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A Comparison of Potentiometric Surfaces for the Cambrian-Ordovician Aquifers of Northeastern Illinois, 2000 and 2007

by
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Illinois State Water Survey
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Champaign, Illinois

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Contents

Page

List of Tables

Page

List of Figures

Page

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Abstract

This report examines groundwater levels of deep wells (800-1700 ft) in a 14-county area of Illinois that extends from Lake Michigan to north-central Illinois and from the Wisconsin border south to Kankakee County. Particular emphasis has been given to the eight counties of the Chicago region because of the significant shift in water usage during the late twentieth century from groundwater supplies of the deep bedrock aquifers to Lake Michigan and other sources.

This report details fall 2007 water-level measurements of wells reaching to the St. Peter and Ironton-Galesville sandstones (deep sandstone aquifers), provides a map illustrating the surface and slope of groundwater levels, and compares fall 2007 levels to fall 2000 observations. The rapid decrease in groundwater pumpage from the deep bedrock aquifers during the 1980s initially resulted in a rapid recovery of groundwater levels. However, the rate of water-level change flattened and has resumed a slow decline since 2000. The greatest recovery during the past seven years occurred in Winnebago County.

In locations where the deep sandstone aquifers of Cambrian-Ordovician age continue to be used, declines in groundwater levels were observed. Most notable declines were in Kane County, Kendall County, southwestern Lake County, and southeastern McHenry County. Outside the Chicago region, water-level declines were observed in deep wells at Rockford and Loves Park in Winnebago County and in the vicinity of DeKalb and Sycamore in DeKalb County.

Comparison of the 2000 and 2007 potentiometric surface maps indicates groundwater declines in the eight-county Chicago region have resumed. Large portions of the study area again have water-level decreases of 25 to 50 feet. This contrasts with the 2000 measurement that observed generally small changes.

The largest drawdown of groundwater levels occurred in southeastern Kendall County. New wells, built since 2003 by Joliet, have caused the potentiometric surface to decline by up to 350-400 feet. Declines also continued at the Aurora pumping center and at the developing pumping center in northern Kendall County.

The water allocation program that substituted Lake Michigan water lessened groundwater withdrawals from deep sandstone aquifers for 10 to 15 years. Today, however, the trend has reversed because of growing usage of groundwater from the deep sandstones, causing a return to declining groundwater levels throughout many inland counties of northeastern Illinois.

Introduction

In May 1959, the Illinois State Water Survey (ISWS) and the Illinois State Geological Survey (ISGS) published a cooperative report (Suter et al., 1959) that discussed the geology and hydrology of groundwater resources in the eight-county Chicago region, aquifer yields, and possible consequences of future groundwater development. Special emphasis was placed on deep sandstone aquifers that had been widely used to obtain large groundwater supplies. The report indicated that pumpage from deep wells during 1958 approached the amount that could be continuously withdrawn without eventually dewatering the most productive formation of the deep sandstone aquifers. Future water-level declines (1958-1980) were predicted, ranging from 190 feet at Elgin to 300 feet at Chicago and Des Plaines. Suter et al. (1959) recognized that actual water-level declines would vary from predicted declines if future distribution and pumpage rates deviated from extrapolations of past groundwater use patterns.

In 1959, as a result of the findings of Suter et al. (1959), the ISWS expanded its program of collecting and reporting water-level and pumpage data for deep wells in the Chicago region. Program objectives were: 1) to provide long-term records of pumpage and water-level fluctuations; 2) to delineate problem areas; and 3) to report hydrologic information to facilitate the planning and development of water resources from deep sandstones in the Chicago region. The importance of the program became apparent during the ensuing years as water demands increased and groundwater levels continued to decline.

This report provides an update and adds to the long-term record of water-level information. This report covers a 14-county area from Lake Michigan to north-central Illinois and from the Wisconsin border south to Kankakee County as shown in Figure 1. A presentation of withdrawals from deep wells, included in previous reports on deep sandstone water levels, was published separately (Burch and Wehrmann, 2007).

For this report, the eight counties of the Chicago region are:

Cook
DuPage
Grundy
Kane
Kendall
Lake
McHenry
Will

The six northern counties outside of the Chicago region included in this report are:

Boone
DeKalb
LaSalle
Lee
Ogle
Winnebago

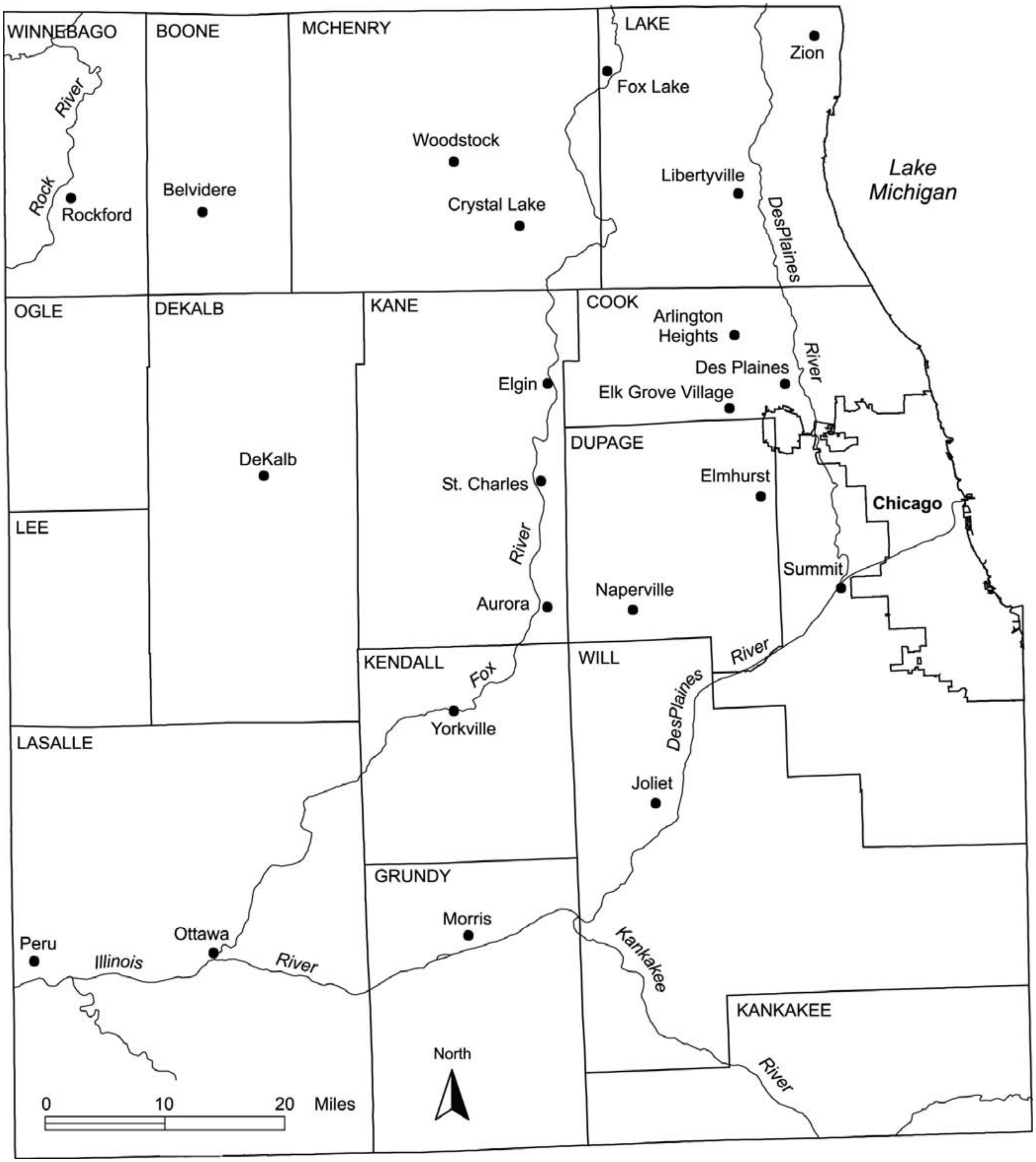


Figure 1. The northeastern Illinois study area

Water levels in deep wells were measured by various methods under a wide range of operating conditions and reliability. Most measurements were obtained from altitude gages attached to air lines permanently suspended in the wells. Very few measurements (7) were obtained with electric droplines that set off light or sound signals when the probe touched water. Groundwater levels in these wells can be measured very accurately with a dropline. The majority of deep wells, however, are equipped with pumps that limit or prevent access for measurement. Water levels are affected by recent pumpage of the well or by pumpage of adjacent wells. Other important considerations are the reliability of the water-level-measuring equipment, knowledge of well construction details, and the experience of the person taking measurements.

Previous Reports

The ISWS has issued many reports on water levels and pumpage from deep wells in the Chicago region since the benchmark publication by Suter et al. (1959). Walton et al. (1960), Sasman et al. (1961, 1962, 1967, 1973, 1977, 1982, 1986), Visocky (1993, 1997), and Burch (2002) summarized data for 1959; 1960; 1961; 1962-1966; 1966-1971; 1971-1975; 1975-1980; 1980-1985; 1985-1991; 1991-1995; and 1995-2000.

Reports broader in scope by Sasman (1965) and Sasman and Baker (1966) summarized data on groundwater pumpage in 17 northern Illinois counties in 1962 and 1963, respectively. Sasman et al. (1974) discussed groundwater pumpage in 20 northern Illinois counties in 1960-1970.

Schicht et al. (1976) and Singh and Adams (1980) described available groundwater and surface water resources for the Chicago region, predicted water shortages depending on various water-use scenarios, and offered alternatives for meeting projected water-supply needs to the year 2010.

Prickett and Lonnquist (1971) developed the first computer simulation of groundwater decline in the Chicago region. Visocky (1982) and Burch (1991) subsequently described the impact of substituting Lake Michigan water for groundwater pumpage from deep wells. Young (1992) incorporated the Chicago region in a groundwater flow model of Illinois, Wisconsin, Minnesota, Iowa, and Missouri.

A cooperative effort by the U.S. Geological Survey, Illinois State Water Survey, and the Illinois State Geological Survey resulted in an updated hydrogeologic evaluation of water resources of the deep bedrock in northern Illinois (Visocky et al., 1985). This report used previously collected and reported data.

Acknowledgments

The principal sponsor of this report was the Illinois Department of Natural Resources, Office of Water Resources. Their support was made available to the ISWS through the Office of Grants and Contracts at the University of Illinois (Award No. 2006-07457). Additional support was provided by ISWS General Revenue Funds. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the author and do not necessarily reflect the views of the Department of Natural Resources, the University of Illinois, or the Illinois State Water Survey.

The author wishes to acknowledge numerous individuals at water-supply systems in various communities and corporations who generously granted access to their wells so water levels could be measured. Staff at these systems voluntarily report their annual pumpage in response to mailed questionnaires from the Illinois Water Inventory Program (IWIP) at the ISWS. Andrew (Andy) Buck, Layne-Western Company (Aurora, Illinois), deserves special recognition for the many details he provided about air line lengths in wells constructed and serviced by that company.

Water-level data were largely obtained during ISWS personnel visits to system operators. Special acknowledgment is extended to Mark Anliker and Kevin Rennels. They collected water-level data in McHenry, Kane, Kendall, Grundy, DeKalb, Boone, Winnebago, and LaSalle Counties during fall 2007. Mr. Anliker collected water-level data at several Cook and Will County facilities. Tim Bryant provided a mailing list and contact list of water operators.

Several other ISWS staff members worked on this project. Kathy Brown generated base maps and digitized hand-drawn contours of water-level data. Review comments of Randall Locke, Yanqing Lian, and H. Allen Wehrmann were incorporated into the text. Lisa Sheppard provided editorial review and Sara Olson provided graphical support. Patti Hill provided clerical support throughout the project and completed the final formatting of the report.

Geology and Hydrology

Groundwater resources in the Chicago region are developed mainly from three aquifer systems: 1) sand-and-gravel deposits of the glacial drift; 2) shallow dolomite formations, mainly of Silurian age; and 3) deep sandstone and dolomite formations of Cambrian and Ordovician age. Figure 2 shows the general stratigraphic relationships that wells in northeastern Illinois encounter.

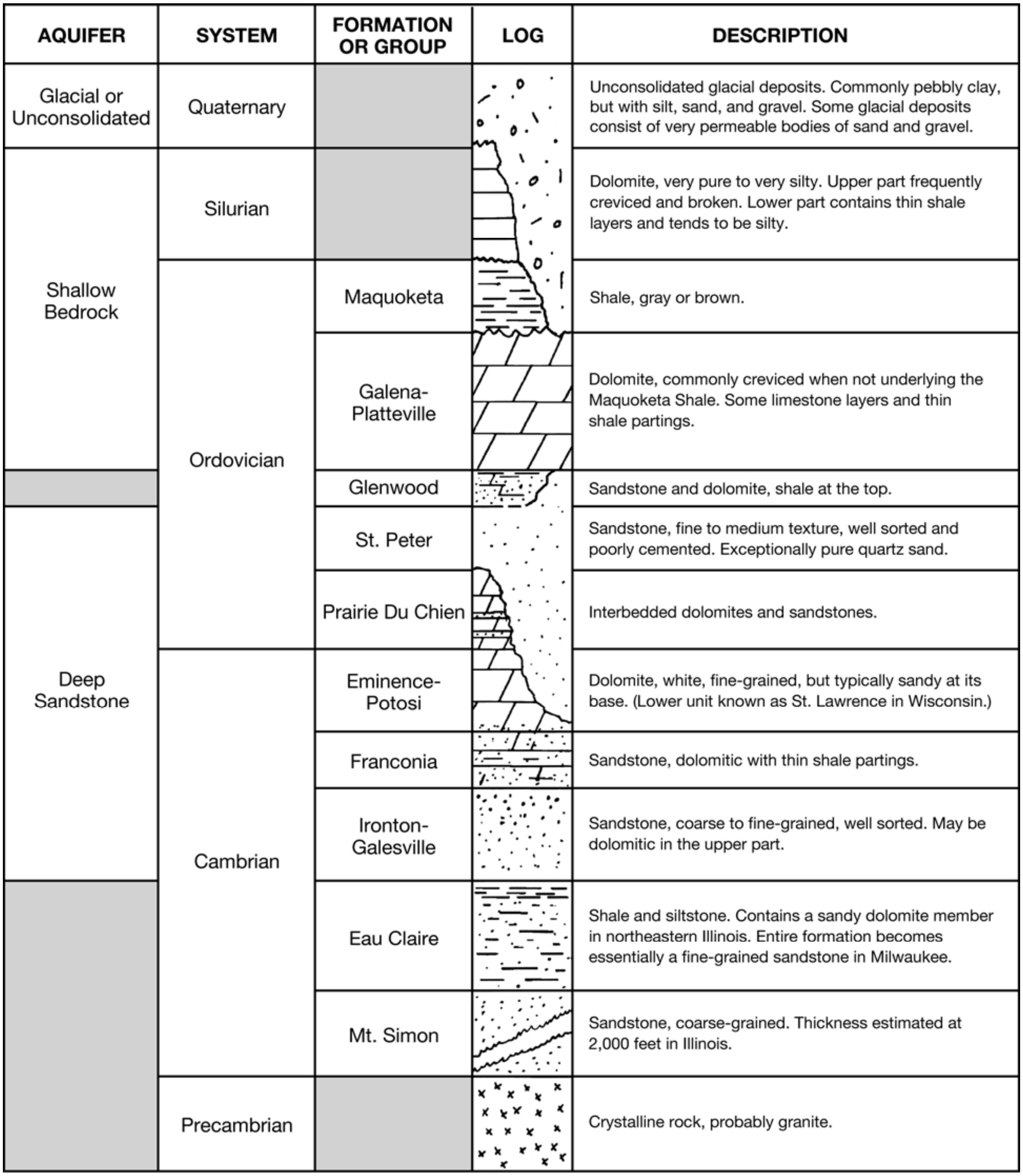
The sequence of rocks that comprises the Cambrian and Ordovician units described in this report were first defined by Suter et al. (1959, p. 48) as the "Cambrian-Ordovician Aquifer," and has been referred to by this name in most subsequent reports. A local term, "deep sandstone aquifers," is often used informally in northeastern Illinois in reference to the two major sandstone aquifers within the deep bedrock, the St. Peter and the Ironton-Galesville. Of the two, the Ironton-Galesville sandstone is the most productive, but supplemental yields are obtained from the overlying St. Peter sandstone.

The shallower St. Peter sandstone is part of the Ancell Group (composed of the Glenwood Formation and St. Peter sandstone). It is present throughout northeastern Illinois and frequently exceeds 200 feet in thickness. The St. Peter is an unusually extensive, very pure, uniformly fine-grained, and well-sorted quartz sandstone. The Galena-Platteville dolomite and the Maquoketa shale overlay the St. Peter sandstone in most of the Chicago region. The majority of municipal and industrial wells finished in the St. Peter sandstone in the Chicago region each produce less than 200 gallons per minute (gpm). In north-central Illinois, however, the St. Peter sandstone yields several hundred gallons per minute to wells and is the primary source of groundwater for some municipal and industrial supplies (Sasman et al., 1986).

Strata of low permeability comprised mainly of dolomite and shale with some sandstone separate the St. Peter and Ironton-Galesville. This interval, composed of the Prairie du Chien, Eminence-Potosi, and Franconia Formations, constitutes the "confining unit" between the St. Peter and Ironton-Galesville aquifers. The Prairie du Chien is important because it thins in the northern two tiers of Illinois counties, while the other formations are uniformly thick throughout much of northern Illinois.

The Ironton-Galesville underlies a strata of low permeability and is the most consistently permeable and productive aquifer in the region. The Ironton-Galesville sandstone dips to the east at a rate of about 10 feet per mile and is generally 175 to 200 feet thick (Suter et al., 1959). Most high-capacity, deep municipal and industrial wells in the Chicago region obtain a major part of their yields from this aquifer.

The hydraulic properties of an aquifer are determined by means of a pumping test. That is, a well is pumped at a known, constant rate, and the drawdown of groundwater levels around the well versus time is used to solve equations that express the relationship between transmissivity (T) and storage coefficient (S). Tests run in the Chicago region have led to a simplistic conceptual model of the Cambrian-Ordovician aquifer, which is loosely described as a confined aquifer with T approximately equal to 17,000 gallons per day/foot (gpd/ft) and with S approximately equal to 0.0003 (Prickett & Lonnquist, 1971).



AQUIFER	SYSTEM	FORMATION OR GROUP	LOG	DESCRIPTION
Glacial or Unconsolidated	Quaternary			Unconsolidated glacial deposits. Commonly pebbly clay, but with silt, sand, and gravel. Some glacial deposits consist of very permeable bodies of sand and gravel.
Shallow Bedrock	Silurian			Dolomite, very pure to very silty. Upper part frequently creviced and broken. Lower part contains thin shale layers and tends to be silty.
	Ordovician	Maquoketa		Shale, gray or brown.
		Galena-Platteville		Dolomite, commonly creviced when not underlying the Maquoketa Shale. Some limestone layers and thin shale partings.
		Glenwood		Sandstone and dolomite, shale at the top.
Deep Sandstone		St. Peter		Sandstone, fine to medium texture, well sorted and poorly cemented. Exceptionally pure quartz sand.
		Prairie Du Chien		Interbedded dolomites and sandstones.
	Cambrian	Eminence-Potosi		Dolomite, white, fine-grained, but typically sandy at its base. (Lower unit known as St. Lawrence in Wisconsin.)
		Franconia		Sandstone, dolomitic with thin shale partings.
		Ironton-Galesville		Sandstone, coarse to fine-grained, well sorted. May be dolomitic in the upper part.
		Eau Claire		Shale and siltstone. Contains a sandy dolomite member in northeastern Illinois. Entire formation becomes essentially a fine-grained sandstone in Milwaukee.
		Mt. Simon		Sandstone, coarse-grained. Thickness estimated at 2,000 feet in Illinois.
	Precambrian			Crystalline rock, probably granite.

Figure 2. Stratigraphic column showing typical sequence encountered in deep wells of northeastern Illinois

Although Suter et al. (1959) illustrated structure, contour, and thickness maps for both sandstones in the Cambrian-Ordovician, they did not discuss differences in hydraulic head between the two sandstones. For all practical purposes, since development of the deep sandstone aquifers began, artesian pressures in the St. Peter and Ironton-Galesville have been regarded as nearly equal. Burch (2004) noted, however, that the head difference between the two aquifers increases to the south. That is, groundwater levels in Lake County sandstones are nearly the same; wells open to the Ironton-Galesville sandstone in the Joliet area are about 60 feet lower than are those of wells open only to the St. Peter sandstone. Because the contour interval is so large, this difference is lost and is less important to this current project. Awareness of this difference, however, encourages the selection of the deeper of two wells in the southern part of the study area.

In the Chicago Region, the Maquoketa shale overlies the Cambrian-Ordovician sandstones and severely limits the amount of vertical leakage to the sandstones. The shale has been eroded in north-central Illinois, however, and is absent from the stratigraphic sequence. The outline of this absence is shown on the subsequent maps.

Water Levels in Deep Sandstone Wells

As described earlier, the ISWS has issued many reports on water levels and pumpage from deep sandstone wells since 1959. The ISWS has made routine mass measurements of water levels in deep sandstone wells about every five years since 1966. During the 1985 measurement, it was observed that water levels had risen in a significant number of deep sandstone wells in the Chicago region since detailed water-level information was first recorded. These rises were attributed to major shifts in water sources and to local reductions in pumpage between 1980 and 1985.

Groundwater pumpage continued to decline between 1985 and 1991, again primarily due to a shift to the use of Lake Michigan water. As a result, water levels in many deep wells (800-1700 ft) rose, particularly in northwestern Cook and southern Lake Counties. Visocky (1993) reported that average annual water-level changes were upward in five of the eight counties and varied from a rise of 12 feet in Cook County to a decline of 8 feet in Will County, with an overall average rise in the Chicago region of about 3 feet during this six-year period. AThis marked the first time that the average change was upward since detailed record-keeping began in the 1950s@ (Visocky, 1997, p. 16).

Method Used to Collect Water-Level Data

Water levels were measured during fall 2007 in 330 deep wells in 14 counties of northeastern Illinois (see Appendix for data). Attempts were made to measure water levels in other wells but were unsuccessful due to air-line leaks, or plugged air lines. Well operation also affected our ability to take a static measurement. Table 1 presents the number of wells measured by county. As Figure 3 illustrates, these wells are concentrated in the western suburbs of Chicago. Water-level changes were calculated for 221 wells that were measured in both 2000 and 2007.

Within the eight-county Chicago region, 271 deep sandstone wells were measured, or static water-level information for new wells was provided by the drilling contractor. Head change was calculated for 183 wells in the Chicago region that also were measured in 2000. The greatest numbers of wells measured in 2007 were in Cook (65), Kane (51), Lake (51), and Kendall (29) Counties.

Table 1. Number of Wells Measured, 2000 and 2007

County	*2000*	*2007*
Boone	7	5
Cook	66	65
DeKalb	23	22
DuPage	35	23
Grundy	13	11
Kane	52	51
Kendall	10	29
Lake	51	51
LaSalle	12	10
Lee	4	3
McHenry	27	19
Ogle	2	1
Will	34	23
Winnebago	31	17
Totals	**367**	**330**

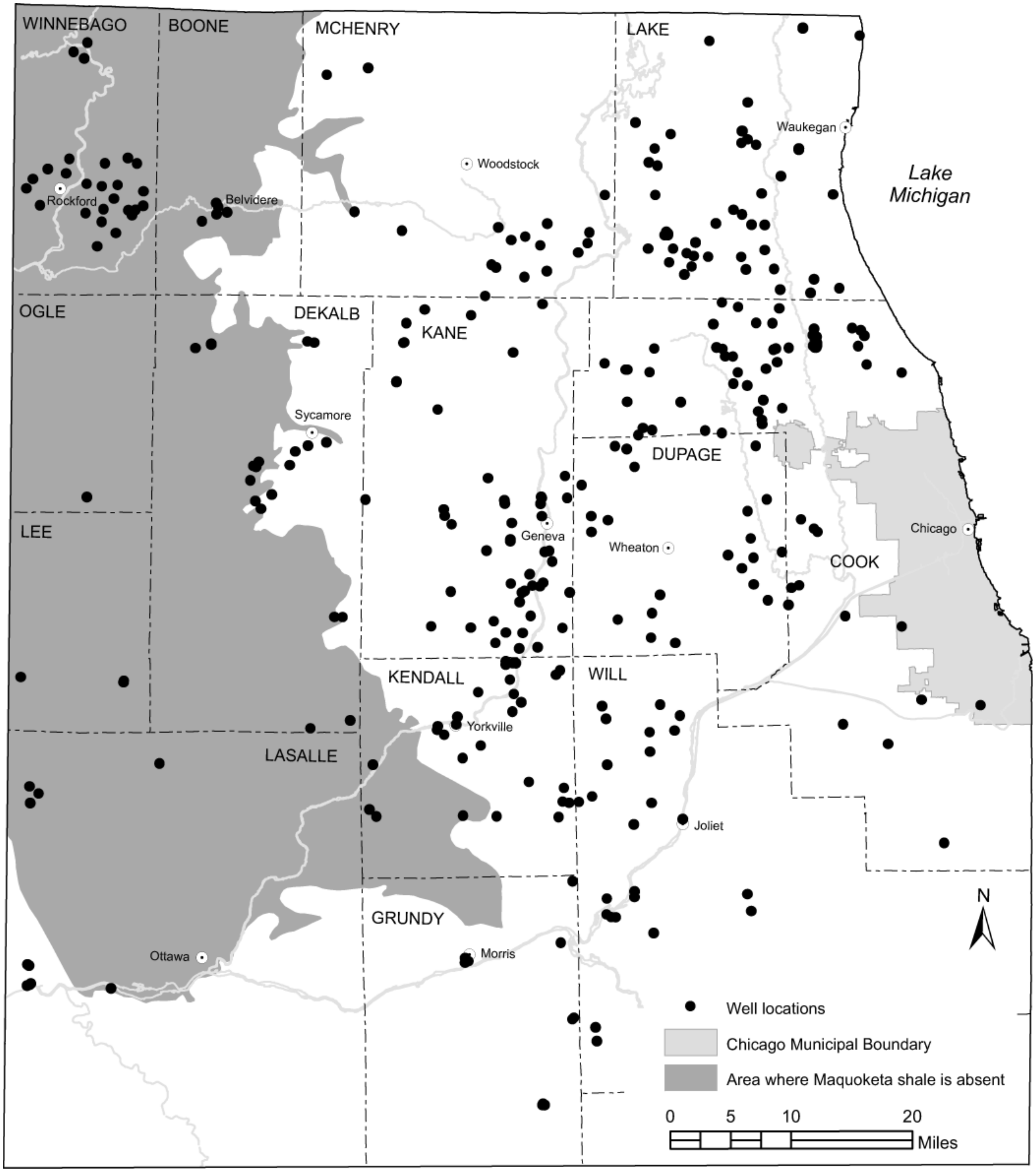


Figure 3. Distribution map of wells used in 2007 measurement

Figure 4 shows groundwater-level recovery in a hypothetical deep sandstone well similar to that found in northeastern Illinois. The hydrograph illustrates the rapid recovery that occurs immediately after a pump is switched off. As time progresses, the rate of recovery slows, and the water level in the well approaches some static level. Consequently, it was desirable that a pump be turned off for more than 30 minutes prior to measuring the water level in the well. Most readings were collected from wells that had not operated for weeks or even years prior to measurements.

Measuring groundwater levels in deep wells requires a different method from that typically used in shallow wells. Instead of electric droplines or steel tapes with chalked ends to directly determine the depth to water, air lines fitted with pressure gages are used. Although the air-line method is generally less accurate than electrical droplines, it offers the most practical means for measuring water levels in a pumped well (Driscoll, 1986). The air-line method is also useful because pump motors and casing tops on active wells are sealed. Production wells, unlike observation wells, do not provide direct access to water levels. The air-line method is noninvasive and offers a way to work around this difficulty by using the principle that air pressure is proportional to water pressure; that is, 1 pound per square inch (psi) of air is equivalent to 2.31 feet of water in a vertical column. The air line consists of small-diameter tubing of stainless steel, plastic, and/or copper that extends from the top of the well down to a point usually near the pump. Air lines in the Chicago region are frequently 600 to 1,100 feet long. The exact length of the air line must be measured (usually when the pump is installed or serviced) to determine the depth to water.

The submerged portion of the air line fills with groundwater. Measuring the depth to water requires injecting 200 to 300 psi of compressed air through a valve at the upper end of the air line to clear it. Once the line is cleared, the application of pressure is suspended. Groundwater then rushes back into the empty air line and compresses the air space above the static water level. The observer monitors the pressure gage (attached to the air line) until it stabilizes and then records the reading. The gage reading corresponds with the amount of water above the bottom of the air line, usually in feet. By subtracting this amount from the total length of the air line, one can calculate the depth to water below the land surface (the upper end of the air line).

For example, suppose the length of an air line inside a well is 1,000 feet. Compressed air is forced into the air line and clears it of water. When the pressure is released, groundwater refills the submerged portion of the air line and deflects the needle on an altimeter gage at the surface. A reading is taken when the gage steadies. If the water pressure above the bottom of the air line equals 250 feet, then the depth to water equals 750 feet (1000 - 250 = 750). Pressure maximums for gages of this type (used in the Chicago region) are typically 100 psi (230 feet), 200 psi (460 feet), or even 300 psi (690 feet). Gages are usually accurate to within 1 percent in the center portion of their ranges (2.3 to 6.9 feet in 100 to 300 psi gages, respectively), and accurate to within 2 percent at full deflection (4.6 to 13.8 feet in 100 to 300 psi gages, respectively). Since the majority of wells use 200 psi gages, it is estimated that most readings are accurate to within 10 feet.

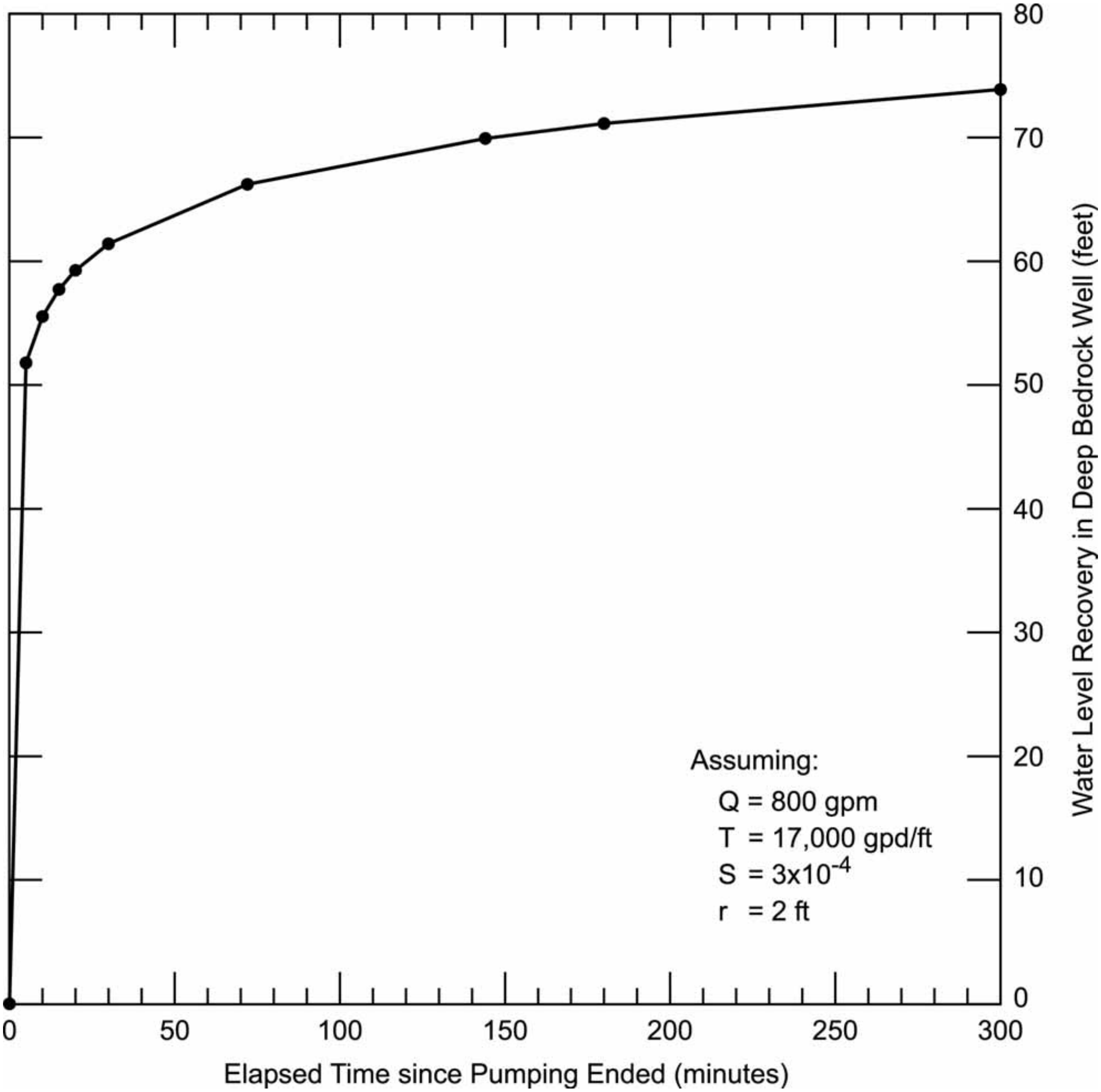


Figure 4. Time necessary for water-level recovery in a hypothetical deep sandstone well

Potentiometric Surface of Deep Sandstone Aquifers

Groundwater will rise to some height above the top of an artesian aquifer in tightly cased wells. It does so in response to the potentiometric pressures that exist within confined (artesian) aquifers such as those found in the deep wells of northeastern Illinois. The potentiometric pressures of wells, shown in feet of elevation above the National Geodetic Vertical Datum (NGVD), commonly referred to as mean sea level, can be plotted on a map and contoured. The resulting map of the potentiometric surface is important because the general direction of groundwater flow can be inferred from the pattern of contour lines drawn on the map. The potentiometric map may also illustrate where cones of depression have developed in response to pumping. The contour map, in effect, depicts a three-dimensional surface of potentiometric pressures, and is often referred to as a potentiometric map.

A potentiometric map can be constructed for each aquifer. One common mistake in preparing potentiometric maps is the Afailure to distinguish between water levels of different aquifers and to identify which wells have contact with more than one aquifer@ (Davis and DeWeist, 1966, p. 51). As was stated previously, Suter et al. (1959) did not discuss differences in hydraulic head between the St. Peter and Ironton-Galesville sandstones in northeastern Illinois. Previous studies have regarded these sandstones as having one potentiometric surface and this report continues with that premise for two reasons: 1) at most locations, wells are open to both sandstones, and hydraulic communication occurs freely within the well, and 2) head differences between the sandstones often are much less than 60 feet (particularly in the northern part of the study area), i.e., less than the 100-foot contour interval shown on the 2007 potentiometric surface map.

The predevelopment potentiometric surface (mid-1860s) in Wisconsin was characterized by Weidman and Schultz (1915) and in Illinois by Anderson (1919). Both reports provided maps illustrating that the surface in southeastern Wisconsin and northeastern Illinois was featureless and sloped gently away from a groundwater divide located between Chicago and the Rock River. The natural equilibrium of groundwater flow in the St. Peter and Ironton-Galesville sandstones was: 1) southeast (down dip) and into the geologic basins; 2) west to the bedrock valley of the Rock River; and 3) south to the outcrop areas along the Illinois River in LaSalle County. Figure 5 illustrates the approximate potentiometric surface in 1865 and the likely directions of groundwater flow within deep sandstone aquifers.

Since then, cones of depression have formed around each well as the groundwater level was drawn down. Individual pumping centers have grown under the influence of continued withdrawals until they eventually overlapped and formed regional pumping centers at Milwaukee and Chicago. For example, by 1915, groundwater withdrawals at Chicago and Joliet had lowered the potentiometric surface by 300 feet, and the resulting cones were clearly visible on the potentiometric map (Suter et al., 1959). Other cones formed on the potentiometric surface as pumpage increased during the ensuing years. By 1958, depressions on the potentiometric surface also were recognized at Aurora, Elgin, Des Plaines, and Elmhurst. Suter et al. (1959) reported that the cone at Summit, just southwest of Chicago, had declined another 350 feet by 1958, making it the deepest cone in Cook County.

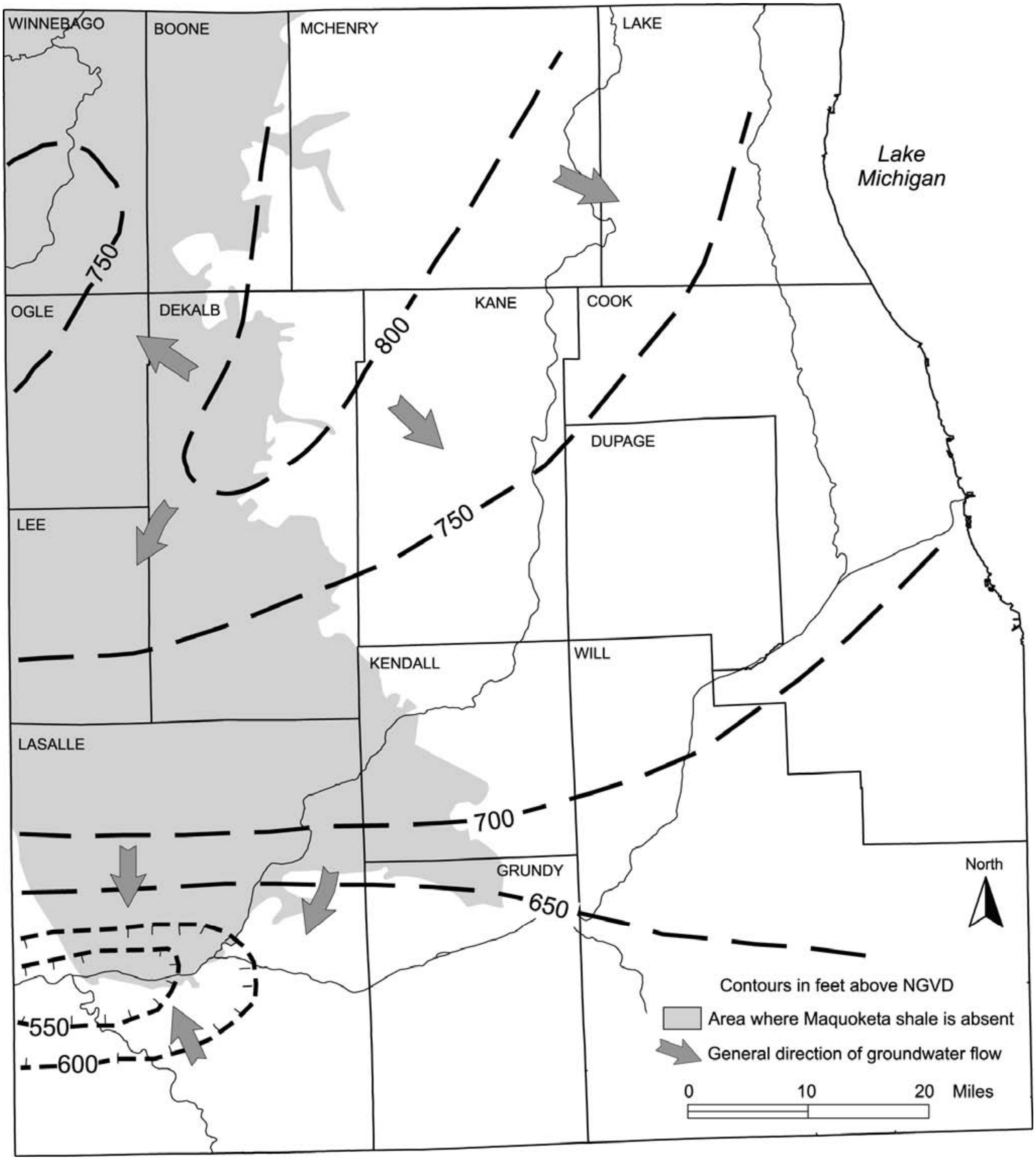


Figure 5. Approximate potentiometric surface of the deep sandstones in 1865 (after Weidman and Schultz, 1915; Anderson, 1919)

Groundwater levels in wells reaching to the deep sandstones have been checked periodically since 1958. Annual measurements of the depths to water and pumpage summaries were made from 1959 until 1962. The scope of reporting was broadened to include Belvidere, DeKalb, Morris, Waukegan, and Woodstock pumping centers, and the publication interval for reports expanded to approximately every five years. The last Amass measurement,@ as they came to be known at the ISWS, was made at the end of 2000.

Potentiometric Surface, 2000

Figure 6 shows the potentiometric surface of the deep sandstone aquifers in fall 2000. Water-level data used to prepare the map appear in Appendix A. The primary features of the 2000 potentiometric surface map include: 1) the area of high groundwater levels where the Maquoketa shale is absent; 2) the steep slope of the surface east into the Chicago region; and 3) the deep cone surrounding Joliet and the I-55 industrial corridor. Although potentiometric levels have declined by 500 feet or more over a broad area of the Chicago region since 1865, some levels in the Joliet area have declined 850 to 900 feet.

Smaller noticeable cones were present in West Chicago (DuPage County), Northbrook-Glenview (western and northern Cook County), and in the vicinity of Aurora and Oswego (southeastern Kane and northeastern Kendall counties). Beyond the Chicago region, cones of depression occurred at DeKalb-Sycamore, and smaller ones at Belvidere, LaSalle-Peru, and Ottawa.

The 100-foot contour line cut east-west across the middle of DuPage County in 2000 rather than north-south through the county. Groundwater elevations in DuPage seemed to have reached the highest levels in many years. Comparisons indicated that the trend of rising water levels may have peaked and begun declining again.

Potentiometric Surface, 2007

Figure 7 shows the potentiometric surface of the deep sandstone aquifers in fall 2007. Water-level data used to prepare the map appear in Appendix A. The major feature of the 2007 potentiometric surface map continues to be the pumping cone around Joliet. That city continues to be the largest public water supply using the deep sandstone aquifers. Some potentiometric levels in Will County continue to be 850 to 900 feet lower than in 1865.

The shape or configuration of the potentiometric surface around Joliet has remained largely unchanged for decades. Even the map presented 50 years ago by Suter et al. (1959) looks similar to those published for 1992, 1995, and 2000. But the 2007 map presented here as Figure 7 has a very different shape. The 2007 potentiometric surface differs in that the depression of the potentiometric surface near Joliet now extends westward into Kendall County as a result of about five new, high-capacity wells.

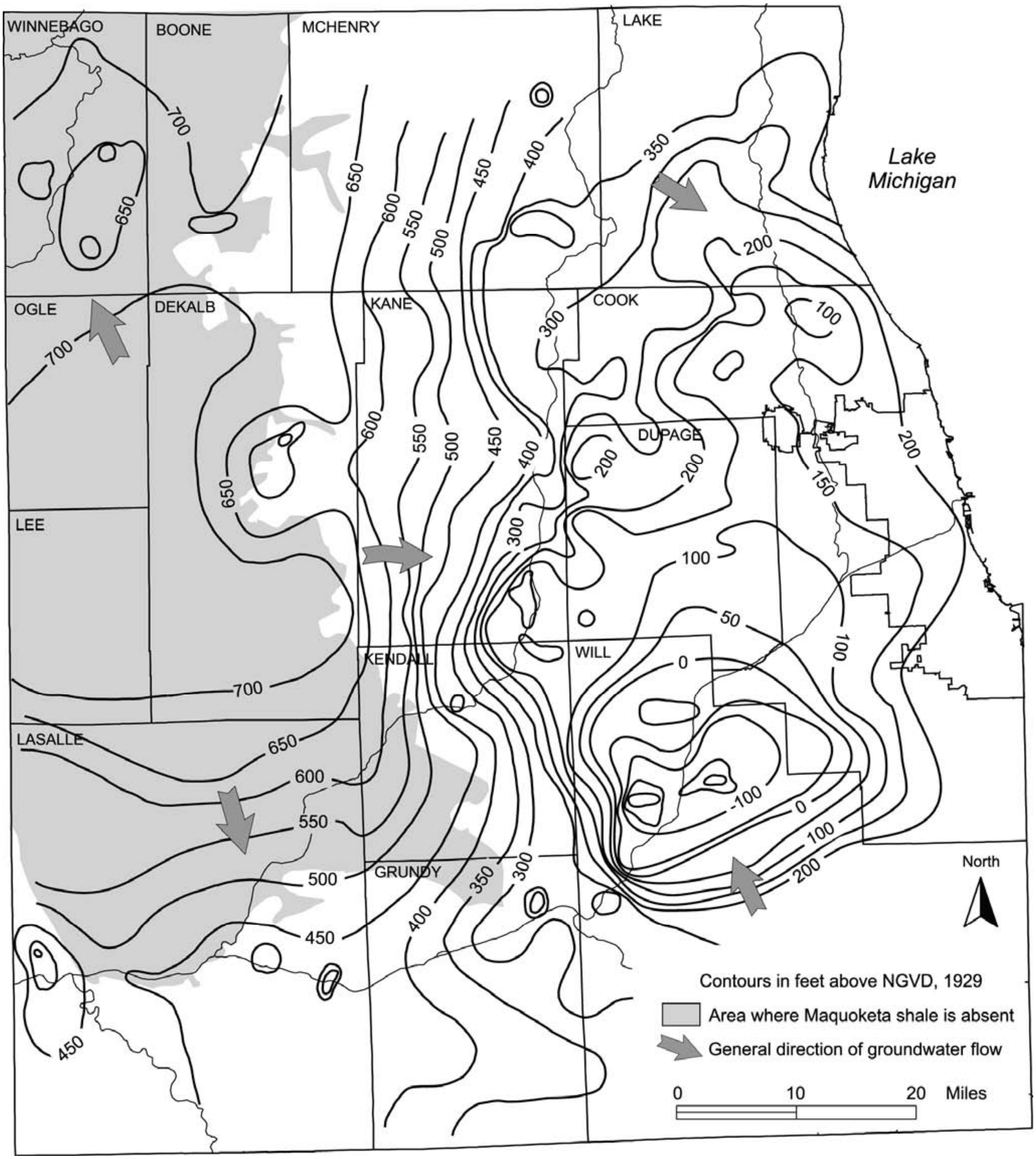


Figure 6. Potentiometric surface of the deep sandstones in northeastern Illinois, fall 2000 (from Burch, 2002)

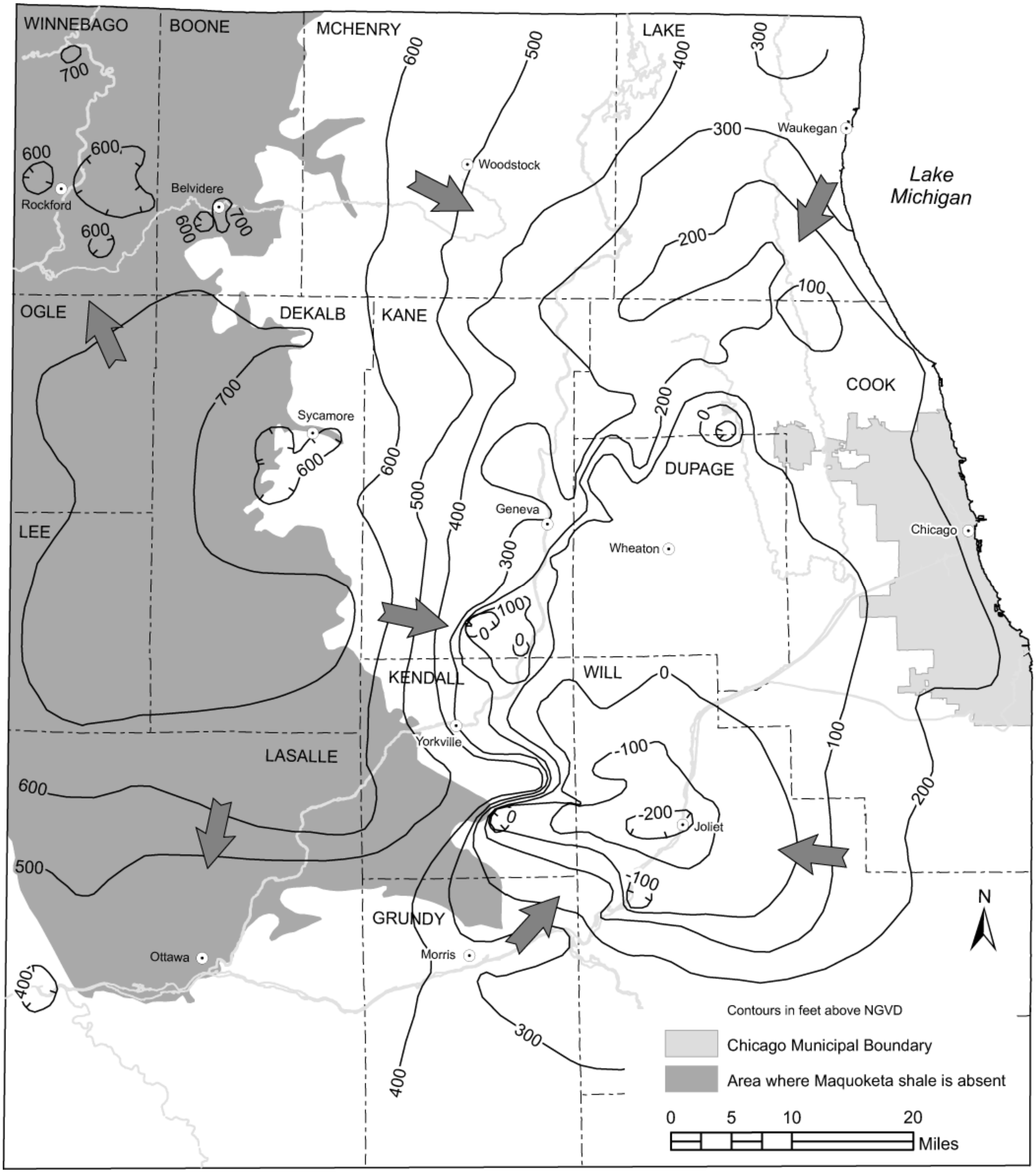


Figure 7. Potentiometric surface of the deep sandstones in northeastern Illinois, fall 2007

New wells, about 1550 feet deep, have been constructed in southeastern Kendall County since the 2000 measurement. Consequently, new information is available for making a water-level map. It was realized while attempting to contour the potentiometric surface that very low values were being reported for the new Joliet wells (#25, #27, and #28). Values of -141, -63, and -100 feet, respectively, were reported at these wells. These low potentiometric elevations cause the mean sea level contour to extend far into Kendall County, instead of being confined to Will County.

The pumping cone around Aurora and Oswego continues to deepen and become more prominent on the potentiometric map. Groundwater levels in deep sandstone wells of this area (southeastern Kane and northeastern Kendall counties) are now less than 100 feet in elevation.

In Kane County, the 400-foot contour line has shifted westward. Previously, this contour had been steady in its location. It is speculated that its westward movement coincides with the steepening hydraulic gradient into the Fox River valley pumping centers.

An increased area of DuPage County is now below the 100-foot contour line. This shift of the contour to the north and west (when compared to its location in 2000) is likely in response to the growing water demand in Kane County. To longtime watchers of the Chicago region, this shift is noteworthy because previous researchers (Suter et al., 1959; Schicht et al., 1976) speculated about how the westward movement of the pumping centers might increase the practical sustained yield of the aquifer.

Contours in other areas of the Chicago region appear in their previous positions. For example, in eastern Cook County, the 200-foot contour remains closed with corresponding contours in Lake County. This pattern was also seen in 2000 (Burch, 2002), and before 1958. Likewise, the 300-foot contour in Lake County and the 600-foot contour in Kane County appear to be located where they were in 2000.

Selected water-level observations were intentionally ignored and not considered when contouring the 2007 potentiometric surface. Table 2 identifies wells that were excluded.

Table 2. Wells Excluded from 2007 Potentiometric Surface Map

Well	*Reason omitted*	*Elevation (ft)*	*County*
Oak Brook #6	Anomalously high level	370	DuPage
West Chicago #9	Anomalously low level	-11	DuPage
Sugar Grove #11	Anomalously low level	-192	Kane
North Aurora #7	Anomalously low level	-50	Kane
Elburn #4	Anomalously high level	536	Kane
Hampshire #6	Anomalously high level	633	Kane
Vernon Hills #6	Anomalously high level	300	Lake
Lake in the Hills #11	Anomalously low level	180	McHenry

Changes in Groundwater Levels, 2000 and 2007

Groundwater levels at 221 wells were measured in both 2000 and 2007. Differences in levels were plotted on a working map and examined. It was apparent that the 50-foot contour interval, previously used in publications to illustrate recovery in the 1991 and 1995 measurements, would again be appropriate because the magnitude of change was larger than in the 1995-2000 comparison. Consequently, it was judged that an increase from the 25-foot interval would be more illustrative for the current measurement.

Figure 8 illustrates a comparison between the observed groundwater levels in 2000 and in 2007. Groundwater levels in a large portion of the Chicago region have declined from 0 to 50 feet.

Groundwater levels throughout the southern two-thirds of Cook County were relatively stable. An unused well at Chicago Heights (#22; T35N-14E-19) was opened and measured for the first time since 1995. Its level had risen by only 12 feet in the past 12 years. Likewise, Orland Park Well #11 (T36N-R12E-02) rose by 8 feet in the past seven years. Based on these two sites in southern Cook County, one might conclude that groundwater levels are steadily recovering at about 1 foot per year. Detailed data from Hickory Hills Well #2 (T37N-R12E-02), however, suggest that more variability occurs. A pressure transducer and datalogger were installed in September 2006 at this location and subsequently recorded groundwater levels daily. The data revealed a much more dynamic situation occurs in the deep sandstone. Figure 9 illustrates the detail that is lost by only observing a well every five to seven years.

Groundwater levels continued to decline at the Aurora pumping center. Water levels in deep wells in southeastern Kane and northern Kendall Counties declined 50 to 100 feet during the 2000-2007 period. The pumping cone, encompassing the area from Aurora to Plainfield and west to Yorkville, deepened, reflecting increased pumpage in the area (Burch and Wehrmann, 2007).

Likewise, the new wells (Joliet) in southeastern Kendall County have lowered groundwater levels by an estimated 350-400 feet. The exact shape of this new pumping cone is largely unknown because little or no previous data exist. Instead, its existence and outline on Figure 8 is inferred by subtracting the 2007 potentiometric surface from the 2000 surface (Burch, 2002). The only supporting data comes from Joliet Well #21 (located along Ridge Road in southeast Kendall County). The pre-pumping (2003) depth-to-water was 373 feet according to the well construction log. However, in fall 2007, the depth-to-water was 681 feet—a decline of 308 feet. As this extension of the pumping cone comes into equilibrium, it will tend to stabilize in shape and depth. Consequently, it is expected that future changes will not be as large as the one observed for this report.

A much smaller pumping cone is continuing to deepen in the area of southwestern Lake County near the communities of Lake Zurich and Wauconda. Groundwater levels have declined by 50 feet at both locales since 2000.

Outside the Chicago region, water-level declines of another 25 to 50 feet were observed in deep sandstone wells in the immediate vicinity of the DeKalb-Sycamore pumping center (DeKalb County) and at Belvidere (Boone County). Groundwater levels in public supply wells at Rockford (Winnebago County) also continued to decline.

It should be noted that wells with questionable head change were removed from the potentiometric surface mapping process in addition to those wells previously excluded due to unreasonable potentiometric values (Table 2). Such wells are presented in Table 3. For example, although the general pattern of water-level change was consistent with knowledge of the pumping history in DuPage and Cook Counties, it became apparent that some change values were in error. Extra care was taken to examine changes in water levels observed at Villa Park #7 and #10 (-200 and -233 feet, respectively), Elmhurst #6 (-121 feet), Lombard #8 (-155 feet), and West Chicago #3 (-136 feet) and Oak Brook #6 (+269 feet). The observed water-level elevations were viewed initially with skepticism, and when the change values were found to be inconsistent with nearby pumpage patterns, these datapoints were excluded from preparation of the potentiometric surface map (Figure 7) and the change map (Figure 8).

Similarly, two McHenry County wells were also excluded from consideration based upon the calculated head change. The potentiometric surface value for Lake in the Hills #11 was suspect and listed in Table 2. Its unreasonableness was confirmed when the head change was calculated (-180 feet). Likewise, Crystal Lake #16 (-210 feet change) was considered suspect in light of pumping history and previous water-level elevation. Consequently, both McHenry County wells were deemed inconsistent with pumpage patterns and are listed in Table 3.

Table 3. Well Heads with Questionable Head Change

	Water-level elevations (ft)		
Well name	*1995*	*2000*	*2007*
Villa Park #7	107	107	-93
Villa Park #10	103	113	-120
Elmhurst #6	83	90	-31
Lombard #8	106	92	-63
Oak Brook #6	24	101	370
Crystal Lake #16	N/A*	422	212
Lake in the Hills #11	364	360	180
West Chicago #3	146	241	105

Note: *Not available in 1995.

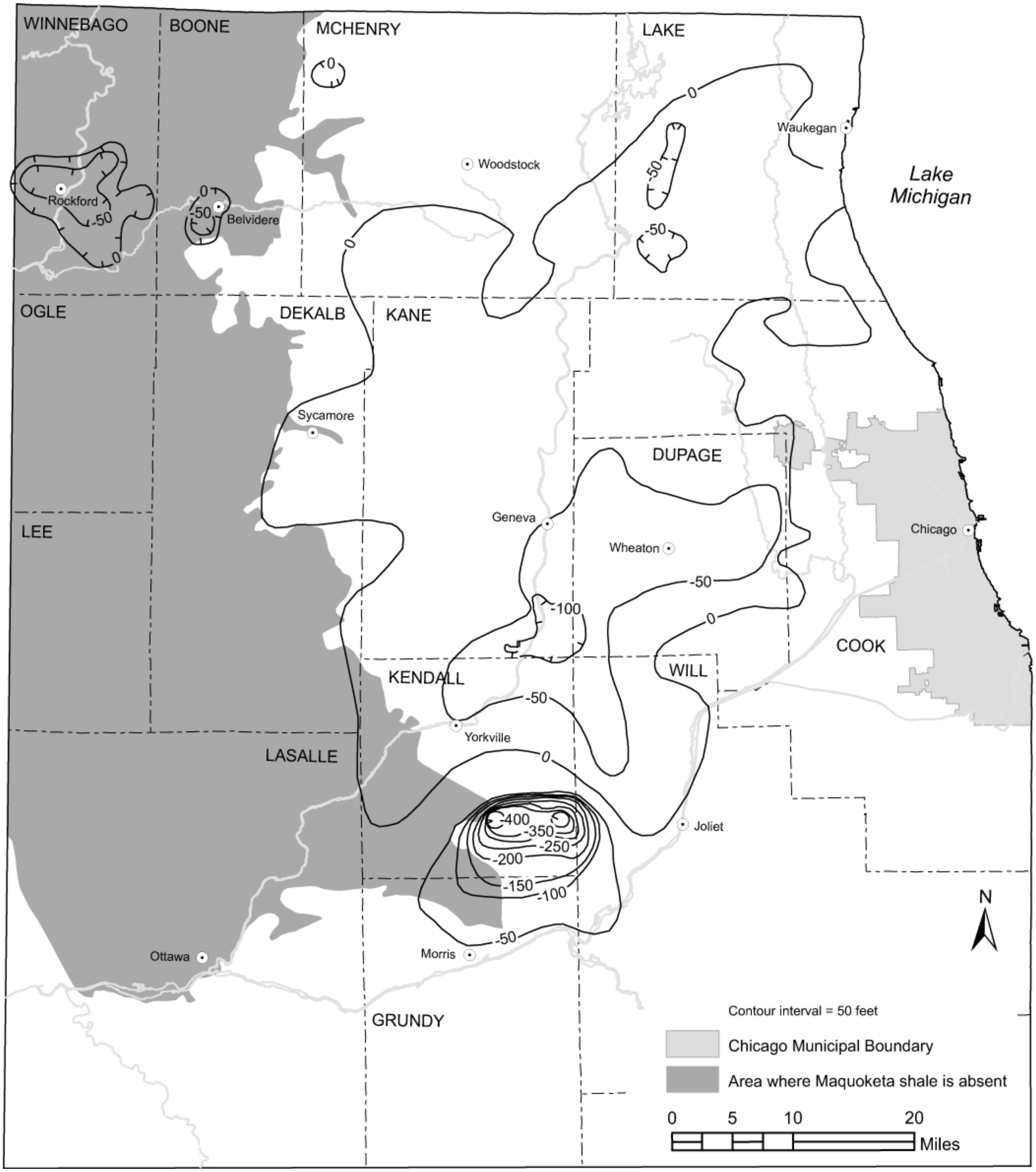


Figure 8. Changes in groundwater levels in deep sandstone wells in northeastern Illinois between 2000 and 2007

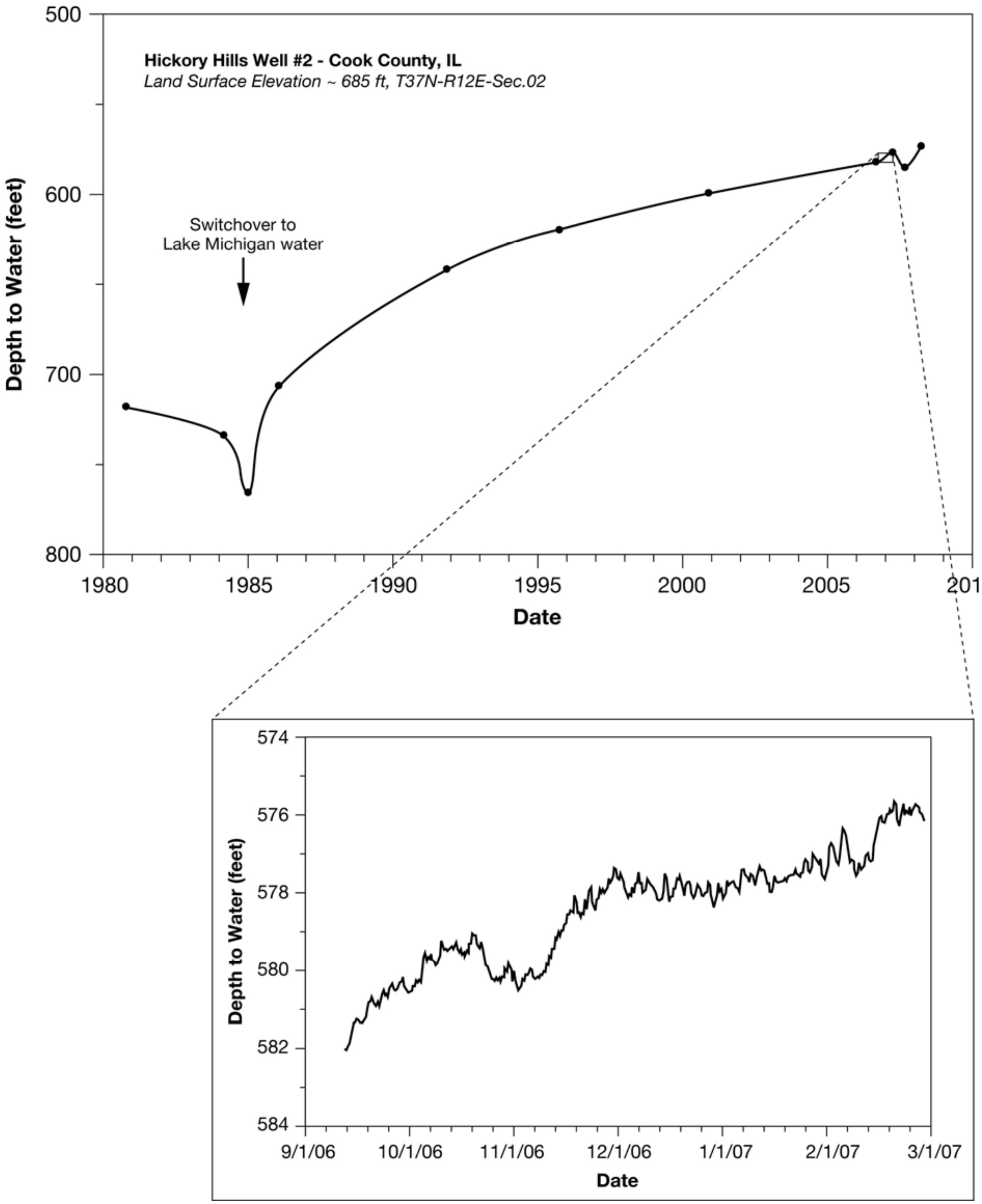


Figure 9. Comparison of daily groundwater fluctuations with the long-term trend

Summary and Conclusion

In response to expanding urban development and a growing interest in regional water resources development, a field investigation of groundwater levels was made in northeastern Illinois. This report presents observations from a 14-county area extending from Lake Michigan to north-central Illinois and from the Wisconsin border south to Kankakee County. Groundwater levels were measured in 330 deep sandstone wells during fall 2007, and where possible, were compared with the 2000 measurement. Typically these wells are 800 to 1700 feet deep and require specialized measuring equipment.

Depths to groundwater levels in deep wells can be measured by using compressed air and pressure gages. These data can be converted so that the groundwater level can be plotted on a map as an elevation above or below the National Geodetic Vertical Datum, commonly referred to as mean sea level. By contouring points of equal elevation, the groundwater surface can be mapped. Such a potentiometric map is important because the general direction of groundwater flow can be inferred from the contour pattern. Furthermore, the influence of withdrawals and changes in withdrawals can be examined on a potentiometric map.

The 2007 potentiometric surface shows a pattern of groundwater flow east and west from a small divide in northeastern Illinois and southeastern Wisconsin. Deviations from this pattern occur in Illinois, especially in northern Cook County, near Joliet, and near DeKalb. Groundwater also flows south in LaSalle County and discharges to the Illinois River.

Comparison of the 2000 and 2007 potentiometric surface maps indicates groundwater declines in the eight-county Chicago region have resumed. Large portions of the study area again have water-level decreases of 25 to 50 feet. This contrasts with the 2000 measurement that observed generally diminishing changes.

The largest drawdown of groundwater levels occurred in southeastern Kendall County. New wells, built since 2003 by Joliet, have caused the potentiometric surface to decline by up to 400 feet. It is anticipated that the drawdown associated with these new wells will stabilize and that future changes will be similar to those in the surrounding region. Declines of 50 and 100 feet also continued at the Aurora pumping center and at the developing pumping center in northern Kendall County.

The water allocation program that substituted Lake Michigan water reduced groundwater withdrawals from the deep sandstones for 10 to 15 years. Today, however, the trend has reversed because of growing usage of groundwater from the deep sandstones, causing a return to declining groundwater levels throughout many inland counties of northeastern Illinois.

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Appendix. Water-Level Elevations of the Deep Sandstone Aquifers in Northern Illinois, 2000 and 2007

Appendix. Water-Level Elevations of the Deep Sandstone Aquifers in Northern Illinois, 2000 and 2007

County location	*Well no.*	*Owner*	*Depth ft.*	*Surface elevation ft.*	*Water-level elevation 2000, ft.*	*Water-level elevation 2007, ft.*	*Water-level change, ft.*
Boone							
44N03E24.8a	6	Belvidere	868	784	726		
44N03E25.7c	2	Belvidere	1861	763	743		
44N03E25.8b	3	Belvidere	1803	765	759	741	-18
44N03E26.1e	4	Belvidere	1801	778	721	711	-10
44N03E34.2a	8	Belvidere	1393	780	640	574	-66
44N03E35.1f	5	Belvidere	610	800	734	734	0
44N03E36.2g	7	Belvidere	969	840	620	635	15
Cook							
35N14E19.4c	22	Chicago Heights	1800	677		250	
35N14E21.2h	2	Rhodia Co.	1796	640	172		
36N12E02.5h	11	Orland Park	1683	712	101	109	8
36N12E22.6b	3	Citizens Fernway Utilities	1712	720	-65		
36N13E09.8b	1	Oak Forest	1701	672	132	145	13
37N12E02.8h	2	Hickory Hills	1610	685	86		
37N13E26.1g	2	Oak Hill Cemetery	1637	617	223	205	-18
		Metropolitian Sanitary District	1684	590		217	
37N14E27.5e	3	Western Springs	1540	673	63	48	-15
38N12E05.8d	4	Western Springs	1910	642	74	54	-20
38N12E06.6b	3	R.M.L. Speciality Hospital	1540	685	38	37	-1
38N12E18.8g	13	CPC International, Inc.	1525	600		44	
38N12E23.2g	1	Tootsie Roll Industries	1565	617	132	159	27
38N13E27.5g	2	Froedtert Malt Co.	1966	594	155		
38N14E07.6d	4	Bellwood	1965	645	140	240	100
39N12E08.5g	3	Bellwood	1480	624	133	143	10
39N12E09.5a	5	Bellwood	1834	627	163	183	20
39N12E16.2f	3	Streamwood	1410	820	315	314	-1
41N09E23.5g	2	Hanover Park	1429	828	247	210	-37
41N09E36.3f	4	Hanover Park	1434	820	282	283	1
41N09E36.6b	10	Hoffman Estates	1357	810	262	250	-12
41N10E06.5b	21	Schaumburg	1355	735	99		
41N10E12.3g	20	Schaumburg	1440	800	153	120	-33
41N10E21.1f	3	Hanover Park	1952	798	281	277	-4
41N10E31.3e	11	Elk Grove Village	1367	725		-51	
41N10E36.8b	6	Rolling Meadows	1602	694	186	131	-55
41N11E08.3a	0	Arlington Heights Park Dist	1300	705		185	
41N11E09.4d	12	Arlington Heights	1780	714	164	179	15
41N11E16.2h	16	Mt. Prospect	1961	675		185	
41N11E23.7f	7	Des Plaines	1815	655	284	287	3
41N11E25.2h	2	Elk Grove Village	1395	682		175	
41N11E26.8a	9	Elk Grove Village	1403	681	91	121	30
41N11E27.3f	14	Elk Grove Village	1390	702		-113	
41N11E31.3a	6	Elk Grove Village	1396	680		170	
41N11E35.8f	4	Willow Creek Church	947	840	252	249	-3
42N09E25.5g	1	Sears Roebuck & Co.	1380	845	245	235	-10
42N09E32.6e	1	Allstate Insurance Co.	1250	850	299	280	-19
42N09E34.7a	3	Allstate Insurance Co.	1370	850	316	304	-12
42N09E34.8a	15	Palatine	1603	750	252	240	-12
42N10E01.8f	10	Palatine	1995	750	273	252	-21
42N10E14.6h	1	Rolling Meadows	1535	715		170	
42N10E25.1b	2	Rolling Meadows	1401	710		201	
42N10E25.6b	4	Arlington Park Jockey Club	1906	728	68	183	115

Appendix (continued)

County location	*Well no.*	*Owner*	*Depth ft.*	*Surface elevation ft.*	*Water-level elevation 2000, ft.*	*Water-level elevation 2007, ft.*	*Water-level change, ft.*
42N10E25.8g	5	Rolling Meadows	1555	733	196	208	12
42N10E26.4h	5	Wheeling	1282	650	7	35	28
42N11E03.3b	1	Buffalo Grove	1335	725	135		
42N11E05.8e	13	Arlington Heights	1795	730	220	220	0
42N11E06.6c	11	Arlington Heights	1647	689	226	234	8
42N11E08.1a	7	Wheeling	1222	661	154	138	-16
42N11E10.7a	2	Prospect Heights	1318	648	118	118	0
42N11E26.4h	17	Mt. Prospect	1947	663	143	168	25
42N11E27.5h	6	Old Orchard Country Club	1370	670		165	
42N11E27.7f	4	Mt. Prospect	1375	693		3	
42N11E33.3b	5	Mt. Prospect	1820	670		160	
42N11E34.4g	3	Sunset Ridge Country Club	1396	655	133	134	1
42N12E14.2a	2	Sunset Ridge Country Club	1247	655	161	160	-1
42N12E14.2c	1	Northbrook Park District	1311	640		155	
42N12E15.5g	3	Mission Hills Country Club (1)	1400	660		95	
42N12E18.3e	1	Donlen Corp.	1300	660	113	133	20
42N12E18.4a	3	Allstate Insurance Co.	1401	662	83	102	19
42N12E19.1b	1	Allstate Insurance Co.	1400	663	90	103	13
42N12E19.1c	2	Allstate Insurance Co.	1404	663	15	121	106
42N12E19.1d	4	Allstate Insurance Co. (G)	1400	655	105	128	23
42N12E19.2a	2	Allstate Ins. - Willow Rd South	1400	657	88	118	30
42N12E19.2e	2	Culligan U.S.A.	1380	655	85	75	-10
42N12E19.2h	1	Allstate Ins. Co. - West Plaza South	1352	640	103	168	65
42N12E19.3a	1	Allstate Ins. - Willow Rd North	1400	655	73	113	40
42N12E19.3f	2	Allstate Ins. Co. - West Plaza North	1328	650	115	102	-13
42N12E19.4b	1	Sunset Mobile Home Park	1415	626		213	
42N12E23.6b	3	North Shore Country Club	1444	640	130	150	20
42N12E36.8f	2	Westmoreland Country Club	1477	630		100	
DeKalb							
37N05E32.1c	1	Somonauk	190	685	657	667	10
37N05E32.1c	2	Somonauk	502	685	661	678	17
37N05E36.7h	1	Sandwich	600	667	646	648	2
37N05E36.7h	2	Sandwich	600	667		651	
38N05E14.4d	3	Hinckley	605	740	719	721	2
38N05E15.2d2	4	Hinckley	612	740	664	867	203
40N04E01.4e	7	Sycamore	1233	835	512		
40N04E10.7b	14	DeKalb	1313	890	589	590	1
40N04E13.2h	11	DeKalb	1312	885	580	576	-4
40N04E15.7a	6	DeKalb	1291	855	597		
40N04E16.1g	1	Suburban Apts & Estates	805	880		767	
40N04E16.2g	2	Suburban Apts & Estates	970	883		742	
40N04E21.4f	10	DeKalb	1310	880	616	623	7
40N04E26.6e	7	DeKalb	1320	885	544	562	18
40N04E33.1h	12	DeKalb	1200	862	612	627	15
40N04E34.5c	13	DeKalb	1222	865	635	615	-20
40N05E04.1g	9	Sycamore	1285	853		583	
40N05E05.5e	5	Sycamore	1270	872		587	
40N05E06.7a	8	Sycamore	1300	880	651	606	-45
40N05E29.3g	3	Cortland	1307	892	620		
41N05E32.1g	3	Sycamore	1002	845	759		
41N05E32.3e	1	Sycamore	902	870	800		
41N05E32.7g	6	Sycamore	1214	845	600		

Appendix (continued)

County location	*Well no.*	*Owner*	*Depth ft.*	*Surface elevation ft.*	*Water-level elevation 2000, ft.*	*Water-level elevation 2007, ft.*	*Water-level change, ft.*
42N03E26.3h	0	Kirkland	737	767	731	748	17
42N03E26.3h	1	Kirkland	630	764		762	
42N03E27.6e	3	Kirkland	560	790		694	
42N05E19.4b	3	Genoa	732	830	685	716	31
42N05E20.7a	4	Genoa	770	847	626	673	47
DuPage							
38N09E01.5a	28	Naperville	1490	730	120		
38N09E22.2h	26	Naperville	1500	700	103	63	-40
38N10E08.5h	24	Naperville	1560	772	92	72	-20
38N10E18.3d	25	Naperville	1491	695	100	80	-20
38N10E30.4d	16	Naperville	1481	690	95	65	-30
38N10E33.4h	20	Naperville	1572	748	46	51	5
38N11E03.7e	13	Westmont	1578	740	70	30	-40
38N11E11.5c	7	Clarendon Hills	1585	722	72	63	-9
38N11E23.5e	3	Willowbrook	1620	734	87		
38N11E28.1c	4	Darien	1612	767	65		
39N09E04.1b	3	West Chicago	1365	762	241*	105	-136**
39N09E05.4d	5	West Chicago	1372	751	221	171	-50
39N09E08.4b	9	West Chicago	1402	751	79	-11*	-90**
39N09E15.7h	4	West Chicago	1465	746	145		
39N11E04.1e	7	Villa Park	1419	702	107	-93*	-200**
39N11E09.2h	2	Villa Park	2125	699	149		
39N11E10.1h	4	Elmhurst	2205	669	136		
39N11E15.8d	10	Villa Park	1458	685	113	-120*	-233**
39N11E20.7a	8	Lombard	1630	775	92	-63*	-155**
39N11E24.3b	5	Oak Brook	1503	680	75	80	5
39N11E27.6g	7	Oak Brook	1513	715	33	-30	-63
39N11E33.6h	6	Oak Brook	1522	695	101	370*	269**
40N09E03.5b	7	Bartlett	1996	812	202	154	-48
40N09E11.6h	4	Bartlett	1985	770	235	193	-42
40N09E13.8d	8	Bartlett	1445	793	234	208	-26
40N09E19.3a	10	West Chicago	1425	750	186	120	-66
40N10E20.4g	8	Bloomingdale	1415	765			
40N11E03.5e	8	Elk Grove Village	1403	698		178	
40N11E10.4h	5	Wood Dale	1400	695		155	
40N11E16.6g	7	Wood Dale	1356	693	25		
40N11E26.2h	6	Bensenville	1900	684	144		
40N11E35.5e	6	Elmhurst	1476	703	90	-31*	-121**
Grundy							
31N08E04.1a	4	Gardner	1933	588	332	332	0
31N08E04.2a	5	Gardner	1929	587	360	327	-33
31N08E04.2b	3	Gardner	973	586		327	
33N07E04.2a	3	Morris	1485	523	327	335	8
33N07E04.4c	5	Morris	1462	506	293	310	17
33N07E09.4h	7	Morris	1449	510		290	
33N08E34.1d	5	Coal City	1785	560	299		
33N08E36.4a	2	Diamond	850	565		263	
33N08E36.5a	1	Diamond	723	562	462	450	-12
34N08E01.3e	3	Minooka	1508	610		172	
34N08E01.3e	4	Minooka	725	610	342	325	-17
34N08E21.3f	2	Alcoa Engineered Products	1515	525	164		
34N08E21.4f	3	Alcoa Engineered Products	1540	528	168		
34N08E28.5f	5	Equistar	1455	502	103		

Appendix (continued)

County location	*Well no.*	*Owner*	*Depth ft.*	*Surface elevation, ft.*	*Water-level elevation 2000, ft.*	*Water-level elevation 2007, ft.*	*Water-level change, ft.*
34N08E35.1e	2	Comm. Ed. - Dresden Station	1500	515	281		
34N08E35.1g	1	Comm. Ed. - Dresden Station	1499	519	304		
34N08E35.4d	2	General Electric Co.	788	533	305	305	0
Kane							
38N07E05.2d	1	Waubonsee College	1323	703	438	395	-43
38N07E19.7e	4	Sugar Grove	1475	705	427	401	-26
38N07E22	11	Sugar Grove	1400	700		-192*	
38N07E24.6h	21	Aurora	1447	670	199	2	-197
38N07E25.5b	23	Aurora	1420	670	127	34	-93
38N08E01.2c	20	Aurora	1400	715	168	87	-81
38N08E03.6g	5	North Aurora	1330	700	148	142	-6
38N08E04.3g	3	North Aurora	1305	675		110	
38N08E04.8d	4	North Aurora	994	689	126	25	-101
38N08E05.2c	6	North Aurora	1335	687		121	
38N08E08.3a	25	Aurora	1460	695	73	61	-12
38N08E16.4d	17	Aurora	2152	685	226	138	-88
38N08E19.5a	19	Aurora	1424	685	138	74	-64
38N08E24.7c	18	Aurora	1486	715	226	72	-154
38N08E29.2h	15	Aurora	1719	665	108	88	-20
38N08E32.4f	4	Montgomery	1353	641		-31	
38N08E33.7c	3	Montgomery	1336	635	92		
38N08E34.6b	8	Montgomery	1378	665	76		
38N08E34.8g	16	Aurora	2139	660	280	115	-165
39N07E05.7f	4	Elburn	1353	840	454	536*	82**
39N07E08.4f	5	Elburn	1400	805		385	
39N08E02.4c	5	Geneva	2292	753	319		
39N08E03.5e	1	Burgess Norton Mfg. Co.	1308	760	362	314	-48
39N08E03.8g	3	Geneva	2300	759	299		
39N08E06.1a	12	Geneva	1310	765		332	
39N08E09.8h	6	Geneva	1350	758	280		
39N08E11.7e	7	Geneva	2001	730	249		
39N08E18.2e	11	Geneva	1300	705		222	
39N08E18.2f	10	Geneva	1300	705		218	
39N08E22.3e	2	Batavia	2200	667	238	201	-37
39N08E22.3e	3	Batavia	2200	667	423		
39N08E23.8f	4	Batavia	1357	721	237	238	1
39N08E26.6g	5	Batavia	1437	780	190	95	-95
39N08E31.1a	13	Geneva	1310	735		287	
39N08E33.5g	2	Mooseheart Home	1508	704	209	232	23
39N08E33.5g	3	Mooseheart Home	1386	713	254	285	31
39N08E34.4a	7	North Aurora	1332	710		-50*	
40N06E30.5a	4	Maple Park	960	862	600	595	-5
40N06E30.7a	5	Maple Park	1300	863			
40N07E23.3f	2	Wasco Sanitary Dist. Water System	870	805		256	
40N07E23.3g	3	Wasco Sanitary Dist. Water System	1308	805		393	
40N07E24.5d	1	Wasco Sanitary Dist. Water System	875	800	439		
40N07E32.8b	3	Elburn	1393	900	492	460	-32
40N08E09.1h	1	Silver Glen Estates (south well)	705	735	432		
40N08E24.6g	1	Royal Fox Golf Course	1345	760	332	338	6
40N08E25.4a	8	St. Charles	1368	761	391	350	-41
40N08E27.5a	3	St. Charles	2200	690	282	254	-28
40N08E27.6b	4	St. Charles	2200	692	289	272	-17
40N08E31.6f	5	Illinois Youth Center	1292	763	420	339	-81
40N08E31.6h	4	Illinois Youth Center	1322	790	384	346	-38

Appendix (continued)

County location	*Well no.*	*Owner*	*Depth ft.*	*Surface elevation, ft.*	*Water-level elevation 2000, ft.*	*Water-level elevation 2007, ft.*	*Water-level change, ft.*
40N08E34.6e	5	St. Charles	2226	764	336	303	-33
41N06E09.1g	2	Burlington	1105	922		548	
41N06E09.1g	3	Burlington	1105	925	567	563	-4
41N07E19.4d	3	Central School District #301	1035	1040		542	
41N08E11.1h	2	Elgin (Slade Ave. #2)	1965	723	290		
41N08E11.1h	3	Elgin (Slade Ave. #3)	1960	725	298		
41N08E11.2g	1	Elgin (Slade Ave. #1)	2000	721	345		
41N08E11.2g	5	Elgin (Slade Ave. #5)	1225	720	310		
41N08E11.3f	6	Elgin (Slade Ave. #6)	1300	720	277		
41N08E16.4c	701	Elgin (1A)	1305	858	275		
41N08E16.4d	702	Elgin (2A)	1353	861	335		
41N08E16.4d	703	Elgin (3A)	1378	866	335		
41N08E16.7c	705	Elgin (5A)	1310	815	286		
42N06E11.116h	7	Hampshire	997	955		512	
42N06E16.2g	10	Hampshire	1200	875		526	
42N06E21.2b	5	Hampshire	818	878		560	
42N06E21.3b	6	Hampshire	1195	878		633*	
42N07E09.7d	7	Huntley	1268	905	457	397	-60
42N07E25.3c	4	Gilberts	1330	893		383	
42N08E04.8d	10	Algonquin	1315	880	305	298	-7
Kendall							
35N06E05.6a	3	Newark	336	690	601	600	-1
35N06E06.2e	2	Newark	287	663	577	575	-2
35N07E04.5a	7	Central Sod Farms	685	662		420	
35N08E01.5h	28	Joliet	1554	660		-100	
35N08E11.4g	25	Joliet	1533	600		-141	
35N08E12.7h	27	Joliet	1523	630		-63	
36N06E17.8c	4	Dickson Valley Camp	140	590		568	
36N07E06.1g	1	Fox Lawn Subdivision	715	665		435	
36N07E16.5g	1	IL Dept of Transportation	750	725		458	
36N07E31.5d	6	Central Sod Farms	500	695		541	
36N08E25.8a	21	Joliet	1565	665		-16	
36N08E28.7f	2	Central Sod Farms	900	602		470	
36N08E35.1a	20	Joliet	1556	662		21	
37N07E10.1g	7	Yorkville	1527	770		141	
37N07E11.2a	8	Yorkville	1384	650		233	
37N07E15.2b	9	Yorkville	1368	639		259	
37N07E28.8b	4	Yorkville	1393	628	305	254	-51
37N07E31.5b	1	Hoover Outdoor Ed. Center	850	640	451	440	-11
37N07E32.1e	3	Yorkville	1335	584	311	299	-12
37N08E05.6e	2	Fox Metro Wtr Reclam. Dist.	1288	628	129	80	-49
37N08E05.9f	1	Caterpillar Tractor Co.	1379	661		65	
37N08E06.2d	3	Caterpillar Tractor Co.	1352	661		66	
37N08E06.2f	2	Caterpillar Tractor Co.	1346	660		54	
37N08E07.2b	6	Oswego	1392	652	132	53	-79
37N08E11.1h	7	Oswego	1535	735	75	-1	-76
37N08E11.4e	9	Oswego	1514	715		23	
37N08E20.3c	8	Oswego	1440	656		39	
37N08E20.8h	3	Oswego	1372	640	200	154	-46
37N08E30.1e	10	Oswego	1397	635		76	

Appendix (continued)

County location	*Well no.*	*Owner*	*Depth ft.*	*Surface elevation ft.*	*Water-level elevation 2000, ft.*	*Water-level elevation 2007, ft.*	*Water-level change, ft.*
Lake							
43N09E11.2a	2	Lake Barrington Shores	1305	815	356	266	-90
43N10E06.5b	1	Wynstone Water Co.	1000	850	215	203	-12
43N10E06.5b	3	Wynstone Water Co.	1000	850	306	262	-44
43N10E06.5c	2	Wynstone Water Co.	1000	860	270	259	-11
43N10E06.6c	5	Wynstone Water Co.	1332	860		206	
43N10E06.7b	4	Wynstone Water Co.	1321	830	205	136	-69
43N10E07.1a	11	Lake Zurich	1358	838	233	183	-50
43N10E09.2e	1	Aqua Illinois-Hawthorn Woods	1320	872		184	
43N10E09.2e	3	Aqua Illinois-Hawthorn Woods	1320	872		148	
43N10E13.2g	3	Fields of Long Grove	980	741	161		
43N10E15.2d	2	Kemper Lakes Business Center	1402	796		164	
43N10E16.4d	8	Lake Zurich	1373	868	217	192	-25
43N10E16.8f	12	Lake Zurich	1359	860	210	179	-31
43N10E19.4h	10	Lake Zurich	1340	850	210	180	-30
43N10E21.5e	7	Lake Zurich	1333	846	198	192	-6
43N10E23.2b	1	Glenstone Subdivision	980	750	198		
43N10E29.2h	9	Lake Zurich	1365	875	211	196	-15
43N11E09.4a	8	Vernon Hills (Well 3)	1290	700	233	211	-22
43N11E18.4d	1	Royal Melbourne Golf Course	1290	740	197	94	-103
43N11E18.5a	3	Royal Melbourne Homeowner Assn.	925	725	156		
43N11E18.6a	2	Royal Melbourne Homeowner Assn.	958	725	159		
43N11E18.7a	1	Royal Melbourne Homeowner Assn.	945	725	176		
43N11E19.1d	1	Briarcrest Subd. Homeowners Assn.	960	690	243	216	-27
43N11E19.1d	3	Briarcrest Subd. Homeowners Assn.	940	695	193	169	-24
43N11E21.3g	1	Powernail Co.	1258	685	165		
43N11E22.6d	3	Lincolnshire	1300	667	217	206	-11
43N11E34.2g	6	Pekara Subdivision	980	642	124	113	-11
43N12E30.4f	1	Deerfield Park District	1375	660	177	177	0
43N12E31.6e	1	Baxter Corp. Headquarters	1456	685	156	77	-79
43N12E33.3h	1	Briarwood Country Club	1333	680	178	180	2
44N09E02	4	Volo	1247	780		276	
44N09E02	5	Volo	1268	780		316	
44N09E12.4h	7	Wauconda	1020	805		261	
44N09E24.5d	4	Wauconda	1264	792	322	261	-61
44N10E25.1c	10	Mundelein	1420	760	220	153	-67
44N10E33.4d	3	Hawthorn Woods Country Club	1400	809			
44N10E35.5b	4	Countryside Lakes	1085	780	243	243	0
44N11E10.3b	3	Countryside Manor Subdiv	1040	672	259	246	-13
44N11E21.7f	11	Libertyville	1485	703	288	188	-100
44N11E31.4h	8	Mundelein	1383	730		113	
44N11E32.6a	6	Vernon Hills	1912	725	265	300*	35**
44N11E33.5a	7	Vernon Hills	1870	685	230	172	-58
44N12E21.8f	4	Lake Bluff #2	1804	680	385	352	-33
45N09E22.3d	2	Volo	1012	790	371	414	43
45N09E22.4c	1	Volo	975	790	345		
45N09E36.6c	1	Baxter Healthcare	1410	810	353	322	-31
45N10E15.7e	6	Round Lake Beach	1287	790	410		
45N10E26.2b	4	Grayslake	1354	780	328		

Appendix (continued)

County location	*Well no.*	*Owner*	*Depth ft.*	*Surface elevation, ft..*	*Water-level elevation 2000, ft.*	*Water-level elevation 2007, ft.*	*Water-level change, ft.*
45N10E30.3d	3	Round Lake	1241	791	372	311	-61
45N11E07.1b	7	Grandwood Park	1020	772	356	340	-16
45N11E30.1a	2	Wildwood	1845	785	345	325	-20
45N11E30.4g	4	Wildwood	1320	795	337	337	0
45N11E30.4g	8	Wildwood	1088	795	342	215	-127
45N11E31.5g	7	Wildwood	1320	813	298	288	-10
45N11E32.3f	1	Merit Club	1367	755	305	227	-78
45N11E36.7c	3	Cardinal Health	1415	710	274	304	30
45N11E36.7d	1	Cardinal Health	1421	710	273	288	15
46N10E15.2b	10	Antioch	1300	800		360	
46N11E12.5c	2	Calpine	1170	694		252	
46N11E12.5d	1	Calpine	1170	694		242	
46N12E14.6g	1	U.S. Geological Survey	1203	585	375	366	-9
LaSalle							
33N01E08.1e	9	Peru	2579	641		446	
33N01E08.2f	8	Peru	2764	638	340	408	68
33N01E16.8a	6	Peru	2665	540	348	340	-8
33N01E20.1h	7	Peru	2591	460		261	
33N01E20.2h	5	Peru	2601	465	414	300	-114
33N02E21.2g	3	Starved Rock State Park	401	470	460	458	-2
36N01E29.2d	6	Mendota	1408	771	546	655	109
36N01E32.1a	4	Mendota	1360	740	597	587	-10
36N01E33.3g	3	Mendota	1377	740	583	588	5
36N03E18.4d	3	Earlville	625	703	678	659	-19
Lee							
37N01E08.8c	5	West Brooklyn	680	945	675	694	19
37N02E10.2b	1	Paw Paw	1018	928	728	760	32
37N02E10.2c	2	Paw Paw	1053	945	732	747	15
McHenry							
43N06E04.5d	4	Union	760	841	579	572	-7
43N07E11.6e	3	Lakewood	900	900	429	432	3
43N07E12.5f	16	Crystal Lake	1293	900	422	212*	-210**
43N07E22.2f	11	Lake in the Hills	1256	875	360	180*	-180**
43N07E23.7d	8	Huntley	1260	880	372	411	39
43N07E34.6a	10	Huntley	1330	888	385	417	32
43N08E01	13	Cary	1304	860		332	
43N08E06.3a	6	Crystal Lake	1295	892	321	400	79
43N08E08.2c	8	Crystal Lake	1300	900	406	392	-14
43N08E12.2d	4	Cary	1345	855	358	319	-39
43N08E14.1e	6	Cary	1300	840	334	310	-24
43N08E20.4c	5	Lake in the Hills	910	870	455		
43N08E21.3a	1	Material Service Corp.	1255	835	437		
43N08E21.5a	14	Lake in the Hills	1311	860	173	317	144
43N08E30.4f	15	Lake in the Hills	1260	885		380	
43N08E32.4c	1	The Golf Club of Illinois	1295	910	410		
43N08E33.4h	4	Algonquin	955	870	495		
44N05E35.5h	1	Arnold Engineering	846	818	656	658	2
44N08E33.5a	7	Crystal Lake	1400	930	341	316	-25
44N09E20.6e	9	Island Lake	1337	740	340		
44N09E20.6e	9	Island Lake	1337	745	340		
44N09E20.7d	8	Island Lake	950	740	372	326	-46

Appendix (continued)

County location	*Well no.*	*Owner*	*Depth ft.*	*Surface elevation ft.*	*Water-level elevation 2000, ft.*	*Water-level elevation 2007, ft.*	*Water-level change, ft.*
45N08E10.7a	9	Rohm & Haas	1161	843	526		
45N08E10.7c	8	Rohm & Haas	1160	835	283		
45N08E10.8a	2	Modine Mfg. Co.(owner #1)	1200	843	362		
45N08E10.8d	7	Rohm & Haas	1161	850	390		
46N05E33.8b	2	Dean Foods Co.(owner #1)	1783	880	681	666	-15
46N05E33.8b	4	Dean Foods Co.	825	880	745	714	-31
46N05E36.5g	9	Harvard	1271	1040	657	665	8
Ogle							
40N02E30.3b	8	Rochelle	935	793	696	704	8
Will							
26N09E32.4d	15	Joliet (15D)	1556	620		-80	
32N09E05.6d	3	Braidwood	1733	560	293	270	-23
32N09E08.5c	1	Braidwood	1647	575		230	
32N09E28.1d	2	Exelon Generation (Training Center)	1690	594	353		
34N09E09.4a	1	Channahon	765	570	255	256	1
34N09E10.1h	2	Flint Hills (formerly BP Amoco)	1405	568	-86		
34N09E11.2e	3	Stepan Chemical Co.	1410	525		-189	
34N09E11.2e	4	Stepan Chemical Co.	1415	525		-179	
34N09E11.7g	1	Flint Hills (formerly BP Amoco)	1422	569	-107		
34N09E21.2d	1	Ineos Nova (formerlyBASF Corp.)	1573	545	188	100	-88
34N09E28.5h	1	Dow Chemical Co.	1605	534	182		
34N09E30.5d	4	Channahon	1647	603	216		
34N10E07.5a	1	Peoples Gas SNG Plant	1581	609	52		
34N10E07.6b	2	Peoples Gas SNG Plant	1597	609	7		
34N10E20.4e	6	Elwood	1725	640	120		
34N09E22.7d	1	Exxon Mobil Oil Corp.	1578	555		95	
34N10E30.6a	1	Abraham Lincoln National Cemetery	1665	620	220	177	-43
34N11E09.7a	8	Manhattan	1730	690		-40	
34N11E17.5d	6	Manhattan	1703	685	82		
34N11E21.5f	7	Manhattan	1770	695	198	-6	-204
35N09E09.3c	2	Shorewood	1499	605	65		
35N09E11.1b	10	Joliet (10D)	1572	610		-203	
35N10E06.6g	23	Joliet (23D)	1665	610		-133	
35N10E09.1d	1	Joliet (1D, Ottawa St)	1621	536		-202	
35N10E20.6a	2	Midwest Generation - Station 9, Unit 5	1487	536	-278		
35N10E29.8h	5	Midwest Generation - Station 9, Unit	1505	527	-2		
35N10E30.6e	2	Caterpillar Tractor Co.	1420	546	-104		
35N10E30.6e	4	Caterpillar Tractor Co.	1550	542	-85		
36N09E04.4a	4	Plainfield	1443	620	-9		
36N09E10.7d	3	Plainfield	1480	612	-21		
36N09E16.2a	5	Plainfield	1508	604	-56	-175	-119
36N09E31.6a	17	Joliet (17D)	1525	637		27	
36N10E04.6g	4	Romeoville	1524	670	-64	-79	-15
36N10E06.6f	11	Romeoville	1555	650	-94	-14	80
36N10E07.6a	13	Romeoville	1524	625		-135	
36N10E16.4e	3	Joliet Regional Port Dist. Airport	1523	666	-29		
36N10E23.2f	4	Lockport	1560	650	-109		

Appendix (concluded)

County location	*Well no.*	*Owner*	*Depth ft.*	*Surface elevation ft.*	*Water-level elevation 2000, ft.*	*Water-level elevation 2007, ft.*	*Water-level change, ft.*
36N10E23.6d	2	Lockport	1475	589	-70		
37N09E28.8h	6	Plainfield	1490	670	75	5	-70
37N09E33.2h	7	Plainfield	1500	616		-24	
37N10E29.7h	10	Romeoville	1505	640	-31	-59	-28
37N10E33.1h	2	Romeoville	1520	640	-35	-8	27
Winnebago							
43N02E04.3a	43	Rockford	1500	812	616		
43N02E17.7h	36	Rockford (Unit Well 36)	1505	864	591	564	-27
44N01E02.3b	3	Rockford (Unit Well 3)	1127	760	666		
44N01E09.1c	20	Rockford (Unit Well 20)	1200	735	625		
44N01E14.5h	37	Rockford	1434	740	659		
44N01E17.2d	22	Rockford (Unit Well 22)	1381	760	635	547	-88
44N01E20.7f	21	Rockford (Unit Well 21)	1205	820	690		
44N01E28.5c	18	Rockford (Unit Well 18)	1380	820	670	649	-21
44N01E34.6h	4	Rockford (Unit Well 4)	1219	730	672		
44N02E03.4c	30	Rockford (Unit Well 30)	1325	905	558	578	20
44N02E08.2g	29	Rockford (Unit Well 29)	1357	845	593	541	-52
44N02E11.5g	39	Rockford (Unit Well 39)	1500	890	690		
44N02E16.2a	27	Rockford (Unit Well 27)	1280	840	573	575	2
44N02E18.7a	5	Rockford (Unit Well 5)	1312	792	633	580	-53
44N02E20.4h	13	Rockford (Unit Well 13)	1457	835	583	546	-37
44N02E23.1d	40	Rockford	1466	855	623	620	-3
44N02E26.1c	5	Cherry Valley	1500	820		593	
44N02E28.5h	26	Rockford (Unit Well 26)	1326	835	630		
44N02E29.3a	10	Rockford (Unit Well 10)	1426	865	588		
44N02E31.7f	6	Rockford (Unit Well 6)	1372	790	680	625	-55
44N02E32.4a	16	Rockford (Unit Well 16)	1310	840	540		
44N02E34.3h	42	Rockford (Unit Well 42)	1500	830		571	
44N02E35.6h	2	Cherry Valley	1206	820	650	645	-5
44N02E35.8e	1	Cherry Valley	1201	810	650	658	8
45N02E26.1a	5	Loves Park	1390	890	655		
45N02E33.3a	4	Loves Park	1313	888	588		
45N02E34.4g	3	Loves Park	863	885	796		
46N01E24.8a	6	Rockton	728	828	714	752	38
46N01E25.1d	8	Rockton	660	790		621	
46N02E18.8a	1	Woodward Governor C. - Air	601	765	689		
46N02E18.8a	2	Woodward Governor C. - Air	600	765	686		
46N02E19.7g	7	Rockton	594	753	633	602	-31
46N02E28.1b	6	North Park Public Water Dist.	780	750	693		
46N02E29.1b	7	North Park Public Water Dist.	780	750	696		

Note:
*Indicates value is likely incorrect.
**Indicates calculation was based on data and was not used.