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The Impact of Emergency Pumpage at the Decatur Wellfields on the Mahomet Aquifer:
Model Review and Recommendations

by

George S. Roadcap and Steven D. Wilson

Prepared for the
City of Decatur

June 2001

Illinois State Water Survey
Ground-Water Section
Champaign, Illinois

A Division of the Illinois Department of Natural Resources

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Abstract

The City of Decatur operates a series of ten groundwater wells in DeWitt and Piatt Counties that serve as an emergency water supply in times of low surface water levels in Lake Decatur. The City of Decatur contracted with Layne-Geosciences, Inc. (LGI) to develop a computer model of the groundwater system to simulate the effects of pumpage on the Mahomet Aquifer and surrounding wells. The LGI model was completed in April 1999. In response to lowering lake levels, Decatur began pumping their wells in November 1999 for 84 days at daily rates from 3 million gallons a day (mgd) to 16 mgd.

The Illinois State Water Survey (ISWS) reviewed and tested the LGI model against the known drawdown encountered during the 84 days of operation. The LGI model was found to be only marginally successful in reproducing the measured water levels. The largest error occurred in the Piatt County area where the model significantly overpredicted the drawdown. These errors were the result of several factors, including errors in the aquifer thickness map, calibration to data only within 5 miles of the wellfield, errors in the location of pumping wells, the use of general head boundaries throughout the model, and, most importantly, the absence of a hydraulic connection between the Mahomet Aquifer, the Glasford Aquifer, and the Sangamon River near Allerton Park. Additional data available in the ISWS well records, and new data provided by Decatur through Guillou & Associates, Inc., indicate a connection between the aquifer system and the Sangamon River. Adding this connection represents a change in the conceptual model of the flow system not included in the LGI model. When this connection was added, a much closer match between observed and calculated water levels was obtained.

Future work should focus on developing a more complete understanding of the connections between the aquifer system and the Sangamon River. Those efforts should include a pump test of the Cisco wellfield with complete monitoring of the river and aquifers. Monitoring of water levels at selected locations should continue and expand. The groundwater flow model should be re-calibrated using the new data and the improved understanding of the flow system. The results of these activities can provide an improved assessment of the potential of the Decatur wellfield for future use.

Introduction

For many communities in Illinois, groundwater provides a consistently safe, adequate supply of water. In Decatur, however, the primary source of water is Lake Decatur, which was constructed by damming the Sangamon River as it flows through the city. The Mahomet Aquifer, which lies just 6-12 miles north of Decatur, is a major source of groundwater for east-central Illinois (figure 1). Because of the potential for drought, Decatur has developed an emergency water system that uses ten wells completed in the Mahomet Aquifer. There are eight wells in DeWitt County (DeWitt wellfield) and two wells in Piatt County (Cisco wellfield). Groundwater is pumped into either Friends Creek (DeWitt wellfield) or the Sangamon River (Cisco wellfield) where it eventually travels downstream into Lake Decatur. During use of these wells, it was discovered that the withdrawals by Decatur have an impact on nearby wells. Because of this concern, and because of the potential use of the wellfield in the future, it is important that the effects of future pumpage be understood prior to long-term pumping of the wellfield.

An accurately calibrated computer flow model of an aquifer system will allow the user to simulate pumping scenarios and, to a certain degree, predict the effects of that pumpage on the aquifer system and nearby wells. Decatur contracted with Layne-Geosciences, Inc. (LGI) to develop a computer model of the Decatur wellfield and surrounding areas that may be affected by their pumpage. A model developed by LGI, relying heavily on data provided by the State Scientific Surveys, was completed in April 1999.

In November 1999, central Illinois experienced a moderate drought, and it became necessary for Decatur to use its wellfield to supplement their Lake Decatur water supply. Decatur pumped its wellfield for 84 days, from November 29, 1999 to February 20, 2000. As many as six wells were pumped, with pumpage varying from 3 to 16 million gallons per day (mgd). This use of the wellfield provided an opportunity for Decatur to test the LGI computer model as well. When the City of Champaign noticed additional drawdown at its wellfield during this pumping event, it was suggested that one of the causes might be Decatur’s wellfield. In response to that inquiry, Decatur contracted with the Illinois State Water Survey (ISWS) to evaluate and test the LGI model using the data gathered during the 84-day operation of their wellfield. The ISWS was to review the assumptions and data included in the LGI model, and then test the model against field data collected during wellfield operation. Following those efforts, the ISWS could make appropriate recommendations regarding the use of the LGI model and potential changes that might produce a better match of model results and the field data.

Acknowledgments

This study was funded by the City of Decatur. Tiraz Birdie, LGI, provided the LGI model and associated data. Guillou & Associates provided the water-level data in the appendix and guidance during the project related to available data and historical perspective regarding the Decatur wellfields. Sean Sinclair assisted in preparation of the figures. Al Wehrmann, Doug Walker, Derek Winstanley, and Tom Prickett reviewed this report. Doug Walker provided a nonparametric statistical analysis of the river and water-level data. Eva Kingston edited the

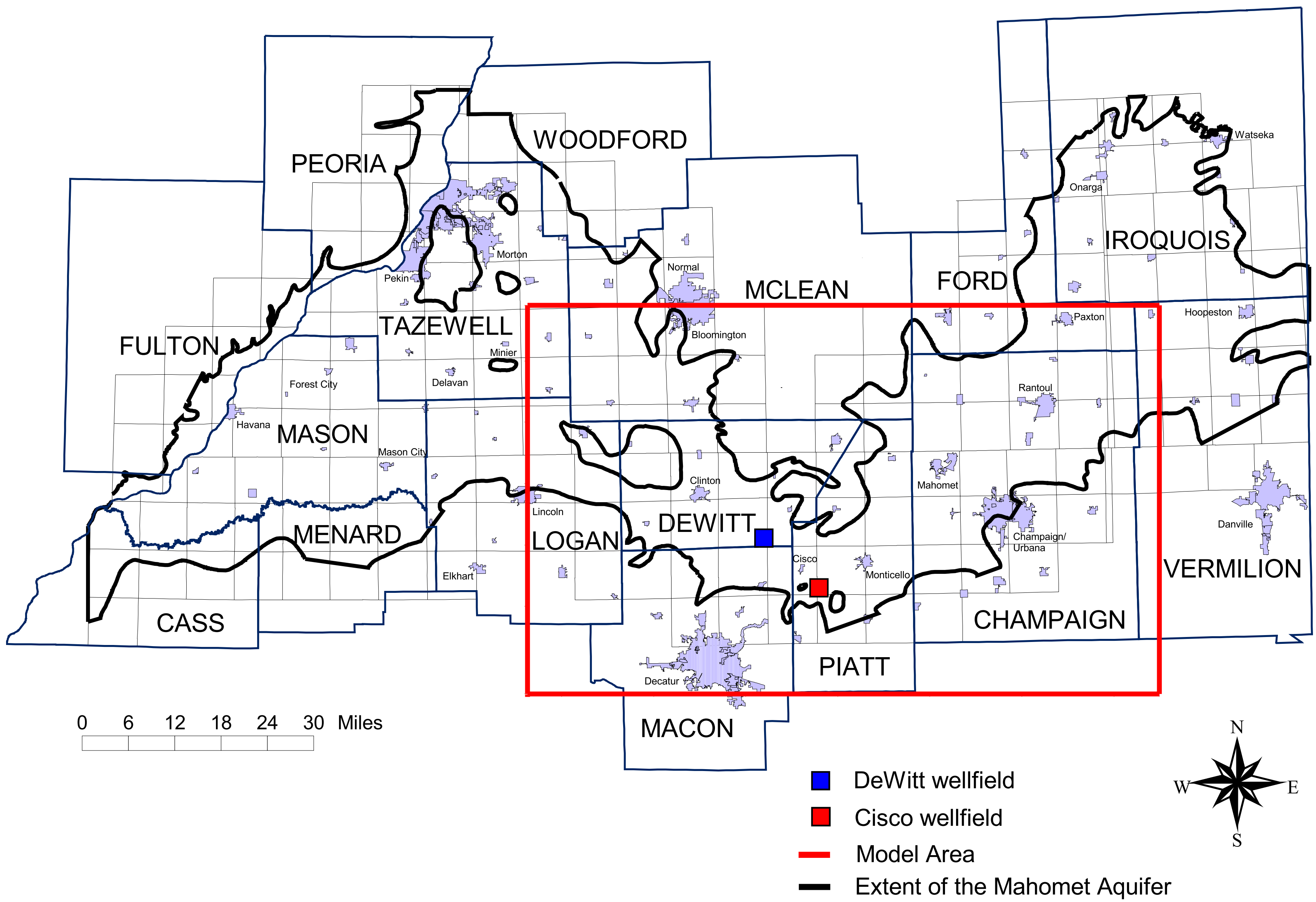

Figure 1. The Mahomet Aquifer in Illinois

report, and Linda Hascall reviewed the figures. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of the City of Decatur.

LGI Model of the Decatur Wellfields

The LGI groundwater flow model of the central portion of the Mahomet Aquifer was constructed for the purpose of evaluating the impacts of pumpage from Decatur's Cisco and DeWitt wellfields. To evaluate this model, the City of Decatur provided the model data files and accompanying report. The finite-difference flow model MODFLOW (McDonald and Harbaugh, 1988), which is generally accepted as the industry standard and also appropriate for the Mahomet Aquifer, was the model that LGI used. The first step in the evaluation process was to use the provided data to verify that the model would return the same results as those reported by LGI. The model files were imported into the MODLFOW pre- and post-processor Visual MODFLOW (Waterloo Hydrogeologic, Inc.,Waterloo, Ontario, Canada). Some manipulation of the data files was required so that Visual MODFLOW would properly recognize the data arrays. Data had to be added for the Cisco wellfield, which were not in the original data files. Using Visual MODFLOW, identical head distributions were replicated for the different scenarios examined by LGI. Figure 2 shows the steady-state, nonpumping head distribution.

For the model of the Mahomet Aquifer, LGI used the latest published information regarding the hydrogeology and aquifer properties. Herzog et al. (1994), Herzog et al. (1995), and unpublished updates prepared by John Kempton (personal communication, November 1998) described the geology of the aquifer system. These reasonable and researched results reflected the current understanding of the system at that time. However, in the LGI model, it appears that these data were modified in the region of the Kenny Bedrock Channel between Clinton and Lincoln. In this region, the thickest part of the Kenney Channel was made inactive, effectively cutting off that area as a component of the flow system. Similarly, for the potentiometric surface mapping, LGI used a map prepared by the ISWS and ISGS (Wilson et al., 1998), which included water levels for the entire Mahomet Aquifer in Illinois. In addition, LGI used published potentiometric surface information from Anliker and Sanderson (1995), which was very detailed in the region of the Decatur wellfields. Along with using published hydraulic property data from the ISWS, LGI conducted a 30-day aquifer test to evaluate the hydraulic properties near the DeWitt wellfield under heavily stressed conditions. Their methods were appropriate for conducting and analyzing the test data, and their results were very similar to other published data.

The two-dimensional LGI model represents only the Mahomet sand explicitly. Leakage through the overlying confining layers from the upper sands was modeled implicitly through the use of *General Head Boundaries*, which are specific representations in MODFLOW. Along the western boundary of the model, constant head nodes were used to constrain the hydraulic head in that area based on water levels mapped by Wilson et al. (1998). No-flow boundaries were used along the northern and southern boundaries of the model where the Mahomet sand pinches out, and along the eastern boundary near Paxton where Wilson et al. (1998) mapped a groundwater divide. A hydraulic conductivity of 350 feet per day (ft/d) was used throughout most of the aquifer except between Monticello and Champaign where conductivity was reduced to 280 ft/d.

The model used a uniform storage coefficient of 0.0004. Groundwater withdrawals in the region were modeled with 84 production wells.

Calibration of LGI Model

While the model appears fairly well calibrated, given LGI's assumptions, an assessment of model accuracy from the LGI report was limited by the lack of a model error map and a comparison of measured versus predicted water levels with distance from the DeWitt wellfield. The LGI report shows the calibration of the model to four observation wells less than 5 miles from the wellfield where the water levels are most likely to match the conditions of the 30-day constant rate pumping test. Because the cone of depression has to extend up and down the valley more than 30 miles to obtain the necessary recharge to balance the 14 mgd of pumpage, a comparison of the model and observed water levels in the shallower part of the cone would have been beneficial. Figure 3 shows a difference map between the measured water levels and those predicted by the model. The largest differences occur in the tributary bedrock valleys and where there are known connections with the overlying aquifers in Tazewell and Champaign Counties. The model allows too much water into the Mahomet Aquifer (blue areas) and not enough water into the Mahomet Aquifer (green areas). The groundwater flow patterns in Champaign County and the shape of the Champaign cone of depression have not been studied in detail, but they appear to be very complex. This makes calibrating a flow model of this area difficult.

Several discrepancies with the simulated pumping wells appear in the LGI model. A map showing the pumping centers would have been useful. In the model, the locations of the eight DeWitt wellfield wells are shifted one mile to the east of their actual location. The wellfield symbol is in the correct location on the figures in the report, but the center of the cone of depression is centered around observation well N, one mile to the east. The location of the pumpage at Monticello appears to be shifted several miles east to the center of Township 18N, Range 6E (T18N, R6E) instead of along the western edge. Another well in the model pumping 485 gallons per minute (gpm) is located near the center of T18N, R5E, which represents all pumpage for that township, presumably based on 1994 data in Anliker and Sanderson (1995). However, most of this pumpage is due to the emergency pumpage at the Decatur wellfield near Cisco in the southwestern corner of the township. Therefore, this simulated pumpage should not be included in the steady-state models.

In the Kenny Bedrock Channel west of Clinton, discrepancies in the aquifer thickness data cause a sudden decrease in drawdown between Clinton and Lincoln (T20N, R1W) without the presence of a nearby boundary. The aquifer thickness data (figure 4) used in the model were based on the map constructed by Kempton et al. (1991) shown in the report; however, the thickness entered into the model cuts off the Kenny Channel so that it is inactive over a significant portion of the channel where it should be active. In addition, the LGI model drapes a thin active area over the large bedrock high where the Mahomet sand is absent; consequently, the model should be inactive at this location (figures 3 and 4). All potentiometric surface and drawdown contours in the LGI model scenarios go through the area where no aquifer is present. This implies that the drawdown near Clinton, which can be as much as 45 feet in some scenarios, may be underestimated because the modeled aquifer has more recharge area than the actual

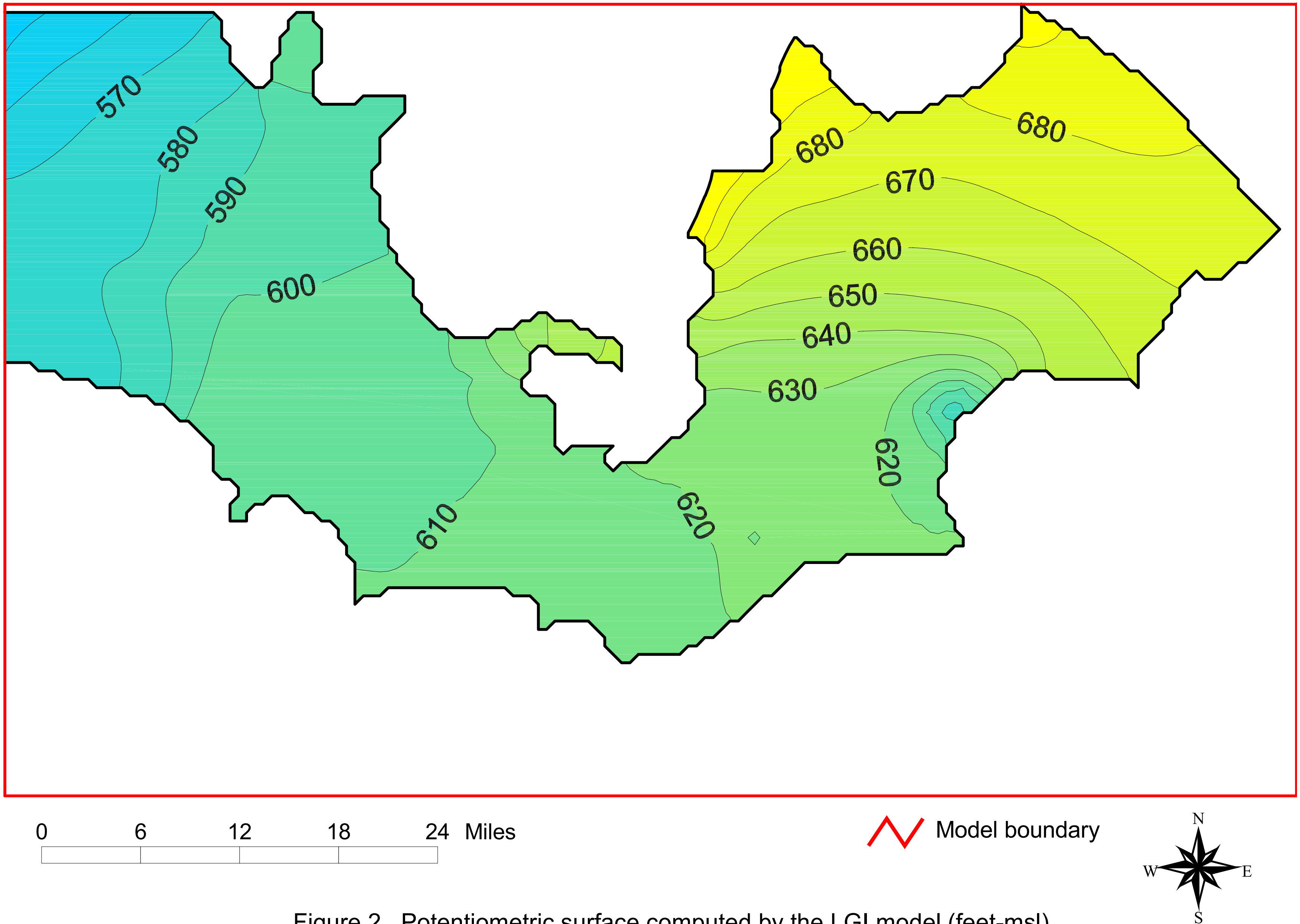

Figure 2. Potentiometric surface computed by the LGI model (feet-msl)

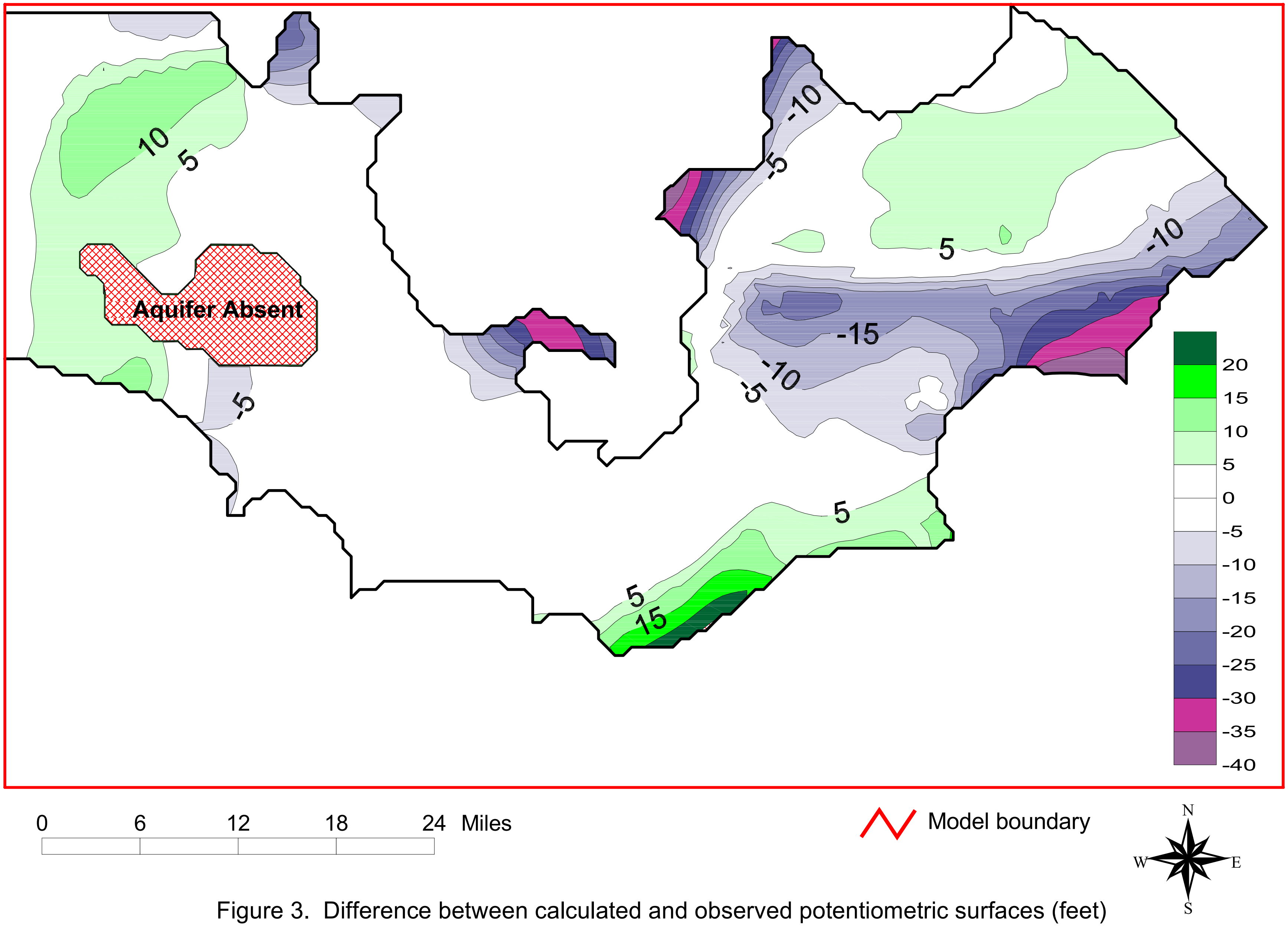

Figure 3. Difference between calculated and observed potentiometric surfaces (feet)

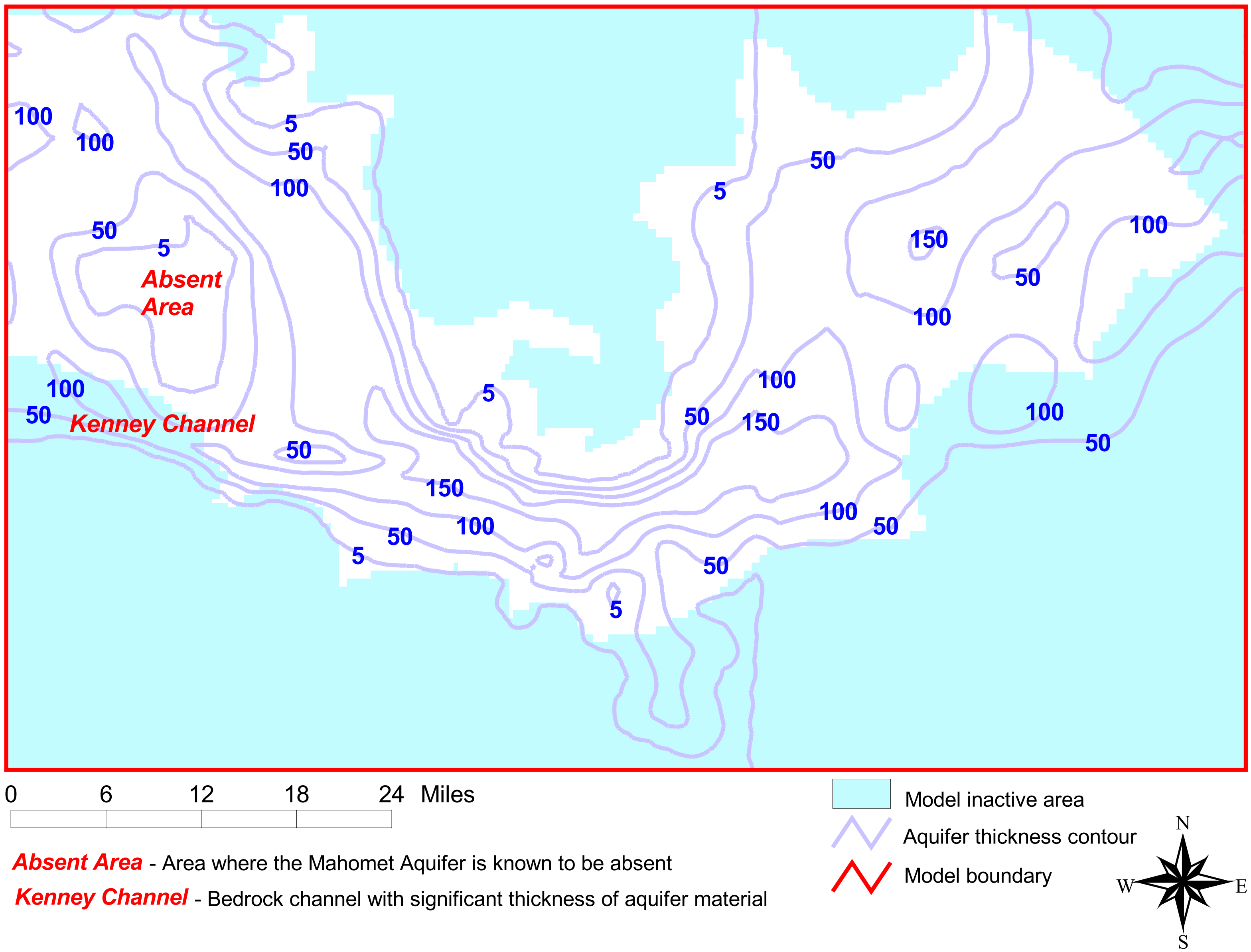

Figure 4. Aquifer thickness from LGI model

aquifer. Conversely, if the Kenny Channel were included, more water could be provided to this area, which may decrease predicted drawdown. The modeled aquifer also contains areas shown on Kempton's map as being comprised of silt, such as the tributary valley north of the DeWitt wellfield. This would cause the model to underestimate drawdown north of the wellfield.

The reliance on general head boundaries to calibrate the LGI model prohibits the examination of any effects related to the Glasford Aquifer. From the sensitivity analysis presented in the LGI report, the model is most sensitive to the leakance assigned to the general head boundary at each cell. The use of this type of boundary can have many drawbacks and unpredictable results when used to represent a three-dimensional aquifer with a two-dimensional model (Michael McDonald, personal communication, October 1998). The general heads assume that the overlying Glasford Aquifer is present everywhere and acts as a constant-head source bed. This approach may be reasonable in the vicinity of the DeWitt wellfield where a thick clay layer separates the Glasford and Mahomet Aquifers. However, the 30-day pumping test showed 0.48 feet of drawdown in the Glasford Aquifer at well OW2-98 (a Glasford Aquifer well installed by LGI at the Dewitt wellfield), indicating that recharge to it may not be sufficient to maintain a constant head. It is not stated in the report how much vertical leakage is induced during the pumping scenarios; however, it may not be reasonable to expect sufficient water to be available in the Glasford Aquifer and for it to leak through the confining clay layer when the vertical gradients are already near a maximum. Because of the assumption that the Glasford Aquifer acts as a constant-head source bed, general head conditions cannot be modified to simulate water levels where the Glasford and Mahomet Aquifers are directly connected.

The vertical hydraulic leakance assigned to the general head boundary ranges from 0.8 feet per day per foot (ft/d/ft) in DeWitt County to 197 ft/d/ft in northern Champaign County. This range was probably necessary to calibrate the model but also suggests that the aquifer system is more complex than can be represented with a two-dimensional model. The sand units have a permeability that is six orders of magnitude greater than the confining glacial till units. Therefore, it is more likely that water is entering directly into the Mahomet Aquifer where the Glasford and the Mahomet Aquifers are connected, such as in Tazewell County (Wilson et al., 1998), than it is to have a more permeable glacial till over a wide area. Such connections could have potentially large implications on the projected impacts of Decatur's pumping on private wells because secondary cones of depression could form in the Glasford Aquifer at these locations. The center of these smaller cones would be located at the connection and drawdown in the Glasford Aquifer could be as much as the drawdown in the Mahomet Aquifer at those points.

One important aquifer interconnection discovered during the current evaluation occurs along the Sangamon River near the Cisco wellfield. Because this connection has a significant impact on the model, it is discussed separately below.

New Data

A review of the ISWS well records for the area revealed some differences in geology overlying the Mahomet Aquifer that had not been included in previous interpretations. Twenty test holes were drilled for the City of Decatur in the 1950s around the Allerton Park area (figure 5). One of these test holes, Boring #2, encountered 205 feet of sand without a confining layer, indicating a connection between the Mahomet Aquifer and shallower Glasford Aquifer. Because so much work had been completed in the area, it was unclear if this drilling log may have been considered unreliable by previous researchers or if it was simply overlooked. A thorough review revealed that these data appeared to be valid and that a connection between the aquifers, and possibly the Sangamon River as well, was likely.

The City of Decatur, through their consultant, Guillou & Associates, provided water-level data for all the observation wells monitored during the 84 days of operation, as well as river stage. This included data for nine observation wells near the DeWitt wellfield, five wells near the Cisco wellfield, and the Sangamon River at Hog Chute Bridge (figure 6). Data for the nine wells near the DeWitt wellfield were provided as continuous measurements on Steven's recorder charts. To prepare these data for analysis, daily values from the charts were entered into a spreadsheet. Figure 7 shows the drawdown recorded at eight observation wells surrounding the wellfield during the 84-day stress period and for the first 20 days of recovery. The recovery at observation Well E was measured for 52 days. For the five wells near the Cisco wellfield and the Sangamon River, weekly measurements were provided in paper form, entered into a spreadsheet, and graphed (figure 8).

Some weeks later, as this work progressed, Guillou & Associates provided monthly water-level information covering the last ten years near the Cisco wellfield that was instrumental in completing the project. Figure 9 plots these data and the appendix includes the data for each plot. These data were "new" information and had not been mentioned in the LGI report.

Other Data

The ISWS also collected data for the 84 days of pumpage at several observation wells being monitored in the area. Specifically, near Seymour, an observation well maintained by the ISWS clearly indicates drawdown in the Mahomet Aquifer during operation of Decatur's wellfield. The Seymour data were not used explicitly in evaluating the LGI model because the water-level data indicate that there may be other influences on the observed drawdown. After the 84 days of pumpage ceased, water levels in the Seymour well began to recover slightly, then reversed, and continued drawdown. This reaction may have been the result of other pumpage in the area, most likely from Equistar Chemical's wells nearby or possibly from pumpage in Champaign.

In discussions with Guillou & Associates, ISWS researchers became concerned about the drilling logs of some of the observation wells near the Cisco wellfield. The logs suggest that OW-2A and OW-2B are more likely to show a hydraulic connection between the Mahomet and Glasford Aquifers than are OW-1A and OW-1B. However, water-level data suggest the opposite is true (figure 9). Guillou & Associates mentioned that the driller had trouble when installing OW-1A and OW-1B. These wells were never downhole logged so the ISWS has requested that the ISGS gamma log the wells in an attempt to verify the geology described by the driller. The ISGS has agreed to log OW-1A during the summer of 2001.

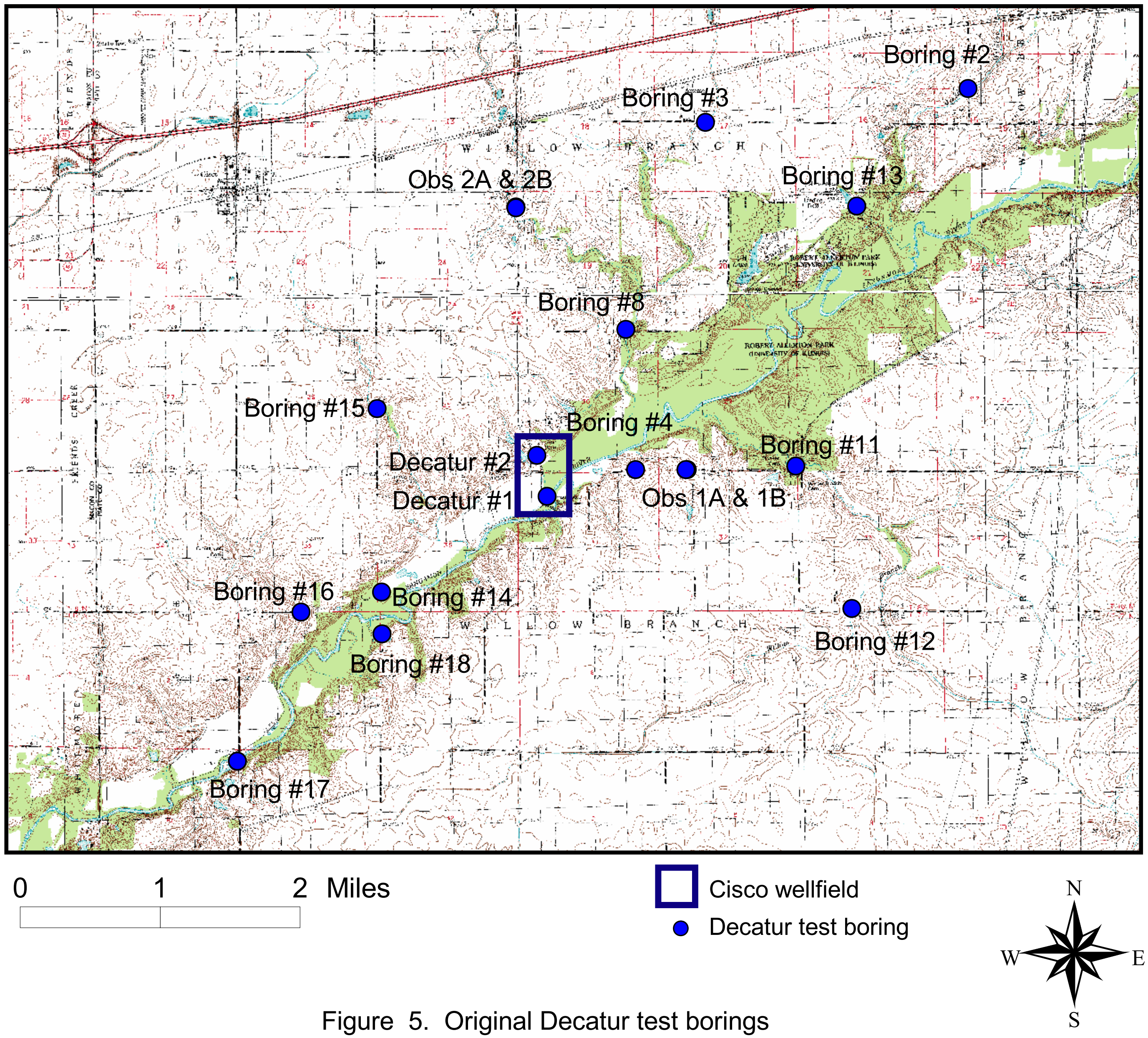

Figure 5. Original Decatur test borings

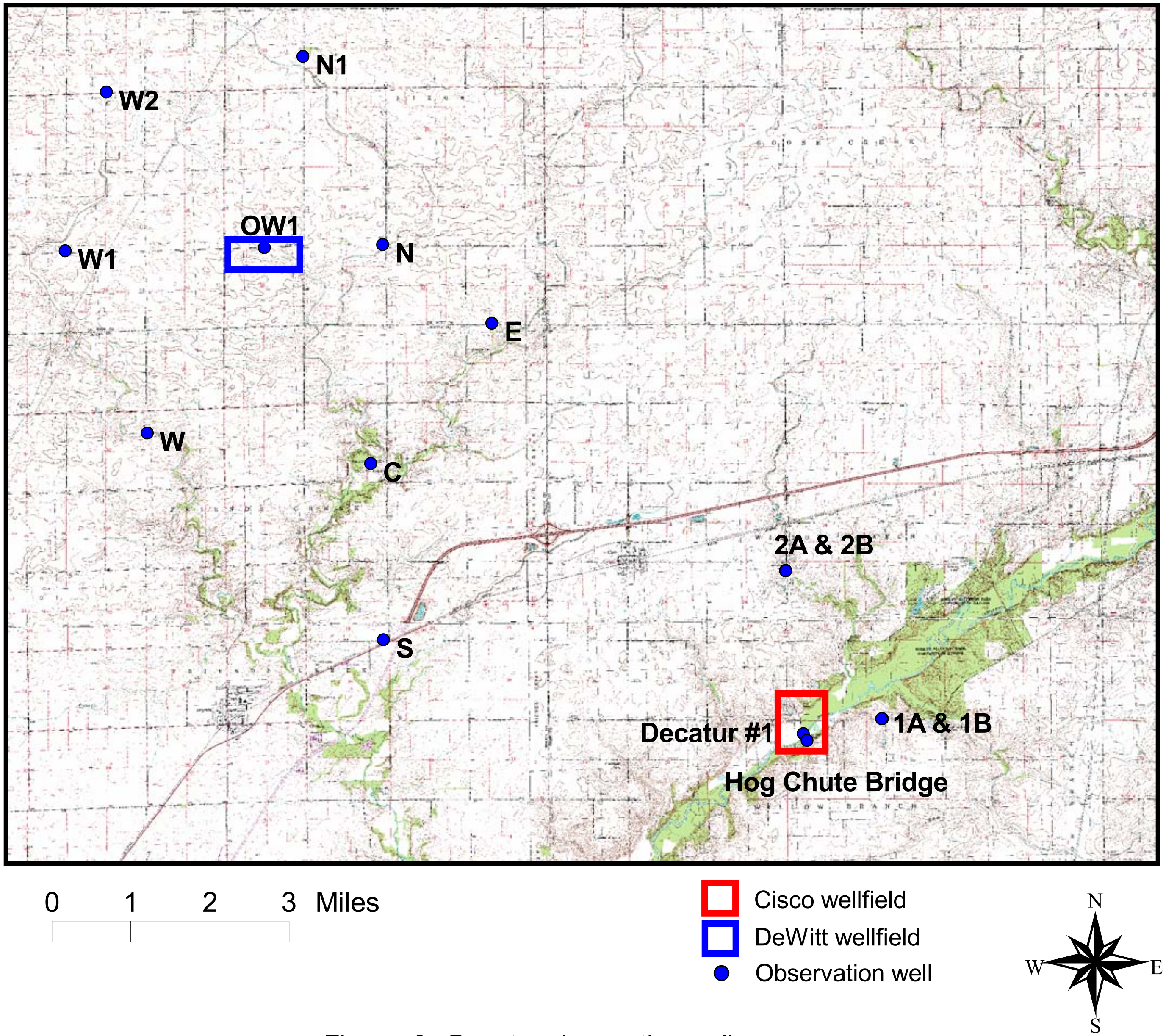

Figure 6. Decatur observation wells

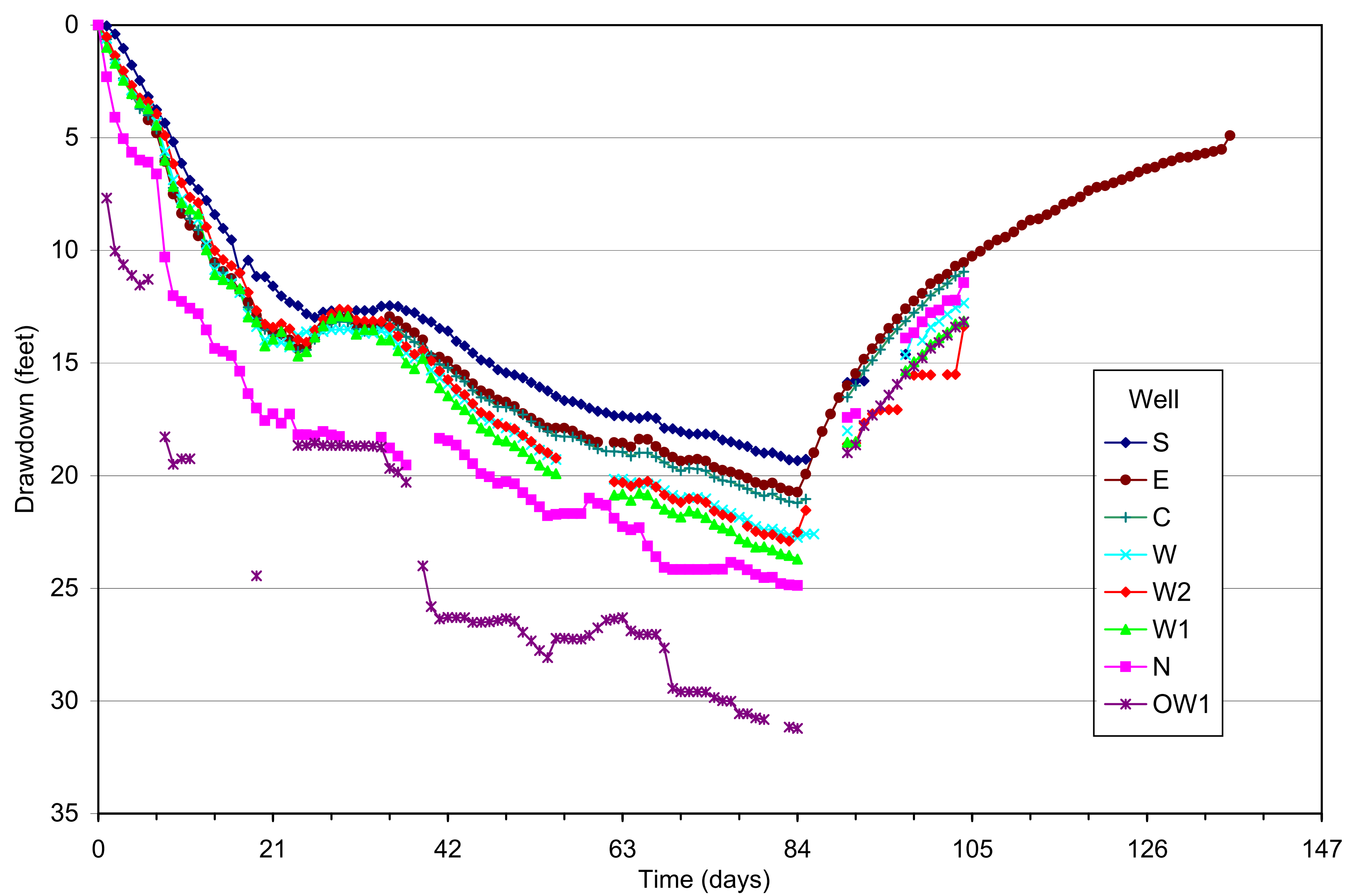

Figure 7. Observed water levels near the DeWitt wellfield during the emergency pumpage

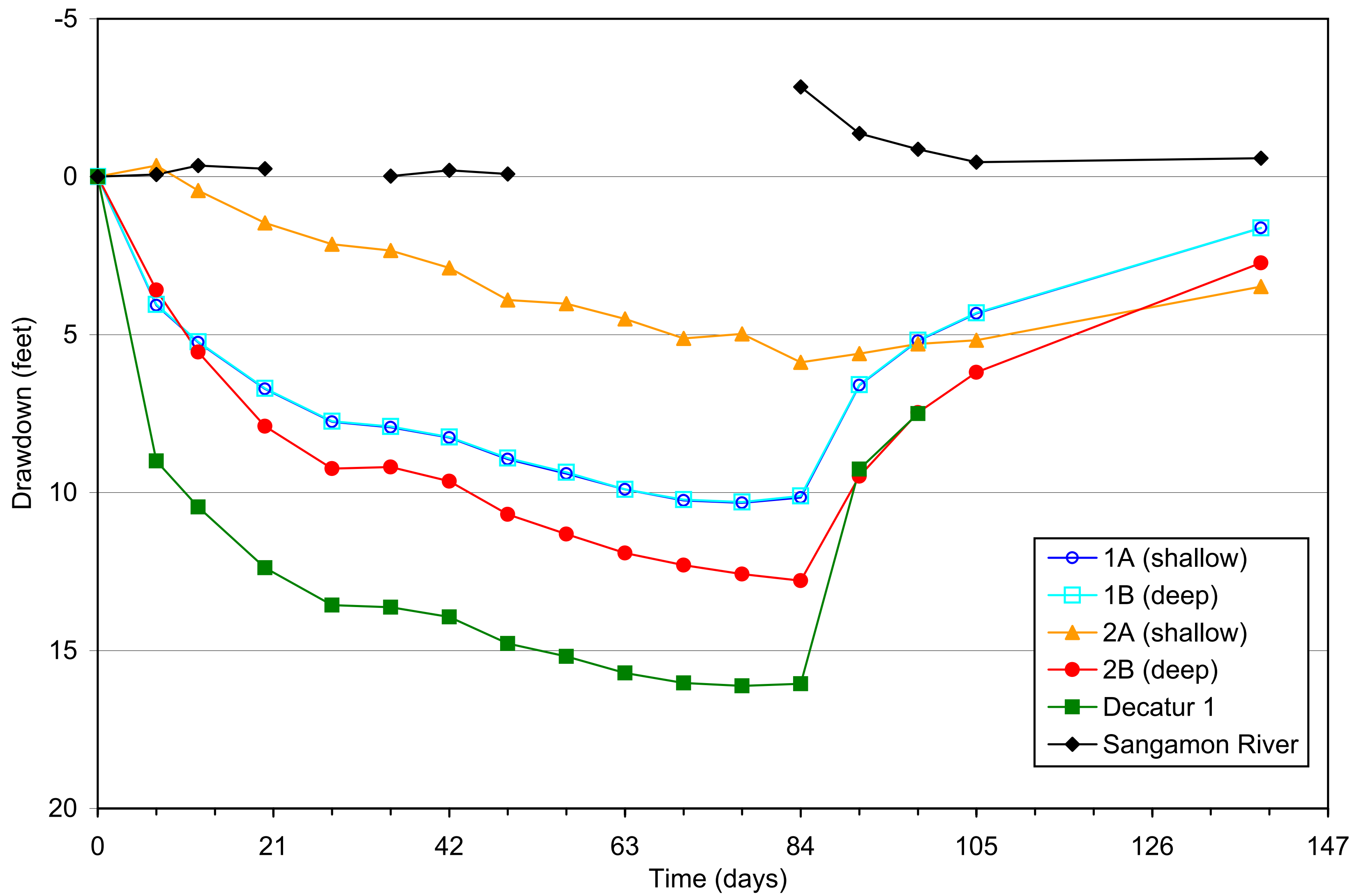

Figure 8. Observed water levels near the Cisco wellfield during the emergency pumpage

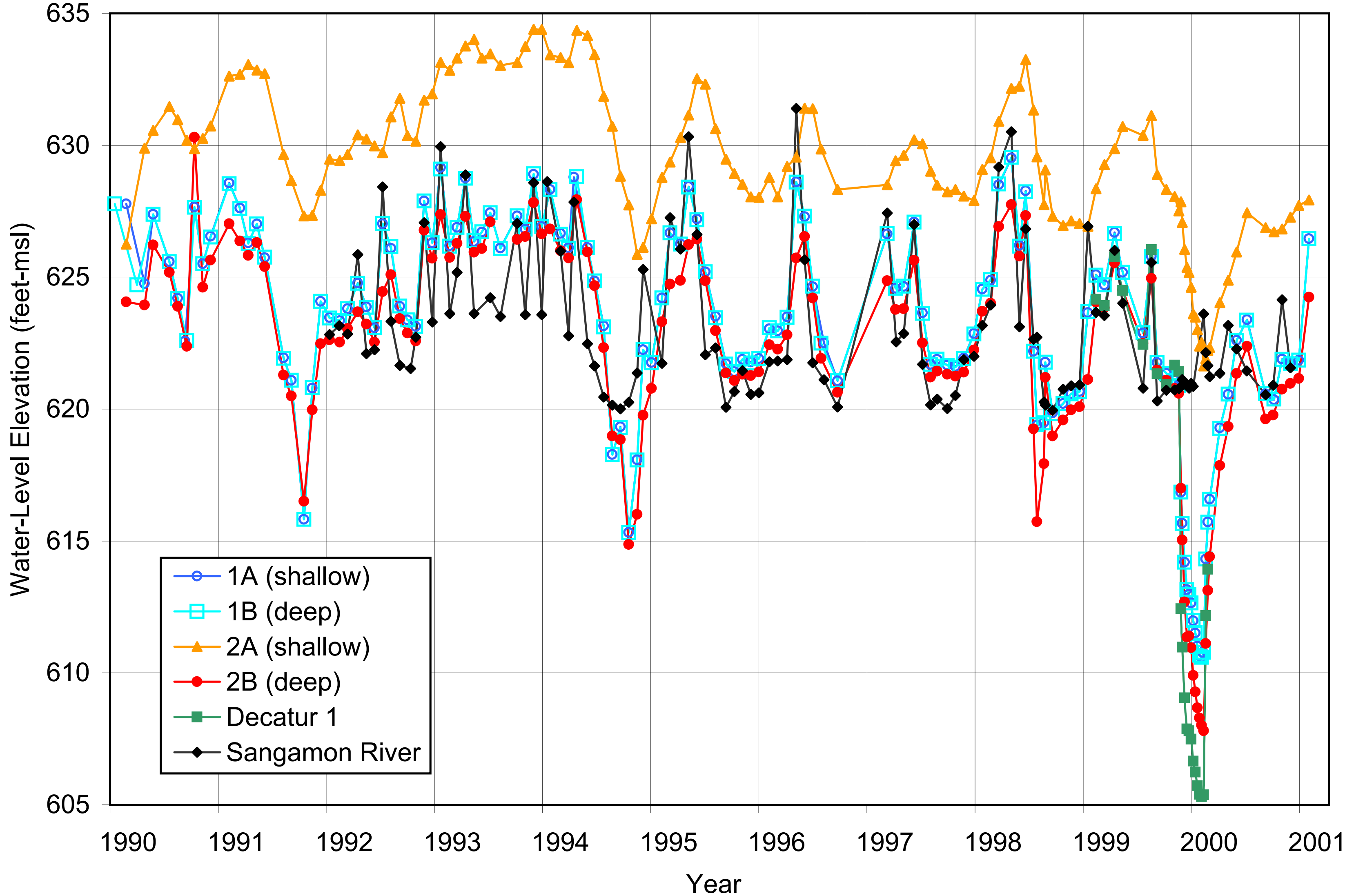

Figure 9. Water-level elevations near the Cisco wellfield, 1990-2001

Connection between the Mahomet Aquifer and the Sangamon River

Based on geological, geochemical, and hydrological data, it was determined during this study that there appears to be a connection between the Mahomet Aquifer, the Glasford Aquifer, and the Sangamon River in the Allerton Park area. Previous interpretations of the geology and hydrology of the Mahomet Aquifer considered the east and central portion of the aquifer to be covered with a sufficient thickness of glacial till to isolate it from any surface waters. The existence and impact of this connection, as described herein, would represent a major departure from previous interpretations of recharge to the aquifer and how much water the aquifer system could potentially provide to the water users of central Illinois.

The geological evidence for this hydraulic connection is the log from Decatur test Boring #2, which shows a direct geologic connection between the Mahomet and the Glasford sands, and Boring #11, which shows an upper sand at the same elevation as the river. A field inspection was conducted on January 16, 2001 in the tributary streams in this area. While most of the creeks in the region were frozen, the Wildcat Creek and Willow Branch Creek tributaries were ice free where they ran over sand bottoms close to the Sangamon River. Wildcat Creek had active algal growth in the stream. The ice-free stretches and algal growth suggest that groundwater is discharging to the streams at these locations.

Two unusual patterns in groundwater geochemistry around Allerton Park further suggest an interaction between the Mahomet Aquifer and the Sangamon River in this region. The chloride levels in the Mahomet Aquifer are extremely high (> 100 mg/L) south of the Sangamon River and along the two valley walls to the west (Kelly and Wilson, 2000). Chlorides are very low (<10 mg/L) in the center of the valley, however, suggesting that low-chloride water is diluting the high-chloride water that may be coming from the underlying bedrock. The source of the low-chloride water would be the Glasford Aquifer or a surface stream. In addition, the isotopic composition of carbon in the water suggests that there is near-surface or surface water recharging the aquifer in the center of the valley (Keith Hackley, ISGS, personal communication, February 2001).

The third piece of evidence for a hydrologic connection is the water-level data collected by Anliker and Sanderson (1995) and Guillou & Associates. The regional potentiometric surface map constructed by Anliker and Sanderson with 1994 data shows groundwater levels in the Allerton Park area to be around 620 feet above mean sea level (ft-msl), approximately the same elevation as the Sangamon River at that location. The larger potentiometric surface map of the entire aquifer shows this area near a groundwater divide that separates the regional flow to the west from flow back east toward the cone of depression at Champaign. Previous studies indicated similar water levels between the Sangamon River and the Mahomet Aquifer, but none of these studies had suggested that the Sangamon River was exerting some control on the aquifer.

The best evidence for the connection between the Mahomet Aquifer and shallower water sources is the water-level data collected by Guillou & Associates around the Cisco wellfield. As shown on figure 9, there is a strong correlation between the water level in the Sangamon River at the Cisco wellfield and the water levels in the deeper well OW-2B, one mile to the east, and well OW-1B, two miles to the north. During the periods when the Decatur wellfields were operating in 1991, 1994, 1998, and 1999-2000, there was a significant drop in groundwater levels. At the same time, water levels in the Sangamon River could not drop below the river's bottom elevation, 620 ft-msl. Figure 10 is an equal elevation plot showing the correlation between the water level of the river and the groundwater levels in wells OW-1B and OW-2B. Without the data collected during the emergency pumpage, the correlation coefficient for OW-1B was 0.86 while the correlation coefficient for OW-2B, which is farther from the river, was 0.75. A nonparametric correlation produced similar coefficients of 0.87 and 0.78 for OW-1B and OW-2B, respectively. These correlations suggest that the water-level fluctuations in the aquifer caused by the river are damped with distance from the river/aquifer connection. Above the equal elevation line, groundwater is discharging to the river; below this line, the river is recharging the aquifer. From the trend shown on this plot, it is evident that the aquifer is generally discharging to the river except during high river stages or when the Decatur wells are operating. Historically, the Sangamon River would have been a discharge point for the Mahomet Aquifer because of the higher pre-settlement water levels in the Mahomet Aquifer.

Shallow well OW-1A shows the exact same water levels as OW-1B. Assuming these wells are properly constructed, this indicates a strong nearby connection between the Glasford and Mahomet Aquifers. The water levels in shallow well OW-2A have similar fluctuations to those in OW-2B, but are 4 to 14 feet higher, which may indicate a connection between the aquifers at some distance away from OW-2A and OW-2B.

An additional piece of hydrological evidence for the river/aquifer connection is the City of Decatur's observation that roughly half of the groundwater discharged by the emergency wellfield into the Sangamon River does not reach Lake Decatur. Bank storage and evaporation could only account for some of this loss. If a river/aquifer connection exists upstream of the Cisco wellfield in Allerton Park, then the drawdown produced by the wellfield could induce a large amount of the existing flow out of the river and into the aquifer. Hypothetically, the Cisco wellfield then cycles this water back into the river just downstream of the connection. Therefore, the net increase in streamflow downstream of the wellfield would be only a fraction of the well's actual pumpage. Any additional connections between the aquifer system and the Sangamon River that have not been identified would further affect the efficiency of Decatur's wellfields.

Pumpage during 84-day Emergency Operation

The City of Decatur provided pumpage data for the wellfields for the 84 days of operation. These data indicate that the pumpage varied dramatically. Not only did the total amount vary, but the individual wells used varied as well. Decatur Well #2, the only active well at the Cisco wellfield, pumped continuously for all 84 days at a rate of 3.46 mgd. At the DeWitt wellfield, Decatur wells #3 and #4 pumped continuously. However, Decatur wells #5, #6, and #8 were also pumped for a portion of the 84 days. The exact pumping configuration was not available, but the total pumpage was available. Pumpage was assigned to individual wells based on information on daily total pumpage provided by the City of Decatur. Because the daily values were so variable, these data were combined into four consistent pumping rates for use in the model. Figure 11 is a graph depicting the actual and modeled pumpage. Table 1 shows the actual pumpage scenario by well input into the model.

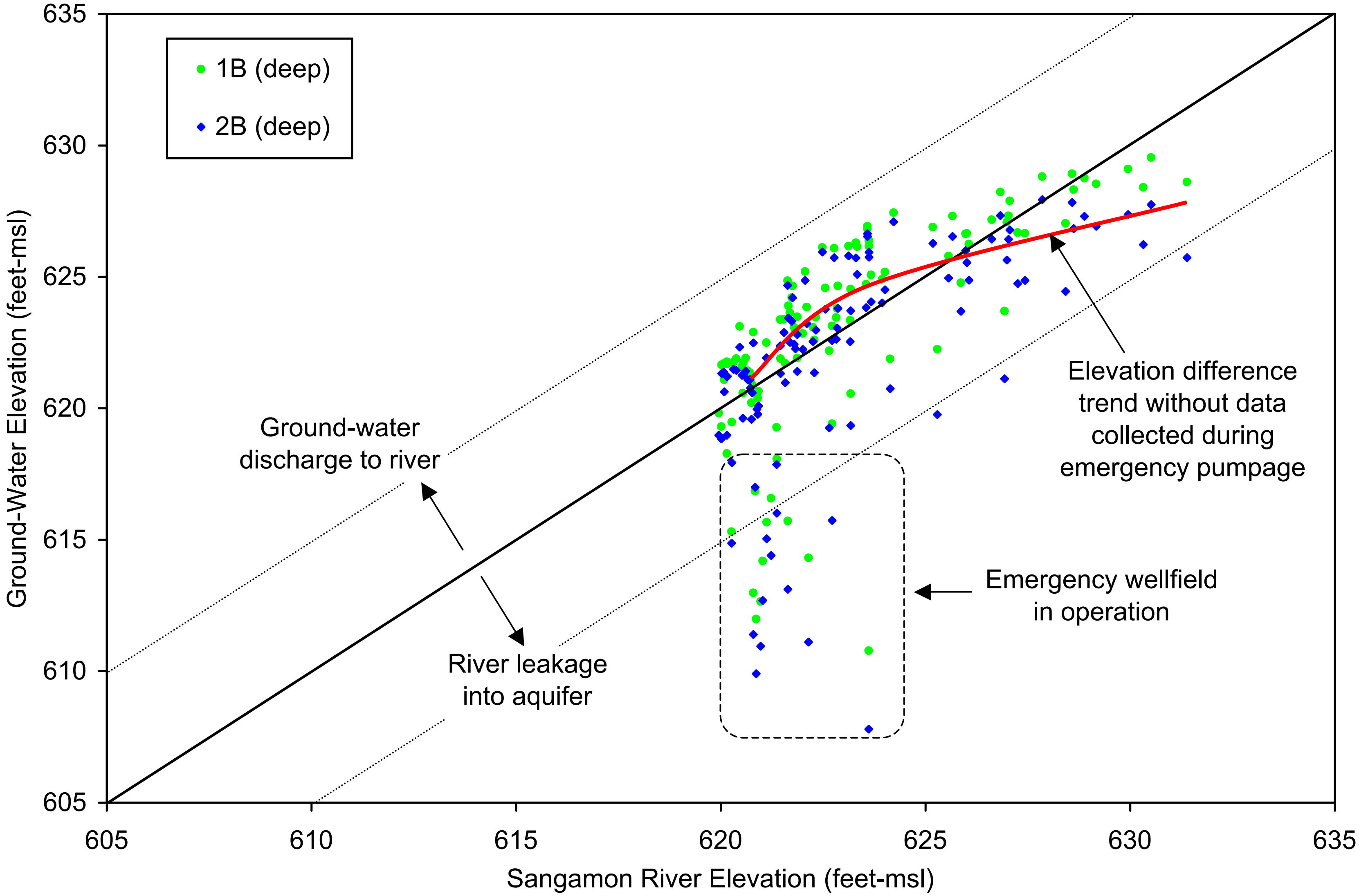

Figure 10. Sangamon River elevation versus ground-water elevation in the Mahomet Aquifer

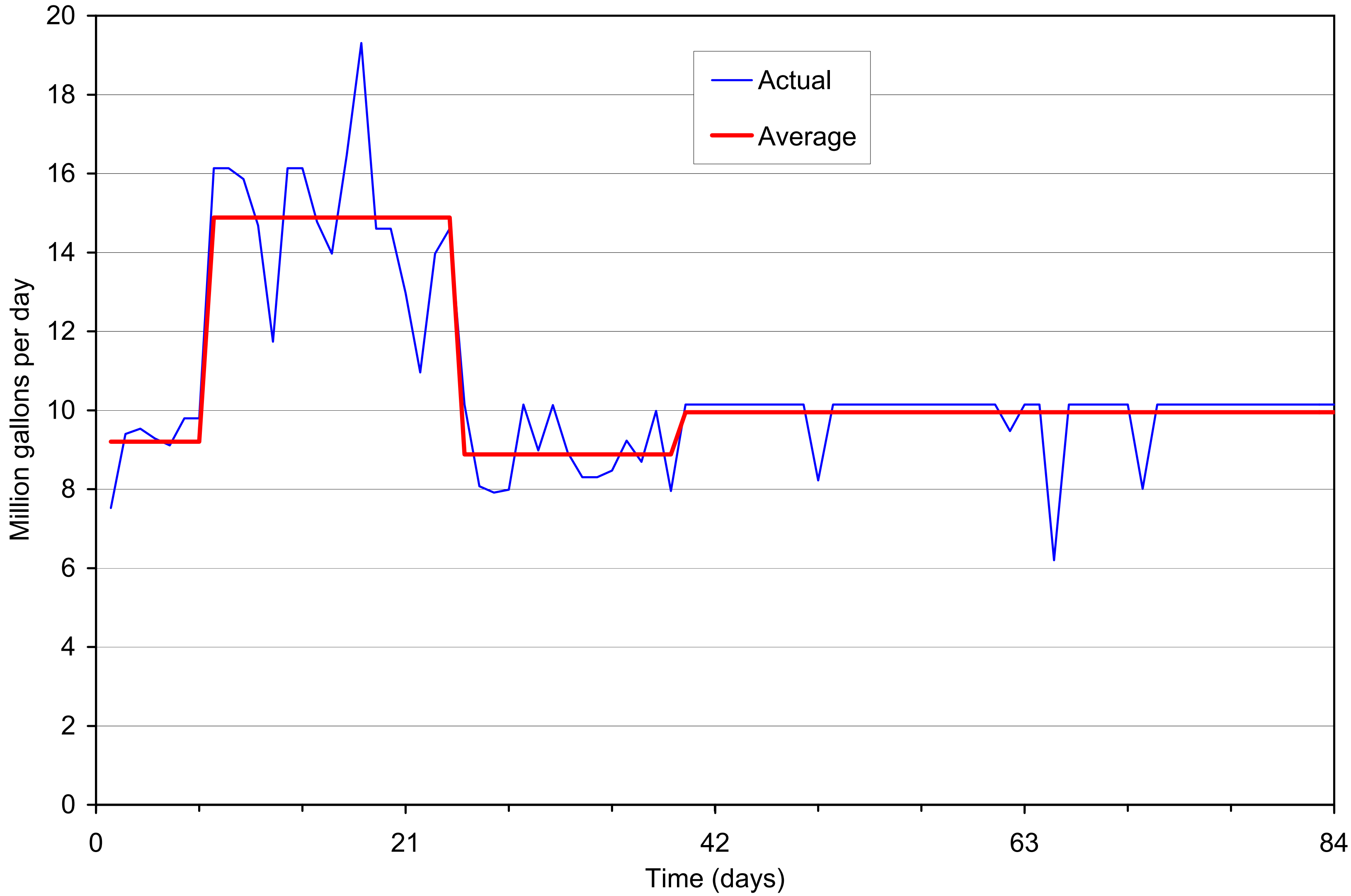

Figure 11. Actual and average pumpage from Decatur wellfields

Table 1. Pumping Schedule Used in the Model (gallons per day)

Start (days)	Stop (days)	DeWitt Well 3	DeWitt Well 4	DeWitt Well 8	DeWitt Well 5	DeWitt Well 6	Cisco Well 2	Total
0	7	2,164,030	2,164,030	1,420,131	0	0	3,457,714	9,205,904
7	24	2,164,030	2,164,030	2,164,030	2,466,895	2,466,895	3,457,714	14,883,593
24	39	2,164,030	2,164,030	1,096,889	0	0	3,457,714	8,882,663
39	84	2,164,030	2,164,030	2,164,030	0	0	3,457,714	9,949,804
84	365	0	0	0	0	0	0	0

Simulation of 84-day Emergency Pumpage

The effect of the 84-day emergency pumpage on the Mahomet Aquifer was evaluated with the existing LGI model and a modified version of the model that includes the connection with the Sangamon River. Because the existing model did not match the observed water levels very well, the discussion of the existing and the modified river models will be combined. The model was modified to improve the match with the observed water-level data around the Cisco wellfield. Adding three river cells to the model greatly improved the calibration. However, because extensive modification or development of a new model was beyond the scope of this project, the modified river model discussed herein should not be considered fully calibrated.

Transient simulations were run using the 84-day pumping schedule shown in table 1 plus a 281-day recovery period for a total time of one year. The starting heads for the simulations were computed by running a steady-state model with all of the same parameters except without the Decatur pumpage. The only other modification made to the original LGI model was to correct the location of the DeWitt wellfield. Several modifications were made for the modified river model. Figure 12 shows the location of the added river cells. The position, number, and conductance values of river cells were varied to produce the best match with the data collected from the nearby observation wells. A final conductance value of 80,000 ft^2/d was used, which corresponds to a streambed composed of 3 feet of dirty sand having a hydraulic conductivity of 1 ft/d. The elevation of the river in the river cells was held at a constant 622 feet throughout the simulation but should probably be allowed to change, based on stage data at Monticello, in any future model recalibration. Hydraulic conductivity also was lowered slightly in Champaign County. However, this change caused the existing general head boundaries to allow too much recharge into the Mahomet Aquifer during the recovery after the 84 days of pumpage so a constant recharge rate of 0.1 inches per year was used in the central part of the model.

Figures 13 and 14, respectively, show the drawdown at 84 days simulated by the existing LGI model and by the modified river model. The drawdown distribution computed by the LGI model is similar in shape to the other drawdown distributions shown in the LGI report with a maximum drawdown of more than 30 feet in the model cells at the DeWitt wellfield. The modified river model computed considerably less drawdown around the Allerton Park region. Figure 15 shows the difference between the two drawdown distributions. The water budget computed by the river model had the Sangamon River losing an average of 5.1 mgd [7.9 cubic feet per second (cfs)] during the 84-day stress period, which is greater than the 7-day, 10-year low flow of 4.6 cfs at Hog Chute Bridge estimated by Singh et al. (1988). If these numbers hold true, this suggests that it would be possible to dry up the Sangamon River during low flow in the stretch of the river between the connections and the Cisco wellfield. Gravity drainage of the shallow, alluvial sands near the Sangamon River also could provide water to the Mahomet Aquifer during these pumping events. These upper sands would have to be mapped and then simulated as additional layers in a recalibrated model to accurately account for their contribution.

Figures 16-18 compare the computed drawdowns and the observed drawdowns. As shown in figure 16, the addition of the river cells drastically improved the model calibration with the observed data. The predicted drawdowns at OW-1B and OW-2B in the LGI model are roughly double what the river model predicts and double what the field data show. Because of the additional recharge entering the aquifer, the river model was able to more closely match the recovery data at wells OW-E and OW-N without any further modifications to the model (figures 17 and 18).

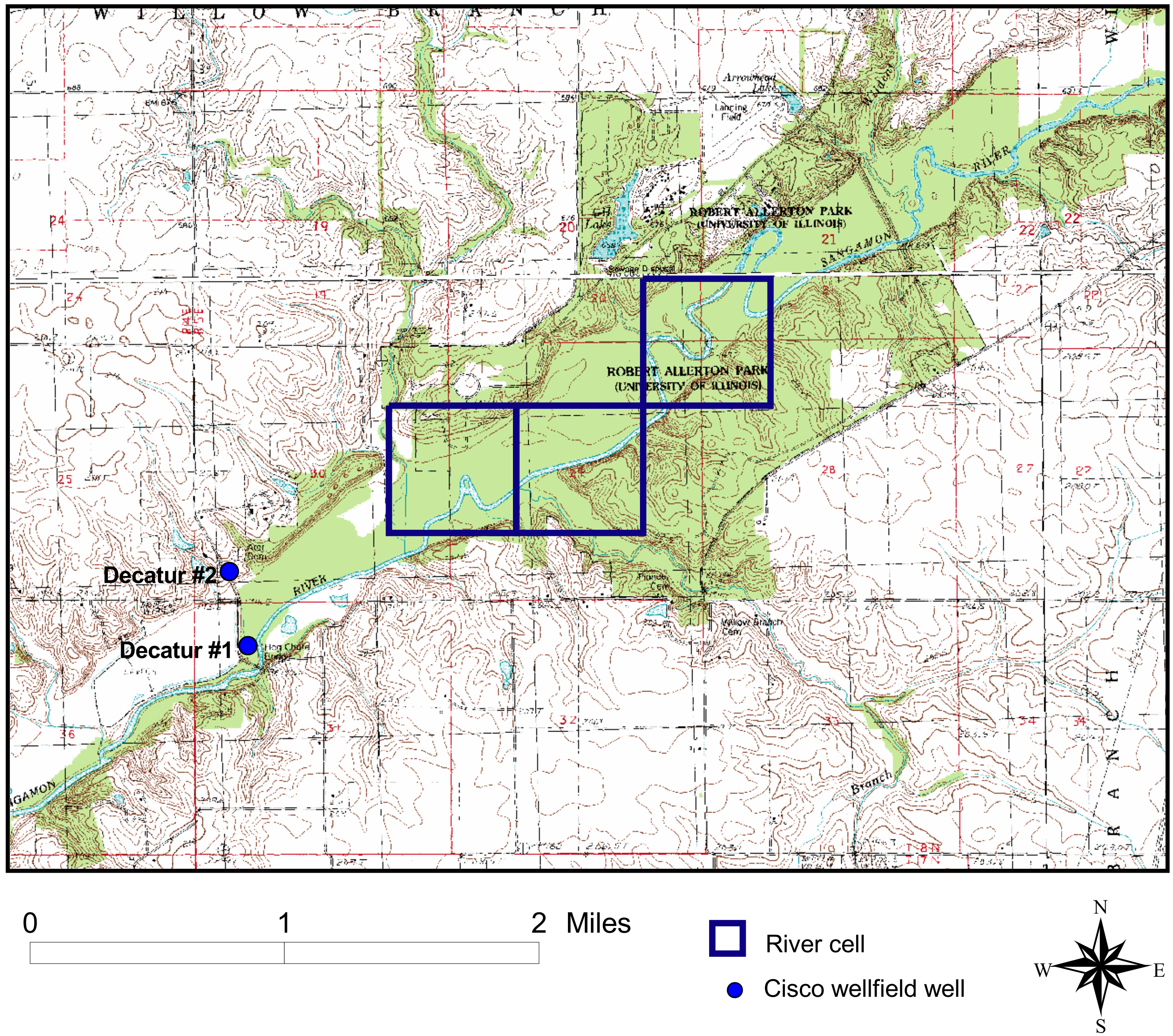

Figure 12. Cisco wellfield and river cells

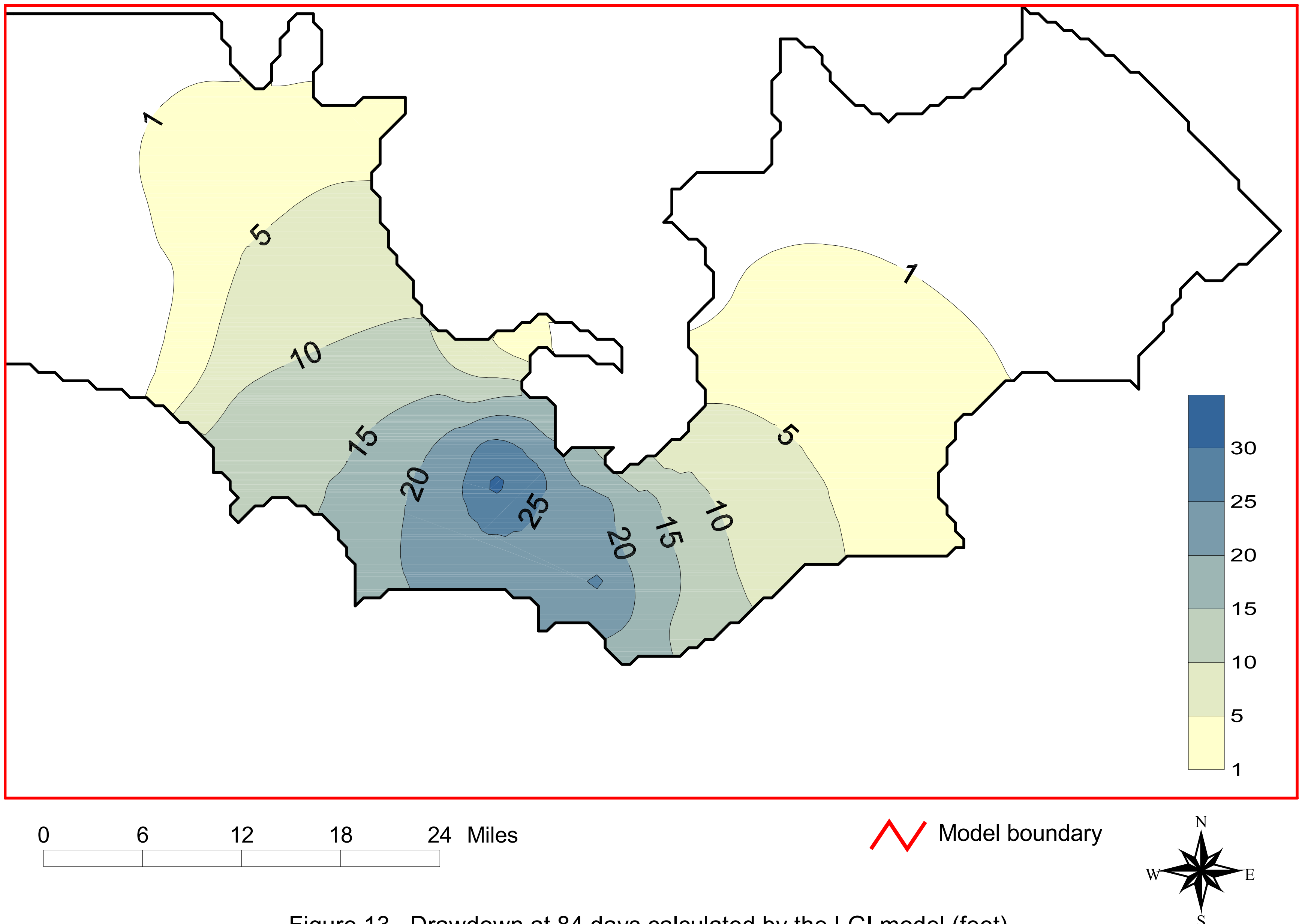

Figure 13. Drawdown at 84 days calculated by the LGI model (feet)

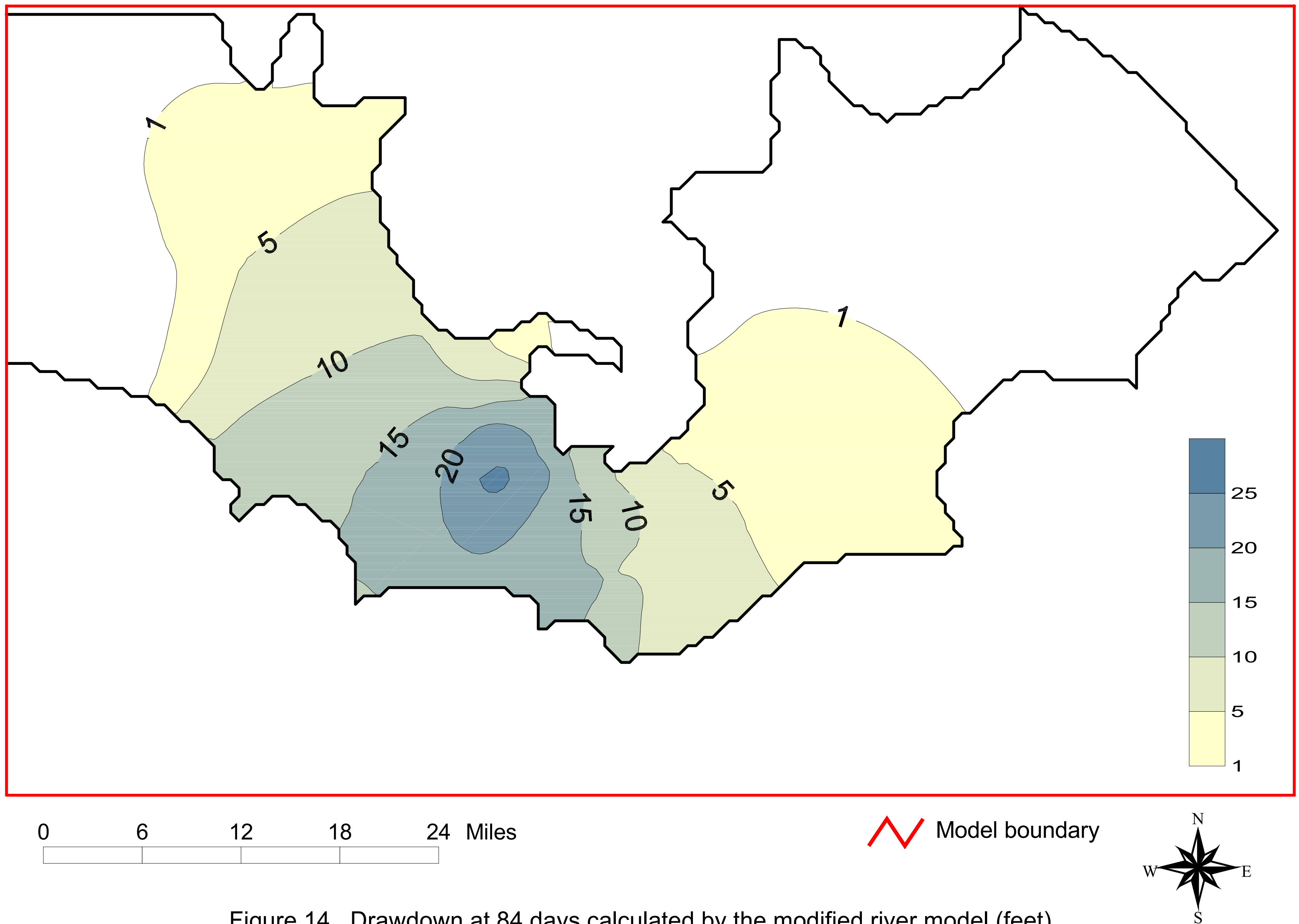

Figure 14. Drawdown at 84 days calculated by the modified river model (feet)

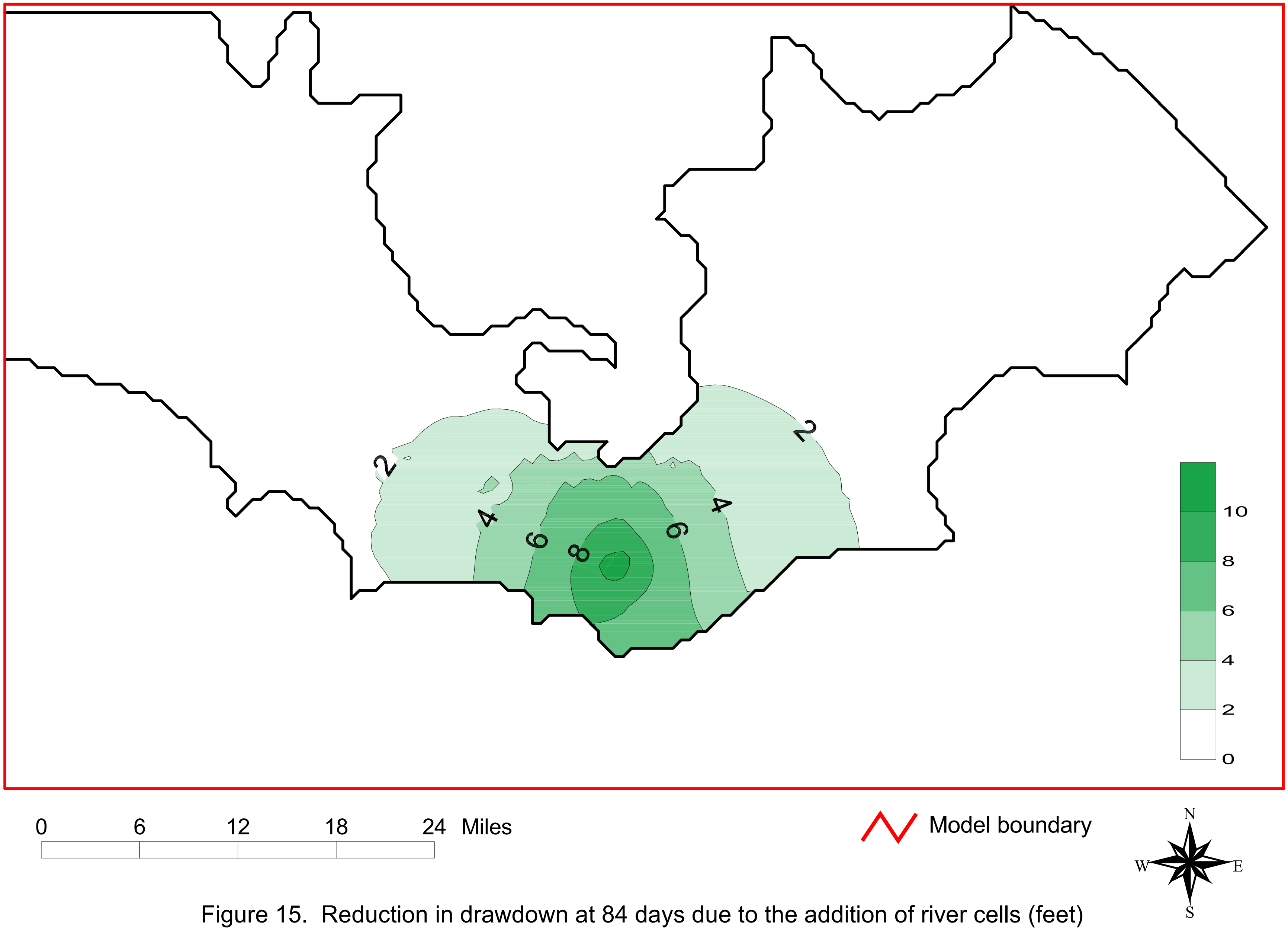

Figure 15. Reduction in drawdown at 84 days due to the addition of river cells (feet)

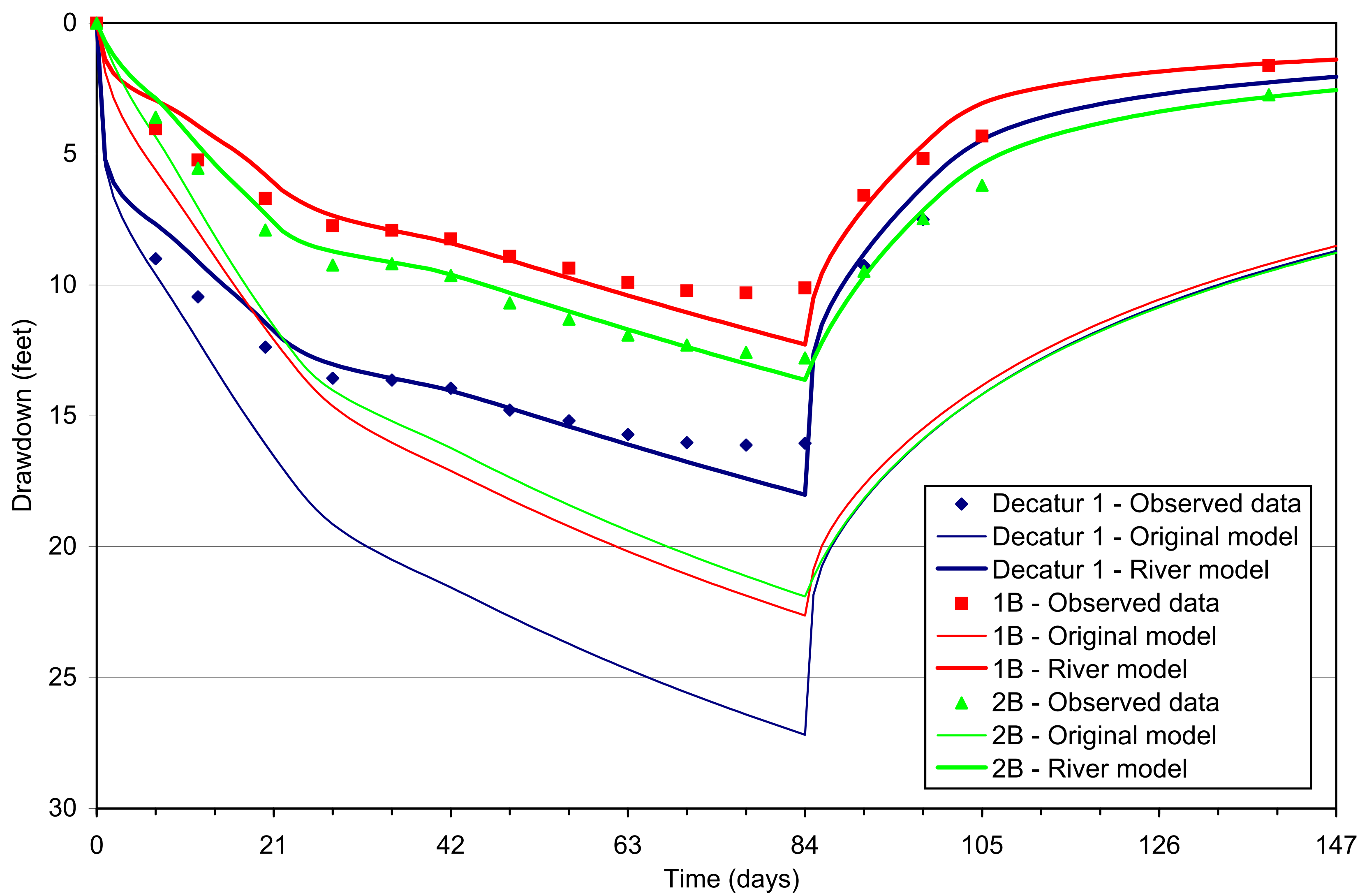

Figure 16. Calculated versus observed water levels at the Cisco wellfield

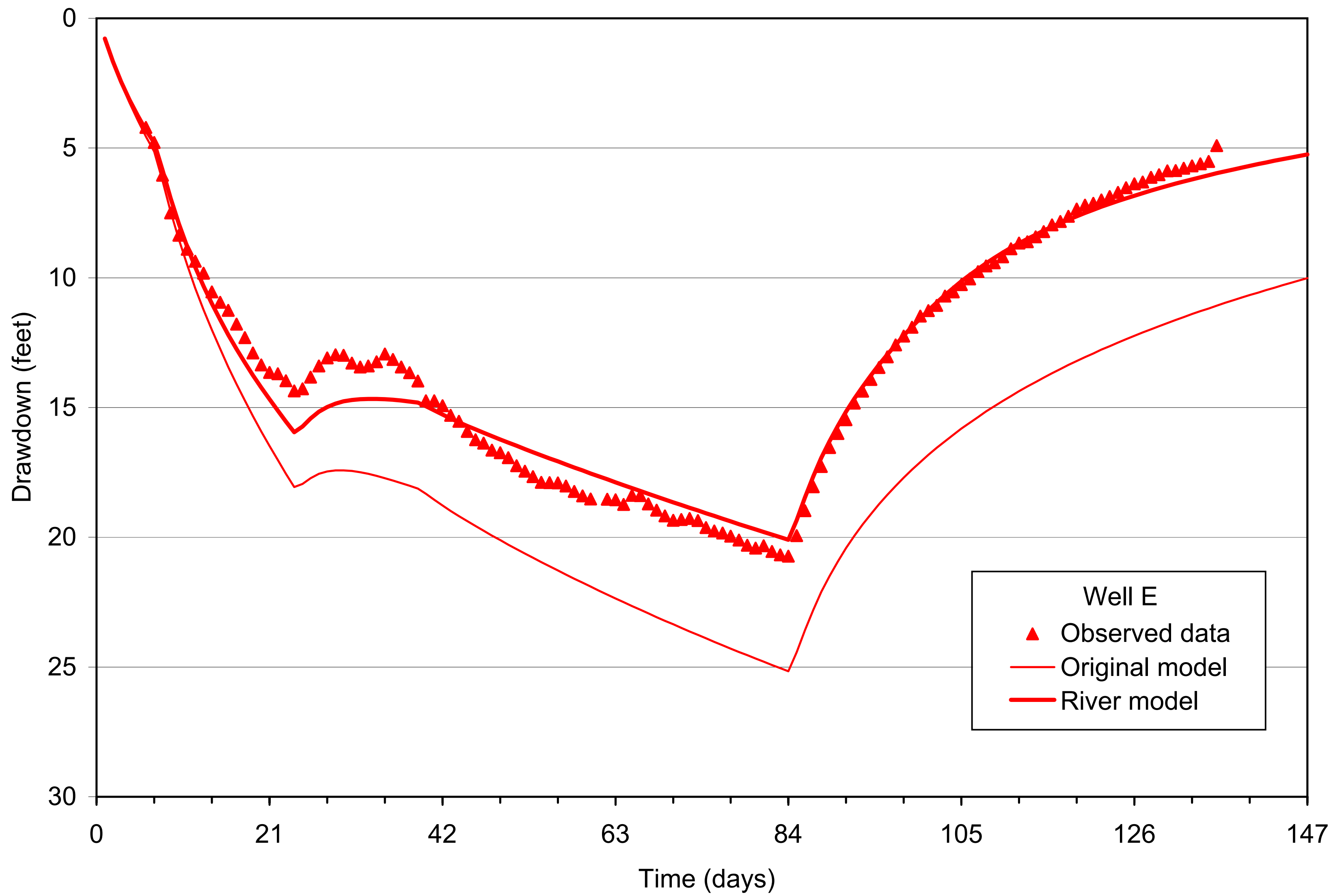

Figure 17. Calculated versus observed water levels at well E

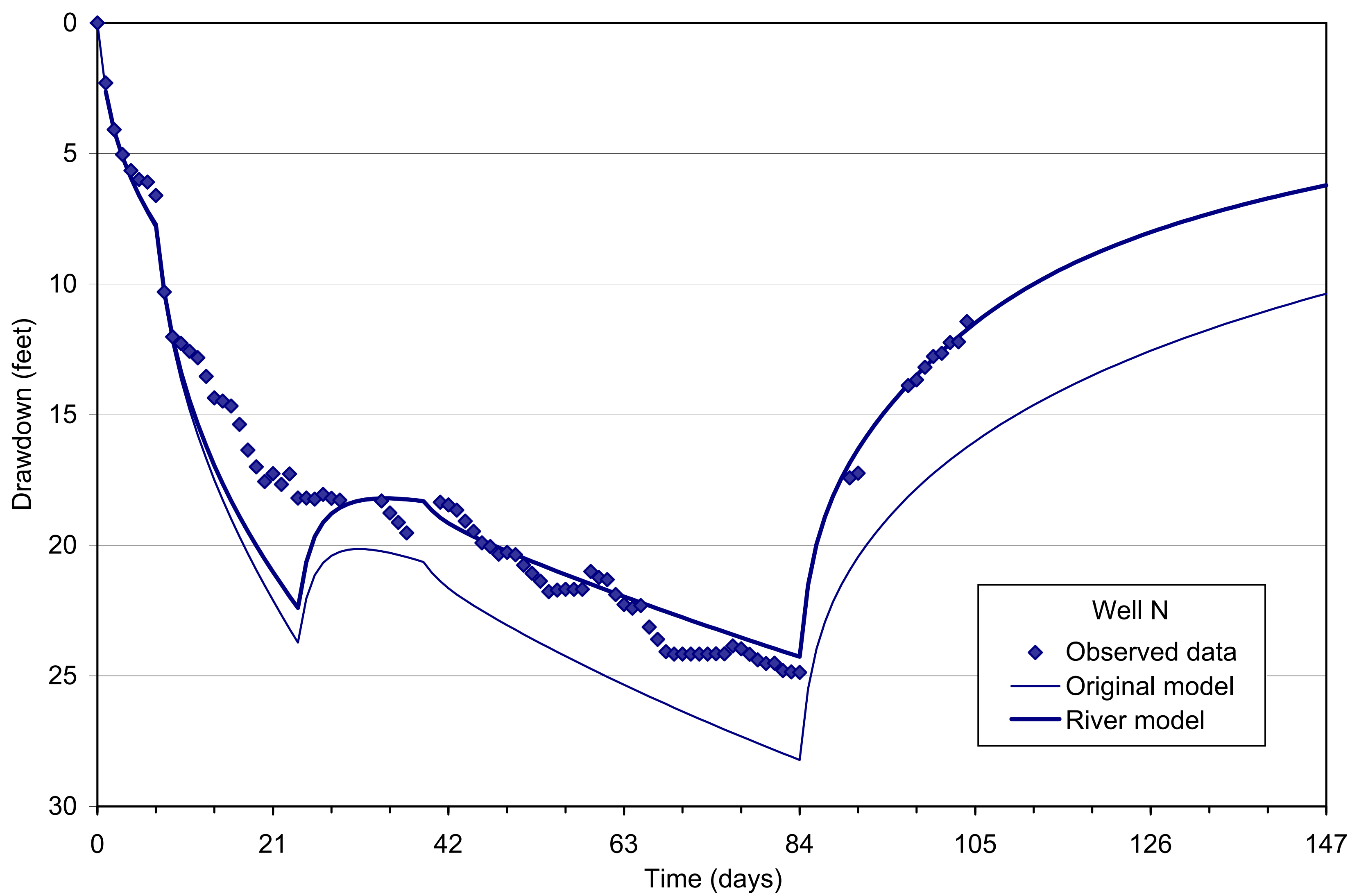

Figure 18. Calculated versus observed water levels at well N

Conclusions

Several shortcomings identified in the LGI modeling study include data interpretation errors (mislocating the pumping wells, altering the thickness map), as well as not including data collected by Guillou & Associates near the Cisco wellfield. Data for the observation wells near the Cisco wellfield apparently were not made available to LGI when they were completing their model. A review of well records and site visits provided additional information that led to the current conceptual interpretation of the flow system.

The model should be revised by altering the thickness distribution in the Kenney Channel and in the areas where the Mahomet Aquifer is absent. It also would be necessary to move the pumping centers in the model to their proper locations. Most importantly, the model should be modified to better represent the hydraulic connection of the Mahomet Aquifer with the Glasford Aquifer and the Sangamon River, possibly by adding model layers. Creating a three-dimensional model of the aquifer system, although much more complex, will permit better use of the data provided near the Cisco wellfield. In addition, field data would need to be collected on the flow in the Sangamon River, the elevation of the stream bottom, the distribution of sand along the stream bottom, water-level changes in the Glasford Aquifer, and the amount of water induced into the aquifers during operation of the Cisco wellfield. A full recalibration of the model may also require adjusting the hydraulic conductivity values and using a constant recharge rate instead of the general head boundaries.

The results of this study show that the Sangamon River and the Glasford Aquifer may provide recharge to the Mahomet Aquifer, which may allow for more water to be withdrawn from the aquifer than was previously believed. However, care also must be taken not to allow overdevelopment of the aquifer to negatively affect the Sangamon River. The model could be used to evaluate the impacts of alternative pumping scenarios so a more optimal strategy could be developed for efficient use the aquifer with the least amount of environmental impact. Integration of future groundwater studies with the Sangamon River studies currently underway at the ISWS would be vital to understanding the region's water resources.

Recommendations

Both the "new" information uncovered during this study and the problems identified in the LGI model could be corrected to provide a better match with the pumping data. However, before that is attempted, the City of Decatur should consider additional testing near the Cisco wellfield to better identify aquifer properties and the nature of the connections between aquifers and the Sangamon River. This could be accomplished by pumping Decatur well #1 while outfitting OW-1A, OW-1B, OW-2A, and OW-2B with recorders. In addition, several additional locations should be monitored, especially along the Sangamon River and at two or three additional well locations, so that a more complete understanding of the extent of the hydraulic connection could be gained. Monitoring the Sangamon River also would be necessary and only would require installation of hand-driven wells. Once such a test were completed, the knowledge gained could be used to develop a better conceptual model. This would allow improvement of the computer model using this new view of the system.

Regardless of how Decatur proceeds with future modification of their groundwater flow model, it is imperative that they continue monitoring their observation wells on a regular basis. One very useful modification to the observation well network would be the installation of permanent recorders at OW-1A, OW-1B, OW-2A, and OW-2B. Existing data from these wells were essential in providing a new conceptual model of the groundwater flow system in this region. Without these data, the interpretation provided in this report would not have been as certain. Because the system appears to be so complex in this region, permanent recorders likely would be instrumental in any future improvement to the conceptual model of the flow system.

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Appendix. Observation Well Water-Level Data

Observation Well S

Date	Elevation (ft-msl)	Date	Elevation (ft-msl)	Date	Elevation (ft-msl)
11/14/1999	616.67	12/26/1999	603.60	02/06/2000	598.43
11/15/1999	616.65	12/27/1999	603.66	02/07/2000	598.31
11/16/1999	616.64	12/28/1999	603.68	02/08/2000	598.20
11/17/1999	616.44	12/29/1999	603.68	02/09/2000	598.20
11/18/1999	616.35	12/30/1999	603.68	02/10/2000	598.20
11/19/1999	616.36	12/31/1999	603.68	02/11/2000	598.14
11/20/1999	616.35	01/01/2000	603.68	02/12/2000	597.93
11/21/1999	616.36	01/02/2000	603.87	02/13/2000	597.85
11/22/1999	616.38	01/03/2000	603.90	02/14/2000	597.72
11/23/1999	616.38	01/04/2000	603.86	02/15/2000	597.64
11/24/1999	616.39	01/05/2000	603.67	02/16/2000	597.44
11/25/1999	616.37	01/06/2000	603.58	02/17/2000	597.35
11/26/1999	616.43	01/07/2000	603.30	02/18/2000	597.36
11/27/1999	616.43	01/08/2000	603.18	02/19/2000	597.21
11/28/1999	616.36	01/09/2000	602.89	02/20/2000	597.05
11/29/1999	616.35	01/10/2000	602.77	02/21/2000	597.02
11/30/1999	616.32	01/11/2000	602.32	02/22/2000	597.08
12/01/1999	615.95	01/12/2000	602.11	02/23/2000	n/a
12/02/1999	615.32	01/13/2000	601.79	02/24/2000	n/a
12/03/1999	614.58	01/14/2000	601.48	02/25/2000	n/a
12/04/1999	613.89	01/15/2000	601.37	02/26/2000	n/a
12/05/1999	613.17	01/16/2000	601.05	02/27/2000	600.48
12/06/1999	612.59	01/17/2000	600.92	02/28/2000	600.55
12/07/1999	612.00	01/18/2000	600.82	02/29/2000	600.55
12/08/1999	611.17	01/19/2000	600.69	03/01/2000	n/a
12/09/1999	610.21	01/20/2000	600.49	03/02/2000	n/a
12/10/1999	609.46	01/21/2000	600.29	03/03/2000	n/a
12/11/1999	609.06	01/22/2000	600.11	03/04/2000	n/a
12/12/1999	608.57	01/23/2000	599.87	03/05/2000	601.74
12/13/1999	607.94	01/24/2000	599.69		
12/14/1999	607.33	01/25/2000	599.64		
12/15/1999	606.82	01/26/2000	599.52		
12/16/1999	605.34	01/27/2000	599.35		
12/17/1999	605.91	01/28/2000	599.21		
12/18/1999	605.19	01/29/2000	599.14		
12/19/1999	605.18	01/30/2000	599.01		
12/20/1999	604.76	01/31/2000	599.00		
12/21/1999	604.32	02/01/2000	598.93		
12/22/1999	604.04	02/02/2000	598.90		
12/23/1999	603.90	02/03/2000	598.98		
12/24/1999	603.54	02/04/2000	598.90		
12/25/1999	603.37	02/05/2000	598.45		

Note: n/a = not available

Observation Well N

Date	Elevation (ft-msl)	Date	Elevation (ft-msl)	Date	Elevation (ft-msl)
11/14/1999	615.40	12/31/1999	n/a	02/16/2000	590.57
11/15/1999	615.38	01/01/2000	n/a	02/17/2000	590.43
11/16/1999	615.37	01/02/2000	596.66	02/18/2000	590.44
11/17/1999	615.34	01/03/2000	596.19	02/19/2000	590.16
11/18/1999	615.32	01/04/2000	595.83	02/20/2000	590.11
11/19/1999	615.31	01/05/2000	595.43	02/21/2000	590.09
11/20/1999	615.23	01/06/2000	n/a	02/22/2000	n/a
11/21/1999	615.23	01/07/2000	n/a	02/23/2000	n/a
11/22/1999	615.23	01/08/2000	n/a	02/24/2000	n/a
11/23/1999	615.23	01/09/2000	596.61	02/25/2000	n/a
11/24/1999	615.21	01/10/2000	596.51	02/26/2000	n/a
11/25/1999	615.20	01/11/2000	596.31	02/27/2000	597.54
11/26/1999	615.23	01/12/2000	595.88	02/28/2000	597.72
11/27/1999	615.20	01/13/2000	595.49	02/29/2000	n/a
11/28/1999	615.10	01/14/2000	595.05	03/01/2000	n/a
11/29/1999	614.96	01/15/2000	594.91	03/02/2000	n/a
11/30/1999	612.66	01/16/2000	594.62	03/03/2000	n/a
12/01/1999	610.87	01/17/2000	594.69	03/04/2000	n/a
12/02/1999	609.92	01/18/2000	594.60	03/05/2000	601.07
12/03/1999	609.31	01/19/2000	594.20	03/06/2000	601.30
12/04/1999	608.97	01/20/2000	593.89	03/07/2000	601.78
12/05/1999	608.87	01/21/2000	593.58	03/08/2000	602.19
12/06/1999	608.35	01/22/2000	593.18	03/09/2000	602.31
12/07/1999	604.66	01/23/2000	593.24	03/10/2000	602.72
12/08/1999	602.94	01/24/2000	593.27	03/11/2000	602.75
12/09/1999	602.69	01/25/2000	593.27	03/12/2000	603.52
12/10/1999	602.39	01/26/2000	593.27		
12/11/1999	602.14	01/27/2000	593.96		
12/12/1999	601.43	01/28/2000	593.73		
12/13/1999	600.60	01/29/2000	593.64		
12/14/1999	600.48	01/30/2000	593.07		
12/15/1999	600.29	01/31/2000	592.69		
12/16/1999	599.59	02/01/2000	592.55		
12/17/1999	598.60	02/02/2000	592.65		
12/18/1999	597.96	02/03/2000	591.83		
12/19/1999	597.40	02/04/2000	591.36		
12/20/1999	597.70	02/05/2000	590.88		
12/21/1999	597.29	02/06/2000	590.79		
12/22/1999	597.69	02/07/2000	590.79		
12/23/1999	596.77	02/08/2000	590.79		
12/24/1999	596.77	02/09/2000	590.79		
12/25/1999	596.73	02/10/2000	590.79		
12/26/1999	596.91	02/11/2000	590.80		
12/27/1999	596.76	02/12/2000	590.80		
12/28/1999	596.69	02/13/2000	591.10		
12/29/1999	n/a	02/14/2000	590.99		
12/30/1999	n/a	02/15/2000	590.78		

Note: n/a = not available

Observation Well N1

Date	Elevation (ft-msl)	Date	Elevation (ft-msl)	Date	Elevation (ft-msl)
12/05/1999	608.85				
12/06/1999	607.81				
12/07/1999	606.48				
12/08/1999	605.96				
12/09/1999	604.88				
12/10/1999	603.57				
12/11/1999	603.57				
12/12/1999	603.57				
12/13/1999	603.03				
12/14/1999	602.54				
12/15/1999	602.02				
12/16/1999	601.61				
12/17/1999	601.52				
12/18/1999	598.81				
12/19/1999	598.81				
12/20/1999	598.81				
12/21/1999	598.81				
12/22/1999	598.81				
12/23/1999	599.01				
12/24/1999	599.01				
12/25/1999	599.01				

Note: n/a = not available

Observation Well W1

Date	Elevation (ft-msl)	Date	Elevation (ft-msl)	Date	Elevation (ft-msl)
11/14/1999	612.92	12/31/1999	599.08	02/16/2000	589.42
11/15/1999	612.89	01/01/2000	599.07	02/17/2000	589.43
11/16/1999	612.89	01/02/2000	598.61	02/18/2000	589.29
11/17/1999	612.86	01/03/2000	598.62	02/19/2000	589.12
11/18/1999	612.88	01/04/2000	598.14	02/20/2000	589.05
11/19/1999	612.88	01/05/2000	597.59	02/21/2000	588.88
11/20/1999	612.80	01/06/2000	597.34	02/22/2000	n/a
11/21/1999	612.80	01/07/2000	597.79	02/23/2000	n/a
11/22/1999	612.78	01/08/2000	596.93	02/24/2000	n/a
11/23/1999	612.79	01/09/2000	596.49	02/25/2000	n/a
11/24/1999	612.74	01/10/2000	596.13	02/26/2000	n/a
11/25/1999	612.71	01/11/2000	595.75	02/27/2000	594.07
11/26/1999	612.79	01/12/2000	595.52	02/28/2000	594.10
11/27/1999	612.78	01/13/2000	595.11	02/29/2000	n/a
11/28/1999	612.64	01/14/2000	594.71	03/01/2000	n/a
11/29/1999	612.59	01/15/2000	594.57	03/02/2000	n/a
11/30/1999	611.60	01/16/2000	594.19	03/03/2000	n/a
12/01/1999	610.90	01/17/2000	594.13	03/04/2000	n/a
12/02/1999	610.14	01/18/2000	593.92	03/05/2000	597.25
12/03/1999	609.55	01/19/2000	593.66	03/06/2000	597.64
12/04/1999	609.14	01/20/2000	593.35	03/07/2000	597.97
12/05/1999	608.88	01/21/2000	593.06	03/08/2000	598.41
12/06/1999	608.15	01/22/2000	592.81	03/09/2000	598.71
12/07/1999	606.60	01/23/2000	592.68	03/10/2000	598.95
12/08/1999	605.43	01/24/2000	n/a	03/11/2000	599.32
12/09/1999	604.70	01/25/2000	n/a	03/12/2000	599.45
12/10/1999	604.42	01/26/2000	n/a		
12/11/1999	604.20	01/27/2000	n/a		
12/12/1999	602.62	01/28/2000	n/a		
12/13/1999	601.52	01/29/2000	n/a		
12/14/1999	601.29	01/30/2000	591.73		
12/15/1999	601.10	01/31/2000	591.77		
12/16/1999	600.89	02/01/2000	591.50		
12/17/1999	599.64	02/02/2000	591.81		
12/18/1999	599.42	02/03/2000	591.74		
12/19/1999	598.35	02/04/2000	591.36		
12/20/1999	598.65	02/05/2000	591.10		
12/21/1999	598.99	02/06/2000	590.94		
12/22/1999	598.40	02/07/2000	590.75		
12/23/1999	597.90	02/08/2000	591.02		
12/24/1999	598.09	02/09/2000	590.93		
12/25/1999	598.74	02/10/2000	590.73		
12/26/1999	599.24	02/11/2000	590.43		
12/27/1999	599.57	02/12/2000	590.27		
12/28/1999	599.68	02/13/2000	590.15		
12/29/1999	599.66	02/14/2000	589.79		
12/30/1999	598.87	02/15/2000	589.64		

Note: n/a = not available

Observation Well W

Date	Elevation (ft-msl)	Date	Elevation (ft-msl)	Date	Elevation (ft-msl)
11/14/1999	612.43	12/31/1999	600.37	02/16/2000	591.80
11/15/1999	612.40	01/01/2000	600.39	02/17/2000	591.66
11/16/1999	612.40	01/02/2000	600.49	02/18/2000	591.69
11/17/1999	612.36	01/03/2000	600.36	02/19/2000	591.55
11/18/1999	612.35	01/04/2000	599.88	02/20/2000	591.42
11/19/1999	612.34	01/05/2000	599.51	02/21/2000	591.32
11/20/1999	612.29	01/06/2000	599.27	02/22/2000	591.47
11/21/1999	612.27	01/07/2000	599.34	02/23/2000	591.47
11/22/1999	612.27	01/08/2000	598.74	02/24/2000	n/a
11/23/1999	612.26	01/09/2000	598.39	02/25/2000	n/a
11/24/1999	612.24	01/10/2000	598.13	02/26/2000	n/a
11/25/1999	612.21	01/11/2000	597.68	02/27/2000	596.05
11/26/1999	612.27	01/12/2000	597.44	02/28/2000	n/a
11/27/1999	612.28	01/13/2000	597.04	02/29/2000	n/a
11/28/1999	612.10	01/14/2000	596.68	03/01/2000	n/a
11/29/1999	614.06	01/15/2000	596.51	03/02/2000	n/a
11/30/1999	613.47	01/16/2000	596.39	03/03/2000	n/a
12/01/1999	612.56	01/17/2000	596.18	03/04/2000	n/a
12/02/1999	611.81	01/18/2000	596.00	03/05/2000	599.43
12/03/1999	611.18	01/19/2000	595.75	03/06/2000	600.41
12/04/1999	610.59	01/20/2000	595.44	03/07/2000	600.06
12/05/1999	610.39	01/21/2000	595.19	03/08/2000	600.65
12/06/1999	609.75	01/22/2000	594.98	03/09/2000	600.91
12/07/1999	608.46	01/23/2000	594.77	03/10/2000	601.22
12/08/1999	607.19	01/24/2000	n/a	03/11/2000	601.51
12/09/1999	606.34	01/25/2000	n/a	03/12/2000	601.72
12/10/1999	605.86	01/26/2000	n/a		
12/11/1999	605.44	01/27/2000	n/a		
12/12/1999	604.33	01/28/2000	n/a		
12/13/1999	603.20	01/29/2000	n/a		
12/14/1999	602.89	01/30/2000	593.91		
12/15/1999	602.59	01/31/2000	593.90		
12/16/1999	602.18	02/01/2000	593.75		
12/17/1999	601.24	02/02/2000	593.70		
12/18/1999	600.68	02/03/2000	593.70		
12/19/1999	600.07	02/04/2000	593.67		
12/20/1999	599.97	02/05/2000	593.39		
12/21/1999	599.97	02/06/2000	593.18		
12/22/1999	599.77	02/07/2000	593.05		
12/23/1999	600.30	02/08/2000	593.09		
12/24/1999	600.45	02/09/2000	593.09		
12/25/1999	600.48	02/10/2000	593.03		
12/26/1999	600.46	02/11/2000	592.73		
12/27/1999	600.54	02/12/2000	592.54		
12/28/1999	600.55	02/13/2000	592.39		
12/29/1999	600.55	02/14/2000	592.21		
12/30/1999	600.33	02/15/2000	592.09		

Note: n/a = not available

Observation Well OW1

Date	Elevation (ft-msl)	Date	Elevation (ft-msl)	Date	Elevation (ft-msl)
11/14/1999	615.88	12/31/1999	596.92	02/16/2000	584.83
11/15/1999	615.86	01/01/2000	596.90	02/17/2000	584.77
11/16/1999	615.86	01/02/2000	596.86	02/18/2000	n/a
11/17/1999	615.81	01/03/2000	595.91	02/19/2000	n/a
11/18/1999	615.81	01/04/2000	595.75	02/20/2000	584.43
11/19/1999	615.79	01/05/2000	595.29	02/21/2000	584.37
11/20/1999	615.72	01/06/2000	n/a	02/22/2000	n/a
11/21/1999	615.71	01/07/2000	591.58	02/23/2000	n/a
11/22/1999	615.71	01/08/2000	589.78	02/24/2000	n/a
11/23/1999	615.71	01/09/2000	589.23	02/25/2000	n/a
11/24/1999	615.69	01/10/2000	589.30	02/26/2000	n/a
11/25/1999	615.65	01/11/2000	589.29	02/27/2000	596.60
11/26/1999	615.69	01/12/2000	589.29	02/28/2000	596.95
11/27/1999	615.71	01/13/2000	589.08	02/29/2000	597.81
11/28/1999	615.59	01/14/2000	589.08	03/01/2000	598.28
11/29/1999	n/a	01/15/2000	589.10	03/02/2000	598.69
11/30/1999	607.91	01/16/2000	589.16	03/03/2000	599.17
12/01/1999	605.56	01/17/2000	589.24	03/04/2000	599.64
12/02/1999	604.95	01/18/2000	589.12	03/05/2000	600.10
12/03/1999	604.48	01/19/2000	588.64	03/06/2000	600.45
12/04/1999	604.05	01/20/2000	588.26	03/07/2000	600.82
12/05/1999	604.31	01/21/2000	587.83	03/08/2000	601.25
12/06/1999	n/a	01/22/2000	587.51	03/09/2000	601.50
12/07/1999	597.31	01/23/2000	588.37	03/10/2000	601.82
12/08/1999	596.09	01/24/2000	588.37	03/11/2000	602.18
12/09/1999	596.34	01/25/2000	588.34	03/12/2000	602.42
12/10/1999	596.34	01/26/2000	588.34		
12/11/1999	n/a	01/27/2000	588.50		
12/12/1999	n/a	01/28/2000	588.83		
12/13/1999	n/a	01/29/2000	589.17		
12/14/1999	n/a	01/30/2000	589.23		
12/15/1999	n/a	01/31/2000	589.29		
12/16/1999	n/a	02/01/2000	588.70		
12/17/1999	n/a	02/02/2000	588.53		
12/18/1999	591.14	02/03/2000	588.55		
12/19/1999	n/a	02/04/2000	588.54		
12/20/1999	n/a	02/05/2000	587.94		
12/21/1999	n/a	02/06/2000	586.15		
12/22/1999	n/a	02/07/2000	585.99		
12/23/1999	596.93	02/08/2000	585.99		
12/24/1999	596.93	02/09/2000	585.99		
12/25/1999	597.03	02/10/2000	585.98		
12/26/1999	596.93	02/11/2000	585.74		
12/27/1999	596.93	02/12/2000	585.60		
12/28/1999	596.93	02/13/2000	585.58		
12/29/1999	596.93	02/14/2000	585.02		
12/30/1999	596.89	02/15/2000	585.02		

Note: n/a = not available

Observation Well E

Date	Elevation (ft-msl)	Date	Elevation (ft-msl)	Date	Elevation (ft-msl)
10/17/1999	617.07	12/03/1999	n/a	01/19/2000	599.28
10/18/1999	617.07	12/04/1999	n/a	01/20/2000	599.07
10/19/1999	617.06	12/05/1999	612.31	01/21/2000	598.86
10/20/1999	617.04	12/06/1999	611.73	01/22/2000	598.64
10/21/1999	617.07	12/07/1999	610.47	01/23/2000	598.63
10/22/1999	617.13	12/08/1999	609.02	01/24/2000	598.62
10/23/1999	617.05	12/09/1999	608.16	01/25/2000	598.50
10/24/1999	617.00	12/10/1999	607.62	01/26/2000	598.29
10/25/1999	617.00	12/11/1999	607.16	01/27/2000	598.12
10/26/1999	617.01	12/12/1999	606.70	01/28/2000	598.00
10/27/1999	616.99	12/13/1999	605.98	01/29/2000	n/a
10/28/1999	616.98	12/14/1999	605.58	01/30/2000	597.99
10/29/1999	616.98	12/15/1999	605.27	01/31/2000	597.97
10/30/1999	616.97	12/16/1999	604.73	02/01/2000	597.79
10/31/1999	616.95	12/17/1999	604.21	02/02/2000	598.14
11/01/1999	616.96	12/18/1999	603.62	02/03/2000	598.13
11/02/1999	616.97	12/19/1999	603.16	02/04/2000	597.81
11/03/1999	616.95	12/20/1999	602.87	02/05/2000	597.56
11/04/1999	616.95	12/21/1999	602.82	02/06/2000	597.34
11/05/1999	616.88	12/22/1999	602.55	02/07/2000	597.17
11/06/1999	616.84	12/23/1999	602.16	02/08/2000	597.20
11/07/1999	616.84	12/24/1999	602.24	02/09/2000	597.24
11/08/1999	616.84	12/25/1999	602.69	02/10/2000	597.16
11/09/1999	616.86	12/26/1999	603.12	02/11/2000	596.89
11/10/1999	616.87	12/27/1999	603.43	02/12/2000	596.76
11/11/1999	616.79	12/28/1999	603.55	02/13/2000	596.68
11/12/1999	616.77	12/29/1999	603.53	02/14/2000	596.56
11/13/1999	616.79	12/30/1999	603.23	02/15/2000	596.41
11/14/1999	616.79	12/31/1999	603.08	02/16/2000	596.21
11/15/1999	616.87	01/01/2000	603.12	02/17/2000	596.10
11/16/1999	616.76	01/02/2000	603.28	02/18/2000	596.19
11/17/1999	616.65	01/03/2000	603.58	02/19/2000	595.97
11/18/1999	616.62	01/04/2000	603.37	02/20/2000	595.84
11/19/1999	616.62	01/05/2000	603.08	02/21/2000	595.79
11/20/1999	617.56	01/06/2000	602.86	02/22/2000	596.58
11/21/1999	617.57	01/07/2000	602.54	02/23/2000	597.54
11/22/1999	617.57	01/08/2000	601.78	02/24/2000	598.47
11/23/1999	616.60	01/09/2000	601.78	02/25/2000	599.25
11/24/1999	616.56	01/10/2000	601.59	02/26/2000	599.98
11/25/1999	616.55	01/11/2000	601.22	02/27/2000	600.52
11/26/1999	616.62	01/12/2000	600.99	02/28/2000	601.05
11/27/1999	616.62	01/13/2000	600.60	02/29/2000	601.69
11/28/1999	616.52	01/14/2000	600.28	03/01/2000	602.15
11/29/1999	n/a	01/15/2000	600.15	03/02/2000	602.60
11/30/1999	n/a	01/16/2000	599.88	03/03/2000	603.06
12/01/1999	n/a	01/17/2000	599.78	03/04/2000	603.47
12/02/1999	n/a	01/18/2000	599.59	03/05/2000	603.93

Note: n/a = not available

Date	Elevation (ft-msl)
03/06/2000	604.27
03/07/2000	604.61
03/08/2000	605.04
03/09/2000	605.25
03/10/2000	605.46
03/11/2000	605.82
03/12/2000	605.98
03/13/2000	606.26
03/14/2000	606.48
03/15/2000	606.76
03/16/2000	606.98
03/17/2000	607.10
03/18/2000	607.33
03/19/2000	607.64
03/20/2000	607.86
03/21/2000	607.91
03/22/2000	608.10
03/23/2000	608.30
03/24/2000	608.56
03/25/2000	608.69
03/26/2000	608.89
03/27/2000	609.17
03/28/2000	609.32
03/29/2000	609.39
03/30/2000	609.52
03/31/2000	609.65
04/01/2000	609.81
04/02/2000	609.99
04/03/2000	610.14
04/04/2000	610.21
04/05/2000	610.39
04/06/2000	610.49
04/07/2000	610.64
04/08/2000	610.65
04/09/2000	610.74
04/10/2000	610.83
04/11/2000	610.91
04/12/2000	611.00
04/13/2000	611.61

Note: n/a = not available

Observation Well C

Date	Elevation (ft-msl)	Date	Elevation (ft-msl)	Date	Elevation (ft-msl)
11/14/1999	616.21	12/26/1999	602.35	02/03/2000	596.91
11/15/1999	616.21	12/26/1999	602.46	02/04/2000	596.73
11/16/1999	616.16	12/27/1999	602.66	02/05/2000	596.49
11/17/1999	616.05	12/28/1999	602.74	02/06/2000	596.28
11/18/1999	616.03	12/29/1999	602.72	02/06/2000	596.27
11/19/1999	616.00	12/30/1999	602.41	02/07/2000	596.11
11/20/1999	615.99	12/31/1999	602.31	02/08/2000	596.23
11/21/1999	616.02	01/01/2000	602.36	02/09/2000	596.20
11/22/1999	615.99	01/02/2000	602.47	02/10/2000	596.11
11/23/1999	616.03	01/02/2000	602.49	02/11/2000	595.82
11/24/1999	n/a	01/03/2000	602.66	02/12/2000	595.69
11/25/1999	616.02	01/04/2000	602.38	02/13/2000	595.63
11/26/1999	616.07	01/05/2000	602.06	02/13/2000	595.63
11/27/1999	615.99	01/06/2000	601.83	02/14/2000	595.47
11/28/1999	615.92	01/07/2000	601.59	02/15/2000	595.32
11/29/1999	615.90	01/08/2000	601.23	02/16/2000	595.13
11/30/1999	615.27	01/09/2000	600.84	02/17/2000	595.00
12/01/1999	614.38	01/09/2000	600.83	02/18/2000	595.09
12/02/1999	613.53	01/10/2000	600.68	02/19/2000	594.86
12/03/1999	612.82	01/11/2000	600.31	02/20/2000	594.75
12/04/1999	612.19	01/12/2000	600.08	02/20/2000	594.75
12/05/1999	611.92	01/13/2000	599.69	02/21/2000	594.69
12/05/1999	611.89	01/14/2000	599.37	02/22/2000	594.86
12/06/1999	611.29	01/15/2000	599.23	02/23/2000	n/a
12/07/1999	609.97	01/16/2000	598.97	02/24/2000	n/a
12/08/1999	608.67	01/16/2000	598.95	02/25/2000	n/a
12/09/1999	607.83	01/17/2000	598.95	02/26/2000	n/a
12/10/1999	607.33	01/18/2000	598.81	02/27/2000	599.37
12/10/1999	607.29	01/19/2000	598.61	02/27/2000	599.40
12/11/1999	606.81	01/20/2000	598.31	02/28/2000	599.90
12/12/1999	606.13	01/21/2000	598.06	02/29/2000	600.57
12/13/1999	605.30	01/22/2000	597.87	03/01/2000	601.02
12/14/1999	604.92	01/23/2000	597.67	03/02/2000	601.50
12/15/1999	604.58	01/23/2000	597.67	03/03/2000	602.00
12/16/1999	604.07	01/24/2000	597.64	03/04/2000	602.40
12/17/1999	603.37	01/25/2000	597.62	03/05/2000	602.74
12/18/1999	602.89	01/26/2000	597.48	03/05/2000	602.78
12/18/1999	602.87	01/27/2000	597.27	03/06/2000	603.13
12/19/1999	602.39	01/28/2000	597.09	03/07/2000	603.46
12/20/1999	602.15	01/29/2000	596.99	03/08/2000	603.90
12/21/1999	602.16	01/30/2000	596.94	03/09/2000	604.17
12/22/1999	601.82	01/30/2000	596.99	03/10/2000	604.43
12/23/1999	601.41	01/31/2000	596.95	03/11/2000	604.76
12/24/1999	601.49	02/01/2000	596.76	03/12/2000	604.95
12/25/1999	601.95	02/02/2000	596.91		

Note: n/a = not available

Observation Well W2

Date	Elevation (ft-msl)	Date	Elevation (ft-msl)	Date	Elevation (ft-msl)
11/14/1999	612.31	12/26/1999	598.97	02/06/2000	590.98
11/15/1999	612.29	12/27/1999	599.21	02/06/2000	590.98
11/16/1999	612.28	12/28/1999	599.40	02/07/2000	590.83
11/17/1999	612.25	12/29/1999	599.38	02/08/2000	591.00
11/18/1999	612.25	12/30/1999	598.93	02/09/2000	590.98
11/19/1999	612.28	12/31/1999	598.88	02/10/2000	590.83
11/20/1999	612.22	01/01/2000	598.88	02/11/2000	590.45
11/21/1999	612.21	01/02/2000	598.87	02/12/2000	590.29
11/22/1999	612.21	01/02/2000	598.88	02/13/2000	590.16
11/23/1999	612.19	01/03/2000	598.62	02/13/2000	n/a
11/24/1999	612.17	01/04/2000	598.21	02/14/2000	n/a
11/25/1999	612.13	01/05/2000	597.74	02/15/2000	589.78
11/26/1999	612.18	01/06/2000	597.41	02/16/2000	589.55
11/27/1999	612.18	01/07/2000	597.58	02/17/2000	589.41
11/28/1999	612.05	01/08/2000	597.12	02/18/2000	589.41
11/28/1999	612.05	01/09/2000	596.70	02/19/2000	589.22
11/29/1999	612.02	01/09/2000	596.64	02/20/2000	589.12
11/30/1999	611.50	01/10/2000	596.28	02/20/2000	589.51
12/01/1999	610.66	01/11/2000	595.86	02/21/2000	589.51
12/02/1999	609.98	01/12/2000	595.61	02/22/2000	590.48
12/03/1999	609.34	01/13/2000	595.22	02/23/2000	n/a
12/04/1999	608.79	01/14/2000	594.82	02/24/2000	n/a
12/05/1999	608.63	01/15/2000	594.67	02/25/2000	n/a
12/05/1999	608.59	01/16/2000	594.33	02/26/2000	n/a
12/06/1999	608.09	01/16/2000	594.30	02/27/2000	593.42
12/07/1999	607.11	01/17/2000	594.20	02/27/2000	593.42
12/08/1999	605.86	01/18/2000	594.09	02/28/2000	593.47
12/09/1999	605.01	01/19/2000	593.81	02/29/2000	594.36
12/10/1999	604.43	01/20/2000	593.54	03/01/2000	594.76
12/10/1999	604.34	01/21/2000	593.21	03/02/2000	594.94
12/11/1999	604.13	01/22/2000	593.04	03/03/2000	594.95
12/12/1999	603.06	01/23/2000	592.80	03/04/2000	594.95
12/13/1999	602.01	01/23/2000	n/a	03/05/2000	n/a
12/14/1999	601.61	01/24/2000	n/a	03/06/2000	596.48
12/15/1999	601.34	01/25/2000	n/a	03/06/2000	596.48
12/16/1999	601.03	01/26/2000	n/a	03/07/2000	596.49
12/17/1999	600.16	01/27/2000	n/a	03/08/2000	596.49
12/18/1999	599.37	01/28/2000	n/a	03/10/2000	596.50
12/18/1999	599.33	01/29/2000	n/a	03/11/2000	596.51
12/19/1999	598.74	01/30/2000	591.75	03/12/2000	598.65
12/20/1999	598.60	01/30/2000	591.75		
12/21/1999	598.76	01/31/2000	591.71		
12/22/1999	598.53	02/01/2000	591.55		
12/23/1999	598.06	02/02/2000	591.70		
12/24/1999	597.94	02/03/2000	591.77		
12/25/1999	598.49	02/04/2000	591.52		
12/26/1999	598.95	02/05/2000	591.17		

Note: n/a = not available

Sangamon River at Hog Chute Bridge

Date	Elevation (ft-msl)	Date	Elevation (ft-msl)	Date	Elevation (ft-msl)
01/14/1992	622.82	09/17/1995	620.07	07/30/1999	620.79
02/16/1992	623.16	10/15/1995	620.66	08/27/1999	625.56
03/15/1992	622.84	11/12/1995	621.46	09/16/1999	620.31
04/19/1992	625.86	12/10/1995	620.55	10/17/1999	620.71
05/18/1992	622.10	01/07/1996	620.61	11/14/1999	620.72
06/14/1992	622.25	02/11/1996	621.79	11/28/1999	620.77
07/12/1992	628.42	03/10/1996	621.82	12/05/1999	620.84
08/09/1992	623.33	04/11/1996	621.87	12/10/1999	621.12
09/08/1992	621.65	05/12/1996	631.39	12/18/1999	621.02
10/14/1992	621.54	06/09/1996	625.66	01/02/2000	620.79
11/01/1992	622.72	07/07/1996	621.75	01/09/2000	620.97
11/29/1992	627.06	08/14/1996	621.11	01/16/2000	620.86
12/27/1992	623.30	09/29/1996	620.08	02/20/2000	623.61
01/24/1993	629.95	03/16/1997	627.43	02/27/2000	622.14
02/24/1993	623.62	04/15/1997	622.55	03/05/2000	621.64
03/21/1993	625.18	05/11/1997	622.86	03/12/2000	621.23
04/18/1993	628.88	06/15/1997	626.99	04/15/2000	621.36
05/17/1993	623.62	07/13/1997	621.69	05/13/2000	623.17
07/11/1993	624.22	08/10/1997	620.16	06/11/2000	622.28
08/15/1993	623.51	09/01/1997	620.38	07/15/2000	621.45
10/10/1993	627.03	10/05/1997	620.02	09/17/2000	620.54
11/07/1993	623.58	11/02/1997	620.52	10/13/2000	620.90
12/05/1993	628.58	11/30/1997	621.87	11/12/2000	624.14
01/01/1994	623.58	01/04/1998	622.00	12/10/2000	621.57
01/20/1994	628.62	02/01/1998	623.17		
03/06/1994	625.98	03/01/1998	623.94		
04/03/1994	622.77	03/29/1998	629.17		
04/20/1994	627.85	05/10/1998	630.51		
06/05/1994	622.48	06/07/1998	623.12		
06/29/1994	621.63	06/28/1998	626.83		
07/30/1994	620.46	07/24/1998	622.65		
08/28/1994	620.15	08/05/1998	622.72		
09/25/1994	620.01	08/29/1998	620.27		
10/23/1994	620.26	09/02/1998	620.15		
11/20/1994	621.37	09/27/1998	619.95		
12/11/1994	625.29	11/01/1998	620.75		
02/12/1995	621.73	11/29/1998	620.88		
03/12/1995	627.25	12/27/1998	620.92		
04/16/1995	626.06	01/24/1999	626.93		
05/14/1995	630.32	02/21/1999	623.67		
06/11/1995	626.62	03/21/1999	623.55		
07/09/1995	622.06	04/25/1999	626.01		
08/13/1995	622.32	05/22/1999	624.01		

Note: n/a = not available

Decatur Well #1

Date	Elevation (ft-msl)
02/21/1999	624.16
03/21/1999	623.92
04/25/1999	625.77
05/22/1999	624.50
07/30/1999	622.45
08/27/1999	626.04
09/16/1999	621.34
10/17/1999	620.93
11/14/1999	621.66
11/28/1999	621.43
12/05/1999	612.43
12/10/1999	610.97
12/18/1999	609.05
12/26/1999	607.87
01/02/2000	607.80
01/09/2000	607.49
01/16/2000	606.65
01/23/2000	606.24
01/30/2000	605.72
02/06/2000	605.40
02/13/2000	605.31
02/20/2000	605.38
02/27/2000	612.17
03/05/2000	613.93

Note: n/a = not available

Observation Well 1A

Date	Elevation (ft-msl)	Date	Elevation (ft-msl)	Date	Elevation (ft-msl)
02/25/1990	627.78	01/01/1994	626.92	11/30/1997	621.93
04/28/1990	624.76	01/30/1994	628.32	01/04/1998	622.86
05/27/1990	627.38	03/06/1994	626.66	02/01/1998	624.55
07/21/1990	625.59	04/03/1994	626.11	03/01/1998	624.88
08/18/1990	624.20	04/20/1994	628.79	03/29/1998	628.50
09/12/1990	622.58	06/05/1994	626.12	05/10/1998	629.52
10/14/1990	627.66	06/29/1994	624.85	06/07/1998	626.20
11/11/1990	625.51	07/30/1994	623.15	06/28/1998	628.27
12/08/1990	626.55	08/28/1994	618.28	07/24/1998	622.19
02/08/1991	628.57	09/25/1994	619.33	08/05/1998	619.39
03/17/1991	627.62	10/23/1994	615.32	08/29/1998	619.48
04/14/1991	626.30	11/20/1994	618.08	09/02/1998	621.77
05/13/1991	627.01	12/11/1994	622.25	09/27/1998	619.85
06/09/1991	625.74	01/08/1995	621.76	11/01/1998	620.21
08/11/1991	621.94	02/12/1995	624.21	11/29/1998	620.58
09/07/1991	621.09	03/12/1995	626.68	12/27/1998	620.66
10/19/1991	615.82	04/16/1995	626.26	01/24/1999	623.66
11/17/1991	620.79	05/14/1995	628.43	02/21/1999	625.09
12/15/1991	624.08	06/11/1995	627.20	03/21/1999	624.71
01/14/1992	623.47	07/09/1995	625.20	04/25/1999	626.70
02/18/1992	623.35	08/13/1995	623.52	05/22/1999	625.18
03/15/1992	623.80	09/17/1995	621.72	07/30/1999	622.88
04/19/1992	624.78	10/15/1995	621.42	08/27/1999	625.79
05/18/1992	623.87	11/12/1995	621.88	09/16/1999	621.76
06/14/1992	623.08	12/10/1995	621.78	10/17/1999	621.36
07/12/1992	627.02	01/07/1996	621.91	11/14/1999	621.09
08/09/1992	626.09	02/11/1996	623.04	11/28/1999	620.91
09/08/1992	623.89	03/10/1996	622.96	12/05/1999	616.84
10/04/1992	623.38	04/11/1996	623.50	12/10/1999	615.67
11/01/1992	623.13	05/12/1996	628.61	12/18/1999	614.19
11/29/1992	627.89	06/09/1996	627.29	12/26/1999	613.15
12/27/1992	626.30	07/07/1996	624.64	01/02/2000	612.98
01/24/1993	629.15	08/14/1996	622.51	01/09/2000	612.65
02/24/1993	626.19	09/29/1996	621.07	01/16/2000	611.97
03/21/1993	626.89	03/16/1997	626.64	01/23/2000	611.51
04/18/1993	628.76	04/13/1997	624.58	01/30/2000	611.01
05/17/1993	626.35	05/11/1997	624.65	02/06/2000	610.66
06/13/1993	626.71	06/15/1997	627.08	02/13/2000	610.59
07/11/1993	627.44	07/13/1997	623.65	02/20/2000	610.75
08/15/1993	626.10	08/10/1997	621.69	02/27/2000	614.31
10/10/1993	627.32	09/01/1997	621.88	03/05/2000	615.72
11/07/1993	626.82	10/05/1997	621.66	03/12/2000	616.58
12/05/1993	628.90	11/02/1997	621.61	04/15/2000	619.29

Note: n/a = not available

Observation Well 1A (concluded)

Date	Elevation (ft-msl)
05/13/2000	620.55
06/11/2000	622.61
07/16/2000	623.39
09/17/2000	620.57
10/15/2000	620.36
11/12/2000	621.89
12/10/2000	621.72
01/07/2001	621.85
02/11/2001	626.46

Note: n/a = not available

Observation Well 1B

Date	Elevation (ft-msl)	Date	Elevation (ft-msl)	Date	Elevation (ft-msl)
01/17/1990	627.78	01/01/1994	626.92	11/30/1997	621.91
04/02/1990	624.71	01/30/1994	628.32	01/04/1998	622.84
05/27/1990	627.38	03/06/1994	626.63	02/01/1998	624.54
07/21/1990	625.59	04/03/1994	626.09	03/01/1998	624.90
08/18/1990	624.18	04/30/1994	628.81	03/29/1998	628.53
09/18/1990	622.60	06/05/1994	626.12	05/10/1998	629.54
10/14/1990	627.65	06/29/1994	624.85	06/07/1998	626.17
11/11/1990	625.51	07/30/1994	623.11	06/28/1998	628.23
12/08/1990	626.52	08/28/1994	618.28	07/24/1998	622.19
02/08/1991	628.54	09/25/1994	619.30	08/05/1998	619.41
03/17/1991	627.60	10/23/1994	615.31	08/29/1998	619.47
04/14/1991	626.27	11/20/1994	618.07	09/02/1998	621.77
05/12/1991	627.01	12/11/1994	622.25	09/27/1998	619.82
06/09/1991	625.76	01/08/1995	621.75	11/01/1998	620.21
08/11/1991	621.92	02/12/1995	624.21	11/29/1998	620.57
09/07/1991	621.09	03/12/1995	626.68	12/27/1998	620.65
10/19/1991	615.82	04/16/1995	626.25	01/24/1999	623.70
11/17/1991	620.81	05/14/1995	628.41	02/21/1999	625.07
12/15/1991	624.08	06/11/1995	627.17	03/21/1999	624.71
01/14/1992	623.45	07/09/1995	625.20	04/25/1999	626.65
02/18/1992	623.35	08/13/1995	623.46	05/22/1999	625.18
03/15/1992	623.80	09/17/1995	621.70	07/30/1999	622.89
04/19/1992	624.77	10/15/1995	621.42	08/27/1999	625.79
05/18/1992	623.85	11/12/1995	621.89	09/16/1999	621.75
06/14/1992	623.08	12/10/1995	621.74	10/17/1999	621.35
07/12/1992	627.03	01/07/1996	621.91	11/14/1999	621.07
08/09/1992	626.15	02/11/1996	623.08	11/28/1999	620.89
09/08/1992	623.90	03/10/1996	622.96	12/05/1999	616.85
10/04/1992	623.38	04/11/1996	623.48	12/10/1999	615.66
11/01/1992	623.13	05/12/1996	628.60	12/18/1999	614.19
11/29/1992	627.89	06/09/1996	627.31	12/26/1999	613.15
12/27/1992	626.30	07/07/1996	624.66	01/02/2000	612.98
01/24/1993	629.10	08/04/1996	622.50	01/09/2000	612.65
02/24/1993	626.17	09/29/1996	621.08	01/16/2000	611.98
03/21/1993	626.89	03/16/1997	626.65	01/23/2000	611.53
04/18/1993	628.75	04/13/1997	624.58	01/30/2000	610.99
05/17/1993	626.38	05/11/1997	624.66	02/06/2000	610.67
06/13/1993	626.72	06/15/1997	627.08	02/13/2000	610.59
07/11/1993	627.44	07/13/1997	623.63	02/20/2000	610.78
08/15/1993	626.08	08/10/1997	621.69	02/27/2000	614.31
10/10/1993	627.32	09/01/1997	621.89	03/05/2000	615.71
11/07/1993	626.82	10/05/1997	621.65	03/12/2000	616.58
12/05/1993	628.92	11/02/1997	621.59	04/15/2000	619.27

Note: n/a = not available

Observation Well 1B (concluded)

Date	Elevation (ft-msl)
05/13/2000	620.56
06/11/2000	622.60
07/15/2000	623.37
09/17/2000	620.58
10/15/2000	620.38
11/12/2000	621.88
12/10/2000	621.71
01/07/2001	621.85
02/11/2001	626.46

Note: n/a = not available

Observation Well 2A

Date	Elevation (ft-msl)	Date	Elevation (ft-msl)	Date	Elevation (ft-msl)
02/25/1990	626.25	01/01/1994	634.39	11/30/1997	628.07
04/28/1990	629.89	01/30/1994	633.42	01/04/1998	627.91
05/27/1990	630.56	03/06/1994	633.33	02/01/1998	629.09
07/21/1990	631.46	04/03/1994	633.13	03/01/1998	629.52
08/18/1990	630.97	04/30/1994	634.36	03/29/1998	630.91
09/18/1990	630.18	06/05/1994	634.16	05/10/1998	632.16
10/14/1990	629.87	06/29/1994	633.43	06/07/1998	632.24
11/11/1990	630.25	07/30/1994	631.86	06/28/1998	633.25
12/08/1990	630.73	08/28/1994	630.72	07/24/1998	631.33
02/08/1991	632.62	09/25/1994	628.83	08/05/1998	629.56
03/17/1991	632.69	10/23/1994	627.74	08/29/1998	627.75
04/14/1991	633.06	11/20/1994	625.87	09/02/1998	629.07
05/13/1991	632.85	12/11/1994	626.13	09/27/1998	627.31
06/09/1991	632.71	01/08/1995	627.21	11/01/1998	626.96
08/11/1991	629.65	02/12/1995	628.78	11/29/1998	627.13
09/07/1991	628.66	03/12/1995	629.36	12/27/1998	627.03
10/19/1991	627.32	04/16/1995	630.29	01/24/1999	626.93
11/17/1991	627.34	05/14/1995	631.15	02/21/1999	628.35
12/15/1991	628.29	06/11/1995	632.52	03/21/1999	629.26
01/14/1992	629.47	07/09/1995	632.32	04/25/1999	629.87
02/18/1992	629.42	08/13/1995	630.63	05/22/1999	630.71
03/15/1992	629.65	09/17/1995	629.47	07/30/1999	630.37
04/19/1992	630.39	10/15/1995	628.93	08/27/1999	631.13
05/18/1992	630.23	11/12/1995	628.52	09/16/1999	628.89
06/14/1992	629.98	12/10/1995	628.04	10/17/1999	628.32
07/12/1992	629.72	01/07/1996	628.03	11/14/1999	628.05
08/09/1992	631.08	02/11/1996	628.78	11/28/1999	627.51
09/08/1992	631.78	03/10/1996	628.04	12/05/1999	627.86
10/04/1992	630.36	04/11/1996	629.19	12/10/1999	627.07
11/01/1992	630.16	05/12/1996	629.55	12/18/1999	626.05
11/29/1992	631.71	06/09/1996	631.40	12/26/1999	625.37
12/27/1992	631.95	07/07/1996	631.38	01/02/2000	625.17
01/24/1993	633.15	08/04/1996	629.86	01/09/2000	624.62
02/24/1993	632.84	09/29/1996	628.32	01/16/2000	623.61
03/21/1993	633.31	03/16/1997	628.50	01/23/2000	623.49
04/18/1993	633.76	04/13/1997	629.41	01/30/2000	623.01
05/17/1993	634.01	05/11/1997	629.62	02/06/2000	622.39
06/13/1993	633.31	06/15/1997	630.20	02/13/2000	622.53
07/11/1993	633.46	07/13/1997	630.06	02/20/2000	621.63
08/15/1993	633.03	08/10/1997	629.02	02/27/2000	621.91
10/10/1993	633.14	09/01/1997	628.49	03/05/2000	622.22
11/07/1993	633.74	10/05/1997	628.23	03/12/2000	622.33
12/05/1993	634.40	11/02/1997	628.32	04/15/2000	624.03

Note: n/a = not available

Observation Well 2A (concluded)

Date	Elevation (ft-msl)
05/13/2000	624.88
06/11/2000	625.95
07/16/2000	627.44
09/17/2000	626.88
10/15/2000	626.72
11/12/2000	626.83
12/10/2000	627.27
01/07/2001	627.72
02/11/2001	627.93

Note: n/a = not available

Observation Well 2B

Date	Elevation (ft-msl)	Date	Elevation (ft-msl)	Date	Elevation (ft-msl)
02/25/1990	624.06	01/01/1994	626.64	11/30/1997	621.40
04/28/1990	623.94	01/30/1994	626.83	01/04/1998	622.24
05/27/1990	626.22	03/06/1994	626.00	02/01/1998	623.71
07/21/1990	625.18	04/03/1994	625.73	03/01/1998	624.01
08/18/1990	623.89	04/30/1994	627.94	03/29/1998	626.92
09/18/1990	622.38	06/05/1994	625.95	05/10/1998	627.75
10/14/1990	630.30	06/29/1994	624.68	06/07/1998	625.80
11/11/1990	624.62	07/30/1994	622.33	06/28/1998	627.33
12/08/1990	625.65	08/28/1994	618.98	07/24/1998	619.25
02/08/1991	627.02	09/25/1994	618.84	08/05/1998	615.73
03/17/1991	626.37	10/23/1994	614.87	08/29/1998	617.93
04/14/1991	625.83	11/20/1994	616.01	09/02/1998	621.20
05/13/1991	626.31	12/11/1994	619.76	09/27/1998	618.98
06/09/1991	625.40	01/08/1995	620.78	11/01/1998	619.58
08/11/1991	621.29	02/12/1995	623.31	11/29/1998	619.97
09/07/1991	620.50	03/12/1995	624.74	12/27/1998	620.09
10/19/1991	616.50	04/16/1995	624.87	01/24/1999	621.12
11/17/1991	619.97	05/14/1995	626.23	02/21/1999	624.05
12/15/1991	622.48	06/11/1995	626.44	03/21/1999	623.83
01/14/1992	622.63	07/09/1995	624.86	04/25/1999	625.54
02/18/1992	622.54	08/13/1995	622.97	05/22/1999	624.51
03/15/1992	623.05	09/17/1995	621.37	07/30/1999	622.49
04/19/1992	623.69	10/15/1995	621.08	08/27/1999	624.95
05/18/1992	623.22	11/12/1995	621.32	09/16/1999	621.48
06/14/1992	622.54	12/10/1995	621.27	10/17/1999	621.09
07/12/1992	624.45	01/07/1996	621.41	11/14/1999	620.78
08/09/1992	625.09	02/11/1996	622.44	11/28/1999	620.59
09/08/1992	623.43	03/10/1996	622.27	12/05/1999	617.00
10/04/1992	622.88	04/11/1996	622.81	12/10/1999	615.04
11/01/1992	622.58	05/12/1996	625.73	12/18/1999	612.69
11/29/1992	626.78	06/09/1996	626.54	12/26/1999	611.35
12/27/1992	625.72	07/07/1996	624.21	01/02/2000	611.40
01/24/1993	627.37	08/04/1996	621.92	01/09/2000	610.95
02/24/1993	625.75	09/29/1996	620.63	01/16/2000	609.90
03/21/1993	626.28	03/16/1997	624.86	01/23/2000	609.28
04/18/1993	627.30	04/13/1997	623.77	01/30/2000	608.68
05/17/1993	625.94	05/11/1997	623.80	02/06/2000	608.29
06/13/1993	626.08	06/15/1997	625.64	02/13/2000	608.01
07/11/1993	627.09	07/13/1997	622.51	02/20/2000	607.80
08/15/1993	n/a	08/10/1997	621.21	02/27/2000	611.11
10/10/1993	626.43	09/01/1997	621.44	03/05/2000	613.12
11/07/1993	626.54	10/05/1997	621.32	03/12/2000	614.40
12/05/1993	627.83	11/02/1997	621.25	04/15/2000	617.86

Note: n/a = not available

Date	Elevation (ft-msl)
05/13/2000	619.34
06/11/2000	621.35
07/16/2000	622.38
09/17/2000	619.62
10/13/2000	619.77
11/12/2000	620.75
12/10/2000	620.97
01/07/2001	621.16
02/11/2001	624.24

Note: n/a = not available

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