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July 25, 2007

Sybil Kolon
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MDEQ-Jackson District
301 Louis Glick Highway
Jackson, Michigan 49201-1596

Re: DEQ Response to Evergreen System Review

Dear Ms. Kolon:

This is in response to the DEQ's July 16, 2007 review of the Evergreen System Review ("ESR") submitted by Pall Life Sciences ("PLS") on May 10, 2007. PLS has reviewed the cover letter and the attached model review prepared by Rick Mandle. PLS offers the following general comments as well as specific responses to key DEQ conclusions.

PLS submitted the ESR in response to the changing conditions it has observed in the Evergreen System. Specifically, the current Evergreen extraction system (AE-3, LB-1 and LB-3) is drawing contamination from the shallower portion of the Unit E aquifer (E_1) located south of Valley Street into the Evergreen Subdivision area. This intrusion of groundwater contamination is frustrating the ability of the extraction wells to achieve the Consent Judgment objectives for the Evergreen system. This forced migration is also changing the boundaries of the Unit E plume in a way that may require further revision of the Prohibition Zone.

PLS had no reason to anticipate that the DEQ would dispute the fact that there is a connection between the shallow portion of the Unit E (sometimes referred to as the E_1) and D_2 aquifers within the zone of influence of the capture zones of the three wells. This relationship has been well understood by both PLS and the DEQ for some time. Although PLS has not previously had an occasion to formally present the evidence supporting this interpretation, PLS' technical representatives have often discussed this issue with the DEQ over the last three years. The DEQ acknowledged this relationship in its April 14, 2004 Memo authored by Mr. Lipinski, the former DEQ geologist assigned to this Site who had over 15 years of experience at this Site. Mr. Lipinski noted:

> It is important that we balance the concerns about the ability of the current monitoring system to demonstrate capture of the D2 plume in Evergreen *with the reality that the purging in the Evergreen Area is most likely having an effect on the flow of the E1 plume . . . the current pumping in the Evergreen Area is potentially pulling contaminated groundwater from the E1 plume into the Evergreen Area.*"

April 14, 2004 Interoffice Communication, attached as Attachment 1.[1] Consistent with Mr. Lipinski's memo, the DEQ has requested (and sometimes insisted) that PLS provide a combined potentiometric surface map for the Evergreen area that includes data from both aquifers in its quarterly reports. PLS has complied with these requests.

Even a close review of the DEQ's letter and attachments does not reveal whether the DEQ now disputes that the interaction exists. Instead, it appears that the DEQ may mistakenly believe that PLS is claiming that operation of the Evergreen wells has pulled groundwater contamination from the deeper portion of the Unit E aquifer (sometimes referred to as the "E_2") into the D_2 aquifer. As discussed below, PLS agrees that there is no evidence that contamination is migrating vertically into the D_2, and the ESR does not discuss that scenario. PLS still maintains, however, that there is no dispute over whether the Evergreen purge wells are capturing a portion of the Unit E contamination. Accordingly, PLS would like to focus on a discussion of the appropriate response to that condition.

It is in this context that the related issue of whether the Allison Street well location (AE-3) is still viable must be judged. The DEQ and PLS apparently agree that the location has experienced significant problems in the past. The DEQ's solution is to continue to invest more resources at this location without any analysis of whether it is necessary, appropriate, or viable to do so. On this point PLS strongly disagrees. Not only is it impractical for PLS to maintain the required purge rate at this location, it is also imprudent and short-sighted for the DEQ to continue to impose this requirement. Operation of this well is no longer necessary to accomplish the objective of capturing the leading edge of Evergreen plume and, at this point, is only exacerbating the negative effect the Evergreen operation is having on the Unit E plume.

The DEQ also misconstrues the importance and role of the groundwater model PLS has used to support its interpretations of the data. The DEQ devotes a majority of its response to criticizing the groundwater model. PLS notes that this same groundwater model, now updated with new data and information, has served as the basis for the DEQ's approval of multiple capture zone analyses and work plans. The DEQ's current comments on the model are largely unfounded and appear to be the result of either an incomplete review of the model or an incomplete understanding of the geology in the area modeled. More importantly, the model is only a tool to assist PLS and the DEQ in making decisions. The model suggests that the Evergreen extraction wells would still be effective in containing the Evergreen plume with a significant reduction in the purge rates. But PLS' proposal also relies on actual field data to make adjustments to the Evergreen System flow, not merely the model.

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[1] Mr. Lipinski also notes that additional performance monitoring wells southeast of AE-3 would be "of limited value for verifying the containment of the D2 plume" since if dioxane was detected in wells at this location, "it would be difficult to determine if it originated from the D2 or E1 plumes."

It appears to PLS that the DEQ has focused on the minutiae of the model at the expense of conducting a full review of the comprehensive data that have been collected regarding the issues presented in the ESR. PLS hopes that during our upcoming meeting we can move past these side issues and focus on the important cleanup matters presented in the ESR.

PLS offers the following specific responses to the DEQ's comments:

Relationship of D_2 and E in the Evergreen Area

We do not believe that PLS has presented sufficient data to support its premise that the concentrations of 1,4-dioxane in portions of the Unit D_2 aquifer that are upgradient of the Evergreen Subdivision are declining.

The DEQ correctly notes that the ESR presented evidence that upgradient concentrations have generally declined in the Evergreen area in support of its conclusion that pumping in the Evergreen system has drawn 1,4-dioxane from the Unit E. The DEQ does not, however, respond directly to this evidence. Instead, the DEQ states that data from two wells "show that high concentrations of 1,4-dioxane are continuing to migrate toward the Evergreen Subdivision." This is a bit of a "straw man." The evidence submitted by PLS was based on data from key wells that are proximate to the purge system which support PLS' premise and which the DEQ apparently does not dispute. PLS has never claimed that there are no downgradient D_2 wells that have high concentrations (like MW-94s) or that have shown an upward trend (like MW-17). Data from the two wells cited by the DEQ, however, do not undermine PLS' premise because they are not particularly relevant to what should be observed in the key wells at this time. They do not explain why concentrations in key upgradient wells have declined, while concentrations in the purge well area have not. In addition to the generally lower concentrations that should be reaching the purge well area (and probably are), there is also unaccounted for mass in the purge well area that PLS believes is likely to be from the Unit E (specifically E_1). The wells the DEQ has cited could not be the cause of this phenomenon. If higher concentrations from these wells or wells located elsewhere in the D_2 (resulting from turning off the north horizontal well, for example) were reaching the Evergreen purge wells, evidence of this would be reflected in data from the wells PLS presented in the ESR.

Based on this information, we do not believe it can be concluded that stable or increasing levels of contamination must be coming from a source other than upgradient Unit D_2 plume.

This conclusion misses the point. PLS presented three lines of evidence in the ESR supporting its conclusion that dioxane from the Unit E is being pulled into the Evergreen purge wells (concentrations, water levels and geology, and modeling). PLS did not attempt to examine and rule out all other possible explanations based on any one of the individual lines of evidence presented. The data demonstrating generally declining upgradient concentrations may not, in and of itself, be sufficient to unequivocally rule out all other possible explanations, but it does support PLS' conclusion. Taken as a whole, the evidence presented demonstrates that it is extremely unlikely that the contamination being extracted by the Evergreen wells is coming solely from within the D_2.

We also do not believe that there are measurements of groundwater level elevations that show the potential for the Unit E contaminated groundwater south of the Evergreen Subdivision to move either laterally or vertically into the Unit D_2 aquifer or toward the Evergreen System wells.

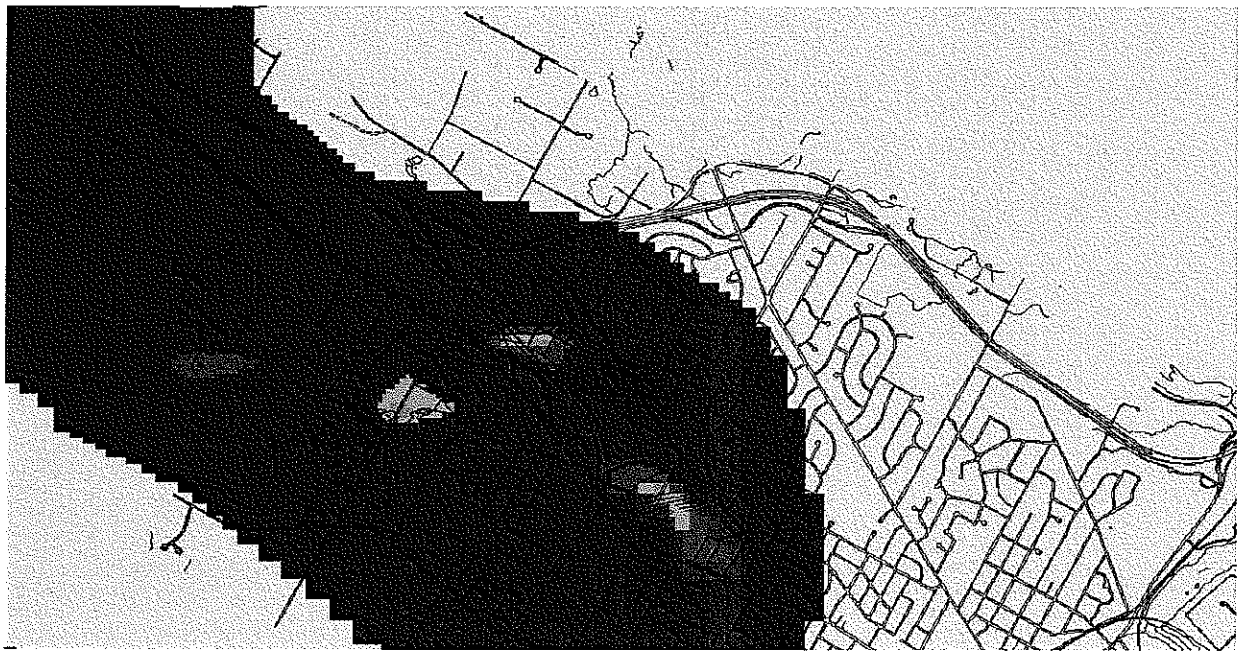
This statement is totally unsupported by the data and is inconsistent with the DEQ's previous interpretations. The DEQ specifically requested that PLS contour water levels collected from wells in the Evergreen Subdivision with data from the Unit E to the south and east for the sole purpose of understanding the relationship between these areas. As noted above, Mr. Lipinski believed that there was a potential for a relationship between the Unit D_2 and the Unit E and suggested that PLS investigate it more thoroughly. PLS complied with this request because it made sense. The Unit E south of the Unit D_2 plume is at the same elevation as the Unit D_2, and geological interpretations have shown that there is no lateral separation between these two plumes/aquifer areas in key areas. These data and interpretations were provided in Appendix A of the ESR. The water level data conclusively demonstrate that the Evergreen System has a hydraulic influence on areas to the south (Unit E_1) and creates the potential for flow from the south (the Unit E_1 plume area) to the wells. These data have been discussed with the DEQ at numerous technical meetings over the last three years, and the DEQ has never disputed this interpretation. To now claim that the measurements of groundwater elevations do not show this potential is simply wrong and not based on sound science.

As for the deeper Unit E (Unit E_2), we do agree with the DEQ that there is little data to show that 1,4-dioxane would migrate into the Unit D_2 from this unit. That's why PLS has never made this claim, contrary to what Mr. Mandle and the DEQ's response assert. PLS does, however, believe that it has demonstrated to DEQ repeatedly over the last few years that the Unit E_1 portion of the aquifer is connected to D_2 in the vicinity of the Evergreen area, as shown in the Figures attached to the ESR.

As outlined in detail by Mr. Mandle, there are deficiencies in the construction and calibration of the model PLS relied upon for this analysis. The deficiencies include the model representation of the degree of hydraulic connection between the Unit D_2 and Unit E aquifer and the model boundary conditions. The PLS model assumes there is no connection between water bearing layers that represent the Unit D_2 and Unit E aquifers, while at the same time asserting that pumping from the Evergreen extraction wells are pulling in contaminated groundwater from the Unit E aquifer. Evidence that this assumption is not applicable include the fact that soil boring GSI-96-01, installed in the southwestern area of the Evergreen Subdivision, showed there is no confining unit that hydraulically separates the Unit D_2 from the Unit E aquifer in this area.

Contrary to this statement, the model does include a connection between the Unit D_2 and Unit E (specifically the upper E or E_1) in the areas where data suggest such a connection exists. Figure 1 is a screen print of the hydraulic conductivity of the model layer (Layer 3) that vertically separates the two aquifers. The figure shows four areas where zones of high hydraulic conductivity were assigned to simulate the connection between the two aquifers. These areas include the area around GSI-96-01, the Maple Village area, the Wagner Road area, and west of the Pall property north of Third Sister Lake.

Figure 1



Layer 3 of the Model Hydraulic Conductivity (x,y,z)

Dark Blue = 0.0006 ft/day
Light Blue = 50-75 ft/day

In addition, the stratigraphy in the central and eastern areas have not been vertically profiled to depths sufficient to conclude that there is no connection between the Unit D_2 and Unit E aquifers in this area.

Figure 2, (attached as Attachment 2), identifies all of the borings that were drilled to the bedrock surface in the area of the Evergreen Subdivision. Also shown are borings that were drilled to depths (over 200 feet) sufficient to encounter Unit E (E_2). All of these borings were drilled with the knowledge and involvement of the DEQ. At each of these locations, significant separation was observed and documented between the Unit D_2 and E aquifers. Drilling data indicates that the diamicton separating these aquifers in this area is extremely stiff (often exceeding 100 blow counts/6-inches). In fact, at two locations, drillers broke auger strings drilling through it.

The DEQ has never, until now, suggested this data was not sufficient to demonstrate hydraulic separation between the Unit D_2 and E (E_2) in the Evergreen Subdivision, nor has the DEQ requested that PLS further investigate this issue. The DEQ's response in this regard inexplicably ignores the voluminous data PLS has provided on this issue.

PLS's consultant did not revise the model to reflect the greater degree of connection that geologic data collected since 2002 suggests.

Again, this statement is simply incorrect. As discussed above, the model does account for areas where there is known communication between the Unit D_2 and E. Figure 3 shows the Layer 3 hydraulic conductivity assignment for the pre-2002 model. In 2002, the hydraulic conductivity of the model was increased in the area of GSI-96-01. Based on data at that time, this was the only site area were an aperture was known to exist. Since that time, the model has been modified to reflect other areas where such a connection exists. Compare Figure 3 to Figure 1, which shows the current model assumptions in this regard. The model now reflects additional modifications to the GSI-96-01 area as well as inclusion of other known site areas where there appears to be direct communication between these aquifers.

Figure 3 - Layer 3 Hydraulic Conductivity - 2002 Model

The model boundary conditions force the model to simulate a direction of groundwater and contamination movement that has not been verified by field data.

This statement reflects a misunderstanding of the data PLS has gathered and presented. The boundary conditions in the model were based on interpretations of actual field data and were not selected to "force" a particular result. The northern "boundary," for example, was selected based on an extensive review of area well logs which show a geological limitation to the Unit D_2 aquifer to the north. The eastern constant head boundary is an artificial boundary placed to direct flow to the east/northeast as suggested by available water level data. Such boundaries are commonly used in modeling.

LB-1 and LB-3 Extraction Rates

The ESR proposes lowering the extraction rates from LB-1 and LB-2 to a level that will continue to contain the contamination in Unit D_2 while reducing the amount of mass drawn from Unit E. PLS has proposed a staged reduction and monitoring of the change and making adjustments as needed in order to maintain the objectives of containing contamination in Unit D_2.

As discussed in more detail by Mr. Mandle, the DEQ does not believe that the groundwater model is appropriate constructed or calibrated and thus cannot support PLS's proposal.

As discussed above, the criticisms of the model are largely unfounded and appear to be the result of an incomplete review of the model or an incomplete understanding of the geology. More importantly, they miss the point. PLS has not proposed, and does not intend, to rely solely on the model to base decisions. The model is only one tool to assist PLS and the DEQ in making decisions. PLS' proposal relies on actual field data to make adjustments to the flow, and not the model by itself.

In addition, the DEQ does not believe that the lateral and vertical extents of the groundwater contamination or groundwater flow directions in the Evergreen Subdivision area have been properly characterized.

Hopefully, this is an overstatement based on the DEQ's request for additional monitoring wells in connection with proposed reduction of purge rates. To be clear, PLS does not agree with, and does not appreciate, implications that neither PLS nor the DEQ knows where the plume is or where it is going in the Evergreen Subdivision Area. That system has been closely observed and has been under remediation with DEQ oversight and using approved performance monitoring systems for more than twenty years. For many years PLS has worked with the DEQ and has complied with requests for wells suggested by DEQ, the most recent being MW-92 and MW-107. Installation of these wells has confirmed PLS' prior understanding of the plume boundaries and direction.

The overall shape and direction of the plume has been very stable. In the one area of apparent expansion (the northern boundary of the plume near MW-KD1d), PLS has agreed to install a well to adjust the northern boundary of the plume in this area.

PLS, therefore, does not accept any suggestion or implication that the plume and groundwater flow directions have not been "properly characterized" in general. With respect to the changes suggested by PLS in the ESR, PLS respects and understands that the DEQ may want additional characterization, and PLS has offered to install a new well for that purpose. PLS certainly is willing to discuss the appropriate extent of performance monitoring during the proposed staged reduction of purge rates at the upcoming meeting. This is not tantamount to stating (as the DEQ has) or acknowledging that PLS does not know the nature and extent of the contamination in the area.

Allison Extraction Wells

The ESR proposes discontinuing purging at the Allison location. The rationale for this proposal is: (1) *current* aquifer conditions make purging in that location ineffective due to chronic decline in water levels and poor aquifer conditions; (2) the wells have already captured the dioxane that they were installed to gather (that which may have escaped in 1996 during the period LB-1 was shut down), and hence serve no useful purpose; and (3) continued extraction at this location exacerbates the capture of contamination from the Unit E and contributes to the distortion of the Unit E plume. Moreover, concentrations in the Allison Street extraction well have been below 85 ppb for some time.

The DEQ disputes the impracticality of purging at this location and asserts that operational difficulties can be overcome by replacing one failing well with two new wells, followed by repeated rehabilitation. The premise is that two wells can be operated in tandem and thus will fail more slowly than one. PLS disagrees with this premise. Until water levels recover, PLS does not expect any purge wells to last more than a short time in this area. Also, previous purging operation indicates that the geological formation will not support constant purging rates in this area.

More importantly, however, PLS does not see anything in the DEQ's response actually addressing whether such purge wells continue to be necessary at this location. This is something PLS and the DEQ hopefully can address during the upcoming meeting.

Sincerely,

Farsad Fotouhi

Farsad Fotouhi
Corporate Vice President
Environmental Engineering

cc: Jim Coger, MDEQ
Celeste Gill, MDAG
Alan Wasserman, Esq.
Michael Caldwell, Esq.

EG

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

April 14, 2004

TO: Sybil Kolon, Project Manager
Remediation and Redevelopment Division, Jackson District

FROM: Leonard Lipinski, Senior Geologist
Remediation and Redevelopment Division, Jackson District

SUBJECT: Gelman Sciences, Inc. (GSI) - Evergreen Area - Groundwater Capture Analysis

According to the groundwater capture zone analysis (CZA) provided by Pall, the current purge wells in the Evergreen Area are adequate for capturing the D2 plume. Sample results and groundwater levels from existing domestic wells and monitoring wells support the CZA. Richard Mandle, the groundwater modeling specialist for RRD, has expressed some concern about the ability of the groundwater monitoring in the Evergreen Area to monitor the adequacy of the CZA. This concern, in part, has led to a reevaluation of the D2 plume monitoring in the Evergreen Area.

Due to the original requirements of the Consent Judgment, we have often treated parts of the contamination problem as distinct from other parts. The Consent Judgment was based on our then current understanding of the geology, groundwater flow and extent of contamination. Since that time, our understanding of all these things has changed. Not the least of these changes is the discovery of the E1 and E2 contamination plumes.

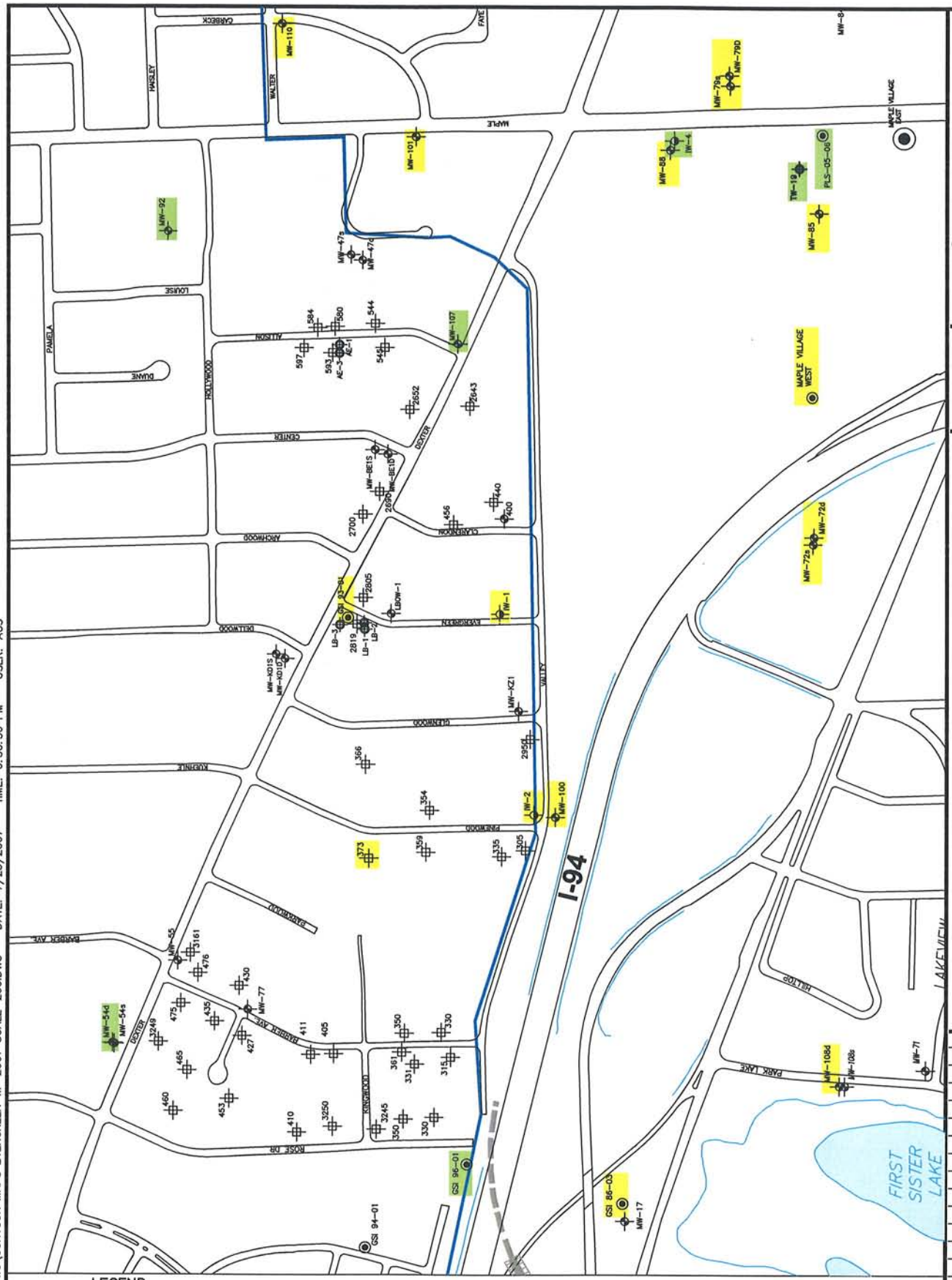
Due to this practice of treating the contamination problem in parts, sometimes it is overlooked that data obtained from one part of the problem area is relevant to another part of the problem area. One example of this is the D2 potentiometric map. There is potentiometric data available from the E1 plume area that is relevant to the D2 potentiometric map, but is not used. It is important that when potentiometric and other maps are produced that all of the relevant data is used.

It is important that we balance the concerns about the ability of the current monitoring system to demonstrate capture of the D2 plume in Evergreen with the reality that the purging in the Evergreen Area is most likely having an effect on the flow of the E1 plume. The extent to which the pumping in Evergreen is affecting the E1 plume may require further study as part of the remedial response for the E1 plume.

There is currently no evidence that the D2 plume is escaping the purge wells in Evergreen. However, the only wells installed specifically for groundwater monitoring near the leading edge of the plume are directly east of AE-1. Although this is the most likely direction of groundwater flow, it is possible that there could be flow to the northeast or southeast. Any additional monitoring wells to the southeast of the D2 plume in Evergreen would be of limited value for verifying the containment of the D2 plume. Based on the CZA, the current pumping in the Evergreen Area is potentially pulling contaminated groundwater from the E1 plume into the Evergreen Area. If dioxane were detected in monitoring wells installed to the southeast of the D2 plume, it would be difficult to determine if it originated from the D2 or E1 plumes. However, monitoring wells installed northeast of AE-1 would be useful.

An additional monitoring well nest should be installed northeast of AE-1 just east of the intersection of Allison and Hollywood. During the drilling for the wells, groundwater samples should be obtained every ten feet through the thickness of the D2 aquifer. Two monitoring wells should be installed at this location. If dioxane is detected during the vertical aquifer sampling, the wells should be screened in the zones of highest concentration. If dioxane is not detected, one well should be screened within the first ten feet of the aquifer and the second should be screened between 25 and 30 feet into the aquifer. As always, the details of the well installation may need to change if the geologic conditions encountered differ significantly from what is expected.

LL/KJ



LEGEND

- MONITOR WELL
- RESIDENTIAL WELL USED FOR MONITORING
- PURGE WELL
- HYDROGEOLOGIC TEST BORING
- TEMPORARY PURGE WELL
- SURFACE WATER ELEVATION POINT
- DRILLED TO BEDROCK
- OVER 200' bgs
- PROHIBITION ZONE BOUNDARY

NORTH

Scale: 1" = 300'

0 150 300

ALL BORINGS DRILLED TO BEDROCK OR GREATER THAN 200 FEET bgs

fishbeck, thompson, carr & huber, inc.

engineers
scientists
architects
constructors

Hard copy is intended to be 8.5"x11" when plotted. Scale(s) indicated and graphic quality may not be accurate for any other size.

Pall Life Sciences
Scio Twp., Washtenaw County, Michigan
Response to Evergreen System Review

PROJECT NO.
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FIGURE NO.
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