	–	316	244	323	52
12.3c(3)	189	79857	0.8	0.0	1.6	–	0.6	1.0	5.0	318	238	332	–
13.1h	166	74937	1.6	0.0	1.7	–	1.4	–	–	352	278	357	–
18.4d(1)	278	130292	0.1	0.0	0.8	0.3	3.3	3.0	0	320	251	324	54
18.8h(4)	310	167077	0.6	0.02	–	0.3	1.3	10.0	–	284	276	362	–
21.3h	260	177279	0.5	0.07	–	0.3	1.3	2.0	–	250	268	363	–
24.4b	154	132296	0.5	–	–	–	–	0	–	256	212	260	54
25.1e	155	108023	0.8	Tr	2.0	–	0.0	2.0	0	244	233	246	54
36.2e	144	160861	0.9	–	–	–	–	1.0	–	252	194	261	–
36.6a	168	100487	3.0	–	–	–	–	1.0	–	474	363	509	55
19N9E													
6.5f3(3)	161	174471	1.6	0.00	1.9	0.4	0.3	0	2.0	328	242	355	58
7.3h(47)	217	*B 100103	2.6	–	3.9	0.3	0.0	2.0	0	360	300	395	–
7.4a(11)	160	108913	1.2	0.0	2.6	0.3	0.5	1.0	2.0	344	271	369	–
7.8g(2)	190	190104	1.1	0.09	–	0.4	0.4	7.0	–	320	252	395	57
8.4a	151	121044	1.2	–	1.9	0.1	–	3.0	6.0	380	353	389	54
18.4h(6)	169	69273	1.8	Tr	2.6	–	0.0	2.0	33.0	350	319	406	–
18.4h(9)	248	72416	0.7	0	1.18	–	0.35	4.0	0	300	248	304	–
21.7g(1)	45	119472	1.5	0.1	0.1	0.3	0.5	19.0	182.0	284	500	562	53
21.7g(2)	174	135291	1.5	–	–	0.2	1.0	4.0	–	328	276	324	55
19N10E													
14.6h(1)	76	162179	1.7	0.02	–	0.4	0.6	5.0	–	352	316	375	56
15.1g(3)	72	187381	0.4	0.00	–	0.4	0.7	4.0	–	364	296	395	56
19N14W													
9.7a(1)	65	129966	1.8	Tr	1.0	0.3	0	30.0	26.0	336	375	426	56
CLK (Clark)													
12N14W													
20.7d(5)	50	193281	4.3	0.07	–	0.4	0.7	9.0	–	426	382	426	55

CHEMICAL ANALYSES OF WATER FROM SELECTED WELLS-continued

County and well number	Depth (ft)	Lab number	Iron Fe (mg/L)	Manganese Mn (mg/L)	Ammonium NH_4 (mg/L)	Fluoride F (mg/L)	Nitrate NO_3	Chloride Cl	Sulfate SO_4	Alkalinity as $CaCO_3$	Hardness as $CaCO_3$ (mg/L)	Total dissolved minerals (mg/L)	Temperature (°F)
COL (Coles)													
11N7E													
18.4e(2)	41	106107	0.7	–	–	–	–	6.0	–	248	277	324	54.5
19.6g	38	137221	0.8	–	–	0.1	0.3	6.0	–	220	272	293	–
11N8E													
10.4g	34	147792	1.6	–	–	0.3	0.3	19.0	–	244	388	429	56
11N9E													
13.6f	159	149506	3.1	0.4	2.7	1.8	0.1	6.0	0.4	492	68	562	58
12N7E													
24.4g(7)	56	86666	2.6	0.0	3.6	–	2.1	16.0	242.3	424	644	813	–
12N8E													
14.2b(2)	113	188930	1.6	–	17.5	–	–	8.0	–	440	128	521	58
14.7c(1)	48	126051	5.4	0.0	9.7	0.3	0.4	2.0	0.0	360	276	357	56
12N11E													
6.7h(1)	42	189816	1.4	0.16	–	0.2	0.5	20.0	–	368	454	533	55
13N7E													
10.7c	16	179311	0.4	0.01	–	0.2	1.1	6.0	–	150	208	264	59
26.1d(1)	33	211147	2.0	0.54	7.4	0.3	0.9	12.0	–	368	336	399	54
13N8E													
30.5c(2A)	42	135068	2.3	–	–	0.3	0.3	12.0	–	364	352	398	–
30.6d(3B)	43	134068	1.3	–	–	0.2	0.2	6.0	–	380	356	391	55.7
14N7E													
26.2d	73	159861	8.1	–	–	–	–	23.0	–	512	312	554	–
DGL (Douglas)													
14N7E													
11.7d(2)	70	204613	2.1	–	5.4	–	–	4.0	–	430	294	449	–
14N8E													
3.8g(6)	119	*B04196	5.1	0.19	6.0	0.4	0.0	35.0	30.0	377	357	456	–
11.6a	88	133028	1.6	0.1	0.9	0.7	0.1	46.0	0.4	388	177	494	55

CHEMICAL ANALYSES OF WATER FROM SELECTED WELLS-continued

County and well number	Depth *(ft)*	Lab number	Iron Fe *(mg/L)*	Manganese Mn *(mg/L)*	Ammonium NH_4 *(mg/L)*	Fluoride F *(mg/L)*	Nitrate NO_3	Chloride Cl	Sulfate SO_4	Alkalinity as $CaCO_3$	Hardness as $CaCO_3$ *(mg/L)*	Total dissolved minerals *(mg/L)*	Temperature *(°F)*
14N10E													
6.5e(3)	140	*B07763	4.2	0.06	22.0	0.6	0.4	280.0	9.6	700	372	1131	–
6.6a(4)	105	208655	7.0	0.13	0.9	0.5	2.3	26.0	–	460	230	603	57
6.6b(2)	28	154979	5.3	0.3	–	0.5	1.6	56.0	–	388	336	524	55
15N7E													
1.2f	55	86875	2.2	0.0	5.1	–	0.9	55.0	0.0	384	242	496	–
6.3f(T17)	95	205785	4.0	0.03	–	0.3	0.9	2.0	–	494	370	512	56
19.8c(6)	84	*B34073	2.5	0.04	3.6	0.3	0.4	5.3	12.0	550	401	540	–
30.7h(3)	90	176641	2.2	0.00	1.5	0.5	1.2	7.0	–	536	352	583	55
15N8E													
20.1g	178	198886	4.2	0.01	5.7	0.7	1.4	36.0	–	532	152	657	56.5
31.8a(10)	79	167767	8.3	0.21	–	–	2.9	9.0	–	492	240	755	56
15N10E													
25.4d	63	173222	1.9	0.14	–	0.2	0.0	10.0	0.0	472	364	477	57
16N7E													
31.8e(2)	96	197808	2.6	0.05	2.5	0.4	0.3	1.0	0.0	472	364	477	–
16N9E													
34.4e(3)	72	186851	9.7	0.00	–	0.3	1.6	25.0	–	692	506	718	54
16N10E													
4.8h(1)	60	144124	1.4	Tr	2.4	0.5	0.3	11.0	1.0	368	267	404	55
16N11E													
31.4h(4)	58	132251	1.1	0.1	1.3	0.5	0	5.0	1.8	348	281	379	54.4
16N14W													
31.7d(2)	143	118843	3.9	0.0	16.6	0.3	3.0	370.0	0.0	524	255	1162	–
32.5a(3)	30	119976	1.1	0.1	0.2	0.3	0.8	5.0	50.6	220	280	318	56
EDG (Edgar)													
13N11W													
11.2a(2)	55	*B08677	2.0	0.03	1.9	0.4	0.0	18.0	20.0	386	377	422	–
14N13W													
21.6a(1)	66	*B30195	5.6	0.15	13.0	0.4	0.0	10.0	5.0	453	382	490	–
15N14W													
25.4g(1)	38	*B0019534	0.2	0.0	2.9	0.3	0.4	7.0	25.0	290	308	362	–

CHEMICAL ANALYSES OF WATER FROM SELECTED WELLS-continued

County and well number	Depth *(ft)*	Lab number	Iron Fe *(mg/L)*	Manganese Mn *(mg/L)*	Ammonium NH_4 *(mg/L)*	Fluoride F *(mg/L)*	Nitrate NO_3	Chloride Cl	Sulfate SO_4	Alkalinity as $CaCO_3$	Hardness as $CaCO_3$ *(mg/L)*	Total dissolved minerals *(mg/L)*	Temperature *(°F)*
16N11W													
26.4b	125	121040	9.0	–	22.1	0.4	0.3	148.0	29.6	584	334	900	54
16N12W													
26.1a(5)	92	185300	4.9	0.00	–	0.5	1.4	48.0	–	468	244	518	54.9
16N13W													
31.3c(2)	57	200294	1.5	0.54	–	0.2	1.3	23.0	–	274	390	478	56
MCN (Macon)													
14N2E													
18.8a(14)	34	205639	0.7	0.65	–	0.3	0.1	13.0	–	316	578	709	56
15N2E													
29.1b(3)	128	152746	5.3	0.0	–	0.4	1.2	25.0	–	680	480	735	55
16N2E													
9.6f	114	76454	4.9	0.0	9.0	–	0.6	23.0	0.0	620	474	683	–
11.5g	84	81395	4.0	0.0	2.8	–	1.9	0.0	15.4	398	377	416	–
12.4b	59	94060	0.7	–	–	–	–	190.0	–	298	767	1322	–
14.7h	65	92888	0.9	1.4	0.1	–	8.7	120.0	624.9	374	988	1470	60.6
15.1d	54	95392	2.0	–	–	–	–	132.0	–	404	720	1093	60.6
15.7h	100	81393	2.0	0.0	0.3	–	1.8	61.0	141.2	372	534	687	–
22.6f(T10)	59	108132	0.1	–	–	–	–	13.0	46.3	300	329	389	53.7
16N3E													
7.1h(1)	97	95472	2.2	–	–	–	–	4.0	–	300	364	380	54.6
16.8f(1)	63	121768	6.8	–	–	–	–	7.0	–	312	426	447	53.6
17N2E													
14.7h	116	211778	3.5	0.03	–	0.3	0.3	12.0	–	414	372	431	–
17N3E													
9.2e(1)	132	157334	8.6	Tr	12.6	0.3	0.5	12.0	0.0	508	378	517	–
10.8f	136	205782	9.1	0.05	–	0.3	1.1	23.0	–	554	392	608	55.5
27.7b(1)	106	205435	4.0	0.06	–	0.5	0.6	40.0	–	536	408	639	–
17N4E													
33.8h(7)	31	186933	0.5	0.11	0.1	0.2	0.5	18.0	–	252	376	448	56.5
18N2E													
2.8b	290	203885	1.5	0.05	–	0.4	1.4	61.0	–	412	316	511	56.4

CHEMICAL ANALYSES OF WATER FROM SELECTED WELLS-continued

County and well number	Depth *(ft)*	Lab number	Iron Fe *(mg/L)*	Manganese Mn *(mg/L)*	Ammonium NH_4 *(mg/L)*	Fluoride F *(mg/L)*	Nitrate NO_3	Chloride Cl	Sulfate SO_4	Alkalinity as CaCO3	Hardness as $CaCO_3$ *(mg/L)*	Total dissolved minerals *(mg/L)*	Temperature *(°F)*
18N3E													
26.1a(1)	230	144135	1.4	0.0	2.0	0.4	2.4	77.0	1.2	432	327	572	55
18N4E													
30.1d(1)	230	198096	1.2	0.00	–	0.3	0.5	27.0	–	414	346	478	54.5
MOU (Moultrie)													
12N6E													
26.4f(3)	110	181232	9.7	0.00	31.9	0.6	2.3	12.0	–	712	464	703	57
13N5E													
13.4e	90	135125	2.8	Tr	–	–	–	6.0	–	392	352	412	–
23.3g(N)	129	115142	3.2	Tr	0.4	0.1	3.4	5.0	4.1	344	335	349	55.5
14N4E													
22.7d	41	75771	5.0	0.0	1.6	–	1.5	9.0	0.0	444	332	450	–
25.5g	89	198788	4.3	0.00	–	0.3	0.0	11.0	–	364	344	414	56
14N5E													
30.8h(2)	71	160859	2.5	0.13	–	0.2	1.5	11.0	–	392	359	418	56
15N4E													
29.2c	78	179935	8.2	0.06	32.1	0.4	1.4	0.0	2.3	728	472	734	–
15N5E													
27.4f	108	*A11752	2.6	0.05	7.0	0.4	0.0	25.0	0	500	390	570	–
PIA (Piatt)													
16N4E													
35.5f(2)	60	208803	0.2	0.09	22.2	0.3	1.1	2.0	–	566	450	592	–
16N5E													
36.8d(1)	87	115790	5.3	0.1	10.3	0.1	0.1	26.0	3.0	472	272	502	56
17N4E													
11.8d(8)	156	198715	0.9	0.06	1.8	0.4	0.6	42.0	–	360	288	445	56.5
17N6E													
19.7g(5)	139	115722	0.4	0.1	2.3	0.3	0.1	22.0	2.1	400	321	444	55.2

CHEMICAL ANALYSES OF WATER FROM SELECTED WELLS-continued

County and well number	Depth (ft)	Lab number	Iron Fe (mg/L)	Manganese Mn (mg/L)	Ammonium NH_4 (mg/L)	Fluoride F (mg/L)	Nitrate NO_3	Chloride Cl	Sulfate SO_4	Alkalinity as $CaCO_3$	Hardness as $CaCO_3$ (mg/L)	Total dissolved minerals (mg/L)	Temperature (°F)
18N4E													
14.8b(2-50)	113	123280	12.0	0.0	24.2	0.1	0.0	2.0	6.8	636	432	657	54.8
18N5E													
7.1h(1)	195	168128	2.1	–	3.2	–	–	7.0	–	412	312	451	55
21.1b	201	124238	0.7	–	–	–	–	6.0	–	320	251	340	55
30.7a(2)	252	138932	2.6	0.1	1.4	0.1	0.5	14.0	3.0	388	324	404	55
31.7g(1)	244	138552	1.9	0.0	0.8	0.1	2.9	11.0	0	380	327	398	54
18N6E													
6.4f(1)	118	110152	1.6	–	–	–	–	3.0	42.0	328	332	386	55
7.6a(1)	209	115726	1.7	0.1	0.5	0.1	0.4	8.0	3.0	320	250	341	55
7.6b(4)	263	153660	1.6	0.1	0.5	0.2	1.3	5.0	0	332	265	356	56
19N5E													
9.8b(1)	83	152582	2.4	0.0	17.9	0.4	0.6	17.0	0	624	475	655	56
19N6E													
22.5d(1)	233	179299	1.6	0.05	–	0.4	1.5	0	–	334	326	421	55
SHL (Shelby)													
11N2E													
23.8e	36	121992	1.5	–	–	0.3	–	15.0	3.3	272	251	314	54.6
11N3E													
23.2h(T2)	54	* 37529	0.5	0.15	–	–	6.2	31.0	73.0	332	384	470	–
26.5h(7)	61	178777	2.8	0.13	–	0.2	1.7	26.0	–	370	386	486	54.5
35.6b(4)	59	182631	1.6	0.14	–	0.1	7.2	13.0	–	316	340	377	54.2
11N5E													
12.7h(4)	100	128973	5.7	0	15.4	0.4	1.2	3.0	1.9	536	329	556	57.1
12N4E													
3.8g(2)	163	208831	3.2	0.00	9.9	0.6	1.1	94.0	–	502	274	681	57.5
12N5E													
34.6f(6)	64	194932	0.3	0.31	5.1	0.4	1.5	14.0	–	328	342	419	54.5
36.5e(2)	133	177411	5.7	0.00	4.5	0.6	3.3	22.0	–	484	174	589	57

CHEMICAL ANALYSES OF WATER FROM SELECTED WELLS-continued

County and well number	Depth *(ft)*	Lab number	Iron Fe *(mg/L)*	Manganese Mn *(mg/L)*	Ammonium NH_4 *(mg/L)*	Fluoride F *(mg/L)*	Nitrate NO_3	Chloride Cl	Sulfate SO_4	Alkalinity as $CaCO_3$	Hardness as $CaCO_3$ *(mg/L)*	Total dissolved minerals *(mg/L)*	Temperature *(°F)*
VER (Vermilion)													
17N11W													
31.7a(3)	92	165496	1.0	0.05	0.3	0.7	0.5	13.0	–	332	244	368	–
17N12W													
17.2d(5-52)	16	129367	0.8	–	–	0.2	0.5	16.0	–	336	353	398	55.2
17.3b(3)	49	203843	1.1	0.07	–	0.2	0.1	54.0	–	356	566	707	55
17N13W													
26.8b(4)	69	164678	0.8	0.06	–	0.5	1.4	16.0	–	370	278	407	54.5
27.6e(3)	28	169596	0.2	0.00	–	0.3	5.2	11.0	–	212	288	354	–
17N14W													
27.4e(1)	50	144820	1.4	0.1	Tr	0.3	1.2	4.0	45.5	312	339	374	54
18N13W													
4.2c(3)	49	163757	2.4	0.13	–	0.1	0.7	24.0	–	288	572	748	56
19N13W													
7.6e(T1)	97	123167	1.3	Tr	2.5	0.4	0.6	480.0	0.8	376	192	1188	54.8
12.2a(1)	71	119115	3.1	Tr	1.7	0.3	0.3	26.0	18.1	404	348	465	55
16.6g(1)	36	144125	0.1	Tr	Tr	0.2	3.4	12.0	82.5	220	308	369	56.5
19N14W													
10.4e(1-65)	97	165793	2.6	0.16	–	0.3	1.6	0	–	392	320	388	54.5
11.4g(1)	105	159953	2.0	0.1	–	0.2	0.7	3.0	–	340	324	342	55

*Analysis by Illinois Environmental Protection Agency laboratory

APPENDIX 3. DATA FROM STRATIGRAPHIC TEST HOLES AND TEST WELLS

DATA FROM STRATIGRAPHIC TEST HOLES AND TEST WELLS DRILLED FOR THIS PROJECT

Test holes and wells	County	Location	Land surface elevation, est. *(ft)*	Depth to rock/ total depth *(ft)*	Aquifer(s) encountered		
					Unit	Depth to *(ft)*	Thickness *(ft)*
Stratigraphic tests							
DAA-1	Vermilion	SE SE NE 17, 17N-12W	678	86/88.5	–	–	–
DAA-2	Champaign	NW NW NW 33, 18N-14W	679	101/110	Banner	70	14
DAA-3	Vermilion	SW NW SE 24, 17N-14W	680	94/110	–	–	–
DAA-4	Edgar	NE SW NE 4, 15N-13W	652	107.5/113.5	Banner	52	5
DAA-5	Douglas	SE SE SE 5, 14N-9E	645	131/136	–	–	–
DAA-6	Champaign	NW NW NE 25, 17N-8E	698	253/257	–	–	–
DAA-7	Piatt	C SE 12, 16N-6E.	678	132/159	Ashmore Glasford	26 58	8 49
DAA-8	Coles	SE SE SW 27, 12N-10E	752	205/205	–	–	–
DAA-9	Shelby	SE SE NE 4, 11N-5E	700	97/113	–	–	–
DAA-10	Moultrie	SE SW NW 26, 14N-6E	660	82/101	Ashmore	50	6
DAA-11	Moultrie	SE NE NE 17, 14N-5E	660	185.5/193.5	Glasford	80	50
DAA-12	Macon	SW SW SW 29, 17N-4E	670	141/148.5	–	–	–
DAA-13	Not drilled						
DAA-14	Coles	NE SE SE 21, 13N-7E	670	75/83.5	Ashmore	22.5	7.5
DAA-15	Piatt	SE SE SE 6, 16N-5E	710	163/203.5	Glasford	121	19
Test wells							
DAA-16*	Champaign	NW SW NW 22, 18N-10E	678	139/150	Banner	122	17
DAA-17	Edgar	SE SE SE 18, 14N-13W	650	105+/105	Banner	40	8
DAA-18	Douglas	SW SE SW 6, 16N-14W	685	75+/75	Glasford	60	5
DAA-19	Coles	SW SW NE 18, 12N-11E	740	130/135	Ashmore	91	3
DAA-20* (DAA-11 site)	Moultrie	SE NE NE 17, 14N-5E	660	120+/120	Glasford	85	40+
DAA-21* (DAA-7 site)	Piatt	C SE 12, 16N-5E	678	75+/75	Glasford	44	31+
DAA-22	Champaign	SE NE NW 35, 20N-10E	660	102/135	Glasford	35	65

* Production test run (see Appendix IV)

APPENDIX 4. PRODUCTION TEST AND LABORATORY DATA FROM WELL DAA 16

PRODUCTION TEST

Well owner	J. H. McArthur
Well location	NW SW NW, Sec. 22, T. 18 N., R. 10 E.
Date well completed	April 28, 1980
Date of production test	May 5, 1980
Length of production test	3 hours
Aquifer	Sand and gravel
Date water sample collected	May 5, 1980

PUMPED-WELL DATA

Well no.	1
Drilling contractor	Eaton Well Drilling, Tolono, IL
Drill cuttings	ISGS
Drilling method	Rotary
Casing record	4-in. plastic, +1.9 to depth of 127 ft
Screen record	4-in. plastic, #25 slot, set from depth of 127 to 132 ft
Test pump and power	Test submersible, generator
Measuring equipment	Electric dropline, folding tape, orifice bucket
Time water sample collected	11:45 a.m.
Temperature of water	56° F
Ground elevation at well	±675 ft MSL, taken from topographic map
Measuring point	Top of casing 1.9 ft above ground
Nonpumping water level	10.38 ft (depth below measuring point)
Remarks	Well drilled primarily to determine aquifer hydraulic properties as part of aquifer assessment program in east-central Illinois.

WATER-SAMPLE ANALYSIS DATA

Date collected	May 5, 1980
Date received	May 30, 1980
Well depth	150ft
Treatment	None
Comments	Sample collected by A. Visocky as part of research project to determine hydraulic properties of the aquifer.

LABORATORY NO. 213531

			mg/L*	me/L*
Iron (total)	Fe		4.4	
Sodium	Na		130	5.66
Phosphate (filtered)	P		0.14	
Phosphate (unfiltered)	P		1.1	
Silica	SiO		16.2	
Nitrate	NO_3		0.7	0.01
Chloride	Cl		31	0.87
Alkalinity	as	$CaCO_3$	492	9.84
Hardness	as	$CaCO_3$	236	4.72
Total dissolved minerals			600	
Turbidity			27	
Color			35	
Odor			None	

*mg/L	milligrams per liter
me/L	milliequivalents per liter
mg/L x .0583	grains per gallon

DAA 16 PUMPED-WELL MEASUREMENTS

Date	Hour	Time (min.)	Depth to water (ft)	Drawdown (ft)	Piez. tube (in.)	Pump rate (gpm)	Remarks
05-05-80	8:40 a.m.		10.36				SWL readings
	8:47		10.36				
	8:52		10.38				
	8:56		10.38				
	9:00	0	10.38				Pump on
	9:00:30	0.5	19.98	9.60	13.0	52	Adjusting rate
	9:01	1	12.30	1.92	12.0	48	
	9:02	2	15.43	5.05			
	9:03	3	16.25	5.87	11.25	45	
	9:04	4	16.28	5.90	11.25	45	
	9:05	5	16.33	5.95	11.25	45	
	9:06	6	16.35	5.97	11.25	45	
	9:07	7	16.40	6.02	11.25	45	
	9:08	8	16.42	6.04	11.25	45	
	9:09	9	16.45	6.07	11.25	45	
	9:10	10	16.47	6.09	11.25	45	
	9:12	12	16.51	6.13	11.25	45	
	9:14	14	16.54	6.16	11.25	45	
	9:16	16	16.58	6.20	11.25	45	
	9:18	18	16.63	6.25	11.25	45	
	9:20	20	16.68	6.30	11.25	45	
	9:25	25	16.75	6.37	11.25	45	
	9:30	30	16.79	6.41	11.25	45	
	9:40	40	16.91	6.53	11.25	45	
	9:50	50	17.01	6.63	11.25	45	
	10:00	60	17.07	6.69	11.25	45	
	10:10	70	17.19	6.81	11.25	45	Electric timer slow by 5 min.
	10:20	80	17.19	6.81	11.20	44.8	Changed to stopwatch
	10:30	90	17.44	7.03	11.25	45	
	10:40	100	17.51	7.13	11.25	45	
	11:00	120	17.57	7.19	11.25	45	
	11:20	140	17.71	7.33	11.25	45	
	11:40	160	17.73	7.35	11.25	45	
	12:00 p.m.	180	17.87	7.49	11.25	45	Pump off
	12:00	0					Recovery
	12:00:30	0.5	11.64				
	12:01	1	12.28				
	12:02	2	12.25				
	12:03	3	12.16				
	12:04	4	12.10				
	12:05	5	12.04				
	12:06	6	12.01				
	12:07	7	11.98				
	12:08	8	11.96				
	12:09	9	11.92				
	12:10	10	11.90				
	12:12	12	11.88				
	12:14	14	11.82				
	12:16	16	11.79				
	12:18	18	11.78				
	12:20	20	11.75				
	12:25	25	11.68				
	12:30	30	11.64				

APPENDIX 5. PRODUCTION TEST AND LABORATORY DATA FROM WELL DAA 20

PRODUCTION TEST

Well owner	Guy Little
Well location	SE NE NE, Sec. 17, T. 14 N., R. 5 E., Moultrie County
Date well completed	May 23, 1980
Date of production test	May 28, 1980
Length of production test	3 hours, constant rate
No. of observation wells	—
Aquifer	Sand and gravel
Date water sample collected	May 28, 1980

PUMPED-WELL DATA

Well no.	1
Depth	107 ft
Drilling contractor	Eaton Well Drilling Co.
Drill cuttings	ISGS
Drilling method	Rotary
Hole record	4 in., 0 to depth of 107 ft
Casing record	4-in. plastic, +2.2 to depth of 102 ft
Screen record	4-in. plastic, #25 slot, set from depth of 102 to 107 ft
Test pump and power	Test submersible, generator
Measuring equipment	Electric dropline, staff gauge, orifice bucket
Time water sample collected	12:10 p.m.
Temperature of water	55.5°F
Ground elevation at well	±660 ft MSL (topographic map)
Measuring point	Top of casing, 2.2 ft above ground
Nonpumping water level	15.32 ft (depth below measuring point)
Remarks	This well drilled to test aquifer hydraulic properties as part of project "Groundwater Resources Assessment of Potential Aquifers in East-Central Illinois."

WATER-SAMPLE ANALYSIS DATA

Date collected	May 28, 1980
Date received	June 10, 1980
Well depth	107 ft
Treatment	None
Comments	Well drilled to determine aquifer properties.

LABORATORY NO. 213578			mg/L*	me/L*
Iron (total)	Fe		3.0	
Sodium	Na		21.7	0.94
Phosphate (filtered)	P		< 0.1	
Phosphate (unfiltered)	P		0.2	
Nitrate	NO_3		1.0	0.02
Chloride	Cl		5	0.14
Alkalinity	as	$CaCO_3$	368	7.36
Hardness	as	$CaCO_3$	312	6.24
Total dissolved minerals			384	
Turbidity			17	
Color			10	
Odor			None	

*mg/L	milligrams per liter
me/L	milliequivalents per liter
mg/L x .0583	grains per gallon

APPENDIX 5-continued

DAA 20 PUMPED-WELL MEASUREMENTS

Date	Hour	Time (min.)	Depth to water (ft)	Draw-down (ft)	Piez. tube (in.)	Pump rate (gpm)	Remarks
05-28-80	9:05 a.m.		15.33				
	9:13		15.40				
	9:18		15.34				
	9:21		15.33				
	9:24		15.31				
	9:27		15.34				
	9:30	0	15.32				Pump on
	9:31	1	22.84	7.52		60	Adjusting slightly
	9:32	2	22.73	7.41		60	Adjusting slightly
	9:33	3	22.50	7.18		60	Adjusting slightly
	9:34	4	22.97	7.65		60	
	9:35	5	23.02	7.70		60	
	9:36	6	23.15	7.83		60	
	9:37	7	23.05	7.73		60	Adjusted rate up
	9:38	8	23.17	7.85			
	9:39	9	23.27	7.95		60	
	9:40	10	23.41	8.09		60	
	9:42	12	23.41	8.09			
	9:44	14	23.49	8.17			
	9:46	16	23.49	8.17			
	9:48	18	23.54	8.22			
	9:50	20	23.60	8.28		60	
	9:55	25	23.75	8.43		60	
	10:00	30	23.87	8.55		60	
	10:05	35	23.97	8.65			
	10:10	40	24.00	8.68			
	10:20	50	24.14	8.82		60	
	10:30	60	24.30	8.98			
	10:40	70	24.46	9.14		48	10:43 generator trouble
	10:50	80	24.56	9.24		56	generator trouble
	11:00	90	24.72	9.40		49	generator trouble
	11:10	100	24.76	9.44		60	
	11:30	120	24.91	9.59		60	
	11:50	140	25.09	9.77			
	12:10 p.m.	160	25.39	10.07			
	12:30	180	25.38	10.06		60	Pump off
	12:30	0	25.38				Recovery
	12:31	1	17.53				
	12:32	2	17.41				
	12:33	3	17.37				
	12:34	4	17.28				
	12:35	5	17.25				
	12:36	6	17.20				
	12:37	7	17.17				
	12:38	8	17.15				
	12:39	9	17.12				
	12:40	10	17.09				
	12:42	12	17.04				
	12:44	14	17.00				
	12:46	16	16.95				
	12:48	18	16.93				
	12:50	20	16.89				
	12:55	25	16.81				
	1:00	30	16.75				End of test

APPENDIX 6. PRODUCTION TEST AND LABORATORY DATA FROM WELL DAA 21

PRODUCTION TEST

Well owner	Ruth Cordts
Well location	C SE, Sec. 12, T. 16 N., Ft. 5 E.
Date well completed	May 23, 1980
Date of production test	May 29, 1980
Length of production test	81 minutes
Aquifer	Sand
Date water sample collected	—

PUMPED-WELL DATA

Well no.	1
Drilling contractor	Eaton Well Drilling Co.
Drill cuttings	ISGS
Depth	59 ft
Hole record	4 in., 0 to depth of 59 ft
Casing record	4-in. plastic, +2.6 to depth of 54 ft
Screen record	4-in. plastic, #25 slot, set from depth of 54 to 59 ft
record	—
Test pump and power	Test submersible, generator
Measuring equipment	Orifice bucket, electric dropline, staff gauge
Time water sample collected	10:06 a.m.
Temperature of water	56°F
Ground elevation at well	670 ft MSL (topographic map)
Measuring point	Top of casing, 2.6 ft above ground
Nonpumping water level	21.13 ft
Remarks	This well drilled to test aquifer hydraulic properties as part of project "Groundwater Resources Assessment of Potential Groundwater Aquifers in East-Central Illinois."

DAA 21 PUMPED-WELL MEASUREMENTS

Date	Hour	Time (min.)	Depth to water (ft)	Draw-down (ft)	Piez. tube (in.)	Pump rate (gpm)	Remarks
05-29-80	8:58 a.m.		21.12				
	9:00		21.13				
	9:02		21.13				
	9:05		21.13				Pump on at 9:06
	9:07	1	37.90	16.77		13	
	9:11	5	38.30	17.17		10	
	9:12	6	40.27	19.14		10	
	9:13	7	39.92	18.79		10	
	9:14	8	41.06	19.93		10	
	9:15	9	41.73	20.60		10.25	
	9:16	10	41.36	20.23		10.5	
	9:18	12	41.19	20.06		9.8	
	9:20	14	41.49	20.36		10	
	9:22	16	41.53	20.40			
	9:24	18	41.65	20.52			
	9:26	20	41.75	20.62		10	
	9:31	25	42.37	21.24		10	
	9:36	30	42.56	21.43		10	
	9:41	35	42.67	21.54			
	9:46	40	43.17	22.04		10	
	9:56	50	43.86	22.73		10	
	10:06	60	44.37	23.24		10	
	10:16	70	45.49	24.36			
	10:26	80				10	Couldn't measure DWL
	10:27	81					Pump off
	10:28	1	26.42				Recovery
	10:29	2	24.57				
	10:30	3	23.75				
	10:31	4	23.31				
	10:32	5	23.04				
	10:33	6	22.87				
	10:34	7	22.75				
	10:35	8	22.64				
	10:36	9	22.56				
	10:37	10	22.49				
	10:39	12	22.38				
	10:41	14	22.29				
	10:43	16	22.20				
	10:45	18	22.15				
	10:47	20	2208 22.04	diff. beads			
	10:52	25	21.93				
	10:57	30	21.88				End of test

NOTE: Chemical analyses not run.

STATE OF ILLINOIS
HON. JAMES R. THOMPSON, Governor

DEPARTMENT OF ENERGY AND NATURAL RESOURCES
MICHAEL B. WITTE, Director

STATE GEOLOGICAL SURVEY
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