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Kane County Water Resources Investigations:

Final Report on Shallow Aquifer Potentiometric Surface Mapping

by

Randall A. Locke II, P.G. and Scott C. Meyer, P.G.

Prepared for the
Kane County Development and Resource Management Department
Phillip S. Bus, Executive Director

August 2007

Illinois State Water Survey
Center for Groundwater Science
Champaign, Illinois

A Division of the Illinois Department of Natural Resources
and an affiliated agency of the University of Illinois

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Executive Summary

Prompted by concerns for their county's water resources, Kane County officials funded a multifaceted project to be conducted by the Illinois State Water Survey (ISWS) and Illinois State Geological Survey (ISGS). The project, initiated in May 2002 and scheduled to conclude in December 2007, will provide baseline water-resources data, analyses, and tools for future analyses of water resources available to the county.

This report presents and discusses groundwater data and analyses performed as a part of the investigations in Kane County. It supersedes the interim report on potentiometric mapping produced in April 2005. Shallow aquifers considered include the unconsolidated sand-and-gravel aquifers and the uppermost bedrock (i.e., the shallow bedrock aquifer). Deeper bedrock aquifers, including the productive Ancell Group and Ironton-Galesville sandstones, are not within the scope of this study, but are discussed in other ISWS reports.

The study area includes Kane County and adjacent townships covering a total area of 1260 square miles. A network of 1010 private, public, industrial, and commercial wells was assembled during the inventory phase (May 2002 - August 2003). During the synoptic phase (September - October 2003), water-level measurements were collected from those wells. Water-level data were used to construct potentiometric maps for three shallow aquifers: the Ashmore Tongue, the aggregated Glasford Formation sands, and the shallow bedrock.

Using only groundwater data to constrain the potentiometric surfaces of individual aquifers, the potentiometric surfaces still closely correlated with perennial stream configurations and land-surface topography. The Fox River and Marengo Ridge are the most influential features that determine regional groundwater flow patterns in the county. Groundwater flow west of the Fox River is predominantly to the south and east. East of the Fox River, flow is to the south and west.

The final potentiometric maps can be used to characterize regional groundwater flow, identify areas of groundwater recharge and discharge, determine regional effects of groundwater withdrawals, and provide a baseline for comparison with future groundwater conditions. The maps have been useful in developing a conceptual model of groundwater flow and corresponding mathematical groundwater flow models for a wide range of analyses, including aquifer development scenarios.

In 2003, 52 high-capacity wells accounted for 6.6 billion gallons or 96 percent of the total reported groundwater withdrawals of 6.9 billion gallons from the shallow aquifers in Kane County. Groundwater withdrawals appear to have locally influenced the head surfaces, particularly in east-central and southeastern Kane County. Areas of relatively low head in the shallow bedrock aquifer may reflect large withdrawals from the aquifer, hydraulically connected units, and/or areas of significant discharge to the Fox River.

Some source aquifer assignments have been changed since the interim report was published in 2005, and this report presents the updated interpretations as well as new potentiometric maps based on those interpretations. This report supersedes the interim report. Because of the mapping scale, updates to the underlying data have not significantly affected the maps from a regional groundwater flow perspective.

Introduction

The Northeastern Illinois Planning Commission projects that the population of Kane County will increase by 30-40 percent from 2000 to 2020, but the capacity of the water resources of the county to accommodate additional demand is poorly understood. Furthermore, legal restrictions on the use of Lake Michigan water for Illinois render it unlikely that Lake Michigan, a water source for Chicago and other suburban areas, will ever become available to Kane County. Withdrawals from the deep bedrock aquifers in northeastern Illinois, a source of groundwater that is heavily used in Kane County, totaled 72 million gallons per day (mgd) in 1999 (Burch, 2002). That withdrawal rate may exceed the practical sustained yield of the deep bedrock aquifers, estimated as 28-180 mgd by Walker et al. (2003), and as a result, continued hydraulic head declines may occur in wells open to those aquifers. Moreover, the potential exists for water quality in the deep bedrock system to degrade as groundwater containing undesirable concentrations of dissolved constituents such as radium, barium, and chloride moves toward pumping centers. To accommodate additional demand in Kane County, water likely will be obtained from the shallow glacial and shallow bedrock aquifers and the Fox River, the most environmentally sensitive water resources available to the county. Yet, an analysis of the groundwater use to potential aquifer yield in Illinois by Wehrmann et al. (2004) identified several townships in Kane County where groundwater from shallow glacial aquifers may already be overused. These shallow and surficial sources are also likely to be more susceptible to changes in precipitation and evapotranspiration rates resulting from regional and/or global climate variations and change. Reduced water availability as a consequence of drought is aggravated by increased water demand during droughts.

Such concerns prompted Kane County officials to fund a multifaceted project, conducted by the Illinois State Water Survey (ISWS) and Illinois State Geological Survey (ISGS). The project, initiated in May 2002 and scheduled to conclude in December 2007, will provide baseline water-resources data, analyses, and tools for future analyses of water resources available to the county. Numerous products are being developed for Kane County as part of the project. The first of these products, an *Interim Report on Geologic Investigations*, was delivered in 2004 (Dey et al., 2004a). Three reports, an *Interim Report on Three-Dimensional Geological Modeling* (Dey et al., 2005), a report on *Temporal Changes in Deep Bedrock Groundwater Quality in Northeastern Illinois* (Kelly and Meyer, 2005), and a report on *Shallow Groundwater Quality Sampling in Kane County, October 2003* (Kelly, 2005), were published concurrently with the *Interim Report on Shallow Aquifer Potentiometric Surface Mapping* (Locke and Meyer, 2005). In addition to this report, three other reports will be completed and delivered in 2007: a report on a *Computer Model for Surface Water Accounting and Availability*, a *Final Report on Geological Investigations*, and a *Final Report on Groundwater Flow Modeling*. Other deliverables in 2007 include a statistical model for surface water flow accounting, two groundwater flow models of the aquifers supplying water to Kane County, and a database of hydrologic information used in support of groundwater flow model development.

Purpose and Scope

The purpose of this report is to present and discuss groundwater-level data collected for water-resources investigations for Kane County. Those data were used to construct potentiometric maps, also sometimes referred to as water-level maps, for shallow aquifers in Kane County. A *potentiometric map* is a contour map of the potentiometric surface of a particular hydrogeologic unit (Fetter, 1988) and illustrates hydraulic head, or the level to which water will rise, in tightly cased wells in that hydrogeologic unit. These maps can be constructed for both confined and unconfined aquifers. Contour values often are expressed as an elevation above a datum such as feet above mean sea level. This report refers to *hydraulic head* simply as *head*, and other components of head are not considered. The maps are being used to develop a conceptual understanding of groundwater flow. The collected head data also are being used in the development of groundwater flow models, mathematical models that allow investigators to evaluate aquifer development scenarios and to conduct a wide range of analyses. Shallow aquifers considered in this report include the unconsolidated sand-and-gravel aquifers and the uppermost bedrock (i.e., the shallow bedrock aquifer). Potentiometric maps presented in this report are final versions that supersede interim versions released in 2005. Heads in deep bedrock aquifers, including the productive Ancell Group and Ironton-Galesville sandstones, are not within the scope of this study, but have been discussed previously by Burch (2002).

Description of Study Area

Kane County (Figure 1) is located in northeastern Illinois and shares borders with several other counties: north (McHenry County), west (De Kalb County), south (Kendall County), and east (Cook and DuPage Counties). Aurora, the largest city in Kane County, also includes portions of DuPage, Kendall, and Will Counties. The Kane County portion of Aurora had a population of 100,290 in 2000; the total population of Aurora in 2000 was 142,990 (U.S. Census Bureau, 2004). About 60-70 percent of Kane County is drained by the Fox River and its tributaries (Figure 2). The Fox River, which flows southward through the eastern townships of the county, drains most of the eastern and southern parts of the county. Tributaries of the Kishwaukee River drain portions of the northwestern part of Kane County. Land-surface elevations range from less than 620 feet along the Fox River south of Aurora to about 1065 feet on Marengo Ridge, a prominent north-south trending moraine in northwestern Kane County. Elevations throughout this report are in feet (ft) above the National Geodetic Vertical Datum, commonly referred to as mean sea level.

The 1260-square-mile study area includes Kane County and adjacent townships in surrounding counties (Figure 1). Head data were collected in areas outside Kane County to help develop a more complete understanding of groundwater movement inside the county.

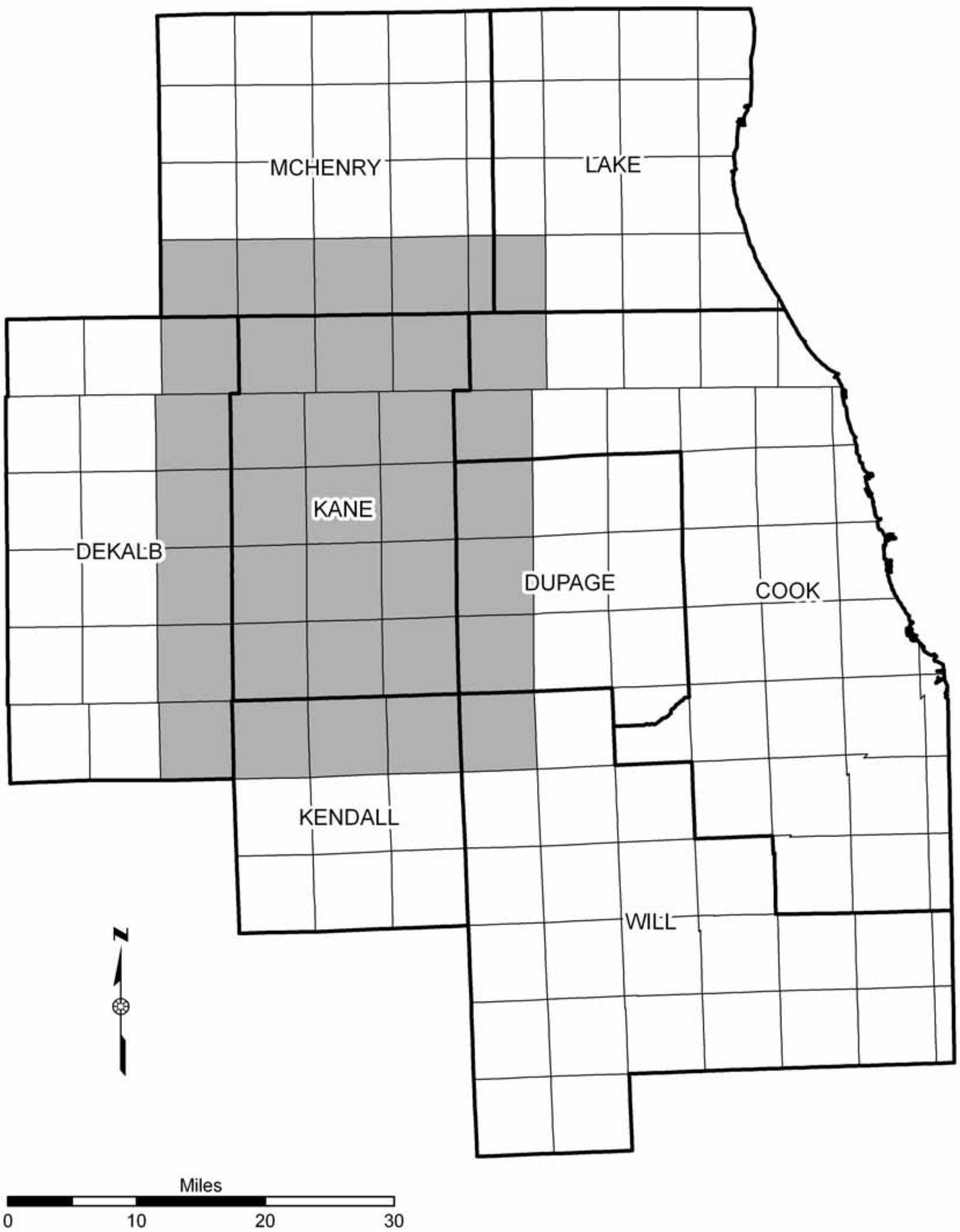

Figure 1. Location of study area (in gray).

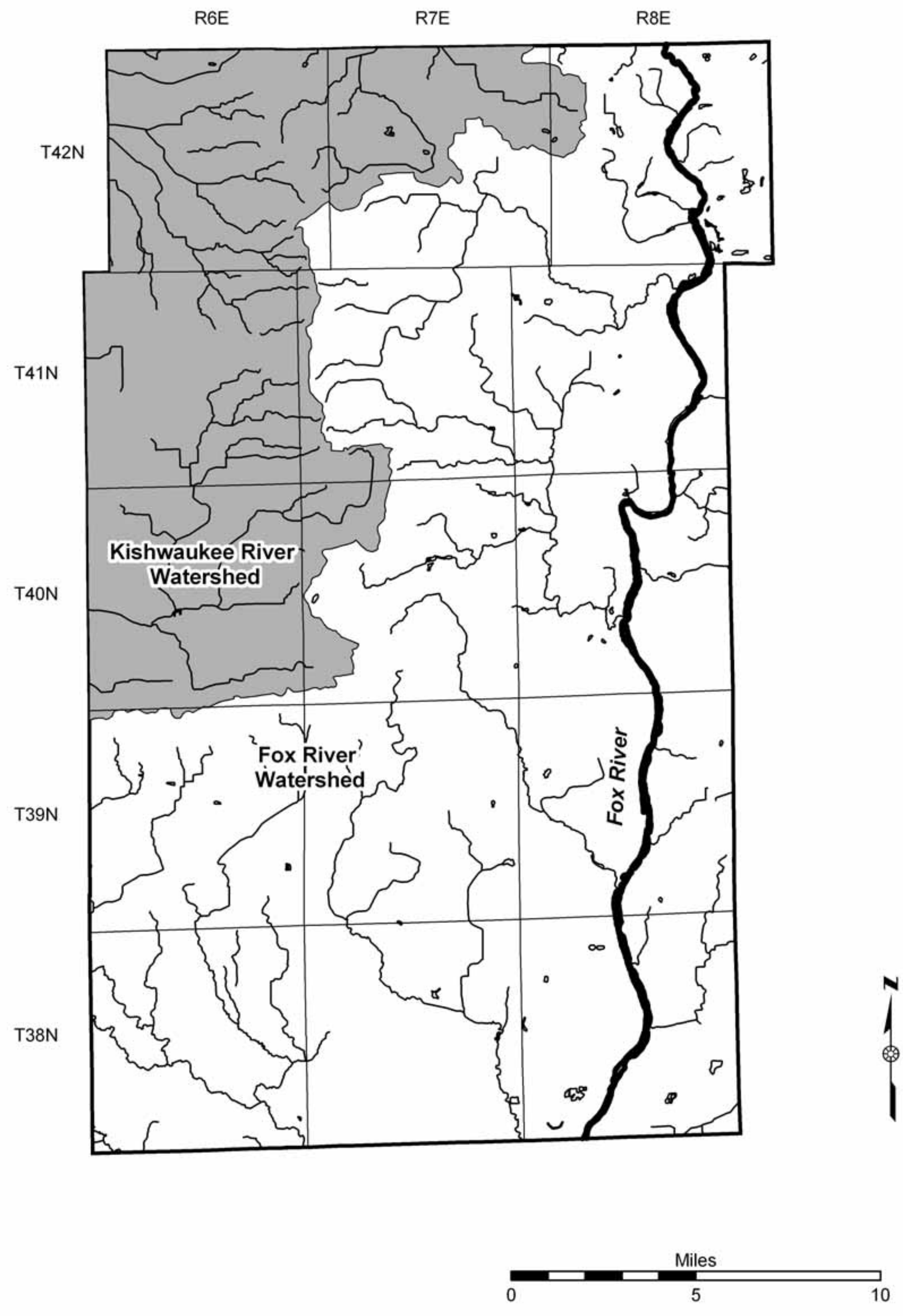

Figure 2. Patterns of surface drainage and locations of major watershed boundaries in Kane County.

Previous Investigations

Previous studies of water levels in the shallow aquifers in Kane County are restricted in scope to the shallow bedrock aquifer. Potentiometric maps of the sand-and-gravel aquifers in Kane County do not appear in the published literature.

Visocky and Schulmeister (1988) mapped the 1986 potentiometric surface of the shallow bedrock aquifer in a portion of Kane County and adjacent areas of DuPage, Kendall, and Will Counties. They observed that the potentiometric surface in that region generally slopes from northwest to southeast and attributed the slope to high regional pumping from the aquifer in the eastern part of the map area and, possibly, to an eastward dip of the bedrock. Graese et al (1988) noted that Visocky and Schulmeister's (1988) mapping showed the shallow bedrock aquifer discharges, in most places, to the Fox River, and that the Fox River is a major influence on the regional slope of the potentiometric surface of the aquifer in Kane County and adjacent areas.

Potentiometric maps (Kay and Kraske, 1996) showed that heads in 1995 in the shallow bedrock aquifer in Campton Township, Kane County, generally decreased from west to east. They noted that, in some areas, the potentiometric surface of the aquifer loosely replicates bedrock topography.

Several previous studies have mapped the potentiometric surface of both the shallow bedrock aquifer and sand-and-gravel aquifers in areas of DuPage, McHenry, and Will Counties that overlap the study area for the present report. Those maps include the 1960, 1966, and 1979 potentiometric surfaces of the shallow bedrock aquifer in Du Page County (Zeizel et al., 1962; Sasman et al., 1981) and the 1990 potentiometric surface of the shallow bedrock aquifer in Will County (Roadcap et al., 1993). Meyer (1998) mapped the 1994 potentiometric surfaces of the shallow bedrock aquifer and major sand-and-gravel aquifers in McHenry County.

Acknowledgments

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General Background

Aquifers and Confining Beds

Although nearly all geologic materials will transmit water, the transmission rate varies widely and is dependent on the permeability of the material and the hydraulic pressure gradient. Groundwater moves relatively rapidly through highly permeable materials and relatively slowly through those of lower permeability. An *aquifer* is a layer of saturated geologic materials that, by virtue of its comparatively high permeability, will yield useful quantities of water to a well or spring. Materials that can function as aquifers include sand and gravel, fractured and jointed carbonate rocks (limestone and dolostone), and sandstone. A *confining bed* is a layer of geologic materials having comparatively low permeability, which impedes water movement to and from adjacent aquifers. Materials that can function as confining beds include shale, unweathered carbonate rocks, silt, clay, and diamicton (a nonsorted sediment, typically of glacial origin, composed of sand-sized or larger particles dispersed through a fine-grained matrix of clay- and silt-sized particles). In general, the term *hydrostratigraphy* refers to the study of spatial relationships, both vertical and lateral, of geologic layers grouped by hydraulic characteristics (e.g., aquifers and confining beds).

Aquifers can be unconfined or confined. An *unconfined aquifer* has no overlying confining bed. The water level in a well open to an unconfined aquifer approximates the water table. The water table represents the top of an unconfined aquifer, and as it rises and falls, aquifer thickness increases and decreases, respectively. Unconfined aquifers frequently have a direct hydraulic connection to rivers, lakes, streams, or other surface-water bodies. In such situations, the water level of the surface-water body may approximate the water level in the adjacent unconfined aquifer. A *confined aquifer* has confining beds both above and below it.

Potentiometric Maps

A *potentiometric map* is a contour map of the potentiometric surface of a particular hydrogeologic unit (Fetter, 1988) and illustrates hydraulic head, or the elevation to which water will rise, in tightly cased wells in that hydrogeologic unit. These maps can be constructed for both confined and unconfined aquifers and are sometimes referred to as water-level maps or head maps. *Contour lines* or *equipotentials* connect points of equal head and represent head values. Groundwater flows from high head to low head, and directions of groundwater flow are perpendicular to equipotentials. A head map can be used to determine groundwater flow directions as well as variations in head distribution.

The potentiometric surfaces of the shallowest aquifers roughly imitate land-surface topography. Nearly all topography, including small hills and valleys, is replicated in the potentiometric surface with only a minor dampening of the relief. Dampening of the relief increases in deeper aquifers, so that only large-scale topographic features are replicated in the potentiometric surfaces of deeply buried aquifers.

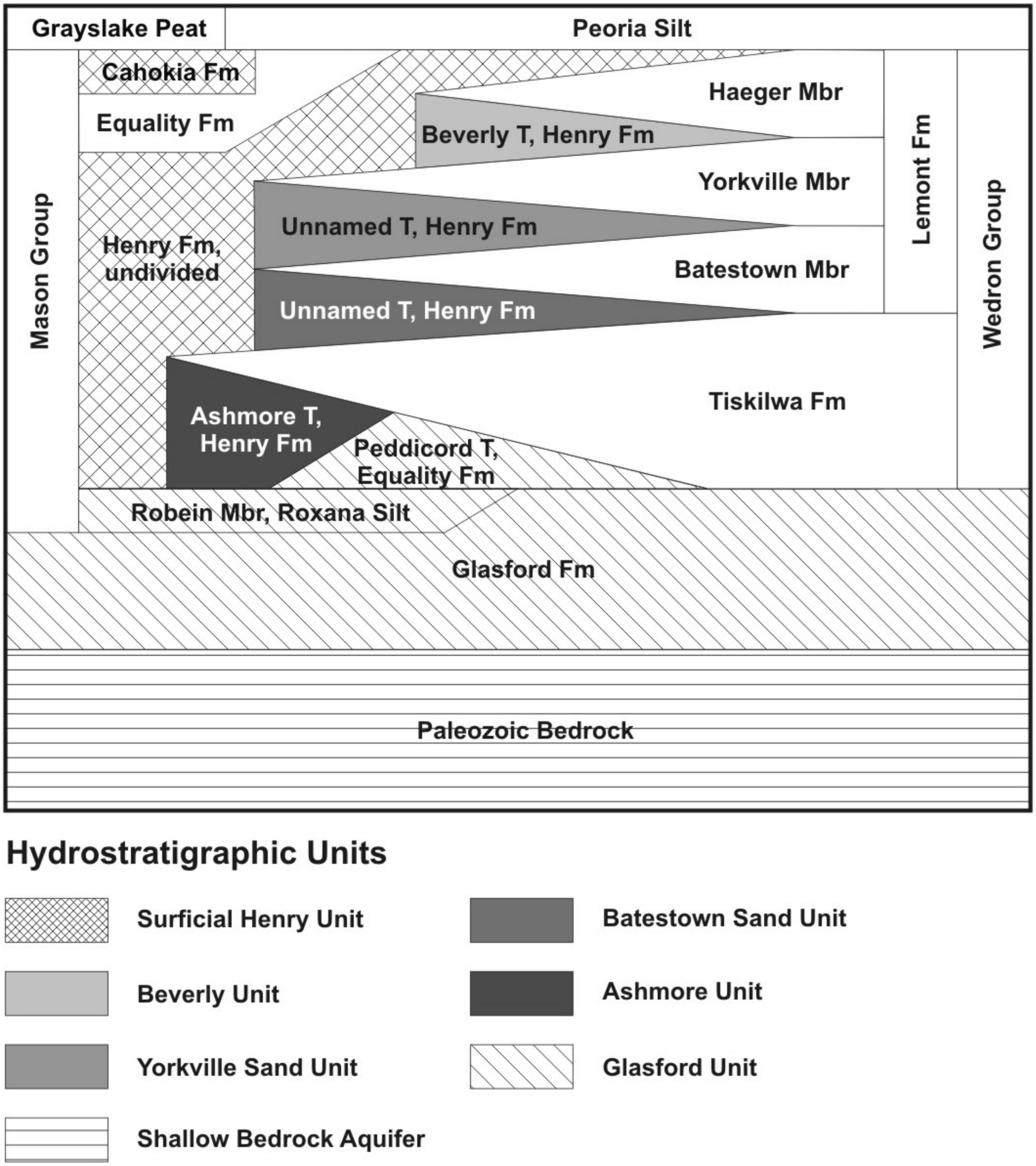
Heads rise and fall in response to groundwater withdrawals, recharge, evaporation and transpiration, and, in the case of confined aquifers, aquifer loading (Freeze and Cherry, 1979). Heads often follow a seasonal cycle that is most noticeable in shallow aquifers and at locations remote from large pumping centers, where pumping effects do not overwhelm natural cycles. Natural declines in heads usually begin in late spring and continue throughout summer and early fall. Heads begin to rise again in late fall and peak during the spring, when groundwater recharge from rainfall and snowmelt has its greatest effect (Visocky and Schicht, 1969).

Shallow Hydrostratigraphy of Kane County

Dey et al. described the geology of the uppermost bedrock and overlying unconsolidated materials in Kane County (2004a), presented cross sections (2004c), and mapped the lithology of the bedrock surface (2004b). Dey et al. (2004d, 2005) depicted the distribution of the St. Charles, Bloomington, Valparaiso, and Kaneville Aquifers, hydrostratigraphic units originally defined and discussed by Curry and Seaber (1990). While they can be useful in characterizing total aquifer thickness, major aquifers shown in Dey et al. (2004d) were not used as a conceptual basis for head mapping in sand-and-gravel aquifers for this report. The major aquifers are inappropriate for head mapping because they often represent total thicknesses of coarse-grained deposits across multiple lithostratigraphic units that are not necessarily hydraulically connected or even fully saturated. For this report, analyses of sand-and-gravel head data are based strictly on individual lithostratigraphic units.

This report discusses heads within hydrostratigraphic units composed principally of unconsolidated sand and gravel that are either equivalent to lithostratigraphic units characterized and mapped by Dey et al. (2004a, 2004c, 2004d, 2005) or aggregations of them (Figure 3). It also discusses heads in the shallow bedrock aquifer, which is a hydrostratigraphic unit comprised of the consolidated bedrock units immediately underlying the unconsolidated deposits. Graese et al. (1988) and Dey et al. (2004a, 2004b, 2004c, 2005) described bedrock stratigraphy in the study area. Together, the shallow bedrock aquifer and the unconsolidated sand-and-gravel aquifers contained in the overlying glacial drift are referred to as the *shallow aquifers*.

Many of the hydrostratigraphic units discussed in this report are separate occurrences of the Henry Formation (Mason Group) — a lithostratigraphic unit consisting of unconsolidated sand and gravel deposited by glacial meltwater — in different stratigraphic contexts. The geometries of the Henry Formation sand-and-gravel deposits are complex. The Henry Formation is sporadically present and may occur at the land surface and/or as projecting tongues beneath adjacent diamicton units of the Wedron Formation, its temporal equivalent (Hansel and Johnson, 1996). For purposes of discussing the shallow hydrogeology of Kane County, these tongues — which function individually as aquifers — require specific nomenclature as described below. Henry Formation tongues are comparatively widespread and occur at consistent stratigraphic positions in relation to named lithostratigraphic units of the Wedron Group. For example, the Beverly Tongue of the Henry Formation occurs consistently beneath diamicton of the Haeger



Source: Modified from Dey et al. (2004a); after Curry et al. (1999).
Notes: Fm = Formation, Mbr = Member, and T = Tongue.

Figure 3. Schematic diagram showing lithostratigraphic units of the Mason and Wedron Groups and their relationships to hydrostratigraphic units.

Member). Other, less widespread tongues of the Henry Formation are present in Kane County but are not recognized in the formal nomenclature.

Where two aquifers are connected, they form a single hydrostratigraphic unit. This occurs in areas without a confining unit due to erosion or nondeposition. As the confining bed thins, heads in the converging aquifers should approach a single value.

The hydrostratigraphic nomenclature used for the Henry Formation, its tongues, and for other shallow aquifers in Kane County, is equivalent to that used for groundwater flow modeling in Kane County and discussed by Meyer et al. (in press). It is summarized in the following paragraphs and in Figure 3:

- *Surficial Henry Unit.* The Surficial Henry Unit includes, primarily, Henry Formation materials not overlain by Wedron Group diamicton, and it consists primarily of sand and gravel with subordinate silt and clay. The Surficial Henry Unit also contains coarse-grained, post-glacial alluvium, present along stream valleys, assigned to the Cahokia Formation.

- *Beverly Unit.* The Beverly Unit includes sand and gravel of the Beverly Tongue of the Henry Formation — a widespread tongue of the Henry Formation occurring beneath the Haeger Member of the Lemont Formation (Wedron Group). The Beverly Unit is up to 80 ft thick in Kane County.

- *Yorkville Sand Unit*. The Yorkville Sand Unit includes sand and gravel comprising the lower portion of the Yorkville Member of the Lemont Formation (Wedron Group), which consists primarily of diamicton. This sand and gravel is considered to be an unnamed tongue of the Henry Formation by Dey et al. (2004a, 2005). The Yorkville Sand Unit is sporadically present in eastern Kane County, where it is up to 80 ft thick, and is only of local importance as a groundwater resource.

- *Batestown Sand Unit*. The lower portion of the Batestown Member, primarily a diamicton, is also commonly composed of sand and gravel. Although not recognized in the formal stratigraphic nomenclature as such, Dey et al. (2004a, 2005) consider this sand and gravel to be a tongue of the Henry Formation, and it is referred to as the Batestown Sand Unit in this report. The Batestown Sand Unit is tapped as a groundwater source by a limited number of wells, although its thickness may exceed 60 ft in limited areas.

- *Ashmore Unit.* A widespread tongue of the Henry Formation, formally recognized in the lithostratigraphic nomenclature as the Ashmore Tongue of the Henry Formation, is sporadically present beneath the Tiskilwa Formation (Wedron Group) in Kane County. Thicknesses of this sand and gravel, referred to in this report as the Ashmore Unit, exceed 80 ft in some parts of northwestern Kane County, but the unit is thinner in the southeastern part of the county.

- *Glasford Unit*. The Glasford Unit consists primarily of the Glasford Formation, a lithostratigraphic unit containing the oldest of the Quaternary materials present in Kane County. It consists of diamicton, silt, and clay, with abundant lenses of sand and gravel, some of which are thick and productive aquifers. As well as containing the Glasford Formation, the Glasford Unit includes two thin and sporadically present units, the Robein Member of the Roxana Silt (Mason Group) and the Peddicord Tongue of the Equality Formation (Mason Group). The Glasford Unit is present throughout much of north, west, and central Kane County. Mapping the distribution of individual aquifers within the Glasford Unit is problematic, because it lies comparatively far below the surface and contains diverse lithologic units that are themselves laterally variable. The Illinois State Geological Survey has approached this challenge by using computer modeling techniques to develop three-layer (Dey et al., 2005) and five-layer (Dey et al., in press) simplified models, using alternating fine- and coarse-grained layers, of the Glasford Unit. The five-layer model is used in groundwater flow modeling in Kane County and discussed by Meyer et al. (in press). For this report, no distinction is made between heads in individual sand-and-gravel deposits within the Glasford Unit, and heads from all Glasford Unit sand-and-gravel deposits are plotted on a base map of total Glasford Unit sand-and-gravel thickness.

- *Shallow Bedrock Aquifer.* This aquifer consists of the upper portion of the Paleozoic bedrock immediately underlying the glacial drift. This interval of bedrock functions as an aquifer as a consequence of secondary porosity that developed from weathering of the rocks and release of confining pressure. Porosity developed when the rocks were at and near the land surface prior to burial by glacial deposition. The shallow bedrock aquifer is conceptualized as weathered bedrock at or near the bedrock surface rather than rocks assigned to a particular lithostratigraphic unit. Nonetheless, the aquifer sometimes is referred to as the Silurian dolomite aquifer because Silurian dolomites are present at the bedrock surface in much of northeastern Illinois. It is these rocks in which the most productive secondary porosity of the shallow bedrock aquifer has developed throughout most of northeastern Illinois. In addition, the lithology and bedding characteristics of the Silurian dolomites facilitate greater secondary porosity development than do the Ordovician Maquoketa Group, which comprise generally less productive portions of the shallow bedrock aquifer in the region. However, the Ordovician rocks can have sufficient porosity to yield useful quantities of water to wells in Kane County.

  The shallow bedrock aquifer underlies all of Kane County. Its thickness is approximately the upper 50-100 ft of bedrock where secondary porosity has developed (Bergeron, 1981; Graese et al., 1988; Visocky and Schulmeister, 1988; Kay and Kraske, 1996). Because the Ordovician and Silurian rocks comprising the uppermost bedrock gently dip eastward, this 50- to 100-ft interval contains rocks assigned to numerous Silurian and Ordovician lithostratigraphic units (Dey et al., 2004b). In eastern and southern Kane County, dolomites of the Silurian Hunton Limestone Megagroup comprise much of the shallow bedrock aquifer, with lower parts of the aquifer possibly including shales and carbonates of the Ordovician Maquoketa Group. In most of the rest of Kane County, where erosion has removed the Silurian dolomites, Maquoketa Group rocks comprise the shallow bedrock aquifer, with the zone of secondary porosity development possibly extending into the underlying dolomite of the Galena and Platteville Groups (here referred to collectively as the Galena-Platteville Group). In extreme west-central Kane County, near Maple Park, erosion has removed both the Silurian dolomites and the Maquoketa Group, and the shallow bedrock aquifer in this area is comprised entirely of Galena-Platteville Group dolomites. In Kane County, the elevation of the top of this aquifer ranges from less than 500 ft near Big Rock in the southwest, to more than 800 ft near Burlington in the northwest.

More domestic wells in Kane County appear to be finished in the shallow bedrock aquifer than in all of the sand-and-gravel aquifers combined. The aquifer also provides water to numerous public water systems in the county.

Groundwater Recharge and Discharge

Groundwater recharge is a process by which water migrates downward through the subsurface and is added to the *saturated zone* in which all pore spaces are filled with water. Although most precipitation runs off to streams or evaporates, some of it percolates downward through the soil and unsaturated zone. A portion of the recharging water taken up by plants is returned to the atmosphere by transpiration. Water that passes through the unsaturated zone and reaches the *water table*, the surface separating the saturated zone from the overlying unsaturated zone, is added to the saturated zone. Groundwater recharge occurs most readily where the materials comprising the unsaturated zone are relatively permeable and where such factors as slope and land-use practices discourage runoff and uptake of water by plants.

Groundwater eventually discharges to surface-water bodies, including springs, wetlands, streams, rivers, and lakes. Discharge processes sustain flow from springs, maintain saturated conditions in wetlands, and provide baseflow of streams and rivers. Discharge also occurs directly to the atmosphere through evapotranspiration.

In Kane County, as in roughly the eastern half of the contiguous United States that is humid, recharge to the saturated zone occurs in all areas between streams or in areas where surface water infiltrates the subsurface. In a simplified sense, discharge from the saturated zone occurs only in streams, lakes, and wetlands together with floodplains and other areas where the saturated zone intersects the land surface.

Recharge and discharge also can be considered in terms of movement of water between aquifers. Where downward vertical hydraulic gradients exist (i.e., where heads decrease with depth within the saturated zone), groundwater moves downward from the water table or from a surficial unconfined aquifer to recharge underlying confined aquifers. Where an upward vertical hydraulic gradient exists between a confined aquifer and the land surface, groundwater moves upward from the confined aquifer towards the land surface.

In general, the discharge areas of aquifers become separated by progressively greater distances as aquifer depths increase. The shallowest groundwater, which directly underlies the water table, is part of a local flow system and discharges to very small ditches and depressions. Recharge to the water table occurs only in the relatively small areas between these local discharge features. Groundwater in more deeply buried confined aquifers is part of a regional flow system and discharges to comparatively large-scale rivers, such as the Fox River, and lakes occupying major valleys and depressions. The recharge areas for these aquifers include the broad areas between the regional discharge features.

Much of Kane County has diamictons at or near the land surface. These clay-rich materials have extremely low permeabilities that inhibit the rate at which precipitation can infiltrate the subsurface, and thus the downward migration of water into underlying aquifers. Prior to European settlement, the county contained vast areas where the water table was at or near the land surface much of the year. To develop the county for agricultural use, extensive networks of tile drains and drainage ditches were constructed. Because the permeability of sand is much greater than that of diamicton, recharge to aquifers will be concentrated in areas with sand at or near the land surface. In some areas, diamictons can be saturated, while underlying sands are only partially saturated or dry.

Groundwater recharge occurs mainly during the spring, when rainfall is high and water losses to evaporation and transpiration are low. Recharge decreases during the summer and early fall when evaporation and transpiration divert most precipitation and infiltrating water back into the atmosphere. Likewise, during winter months surface infiltration is often negligible when soil moisture is frozen, which diverts precipitation into surface-water bodies as runoff. Recharge can occur, however, during mild winters when soil moisture is not frozen (Larson et al., 1997).

Several factors affect the rate of groundwater recharge. Among these are the hydraulic characteristics of the materials both above and below the water table; topography; land use; vegetation; soil moisture content; depth to the water table; intensity, duration, areal extent, and seasonal distribution of precipitation; type of precipitation (rain or snow); and air temperature (Walton, 1965). Hensel (1992) presented a detailed discussion of groundwater recharge processes in Illinois.

Methods

A network of wells was assembled during the inventory phase of the project, and preliminary information about the wells was collected. In a subsequent synoptic phase, all wells in the network were measured in as short a time period as was practical. Head data from the synoptic phase were compiled, reviewed, and used to construct head maps for selected lithostratigraphic units in Kane County. A more detailed discussion of field procedures, data collection and validation, and map production follows.

Inventory Phase

In May 2002, training was conducted for ISWS staff selected to inventory wells in the study area. Training covered procedures for identifying candidate wells, using field equipment (e.g., personal data assistants, global positioning system units, laser rangefinders, and steel tapes) and collecting pertinent data from those wells for which permission had been obtained. The ISWS system used to describe well locations is presented in Appendix A. Between May 2002 and September 2003, ISWS staff inventoried 1010 wells (Appendix B), including 789 private wells and 221 public, industrial, or commercial wells (Figure 4).

Well Selection (PICS and PWDB)

Copies of well completion reports on file in the ISWS Private Well Database (PWDB) as of May 2002 were used to identify candidate wells. The usefulness of completion reports was commensurate with the level of accurately recorded information. Many completion reports could not be matched to an actual field location. Where field locations could be verified, general guidelines were set for desired qualitites of completion reports and wells. For example, newer reports were favored over older ones. Also, wells less than 400 ft deep and wells with open intervals within the top 50-100 ft of bedrock were given preference over deeper wells. However, in the absence of wells with the most desired qualities, other wells were accepted to increase the horizontal density of the measurement network. The goal was to develop a network of regularly spaced wells throughout each aquifer in Kane County. The target density for the well network in the shallow bedrock aquifer was one well per two square miles. Wells in the shallow bedrock aquifer were the primary inventorying objective, but wells finished in sand-and-gravel aquifers also were considered important. While maps of major Quaternary aquifers (Curry and Seaber, 1990) initially were used to locate wells in sand-and-gravel aquifers, a broader effort was made to include as many wells as possible that tapped Quaternary aquifers greater than 5 ft thick. Unfortunately, limited records were available to locate such wells.

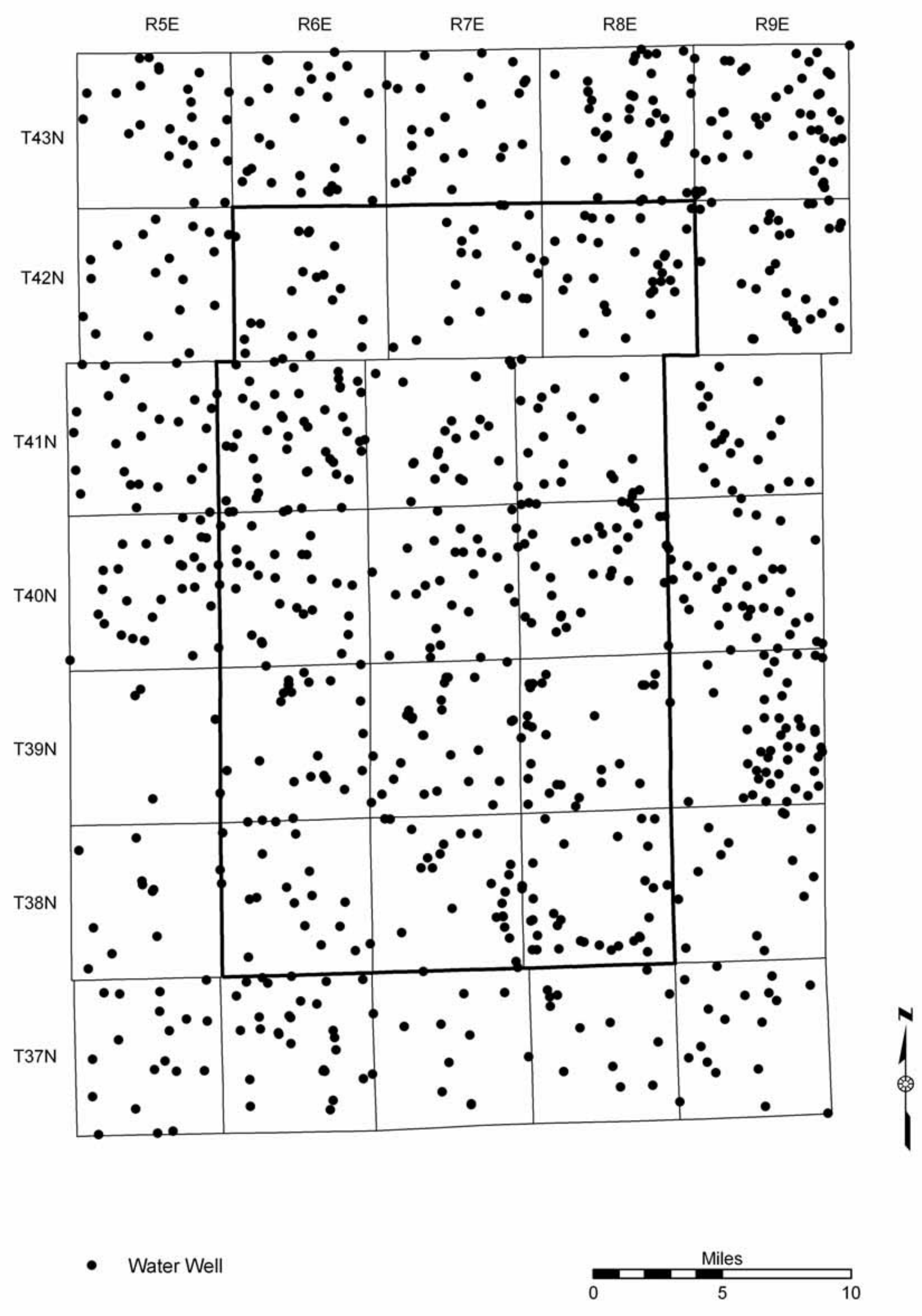


Figure 4. Locations of wells used in the fall 2003 synoptic measurement.

The ISWS Public-Industrial-Commercial Survey (PICS) database was consulted to identify high-capacity wells open to shallow aquifers for inclusion in the well network. Within Kane County, 107 PICS wells were identified (Figure 5) that were drawing water from the Maquoketa Group or overlying materials (Appendix C). Fifty-two of those wells (Figure 6) either pumped greater than 100,000 gallons per day (gpd) or 36.5 million gallons per year (mgy), thus meeting the definition of high-capacity wells established by the Illinois Water Use Act of 1983. Based on the data reported to the ISWS, the total amount of water pumped from the shallow PICS wells in Kane County was 6.9 billion gallons (bg) in 2003. High-capacity wells accounted for 6.6 bg, or 96 percent, of total reported withdrawals. The preceding two estimates are based solely on data reported to the ISWS.

An estimated 6000 well owners and operators were contacted. Some were contacted by phone, but the majority were contacted in person. Site visits were made to verify the location and suitability of a candidate well and to request permission to use the well for head measurements. If permission was granted, data collection was facilitated with an electronic form that was completed on site. Use of the electronic form also greatly aided consistent data entry and assembly of a water-level-related database for the project.

Head Measurements

During well inventorying, an initial head measurement was made following ISWS standard operating procedure and was recorded on electronic and paper forms. Depth to water in most domestic, commercial, and industrial wells was measured with a disinfected steel measuring tape. The measuring point in most cases was the top of the casing after removing the well cap. In other cases, the well cap did not need to be removed and the top of the vent tube, vent hole, or access port was used. The actual measuring point used was noted on the electronic field form. In most public water-supply wells, the depth to water was measured with a disinfected steel measuring tape inserted through a vent tube or access port. All head measurements made with a steel measuring tape were recorded to the nearest 0.01 ft.

It was necessary to measure the depth to water in 54 public water-supply wells (5 percent of the 1010 wells measured) with an air line, a length of tubing attached to the column pipe in the well. Measuring by the air-line method is accomplished by displacing water in the tube using a tire pump or compressed air source. Air pressure in the tube then is read from a gage, and the height above the bottom of the air line of an equivalent column of water is calculated. Accuracy of air-line measurements is based primarily on the gages used. Typical gages register air pressures of up to 100, 200, or 300 pounds per square inch (psi), which equal 230, 460, or 690 ft of water, respectively. Burch (2002) reported gage accuracy within one percent in the center of their ranges (2.3-6.9 ft in 100- to 300-psi gages, respectively), and within 2 percent at full deflection (4.6-13.8 ft in 100- to 300-psi gages, respectively).

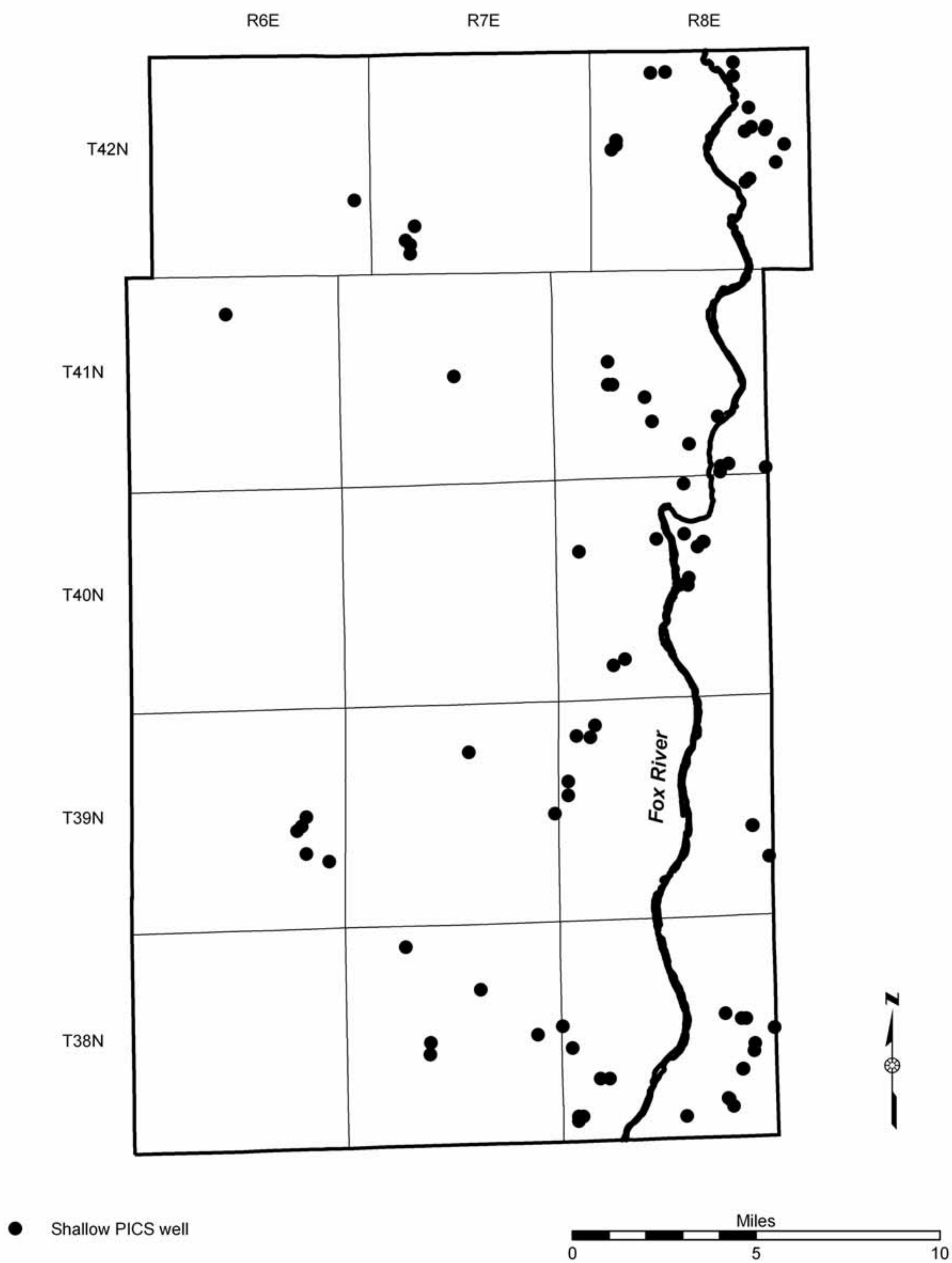


Figure 5. Locations of 107 ISWS PICS wells open to Maquoketa Group or overlying materials in Kane County.

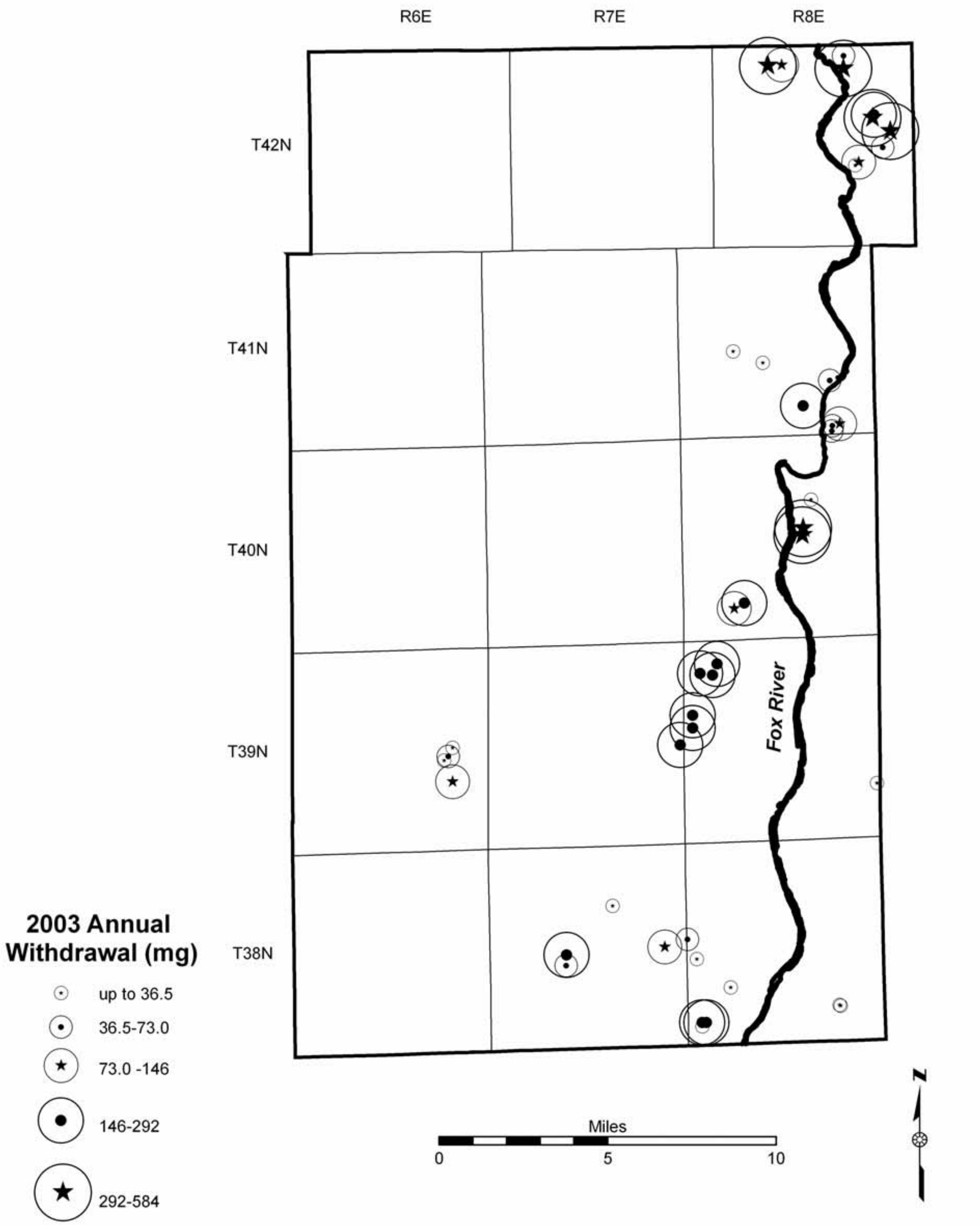


Figure 6. 2003 annual withdrawals and locations of 52 ISWS PICS high-capacity wells open to the shallow bedrock and unconsolidated deposits in Kane County.

Based on the range of gage types and water levels encountered, most air-line measurements for this project have an estimated accuracy within ±5 ft. Head measurement with a steel tape, preferred over the air-line method, was used wherever possible, because of its greater accuracy.

Determination of Well Locations and Measuring Points

At the time water levels were measured, global positioning system (GPS) equipment was used to survey the location of each well. Trimble™ GPS units connected to personal data assistants were used. Because of the size and relatively low relief of the study area, uncorrected, autonomous GPS locations were considered sufficient representations of well location. The maximum error of these positions is expected to be within ±100 ft in the horizontal direction, but a more typical accuracy may be within ±20 ft.

Vertical locations of the measuring points were determined by adding the length of well casing (i.e., stick up) above land surface to an estimated land-surface elevation. Land-surface elevations within Kane County were determined by an ISGS analysis of a 2-ft digital contour map (personal communication with Tom Nicoski, Director, Kane County GIS Technologies Department, June 2003). Those determinations are estimated to be accurate within ±2 ft of land surface. Outside of Kane County, 1:24,000 scale digital raster graphics (DRGs) of topographic maps produced by the USGS were used by the ISWS for visual estimation of elevation. In those areas, it is estimated that the predicted elevation may have maximum errors within ±20 ft, but more typically will be accurate within ±5 ft. For a subset of wells outside of Kane County, horizontal and vertical positions were surveyed previously by the ISWS using high-accuracy GPS techniques during an earlier project, and their locations are expected to be accurate to within ±0.06 ft horizontally and ±0.12 ft vertically (Meyer, 1998).

Synoptic Phase

After the well network was established, the synoptic phase was initiated. Because heads constantly change in response to variations in precipitation, pumpage, and other factors, a potentiometric map must be constructed from data collected over as short a time period as possible. Therefore, wells included in the network during the inventory phase were remeasured in the fall of 2003. Because of the size of the network, the synoptic phase lasted nearly six weeks (September 22, 2003 - October 30, 2003). By collecting the data as rapidly as possible, the resulting maps represent a “snapshot” of heads during the fall of 2003.

During the synoptic phase, field personnel followed procedures to make sure they were measuring the static, or resting, head in the well. After taking a steel tape measurement, personnel waited several minutes before taking a second measurement. In most cases, the second measurement was within ± 0.02 ft of the first one and was considered an adequate validation that the head in the well was not changing significantly. However, if the second measurement was more than ±0.10 ft, an effort was made to determine the source of variation. When variation occurred, water in the well often was recovering from recent use (i.e., rising). In those cases, the well was allowed to recover for about 15 minutes, and the measurement process was repeated until agreement was within the 0.10-ft tolerance. Multiple measurements were not taken for wells measured by the air-line method. Any relevant remarks were noted on the field form and reviewed later as synoptic field data were entered into the project database. Appendix B lists inventoried wells; their township, range, section, and plot location; project identification number; and measured head during the synoptic phase.

In an effort to quantify the variability of heads during the synoptic phase, a subset of 59 wells was measured on September 24, 2003 and again on October 29, 2003. Differences between the paired measurements ranged from +4.6 ft (September head higher) to -3.5 ft (October head higher). Eighty-six percent (51 of 59 wells) had measurements within ±1.0 ft of one another. This suggests that relatively small variations occurred in most heads during the six-week synoptic phase.

In addition to head variability throughout the network, water-level elevations are subject to uncertainties relating to measurements or estimates used to determine elevations. Horizontal positions of wells were measured by uncorrected GPS and are accurate within ±100 ft. Measuring point stick ups were measured with a folding ruler and recorded to the nearest tenth of a foot. Because of unevenness in the land surface at well heads, those measurements are likely to be accurate within ±0.3 ft. Measurements of water depth made with a steel tape were recorded to the nearest hundredth of a foot, and likely are accurate within ±0.1 ft. Measurements of water depth made by air line were recorded to the nearest foot and likely are accurate within ±5 ft. Land-surface elevations within Kane County were determined by plotting horizontal locations determined by GPS on the Kane County 2-ft digital topographic map and likely are accurate within ±2 ft. By combining the uncertainties of each individual measurement, the maximum level of uncertainty in Kane County for reported groundwater elevations based on steel tape measurements is expected to be within ±2.4 ft. For reported elevations based an air-line measurements, the maximum uncertainty is expected to be within ±7.3 ft.

Two methods of determining measuring-point elevations were compared at 72 well locations. High-quality GPS data were collected during a previous study in McHenry County during the fall of 1994. Data were reported to be accurate within ±0.06 ft horizontally and ±0.12 ft vertically (Meyer, 1998). Less accurate GPS data were collected during the inventory phase of the current project between spring 2002 and fall 2003. As previously stated, the horizontal accuracy of those locations is expected to have a maximum error within ±100 ft. Land-surface estimates were made by using the horizontal GPS locations and determining elevations from published topography on 1:24,000 scale United States Geological Survey (USGS) DRGs.

Elevations determined from DRGs then were adjusted to account for the height of the measuring points above the land surface. When the adjusted elevations were subtracted from the high-quality GPS elevations, 92 percent (66 of 72 wells) were within ±5.0 ft of the high-quality GPS elevation with a mean absolute error of 2.5 ft. Differences ranged between 6.5 and -15.2 ft. No high-quality GPS data were collected in Kane County, so this comparison was limited to the portion of the study area in T43N. While not applicable to the data collected within Kane County, this comparison illustrates the uncertainties in elevation estimates from the DRGs made for areas surrounding Kane County.

Head data were validated at several stages in the process. While in the field, synoptic head measurements were compared to historical heads (i.e., those reported on a well completion report and from the inventory phase) to determine if the measurement was consistent. Once constructed, the electronic database of well and head information was reviewed and edited to improve completeness and consistency.

Potentiometric Map Development

Potentiometric maps were constructed for selected lithostratigraphic units. Map construction relied primarily on heads measured in wells. By subtracting the depth to water in a well from the elevation of the measuring point, the head was obtained. Heads from wells open to a single lithostratigraphic unit were plotted on a base map and then contoured. A discussion of some of the main considerations that went into contouring head data follows.

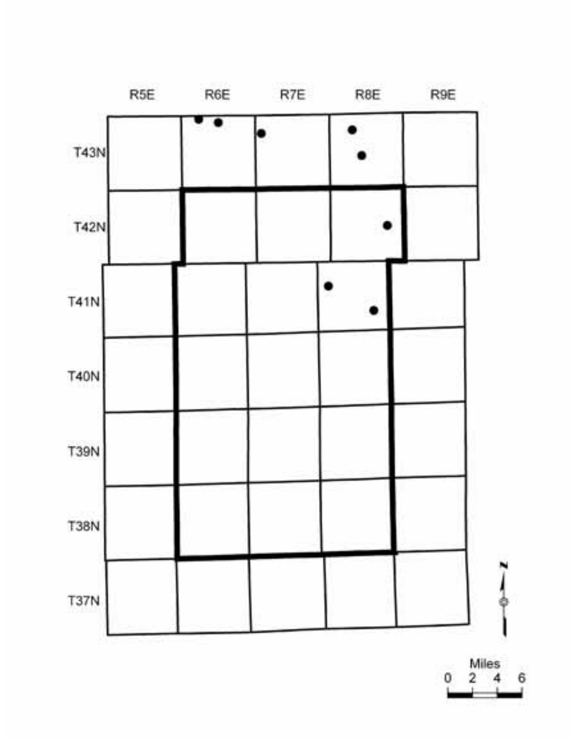
Aquifer Assignments and Data Validation

Heads can differ significantly between aquifers, so care must be taken to assure that head data used to construct a potentiometric map are obtained from wells open only to that aquifer. The ISWS project database with water-level related information was provided to the ISGS so lithostratigraphic determinations for each well could be made. Determinations were made for 991 of 1010 wells. Table 1 gives well counts by lithostratigraphic unit, and Figures 7 and 8 show their distribution throughout the study area.

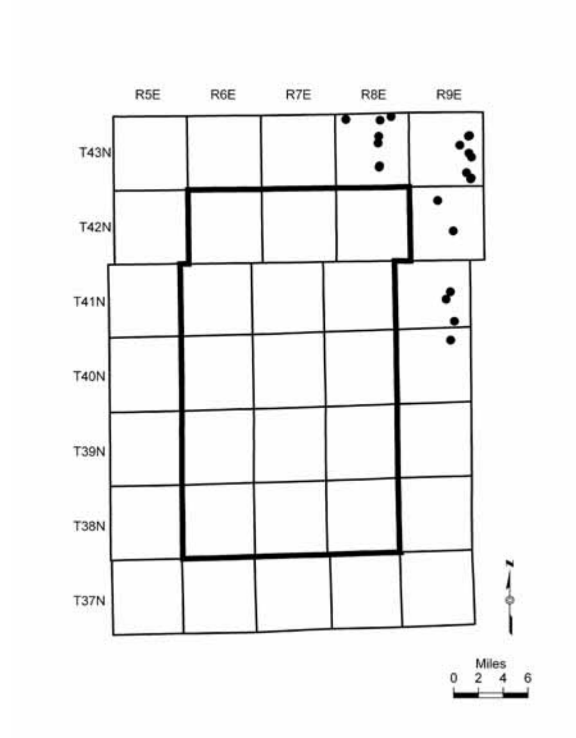
Table 1. Occurrence of Wells by Lithostratigraphy

Lithostratigraphic Unit(s)	*No. of wells in study area*	*No. of wells in Kane County*
Surficial Henry Formation	8	3
Beverly Tongue	20	0
Unnamed tongue below the Yorkville Member*	14	4
Unnamed tongue below the Batestown Member	18	17
Sand in the Tiskilwa Formation	21	8
Ashmore Tongue*	58	40
Sands in the Glasford Formation*	116	67
Total unconsolidated wells	*255*	*139*
Silurian Bedrock (undifferentiated)	202	63
Silurian and Ordovician Maquoketa Bedrock	155	76
Ordovician Maquoketa Bedrock	188	100
Ordovician Maquoketa and Galena-Platteville Bedrock	28	8
Ordovician Galena-Platteville Bedrock	29	2
Ordovician Galena-Platteville and Ancell Bedrock	0	0
Silurian, Ordovician Maquoketa, and Ordovician Galena-Platteville Bedrock	6	1
Ordovician Ancell or Cambrian Bedrock	7	1
Total consolidated wells	*615*	*251*
Total wells with unknown lithostratigraphy or rejected measurements	*140*	*81*
Grand total	**1010**	**471**

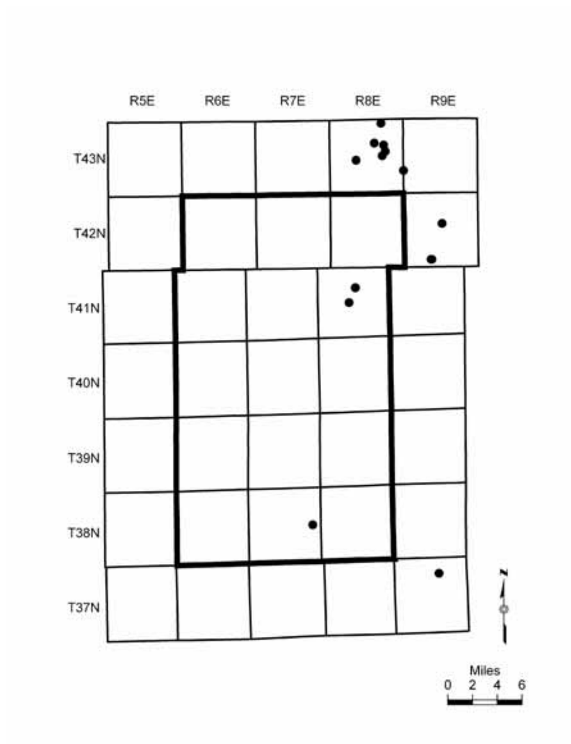
Note:
*Well counts may include one or more wells that were open to another lithostratigraphic unit. When a well had multiple source units, it was counted with the uppermost source unit.



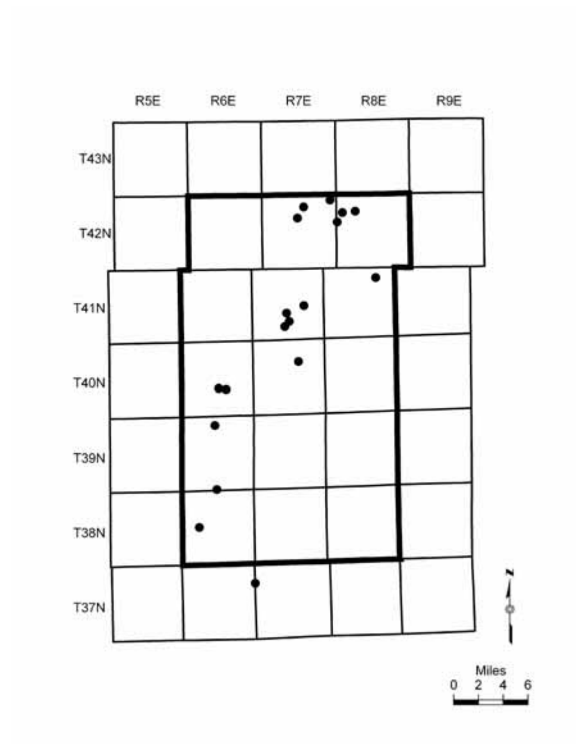
a) Surficial Henry Formation



b) Beverly Tongue

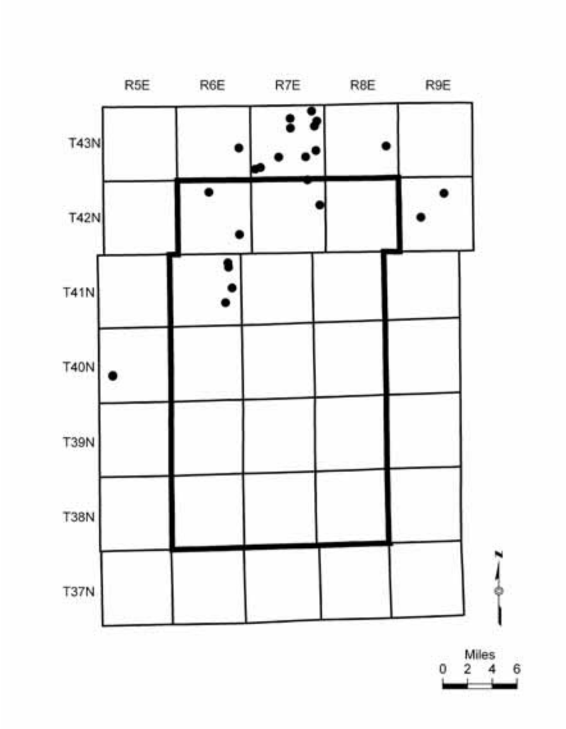


c) Unnamed tongue (below the Yorkville Formation)

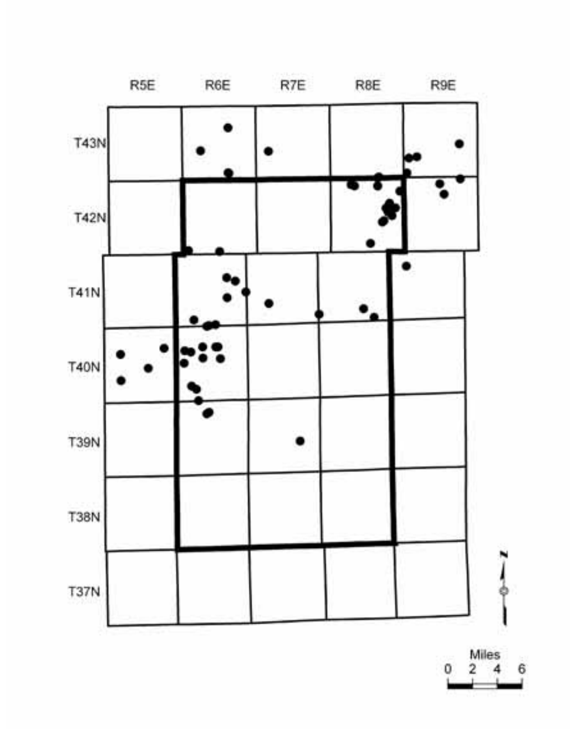


d) Unnamed tongue (below the Batestown Formation)

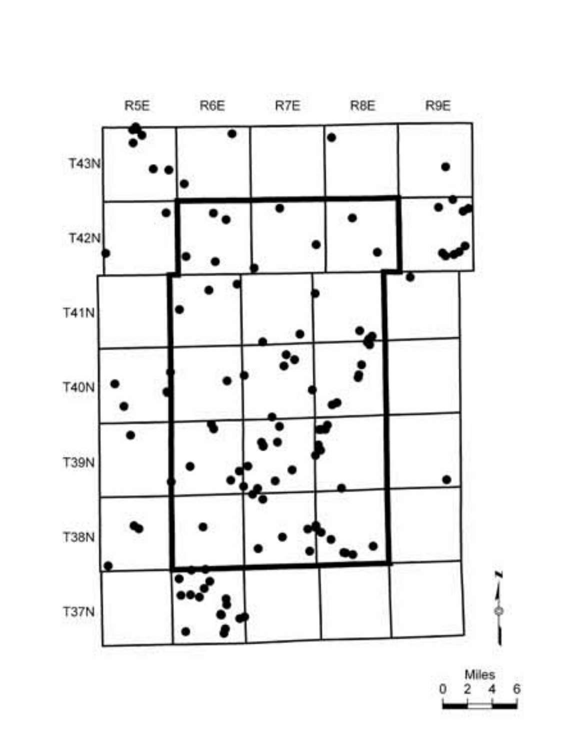
Figure 7. Locations of wells throughout the study area by lithostratigraphic unit.



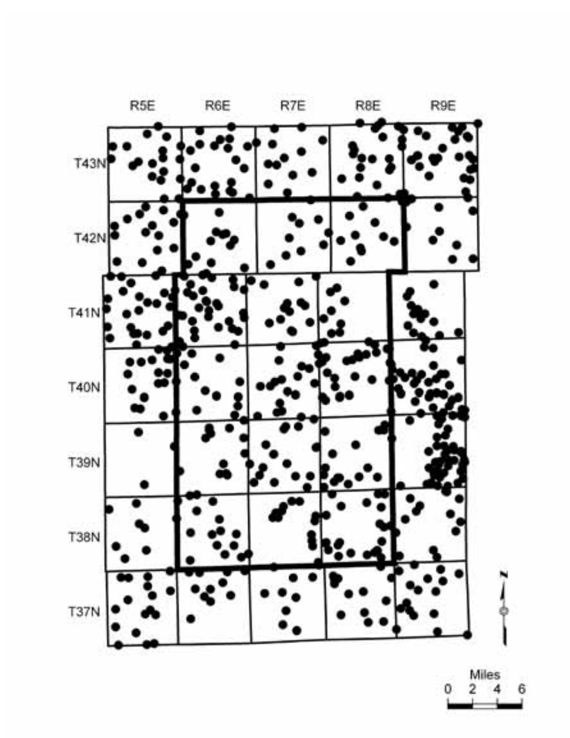
a) Tiskilwa Formation sands



b) Ashmore Tongue



c) Aggregated Glasford Formation sands



d) Shallow bedrock

Figure 8. Locations of wells throughout the study area by lithostratigraphic unit.

After head data were separated by lithostratigraphy, potentiometric surfaces were interpolated using an ordinary kriging routine in the Geostatistical Analyst extension of ArcGIS™ software version 9.1 (Environmental Systems Research Institute, 2001). Parameters of the kriging routine were the same for all head data and used spherical models and a minimum of 40 observed head values distributed among four sectors to determine each interpolated head value. Working maps were used to explore and visually review the head data. Anomalous values were identified, and their source data were reviewed. If a measurement was suspected of being inaccurate, unrepresentative, or inconsistent, it was retained or rejected based on best professional judgment. For example, inaccurate measurements often were rejected based on field notes indicating unclear readings because of condensation or bacterial fouling. In other situations, heads may have been deemed unrepresentative or inconsistent if they were not consistent with previous measurements from the well or with measurements from adjacent wells. If the well was screened in a different lithostratigraphic unit, was too deep, or an anomalous condition was noted at the time of measurement (e.g., recent pumping), the measurement was considered invalid and was not used. A new working map was made and evaluated. This iterative process of validation was used until all anomalous values were identified and addressed. It was used most actively in reviewing data for the shallow bedrock aquifer.

Contouring

The process of contouring head data involves interpolating heads in areas lying between irregularly spaced head measurements. Contouring may be done manually or with computer programs using automated routines. For this report, head maps were constructed using computer methods that were effective, rapid, and systematic for the purposes of error checking, outlier identification, data exploration, and data presentation. Preliminary maps (Locke and Meyer, 2005) were used to develop a conceptual model of the hydrostratigraphy, which in turn allowed development of numerical groundwater flow models. The methods used to contour head data for the preliminary maps in 2005 also were used to contour the final head data presented in this report. Additional details regarding head maps for individual aquifers are discussed later.

Several assumptions were made to allow contouring. Individual aquifers were assumed to be laterally continuous deposits. While this is only strictly true for the shallow bedrock aquifer, it was a starting point from which the analyses could begin. No surface-water data were used to constrain interpolations of any head surface. Areas with sand-and-gravel units at least 5 ft thick were determined by the ISWS using data from the final ISGS three-dimensional Kane County geologic model of April 2006. Five-ft isopachs were used to represent aquifer boundaries, but in reality aquifers exist outside of those boundaries. Potentiometric contour lines were generated using ordinary kriging and clipped to the 5-ft aquifer isopachs. The interpolation errors (standard kriging errors) for the bedrock potentiometric surface were within ± 20 feet of the actual values for greater than 75 percent of Kane County. Where data were sparse, interpolation errors increased to a maximum of ± 25 feet. The head maps presented in this report supersede those presented in the interim report (Locke and Meyer, 2005).

Results and Discussion

Final Potentiometric Maps

Final maps are presented from the shallowest aquifer to the deepest aquifer and have been constructed without using surface-water elevations. Where the well network is sufficiently dense and hydraulic connections between surface water and groundwater exist, groundwater data should be adequate to characterize most regionally significant connections. The well network is not ideally distributed, however, and all hydraulic connections, especially locally significant ones, may not be identified in the head maps.

A head map was not constructed for the Beverly Tongue, because all wells in that unit (Figure 7b) occur outside of the county. Figures 9, 10, and 11 correspond to the surficial Henry Formation, the unnamed tongue of the Henry Formation (below the Yorkville Member), and the unnamed tongue of the Henry Formation (below the Batestown Member), respectively. Those three figures show only the measurement locations and the associated head elevations. Sufficient data were not available for head contouring.

The next deeper aquifer is the aggregated Tiskilwa Formation sands. The April 2006 geologic model did not differentiate among the Tiskilwa Formation sands, and data were insufficient to determine the extent of the aquifer(s). Wells open to the Tiskilwa Formation sands (Figure 8a) were inventoried in northwestern Kane County where the Tiskilwa diamicton is very thick, but insufficient data about aquifer occurrence and thickness exist for head map construction. Measured heads ranged from 733 ft (T43N, R8E) to 989 ft (T42N, R6E).

The Ashmore Tongue is the shallowest coarse-grained deposit with sufficient data for contouring (Figure 12). Measured heads ranged from 678 ft in the Village of South Elgin well 3 (T41N, R8E) to 899 ft (T41N, R6E). Network wells in this aquifer are concentrated in northeastern and western Kane County.

The next deeper potentiometric surface is that of the aggregated Glasford Formation sands, which are greater than 5 ft thick in many parts of the county (Figure 13). Measured heads ranged from 577 ft (T37N, R6E) to 899 ft (T41N, R6E). Network wells occur throughout Kane County, and some are concentrated in the southwest to northeast trending St. Charles Bedrock valley and in the southeast to northwest trending Aurora Bedrock valley.

The deepest potentiometric surface mapped for this report is that of the shallow bedrock aquifer that is laterally continuous throughout the county (Figure 14). Measured heads ranged from 574 ft (T37N, R7E) to 912 ft (T41N, R7E) and were distributed throughout the county. Although some source aquifer assignments were changed since the interim report was published, the final potentiometric map is nearly identical to the interim map.

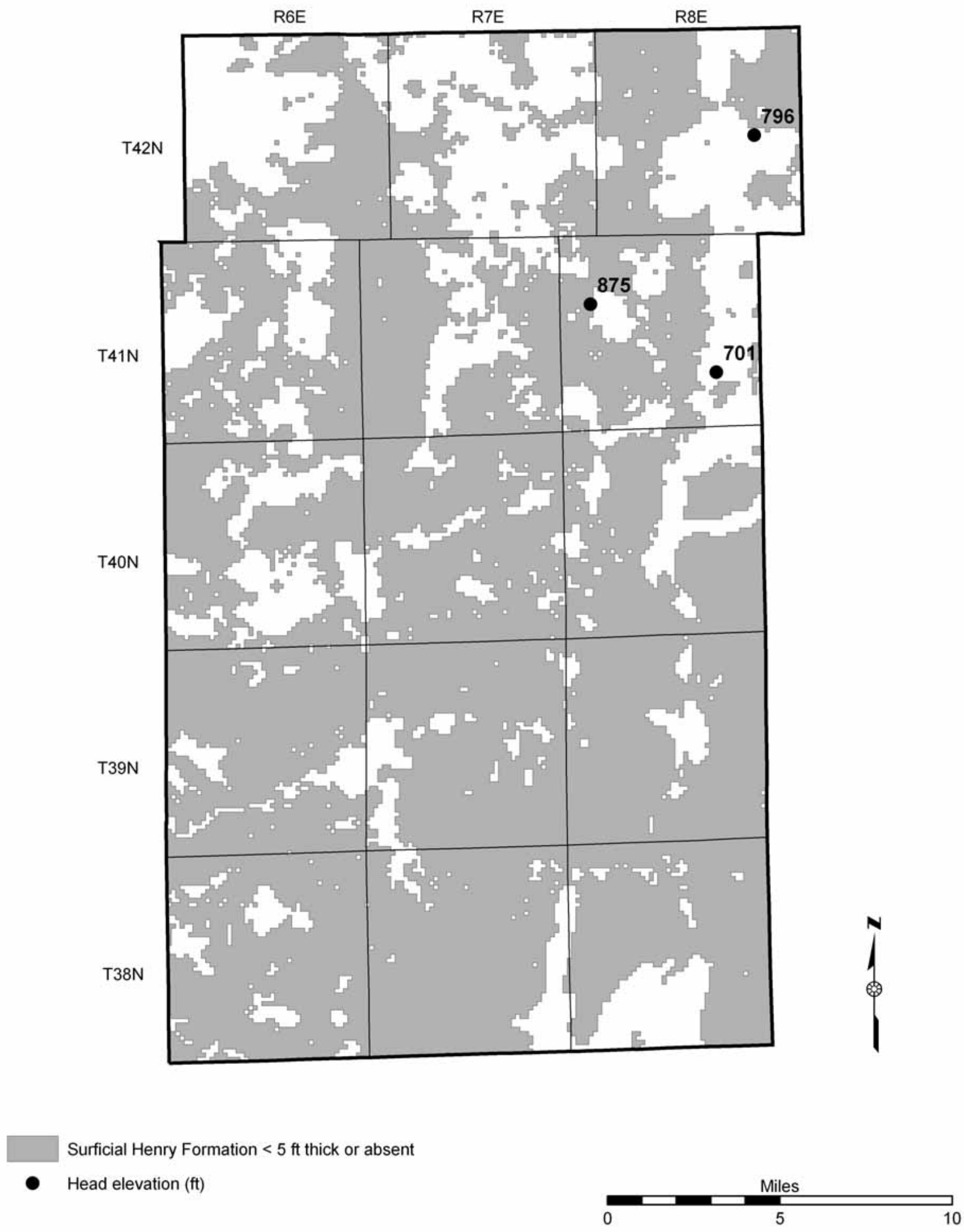


Figure 9. Fall 2003 head elevations for the surficial Henry Formation.

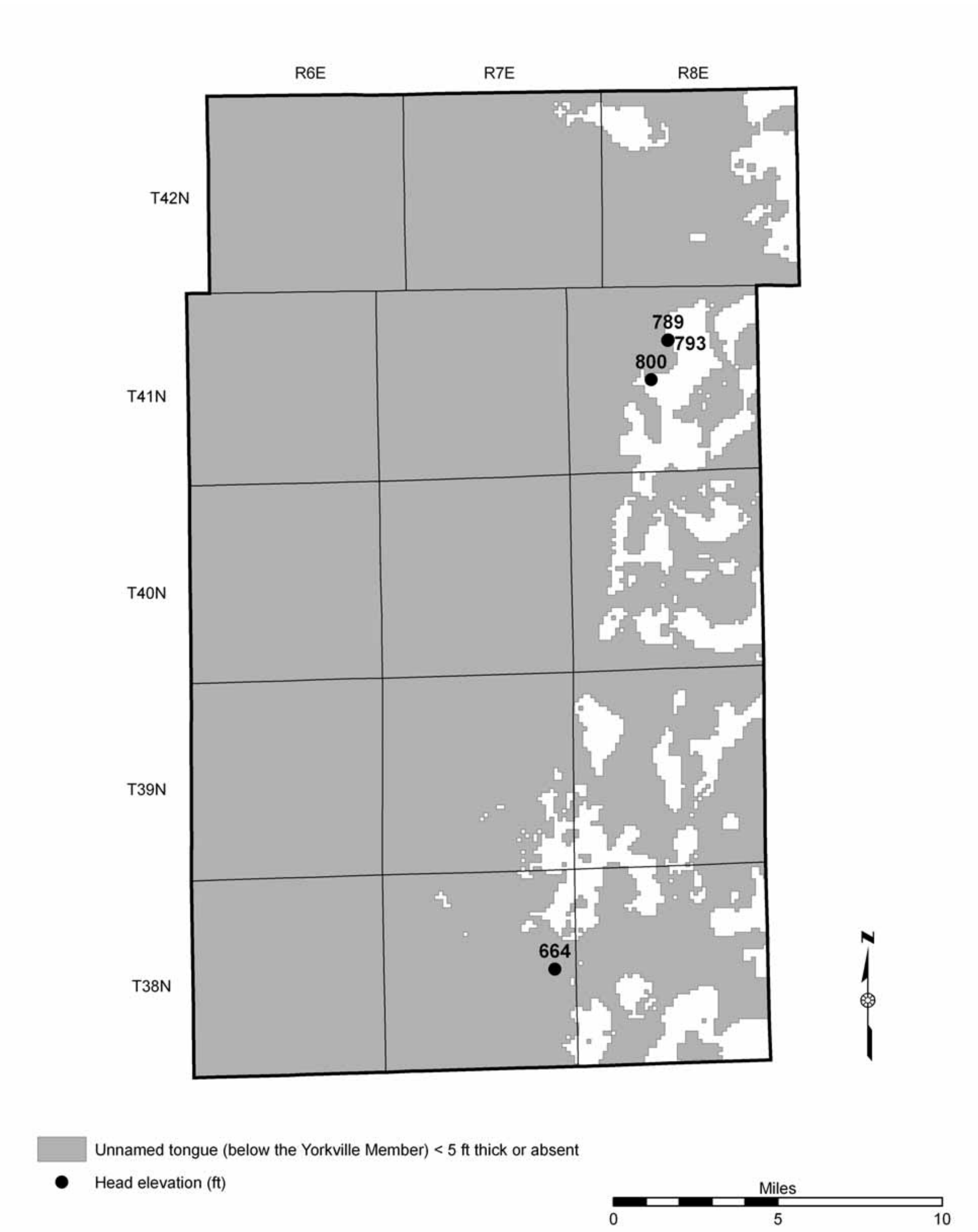


Figure 10. Fall 2003 head elevations for the unnamed tongue of the Henry Formation (below the Yorkville Member).

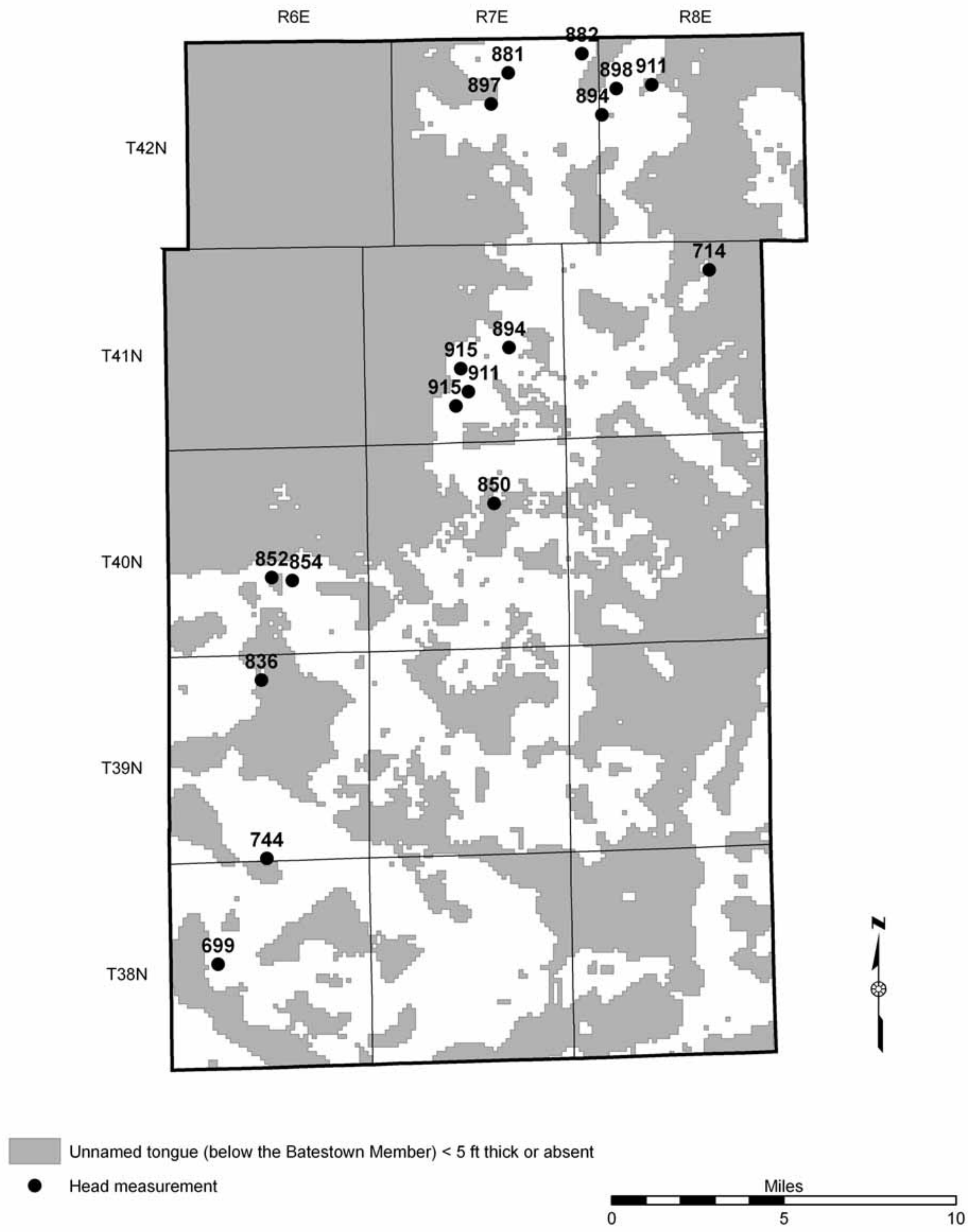


Figure 11. Fall 2003 head map for the unnamed tongue of the Henry Formation (below the Batestown Member).

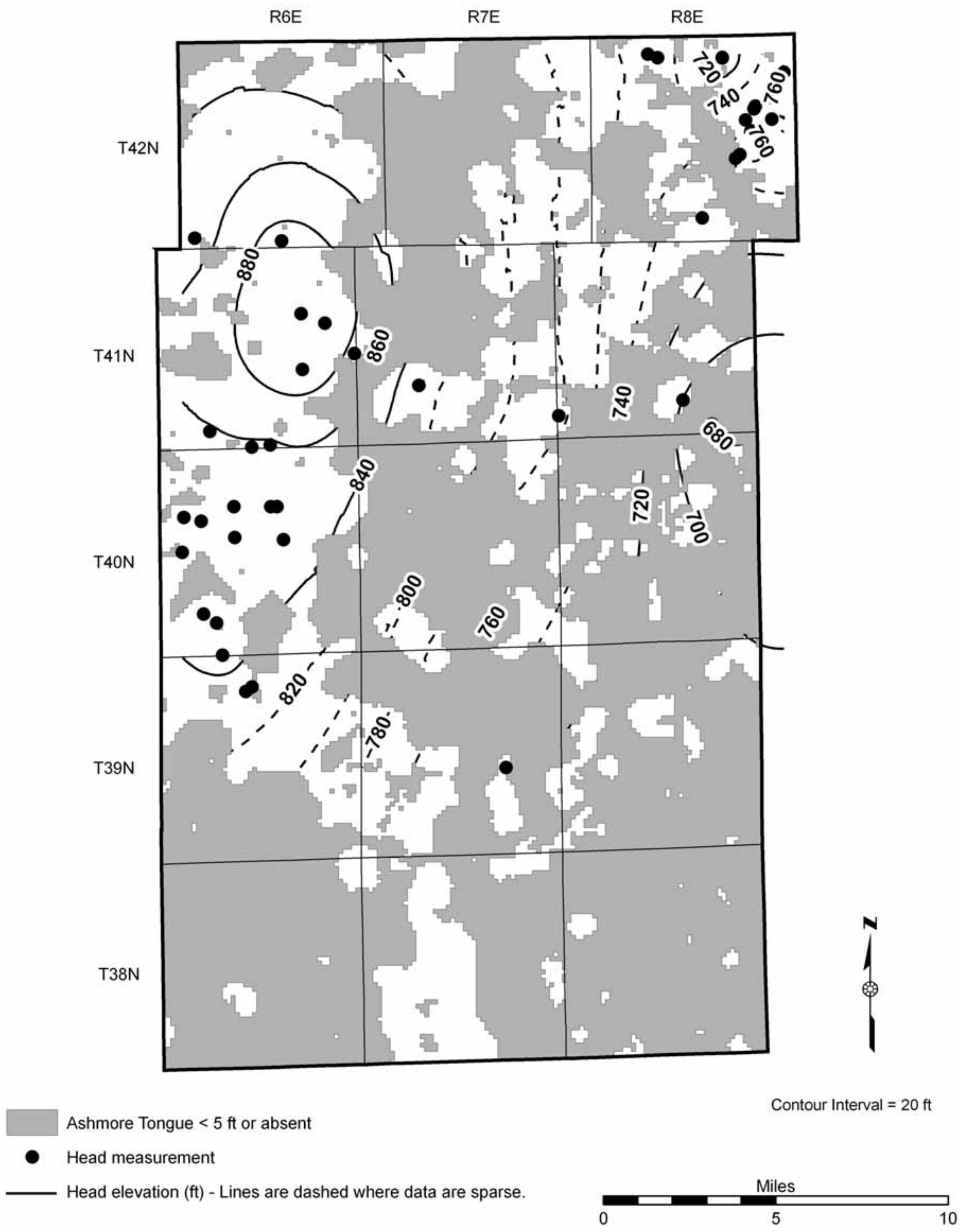


Figure 12. Fall 2003 head map for the Ashmore Tongue.

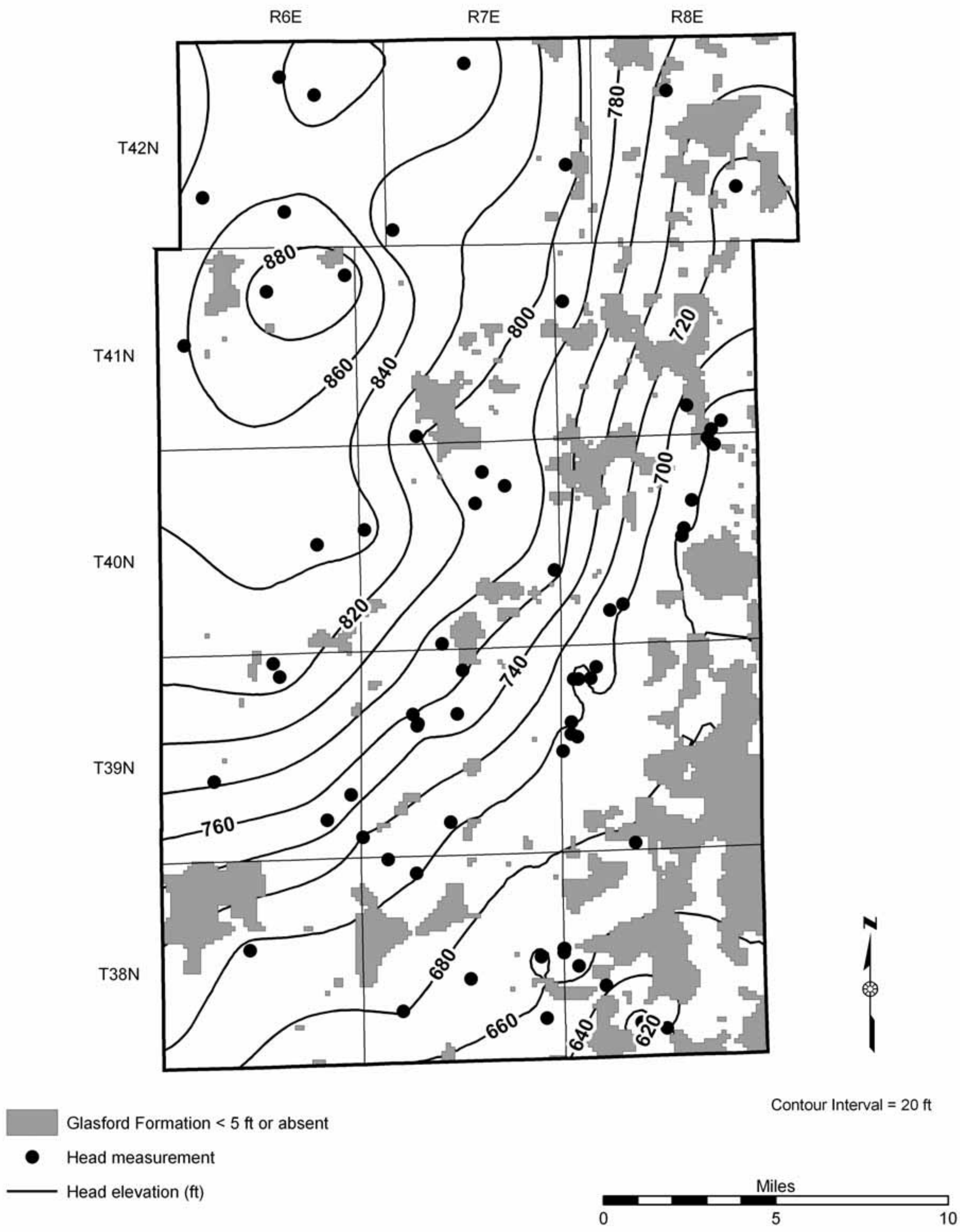


Figure 13. Fall 2003 head map for the total Glasford Formation sands.

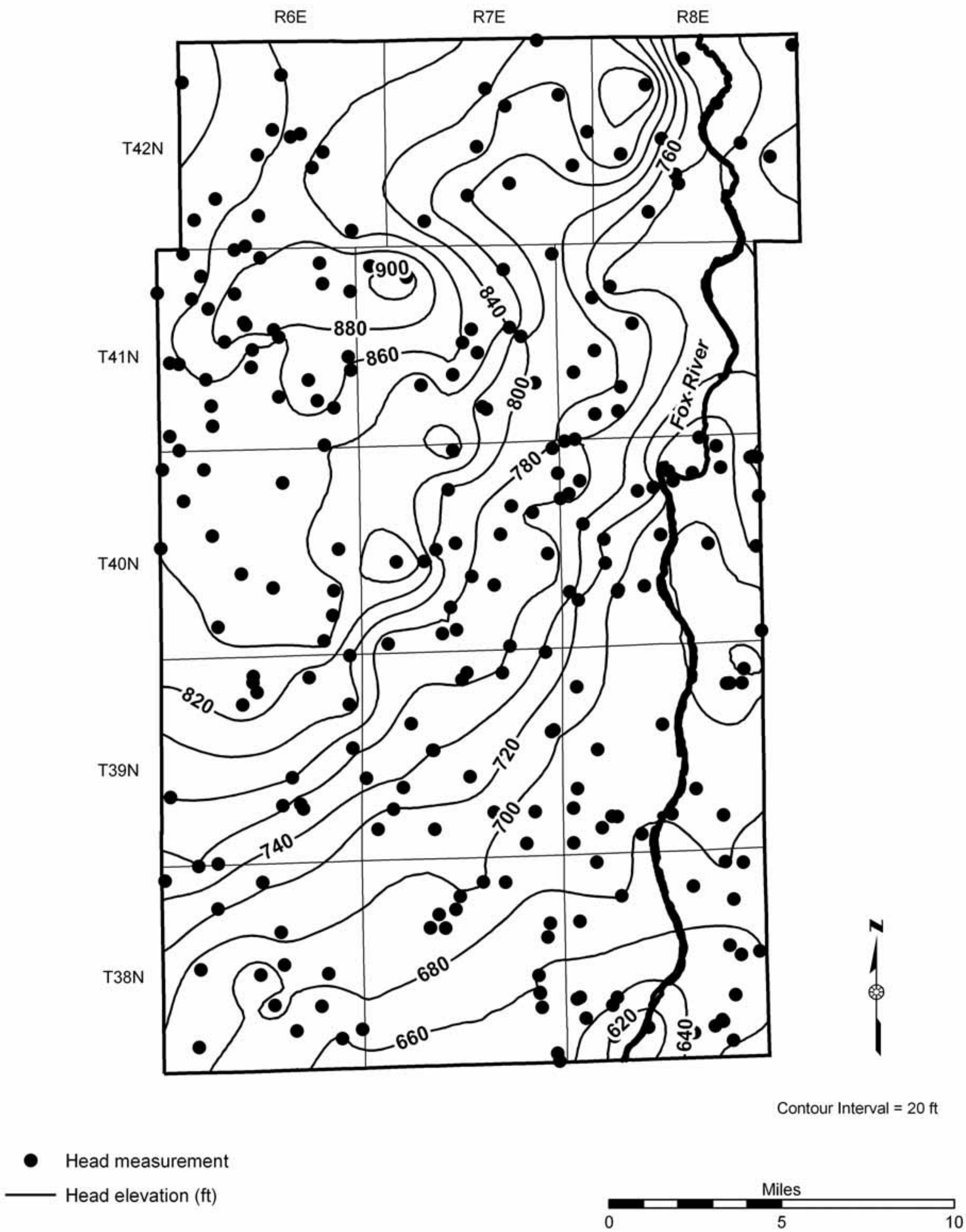


Figure 14. Fall 2003 head map for the shallow bedrock aquifer.

The preceding head maps are based on measured heads during fall 2003 at relatively few locations. Heads in areas between measured locations were interpolated by computer methods. Areas where data are spaced more closely should produce more reliable head contours than areas where data are spaced less closely. Potentiometric surfaces in Kane County are influenced by the Fox River, groundwater withdrawals, aquifer thickness, and aquifer hydraulic conductivity.

Hydraulic conductivity and aquifer thickness can influence potentiometric surface configuration, but these influences are less obvious than those of topography and aquifer connections. Hydraulic conductivity multiplied by aquifer thickness is equal to *transmissivity*, a property that quantifies the ability of an aquifer to transmit water. Where hydraulic conductivity and aquifer thickness are relatively high, so too is transmissivity. While it is only one of several possible explanations, low hydraulic gradients, represented on a head map by widely spaced equipotentials, can indicate high transmissivities. Variation in spacing of equipotentials can reflect corresponding variation in aquifer thickness or hydraulic conductivity. Given limited data on distribution of hydraulic conductivities in the shallow aquifers of Kane County, it is not practical to link specific features of Figures 12-14 to variation in hydraulic conductivity, although subsurface mapping may permit some potentiometric surface features to be associated with variation in aquifer thickness.

Influence of Topography and Perennial Streams

The degree to which a potentiometric surface imitates topography decreases as depth increases so that only major topographic features are reflected in head surfaces of deeply buried aquifers. The two most dominant features in Kane County that appear to influence all shallow potentiometric surfaces are the Fox River and Marengo Ridge. All of the mapped surfaces have their highest heads in the northwest in the vicinity of Marengo Ridge, particularly in or near T41N, R6E. Southerly or easterly regional groundwater flow dominates most of the county west of the Fox River. Southerly and westerly flow is more common east of the Fox River.

The potentiometric surface of the shallow bedrock aquifer correlates very closely with surface-water flow in perennial streams (Figure 15). Surface-water data were not used to constrain interpolations of any groundwater head surface, but stream orientations are nearly perpendicular to groundwater contours in many areas. The head data suggest that the shallow bedrock aquifer primarily discharges to the Fox River except in areas of significant pumping. Maps at the scale presented (as well as in consideration of the data density) may not be appropriate to determine localized gaining and losing relationships with smaller tributaries, but the influence of surficial flow is evident in the orientation of groundwater contours in all potentiometric surfaces presented. The boundary of the Kishwaukee River watershed is a major surface-water divide and is located at the edge of the gray shaded area (Figure 15). All unshaded areas on that map are part of the Fox River surface watershed. The area in Kane County that contributes groundwater to the Fox River, while not entirely coincident, appears in similar

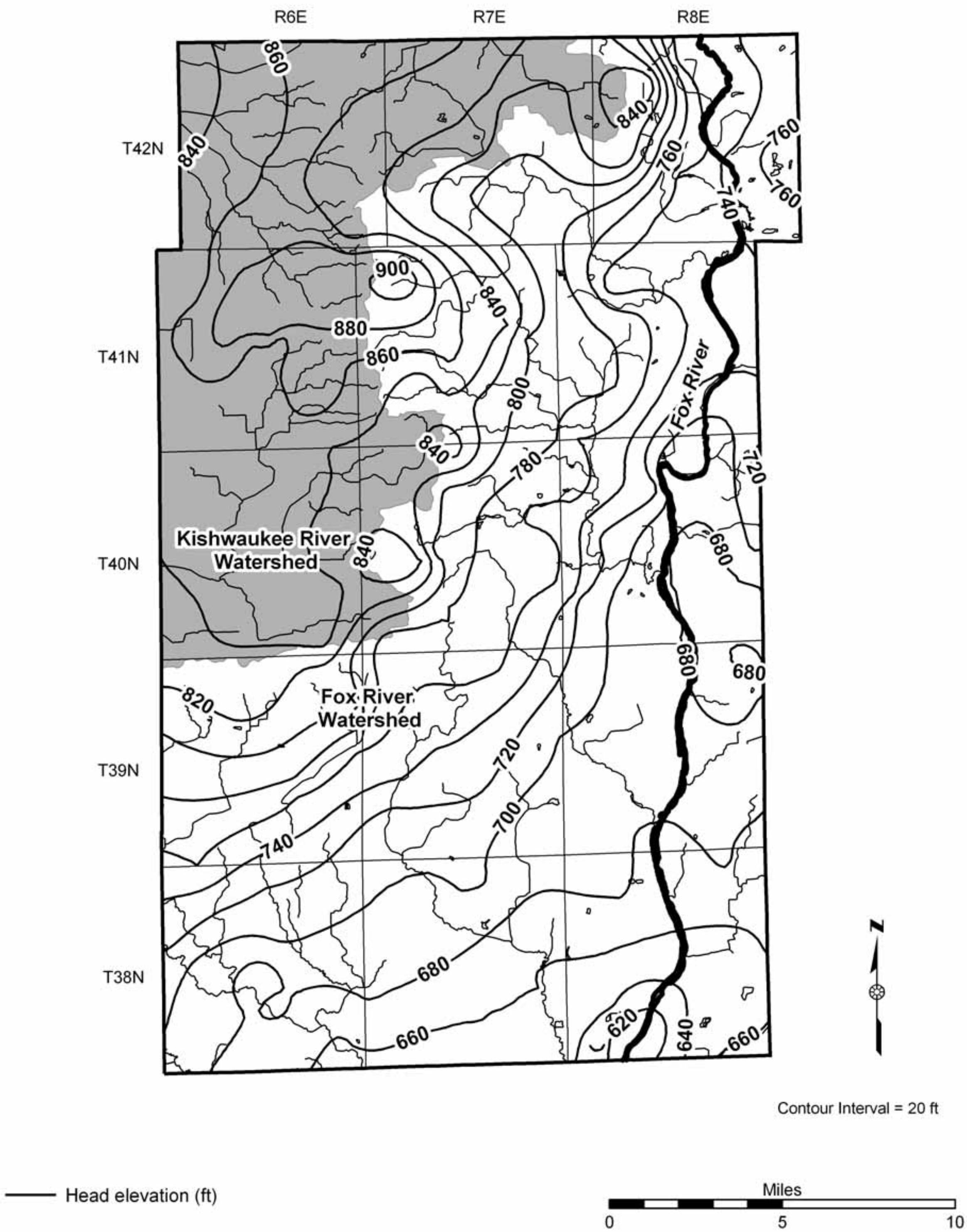


Figure 15. Comparison of potentiometric surface in the shallow bedrock aquifer, stream locations and the Fox River watershed.

locations as the surface watershed. Groundwatershed and surface watershed boundaries often do not match, but groundwater highs in T40N, R7E; T41N, R7E; and T42N, R8E show they are in close proximity in those areas. Elsewhere (e.g., T42N, R6E), the groundwater highs are farther west than the surface watershed boundary. Differences in those boundaries may be at a maximum where the land surface and shallow bedrock are least hydraulically connected.

Representation of Cones of Depression

Groundwater withdrawals create cones of depression in the potentiometric surface of the source aquifer around the withdrawal point. Within a cone of depression, the hydraulic gradient increases toward the withdrawal point. Because of the data density, data interpolation method, and map scale, the final potentiometric maps likely do not show the full extent or occurrence of cones of depression. In addition, the 20-ft contour interval necessary to display head surfaces at the small map scale may be too coarse to identify all but the largest cones of depression. If a more detailed assessment of cone occurrence is desired, the data should be reviewed at finer scales and contour intervals.

Use of Maps

Characterization of Groundwater Flow

Because groundwater flows from areas of high head to areas of low head, the maps presented can be used to identify groundwater flow patterns. Groundwater flow in an aquifer is perpendicular to equipotential contours. By determining locations of groundwater highs, flow divides may be identified. Tracing flow divides in aquifers can be complicated by aquifer geometries and interconnections, which are often incompletely defined. The most distinct regional groundwater flow divides occur near T41N, R6E and T42N, R6E in northwestern Kane County in the Ashmore Tongue (Figure 12), Glasford sands where present (Figure 13), and the shallow bedrock (Figure 14). These features are in the proximity of the surface-water drainage divide between the Fox and Kishwaukee Rivers.

Identification of Recharge and Discharge Areas

Recharge and discharge areas of the aquifers generally can be identified with the final potentiometric maps. Discharge areas can be identified where groundwater flow lines (not shown) converge and water is present at the land surface. A reasonable assumption is that recharge areas include all areas lying between discharge areas. The Fox River, its tributaries, and topography strongly influence locations of recharge and discharge areas.

Calibration of Groundwater Flow Models

Selected data compiled for the potentiometric mapping effort have been used in development and calibration of the local-scale shallow groundwater flow model. Observed and modeled head values will be compared to help determine if the flow model accurately represents groundwater levels. After appropriate calibration has been obtained, the model can be used to evaluate future groundwater scenarios, including those involving increased groundwater withdrawals to meet population demands.

Effects of Groundwater Withdrawals

In 2003, wells finished in the shallow bedrock aquifer accounted for 31 percent (16 of 52) of the shallow high-capacity wells in Kane County. Wells finished in the unconsolidated deposits accounted for 69 percent (36 of 52) of the shallow high-capacity wells. Annual groundwater withdrawals from the unconsolidated deposits were 86 percent (5.9 of 6.9 bg) of the total withdrawals from shallow aquifers. In particular, the Glasford sands and Ashmore Tongue appear to be the most extensively used. The small amount of water derived from high-capacity wells in the shallow bedrock (1.0 bg) can be attributed to low transmissivity.

An area of relatively lower heads occurs in the shallow bedrock aquifer in east-central Kane County and is roughly delineated by the 680-ft contour in southeastern T40N, R8E, and northeastern T39N, R8E (Figure 14). A similar area occurs in southeastern T38N, R8E and is outlined by the 620-ft contour. These areas of lowered heads are likely the cumulative effect of withdrawals from numerous domestic, industrial, and public water-supply wells and discharges to the Fox River. Groundwater withdrawals also are evidenced by deflections of equipotentials, as seen in one case associated with the 660-ft contour in T38N, R7E.

Baseline Data for Comparison to Future Conditions

Data and maps presented in this report and digital files provided to the Kane County Water Resources Department document groundwater conditions throughout the county during fall 2003. These data can be compared with future groundwater data to determine if heads have increased or decreased in response to changes in shallow groundwater withdrawals, climate change, or other factors.

Conclusions

An extensive effort was undertaken to assemble a network of 1010 wells for determination of groundwater conditions in Kane County. These data also serve as a basis to develop a conceptual hydrostratigraphic model and mathematical groundwater flow model. Synoptic head measurements were collected and analyzed to produce potentiometric maps for three shallow aquifers in Kane County. Based on the resulting maps and other data collected, the following conclusions can be made:

- At least seven shallow lithostratigraphic units are used as aquifers in Kane County. The most continuous unit is the shallow bedrock, but the most productive units appear to be sand-and-gravel deposits. Additional geological modeling is necessary to differentiate and characterize the sands in the Tiskilwa and Glasford Formations.

- Head data were of sufficient density to construct potentiometric maps for three aquifers: the Ashmore Tongue, the aggregated Glasford Formation sands, and the shallow bedrock.

- Without using any surface-water elevations to constrain the potentiometric surfaces of individual aquifers, the configuration of the constructed potentiometric surfaces still appears closely related with perennial stream configurations and land-surface topography.

- The Fox River and Marengo Ridge are the most influential features that determine regional groundwater flow patterns in Kane County. Flow west of the Fox River is mostly south and east. East of the Fox River, flow is mostly south and west.

- In 2003, 52 high-capacity wells accounted for 6.6 billion gallons or 96 percent of the total reported groundwater withdrawals of 6.9 billion gallons from the shallow aquifers in Kane County.

- Groundwater withdrawals appear to have local influence on potentiometric surfaces, particularly in southeastern Kane County. Areas of relatively low head in the shallow bedrock aquifer may reflect large withdrawals from the aquifer, hydraulically connected units, and/or significant discharge to the Fox River.

- The final potentiometric maps have multiple uses. They can characterize regional groundwater flow, identify areas of groundwater recharge and discharge, determine regional effects of groundwater withdrawals, and act as a baseline for comparison with future groundwater conditions.

- Previous nomenclature for aquifers of Kane County (i.e., Valparaiso, Kaneville, Bloomington, and St. Charles) may need to be assessed for its ability to accurately represent hydraulic connections between coarse-grained lithostratigraphic units.

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Appendix A. System of Location

Locations are described using township, range, and section numbers as established by the Northwest Ordinance of 1785. This ordinance mandated that all federal lands be surveyed into vertical strips 6 miles wide, called ranges, and horizontal strips of townships, each 6 miles wide. Ranges are numbered east or west of a principal meridian (for example, range 11 west or, alternatively, R11W). Township strips are numbered north or south of a base line (for example, township 5 south or, alternatively, T5S). Ranges and township strips in Kane County are surveyed relative to the Third Principal Meridian and Base Line. Range and township strips intersect to form townships, which ideally are square with sides 6 miles long and an area of 36 square miles. Townships are divided into 36 sections, each section one square mile in area, or 640 acres.

Subsection locations described in this report use a coordinate system that assigns a unique number and letter to each quarter-quarter-quarter section (see figure). Numbers indicate the east–west position of the location within the section, and letters indicate the north–south position. A standard section, which is one square mile in area, contains 64 quarter-quarter-quarter sections, each 10 acres in area. These tracts are referred to as 10-acre plots, or more simply plots.

A complete description of location by this system includes designations for county, township, range, section, and subsection location. For example, the location of a well in Kane County, township 41 north, range 8 east, section 36 with the plot location as shown in the figure below could be referenced as Kane-T41N-R8E-Sec 36.4c.

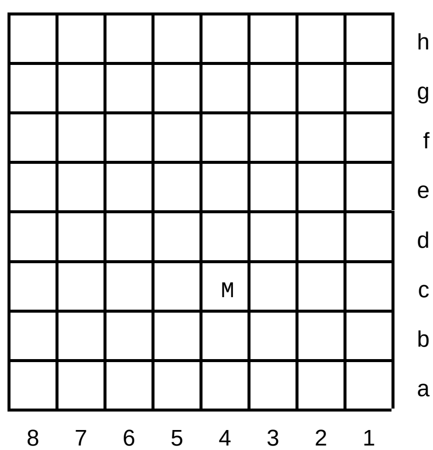

Illustration of plot designation for a section.

Appendix B. Potentiometric Network Well Data

Table B1 provides selected information for 1010 wells inventoried in the study area. The listing includes the lithostratigraphic unit(s) to which the well is open (BR = bedrock), the township, range, section, plot, unique ISWS project number, ISWS P number (a unique number assigned by the ISWS used to identify all non-PICS wells within Illinois), ISWS PICS number (if applicable), measuring point elevation (ft), well depth (ft), head elevation (ft) measured during the synoptic phase, and the measurement method used (ST = steel tape, AL = air line, or XD = transducer). The notes field indicates the following conditions: 1 = synoptic measurement was rejected and 2 = synoptic measurement was not taken. Data are arranged alphabetically by lithostratigraphic unit and then ascending by township, range, section, and plot.

Table B1. Potentiometric Network Well Data

Well open to	Twp	Rge	Sec	Plot	ISWS Project No.	ISWS P No.	ISWS PICS No.	Measuring Point Elevation (ft)	Well Depth (ft)	Head Elevation (ft)	Method	Note
Ashmore Tongue & Glasford sand (undiff.)	39N	6E	4	2a	127	66542		852.1	95	832	ST	
Ashmore Tongue	39N	6E	9	3h	986	72568		842.8	91	835	ST	
Ashmore Tongue	39N	7E	23	5d	13	311509		738.1	75	722	ST	
Ashmore Tongue	40N	5E	12	8c	873	42518		866.8	90	838	ST	
Ashmore Tongue	40N	5	17	4g	886	42542		874.1	79	825	ST	
Ashmore Tongue	40N	5E	22	3f	877	308065		874.2	80	834	ST	
Ashmore Tongue	40N	5E	29	4f	884	304243		900.7	102	837	ST	
Ashmore Tongue	40N	6E	4	3h	752	341958		877.2	90	858	ST	2
Ashmore Tongue	40N	6E	7	1a	885	331671		881.2	123	849	ST	
Ashmore Tongue	40N	6E	9	5c	981	67421		870.3	60	853	ST	
Ashmore Tongue	40N	6E	10	5c		67432		873.2	73	850	ST	
Ashmore Tongue	40N	6E	10	3c	165	307944		869.7	66	855	ST	
Ashmore Tongue	40N	6E	15	2c	875	67476		871.9	51	854	ST	
Ashmore Tongue	40N	6E	16	5d	754	314629		871.4	90	853	ST	
Ashmore Tongue	40N	6E	17	5h	867	67486		883.3	76	851	ST	
Ashmore Tongue	40N	6E	18	2a	865	213675		862.8	93	846	ST	
Ashmore Tongue	40N	6E	29	6b	864	67514		870.1	98	844	ST	
Ashmore Tongue	40N	6E	32	1a	977	67520		886.2	87	845	ST	
Ashmore Tongue	40N	6E	32	2h	157	228568		876.2	112	844	ST	
Ashmore Tongue	41N	6E	13	8e	913	231011		922.2	85	899	ST	
Ashmore Tongue	41N	6E	14	5g	335	268755		923.9	87	898	ST	
Ashmore Tongue	41N	6E	23	5c	910	306153		903.1	97	893	ST	
Ashmore Tongue	41N	6E	24	1f	917	228807		1007.3	220	874	ST	
Ashmore Tongue	41N	6E	32	3d	765	301372		886.4	90	859	ST	
Ashmore Tongue	41N	6E	33	1a	615	69994		877.4	89	858	ST	
Ashmore Tongue	41N	6E	34	5a	930	69997		875.2	55	858	ST	
Ashmore Tongue	41N	7E	28	8g	1113	309833		943.3	178	826	ST	
Ashmore Tongue	41N	8E	31	8f	489	240985		822.3	93	787	ST	
Ashmore Tongue	41N	8E	34	1h	695		6500	776.5	109	700	AL	
Ashmore Tongue	41N	8E	35	3c	697		6506	734.5	112	678	AL	
Ashmore Tongue	41N	9E	8	6b	672	34201		799.3	175	723	ST	

Table B1. Continued

Well open to	Twp	Rge	Sec	Plot	ISWS Project No.	ISWS P No.	ISWS PICS No.	Measuring Point Elevation (ft)	Well Depth (ft)	Head Elevation (ft)	Method	Note
Ashmore Tongue	42N	6	31	5c	353	288801		908.7	105	849	ST	
Ashmore Tongue	42N	6E	33	1b	506	228783		908.2	90	889	ST	
Ashmore Tongue	42N	8E	3	2c	2066		10241	741.5	121	707	AL	
Ashmore Tongue & Glasford sand (undiff.)	42N	8E	4	8d	685		4871	893.2	207	754	ST	
Ashmore Tongue	42N	8E	5	3d	684		4872	913.1	235	752	ST	
Ashmore Tongue	42N	8E	12	3h	658	276121		906.5	185	764	ST	
Ashmore Tongue	42N	8E	13	6d	701		10010	907.2	200	759	XD	
Ashmore Tongue	42N	8E	14	2g	703		6517	882.4	179	758	XD	
Ashmore Tongue	42N	8E	14	2h	702		6520	879.9	183	759	ST	
Ashmore Tongue	42N	8E	14	3b	663	304378		872.1	150	759	ST	
Ashmore Tongue	42N	8E	14	4e	700		11383	864.7	186	756	ST	
Ashmore Tongue	42N	8E	23	6e	693		6532	831.7	128	780	AL	
Ashmore Tongue	42N	8E	23	7d	692		6530	774.1	69	738	AL	
Ashmore Tongue	42N	8E	24	8h	694		5160	854.1	136	759	ST	
Ashmore Tongue	42N	8E	34	6e	666	71834		801.0	93	728	ST	
Ashmore Tongue & Glasford sand (undiff.)	42N	9E	2	4g	820	35062	818	813.3	208	723	ST	
Ashmore Tongue	42N	9E	3	2b	686		72	739.0	100	700	ST	
Ashmore Tongue	42N	9E	4	1d	842	314099		831.0	114	756	ST	
Ashmore Tongue	42N	9E	10	6e	1019	235055		823.3	145	754	ST	
Ashmore Tongue & Glasford sand (undiff.)	43N	6E	10	2b	733	101046		866.2	100	837	ST	
Ashmore Tongue	43N	6E	20	4c	2023	101092		980.2	200	864	ST	
Ashmore Tongue	43N	6E	34	2e	725	103086		923.0	84	876	ST	
Ashmore Tongue	43N	6E	34	4f	2030	103085		922.4	91	873	ST	
Ashmore Tongue	43N	7E	19	1b	2054	106309		872.4	131	692	AL	
Ashmore Tongue	43N	8E	34	1a	2067		3085	796.8	118	859	ST	2
Ashmore Tongue	43N	8	34	1b	2068		3084	716.9	155	703	AL	2
Ashmore Tongue	43N	9E	23	3	576	242586		802.4	194	736	ST	
Ashmore Tongue	43N	9E	29	8f	594	99602		808.3	190	747	ST	
Ashmore Tongue	43N	9E	30	5	460	99618		875.6	152	764	ST	

Table B1. Continued

Well open to	Twp	Rge	Sec	Plot	ISWS Project No.	ISWS P No.	ISWS PICS No.	Measuring Point Elevation (ft)	Well Depth (ft)	Head Elevation (ft)	Method	Note
Ashmore Tongue	43N	9E	31	6c	462	99643		871.4	135	763	ST	
Beverly Tongue	40N	9E	11	6h	391		5425	772.5	61	764	AL	
Beverly Tongue	41N	9E	23	5g	371		10658	829.8	146	760	AL	
Beverly Tongue	41N	9E	23	8c	370		10663	783.8	136	763	AL	
Beverly Tongue	41N	9E	35	3d	369		10673	801.9	115	751	AL	
Beverly Tongue	42N	9E	5	1b	361	35178		808.8	97	767	ST	
Beverly Tongue	42N	9E	22	4c	1032	289278		871.7	152	755	ST	
Beverly Tongue	43N	8E	2	4f	681	106395		850.9	90	811	ST	
Beverly Tongue	43N	8E	3	3	2035	244310		886.4	175	849	ST	
Beverly Tongue	43N	8E	6	1	2041		3058		48			2
Beverly Tongue	43N	8E	10	4b	2040	106620		894.8	90	846	ST	
Beverly Tongue	43N	8E	15	5e	2034	216315		891.7	82	840	ST	
Beverly Tongue	43N	8E	27	4f	2018	214288		884.3	86	820	ST	
Beverly Tongue	43N	8E	27	4g	2037	214289		890.4	96	821	ST	
Beverly Tongue	43N	9E	11	1a	606		6714	817.5	127	737	AL	
Beverly Tongue	43N	9E	11	2a	605		6713	813.4	160	728	AL	
Beverly Tongue	43N	9E	14	7c	845	309981		765.5	152	731	ST	
Beverly Tongue	43N	9E	23	1f	1030	290960		787.0	106	719	ST	
Beverly Tongue	43N	9E	24	8c	491	229302		840.9	250	719	ST	
Beverly Tongue	43N	9E	26	3a	603	273058		825.3	193	717	ST	
Beverly Tongue	43N	9E	35	1e	579		6717	820.7	148	718	AL	
Beverly Tongue	43N	9E	36	8f	580		6719	818.3	151	722	AL	
BR - Galena-Platteville	37N	5E	1	5h	817	252804		712.1	280	695	ST	
BR - Maquoketa & Galena-Platteville	37N	5E	3	4e	818	41088		727.9	215	705	ST	
BR - Galena-Platteville	37N	5E	4	8b	816	247361		725.0	180	713	ST	
BR - Galena-Platteville	37N	5E	5	5e	815	41094		738.6	170	712	ST	
BR - Galena-Platteville	37N	5E	10	1a	998	340004		716.7	240	688	ST	
BR - Galena-Platteville	37N	5E	10	3f	997	301061		721.6	250	694	ST	
BR - Galena-Platteville	37N	5E	11	3d	1132	41108		717.1	320	684	ST	1
BR - Galena-Platteville	37N	5E	12	5d	819	267971		708.9	260	678	ST	
BR - Galena-Platteville	37N	5E	16	8g	1099	41125		732.0	165	694	ST	
BR - Ancell	37N	5E	20	8h	1136	329715		724.4	220	697	ST	

Table B1. Continued

Well open to	Twp	Rge	Sec	Plot	ISWS Project No.	ISWS P No.	ISWS PICS No.	Measuring Point Elevation (ft)	Well Depth (ft)	Head Elevation (ft)	Method	Note
BR - Galena-Platteville	37N	5E	22	2g	1098	258678		696.6	170	667	ST	
BR - Galena-Platteville	37N	5E	22	5e	1100	289816		692.2	125	670	ST	
BR - Galena-Platteville	37N	5E	23	6	1130	195938		692.7	160	661	ST	
BR - Cambrian	37N	5E	24	6d	1129	343156		686.4	205	650	ST	1
BR - Ancell	37N	5	28	3a	1128	206796		679.0	140	657	ST	
BR - Cambrian	37N	5E	30	1e	1133	41147		697.9	140	677	ST	
BR - Ancell or Cambrian	37N	5E	32	7a	1134	41149		682.1	135	663	ST	
BR - Ancell or Cambrian	37N	5E	34	5a	999	41153		667.1	200	636	ST	
BR - Ancell or Cambrian	37N	5E	35	8a	1097	301971		669.7	160	637	ST	
BR - Silurian & Maquoketa & Galena-Platteville	37N	6E	1	4h	247	324817		673.0	260	643	ST	
BR - Silurian & Maquoketa	37N	6E	2	7g	245	77965		685.9	110	661	ST	
BR - Maquoketa & Galena	37N	6E	5	1g	252	77986		712.5	280	663	ST	
BR - Maquoketa & Galena-Platteville	37N	6E	5	8g	256	77988		721.4	222	688	ST	
BR - Galena-Platteville	37N	6E	8	4d	248	320239		694.0	320	632	ST	
BR - Maquoketa	37N	6E	9	2d	1120	77996		668.6	160	652	ST	
BR - Maquoketa	37N	6E	10	2h	269	300128		691.3	180	634	ST	
BR - Maquoketa & Galena-Platteville	37N	6E	10	8d	250	77999		676.3	220	606	ST	1
BR - Galena-Platteville	37N	6E	14	5f	253	78042		661.9	260	597	ST	1
BR - Maquoketa	37N	6E	14	5h	254	78040		663.0	160	612	ST	
BR - Maquoketa	37N	6E	16	2d	1118	78062		650.0	100	600	ST	
BR - Maquoketa & Galena-Platteville	37N	6E	16	6g	1078	78009		669.6	180	623	ST	
BR - Galena-Platteville	37N	6	20	7b	1084	78109		659.6	165	621	ST	
BR - Ancell	37N	6E	24	1a	1131	310797		632.9	550	498	ST	1
BR - Galena-Platteville	37N	6E	35	1d	1126	206772		575.0	120	554	ST	1
BR - Silurian & Maquoketa	37N	7E	1	8a	65	230811		655.1	120	644	ST	
BR - Silurian & Maquoketa	37N	7E	3	5a	68	78297		659.9	130	648	ST	
BR - Silurian & Maquoketa	37N	7	5	1h	64	78301		664.5	124	643	ST	
BR - Maquoketa	37N	7E	9	4a	67	326090		646.5	120	631	ST	
BR - Maquoketa	37N	7E	15	3e	69	287453		643.0	120	626	ST	
BR - Galena-Platteville	37N	7	17	8h	1012	78477		652.4	195	630	ST	
BR - Maquoketa & Galena-Platteville	37N	7E	21	2d	249	230408		642.0	260	621	ST	

Table B1. Continued

Well open to	Twp	Rge	Sec	Plot	ISWS Project No.	ISWS P No.	ISWS PICS No.	Measuring Point Elevation (ft)	Well Depth (ft)	Head Elevation (ft)	Method	Note
BR - Silurian & Maquoketa	37N	7E	24	1e	1002	76889		654.2	100	612	ST	2
BR - Maquoketa & Galena-Platteville	37N	7E	28	4c	1017	292649		638.1	260	606	ST	
BR - Galena-Platteville	37N	7E	29	4d	1016	76654		631.8	340	439	ST	1
BR - Maquoketa & Galena-Platteville	37N	7E	34	3g	1014	76572		584.4	100	574	ST	
BR - Maquoketa & Galena-Platteville	37N	7E	34	3g	1015	238544		583.9	120	574	ST	
BR - Silurian	37N	8E	2	1f	86	230131		696.8	140	667	ST	
BR - Maquoketa	37N	8E	5	8a	87	229524		654.9	140	616	ST	
BR - Maquoketa	37N	8E	8	5h	88	342799		622.9	120	617	ST	
BR - Silurian & Maquoketa	37N	8E	8	7h	1023		6666	641.7	187	611	AL	
BR - Silurian & Maquoketa	37N	8E	8	8a	1000	310800		651.3	140	619	ST	
BR - Silurian & Maquoketa	37N	8E	12	3g	91	238519		702.3	180	661	ST	
BR - Silurian	37N	8E	13	6b	89	76811		771.2	255	660	ST	
BR - Silurian & Maquoketa	37N	8E	15	5h	90	76837		669.5	105	652	ST	
BR - Silurian	37N	8E	16	6e	92	76841		652.0	85	635	ST	
BR - Silurian & Maquoketa	37N	8E	17	5h	1001	76854		608.5	110	567	ST	1
BR - Silurian & Maquoketa	37N	8E	22	5a	1003	229527		682.4	140	654	ST	
BR - Silurian & Maquoketa	37N	8E	26	1c	1005	303542		732.9	180	653	ST	
BR - Silurian & Maquoketa	37N	8E	27	2c	1004	76940		729.7	180	657	ST	
BR - Silurian & Maquoketa	37N	8E	29	4h	1013	244178		658.6	180	636	ST	
BR - Silurian	37N	9E	1	5a	124	312871		667.6	180	643	ST	
BR - Silurian	37N	9E	3	1d	116	159587		684.5	100	652	ST	
BR - Silurian	37N	9E	5	3g	114	159689		702.8	125	672	ST	
BR - Silurian & Maquoketa	37N	9E	6	6c	118	218264		702.6	150	665	ST	
BR - Silurian	37N	9E	8	5b	117	218267		695.8	120	660	ST	
BR - Silurian & Maquoketa	37N	9E	9	2f	120	218273		693.8	170	660	ST	
BR - Silurian & Maquoketa	37N	9E	11	8g	110	159794		664.1	100	651	ST	
BR - Maquoketa	37N	9E	15	5f	119	294528		661.8	240	633	ST	
BR - Silurian	37N	9E	16	8g	121	160150		687.4	120	658	ST	
BR - Silurian & Maquoketa	37N	9E	19	4d	123	245474		699.4	145	656	ST	
BR - Silurian & Maquoketa	37N	9E	20	1h	1027		5199	685.9	205	659	ST	
BR - Silurian	37N	9E	20	6b	122	238946		686.8	110	658	ST	
BR - Silurian & Maquoketa	37N	9E	27	7h	112	160228		644.2	200	623	ST	

Table B1. Continued

Well open to	Twp	Rge	Sec	Plot	ISWS Project No.	ISWS P No.	ISWS PICS No.	Measuring Point Elevation (ft)	Well Depth (ft)	Head Elevation (ft)	Method	Note
BR - Silurian & Maquoketa	37N	9E	29	4f	109	218535		665.1	140	649	ST	
BR - Silurian & Maquoketa	37N	9E	31	8g	115	236880		695.4	140	656	ST	
BR - Maquoketa	37N	9E	34	6c	111	263069		614.8	140	607	ST	
BR - Silurian & Maquoketa	37N	9E	36	2a	113	160376		621.4	145	612	ST	
BR - Galena-Platteville	38N	5E	4	3d	263	333998		785.1	270	747	ST	
BR - Galena-Platteville	38N	5E	6	4a	1072	41268		772.7	140	758	ST	
BR - Galena-Platteville	38N	5E	12	4a	988	41273		753.9	240	628	ST	1
BR - Galena-Platteville	38N	5E	12	8e	266	41274		760.5	380	669	ST	1
BR - Maquoketa	38N	5E	12	1b	262	41269		750.4	185	734	ST	
BR - Maquoketa & Galena-Platteville	38N	5E	13	2a	267	41301		737.7	320	616	ST	1
BR - Galena-Platteville	38N	5E	15	5d	264	340014		740.9	200	727	ST	
BR - Galena-Platteville	38N	5E	16	1g	992	208664		750.9	225	729	ST	
BR - Galena-Platteville	38N	5E	20	8a	1071	285035		750.1	305	733	ST	
BR - Maquoketa & Galena-Platteville	38N	5E	27	5f	265	41306		739.9	215	713	ST	
BR - Galena-Platteville	38N	5E	32	4h	1073	41309		742.0	210	726	ST	
BR - Silurian & Maquoketa	38N	6E	3	8d	995	189440		751.0	160	722	ST	
BR - Silurian & Maquoketa	38N	6E	5	7h	1096	65377		775.0	225	760	ST	
BR - Maquoketa	38N	6E	6	7e	52	65379		766.9	130	745	ST	
BR - Maquoketa	38N	6E	8	2f	60	189455		750.1	160	722	ST	
BR - Galena-Platteville	38N	6E	11	8h	51	189446		741.4	320	654	ST	1
BR - Maquoketa	38N	6E	15	3a	344	65437		704.9	98	687	ST	
BR - Maquoketa	38N	6E	15	4h	343	65439		718.8	160	707	ST	
BR - Maquoketa & Galena	38N	6E	16	4b	996	65456		718.2	240	636	ST	1
BR - Galena-Platteville	38N	6E	18	7e	53	286057		738.2	360	638	ST	2
BR - Maquoketa & Galena-Platteville	38N	6E	20	6h	1095	189451		730.5	320	692	ST	
BR - Maquoketa & Galena-Platteville	38N	6E	21	1g	59	230389		713.2	240	674	ST	1
BR - Galena-Platteville	38N	6E	21	4a	1092	72569		707.3	370	578	ST	1
BR - Maquoketa	38N	6E	22	8g	1094	282851		713.1	200	669	ST	
BR - Maquoketa	38N	6E	23	1f	61	294089		702.3	180	684	ST	
BR - Silurian & Maquoketa	38N	6E	25	1a	62	228579		695.0	140	678	ST	
BR - Maquoketa	38N	6E	26	2f	1093	299280		678.5	160	672	ST	
BR - Silurian & Maquoketa	38N	6E	26	8a	970	295546		679.2	100	673	ST	

Table B1. Continued

Well open to	Twp	Rge	Sec	Plot	ISWS Project No.	ISWS P No.	ISWS PICS No.	Measuring Point Elevation (ft)	Well Depth (ft)	Head Elevation (ft)	Method	Note
BR - Maquoketa	38N	6E	27	5g	969	65711		703.6	200	684	ST	
BR - Galena-Platteville	38N	6E	32	7f	63	189323		713.1	240	692	ST	
BR - Maquoketa & Galena-Platteville	38N	6E	33	3h	1091	189325		726.6	320	590	ST	1
BR - Maquoketa	38N	6E	36	5h	968	287772		686.9	240	658	ST	
BR - Silurian & Maquoketa	38N	7E	2	6c	1107	65758		694.0	140	688	ST	
BR - Silurian & Maquoketa	38N	7E	3	2c	632	246486		727.2	200	702	ST	
BR - Galena-Platteville	38N	7E	5	4g	1006	65785		708.3	260	644	ST	1
BR - Silurian	38N	7E	9	1d	630	189486		716.9	110	690	ST	
BR - Silurian	38N	7E	9	4a	631	65834		701.3	100	689	ST	
BR - Silurian	38N	7E	9	5d	629	306158		697.2	100	688	ST	
BR - Silurian	38N	7E	10	8g	633	295935		748.6	120	699	ST	
BR - Silurian	38N	7E	12	4a	1103	65847		676.4	150	669	ST	
BR - Silurian	38N	7E	13	4e	1009	65849		681.6	160	664	ST	
BR - Silurian	38N	7E	14	1c	1106			672.5	100	659	ST	2
BR - Silurian	38N	7E	16	8h	1010	65866		711.2	100	691	ST	
BR - Silurian	38N	7E	17	1h	1011	65890		711.1	100	690	ST	
BR - Silurian	38N	7E	24	6a	223	254370		680.8	80	660	ST	
BR - Silurian	38N	7E	24	6a	224	230676		685.0	140	660	ST	
BR - Silurian	38N	7E	24	7e	1105	250789		689.7	200	659	ST	
BR - Silurian	38N	7E	25	6e	222	65923		670.8	140	650	ST	
BR - Silurian & Maquoketa	38N	7E	36	2a	220	65950		666.5	105	652	ST	
BR - Maquoketa	38N	7E	36	3c	221	189521		660.4	140	650	ST	
BR - Silurian	38N	8E	1	6e	95	238379		737.4	150	677	ST	
BR - Silurian	38N	8E	2	2e	96	65974		751.9	140	681	ST	
BR - Silurian	38N	8E	5	7g	97	65985		709.9	100	688	ST	
BR - Silurian & Maquoketa	38N	8E	7	4a	303	65989		687.0	220	672	ST	
BR - Silurian	38N	8E	8	2g	98	66003		693.1	75	681	ST	
BR - Silurian	38N	8E	10	1h	99	66026		746.6	135	675	ST	
BR - Silurian	38N	8E	12	8c	100	66105		709.4	106	674	ST	
BR - Silurian & Maquoketa	38N	8E	13	2a	101	321812		710.7	160	658	ST	
BR - Silurian & Maquoketa	38N	8E	14	1c	102	189673		693.1	200	650	ST	
BR - Silurian & Maquoketa	38N	8E	24	8h	107	66198		708.4	170	646	ST	

Table B1. Continued

Well open to	Twp	Rge	Sec	Plot	ISWS Project No.	ISWS P No.	ISWS PICS No.	Measuring Point Elevation (ft)	Well Depth (ft)	Head Elevation (ft)	Method	Note
BR - Silurian & Maquoketa	38N	8E	25	8g	308		6386	721.8	253	652	AL	
BR - Maquoketa	38N	8E	26	1d	309		6389	709.0	147		AL	1
BR - Silurian & Maquoketa	38N	8E	26	3a	311	309590	6387	720.5	210	653	AL	
BR - Silurian & Maquoketa	38N	8E	26	3a	312	309591	6388	701.7	208	657	AL	
BR - Silurian	38N	8E	29	4e	300	66277		656.5	115	642	ST	
BR - Silurian & Maquoketa	38N	8E	29	3f	105	66266		667.5	148	641	ST	
BR - Silurian	38N	8E	30	3b	108	66343		661.0	60	646	ST	
BR - Silurian	38N	8E	30	5g	299	66380		677.4	120	647	ST	
BR - Silurian	38N	8E	30	5h	104	241461		682.7	100	653	ST	
BR - Silurian & Maquoketa	38N	8E	31	4e	1022	301331	2002	668.2	176		AL	2
BR - Silurian & Maquoketa	38N	8E	31	4f	1021	66391	2003	670.9	178	616	AL	2
BR - Silurian & Maquoketa	38N	8E	31	3f	1020	301332	2001	671.1	171	631	AL	2
BR - Silurian & Maquoketa	38N	8E	32	4f	314	308805	10029	646.7	190	616	ST	
BR - Maquoketa	38N	8E	33	4h	317	308806	10030	639.1	183	602	ST	
BR - Maquoketa	38N	8E	34	4e	103	323169		663.6	160	650	ST	
BR - Silurian	38N	8E	34	4e	313	308845	6409	670.5	80	648	ST	2
BR - Silurian	38N	8E	35	1d	106	66508		685.4	80	658	ST	
BR - Maquoketa	38N	8E	35	5h	318			700.3	280	656	ST	
BR - Silurian & Maquoketa	38N	9E	1	5a	399		2754	729.8	223	680	AL	
BR - Silurian	38N	9E	2	6g	282	181754		690.7	135	677	ST	
BR - Silurian & Maquoketa	38N	9E	2	5f	827		2765	691.8	300	667	AL	
BR - Silurian & Maquoketa	38N	9E	5	4a	284	181775		734.1	240	675	ST	
BR - Silurian & Maquoketa	38N	9E	8	1a	400		2798	712.4	310	678	AL	
BR - Silurian & Maquoketa	38N	9E	9	6d	283	181786		707.2	280	677	ST	
BR - Silurian & Maquoketa	38N	9E	13	4b	292	267363		683.7	278	663	ST	
BR - Silurian	38N	9E	14	5f	281	176153		678.3	105	677	ST	
BR - Maquoketa	38N	9E	17	7e	285	181811		717.4	220	678	ST	
BR - Silurian	38N	9E	19	6d	286	181825		714.7	120	659	ST	
BR - Silurian	38N	9E	24	7d	287	288296		706.9	85	681	ST	
BR - Silurian & Maquoketa	38N	9E	31	4e	288	181870		700.1	200	663	ST	
BR - Silurian & Maquoketa	38N	9E	34	3c	293	181893		687.9	240	676	ST	
BR - Silurian	38N	9E	34	6h	289	181887		701.6	105	685	ST	

Table B1. Continued

Well open to	Twp	Rge	Sec	Plot	ISWS Project No.	ISWS P No.	ISWS PICS No.	Measuring Point Elevation (ft)	Well Depth (ft)	Head Elevation (ft)	Method	Note
BR - Galena-Platteville	39N	5E	4	1b	261	304506		897.1	300	824	ST	
BR - Maquoketa	39N	5E	12	2a	255	223993		846.4	200	800	ST	
BR - Galena-Platteville	39N	5E	16	3h	354	285022		811.9	370	717	ST	1
BR - Galena-Platteville	39N	5E	21	1h	257	41729		801.0	260	677	ST	1
BR - Galena-Platteville	39N	5E	24	1h	259	308426		806.4	300	716	ST	1
BR - Galena-Platteville	39N	5E	25	8f	342	41731		795.2	266	740	ST	1
BR - Galena-Platteville	39N	5E	26	8c	258	266047		792.8	300	721	ST	1
BR - Galena-Platteville	39N	5E	34	5h	268	301131		783.4	340	758	ST	
BR - Silurian & Maquoketa	39N	6E	1	3h	125	289662		848.3	220	801	ST	
BR - Maquoketa	39N	6E	2	3a	93	66539		842.4	205		ST	2
BR - Maquoketa	39N	6E	2	5a	985	237340		854.2	225	810	ST	
BR - Silurian & Maquoketa	39N	6E	4	2c	892	319577		857.1	180	834	ST	
BR - Silurian	39N	6E	4	2d	128	66545		865.7	120	830	ST	
BR - Maquoketa & Galena-Platteville	39N	6E	6	2a	129	326963		855.1	400	719	ST	1
BR - Silurian	39N	6E	9	1h	130	66574		846.6	130	830	ST	
BR - Silurian	39N	6E	9	4e	131	212576		836.3	95	829	ST	
BR - Silurian & Maquoketa	39N	6E	12	4e	900	294448		817.9	145	810	ST	
BR - Silurian & Maquoketa	39N	6E	13	3c	132	66600		796.6	140	763	ST	
BR - Silurian & Maquoketa	39N	6E	22	1d	133	262522		803.4	180	782	ST	
BR - Silurian & Maquoketa	39N	6E	24	1c	979	66616		809.9	205		ST	2
BR - Silurian & Maquoketa	39N	6E	26	6e	134	240818		781.8	142	754	ST	
BR - Silurian & Maquoketa	39N	6E	26	7f	135	72343		780.9	160	752	ST	
BR - Maquoketa	39N	6E	27	3g	982	250714		789.9	180	763	ST	
BR - Maquoketa	39N	6E	30	5h	1074	66639		792.9	188	780	ST	
BR - Silurian & Maquoketa	39N	6E	32	3a	137	308368		767.9	220	750	ST	
BR - Maquoketa & Galena-Platteville	39N	6E	35	8a	896	250682		760.4	320	611	ST	1
BR - Silurian	39N	7E	1	5h	78	66652		767.7	125	738	ST	
BR - Silurian	39N	7E	2	3a	74	297912		807.5	120	759	ST	
BR - Silurian	39N	7E	3	8b	83	326535		838.8	147	762	ST	
BR - Silurian & Maquoketa	39N	7E	3	8a	77	213172		837.3	200	764	ST	
BR - Silurian & Maquoketa	39N	7E	13	2f	211	213187		768.9	200	702	ST	
BR - Silurian & Maquoketa	39N	7E	13	3e	210	213188		769.5	200	702	ST	

Table B1. Continued

Well open to	Twp	Rge	Sec	Plot	ISWS Project No.	ISWS P No.	ISWS PICS No.	Measuring Point Elevation (ft)	Well Depth (ft)	Head Elevation (ft)	Method	Note
BR - Silurian & Maquoketa	39N	7E	13	2f	211	213187		768.9	200	702	ST	
BR - Maquoketa	39N	7E	16	6b	716	228716		779.9	250	740	ST	
BR - Silurian & Maquoketa	39N	7E	16	7b	209	240809		778.8	250	740	ST	
BR - Silurian & Maquoketa	39N	7E	17	4h	207	329955		790.1	200	750	ST	
BR - Silurian & Maquoketa	39N	7E	19	6d	147	228900		813.2	200	747	ST	
BR - Silurian	39N	7E	20	6a	10	268759		774.8	140	737	ST	
BR - Silurian	39N	7E	22	6c	12	331376		763.4	200	732	ST	
BR - Silurian	39N	7E	25	7c	19	229662		704.4	122	690	ST	
BR - Silurian	39N	7E	26	8c	23	66936		734.9	160	707	ST	
BR - Silurian & Maquoketa	39N	7E	29	8d	11	299281		730.8	60	718	ST	
BR - Silurian & Maquoketa	39N	7E	31	4h	22	326946		739.0	200	711	ST	
BR - Silurian & Maquoketa & Galena	39N	7E	33	6g	20	67023		731.1	250	708	ST	
BR - Silurian	39N	7E	35	1d	18	213253		701.8	60	688	ST	
BR - Silurian & Maquoketa	39N	8E	1	5b	149	339671		788.3	220	690	ST	
BR - Maquoketa	39N	8E	7	3g	153	67065		733.2	200	708	ST	
BR - Silurian	39N	8E	11	1g	216	228868		763.7	170	665	ST	
BR - Silurian & Maquoketa	39N	8E	12	5g	150	304638		779.2	240	662	ST	
BR - Silurian	39N	8E	12	8g	217	283049		752.9	160	658	ST	
BR - Silurian & Maquoketa	39N	8E	15	8f	152	313063		721.4	180	695	ST	
BR - Silurian	39N	8E	17	5a	159	67136		737.5	130	696	ST	
BR - Silurian	39N	8E	27	6a	302	67289		700.4	107	682	ST	
BR - Maquoketa	39N	8E	27	6e	143	67288		692.4	140	662	ST	2
BR - Silurian & Maquoketa	39N	8E	27	1g	151	230980		729.7	160	695	ST	
BR - Silurian & Maquoketa	39N	8E	29	2a	138	298832		722.9	140	706	ST	
BR - Silurian	39N	8E	29	4a	139	228625		728.2	100	700	ST	
BR - Silurian & Maquoketa	39N	8E	30	4h	140	228789		727.8	180	694	ST	
BR - Maquoketa & Galena-Platteville	39N	8E	30	5c	141	228465		727.2	200	695	ST	
BR - Silurian & Maquoketa	39N	8E	31	5c	142	240892		717.2	200	692	ST	
BR - Silurian & Maquoketa	39N	8E	32	6f	148	263904		730.8	180	695	ST	
BR - Silurian & Maquoketa	39N	8E	33	1f	301	299434		683.1	160	648	ST	1
BR - Silurian	39N	8E	33	4e	146	67375		714.9	118	674	ST	
BR - Silurian	39N	8E	35	2h	145	213525		771.0	180	683	ST	

Table B1. Continued

Well open to	Twp	Rge	Sec	Plot	ISWS Project No.	ISWS P No.	ISWS PICS No.	Measuring Point Elevation (ft)	Well Depth (ft)	Head Elevation (ft)	Method	Note
BR - Silurian	39N	9E	1	1e	558	243505		752.8	180	710	ST	
BR - Silurian & Maquoketa	39N	9E	1	3g	298	32831		736.3	225	706	ST	
BR - Silurian	39N	9E	2	1g	655	184361		739.6	145	713	ST	
BR - Silurian & Maquoketa	39N	9E	2	8e	559	251910		782.7	300	695	ST	
BR - Silurian	39N	9E	3	2a	562	261102		779.7	180	707	ST	
BR - Silurian	39N	9E	3	3f	561	184404		769.4	140	711	ST	
BR - Silurian	39N	9E	5	2f	563	311551		753.7	120	711	ST	1
BR - Silurian & Maquoketa	39N	9E	5	5d	825		4251	753.8	325	658	AL	
BR - Silurian & Maquoketa	39N	9E	7	4h	838		4542		285		AL	2
BR - Silurian	39N	9E	7	8a	656	277054		769.9	180	687	ST	
BR - Silurian & Maquoketa	39N	9E	8	3d	826		9876	750.4	350	666	AL	2
BR - Silurian	39N	9E	10	3a	564	184618		762.6	140	705	ST	
BR - Silurian	39N	9E	11	4f	566	186616		747.5	160	703	ST	
BR - Silurian	39N	9E	11	5b	565	186716		723.3	80	703	ST	
BR - Silurian	39N	9E	13	8c	569	186776		781.8	200	704	ST	
BR - Silurian	39N	9E	14	6d	568	186811		763.3	160	700	ST	
BR - Silurian	39N	9E	15	3d	567	186935		711.0	120	693	ST	
BR - Silurian	39N	9E	22	1a	570	172131		715.0	115	699	ST	
BR - Silurian & Maquoketa	39N	9E	22	5a	294		4962	711.6	220	694	ST	
BR - Silurian & Maquoketa	39N	9E	22	8h	643	243389		713.1	180	697	ST	
BR - Silurian	39N	9E	23	4b	637	172020		736.6	110	708	ST	
BR - Silurian	39N	9E	23	4h	654	172015		750.3	160	698	ST	
BR - Silurian	39N	9E	23	6f	636	171997		748.5	100	703	ST	
BR - Silurian	39N	9E	24	1a	640	172156		749.3	150	702	ST	
BR - Silurian	39N	9E	24	7b	639	172163		748.3	150	700	ST	
BR - Silurian	39N	9E	24	8h	638	339795		774.6	180	704	ST	
BR - Silurian	39N	9E	24	3f	425		4697	737.0	231	706	ST	
BR - Silurian & Maquoketa	39N	9E	24	3g	424	172157	1396	772.2	325	730	AL	
BR - Silurian	39N	9E	25	1h	435	305939		766.9	180	730	AL	
BR - Silurian	39N	9E	25	2f	641	288505		720.1	200	702	ST	
BR - Silurian	39N	9E	25	4c	642	268705		760.0	180	700	ST	
BR - Silurian	39N	9E	26	2f	296	314338		742.9	200	704	ST	

Table B1. Continued

Well open to	Twp	Rge	Sec	Plot	ISWS Project No.	ISWS P No.	ISWS PICS No.	Measuring Point Elevation (ft)	Well Depth (ft)	Head Elevation (ft)	Method	Note
BR - Silurian & Maquoketa	39N	9E	26	7b	295		4960	704.1	190	690	ST	
BR - Silurian	39N	9E	27	2c	645	172332		699.4	120	689	ST	
BR - Silurian	39N	9E	27	2g	644	172335		706.6	120	694	ST	
BR - Silurian & Maquoketa	39N	9E	27	6c	829		4318	732.0	335	683	ST	
BR - Silurian	39N	9E	27	8e	653	172344		732.5	130	674	ST	
BR - Silurian & Maquoketa	39N	9E	31	3b	646	308804		753.3	280	675	ST	
BR - Silurian	39N	9E	33	3c	290	172374		723.5	110	682	ST	
BR - Silurian	39N	9E	34	1g	652	172371		706.2	118	688	ST	
BR - Silurian	39N	9E	34	2b	648	172417		701.2	120	675	ST	
BR - Silurian & Maquoketa & Galena-Platteville	39N	9E	34	5h	828		4339	713.3	365	695	ST	
BR - Silurian	39N	9E	34	7d	647	296971		716.6	120	678	ST	
BR - Silurian	39N	9E	35	4a	649	172437		694.4	115	681	ST	
BR - Silurian	39N	9E	36	2f	651	172477		772.9	220	688	ST	
BR - Silurian	39N	9E	36	5c	650	180714		740.0	150	681	ST	
BR - Maquoketa	40N	5E	1	4a	869	42489		871.0	215	831	ST	
BR - Maquoketa	40N	5E	1	6f	976	42490		890.2	222	827	ST	
BR - Maquoketa	40N	5E	1	5c	904	343431		872.7	225	831	ST	
BR - Maquoketa	40N	5E	2	4f	868	42493		874.0	203	828	ST	
BR - Silurian & Maquoketa	40N	5E	2	7a	870	42495		851.4	200	828	ST	
BR - Maquoketa & Galena	40N	5E	9	7h	903	42506		856.3	175	810	ST	
BR - Maquoketa	40N	5E	10	7g	874	42508		840.4	160	814	ST	
BR - Maquoketa	40N	5E	13	6h	876	28597		856.5	175	833	ST	
BR - Maquoketa & Galena-Platteville	40N	5E	13	8a	879	252799		850.9	220	834	ST	
BR - Galena-Platteville	40N	5E	14	4h	1083	223997		858.4	205	832	ST	
BR - Maquoketa	40N	5E	14	5b	987	42525		846.5	190	828	ST	
BR - Maquoketa	40N	5E	16	2h	872	329538		882.0	160	827	ST	
BR - Maquoketa	40N	5E	21	5f	991	42562		876.7	106	833	ST	
BR - Silurian & Maquoketa	40N	5E	22	5a	878	343437		859.5	105	844	ST	
BR - Silurian & Maquoketa	40N	5E	27	8b	978	42579		867.3	125	848	ST	
BR - Maquoketa	40N	5E	28	3b	902	301162		882.6	121	851	ST	
BR - Silurian & Maquoketa	40N	5E	35	1e	260	41703		868.4	150	847	ST	

Table B1. Continued

Well open to	Twp	Rge	Sec	Plot	ISWS Project No.	ISWS P No.	ISWS PICS No.	Measuring Point Elevation (ft)	Well Depth (ft)	Head Elevation (ft)	Method	Note
BR - Galena-Platteville	40N	5E	36	1f	908	223989		852.8	265	819	ST	
BR - Maquoketa	40N	6E	1	3h	753	67390		944.9	230	765	ST	1
BR - Galena-Platteville	40N	6E	3	1a	164	250802		871.9	370	749	ST	1
BR - Maquoketa	40N	6E	3	2a	746	213534		871.5	200	854	ST	
BR - Maquoketa	40N	6E	5	4d	748	67400		869.2	185	854	ST	
BR - Maquoketa & Galena	40N	6E	6	4g	163	213536		893.0	340	816	ST	1
BR - Maquoketa	40N	6E	6	4h	749			905.7	250	842	ST	2
BR - Maquoketa	40N	6E	6	6d	745	67402		885.2	208	851	ST	
BR - Maquoketa & Galena	40N	6E	7	1e	747	250708		873.4	260	854	ST	
BR - Maquoketa	40N	6E	13	6a	866	292869		876.6	200	826	ST	
BR - Maquoketa	40N	6E	17	3e	162	213599		889.1	248	853	ST	
BR - Maquoketa & Galena	40N	6E	18	6b	161	213677		860.1	200	841	ST	
BR - Galena-Platteville	40N	6E	21	4d	883	213678		867.0	295	849	ST	
BR - Maquoketa	40N	6E	25	7g	155	321818		873.7	205	843	ST	
BR - Maquoketa	40N	6E	25	7b	156	213683		870.8	240	845	ST	
BR - Maquoketa	40N	6E	27	5h	166	291604		876.4	180	851	ST	
BR - Maquoketa & Galena	40N	6E	29	8h	755	67516		863.7	317	731	ST	1
BR - Maquoketa	40N	6E	32	2h	160	254382		869.3	200	844	ST	
BR - Silurian	40N	6E	35	2e	895	267121		895.4	140	847	ST	
BR - Silurian & Maquoketa	40N	7E	1	2b	185	215123		823.1	200	769	ST	
BR - Maquoketa	40N	7E	1	2g	184	72542		821.3	240	779	ST	
BR - Silurian & Maquoketa	40N	7E	4	1g	187	215212		932.8	240	852	ST	
BR - Maquoketa	40N	7E	4	4d	189	231199		938.5	240		ST	2
BR - Ancell	40N	7E	9	2e	188	67622		918.6	300	796	ST	
BR - Galena-Platteville	40N	7E	10	1b	602	215240		863.2	635		ST	2
BR - Maquoketa	40N	7E	11	1f	199	67746		819.0	260	723	ST	1
BR - Maquoketa	40N	7E	11	2e	190	67745		842.9	265	765	ST	
BR - Maquoketa	40N	7E	12	8e	192	67799		853.6	295	666	ST	1
BR - Galena-Platteville	40N	7E	13	3a	194	67848		807.5	450	735	ST	1
BR - Maquoketa	40N	7E	13	7h	198	67882		791.6	166	757	ST	
BR - Maquoketa	40N	7E	14	6c	193	67954		831.9	225	764	ST	
BR - Maquoketa	40N	7E	16	1b	196	230999		898.0	238	796	ST	

Table B1. Continued

Well open to	Twp	Rge	Sec	Plot	ISWS Project No.	ISWS P No.	ISWS PICS No.	Measuring Point Elevation (ft)	Well Depth (ft)	Head Elevation (ft)	Method	Note
BR - Maquoketa	40N	7E	20	7f	231	68267		953.5	300	861	ST	
BR - Maquoketa	40N	7E	21	5h	230	68395		905.1	310	790	ST	
BR - Maquoketa & Galena	40N	7E	21	6f	232	215924		899.7	480	839	ST	
BR - Maquoketa	40N	7E	22	5b	233	240763		918.4	360	777	ST	
BR - Silurian & Maquoketa	40N	7E	24	4f	41	68546		849.1	250	769	ST	
BR - Silurian & Maquoketa & Galena	40N	7E	25	2e	40	250710		844.8	445	679	ST	1
BR - Silurian	40N	7E	26	8g	37	213971		835.0	170	767	ST	
BR - Silurian & Maquoketa	40N	7E	28	2c	38	214049		941.1	280	778	ST	
BR - Silurian & Maquoketa	40N	7E	31	1c	26	238387		922.6	280	765	ST	
BR - Maquoketa	40N	7E	33	1f	17	261107		854.3	300	784	ST	
BR - Silurian & Maquoketa	40N	7E	33	4e	16	268749		856.1	260	773	ST	
BR - Silurian & Maquoketa	40N	7E	35	5a	39	214096		783.4	160	759	ST	
BR - Silurian	40N	8E	1	1c	76	68814		772.7	115	721	ST	
BR - Silurian	40N	8E	1	3c	218	308364		756.3	120	725	ST	
BR - Maquoketa	40N	8E	2	2a	204	68838		756.3	200	684	ST	
BR - Maquoketa & Galena	40N	8E	2	3c	219	70595		701.0	365	684	ST	
BR - Maquoketa	40N	8E	2	3f	498		4559	713.9	260	679	ST	
BR - Silurian & Maquoketa	40N	8E	2	6h	212	68832		764.9	130	686	ST	
BR - Maquoketa & Galena-Platteville	40N	8E	3	6a	80	68877		729.8	260	675	ST	
BR - Silurian & Maquoketa	40N	8E	6	7h	75	68970		823.9	190	778	ST	
BR - Silurian & Maquoketa	40N	8E	7	2g	228	303340		794.3	100	767	ST	
BR - Silurian & Maquoketa	40N	8E	7	5d	200	69039		800.0	90	767	ST	
BR - Silurian & Maquoketa	40N	8E	7	8c	201	69065		775.0	145	761	ST	
BR - Silurian & Maquoketa	40N	8E	9	1e	203	283055		765.0	160	729	ST	
BR - Silurian & Maquoketa	40N	8E	9	4d	202	72228		808.6	145	734	ST	
BR - Maquoketa	40N	8E	10	5f	169	329336		747.0	180	681	ST	
BR - Silurian & Maquoketa	40N	8E	12	1b	171	72537		771.1	160	718	ST	
BR - Maquoketa	40N	8E	15	8b	175	69358		734.0	210	684	ST	
BR - Silurian & Maquoketa	40N	8E	17	3c	174	238357		801.0	210	677	ST	1
BR - Maquoketa	40N	8E	17	5a	179	250481		785.4	240	715	ST	
BR - Maquoketa	40N	8E	18	2e	182	308908		776.8	260	739	ST	
BR - Silurian	40N	8E	20	5d	183	69561		759.9	120	719	ST	

Table B1. Continued

Well open to	Twp	Rge	Sec	Plot	ISWS Project No.	ISWS P No.	ISWS PICS No.	Measuring Point Elevation (ft)	Well Depth (ft)	Head Elevation (ft)	Method	Note
BR - Maquoketa	40N	8E	21	6f	177	305377		740.3	240	659	ST	1
BR - Maquoketa & Galena	40N	8E	22	3d	830	341841	1968	772.3	385	735	AL	1
BR - Silurian & Maquoketa	40N	8E	23	5h	180	72380		763.1	175	673	ST	
BR - Silurian	40N	8E	24	1f	176	69654		800.9	175	706	ST	
BR - Maquoketa	40N	8E	28	4f	168	69672		744.1	230	690	ST	
BR - Silurian & Maquoketa	40N	8E	29	2e	167	228586		781.5	170	697	ST	
BR - Silurian & Maquoketa	40N	8E	29	2e	197	69690		792.1	180	696	ST	2
BR - Silurian & Maquoketa	40N	8E	29	2f	178	69694		793.3	190	696	ST	
BR - Maquoketa	40N	8E	29	5b	172	69697		777.3			ST	2
BR - Silurian	40N	8E	30	3c	831	69783		772.4	140	716	ST	
BR - Silurian	40N	8E	30	4e	173	69808		845.9	190	753	ST	
BR - Silurian	40N	8E	36	1c	181	69844		760.2	175	673	ST	
BR - Silurian	40N	9E	4	3b	529	172504		806.3	200	755	ST	
BR - Silurian & Maquoketa	40N	9E	3	5b	390		5403	822.6	392	775	AL	
BR - Silurian	40N	9E	4	2h	530	172509		829.8	220	760	ST	
BR - Maquoketa	40N	9E	7	8a	712	172520		761.8	220	712	ST	
BR - Silurian	40N	9E	12	3b	711	172539		811.1	200	743	ST	
BR - Silurian & Maquoketa	40N	9E	14	5c	533	172551		773.4	166	727	ST	
BR - Silurian	40N	9	14	8a	560	172554		742.8	137	730	ST	
BR - Silurian	40N	9E	15	5g	535	172565		809.0	160	758	ST	
BR - Silurian	40N	9	15	7a	534	172624		767.6	135	703	ST	1
BR - Silurian	40N	9E	16	5b	536	172626		797.7	138	757	ST	
BR - Silurian	40N	9E	17	3c	537	260682		779.4	175	744	ST	
BR - Silurian	40N	9E	18	3d	531	299799		749.1	140	726	ST	
BR - Silurian & Maquoketa	40N	9E	18	7e	538	288322		750.9	200	718	ST	
BR - Silurian & Maquoketa	40N	9E	19	4a	823		5363	759.0	350	675		
BR - Silurian	40N	9E	19	7g	532	187310		770.2	120	697	ST	
BR - Silurian	40N	9E	20	2d	539	187319		770.1	140	727	ST	
BR - Silurian	40N	9E	20	7g	540	187341		762.5	145	739	ST	
BR - Silurian	40N	9E	21	7f	541	288321		792.0	180	738	ST	
BR - Silurian	40N	9E	22	3f	542	220218		767.3	160	733	ST	
BR - Silurian	40N	9E	22	8d	557	220237		768.5	175	737	ST	

Table B1. Continued

Well open to	Twp	Rge	Sec	Plot	ISWS Project No.	ISWS P No.	ISWS PICS No.	Measuring Point Elevation (ft)	Well Depth (ft)	Head Elevation (ft)	Method	Note
BR - Silurian	40N	9E	23	2b	543	220722		761.8	140	730	ST	
BR - Silurian & Maquoketa	40N	9E	25	5b	544	221902		799.1	220	728	ST	
BR - Silurian	40N	9E	26	1a	546	221989		753.3	180	718	ST	
BR - Silurian	40N	9E	26	6e	545	222017		761.5	150	725	ST	
BR - Silurian	40N	9E	27	3f	547	284566		770.5	160	712	ST	
BR - Silurian & Maquoketa	40N	9E	27	7e	432	269450	4719	781.2	350	699	AL	
BR - Silurian	40N	9E	27	8c	549	314228		793.5	180	709	ST	
BR - Silurian	40N	9E	28	2f	430	269486	4718	797.7	194	770	AL	2
BR - Silurian & Maquoketa	40N	9E	28	2f	431	233911		797.5	329		ST	2
BR - Silurian & Maquoketa	40N	9E	28	6f	550	269511		768.7	178	716	ST	
BR - Silurian & Maquoketa	40N	9E	29	1a	551	269531		761.7	175	683	ST	
BR - Silurian & Maquoketa	40N	9E	30	1	552	251882		755.5	180	699	ST	
BR - Silurian & Maquoketa	40N	9E	33	5a	824		5469	772.0	350	660		
BR - Silurian	40N	9	34	5e	553	269608		763.8	140	716	ST	
BR - Silurian	40N	9E	35	3e	554	251883		743.7	160	718	ST	
BR - Silurian	40N	9E	35	6a	555	269643		744.0	155	705	ST	
BR - Silurian	40N	9E	36	1b	556	269688		743.5	120	715	ST	
BR - Silurian & Maquoketa	40N	9E	36	3d	297	243409		748.3	200	716	ST	
BR - Maquoketa	41N	5E	2	5g	794	42879		883.0	177	852	ST	
BR - Maquoketa	41N	5E	4	5d	625	235153		913.9	220	851	ST	
BR - Silurian & Maquoketa	41N	5E	5	1g	799	235144		862.4	140	816	ST	
BR - Silurian & Maquoketa & Galena	41N	5E	6	2h	795	195940		832.9	180	792	ST	
BR - Maquoketa & Galena	41N	5E	7	3f	624	306344		842.0	385	648	ST	1
BR - Maquoketa & Galena-Platteville	41N	5E	7	4a	797	42948		840.2	165	801	ST	
BR - Silurian & Maquoketa & Galena-Platteville	41N	5E	8	2f	623	230525		865.5	199	846	ST	
BR - Maquoketa	41N	5E	10	7b	801	42975		919.6	205	852	ST	
BR - Maquoketa	41N	5E	12	2a	935	42984		885.6	195	854	ST	
BR - Maquoketa	41N	5E	12	8c	929	308082		891.4	180	849	ST	
BR - Maquoketa	41N	5E	13	4c	934	42985		892.1	181	854	ST	
BR - Maquoketa	41N	5E	14	4e	936	290476		911.2	155	853	ST	
BR - Silurian & Maquoketa	41N	5E	15	2e	937	343466		933.7	205	852	ST	

Table B1. Continued

Well open to	Twp	Rge	Sec	Plot	ISWS Project No.	ISWS P No.	ISWS PICS No.	Measuring Point Elevation (ft)	Well Depth (ft)	Head Elevation (ft)	Method	Note
BR - Silurian & Maquoketa & Galena	41N	5E	15	8a	938	266041		878.3	300	842	ST	
BR - Maquoketa	41N	5E	18	4c	798	223870		862.1	120	815	ST	
BR - Maquoketa & Galena	41N	5E	21	8f	928	333966		851.8	220	801	ST	
BR - Maquoketa	41N	5E	25	5f	926	206233		902.9	200	850	ST	
BR - Maquoketa	41N	5E	26	1c	925	308429		914.0	220	835	ST	
BR - Maquoketa & Galena	41N	5E	27	3a	796	43049		893.5	355	827	ST	
BR - Maquoketa	41N	5E	28	1b	933	333946		872.5	200	817	ST	
BR - Maquoketa	41N	5E	28	4b	994	247370		870.5	185	823	ST	
BR - Maquoketa	41N	5E	28	6f	939	329705		849.0	160	827	ST	
BR - Maquoketa & Galena	41N	5E	30	5g	800	301129		833.4	190	813	ST	
BR - Maquoketa & Galena	41N	5E	31	3g	793	43136		836.4	205	817	ST	
BR - Galena-Platteville	41N	5E	33	2c	927	43138		834.2	225	819	ST	
BR - Maquoketa & Galena	41N	5E	36	3a	932	43147		911.2	285	840	ST	
BR - Silurian	41N	6E	2	1d	336	311520		936.5	128	899	ST	
BR - Maquoketa	41N	6E	3	7d	338	214871		909.7	245	878	ST	
BR - Silurian & Maquoketa	41N	6E	4	4h	332	69878		919.9	190	876	ST	
BR - Maquoketa	41N	6E	5	4a	330	214873		914.4	205	854	ST	
BR - Maquoketa	41N	6E	5	8f	329	69890		908.9	225	847	ST	
BR - Maquoketa	41N	6E	7	6e	931	69894		902.9	246	853	ST	
BR - Silurian & Maquoketa	41N	6E	8	3a	756	238222		903.0	205	873	ST	
BR - Maquoketa	41N	6E	8	6d	940	238221		895.1	185	855	ST	
BR - Maquoketa	41N	6E	9	4a	337	69900		947.7	320	858	ST	1
BR - Maquoketa	41N	6E	9	4e	768	321813		946.4	240	885	ST	
BR - Maquoketa & Galena	41N	6E	10	7f	334	305621		918.4	320	849	ST	1
BR - Maquoketa	41N	6E	12	2e	757	69908		980.1	320	895	ST	
BR - Silurian & Maquoketa	41N	6E	12	8f	328	69912		951.4	220	895	ST	
BR - Maquoketa	41N	6E	15	3b	339	238364		916.5	240	855	ST	
BR - Silurian	41N	6E	15	3c	911	69931		927.1	155	895	ST	
BR - Maquoketa	41N	6E	16	2c	613	309020		954.9	225	891	ST	
BR - Silurian & Maquoketa	41N	6E	16	2f	612	69933		962.9	245	896	ST	
BR - Silurian	41N	6E	16	7b	924	69940		926.9	110	885	ST	
BR - Maquoketa	41N	6E	19	3b	758	286088		895.9	205	858	ST	

Table B1. Continued

Well open to	Twp	Rge	Sec	Plot	ISWS Project No.	ISWS P No.	ISWS PICS No.	Measuring Point Elevation (ft)	Well Depth (ft)	Head Elevation (ft)	Method	Note
BR - Maquoketa	41N	6E	19	2e	770	214879		894.9	150	859	ST	
BR - Maquoketa	41N	6E	20	3a	759	331588		915.3	225	861	ST	
BR - Maquoketa	41N	6E	21	1d	762	228435		905.9	225	854	ST	
BR - Maquoketa	41N	6E	21	1g	761	69950		916.8	280	855	ST	
BR - Maquoketa	41N	6E	24	2c	54	69957		974.9	260	857	ST	
BR - Maquoketa	41N	6E	24	2f	760	301364		1000.0	300	864	ST	
BR - Maquoketa	41N	6E	25	6b	764	308376		931.6	380	857	ST	
BR - Silurian & Maquoketa	41N	6E	26	2d	767	69968		916.2	180	871	ST	
BR - Silurian	41N	6E	26	4h	763	293429		907.4	160	884	ST	
BR - Maquoketa	41N	6E	27	3d	921	69980		890.4	235	847	ST	2
BR - Maquoketa	41N	6E	27	3e	922	69981		891.8	225	855	ST	
BR - Maquoketa & Galena	41N	6E	28	7a	766	339665		878.9	300	847	ST	1
BR - Maquoketa	41N	6E	29	2c	920	228871		891.7	220	854	ST	
BR - Maquoketa	41N	6E	31	2a	610	310293		892.8	260	843	ST	
BR - Maquoketa	41N	6E	31	4d	614	69988		900.5	225	844	ST	
BR - Maquoketa	41N	6E	32	2f	919	69990		891.4	205	856	ST	
BR - Maquoketa	41N	6E	36	8a	769	296681		924.9	305	840	ST	
BR - Maquoketa	41N	7E	1	1e	45	230691		947.3	360		ST	2
BR - Silurian	41N	7E	1	1d	42	70017		931.0	215	787	ST	
BR - Maquoketa	41N	7E	3	7d	46	285740		925.0	320	737	ST	1
BR - Silurian & Maquoketa	41N	7E	6	4b	47	293569		997.4	260	896	ST	
BR - Silurian	41N	7E	8	4h	1055	282843		949.0	195	912	ST	
BR - Maquoketa	41N	7E	9	7g	1054	301862		945.2	340	750	ST	1
BR - Silurian & Maquoketa	41N	7E	11	5h	1057	254371		910.2	280	817	ST	
BR - Maquoketa	41N	7E	14	1a	50	228459		890.4	265	801	ST	
BR - Silurian	41N	7E	14	6b	611	337472		897.1	170	840	ST	
BR - Silurian & Maquoketa	41N	7E	15	4c	49	215255		934.1	245	852	ST	
BR - Silurian & Maquoketa	41N	7E	18	5a	1238	215257		1061.4	325	972	ST	1
BR - Maquoketa	41N	7E	18	6h	714	174108		1004.1	340	797	ST	1
BR - Silurian & Maquoketa	41N	7E	20	6b	48	215258		988.6	340	798	ST	1
BR - Silurian	41N	7E	21	1a	1059	338654		925.2	220	860	ST	
BR - Silurian	41N	7E	22	3e	1060	70302		929.7	184	848	ST	

Table B1. Continued

Well open to	Twp	Rge	Sec	Plot	ISWS Project No.	ISWS P No.	ISWS PICS No.	Measuring Point Elevation (ft)	Well Depth (ft)	Head Elevation (ft)	Method	Note
BR - Silurian	41N	7E	22	6h	1058	319566		925.0	172	860	ST	
BR - Maquoketa	41N	7E	25	6f	713	301857		875.6	300	794	ST	
BR - Maquoketa	41N	7E	27	2a	55	70473		897.2	260	810	ST	
BR - Silurian	41N	7E	28	8g	1112	312795		938.2	210	826	ST	
BR - Maquoketa	41N	7E	34	1h	1111	70548		890.2	240	810	ST	
BR - Maquoketa	41N	8E	6	5e	213	70606		932.5	420	782	ST	2
BR - Maquoketa	41N	8E	8	3d	360	290883		876.8	340	729	ST	
BR - Maquoketa	41N	8E	8	6a	571	216081		853.0	260	771	ST	
BR - Maquoketa	41N	8E	16	5c	366	254417		819.9	225	771	ST	
BR - Maquoketa	41N	8E	20	7d	363	305165		842.8	240	788	ST	
BR - Maquoketa	41N	8E	28	8d	488	216111		801.4	220	778	ST	
BR - Maquoketa	41N	8E	30	4g	341	351520		835.2	240	790	ST	
BR - Silurian & Maquoketa	41N	8E	31	4f	494	250701		802.4	260	727	ST	1
BR - Silurian & Maquoketa	41N	8E	31	5a	490	329077		814.0	260	760	ST	
BR - Silurian & Maquoketa	41N	8E	32	1g	502	324514		803.0	140	766	ST	
BR - Silurian & Maquoketa	41N	8E	32	6f	501	319533		781.6	120	771	ST	
BR - Maquoketa	41N	8E	36	6g	496	321686		759.0	200	675	ST	1
BR - Maquoketa & Galena	41N	8E	36	4d	572		11051	740.6	392		ST	2
BR - Silurian	41N	9E	7	7a	671	34198			150		ST	2
BR - Silurian	41N	9E	10	4c	677	34208		797.7	180	758	ST	
BR - Silurian	41N	9E	17	4g	590	302713		810.9	180	749	ST	
BR - Silurian & Maquoketa	41N	9E	17	5d	589	267988		803.7	200	732	ST	
BR - Silurian & Maquoketa	41N	9E	20	1a	676	302960		805.5	220	752	ST	
BR - Silurian	41N	9E	20	3f	588	34284		795.2	178	757	ST	
BR - Silurian	41N	9E	21	2a	673	34290		821.3	205	763	ST	
BR - Silurian	41N	9E	21	8b	674	308022		834.1	220	755	ST	
BR - Silurian & Maquoketa	41N	9E	21	6d	669	34302		831.4	220	762	ST	
BR - Silurian	41N	9E	22	2h	587	34309		831.9	237		ST	2
BR - Silurian	41N	9E	27	5c	670	331121		846.8	260	766	ST	
BR - Silurian	41N	9E	28	5f	586	34324		838.2	200	768	ST	
BR - Silurian & Maquoketa	41N	9E	29	5a	584	340526		773.9	260	725	ST	
BR - Silurian	41N	9E	32	1e	585	292780		779.4	180	756	ST	

Table B1. Continued

Well open to	Twp	Rge	Sec	Plot	ISWS Project No.	ISWS P No.	ISWS PICS No.	Measuring Point Elevation (ft)	Well Depth (ft)	Head Elevation (ft)	Method	Note
BR - Silurian	41N	9E	33	4b	582	34354		839.3	240	762	ST	
BR - Silurian	41N	9E	34	1b	389		10671	805.6	199	752	AL	
BR - Silurian	41N	9E	36	5d	583	189883		821.9	210	756	ST	
BR - Maquoketa	42N	5E	2	5c	521	191006		836.2	80	822	ST	
BR - Maquoketa	42N	5E	3	8e	526	42408		851.5	191	837	ST	
BR - Maquoketa	42N	5E	7	5a	518	333960		854.0	58	844	ST	
BR - Silurian & Maquoketa	42N	5E	8	4e	519	333948		862.4	160	842	ST	
BR - Maquoketa	42N	5E	9	4h	524	285038		855.9	180	845	ST	
BR - Silurian	42N	5E	10	5a	522	42417		841.0	50	825	ST	
BR - Maquoketa	42N	5E	12	2h	523	42419		836.4	110	825	ST	
BR - Maquoketa	42N	5E	12	6c	618	42420		829.4	145	817	ST	
BR - Maquoketa & Galena-Platteville	42N	5E	14	8b	525	224117		830.4	220	819	ST	
BR - Silurian	42N	5E	16	1d	527	42422		836.0	50	821	ST	
BR - Maquoketa	42N	5E	18	5b	620	234990		824.1	105	791	ST	
BR - Maquoketa	42N	5E	22	2a	528	306596		862.2	200	823	ST	
BR - Silurian & Maquoketa	42N	5E	24	6b	619	230514		844.9	140	836	ST	
BR - Maquoketa	42N	5E	28	3a	622	247283		870.3	185	844	ST	
BR - Maquoketa	42N	5E	30	3a	616	42463		849.6	155	795	ST	
BR - Silurian & Maquoketa & Galena-Platteville	42N	5E	32	6a	617	343448		873.5	220		ST	2
BR - Maquoketa	42N	5E	35	6c	621	42478		874.4	165	848	ST	
BR - Maquoketa	42N	6E	4	1a	509	71116		920.6	270	859	ST	
BR - Maquoketa	42N	6E	7	8g	508	71144		836.6	160	825	ST	
BR - Maquoketa	42N	6E	15	2d	327	283051		906.8	175	864	ST	
BR - Maquoketa	42N	6E	15	7b	326	71197		891.3	235	862	ST	
BR - Maquoketa	42N	6E	16	3d	510	267036		876.4	155	857	ST	
BR - Maquoketa	42N	6E	21	6f	626	71217		872.9	141	859	ST	
BR - Maquoketa	42N	6E	22	2d	627	71219		908.6	242	859	ST	
BR - Maquoketa	42N	6E	23	8g	349	71222		926.7	295	858	ST	
BR - Maquoketa	42N	6E	29	8d	351	228762		879.0	235	857	ST	
BR - Maquoketa	42N	6E	31	5g	505	312211		884.3	300	850	ST	
BR - Maquoketa	42N	6E	32	4a	331	69882		918.4	250	866	ST	

Table B1. Continued

Well open to	Twp	Rge	Sec	Plot	ISWS Project No.	ISWS P No.	ISWS PICS No.	Measuring Point Elevation (ft)	Well Depth (ft)	Head Elevation (ft)	Method	Note
BR - Maquoketa	42N	6E	33	6g	348	282826		905.6	240	862	ST	
BR - Maquoketa	42N	6E	35	1d	628	71271		991.9	377	849	ST	
BR - Silurian & Maquoketa	42N	7E	2	5h	513	217238		899.6	240	837	ST	
BR - Maquoketa	42N	7E	9	2f	244	331641		930.9	260	845	ST	
BR - Maquoketa	42N	7E	10	5a	273	296033		930.3	258	814	ST	
BR - Maquoketa	42N	7E	12	8c	807	297119		899.1	300	814	ST	
BR - Maquoketa	42N	7E	13	1c	272	217246		911.2	240	825	ST	
BR - Maquoketa & Galena-Platteville	42N	7E	13	1f	809	71312		916.7	450	761	ST	1
BR - Maquoketa	42N	7E	21	3g	812	71354		919.8	265	831	ST	
BR - Maquoketa	42N	7E	21	5h	813	71355		906.3	335		ST	2
BR - Maquoketa	42N	7E	23	1h	274	217294		903.8	280	777	ST	1
BR - Maquoketa	42N	7E	23	3c	340			898.9	270	820	ST	2
BR - Silurian & Maquoketa	42N	7E	24	5c	804	229159		893.8	200	810	ST	
BR - Silurian & Maquoketa	42N	7E	24	8f	806	230988		905.2	225		ST	2
BR - Maquoketa	42N	7E	26	4b	270	71432		903.3	295	706	ST	1
BR - Maquoketa	42N	7E	27	4a	271	320034		914.3	300	782	ST	
BR - Maquoketa	42N	7E	28	6d	517	322794		915.3	260	800	ST	
BR - Maquoketa	42N	7E	30	4b	808	71466		951.4	285		ST	2
BR - Maquoketa & Galena-Platteville	42N	7E	31	1h	805	261106		927.8	420	825	ST	
BR - Silurian & Maquoketa & Galena-Platteville	42N	7E	36	2b	214	70605		885.8	410	731	ST	1
BR - Maquoketa	42N	8E	1	2f	1108	217168		813.8	246	745	ST	
BR - Maquoketa	42N	8E	4	2d	661	319518		863.6	260	721	ST	
BR - Maquoketa	42N	8E	8	2f	1244	71648		934.2	278	865	ST	
BR - Maquoketa	42N	8E	9	6h	280	71666		901.8	232	837	ST	1
BR - Silurian & Maquoketa	42N	8E	15	1h	215	241458		727.9	100	723	ST	
BR - Maquoketa	42N	8E	16	8b	277	276243		909.0	300	780	ST	
BR - Silurian	42N	8E	19	2f	276	287605		924.1	200	841	ST	
BR - Silurian	42N	8E	21	5a	717	289692		747.4	42	740	ST	
BR - Silurian & Maquoketa	42N	8E	23	5e	278	231535		787.4	160	740	ST	
BR - Silurian & Maquoketa	42N	8E	24	7d	664	306016		858.0	250	769	ST	
BR - Silurian & Maquoketa	42N	8E	28	4f	279	72391		804.9	205	738	ST	

Table B1. Continued

Well open to	Twp	Rge	Sec	Plot	ISWS Project No.	ISWS P No.	ISWS PICS No.	Measuring Point Elevation (ft)	Well Depth (ft)	Head Elevation (ft)	Method	Note
BR - Silurian	42N	8E	29	6a	718	71777		891.9	220	726	ST	1
BR - Silurian & Maquoketa	42N	8E	32	3h	635	71818		865.6	200	744	ST	
BR - Maquoketa	42N	8E	34	8f	667	71833		776.9	240	658	ST	1
BR - Maquoketa	42N	8E	36	7g	668	230385		833.2	338	654	ST	1
BR - Silurian	42N	9E	1	7h	577		10786	827.8	210	719	ST	
BR - Silurian & Maquoketa	42N	9E	1	7h	578		10787	828.7	305	720	ST	
BR - Silurian	42N	9E	4	2b	706	303972		831.1	200	757	ST	
BR - Silurian	42N	9E	6	3h	467	35150		804.7	165	768	ST	
BR - Silurian	42N	9E	6	7f	469	35156		791.2	153	764	ST	
BR - Silurian	42N	9E	12	5h	451	35203		862.0	260	726	ST	
BR - Silurian & Maquoketa	42N	9E	16	1b	355	35042		893.5	280	772	ST	
BR - Maquoketa	42N	9E	18	7e	683	190274		886.0	402	760	ST	
BR - Maquoketa	42N	9E	21	6e	454	245280		837.7	215	776	ST	
BR - Silurian & Maquoketa	42N	9E	23	6a	847	290561		871.4	280	729	ST	
BR - Silurian & Maquoketa	42N	9E	34	1h	453	35441		842.8	255	741	ST	
BR - Silurian	42N	9E	36	3h	1031	326797		850.3	235	739	ST	
BR - Maquoketa	43N	10E	6	8f	359	262652		852.0	272	745	ST	
BR - Maquoketa & Galena	43N	5E	1	6a	2025	99061		959.3	399		ST	2
BR - Maquoketa	43N	5E	2	2b	855	285528		921.2	290	787	ST	
BR - Galena-Platteville	43N	5E	3	7d	719	188663		803.1	210	770	ST	
BR - Galena-Platteville	43N	5E	7	5d	853	99015		793.0	140	765	ST	
BR - Galena-Platteville	43N	5E	8	4d	2029	99018		795.1	225	778	ST	
BR - Maquoketa	43N	5E	11	5a	723	99036		846.6	125	797	ST	
BR - Maquoketa & Galena-Platteville	43N	5E	11	6e	2008	188739		862.4	280	791	ST	2
BR - Maquoketa	43N	5E	12	1c	738	320291		986.4	350	831	ST	
BR - Maquoketa	43N	5E	13	2d	731	99068		864.9	151	847	ST	
BR - Silurian	43N	5E	14	5e	732	217249		834.9	90	818	ST	
BR - Maquoketa	43N	5E	15	4a	2028	188753		808.0	80	796		
BR - Maquoketa	43N	5E	16	5b	739	290022		802.2	100	786	ST	
BR - Maquoketa	43N	5E	18	7d	740	341905		797.6	97	792	ST	
BR - Maquoketa	43N	5E	20	1h	741	299777		807.0	100	789	ST	
BR - Galena-Platteville	43N	5E	22	2f	734	99120		810.8	405	687	ST	1

Table B1. Continued

Well open to	Twp	Rge	Sec	Plot	ISWS Project No.	ISWS P No.	ISWS PICS No.	Measuring Point Elevation (ft)	Well Depth (ft)	Head Elevation (ft)	Method	Note
BR - Silurian & Maquoketa	43N	5E	22	4a	854	292891		813.5	80	801	ST	
BR - Silurian	43N	5E	23	4d	2013	99125		832.9	80	817	ST	
BR - Maquoketa	43N	5E	25	2f	724	99140		845.4	113	833	ST	
BR - Maquoketa	43N	5E	26	6f	2012	100971		820.4	105	810	ST	
BR - Maquoketa	43N	5E	35	4b	736	296767		820.2	60	812	ST	
BR - Maquoketa	43N	5E	36	3b	730	100984		827.3	126	819	ST	
BR - Maquoketa	43N	6E	2	8h	742	189463		841.1	160	832	ST	
BR - Maquoketa	43N	6E	3	1a	2011	100991		840.9	195	829	ST	
BR - Maquoketa	43N	6E	4	2e	2009	227704		836.8	180	760	ST	1
BR - Maquoketa	43N	6E	5	4f	726	241823		829.9	160	814	ST	
BR - Maquoketa	43N	6E	7	5b	744	28645		931.8	340	855	ST	
BR - Maquoketa	43N	6E	8	5e	2003	101028		902.0	220	852		
BR - Maquoketa	43N	6E	9	3d	2000	101039		875.0	200	820	ST	
BR - Silurian & Maquoketa	43N	6E	10	2b	852	101047		865.7	190	819	ST	
BR - Silurian & Maquoketa	43N	6E	10	6h	849	338880		846.2	140	837	ST	
BR - Silurian & Maquoketa	43N	6E	12	6d	2061	101057		851.6	175	839	ST	
BR - Silurian & Maquoketa	43N	6E	14	7d	743	322523		873.0	180	854	ST	
BR - Galena-Platteville	43N	6E	16	5d	2004	101063		890.1	446	830	ST	2
BR - Maquoketa & Galena-Platteville	43N	6E	16	8f	2005	189495		885.9	440	735	ST	1
BR - Maquoketa	43N	6E	20	8f	2015	101093		969.7	257	858	ST	
BR - Maquoketa	43N	6E	23	5f	2001	101143		895.0	220		ST	2
BR - Maquoketa	43N	6E	24	8e	1034	102988		901.8	230	846	ST	
BR - Maquoketa	43N	6E	26	8d	2007	102998		928.4	301	879	ST	
BR - Maquoketa	43N	6E	28	2b	856	325011		952.9	280	863	ST	
BR - Maquoketa	43N	6E	30	2d	728	103058		892.9	210	853	ST	
BR - Maquoketa	43N	6E	31	6h	1237	189552		851.0	200	843	ST	
BR - Maquoketa & Galena-Platteville	43N	6E	32	4h	857	103069		894.3	285	850	ST	
BR - Maquoketa	43N	6E	33	3e	2002	103074		924.6	320	863	ST	
BR - Maquoketa	43N	6E	35	7f	1038	189550		902.6	220	870	ST	
BR - Maquoketa	43N	6E	35	8g	858	189569		909.7	280	877	ST	
BR - Silurian	43N	6E	36	5c	2060	103106		910.1	211	869	ST	
BR - Silurian	43N	7E	1	2b	863	325673		893.7	208	879	ST	1

Table B1. Continued

Well open to	Twp	Rge	Sec	Plot	ISWS Project No.	ISWS P No.	ISWS PICS No.	Measuring Point Elevation (ft)	Well Depth (ft)	Head Elevation (ft)	Method	Note
BR - Silurian	43N	7E	3	2g	1061	106188		925.4	222	849	ST	
BR - Maquoketa	43N	7E	4	5d	2049	189893		911.6	246	820	ST	1
BR - Maquoketa	43N	7E	5	4g	862	106241		907.7	238	842	ST	
BR - Silurian	43N	7E	7	8f	2057	217210		852.8	150	841	ST	
BR - Silurian & Maquoketa	43N	7E	8	6e	1039	106253		861.2	240	838	ST	
BR - Silurian	43N	7E	12	5g	1062	106268		905.0	240	827	ST	
BR - Maquoketa	43N	7E	13	5g	2045	106293		888.8	310	760	ST	1
BR - Maquoketa	43N	7E	15	3h	861	307643		880.8	230	833	ST	
BR - Maquoketa	43N	7E	16	6d	859	213933		861.7	182	852	ST	
BR - Maquoketa	43N	7E	19	1h	2031	106307		903.6	59	850	ST	
BR - Silurian	43N	7E	20	3g	860	106313		890.5	195	855	ST	
BR - Silurian & Maquoketa	43N	7E	23	1e	2053	217282		883.4	300	766	ST	1
BR - Silurian	43N	7E	23	3b	2006	106318		897.2	184	848	ST	
BR - Maquoketa	43N	7E	28	1h	2039	106327		885.7	280	844	ST	
BR - Maquoketa	43N	7E	30	1c	1063	290049		871.8	218	868	ST	
BR - Maquoketa	43N	7E	33	4e	1037	21399		894.2	215	860	ST	
BR - Silurian	43N	8E	1	3f	971	106387		829.9	192	801	ST	
BR - Silurian	43N	8E	3	1g	974	297735		888.9	260	819	ST	
BR - Silurian & Maquoketa	43N	8E	3	3e	972	106415		902.3	395	818		
BR - Silurian	43N	8E	8	1c	2063		7396	900.4	250	750	AL	
BR - Silurian	43N	8E	8	2c	2021		7395	898.4	250	746	ST	
BR - Silurian	43N	8E	11	6h	1044	106645		855.1	239	815	ST	
BR - Silurian	43N	8E	12	1a	1036	264524		832.2	190	772	ST	
BR - Silurian	43N	8E	12	2f	1042	291457		845.5	220	749	ST	
BR - Silurian	43N	8E	14	2b	2064	216313		891.4	260	767	ST	
BR - Silurian	43N	8E	15	5b	973	290395		899.7	221	786	ST	
BR - Silurian	43N	8E	16	3c	975	312600		860.4	192	801	ST	
BR - Silurian	43N	8E	16	8h	2032	106603		884.9	260	760	ST	
BR - Silurian	43N	8E	17	1f	1043	327965		885.9	212	760	ST	
BR - Silurian	43N	8E	21	4e	2016	216327		843.1	218	804	ST	
BR - Silurian	43N	8E	23	2c	2019	106758		739.8	85	729	ST	
BR - Silurian & Maquoketa	43N	8E	24	7d	1048	106793		738.2	120	734	ST	

Table B1. Continued

Well open to	Twp	Rge	Sec	Plot	ISWS Project No.	ISWS P No.	ISWS PICS No.	Measuring Point Elevation (ft)	Well Depth (ft)	Head Elevation (ft)	Method	Note
BR - Silurian	43N	8E	27	1b	1047	307654		771.8	160	713	ST	
BR - Silurian	43N	8E	27	1e	2069		3078		165			2
BR - Silurian	43N	8E	28	5f	2014		7361	786.2	105	795		
BR - Silurian	43N	8E	30	1e	1041	382183		887.7	210	799	ST	
BR - Maquoketa	43N	8E	33	7b	2020	99182		876.5	200	747		
BR - Silurian & Maquoketa	43N	8E	35	3a	2024	214309		865.1	245	755	ST	
BR - Silurian	43N	8E	36	3a	464	292890		870.3	220	764	ST	
BR - Silurian	43N	9E	2	1a	597		6711	787.5	275			2
BR - Silurian	43N	9E	2	2f	592	291857		750.2	180	725	ST	
BR - Silurian	43N	9E	2	5c	598		6707	792.5	186	726	ST	
BR - Silurian	43N	9E	3	1e	599		5173	759.7	280	727	ST	
BR - Silurian	43N	9E	5	7d	1050	99295		800.8	184	738	ST	
BR - Silurian	43N	9E	6	2b	1045	298622		846.3	250	779	ST	
BR - Silurian	43N	9E	8	2h	1052	99347		773.6	160	730	ST	
BR - Silurian	43N	9E	10	4f	465		6714	772.1	170		ST	2
BR - Silurian & Maquoketa	43N	9E	11	7e	573	272042		769.1	287	715	ST	
BR - Silurian	43N	9E	12	6g	574	304089		811.7	240	731	ST	
BR - Silurian	43N	9E	12	7h	493	272153		813.1	258	732	ST	
BR - Maquoketa	43N	9E	13	4a	358	335804		811.8	235	731	ST	
BR - Silurian	43N	9E	13	6c	575	286956		812.2	218	731	ST	
BR - Silurian	43N	9E	14	5c	843	293546		803.2	205	731	ST	
BR - Silurian	43N	9E	15	7h	821	318493		754.8	158	736	ST	
BR - Silurian & Maquoketa	43N	9E	16	1b	604	312155		801.0	200	737	ST	
BR - Silurian	43N	9E	16	5b	682	228921		792.9	170	739	ST	
BR - Silurian	43N	9E	17	7d	689		5091	741.1	140	734	ST	
BR - Silurian & Maquoketa	43N	9E	17	7d	690		101	740.0	175	736	ST	
BR - Silurian	43N	9E	18	3a	2043		7368	741.3	120	730	AL	
BR - Silurian & Maquoketa	43N	9E	18	3a	2044		7369	724.7	140	723	AL	
BR - Silurian	43N	9E	20	4c	468	252057		798.0	160	752	ST	
BR - Silurian	43N	9E	21	4g	356	284583		793.7	169	752	ST	
BR - Silurian	43N	9E	24	2c	607	306204		840.4	236	716	ST	
BR - Silurian	43N	9E	24	5b	581	270818		842.3	234	720	ST	

Table B1. Continued

Well open to	Twp	Rge	Sec	Plot	ISWS Project No.	ISWS P No.	ISWS PICS No.	Measuring Point Elevation (ft)	Well Depth (ft)	Head Elevation (ft)	Method	Note
BR - Silurian & Maquoketa	43N	9E	25	5d	595		6715	868.5	276	721	ST	
BR - Silurian	43N	9E	25	8d	492	273043		849.1	230	727	ST	
BR - Silurian	43N	9E	28	8f	1046	299567		825.9	184	763	ST	
BR - Silurian	43N	9E	31	8b	456	213926		882.2	220	766	ST	
BR - Silurian	43N	9E	31	8c	357	99648		870.5	240	763	ST	
BR - Maquoketa	43N	9E	36	8d	596		6718	826.0	325	723	ST	
BR - Maquoketa & Galena-Platteville	44N	5E	35	7a	720	99873		850.7	260	792	ST	
BR - Silurian	44N	8	33	4a	2042	219049		928.5	277	788	ST	
BR - Silurian	44N	8	35	6a	680	101596		881.5	226	827	ST	
Glasford sand (undiff.)	37N	6E	3	7a	1079	78014		678.2	100	656	ST	
Glasford sand (undiff.)	37N	6E	4	2h	246	77980		699.7	119	675	ST	
Glasford sand (undiff.)	37N	6E	5	6h	1122	238605		714.8	159	687	ST	
Glasford sand (undiff.)	37N	6E	6	3c	251	245379		716.9	200	688	ST	
Glasford sand (undiff.)	37N	6E	8	4b	1081	77994		666.6	98	636	ST	
Glasford sand (undiff.)	37N	6E	9	2e	1123	78006		668.6	143	646	ST	
Glasford sand (undiff.)	37N	6E	14	4a	1082	312724		651.0	84	604	ST	
Glasford sand (undiff.)	37N	6E	14	5e	1124	78038		658.4	80	615	ST	
Glasford sand (undiff.)	37N	6E	16	6g	1077	77998		669.2	68	643	ST	
Glasford sand (undiff.)	37N	6	18	2h	1121	78105		687.2	62	642	ST	
Glasford sand (undiff.)	37N	6	23	8c	1024		6653	611.2	41	589	ST	
Glasford sand (undiff.)	37N	6	23	8c	1026		6655	611.1	37	590	ST	
Glasford sand (undiff.)	37N	6E	23	8c	1025		6657	612.1	40	591	ST	
Glasford sand (undiff.)	37N	6E	24	1a	1119			636.1	152	558	ST	1
Glasford sand (undiff.)	37N	6E	24	4a	1135	305739		649.1	70	615	ST	
Glasford sand (undiff.)	37N	6	26	4c	1138	229627		635.7	56	596	ST	
Glasford sand (undiff.)	37N	6	29	7a	1125	306986		639.2	95	609	ST	
Glasford sand (undiff.)	37N	6E	35	6g	1137	292655		642.1	107	577	ST	
Glasford sand (undiff.)	38N	5	15	6d	989	301148		741.9	190	729	ST	
Glasford sand (undiff.)	38N	5E	16	1f	990	294098		748.1	150	728	ST	
Glasford sand (undiff.)	38N	5	31	2d	993	285025		735.2	84	720	ST	
Glasford sand (undiff.)	38N	6E	16	3d	346	228688		712.2	80	695	ST	
Glasford sand (undiff.)	38N	7E	5	2d	634	290980		710.9	135	701	ST	

Table B1. Continued

Well open to	Twp	Rge	Sec	Plot	ISWS Project No.	ISWS P No.	ISWS PICS No.	Measuring Point Elevation (ft)	Well Depth (ft)	Head Elevation (ft)	Method	Note
Glasford sand (undiff.)	38N	7E	6	1h	1008	250788		734.1	260	708	ST	
Glasford sand (undiff.)	38N	7	22	6d	225	250681		709.9	92	672	ST	
Glasford sand (undiff.)	38N	7E	24	6h	304		6350	676.0	118	657	AL	
Glasford sand (undiff.)	38N	7	25	5b	325	302194		667.4	34	658	ST	
Glasford sand (undiff.)	38N	7E	29	6e	226	228897		709.0	96	681	ST	
Glasford sand (undiff.)	38N	8	18	7b	306		9884	677.0	125	660	ST	
Glasford sand (undiff.)	38N	8E	18	8a	321	309766		679.0	129	665	ST	
Glasford sand (undiff.)	38N	8E	18	8b	322	309767		680.2	126		ST	2
Glasford sand (undiff.)	38N	8	18	8b	324	309768		681.0	130		ST	2
Glasford sand (undiff.)	38N	8	18	8b	323	309769		679.6	128	665	ST	
Glasford sand (undiff.)	38N	8	19	5e	307		9949	691.8	130	667	ST	
Glasford sand (undiff.)	38N	8E	20	6a	320			691.8	149	643	ST	
Glasford sand (undiff.)	38N	8E	26	2d	310		6393	710.5	180		AL	2
Glasford sand (undiff.)	38N	8E	33	4h	316	302175	6404	639.7	82	612	ST	
Glasford sand (undiff.)	38N	8E	33	5h	315	309360	6403	623.2	59	611	ST	
Glasford sand (undiff.)	38N	8E	34	7g	319			651.8	81	640	ST	
Glasford sand (undiff.)	39N	5E	9	3h	1075	41717		841.1	110	820	ST	
Glasford sand (undiff.)	39N	6E	3	3b	984	313002		845.9	139	828	ST	
Glasford sand (undiff.) & Silurian BR	39N	6E	3	5h	906	309854		857.7	120	832	ST	
Glasford sand (undiff.) & Silurian BR	39N	6E	20	3d	899	310294		791.4	100	782	ST	
Glasford sand (undiff.)	39N	6E	25	3f	841	174135	4537	788.1	155	747	ST	
Glasford sand (undiff.)	39N	6E	25	8a	136	279726		779.4	94	749	ST	
Glasford sand (undiff.)	39N	6E	30	7b	901			777.7	240	675	ST	1
Glasford sand (undiff.)	39N	7E	3	7a	73	213124		833.2	135	762	ST	
Glasford sand (undiff.)	39N	7E	8	2a	206	320027		813.1	135	761	ST	
Glasford sand (undiff.)	39N	7E	9	1a	94	319391		788.1	77	753	ST	
Glasford sand (undiff.)	39N	7E	17	2g	208	311518		779.9	165	745	ST	
Glasford sand (undiff.)	39N	7E	17	2h	72	292565		808.4	195	746	ST	
Glasford sand (undiff.)	39N	7E	19	4b	1239	308381		766.4	140		ST	2
Glasford sand (undiff.)	39N	7E	26	7f	1242	66930		736.6	104		ST	2
Glasford sand (undiff.)	39N	7E	31	7d	15	304373		767.0	106	719	ST	
Glasford sand (undiff.)	39N	7E	32	6d	1241	67019		738.8	110		ST	2

Table B1. Continued

Well open to	Twp	Rge	Sec	Plot	ISWS Project No.	ISWS P No.	ISWS PICS No.	Measuring Point Elevation (ft)	Well Depth (ft)	Head Elevation (ft)	Method	Note
Glasford sand (undiff.)	39N	7E	33	3h	21	319396		722.7	130	702	ST	
Glasford sand (undiff.)	39N	8E	5	7c	832		4894	771.5	179	704	ST	
Glasford sand (undiff.)	39N	8E	5	8a	833		6428	773.1	153	710	ST	
Glasford sand (undiff.)	39N	8E	6	2a	834		10006	734.1	153	670	AL	
Glasford sand (undiff.)	39N	8E	6	4a	158	213467		727.3	110	707	ST	
Glasford sand (undiff.)	39N	8E	18	5d	837		10181	706.7	118	689	ST	
Glasford sand (undiff.)	39N	8E	18	3f	154	310858		701.4	115	692	ST	
Glasford sand (undiff.)	39N	8E	18	5g	836		10180	727.0	157	705	ST	
Glasford sand (undiff.)	39N	8E	19	8h	835		10182	727.8	153	695	ST	
Glasford sand (undiff.) & Silurian BR	39N	8E	33	6c	144	67373		718.1	110	678	ST	
Glasford sand (undiff.) & Silurian BR	39N	9E	35	5e	291	172450		723.4	160	682	ST	
Glasford sand (undiff.)	40N	5E	13	1h	898	42519		867.1	154	841	ST	
Glasford sand (undiff.)	40N	5E	17	5b	871	329550		890.3	102	828	ST	
Glasford sand (undiff.)	40N	5E	24	2c	889	42565		861.7	185	830	ST	
Glasford sand (undiff.)	40N	5E	28	7c	905	42581		888.0	107	846	ST	
Glasford sand (undiff.)	40N	6E	14	1b	888	213548		869.8	160	843	ST	
Glasford sand (undiff.)	40N	7E	3	2a	186	67572		877.1	200	784	ST	
Glasford sand (undiff.)	40N	7E	10	4b	195	72050		868.3	210	797	ST	
Glasford sand (undiff.) & Maquoketa BR	40N	7E	11	5f	191	282964		891.6	250	805	ST	
Glasford sand (undiff.)	40N	7E	18	6e	227	68114		939.2	215	849	ST	
Glasford sand (undiff.)	40N	7E	24	2b	43	228707		800.1	165	767	ST	
Glasford sand (undiff.)	40N	7E	33	4b	36	68746		835.5	122	769	ST	
Glasford sand (undiff.)	40N	8E	2	3f	497	216133		713.7	107	678	ST	
Glasford sand (undiff.)	40N	8E	2	3h	229	267061		704.1	120	677	ST	
Glasford sand (undiff.)	40N	8E	11	8a	704	325427	66	777.9	157	682	ST	
Glasford sand (undiff.)	40N	8E	15	2a	707		6453	709.6	86	676	AL	
Glasford sand (undiff.)	40N	8E	15	1c	708		9889	708.3	130	685	AL	
Glasford sand (undiff.)	40N	8E	28	8a	709		6461	768.3	173	701	AL	
Glasford sand (undiff.)	40N	8E	32	3h	710		67	792.4	152	702	AL	
Glasford sand (undiff.)	41N	6E	10	5e	915	69903		916.0	167	887	ST	
Glasford sand (undiff.)	41N	6E	12	3h	912	69910		970.6	180	899	ST	

Table B1. Continued

Well open to	Twp	Rge	Sec	Plot	ISWS Project No.	ISWS P No.	ISWS PICS No.	Measuring Point Elevation (ft)	Well Depth (ft)	Head Elevation (ft)	Method	Note
Glasford sand (undiff.)	41N	6E	17	8a	923	327120		892.5	125	859	ST	
Glasford sand (undiff.)	41N	7E	32	1c	57	263926		964.3	190	801	ST	
Glasford sand (undiff.)	41N	7E	35	1g	58	215302		842.3		692	ST	1
Glasford sand (undiff.)	41N	8E	18	5h	715	254413		904.8	187	794	ST	
Glasford sand (undiff.) & Silurian BR	41N	8E	34	1g	495		1977	756.3	155	695	ST	
Glasford sand (undiff.)	41N	8E	35	3a	698		6503	734.4	111	668	AL	
Glasford sand (undiff.)	41N	8E	35	1c	699		68	753.9	162	669	ST	
Glasford sand (undiff.)	41N	9E	4	6a	675	34193		882.1	310	721	ST	
Glasford sand (undiff.)	42N	5E	1	8a	520	334581		823.2	49	811	ST	
Glasford sand (undiff.)	42N	5E	30	7g	802		5155	795.0	106	762	AL	
Glasford sand (undiff.)	42N	6E	10	1c	504	71148		943.7	237	864	ST	
Glasford sand (undiff.)	42N	6E	10	7h	515	216005		919.2	225	859	ST	
Glasford sand (undiff.)	42N	6E	27	8b	352	216036		919.1	212	862	ST	
Glasford sand (undiff.)	42N	6E	30	3d	350	71243		878.9	136	848	ST	
Glasford sand (undiff.)	42N	7E	4	6c	512	71289		923.6	216	859	ST	
Glasford sand (undiff.)	42N	7E	24	7c	803	228889		893.1	144	809	ST	
Glasford sand (undiff.)	42N	7E	31	7d	811	217306		959.7	270	819	ST	
Glasford sand (undiff.)	42N	8E	9	6d	657	290337		884.1	195	754	ST	
Glasford sand (undiff.)	42N	8E	26	7e	665	254363		728.0	50	709	ST	
Glasford sand (undiff.)	42N	9E	1	3a	593			861.9	237	717	ST	
Glasford sand (undiff.)	42N	9E	2	5g	455	35112		803.3	118	729	ST	
Glasford sand (undiff.)	42N	9E	3	7b	1029	245244		840.6	176	760	ST	
Glasford sand (undiff.)	42N	9E	12	7g	450	297047		861.2	223	725	ST	
Glasford sand (undiff.)	42N	9E	24	6a	452	217660		860.6	231	732	ST	
Glasford sand (undiff.)	42N	9E	26	2e	839	35353		862.0	231	734	ST	
Glasford sand (undiff.)	42N	9E	26	6c	1028	218708		838.1	197	741	ST	
Glasford sand (undiff.)	42N	9E	27	3b	1018	35371		854.1	195	741	ST	
Glasford sand (undiff.)	42N	9E	27	4d	705	173114		883.8	241	745	ST	
Glasford sand (undiff.)	43N	5E	3	7d	2027	188665		809.7	82	794	ST	
Glasford sand (undiff.)	43N	5E	4	5g	722	99004		793.0	40	784	ST	
Glasford sand (undiff.)	43N	5E	4	6h	2026	99005		796.9	70	788	ST	
Glasford sand (undiff.)	43N	5E	9	5g	737	264535		795.2	50	785	ST	

Table B1. Continued

Well open to	Twp	Rge	Sec	Plot	ISWS Project No.	ISWS P No.	ISWS PICS No.	Measuring Point Elevation (ft)	Well Depth (ft)	Head Elevation (ft)	Method	Note
Glasford sand (undiff.)	43N	5E	23	8f	721	99150		823.6	70	808	ST	
Glasford sand (undiff.)	43N	5E	24	5d	735	325697		847.0	47	830	ST	
Glasford sand (undiff.)	43N	6E	2	4c	851	100987		851.7	78	830	ST	
Glasford sand (undiff.)	43N	6E	30	4c	729	103063		876.2	96	851	ST	
Glasford sand (undiff.)	43N	8E	6	3a	687		7339	891.9	205	768	ST	
Glasford sand (undiff.)	43N	9E	22	2d	846	314595		770.3	122	730	ST	
Glasford sand (undiff.)	44N	5E	33	3e	2022	349574		794.8	48	786	ST	
Surficial Henry	41N	8E	17	8f	500	308369		908.1	38	875	ST	
Surficial Henry	41N	8E	26	3e	696	309038	6498	708.3	68	701	AL	
Surficial Henry	42N	8E	23	3h	660	174325		839.4	60	796	ST	
Surficial Henry	43N	6E	3	8d	2010	100992		838.8	42	828	ST	
Surficial Henry	43N	6E	5	5g	727	101003		828.7	57	817	ST	
Surficial Henry	43N	7E	7	5e	2065	106252		855.8	60	844	ST	
Surficial Henry	43N	8E	8	2f	2033	106585		899.3	58	865	ST	
Surficial Henry	43N	8E	21	3e	2017	216326		835.7	42	824	ST	
Tiskilwa sand (undiff.)	40N	5E	20	6b	882	42593		900.3	90	832	ST	
Tiskilwa sand (undiff.)	41N	6E	2	1a	333	69866		937.7	87	899	ST	
Tiskilwa sand (undiff.)	41N	6E	12	8f	916	69914		952.2	78	910	ST	
Tiskilwa sand (undiff.)	41N	6E	13	6a	914	69917		951.6	92	899	ST	
Tiskilwa sand (undiff.)	41N	6E	26	3g	918	69982		905.7	55	893	ST	
Tiskilwa sand (undiff.)	42N	6E	4	4a	507	342462		889.7	45	859	ST	
Tiskilwa sand (undiff.)	42N	6E	25	8e	347	246429		1011.6	64	989	ST	
Tiskilwa sand (undiff.)	42N	7E	2	4h	514	291598		900.6	90	874	ST	
Tiskilwa sand (undiff.)	42N	7E	13	4g	243	72525		908.5	60	891	ST	
Tiskilwa sand (undiff.)	42N	9E	10	3f	3	245282		851.3	165	747	ST	
Tiskilwa sand (undiff.)	42N	9E	20	2f	840	190197		818.4	91	796	ST	
Tiskilwa sand (undiff.)	43N	6E	24	8e	1035	322347		902.4	67		ST	2
Tiskilwa sand (undiff.)	43N	7E	2	1e	2059	189362		901.7	115	880	ST	
Tiskilwa sand (undiff.)	43N	7E	10	7b	1040	106257			78		ST	2
Tiskilwa sand (undiff.)	43N	7E	10	7h	2055	106258		865.4	68	855	ST	
Tiskilwa sand (undiff.)	43N	7E	12	6f	688		5200	913.2	137	876	ST	
Tiskilwa sand (undiff.)	43N	7E	12	7c	2058	106255		906.0	93	878	ST	

Table B1. Continued

Well open to	Twp	Rge	Sec	Plot	ISWS Project No.	ISWS P No.	ISWS PICS No.	Measuring Point Elevation (ft)	Well Depth (ft)	Head Elevation (ft)	Method	Note
Tiskilwa sand (undiff.)	43N	7E	24	7c	2056		10202	886.4	108	861	AL	
Tiskilwa sand (undiff.)	43N	7E	26	5g	2050		4998	896.0	127	858	ST	
Tiskilwa sand (undiff.)	43N	7E	28	7g	2052	106343		889.2	73	866	ST	
Tiskilwa sand (undiff.)	43N	7E	31	2h	2047	106349		877.7	50	860	ST	
Tiskilwa sand (undiff.)	43N	7E	31	6g	2051	106350		899.6	120	863	ST	
Tiskilwa sand (undiff.)	43N	8E	24	8f	2062	106873		737.9	40	733	ST	
undetermined	36N	8E	5	2e	1234			749.3	165	653	ST	1
undetermined	38N	7E	6	2h	1007	65812		747.2	87	709	ST	1
undetermined	38N	7E	23	1a	1104			708.8	115	671	ST	2
undetermined	39N	6E	27	8d	909			788.3	200	759	ST	1
undetermined	39N	7E	9	2a	85			775.2		759	ST	1
undetermined	40N	5E	11	5a	980			857.2	40	830	ST	1
undetermined	40N	5E	31	7d	880			897.1	400	805	ST	1
undetermined	40N	7E	8	3d	205			937.8	450	820	ST	2
undetermined	40N	8E	6	2h	79			792.1	160	766	ST	2
undetermined	40N	8E	11	5e	170	331659		797.5	153	684	ST	1
undetermined	41N	7E	1	2e	44	70014		924.8	40	916	ST	1
undetermined	41N	7E	11	5h	1056			911.6	100	818	ST	2
undetermined	43N	10E	30	7h	844	324935		859.9	270		ST	2
undetermined	43N	6E	2	4c	850			858.2	161	825	ST	1
undetermined	43N	9E	4	8a	1049			772.9	70	729	ST	1
undetermined	43N	9E	5	4d	1051			761.7	153	732	ST	1
undetermined	43N	9E	10	3b	466			762.8	64	732	ST	1
undetermined	44N	5E	33	3e	1236			795.9	200	784	ST	1
undetermined	44N	6	32	4d	848	100297		824.5	126	812	ST	1
undetermined	44N	8E	23	4b	1127	214673		765.0	92	758	ST	1
unnamed tongue (sub-Batestown)	37N	7E	7	8e	66	78304		673.5	98	634	ST	
unnamed tongue (sub-Batestown)	38N	6E	17	4a	345	189448		725.7	70	699	ST	
unnamed tongue (sub-Batestown)	39N	6E	4	2c	891	72572		854.9	56	836	ST	
unnamed tongue (sub-Batestown)	39N	6E	33	6a	2046			766.4		745	ST	1
unnamed tongue (sub-Batestown)	39N	6E	34	8a	983	238179		756.6	55	744	ST	
unnamed tongue (sub-Batestown)	40N	6E	22	7b	907	67502		867.3	48	852	ST	

Table B1. Concluded

Well open to	Twp	Rge	Sec	Plot	ISWS Project No.	ISWS P No.	ISWS PICS No.	Measuring Point Elevation (ft)	Well Depth (ft)	Head Elevation (ft)	Method	Note
unnamed tongue (sub-Batestown)	40N	6E	22	2c	881	67499		871.6	54	854	ST	
unnamed tongue (sub-Batestown)	40N	7E	10	1b	601			862.9	71	850	ST	
unnamed tongue (sub-Batestown)	41N	7E	22	8b	1110	295542		924.7	56	915	ST	
unnamed tongue (sub-Batestown)	41N	7E	23	5g	1064	332768		905.2	42	894	ST	
unnamed tongue (sub-Batestown)	41N	7E	27	7d	1109	330415		923.3	50	911	ST	
unnamed tongue (sub-Batestown)	41N	7E	28	1a	56			939.9	65	915	ST	
unnamed tongue (sub-Batestown)	41N	8E	11	4g	362	246362		750.0	84	714	ST	
unnamed tongue (sub-Batestown)	42N	7E	1	4d	511	250712		908.9	95	882	ST	
unnamed tongue (sub-Batestown)	42N	7E	9	2a	516	339675		912.8	55	897	ST	
unnamed tongue (sub-Batestown)	42N	7E	10	5h	810	308846	6512	901.2	80	881	ST	
unnamed tongue (sub-Batestown)	42N	8E	7	4d	662	228628		914.9	56	898	ST	
unnamed tongue (sub-Batestown)	42N	8E	8	2f	1243	230994		935.5	43	911	ST	
unnamed tongue (sub-Batestown)	42N	8E	18	1c	275	305737		927.4	90	893	ST	2
unnamed tongue (sub-Batestown)	42N	8E	18	8g	659	270572		932.5	100	894	ST	
unnamed tongue (sub-Yorkville)	37N	9E	10	2g	1033	159770		676.3	60	648	ST	
unnamed tongue (sub-Yorkville)	38N	7E	24	6h	305			672.8	38	664	ST	
unnamed tongue (sub-Yorkville)	41N	8E	15	6h	499	72178		790.9	84	789	ST	
unnamed tongue (sub-Yorkville)	41N	8E	15	6h	503	72177		792.7	71	793	ST	
unnamed tongue (sub-Yorkville)	41N	8E	21	3g	364	335278		821.9	54	800	ST	
unnamed tongue (sub-Yorkville)	42N	9E	15	8d	822	35241		902.3	162	770	ST	
unnamed tongue (sub-Yorkville)	42N	9E	33	7e	377		10790	844.4	119	768	AL	2
unnamed tongue (sub-Yorkville) & Ashmore Tongue	42N	9	33	7e	376		10788	842.5	122	772	AL	
unnamed tongue (sub-Yorkville)	43N	8E	2	7f	679	216183		910.9	141	825	ST	
unnamed tongue (sub-Yorkville)	43N	8E	10	3a	2036	106616		894.3	135	832	ST	
unnamed tongue (sub-Yorkville)	43N	8E	14	4c	691		10380	883.7	163	808	ST	
unnamed tongue (sub-Yorkville)	43N	8E	14	6a	2048		3072	913.2	194	824	AL	
unnamed tongue (sub-Yorkville)	43N	8E	14	6h	2038		5487	862.3	127	816	AL	
unnamed tongue (sub-Yorkville)	43N	8E	21	7g	678	106718		833.4	75	818	ST	
unnamed tongue (sub-Yorkville)	43N	9E	30	8g	463	297394		844.5	57	805	ST	

Notes: Abbreviations used: BR = bedrock, ST = steel tape, AL = air line, and XD = transducer. The notes field indicates the following conditions: 1 = synoptic measurement was rejected and 2 = synoptic measurement was not taken.

Appendix C. 2003 Shallow PICS Groundwater Withdrawals in Kane County

Table C1 provides a summary of groundwater withdrawal information reported to the ISWS for the Public, Industrial, and Commercial Survey (PICS) for 2003. The source of the withdrawal data used and listed in this appendix are annual reports submitted by water operators throughout the state to the Illinois Water Inventory Program. Annual withdrawals are shown in billions of gallons (bg). A high-capacity well is considered to be one that reportedly pumps greater than 100,000 gallons per day or 36.5 millions gallons (mg) annually. Shallow bedrock withdrawals presented are for bedrock units open to the interval above the Galena Group, even if such wells are also open to deeper units.

Table C2 provides more detailed information about the wells used in the summary table including the owner's name, local well number, depth (feet), township, range, section, plot, maximum reported daily withdrawal (mg), total reported annual withdrawal (mg), the unique ISWS PICS number, and the ISWS Aquifer Code (an indication of source aquifer). This listing includes all shallow public wells in Kane County reported in active service during 2003. It also does not generally include wells that are reported on standby, emergency, or unused status. Commercial and industrial wells also are omitted. A value of NR indicates the value was not reported.

Most of the differences between the data included in this appendix and those included in Appendix C of Locke and Meyer (2005) reflect the use of 2003 withdrawal data received by the ISWS after publication of Locke and Meyer's (2005) report. Some differences also arise from a reassessment of the open intervals (aquifer codes) of pumping wells in Kane County, which resulted in some wells being removed from the accounting procedure and other being added.

Table C1. 2003 Summary of Annual Shallow PICS Groundwater Withdrawals in Kane County

Withdrawal type	Withdrawals (bg)	Total wells	Total high-capacity wells
Unconsolidated withdrawals			
Industrial, commercial and noncommunity public wells	0.194	5	4
Community public wells	5.707	47	32
Total	**5.902**	**52**	**36**
Shallow bedrock withdrawals			
Industrial, commercial and noncommunity public wells	0.483	22	5
Community public wells	0.496	33	11
Total	**0.979**	**55**	**16**
Combined Total	**6.881**	**107**	**52**

Table C2. 2003 Annual Shallow PICS Groundwater Withdrawals in Kane County

Name	Well No.	Depth (ft)	Twp	Rge	Sec	Plot	Withdrawals: Daily Maximum (mg)	Withdrawals: Annual Total (mg)	ISWS PICS No.	ISWS Aquifer Code
ALGONQUIN	7	121	42N	08E	03	1C	1.96	361.03	10241	0101
ALGONQUIN	8	207	42N	08E	04	8D	1.20	85.71	4871	0101
ALGONQUIN	9	235	42N	08E	05	3D	1.64	310.42	4872	0101
ALGONQUIN	11	100	42N	08E	03	1F	1.76	52.89	72	0101
AURORA	101	116	38N	07E	24	6H	0.79	105.27	6350	0101
AURORA	103	125	38N	08E	18	7B	0.36	49.40	9884	0101
AURORA	119	130	38N	08E	19	5E	0.39	20.19	9949	0101
AURORA COMMUNITY WATER ASSOCIATION	2	253	38N	08E	25	8G	0.06	2.58	6386	6161
AURORA COMMUNITY WATER ASSOCIATION	3	250	38N	08E	25	8G	0.06	2.66	56	6161
AURORA COUNTRY CLUB	2	785	38N	08E	29	5F	0.36	15.00	1994	5666
AURORA COUNTRY CLUB	5	117	38N	08E	29	7F	<0.01	0.17	4556	5656
AURORA COUNTRY CLUB	6	410	38N	08E	29	5G	0.58	50.73	5088	6161
BATAVIA	6	158	39N	08E	18	5G	NR	203.20	10180	0101
BATAVIA	7	118	39N	08E	18	5D	NR	203.20	10181	0101
BATAVIA	8	150	39N	08E	19	8H	NR	203.20	10182	0101
BURLINGTON	4	106	41N	06E	09	1G	0.08	8.13	9921	0101
CARPENTERSVILLE	5	183	42N	08E	14	2H	2.82	269.10	6520	0101
CARPENTERSVILLE	6	179	42N	08E	14	2G	3.49	544.22	6517	0101
CARPENTERSVILLE	7	200	42N	08E	13	6D	1.69	374.21	10010	0101
CENTRAL SCHOOL DISTRICT #301	4	805	41N	07E	22	6H	NR	0.38	10977	5065
EAST DUNDEE	2	69	42N	08E	23	7D	0.29	26.65	6530	0101
EAST DUNDEE	3	128	42N	08E	23	6E	1.30	89.16	6532	0101
EAST DUNDEE	4	136	42N	08E	24	8H	0.69	64.88	5160	0101
ELGIN COUNTRY CLUB	2	205	41N	08E	17	3B	0.00	1.00	1936	5656
ELGIN COUNTRY CLUB	3	300	41N	08E	20	2E	0.12	7.00	1937	5661
ELGIN COUNTRY CLUB	4	297	41N	08E	20	3E	0.02	<0.01	1938	6161
FERMI NATIONAL ACCELERATOR LAB	1	220	39N	08E	25	1E	0.20	11.41	9760	5661
FERMI NATIONAL ACCELERATOR LAB	29	130	39N	08E	24	5D	<0.01	0.12	9767	5656
FERMI NATIONAL ACCELERATOR LAB	30	240	39N	08E	24	5D	<0.01	0.15	11485	5061
FOX RIVER WATER RECLAMATION DIST - SKYLINE	1	131	40N	08E	11	7B	0.08	13.34	6450	0101

Table C2. Continued

Name	Well No.	Depth (ft)	Twp	Rge	Sec	Plot	Withdrawals: Daily Maximum (mg)	Withdrawals: Annual Total (mg)	ISWS PICS No.	ISWS Aquifer Code
FOX RIVER WATER RECLAMATION DIST - SKYLINE	2	135	40N	08E	11	7B	0.08	13.34	6451	0101
FOX RIVER WATER RECLAMATION DIST - SKYLINE	3	157	40N	08E	11	8A	0.29	8.64	66	0101
GENEVA	8	150	39N	08E	05	8A	NR	198.02	6428	0101
GENEVA	9	153	39N	08E	06	3A	NR	198.02	10006	0101
GENEVA	10	179	39N	08E	05	7C	NR	198.02	4894	0101
HAMPSHIRE	5	818	42N	06E	21	2B	0.26	33.11	6509	6166
HAMPSHIRE	6	1195	42N	06E	21	3B	0.40	101.58	9913	6187
HIGHLAND SUBD	1	152	40N	08E	15	4A	<0.01	1.10	6454	6161
HIGHLANDS OF ELGIN	1	250	41N	08E	21		0.57	25.18	1943	5656
HIGHLANDS OF ELGIN	2	283	41N	08E	21	3B	0.21	13.44	1945	5661
ILLINOIS AMERICAN RIVER GRANGE DIVISION	1	180	40N	08E	09	1C	0.02	2.24	6449	5661
ILLINOIS AMERICAN ROLLINS SWR & WTR DIV	1	300	41N	08E	28	1E	0.04	7.87	6499	5661
MARGARET'S HI-ACRE MHP	1	700	38N	08E	14	3B	0.04	6.73	6362	5666
MARGARET'S PARK VIEW EST MHP	1	208	38N	08E	26	3A	0.11	0.19	6387	5661
MARGARET'S PARK VIEW EST MHP	2	210	38N	08E	26	3A	0.10	8.57	6388	5661
MOECHERVILLE WATER DISTRICT - NFP	1	147	38N	08E	26	1H	0.10	19.53	6389	6161
MOECHERVILLE WATER DISTRICT - NFP	2	180	38N	08E	26	2H	0.06	5.40	6392	6161
MOECHERVILLE WATER DISTRICT - NFP	3	196	38N	08E	26	2H	0.07	12.26	6393	6161
MONTGOMERY	10	82	38N	08E	33	4H	0.08	0.17	6404	0101
MONTGOMERY	11	59	38N	08E	33	5H	0.38	11.40	6403	0101
MONTGOMERY	13	183	38N	08E	33	4H	0.81	93.24	10030	6161
OAK HILL GARDENS	1	400	42N	08E	18	3E	NR	0.07	4753	6161
OAK HILL GARDENS	2	40	42N	08E	18	3E	NR	0.05	4754	0101
OAK HILL GARDENS	3	72	42N	08E	18	3E	NR	0.01	4755	0101
OAK HILL GARDENS	4	40	42N	08E	18	3E	NR	0.15	5197	0101
OGDEN GARDENS SUBD	1	185	38N	08E	24	5C	NR	2.30	6383	5661
OGDEN GARDENS SUBD	2	176	38N	08E	24	5E	NR	14.61	6381	6161
PARK VIEW WATER CORP	1	250	38N	08E	35	2G	0.01	2.22	6415	5661
PATTERSON MHP	1	80	38N	08E	34	4E	<0.01	0.43	6409	5656
POWERS WATER CO INC	1	78	42N	07E	10	5H	NR	6.57	6512	0101

Table C2. Concluded

Name	Well No.	Depth (ft)	Twp	Rge	Sec	Plot	Withdrawals		ISWS PICS No.	ISWS Aquifer Code
							Daily Maximum (mg)	Annual Total (mg)		
RANDALL OAKS COUNTRY CLUB	1	65	42N	08E	18	3D	NR	0.55	4756	0101
RANDALL OAKS COUNTRY CLUB	2	69	42N	08E	18	4C	NR	10.00	4757	0101
SOUTH ELGIN	3	112	41N	08E	35	3C	0.35	64.45	6506	0101
SOUTH ELGIN	4	109	41N	08E	34	1H	0.97	178.71	6500	0101
SOUTH ELGIN	5	68	41N	08E	26	3E	0.24	56.53	6498	0101
SOUTH ELGIN	6	111	41N	08E	35	3A	0.28	56.53	6503	0101
SOUTH ELGIN	10	165	41N	08E	35	1C	0.56	89.62	68	0101
ST CHARLES	7	173	40N	08E	28	8A	1.20	150.15	6461	0101
ST CHARLES	9	86	40N	08E	15	2A	3.09	572.80	6453	0101
ST CHARLES	11	130	40N	08E	15	1C	2.76	569.89	9889	0101
ST CHARLES	13	152	40N	08E	32	3H	2.21	91.00	67	0101
ST CHARLES COMM SCH DIST #303	1	333	40N	08E	07	2A	0.01	1.10	1970	5665
ST CHARLES COMM SCH DIST #303	2	130	40N	08E	10	3D	<0.01	0.04	51	0101
ST CHARLES COMM SCH DIST #303	3		40N	08E	10		<0.01	0.48	52	6161
ST CHARLES COUNTRY CLUB	1	385	40N	08E	22	3B	0.22	16.00	1968	6163
SUGAR GROVE	2	107	38N	07E	21	5E	0.51	54.19	6348	0101
SUGAR GROVE	5	200	38N	07E	10	2B	0.53	30.39	6342	5661
SUGAR GROVE	7	100	38N	07E	21	5G	1.04	155.80	9971	0101
UTILITIES INC - FERSON CREEK UTIL CORP	2	186	40N	07E	16	4C	NR	17.90	6444	0101
UTILITIES INC - FERSON CREEK UTIL CORP	3	175	40N	07E	16	3C	NR	17.90	6445	0101
UTILITIES INC - LAKE MARIAN WATER CORP	1	270	42N	08E	14	5H	NR	14.12	6516	5661
UTILITIES INC - LAKE MARIAN WATER CORP	2	265	42N	08E	11	6D	NR	4.85	6514	5661
UTILITIES INC - LAKE MARIAN WATER CORP	3	75	42N	08E	14	7G	NR	2.53	6518	0101
WAUBONSEE COMMUNITY COLLEGE	3	135	38N	07E	05	2D	NR	0.07	5457	101

Note:
mg = million gallons