BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	
AMEREN ASH POND CLOSURE RULES	)	R09-21
(HUTSONVILLE POWER STATION) :	)	(Rulemaking – Land)
PROPOSED 35 ILL. ADM. CODE 840.101	)	
THROUGH 840.144	)	

NOTICE

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Attached Service List

PLEASE TAKE NOTICE that I have today filed with the Office of the Clerk of the Illinois Pollution Control Board the Agency's Motion for Leave to File Response Concerning Board's Order of January 7, 2010, and the Agency's Response Concerning Board's Order of January 7, 2010, copies of which are herewith served upon you.

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

By: Mark Wight
Mark Wight
Assistant Counsel
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DATE: March 9, 2010

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AGENCY'S MOTION FOR LEAVE TO FILE RESPONSE CONCERNING BOARD'S ORDER OF JANUARY 7, 2010

The ILLINOIS ENVIRONMENTAL PROTECTION AGENCY ("Illinois EPA" or "Agency") states the following in support of the Agency's Motion for Leave to File Response Concerning Board's Order of January 7th:

1. On January 7, 2010, the Illinois Pollution Control Board ("Board") issued an order ("Board Order") in response to post-hearing comments filed by Prairie Rivers Network ("PRN") directing Ameren Energy Generating Company ("Ameren") to provide additional information concerning environmental impacts from contaminated groundwater to irrigation wells on agricultural property south of the Hutsonville facility and on environmental impacts to the Wabash River from the discharge of contaminated groundwater from the proposed groundwater collection system. The Board Order stated the latter information "would be helpful in evaluating the alternative options for the management of contaminated groundwater . . . ." Board Order at 4.

2. Ameren filed "Ameren's Response to Request for Additional Information" on February 22, 2010, and "Ameren's Supplemental Response to Request for More Information" on February 26, 2010.

3. The Agency is uncertain of the Board's intentions concerning the additional information, but PRN has argued that the proposal cannot be adopted consistent with 35 Ill.

Adm. Code 102.210(d) because Ameren has not provided sufficient information to characterize the impact of off-site groundwater contamination to irrigation wells and the environmental impact of the discharge of contaminated groundwater to the Wabash River from the collection system must be subjected to an antidegradation analysis in this proceeding. Comments of PRN, PC # 6 at 1-2.

4. For reasons stated in the attached response, the Agency disagrees with both assertions by PRN. The Agency testified to its general conclusions as to the extent and effects of off-site groundwater contamination based on its independent analysis of information contained in the Technical Support Document. However, the Agency did not provide an explanation of the underlying analysis leading to those conclusions and believes the attached explanation now might provide an additional level of assurance that the potential for off-site impacts to irrigation wells already has been considered. Further and for reasons set forth in the attached response, the Agency's position is that conducting an antidegradation analysis of discharge options for contaminated groundwater in this proceeding would be premature. The proposed rule provides a mechanism for conducting the analysis, if necessary, at an appropriate time under applicable legal procedures. Moreover, Section 102.210(d) does not require the analysis in this proceeding.

5. Under the Board's procedural rules, a participant's comment will not be considered if filed outside a comment period unless allowed by the hearing officer or the Board to prevent material prejudice. 35 Ill. Adm. Code 102.108(d).

6. The Agency's view is that the concerns raised by PRN already have been addressed and accounted for in the record and proposal. The additional information and procedures advocated by PRN will unnecessarily prolong the proceeding and consume scarce resources.

7. The Agency seeks leave to file the attached response with the Board to prevent material prejudice to the Agency's interest in a thorough and efficient proceeding that does not unnecessarily consume scarce resources.

WHEREFORE, the Agency respectfully requests that the Hearing Officer or the Illinois Pollution Control Board grant the Agency leave to file its attached response and accept the response for consideration.

Respectfully submitted,

ILLINOIS ENVIRONMENTAL
PROTECTION AGENCY

By: Mark Wight
Mark Wight
Assistant Counsel

Date: March 9, 2010

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BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	
AMEREN ASH POND CLOSURE RULES	)	R09-21
(HUTSONVILLE POWER STATION) :	)	(Rulemaking – Land)
PROPOSED 35 ILL. ADM. CODE 840.101	)	
THROUGH 840.144	)	

AGENCY'S RESPONSE CONCERNING BOARD'S ORDER OF JANUARY 7, 2010

The ILLINOIS ENVIRONMENTAL PROTECTION AGENCY ("Illinois EPA" or "Agency") submits the following response to the January 7, 2010, order of the Pollution Control Board ("Board") directing Ameren Energy Generating Company ("Ameren") to provide additional information in the above-captioned proceeding. In response to post-hearing comments from Prairie Rivers Network ("PRN"), the Board generally requested additional information characterizing the environmental impacts of Ash Pond D on the agricultural property immediately to the south of the Hutsonville facility and for assessing the environmental impacts of the discharge of contaminated groundwater to the Wabash River. In particular, the Board directed Ameren to provide water quality data related to irrigation wells located on the property south of the facility and an environmental assessment of a discharge to the Wabash "that would be helpful in evaluating the alternative options for the management of contaminated groundwater . . . ." *In the Matter of: Ameren Ash Pond Closure Rules (Hutsonville Power Station): Proposed 35 Ill. Adm. Code 840.101 through 840.144*, R09-21, Order of January 7, 2010 at 4.[1]

Assuming permission to file has been granted, the Illinois EPA appreciates this opportunity to provide its perspective on the matters specified by the Board. The Agency already has testified to its general conclusion that the Technical Support Document ("TSD")

[1] Additional references to this order will be cited as "Board Order at _____."

provided by Ameren contains sufficient information to support the proposal. Testimony of Richard P. Cobb, P.G., Transcript of Hearing (September 29, 2009) at 50-54.[2] This includes information sufficient to determine that any contaminant concentrations from Ash Pond D in the irrigation wells to the south of the Hutsonville facility will remain below the applicable numeric groundwater quality standards and are likely to diminish with the installation and operation of the proposed remedy. However, in light of the Board's request for additional information and in the interest of avoiding the collection and evaluation of information that may be unnecessary, the Agency believes it would be useful to provide a more detailed explanation of the technical basis for its conclusions.

In addition, the Agency wishes to provide its perspective regarding assessments and evaluations in this proceeding of alternatives for the management of contaminated groundwater from the proposed collection trench. The joint proposal is protective as proposed because all the available options for management of contaminated groundwater are regulated by existing and well-settled laws subject to Agency administration. Nonetheless, the Agency does propose one clarifying amendment to Section 840.122, and Ameren's counsel has informed the Agency that Ameren does not object to the proposed amendment.

The Agency realizes that some of the information provided below is duplicative of information provided in "Ameren's Response to Request for Additional Information" filed February 22, 2010, and "Ameren's Supplemental Response to Request for More Information" filed February 26, 2010 (collectively "Ameren's Response"). However, as stated above, the Agency believes that providing its own analysis and perspective will be useful to the Board.

I. AGENCY'S OPINION THAT IRRIGATION WELLS ARE NOT IMPACTED BY CONTAMINANTS FROM ASH POND D

[2] Additional references to this transcript will be cited as "TR. at ____."

In response to post-hearing comments from PRN, the Board requested additional information related to "irrigation wells located on the property adjacent to the southern edge of Ash Pond D (Dement Wells, Nos. 60, 61 and 64, and Wampler-Well No. 66). *See* TSD at 482-484 (Chapter 7)." Board Order at 3.

> Ameren notes that groundwater quality in monitoring well MW-7D, which is a relatively deep well, indicates very little vertical migration to the deep sand and gravel aquifer in which the irrigation wells are completed. TSD at 209 (Chapter 6). However, the Board notes that MW-7D is not located along the southern property line of the ash pond. *E.g.,* TSD at 213. **Further, it appears that there are no other deep monitoring wells located along the southern edge of Ash Pond D. In light of this, the Board believes that additional groundwater quality information concerning the irrigation wells would be helpful for further evaluation of Ameren's proposal**. The record does not clearly demonstrate whether these data from the irrigation wells are available. If recent water quality data from the irrigation wells are available, the Board directs Ameren to submit such data to the Board. If not, the Board directs Ameren to sample the irrigation wells for the same parameters of concern considered in Ameren's hydrogeologic assessment and submit the sampling results. *See* TSD at 205 (Chapter 6). **Alternatively, Ameren may install a deep monitoring well to sample the deep sand and gravel aquifer along the southern edge of Ash Pond D and supply the Board with sampling results from the new monitoring well.**

Id. (emphasis added).

First, the Agency notes there is a deep monitoring well (MW-14) located along the southern boundary of the Hutsonville property at the southeast corners of the property and Ash Pond D. MW-14 is 33 feet deep and approximately 150 feet east of the southeast corner of Ash Pond D. TSD at 33 - 48. It is installed in the coarse-grained lower zone of the underlying aquifer. *Id*. The geologic cross-sections A-A' and B-B' at TSD 32 illustrate that MW-14 is in the top of the coarse-grained lower zone of the underlying aquifer and show its position relative to irrigation well 1 ("IRR-1").[3] The TSD shows four irrigation wells within one-half mile of Ash Pond D. These locations are based on Illinois State Geological Survey plots. TSD at 482 – 84.

[3] IRR-1 is identified as the "Wampler irrigation well (ISGS Well # 12-033-36667-00)." TSD at 32. It is identified as Well 66 at TSD 484.

PRN references “three wells actively used by Mrs. Dement and Mr. Wampler for irrigation, located approximately 50 feet, one-half mile and three-quarters of a mile from Ameren’s property boundary . . . .” Comments of PRN, PC # 3 at 2. The closest active irrigation well on the adjacent property (IRR-1) is approximately 50 feet south of the Ameren property boundary. TSD at 33-48. In addition to IRR-1, the TSD and Ameren’s Response confirm a second irrigation well approximately one-half mile to the west of Ash Pond D and a third approximately three-quarters of a mile to the south of Ash Pond D. Ameren’s Response indicates the fourth well shown in the TSD, ISGS No. 61, is no longer present but, in any case, would be in a position similar to IRR-1. IRR-1 is down-gradient from MW-14 at times when the seasonal effects of irrigation influence the direction of groundwater flow from Ash Pond D. This relationship will be discussed in more detail at Section I(B) below in the Agency’s analysis of the data provided in the TSD.

The Agency’s conclusion is that a worst case concentration of 1.6 milligrams per liter (mg/L) of boron in MW-14 will not increase and is more likely to be reduced by the processes of hydrodynamic dispersion <u>before reaching IRR-1</u>, and this is assuming a constant source of contamination. In reality, the source of contamination to the lower zone of the underlying aquifer is not constant; it is transient based on the growing season and the climatic conditions, which in turn have a direct relationship to a limited irrigation season. Installing a new monitoring well down-gradient of Ash Pond D will not provide any new information beyond what is being detected in existing MW-14. Thus, as discussed in Mr. Cobb’s testimony, the Agency’s opinion is that contaminant concentrations in IRR-1 will not equal or exceed Class I numeric groundwater quality standards due to existing or future groundwater contamination from Ash Pond D. *See* Testimony of Mr. Cobb, TR. at 89-91. A more detailed explanation of the analysis used in reaching this conclusion follows in Sections I(A) and (B). Considering that IRR-1 is the closest to Ash Pond D and most directly down-gradient of the irrigation wells, the explanation below also pertains to other irrigation wells south and west of the facility.

A. General Principles of Hydrology and Hydrogeology

1. Natural Conditions

The analysis begins with general principles of hydrology and hydrogeology. Water infiltrating the soil may evaporate or be used by plants and be transpired. The remainder migrates downward through pore spaces in soil or rock, eventually reaching a zone where all pore spaces are saturated. The surface of this zone of saturation is called the ***water table***. All water below the water table is considered groundwater. 415 ILCS 5/3.210; 35 Ill. Adm. Code 620.110. The water table can be determined by measuring the elevation of water surfaces in wells that penetrate the saturated zone. Under natural conditions, the water table forms a surface that resembles the overlying land surface topography, only in a more subdued and smoother configuration. The water table generally will be at higher elevations beneath upland areas and at lower elevations in valley bottoms. The water table may intersect the ground surface along perennial streams, springs, and lakes, which are natural areas of groundwater discharge. Groundwater moves in a fashion somewhat analogous to surface water, only at much slower rates. While surface water moves downhill in response to gravity, groundwater moves down-gradient from areas of higher potential energy to areas of lower potential energy. These areas of equal elevation are described as ***hydraulic head***. Groundwater flows from recharge zones, where infiltration occurs (*e.g.*, uncovered Ash Pond D), to discharge zones, where groundwater discharges into streams, lakes, and wells.

The ***direction*** of groundwater movement can be estimated from a map of the ***potentiometric surface***, (*i.e.*, a contour map of the elevations of water levels in observation wells). Generally, groundwater flow will be perpendicular to the contours (*i.e.*, areas of equal elevation) of the potentiometric surface. The ***rate*** of groundwater movement is related to the permeability of the aquifer and the magnitude of the slope of the potentiometric surface. In quantitative terms, ***hydraulic conductivity*** is used in place of permeability and is a function of the size and shape of pore spaces, the degree of interconnection of these spaces, and the type of fluid (*e.g.*, water, oil, or brines) passing through the medium.

In general, contaminants are transported in the direction of groundwater flow. Transport in this manner, that is, transport of dissolved constituents (solutes) at the same speed as the average groundwater pore velocity, is called ***advection***. Groundwater movement is governed by the hydraulic principles described by ***Darcy's Law***. This equation states that the flow rate of a liquid through a porous medium is proportional to the head loss and inversely proportional to the length of the flow path. The Darcian velocity assumes that flow occurs across the entire cross-section of the porous material without regard to solid or pore spaces. Actually, flow is limited to the pore space only. Darcy’s Law can be rearranged to determine the average linear velocity or a velocity representing the average rate at which groundwater moves between two points, as follows:

$$V_x = -\frac{Kdh}{n_e dl}$$

Where:

V_x = average linear velocity feet per day (ft/d)

K = hydraulic conductivity (ft/d)

n_e = effective porosity (dimensionless)

dh = delta or change in groundwater head elevation (ft)

dl = delta or change in distance between wells (ft)

2. *Affects of Wells on Natural Conditions*

The general principles of hydrogeology include the affects of pumping wells on the potentiometric surface. The withdrawal of groundwater by a well causes a lowering of water levels in the water table around the well. The difference between water levels during non-pumping and pumping conditions is called ***drawdown***. *See* Attachment 1. From a three-dimensional perspective, the pattern of drawdown around single or multiple pumping wells resembles a cone, with the greatest drawdown adjacent to the pumping well. Therefore, the water table drawdown area affected by the pumping well is called the ***cone of depression***. *See* Attachment 1.

The cone of depression's entire surface area defined by the cone's rim is referred to as the ***lateral area of influence*** (LAI). The area of groundwater entering the LAI of the well is referred to as the ***zone of capture*** (ZOC). The ZOC is the entire three-dimensional area from which groundwater is eventually pulled into a pumping well. *See* Attachment 2. A ZOC is produced when a cone of depression is superimposed on a sloping water table surface. *Id*.

B. Application of General Principles of Hydrology and Hydrogeology at Hutsonville Facility

1. Brief Description of Hutsonville Hydrogeology Pertaining to Off-Site Irrigation Wells

Mr. Cobb's testimony briefly describes the key portion of the site hydrogeology and the effects of the off-site irrigation wells on the upper and lower migration zones of the underlying aquifer south of Ash Pond D during the growing season:

> The Illinois EPA recommends that the upper and lower aquifers should be considered one hydrologic unit, especially in the southeast corner where monitoring well ("MW") 14 is showing contamination (TSD, Chapter 5, p. 51) . . . . The deep alluvial aquifer is hydraulically connected to the fine-grained alluvium in some areas of the site, as can be seen in the potentiometric surface [footnote omitted] maps (TSD, Chapter 5, Fig. 2-9, p. 40) . . . confirmed by groundwater quality data (TSD, Chapter 5, pp. 51-52) . . . . Potentiometric surface maps in this exhibit show nested wells MW-7 (fine-grained shallow alluvium) and MW-7D (coarse grained deep alluvium) with identical water levels, or near

> identical levels with a slight downward gradient (TSD, Chap. 6, Fig. 2, p. 214) . . . . This hydraulic connection is further reflected by the boron, sulfate, manganese, pH and total dissolved solids ("TDS") contamination (boron, sulfate, TDS, pH) seen in the coarse grained deep alluvial well MW-14. [footnote omitted] It should be noted that this represents an exceedence of the Board's nondegradation standards. Based on the hydraulic connection, the uppermost aquifer must include the deep alluvial aquifer in relation to evaluating off-site impacts to the south and southeast of Ash Pond D. This issue is not critical on-site.
>
> . . . Contamination in the lower zone appears to be attributable to the radial gradient produced by mounding in Ash Pond D and seasonal pumping in the off-site irrigation well, which appears to eventually change the direction of groundwater flow to the southeast. TSD, Chap. 5, p. 40, Fig. 2-9. . . . Moreover, the irrigation well is screened in the lower zone of the aquifer. There may be less impact to the lower part of the aquifer than to the upper part because of the transient nature of the cone of depression, produced by the seasonal use of the off-site irrigation well.

Testimony of Richard P. Cobb, P.G., Exhibit 2 at 6-7, 8.

Chapter 5 of the TSD provides a ***time series*** of potentiometric surface maps at the Hutsonville facility for both the upper and lower zones of the underlying aquifer with flow lines perpendicular to the contour lines. TSD at 33 – 48. The time series accounts for variation in the potentiometric surface due to the effects of seasonality, which includes all off-site pumping stresses (*i.e.*, any irrigation or other pumping wells where the ZOC influences groundwater flow at this site). The map at Attachment 3 of this comment (and TSD at p. 40) illustrates the impact of the off-site irrigation wells' LAI and ZOC on the upper migration zone of the aquifer due to the hydraulic connection between the upper and lower zones in the aquifer. The direction of groundwater flow in Attachment 3 has moved to the southeast. This impact of the LAI and ZOC are not reflected in any of the other potentiometric surface maps in TSD Chapter 5. This makes sense because it would take time for the pumping stress in the lower zone of the aquifer to actually change the shape of the potentiometric surface in the upper zone of the aquifer. In fact, the time series indicates it took from the beginning of the growing season until October for this to occur.

The map at Attachment 3 shows that Ash Pond D, which is recharging the water table of the upper zone of the aquifer, is now up-gradient of MW-14 and IRR-1 and is in a position to recharge the LAI and ZOC of IRR-1 in the lower zone of the aquifer. The map also shows the location of MW-14. MW-14 is screened in the coarse-grained lower zone of the aquifer, is down-gradient of Ash Pond D during the transient condition just described, and more importantly for the Board's concerns, it is up-gradient from the influence of IRR-1, the closest irrigation well. Attachment 3; TSD at 40.

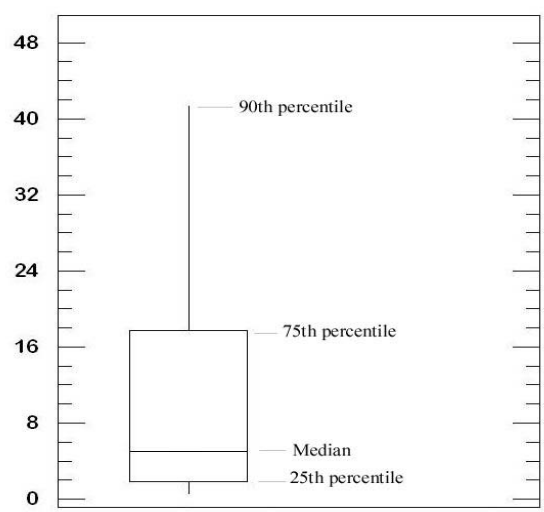
2. Concentrations of Contaminants at Ameren-Hutsonville Facility

Contaminants of concern at the Hutsonville facility are discussed in Chapter 5 of the TSD and depicted at TSD pages 49 through 52 in "box and whisker plots" representing concentrations of boron, sulfate, manganese and TDS in both the upper and lower zones of the underlying aquifer for the six-year span 2002 through 2008. Mr. Cobb testified at hearing that box and whisker plots are a useful and concise graphical display for summarizing the distribution of data from a data set. TR. at 50 - 51.

Box plots provide visual summaries of:

1) The center of the data (the median - the center line of the box);
2) The variation or spread (interquartile-range - the box height);
3) The skewness (quartile skew - the relative size of box halves); and

A sample box-whisker plot



4) The presence or absences of unusual values ("outside" and "far outside" values.)

Box plots are even more useful in comparing these attributes among several data sets or, in this case, the different monitoring wells at the Hutsonville site. The box plot shows the concentrations occurring between 90, 75, and 25 percent of the time. Attachment 4 shows that the boron concentration (most mobile contaminant of concern) in MW-14 is at a concentration of less than or equal to 1.6 mg/L ninety percent of the time. More importantly, the greatest paucity of the data shows boron to be at a concentration of less than 0.8 mg/L. Statistically, this means that concentrations of 0.8 mg/L are more likely than 1.6 mg/L at this location. In addition, Mr. Cobb testified in a follow-up answer to a question from Ms. Barkley of PRN to Mr. Bollinger of Ameren questioning the accuracy of the depicted data sets:

> Statistically, you have an accurate picture here. In my pre-filed testimony, Attachment I really gives the current extent of the plume, so, I mean, that's -- that is reflective of what's been happening since the ash impoundment was there. I mean, that is the cumulative effect, and the monitoring data that's there is statistically reflective of the conditions in the upper zone and the lower zone, so I don't -- those -- in my opinion, I don't think those would change even if you had -- those would just be averaged into the plot, and then in fact they are represented in Attachment I of my pre-filed testimony, and then the statistical information is in Attachment II and III of my pre-filed testimony.

Testimony of Mr. Cobb, TR. at 53 - 54. Therefore, the Agency has concluded (based on the statistically accurate data in the TSD) the worst-case scenario for modeling contaminant transport would start with a concentration of 1.6 mg/L of boron. However, a more statistically accurate and representative starting place would be a concentration of 0.8 mg/L of boron.

3. Transport of Contaminants in Groundwater Generally and at Hutsonville Facility

As stated in Section I(A)(1) above, contaminants generally are transported in the direction of groundwater flow. Transport in this manner, that is, transport of dissolved constituents (solutes) at the same speed as the average groundwater pore velocity, is called ***advection***. In porous natural materials the pores possess different sizes, shapes, and orientations. Similar to stream flow, a velocity distribution exists within the pore spaces such that the rate of movement is greater in the center of the pore than at the edges. Thus, in saturated flow through these materials, velocities vary widely across any single pore and between pores. As a result, when a miscible fluid is introduced into a flow system it will mix mechanically and diffuse (because of tightly packed molecules bumping into one another) to occupy an ever increasing portion of the flow field. This mixing phenomenon is known as ***dispersion***. In this sense, dispersion is a mechanism of ***dilution***. Dispersion acts to reduce the peak concentration of material introduced into a flow field. Solute transport can be described using the following simplified analytical version of the ***Advection-Dispersion Equation***[4]:

$$C_{(x)} = C_{source} \bullet \exp\left[\left(\frac{X}{2\alpha_x}\right) \bullet \left(1 - \sqrt{1 + \frac{4\lambda \bullet \alpha_x}{U}}\right)\right] \bullet erf\left[\frac{S_w}{4 \bullet \sqrt{\alpha_y \bullet X}}\right] \bullet erf\left[\frac{S_d}{2 \bullet \sqrt{\alpha_z \bullet X}}\right]$$

Where:

X = distance from the planar source to the location of concern, along the centerline of the groundwater plume (i.e., y=0, z=0)

C_x = the concentration of the contaminant at a distance X from the source, along the centerline of the plume

C_{source} = the greatest potential concentration of the contaminant of concern in the groundwater at the source of the contamination, based on the concentrations of contaminants in groundwater due to the release and the projected concentration of the contaminant migrating from the soil to the groundwater. As indicated above, the model assumes a planar source discharging groundwater at a concentration equal to C_{source}.

α_x = dispersivity in the x direction

α_y = dispersivity in the y direction

α_z = dispersivity in the z direction

U = specific discharge (i.e., actual groundwater flow velocity through a porous medium; takes into account the fact that the groundwater actually flows only through the pores of the subsurface materials) where the aquifer hydraulic conductivity (K), the hydraulic gradient (I) and the total soil porosity θ_T must be known

λ= first order degradation constant

S_w = width of planar groundwater source in the y direction

S_d = depth of planar groundwater source in the z direction

As water soluble contaminants migrate hydraulically down-gradient from their source

[4] Domenico, P. A., and F. W. Schwartz, 1997, *Physical and Chemical Hydrogeology*, Wiley, pp. 372-383.

(*i.e.*, Ash Pond D) and are acted on by advection and dispersion, their peak concentrations tend to decline progressively.[5] Further, contaminant masses generally move either as a slug from a ***one-time source*** of contamination or as a contamination plume from a ***continuous source*** of contamination. However, in the case of the Hutsonville site, Ash Pond D is not a continuous source of contamination to the lower zone of the underlying aquifer because of the transient nature of the groundwater flow direction due to the off-site influence of IRR-1 and any other pumping wells sufficiently close to influence groundwater movement during a limited growing season. Thus, in reality there is an ***intermittent source of contamination*** to the lower zone in the aquifer.

To summarize, advection and dispersion (mechanical mixing and molecular diffusion) result in dilution of concentrations of contaminants moving through the flow field. Contaminants spread laterally and horizontally through an increasing volume of the aquifer. The ratio of longitudinal to transverse dispersion is 10:1 (*i.e.*, a plume that is 300 feet long is approximately 30 feet wide). At the Hutsonville facility, the intermittent source of contamination also contributes to diminishing concentrations of contaminants in groundwater as it migrates from Ash Pond D and down-gradient from MW-14. Therefore, even using the worst case scenario of 1.6 mg/L (versus the more likely starting concentration of 0.8 mg/L or lower), the concentration of boron (or other contaminants from Ash Pond D) in groundwater will be reduced via the process of hydrodynamic dispersion as the plume moves down-gradient toward IRR-1.

4. Predictive Modeling

[5] Other factors in reducing peak concentrations include retardation and transformation. Retardation of a plume front occurs due to reactions with soil or aquifer materials. Transformation occurs because of the biological degradation of a parent compound that results in the subsequent production of transformation products (e.g., perchloroethylene breaks down to vinyl chloride).

The United States Environmental Protection Agency has developed a public domain analytical contaminant transport model based on the Advection-Dispersion Equation provided above. To further illustrate the principles of hydrogeology used to evaluate this site, this model was used by the Agency to predict the concentration of 1.6 mg/L of boron as it moves down-gradient from MW-14 toward off-site irrigation wells. The model was run under extremely conservative conditions for a ten year period assuming *steady state* conditions and a *constant source* of contamination to the *lower* zone of the aquifer.

Attachment 5 provides a screen shot of the model input. Attachment 6 is another screen shot illustrating a graph of how dispersion is predicted to reduce the peak concentration of boron along the center line of the boron plume in the ZOC and LAI of IRR-1 or any other off-site irrigation wells, given the assumptions used. As described in Section I(B)(2) above, the greatest paucity of the data is at a concentration of 0.8 mg/L, so it would be very reasonable to slide both graph lines to the left until they intersect with 0.8 mg/L on the y axis of the graph. Attachment 7 is a screen shot predicting the effects of dispersion on the boron plume in the X, Y, and Z directions, given the assumptions used. In each case, the screen shots show that concentrations will drop off rapidly from the concentration assumed at MW-14.

Even in the worst case scenario – starting concentration at MW-14 of 1.6 mg/L of boron, steady state conditions, and a constant source of contamination -- the modeling predicts that over a ten year period the concentrations of boron from Ash Pond D in the lower zone of the underlying aquifer will diminish from 1.6 mg/L at MW-14 as the groundwater intermittently migrates down-gradient from MW-14 toward IRR-1. In no case will concentrations equal or exceed the numeric groundwater quality standard for boron of 2.0 mg/L, which is based on irrigation as discussed in Section I(B)(5) immediately below. Moreover, based on the same reasons and the observed concentrations displayed for other contaminants of concern in MW-14 (*i.e.*, sulfate and TDS), we can also conclude similar outcomes for these contaminants. *See* TSD at 51 – 52.

5. Groundwater Quality Standard for Boron

The Class I and II numeric groundwater quality standard for boron of 2.0 mg/L is based on irrigation.[6] Boron can be toxic to a number of sensitive plants (phytotoxicity). The Board record in the adoption of the groundwater quality stand for boron shows that the *Water Quality Criteria 1972* (WQC 72)[7] was the source of this standard.[8] The WQC 72 states:

> For neutral and alkaline fine textured soils the recommended maximum concentration of boron in irrigation water used for a 20-year period on sensitive crops is 2.0 mg/l. With tolerant plants for short periods of time higher boron concentrations are acceptable.

WQC 72 at 341. Sensitive crops are primarily citrus and other fruit and nut crops and do not include corn, soy beans and wheat. Corn and wheat are among crops considered semi-tolerant. *Id*.

Evaluation of Illinois land cover and the United States Department of Agriculture's State Soil Geographic ("STATSGO") Data Base map of surface soil texture shows that the surface soil texture of the agricultural cropland south of the Hutsonville facility is a silty clay loam. *See* Attachments 8 and 9. Texture refers to the relative amounts of differently sized soil particles or the fineness/coarseness of the mineral particles in the soil. Soil texture depends on the relative amounts of sand, silt and clay.

[6] "In the Matter of: Groundwater Quality Standards (35 Ill. Adm. Code 620)," PCB R89-14(A) and R89-14(B), Second Notice Opinion and Order of the Board at 21 (July 25, 1991) (referencing testimony of Richard P. Cobb, Illinois Environmental Protection Agency, R3 (Third Transcript) at 50).
[7] Water Quality Criteria, 1972: A Report of the Committee on Water Quality Criteria, Environmental Studies Board, National Academy of Sciences, National Academy of Engineering, Washington D.C., 1972 by National Research Council (U.S), Committee on Water Quality Criteria.
[8] "In the Matter of: Groundwater Quality Standards (35 Ill. Adm. Code 620)," PCB R89-14 and R89-14(B), Agency Statement of Reasons at 17.

In each texture class, there is a range in the amount of sand, silt and clay the class contains. The coarser particles are called sand. These vary in size but most can be seen without a magnifying glass. Silt consists of relatively fine particles that feel smooth and floury. These particles are so fine that they usually cannot be seen by the unaided eye and are best seen with a microscope. Clays are the finest soil particles. Clay particles can be seen only with the aid of a very powerful (electron) microscope. Loam is a textural class of soil that contains moderate amounts of sand, silt and clay with organic matter. A silty clay loam would contain larger portions of the finer silt and clay particles and a smaller portion of sand particles. Thus, the soils south of the Hutsonville property are comprised primarily of fine textured silt and clay.

Further, the Natural Resources Conservation Service of the United States Department of Agriculture has set standard soil pH classifications.[9] The STATSGO map unit for soil pH indicates that the agricultural cropland south of the Hutsonville facility has a pH that ranges from 6.6 to 7.3 and is considered, according to the standard soil pH classification, to be neutral. *See* Attachment 10. Therefore, the soils south of the Hutsonville facility fall within the conditions referenced by the WQC 72 as appropriate even for sensitive crops under the current standard of 2.0 mg/L for boron concentrations in irrigation water.

C. Agency's Conclusions Concerning Off-Site Irrigation Wells

Based on the forgoing discussion, the Agency concluded during the development of the proposal that concentrations of boron and other contaminants of concern from Ash Pond D will remain below the applicable numeric groundwater quality standards at IRR-1 and other nearby

[9] Soil Quality Information Sheet, http://soils.usda.gov/sqi/publications/files/indicate.pdf

irrigation wells. In addition, boron concentrations will remain below levels that would be expected to have phytotoxic effects on local crops.

Under the worst-case scenario of boron concentrations of 1.6 mg/L at MW-14, steady-state conditions, and a continuous source of contaminants to the lower zone of the underlying aquifer, the concentrations of boron migrating toward IRR-1 and any other nearby irrigation wells will be reduced via hydrodynamic dispersion. As shown in Attachment 6, the model predicts a slight decrease in concentration over the 50 feet from MW-14 to IRR-1, but at no time does the predicted boron concentration increase. Therefore, the concentration of boron at IRR-1 will not exceed the boron concentration at MW-14. At the next closest irrigation well one-half mile away, the boron concentration, if groundwater could flow that direction, would be less than 0.6 mg/L. Under the more likely scenario of boron concentrations of 0.8 mg/L at MW-14, concentrations would be reduced even further by hydrodynamic dispersion even if steady-state conditions and a continuous source of contaminants are assumed.

Moreover, if the rule is adopted as proposed, the concentrations of boron will be further reduced by the following three factors: 1) the capping of Ash Pond D; 2) a decrease in the associated rate of recharge to the lower zone of the aquifer (when the irrigation wells stop pumping); and 3) a reduction in the groundwater source area due to the effects of the groundwater collector trench.[10] Therefore, the Agency believes that adoption of the proposal will provide an additional margin of protection for irrigation wells south of the Hutsonville facility.

[10] "The contaminant transport modeling conducted by Ameren shows that these concentrations in the upper migration zone of the aquifer will decrease over time in response to the interceptor trench and capping. TSD, Chap. 8, p. 534, Fig. 17D. [additional citation omitted] The Illinois EPA believes that, if the concentration in the upper zone of the aquifer is decreased by the corrective action measures, it will at least not increase the concentration in the lower zone of the aquifer and probably will decrease it as shown in Ameren's modeling." Testimony of Mr. Cobb, Exh. 2 at 12.

II. ALTERNATIVES FOR MANAGEMENT OF CONTAMINATED GROUNDWATER FROM PROPOSED COLLECTION TRENCH

In its order of January 7th, the Board also directed Ameren to provide an environmental assessment of a discharge of contaminated groundwater to the Wabash River that would be helpful in evaluating the alternative options for the management of contaminated groundwater from the collection trench. Board Order at 4. The Board's directive was based on PRN's comment that the joint proposal fails to meet the requirements of 35 Ill. Adm. Code 102.210(d) because it does not provide an antidegradation analysis and resolve once and for all the ultimate destination of the contaminated groundwater. *Id*. at 3 - 4; Comments of PRN, PC # 6 at 1-2. PRN argues that the contaminated groundwater management issues must be resolved in this proceeding.

The Board has recognized that the environmental impact of the discharge to the Wabash River would be assessed in the National Pollutant Discharge Elimination System ("NPDES") permit context. Board Order at 4. In addition, alternative options for the management of contaminated groundwater would be evaluated in the NPDES context as part of the antidegradation analysis conducted pursuant to 35 Ill. Adm. Code 302.105. Although the Board has not stated its intention to resolve these matters in the current proceeding, the Board's purpose in gathering the information is not entirely clear in light of PRN's argument that the Board must resolve them to comply with Section 102.210(d). The Agency's view, for reasons discussed further below, is that Section 102.210(d) does not require comprehensive assessment of the environmental impacts of discharge to the Wabash River and evaluation of alternative management options (including discharge to the Wabash) for the purpose of designating a management option. The ultimate management of contaminated groundwater from the collection trench was intentionally left unresolved in this proposal and should not be resolved in this proceeding because other legal mechanisms exist that were developed for, and are better suited to, the task.

A. Section 102.210 Does Not Require Resolution in This Proceeding

Again, the Agency acknowledges the Board has not stated its intention to proceed with the assessment of environmental impacts and evaluation of discharge alternatives to the extent advocated by PRN. The Agency further acknowledges the Board's authority under Section 102.210(d) to require the assessment of environmental impacts of proposed site-specific rules and to resolve issues related to treatment and control options. On the other hand, the Act and implementing rules authorize the Agency to review applications and issue NPDES and state operating permits for the contaminated groundwater management options theoretically available to Ameren. 415 ILCS 5/4(g), 39(a), 39(b); 35 Ill. Adm. Code 309. Therefore, the Agency disagrees with PRN's rigid interpretation of Section 102.210(d) that all such issues always must be resolved in site-specific rulemakings. Instead, the Board must use its discretion to determine what is appropriate in each proceeding. There undoubtedly are situations when it would be essential in a site-specific proceeding for the Board to require a level of finality similar to that advocated by PRN. There also are situations when it is appropriate to defer the resolution of unresolved matters to existing procedures outside the site-specific rule that have been developed for the purpose of resolving those matters.

This instance represents a particularly striking example of when deference to established procedures is warranted. The management options listed in Section II(B) below illustrate a number of choices that may be available to Ameren. All of the options are regulated in some way under the Act and/or implementing rules as promulgated by the Board and administered by the Agency. There is no unregulated scenario in which Ameren could manage the contaminated groundwater as it pleases without restriction. With this in mind, the proposal offers the flexibility to Ameren to select a management option with approval by the Agency in a closure or post-closure care plan subject to applicable laws including permit requirements.

B. Discharge to the Wabash River Is Not the Only Management Option Available for Contaminated Groundwater

Another reason that these matters do not require resolution and should not be resolved in this proceeding is that the proposal is structured to recognize that more than one option exists for the management of contaminated groundwater. Without evaluating or advocating any of them, the management options theoretically include, without limitation: 1) Discharge to the Wabash by Ameren at the Hutsonville facility through an existing outfall; 2) discharge to the Wabash by Ameren at the Hustonville facility through a new outfall; 3) discharge by Ameren to a publicly-owned treatment works ("POTW") or other waste treatment facility; 4) discharge by Ameren or another entity to another stream with greater assimilative capacity; 5) deep well injection; 5) use as process water; and 6) land application. Some of the options do not involve discharge to the Wabash River by Ameren, some do not involve discharge to the Wabash River, and some do not involve discharge to waters of the state. Therefore, not all of the options require NPDES permits or the antidegradation assessments PRN argues should be conducted in this proceeding. Evaluating options that might not come to pass would be premature and a waste of resources.

The proposal is structured without resolving the management issue for a reason. In Ameren's original proposal filed May 19, 2009, only one management alternative for the contaminated groundwater was identified – direction to Ash Pond B for discharge to the Wabash as authorized in the Hutsonville station's NPDES permit. Ameren Statement of Reasons at 19-20; Ameren Proposal, § 840.120. In its initial review of the Ameren proposal, the Agency workgroup reasoned that: 1) Outcomes of applications for NPDES permits or permit modifications could not be prejudged in this proceeding because a federally-delegated, independent regulatory structure exists for making that determination; 2) it was possible that any such application would be rejected; and 3) a proposal with one uncertain method for management of the contaminated groundwater was unacceptable. If the NPDES permit application was denied and the denial upheld, the groundwater corrective action proposed in the rule could not be implemented.

The closure plan and post-closure care plan mechanisms with administrative review and approval authority exercised by the Agency provide Ameren the opportunity to select a legally available management option while insuring that all applicable legal steps are followed for approval and implementation of the option. The Agency may approve an option in the closure plan subject to Ameren's obtaining all necessary approvals. If a required approval is not obtained, the closure plan will have to be amended accordingly to propose another option.

However, the Agency proposes the following amendment to proposed Section 840.122 to make even clearer that these decisions will not be left unaddressed but are merely being deferred to other appropriate procedures:

> **Section 840.122 Groundwater Discharge System**
>
> Groundwater collected in the groundwater collection trench must be directed to an outfall for which the Hutsonville Power Station has NPDES authorization or to another option as approved by the Agency in the closure plan or post-closure care plan <u>in accordance with applicable law, including, without limitation, permit requirements</u>. Plans for the groundwater discharge system including, but not limited to, a plan for operation and maintenance, must be approved by the Agency in the closure plan. The groundwater discharge system must be constructed according to a construction quality assurance program that meets the requirements of Section 840.146 of this Subpart.

Ameren's counsel has informed the Agency that Ameren does not object to the proposed amendment.

<u>C. If Ameren Proposes Discharge to the Wabash River at the Hutsonville Facility . . . .</u>

Since Ameren's original proposal was amended to recognize that other options may be available for management of contaminated groundwater, Ameren has consistently indicated in filings that it has not settled on an option. Assume, for purposes of discussion, that Ameren selects its original plan and decides to request NPDES authorization for discharge to the Wabash from an existing outfall at the Hutsonville facility. The NPDES application review procedures and antidegradation assessment procedures set forth in the Board's rules have been developed to make precisely the evaluations PRN has argued must take place in this proceeding, and they are better suited to the task.

The NPDES review procedures include a number of provisions protecting the rights and interests of all parties including PRN. Among them are a public notice and comment provision at Section 309.109, notice to governmental agencies at Section 309.114, opportunity for public hearing at Section 309.115, and, at Section 309.120, reopening of the public comment period following the hearing if the draft permit is significantly modified after the initial comment period or public hearing. In addition, the Act grants third parties the right of appeal to the Board to contest the Agency's final decision. 415 ILCS 5/40(e). These procedures are compliant with federal requirements under the Clean Water Act and implementing rules for making such decisions. As state administrator of a delegated federal program, the Agency must take care to conduct reviews in accordance with the federally approved procedures, standards and requirements including an antidegradation assessment.

If Ameren were to propose the Hutsonville facility discharge option, PRN asserts that adoption of the proposal might bias the outcome of NPDES/antidegradation proceedings if not preclude them altogether:

> Authorizing ash pond closure rules now without fully analyzing available alternatives may have the practical effect of precluding appropriate alternatives

> during a future NPDES permitting process. An antidegradation analysis will only be meaningful if conducted now, before costly capital investments have been made into the project. . . .
>
> Approval of the rule will result in the release of additional pollutants into the environment, but when the time comes for the antidegradation analysis of the proposed increase in pollution required for an NPDES permit by 35 Ill. Adm. Code § 302.105(c), the analysis of available alternatives will be biased (if not precluded entirely) by construction and capital investments made toward Ameren's choice of groundwater collection trench, pump station, and ultimately outfall.

PRN, PC # 6 at 1, 2. The Agency disagrees with PRN's assessment on both bias and preclusion.

The proposal includes a schedule of activities with built-in flexibility sufficient for Ameren to avoid construction and capital investments on the groundwater collection system until all permitting issues are resolved. Ameren has 180 days after the effective date of the rule to complete its engineering and design activities, submit its closure plan and post-closure care plan to the Agency for review, and, if necessary, submit an application for the NPDES permit or permit modification and/or state operating permits. Joint Proposal, Exh. 8, §§ 840.128(a), 840.132, 840.134(a) – (b), 840.138(a). The Agency then has 90 days for review and approval or rejection of the closure and post-closure care plans. *Id*. § 840.148(a). Following Agency approval, Ameren has eighteen months to implement the construction phase of the approved closure plan "unless the Agency approves an alternative timeline." *Id*. § 840.134(b).

The quoted phrase was added to the joint proposal in anticipation of twelve months or more for an NPDES application review including the antidegradation assessment. Ameren thus has the option of requesting additional time for the construction phase rather than making costly construction and capital investments in mechanisms for which approval remains uncertain. The Agency will be in a position to evaluate the reasonableness of the request for an extension of time because it will have the best information available on the progress of the permit application(s). Therefore, the Agency's position is that Ameren bears the financial risk if it fails to request an extension and its expenditures get too far ahead of the permit process.

To summarize this Section II of the response, the Agency's position is that a comprehensive assessment of environmental impacts to the Wabash River from discharges of contaminated groundwater at the Hutsonville facility and a final determination of the groundwater management option are premature, unnecessary, and not required in this proceeding. All the issues raised by PRN are accounted for in the joint proposal and will be addressed in due course in the appropriate regulatory context. The Agency recommends that the Board trust in the procedures it has established for resolution of these matters and adopt for First Notice the proposal with the limited amendment suggested in this document.

III. CORRECTION

A typographical error appears in proposed Section 840.152. The public law referenced for the Resource Conservation and Recovery Act of 1976 should be P.L. 94-580 instead of 94-480. The Agency requests correction and apologizes for the error.

Respectfully submitted,

ILLINOIS ENVIRONMENTAL
PROTECTION AGENCY

By: Mark Wight
Mark Wight
Assistant Counsel

Date: March 9, 2010

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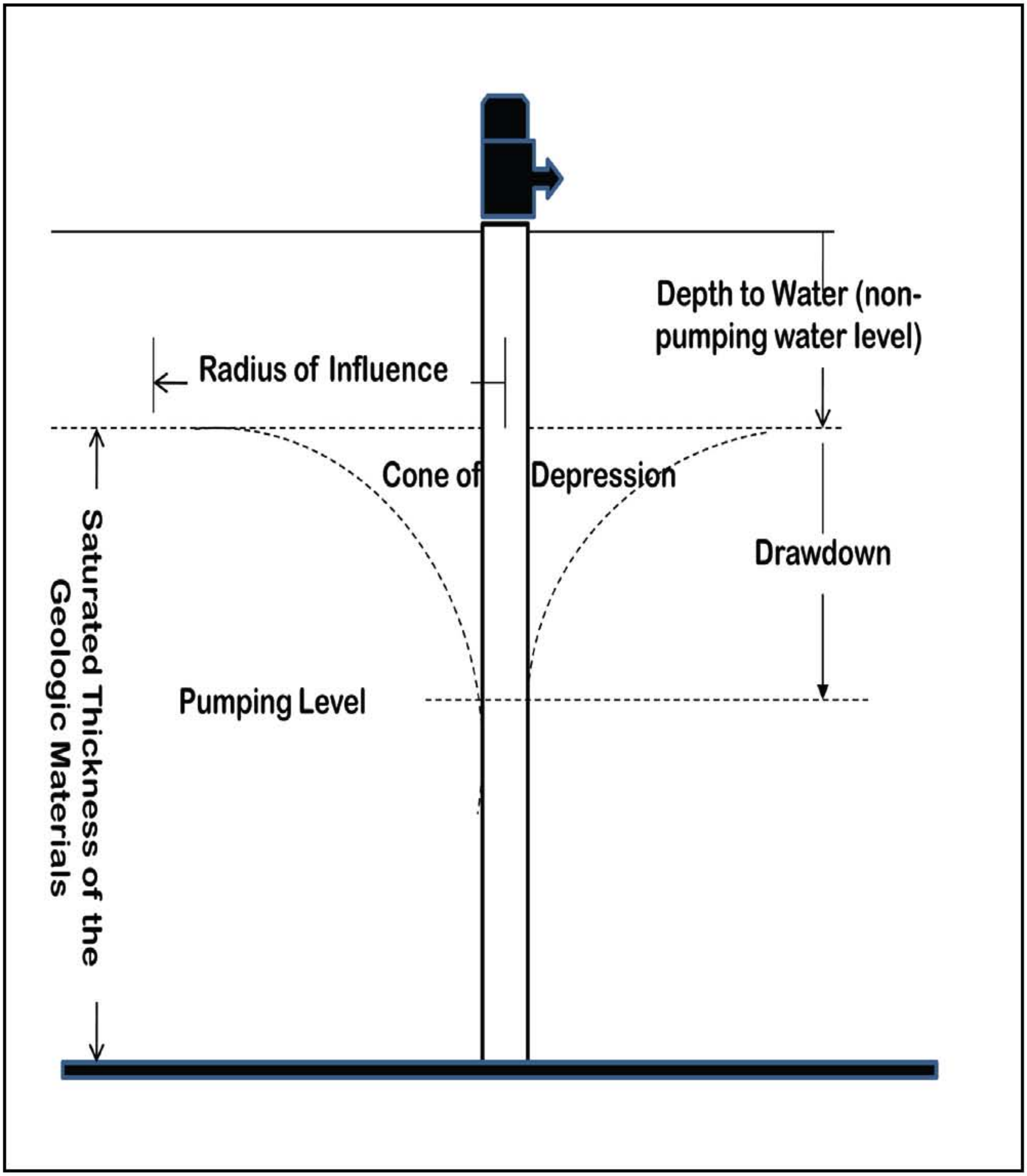
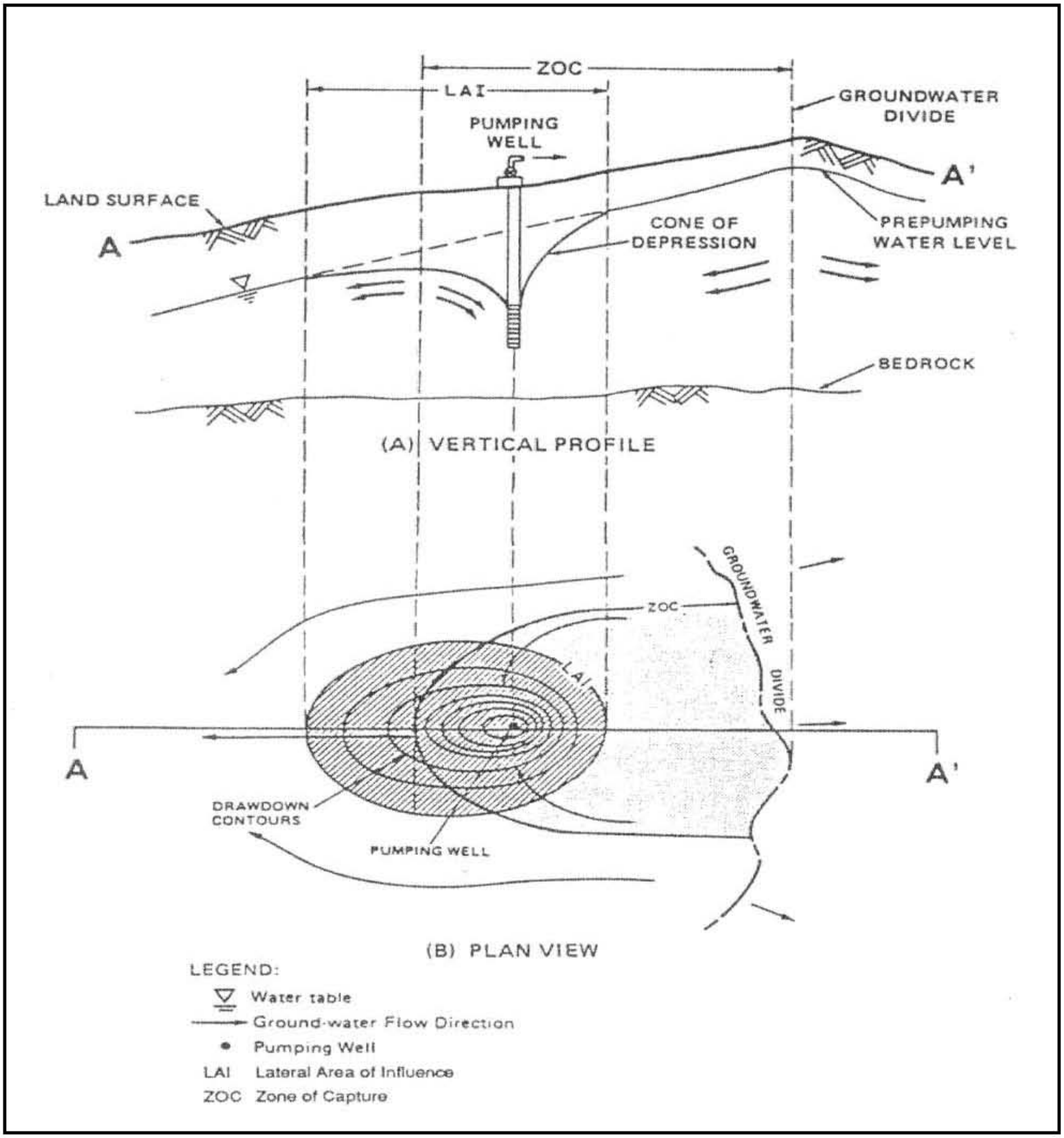
ATTACHMENT 1



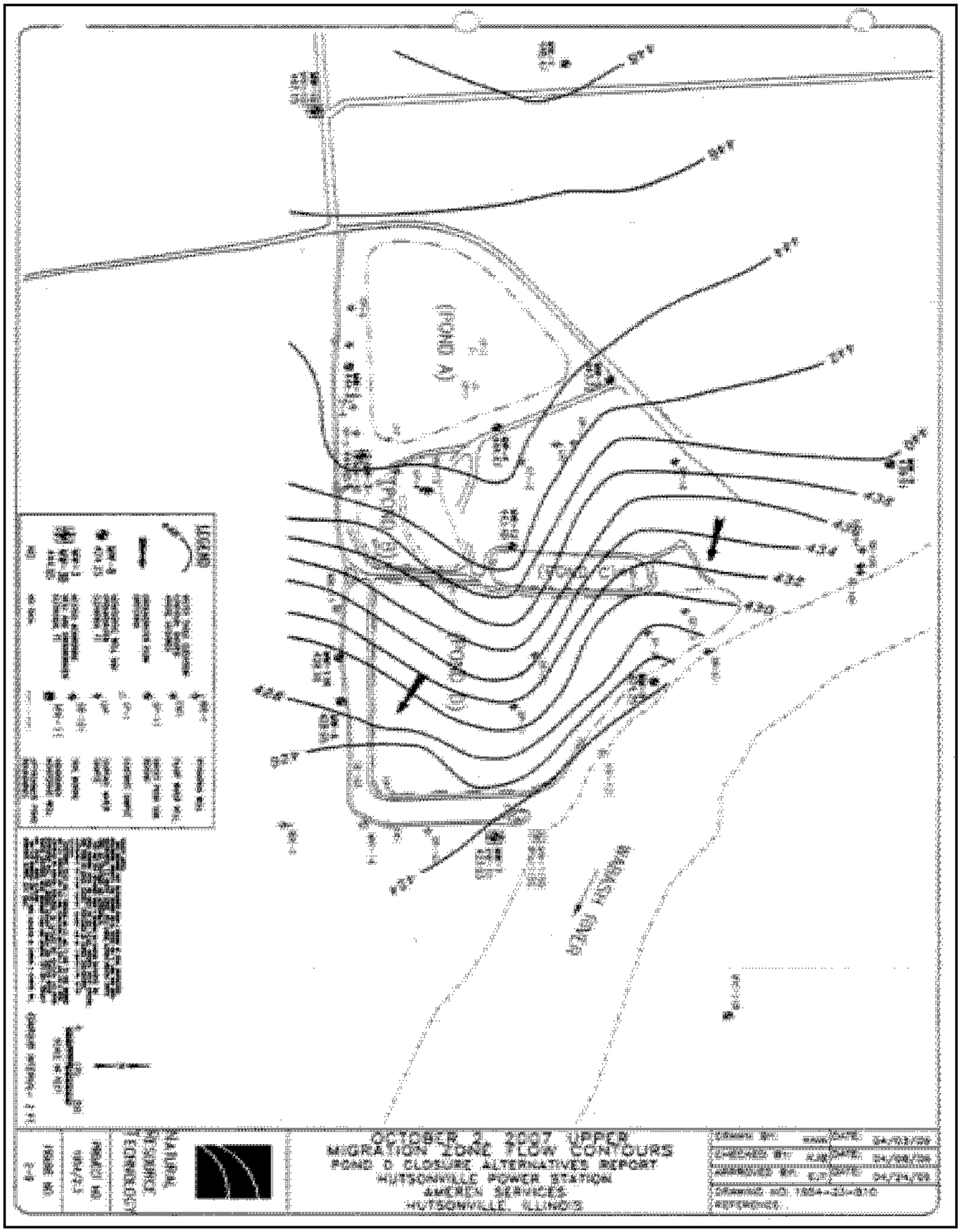
Conceptual cone of depression caused by a pumping well

ATTACHMENT 2



Conceptual cone of depression, lateral area of influence (LAI), and zone of capture (ZOC)

ATTACHMENT 3



Map of Upper Migration Zone Flow Contours (TSD at 000040)

ATTACHMENT 4

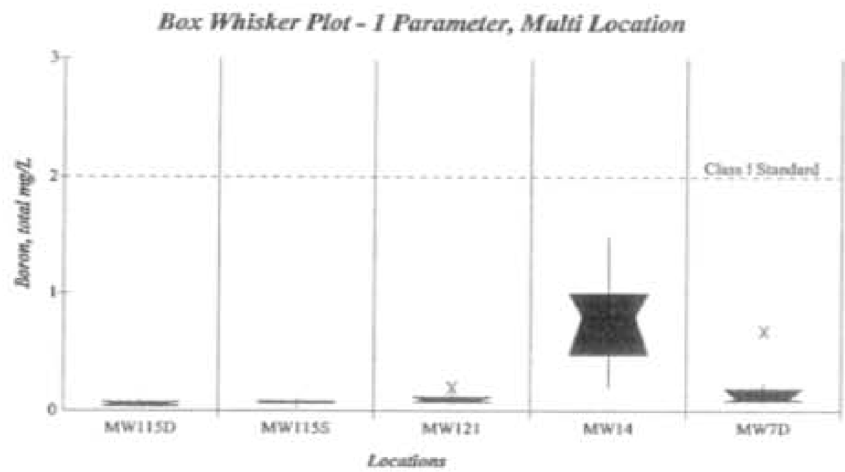


Figure 2-19a. Box-whisker plot showing boron concentrations in the deep alluvial aquifer from 2002 through 2008.

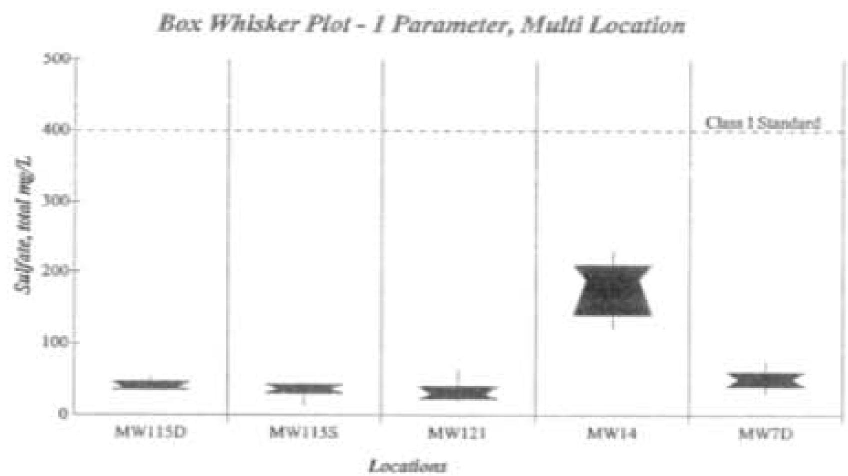
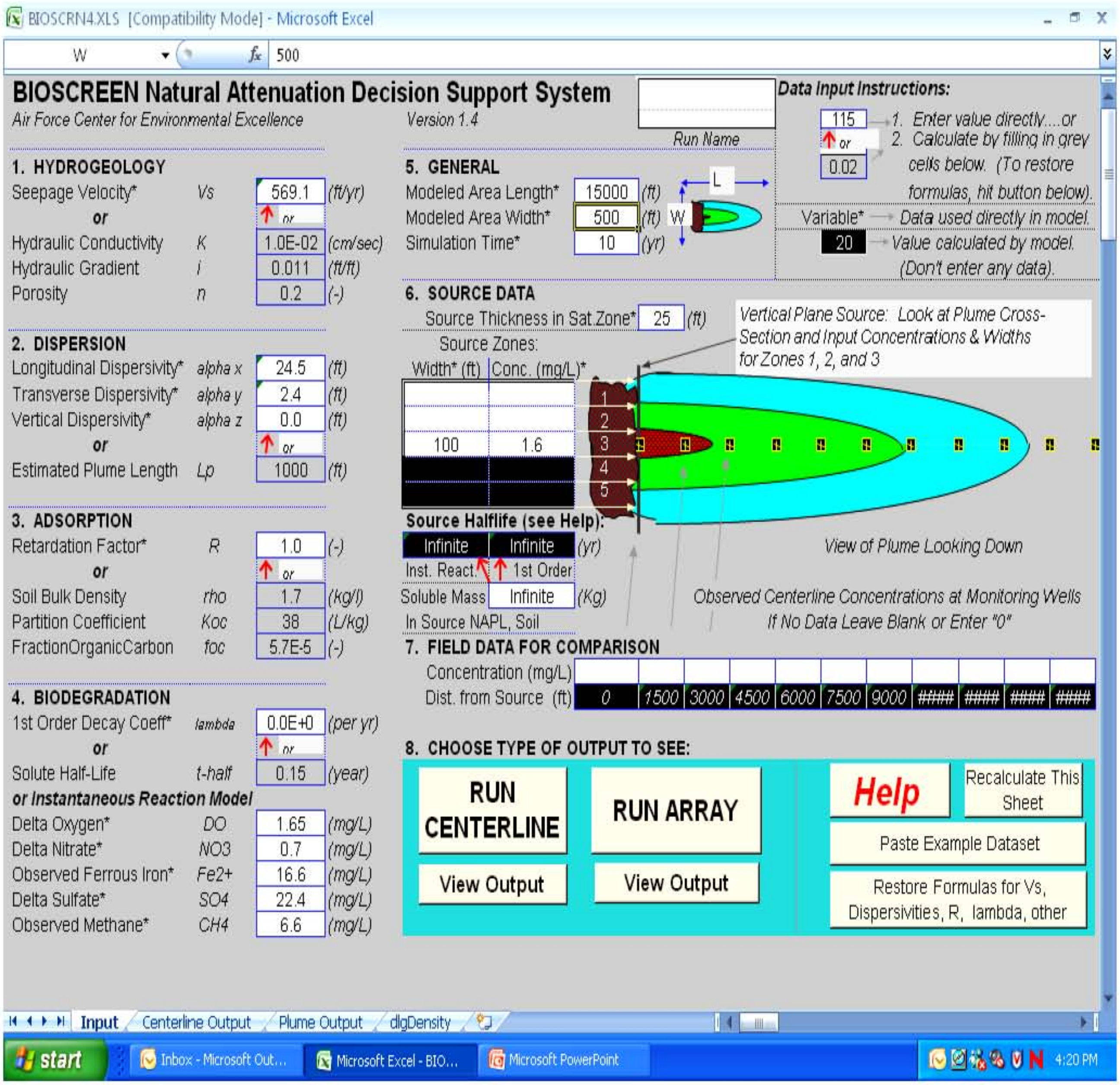


Figure 2-19b. Box-whisker plot showing sulfate concentrations in the deep alluvial aquifer from 2002 through 2008.

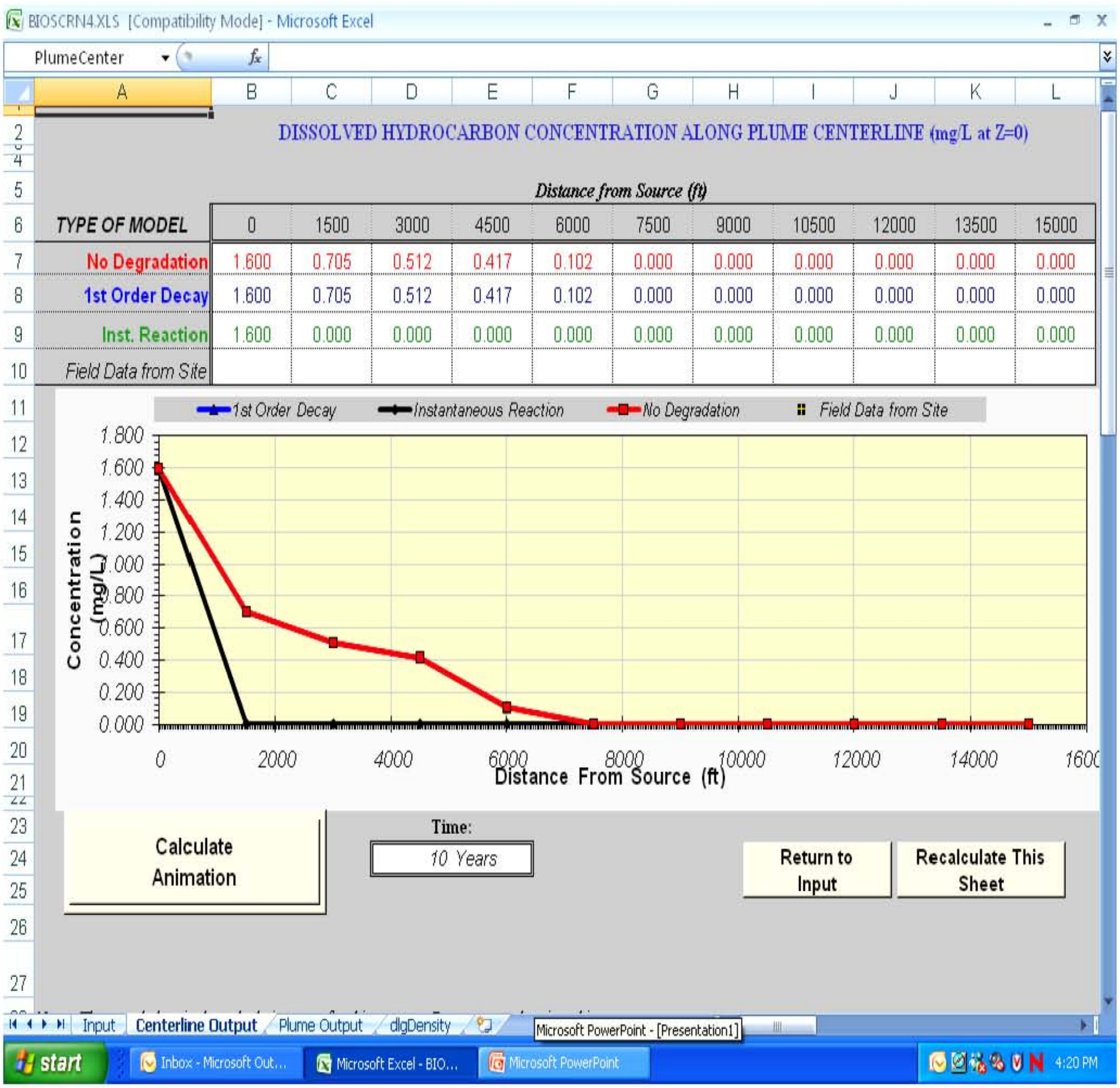
Box-Whisker Plot for Boron and Sulfate at Ameren-Hutsonville Facility (TSD at 51)

ATTACHMENT 5



Inputs to model dissolved boron from MW-14

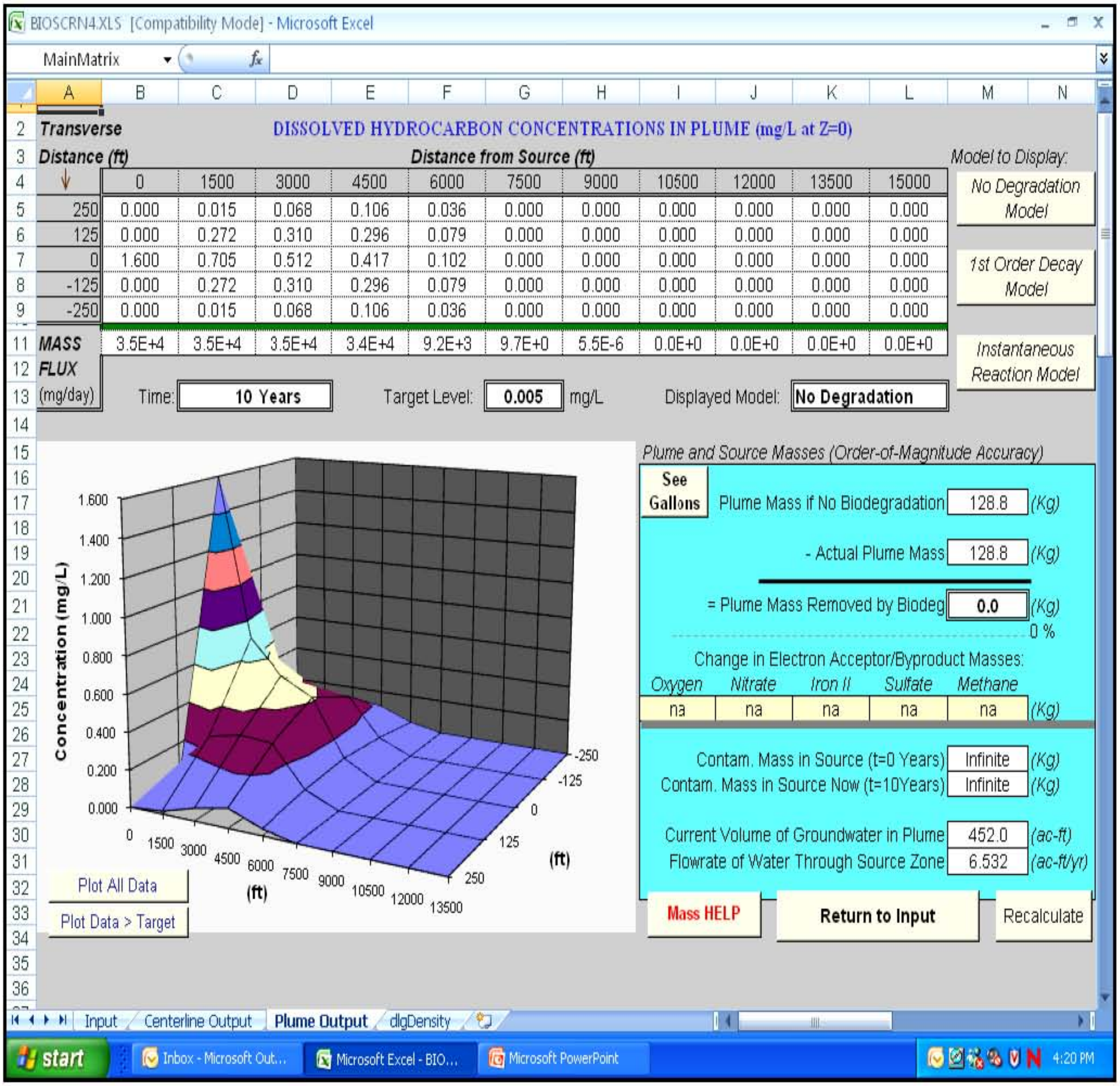
ATTACHMENT 6



TYPE OF MODEL	0	1500	3000	4500	6000	7500	9000	10500	12000	13500	15000
No Degradation	1.600	0.705	0.512	0.417	0.102	0.000	0.000	0.000	0.000	0.000	0.000
1st Order Decay	1.600	0.705	0.512	0.417	0.102	0.000	0.000	0.000	0.000	0.000	0.000
Inst. Reaction	1.600	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Field Data from Site											

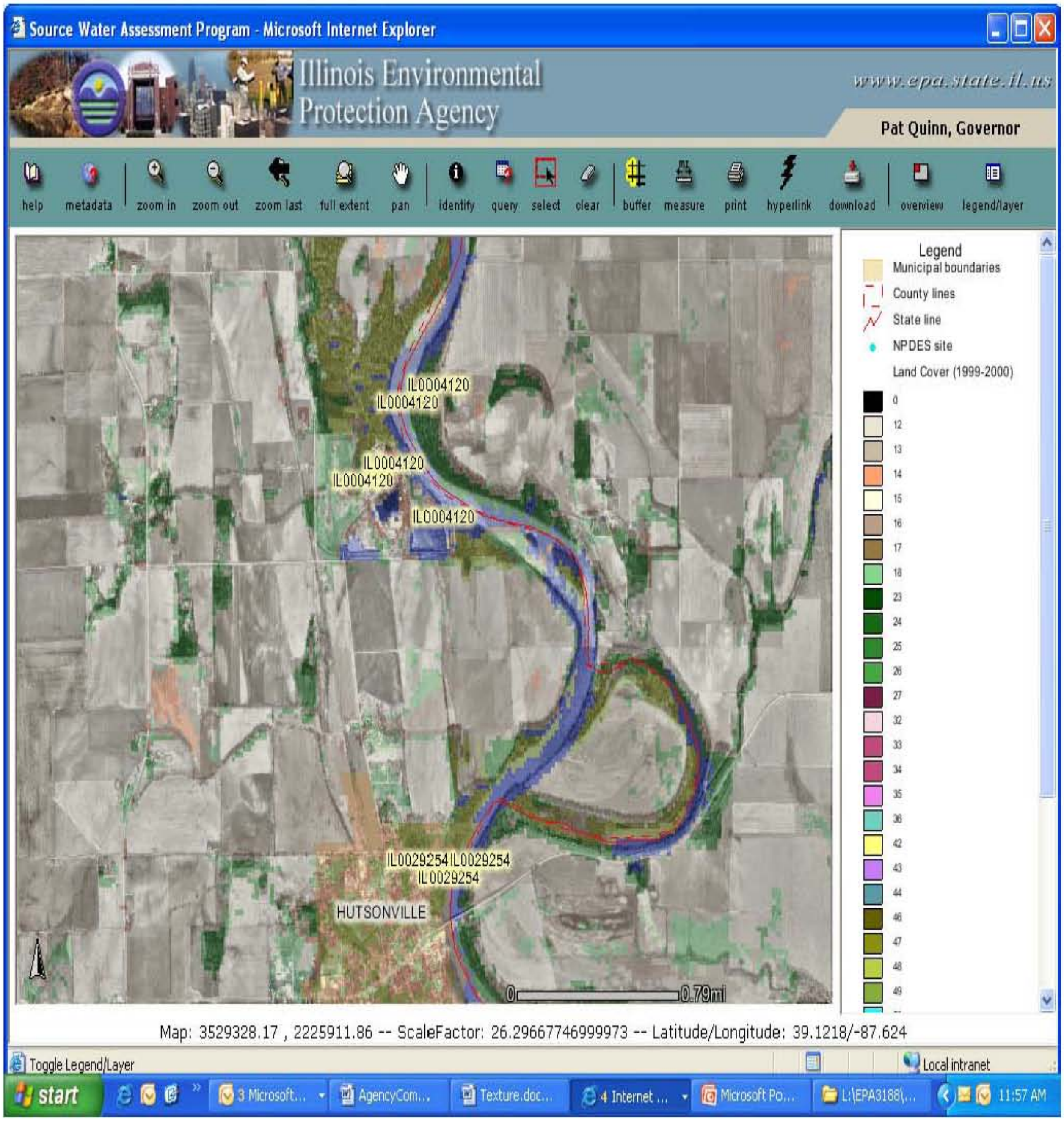
Dissolved boron transported along plume center line

ATTACHMENT 7



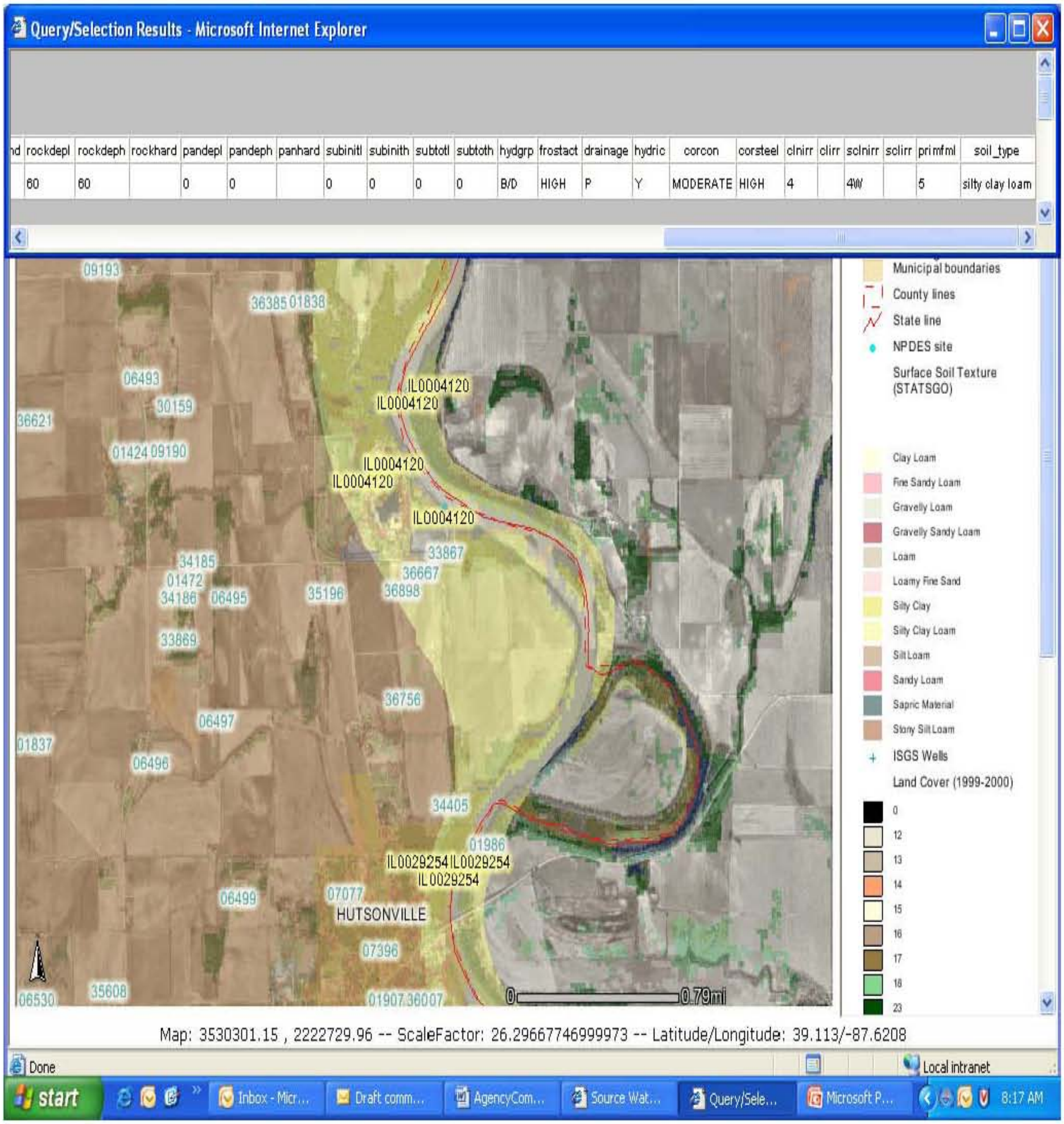
Prediction of effects of boron plume in X,Y,Z directions given assumptions used

ATTACHMENT 8



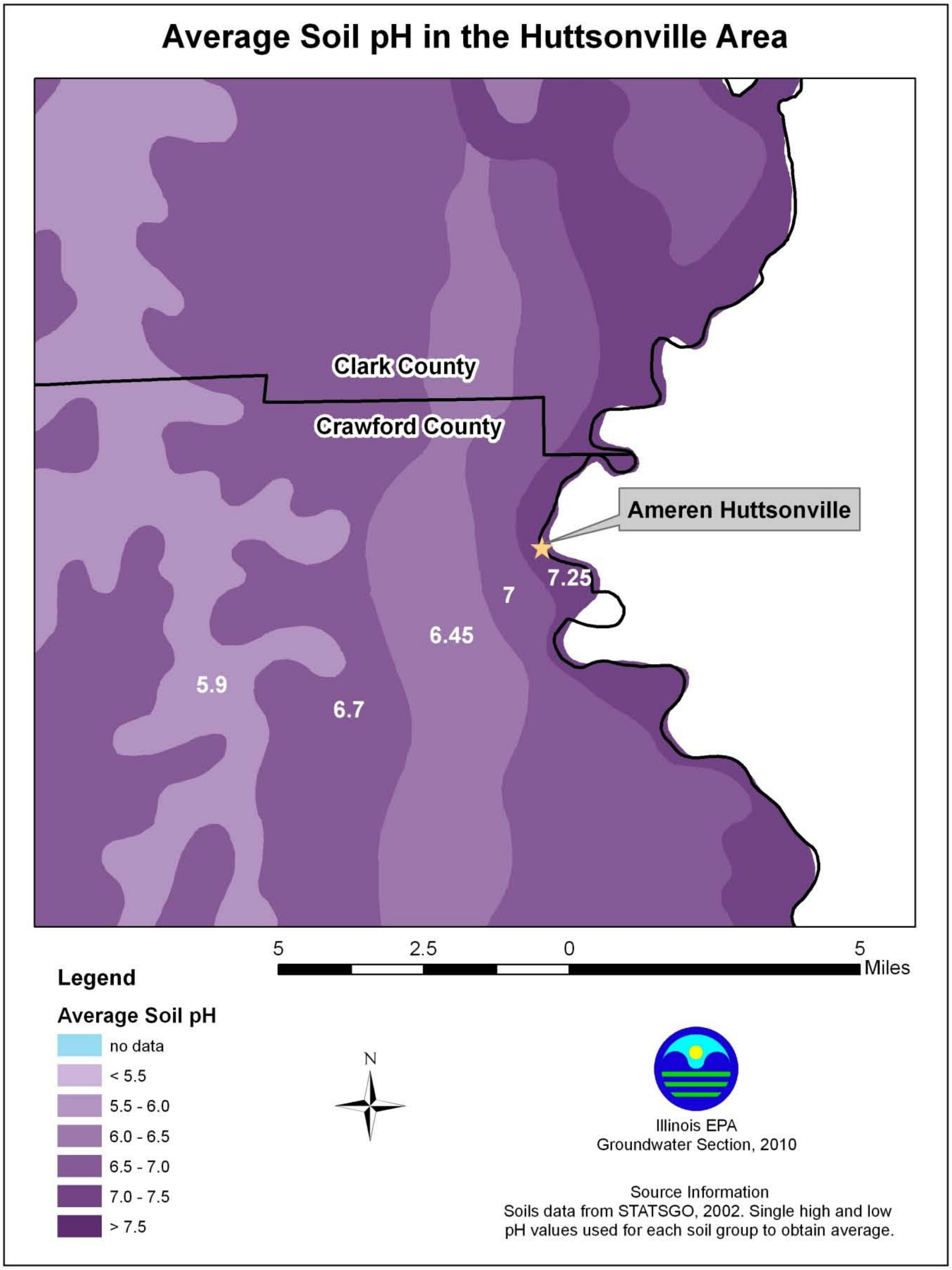
United States Department of Agriculture State Soil Geographic ("STATSGO") Data Base map of agricultural cropland south of the Hutsonville facility

ATTACHMENT 9



United States Department of Agriculture's State Soil Geographic ("STATSGO") Data Base map of surface soil texture showing that the surface soil texture of the agricultural cropland south of the Hutsonville facility is a silty clay loam.

ATTACHMENT 10



STATE OF ILLINOIS)
)
COUNTY OF SANGAMON)

PROOF OF SERVICE

I, the undersigned, on oath state that I have served the attached Agency's Motion for Leave to File Response Concerning Board's Order of January 7, 2010, and the Agency's Response Concerning Board's Order of January 7, 2010, upon the persons to whom they are directed by procedures specified by the Illinois Pollution Control Board or by placing copies in envelopes addressed to:

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Tim Fox, Hearing Officer
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(Attached Service List – **First Class Mail)**

and sending or mailing them, as applicable, from Springfield, Illinois on March 9, 2010, and with sufficient postage affixed as indicated above.

Mark Wight
Brenda Boehner

SUBSCRIBED AND SWORN TO BEFORE ME

This 9th day of March, 2010.

Cynthia L. Wolfe
Notary Public

OFFICIAL SEAL
CYNTHIA L. WOLFE
NOTARY PUBLIC, STATE OF ILLINOIS
MY COMMISSION EXPIRES 10-2-2011

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