PLS RESPONSE TO MDEQ JUNE 23, 2008 MEMO REGARDING REVIEW OF PLS DUPONT AREA INVESTIGATION REPORT

August 7, 2008

Introduction - Background

The vertical and horizontal extent of the 1,4-dioxane plume that is migrating into the western Evergreen Subdivision area has not been defined. There has been no vertical aquifer sampling performed in the western Evergreen area. The vertical and horizontal axis of the contaminant plume "upgradient" from Dupont Circle has not been determined. Until the extent of contamination has been defined, and plume migration flow paths evaluated, it is not possible to determine whether the current monitoring well network, which includes monitoring wells MW-54s, MW-54d, MW-55, MW-77, and various residential water supply wells, is adequate for evaluating the fate and transport of 1,4-dioxane contamination in the western area of the Evergreen Subdivision.

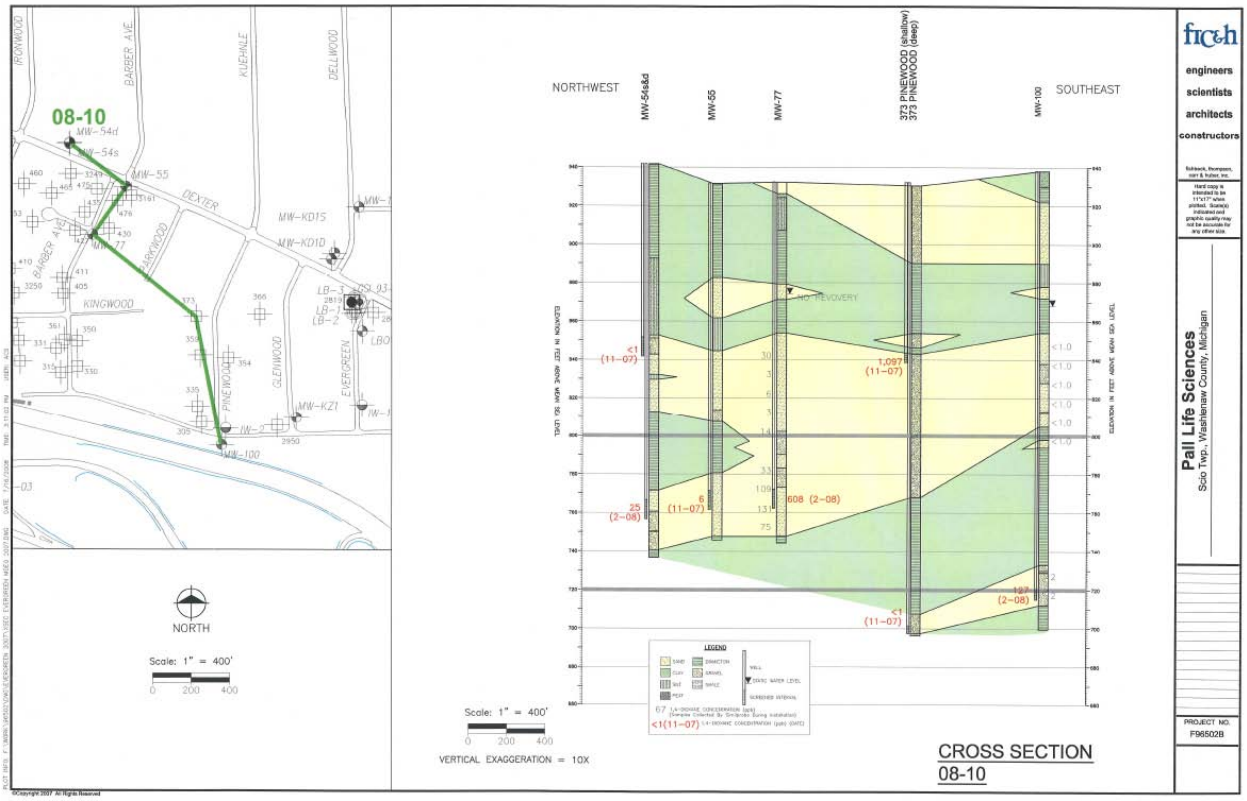
PLS Response *– These are broad statements with little technical basis. In particular, PLS disagrees with the suggestion that the vertical and horizontal extent of the Evergreen Plume has not been defined. PLS has delineated the extent of the Evergreen Plume pursuant to MDEQ-approved work plans over the last two decades. The MDEQ's recent development of a new theory regarding the origin of the contamination in the Dupont Circle area does not render the MDEQ-approved delineation a nullity. PLS has always been willing to obtain additional data to refine this delineation whenever the MDEQ has made a technically supported its request for data. Other more specific comments will be addressed below in our responses.*

Data Interpretations

PLS has generated several cross sections, based on data from the recent investigations. The cross sections generally transect the study area on a north - south, and east - west axis.

As depicted in cross section 08-11, a confining unit was not encountered in technical boring GSI-96-01, located at the south end of Rose Drive. Sufficient investigation has not been conducted in this area to determine the vertical distribution, and/or horizontal extent of 1,4-Dioxane contamination. It is apparent from the increasing contaminant trends in monitor well MW-100, located on the northern prohibition zone boundary, approximately 1,200 feet east of GSI-96-01, that deep (Unit E) contamination extends into the Evergreen Subdivision for an unknown distance north and west of MW-100.

PLS Response *North of MW-100 is 373 Pinewood. The MDEQ contends this well cannot be used for monitoring because there was no VAS at this location, and it is not technically a monitoring well. To the contrary, the geologic formation into which this well was placed makes it a very useful monitoring point and the data from this well rule out the possibility that the 1,4-dioxane from MW-100 is migrating north from the MW-100 area toward the Dupont Circle area. The relationship between this well and MW-100 is on cross section 08-10 (shown below). PLS installed the 373 Pinewood well in 1991 and bedrock was encountered at this location at a depth of 233 feet below ground level (bgl). (This was not shown clearly on the cross section previously provided to the MDEQ.) The top of the aquifer at this location is approximately 224 feet bgl, and the base of the aquifer is 233 feet bgl, making the aquifer 9 feet thick at 373 Pinewood. A 4-foot screen was installed in this well from 229 to 233 feet bgl.*



1,4-Dioxane samples have been routinely collected from this private supply well since that time; however, 1,4-dioxane has never been detected at this location.

Given the thinness of the aquifer at this location and the well's screen length, it is not possible for 1,4-dioxane to migrate north toward 373 Pinewoodfrom the MW-100 location without some level of 1,4-dioxane being present at this location.

PLS believes data from the deep well at 373 Pinewood can be used to show the plume is not migrating north from MW-100. It is plausible that 1,4-dioxane at this location is migrating northeast toward the LB area, or more due east, toward the Maple Road area. Considering the aquifer characteristics of the lower E in the LB area (thin and fine grained at GSI 93-01) compared to areas to the east, the most probable pathway of 1,4-dioxane in the MW-100 area is east toward the Maple Road area.

The GSI-96-01 was installed approximately 12 years ago to evaluate the hydrogeological conditions at a potential groundwater injection location near the south end of Rose Street. Very valuable geological information was obtained from this boring including physical descriptions of cutting materials, an electrical resistivity and a natural gamma log. 1,4-Dioxane samples were not collected from this boring because it was drilled using mud rotary drilling methods. At this boring, very difficult drilling conditions were encountered, and the hole could not be advanced below 217 feet below ground level.
Although samples were not collected for 1,4-dioxane analysis at this location, PLS believes 1,4-dioxane is present at this location above 85 ug/L. PLS has not proposed to investigate this area, since it would provide little information that would be relevant to meeting the Consent Judgment

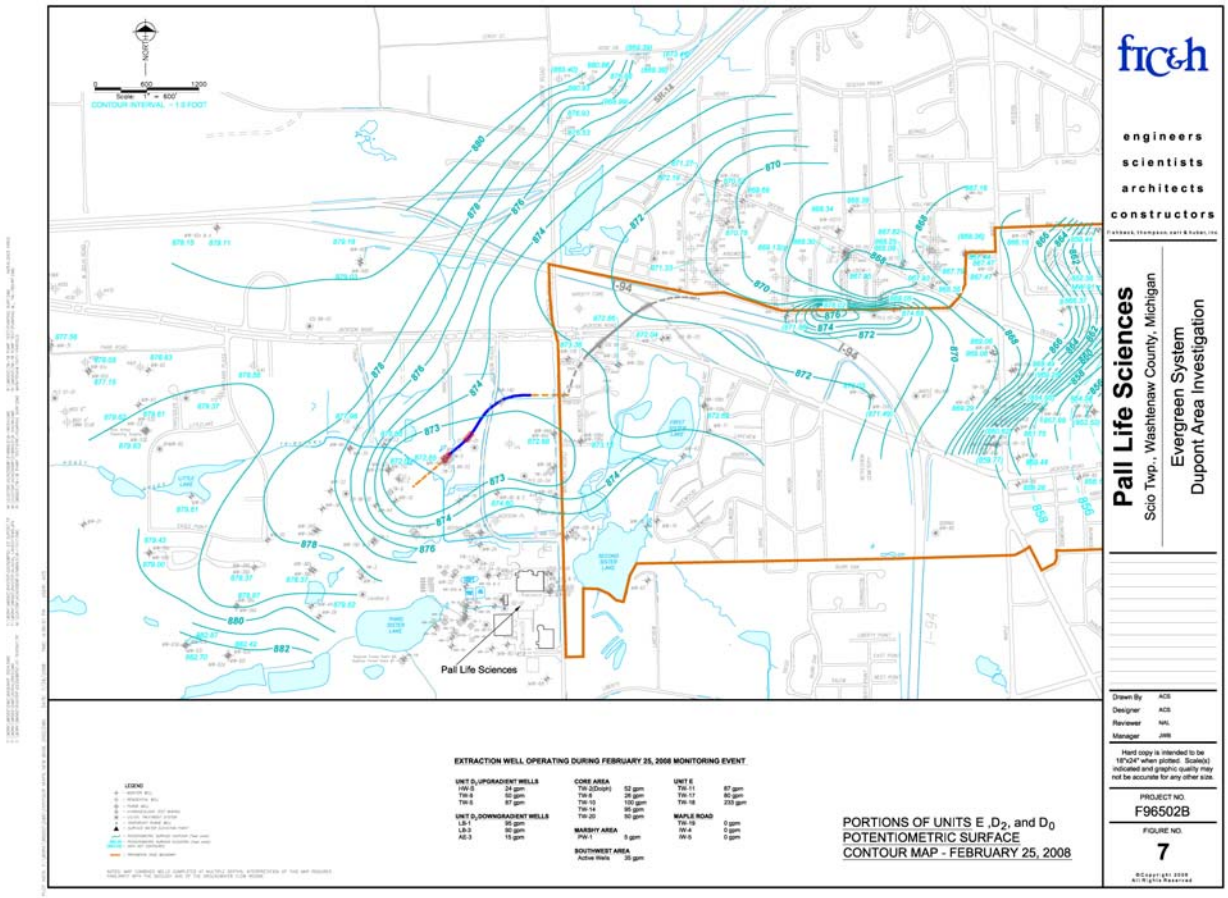
objectives. The difficult drilling conditions encountered at this location are also a deterrent to further invegiations at this location.

PLS acknowledges in the Data Interpretation - Hydrostratigraphy Section of the Report, that the deep contamination in monitoring well MW-30d, may be hydraulically connected to the screened intervals at 465 Dupont Circle, and MW-77, via a southern route through the confining unit "gap" at GSI-96-01. PLS has not installed any vertically profiled monitor wells between MW-30d and Dupont Circle. Data describing aquifer hydraulic properties and contaminant distribution parameters have not been collected for the area between MW-30d and Dupont Circle. PLS did not propose any additional investigation activities for this area.

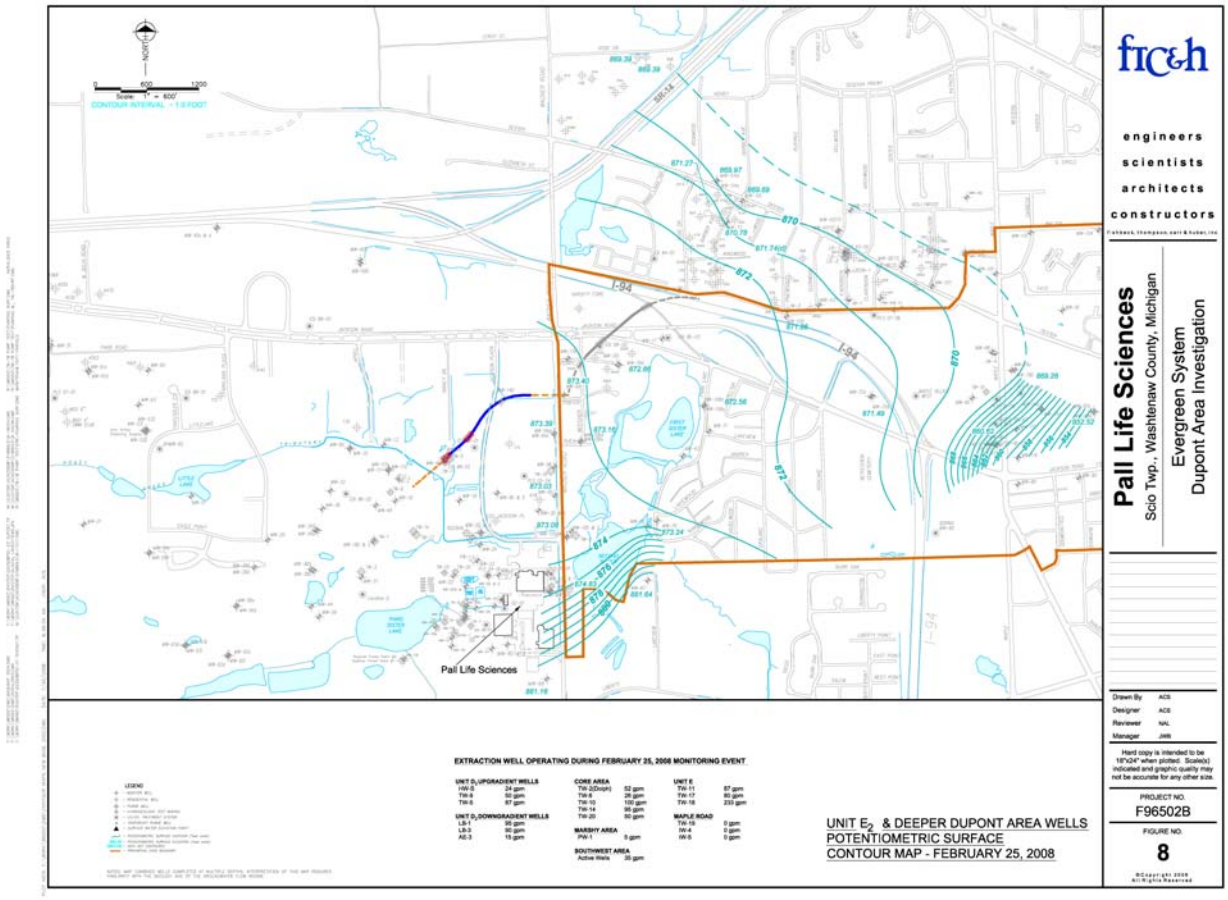
PLS Response *– The PLS Dupont report states the following: "The most plausible explanation for 1,4-dioxane in the Dupont area continues to be the migration of 1,4-dioxane at a deeper elevation from the south, such as the area near MW-30d or GSI-98-01." Please note that in this statement, GSI-98-01 should have been GSI-96-01. PLS continues to believe that this remains the most plausible explanation for the Dupont Circle area contamination. Again, PLS has not proposed to investigate this area, since it would provide little information that would be relevant to meeting the Consent Judgment objectives.*

PLS's analysis of water level and hydraulic gradient data appears to conflict with the concept of 1,4-dioxane migrating from the south, near MW-30d as referenced above. Figure 7 of the Report, Portions of Units E, D2, and Do, Potentiometric Surface Contour Map - February 2008 (Fig. 7) depicts a groundwater flow direction from the northwest to east/southeast, in the Unit D2/E1. On the basis of these flow directions, the source of contamination at Dupont Circle would have originated in an area northwest of M-14 and Wagner Road, rather than from the PLS facility located south -southwest of the Evergreen Subdivision.

PLS Response *– In our report, we stated the following: "It has been demonstrated by interpretations of the hydraulic testing that there is a hydraulic connection between the Dupont Area Extraction wells. As such, the two potentiometric surfaces (Figures 7 and 8) cannot be viewed independently, rather they need to be considered two-dimensional representations of a three-dimensional flow field."*



Looking at Figure 8, 1,4-dioxane in the MW-30d, GSI-96-01 area clearly has the potential to migrate to the northeast toward the Dupont Circle area.



PLS's analysis of water level data from deeper wells, northwest of Dupont, Figure 8, Unit E2 and Deeper Dupont Area Wells, Potentiometric Surface Contour Map (Fig.8), indicates that groundwater has "a north/northeast component of flow".

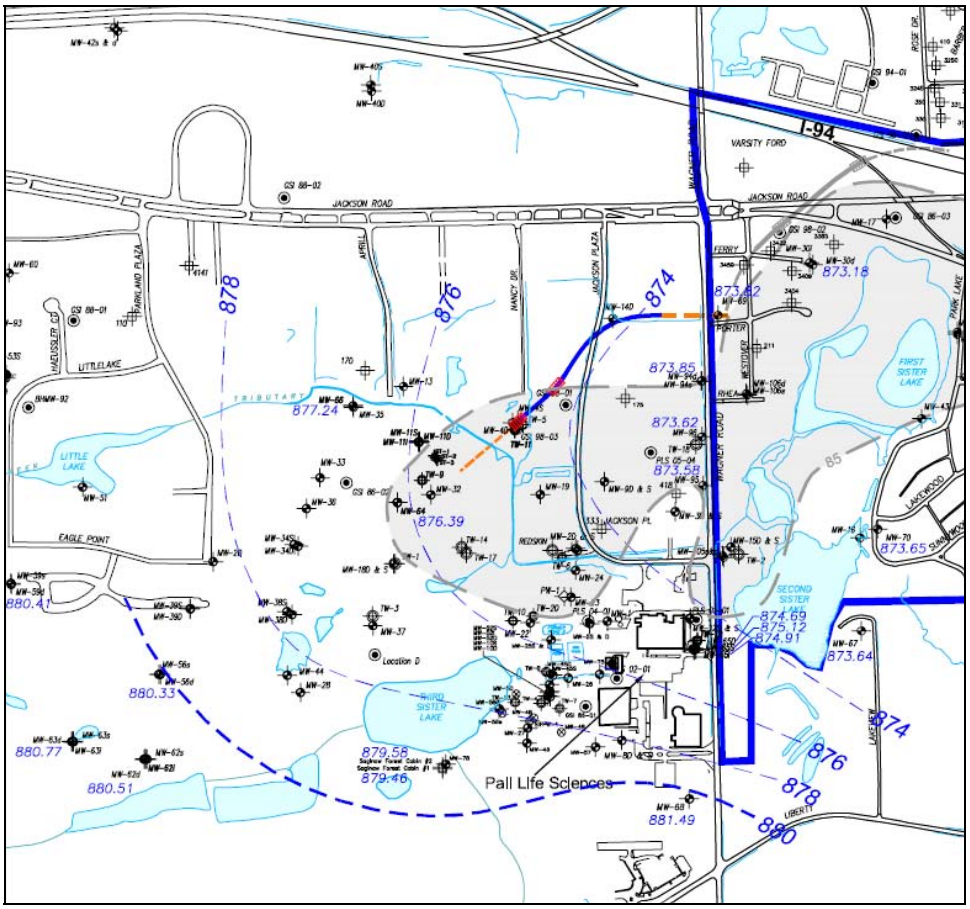
My review of static water levels from 776 and 788 Rose Drive, 465 Dupont Circle, and MW-54d, indicates that groundwater elevations were lower in the Rose Drive wells. The data from the static water level investigation indicates that depth to groundwater in the Rose Drive residential wells were taken on February 25, 2008 between 8:35 and 8:45 am. Contingent on the amount of groundwater withdrawn from the aquifer during morning household activities, and well efficiencies, sufficient time may not have elapsed for groundwater elevations to have equilibrated. PLS did not provide information addressing when the wells were last used. The groundwater elevations collected from these residential wells may or may not represent regional potentiometric elevations.

PLS Response *– It is possible the wells were recovering during the measurements, however this does not materially effect the overall interpretations. If they were recovering as hypothesized, that would mean the measurements (heads) provided by PLS could be slightly lower than if they were measured when the water levels were stable. If the water levels were higher from additional recovery, flow from the Rose Drive area would be more strongly to the east-northeast, away from this area. This would further eliminate the possibility that 1,4-dioxane from the Dupont area is migrating toward the Rose Drive area.*

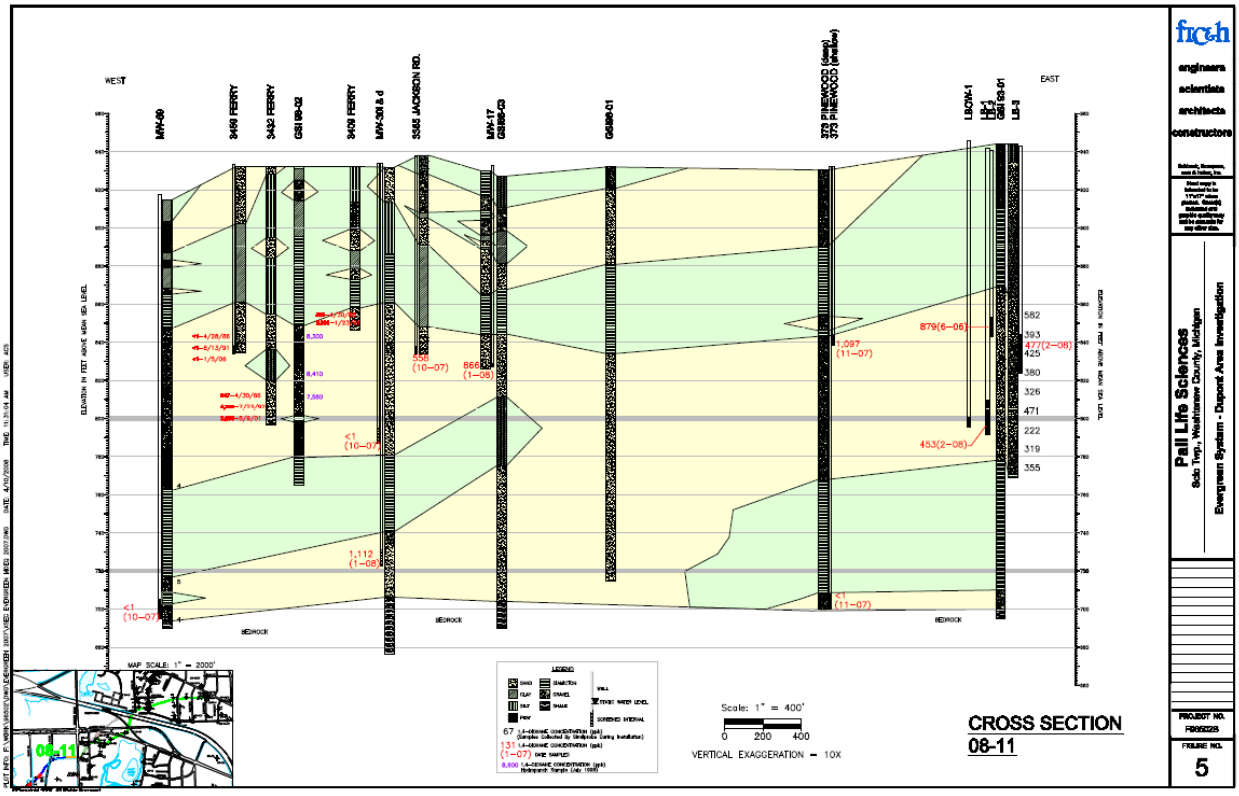
Summary of Findings

Historical data from purge well TW-11, located south of Nancy Drive, documents that significant concentrations of 1,4-dioxane (3,100 ug/l @ 149 - 150.5 feet below grade (fbg), 2,200 ug/l @ 169 - 170.5 fbg, and 1,800 ug/l @ 189 -190.5 fbg) were detected at depth when this boring was installed in December 2001. Fig. 8 of the PLS Report depicts a groundwater flow direction from the southwest to northeast for the deeper saturated intervals of the western Evergreen Subdivision. Review of historical and current data sets from TW-11, Dupont Circle, and the MW-30d area indicates that 1,4-dioxane exceeding 85 ug/L was detected at 465 Dupont Circle in April 1999. The 1,4-dioxane concentrations did not exceed 85 ug/l at monitoring well MW-30d until April 2002. As noted above, the groundwater flow direction depicted in Fig. 8 of the PLS Report, suggests that the source of contamination in the western Evergreen Subdivision area is from an area west of Wagner Road, proximal to Nancy Drive and TW-11.

PLS Response *– Figure 8 does not show water level data from onsite (areas west of Wagner Road). For this investigation, a decision was made to focus data collection efforts east of Wagner Road. Previous rounds of water level data collection have included deeper wells in the site area. For reference, the March 13, 2007 potentiometric surface map is shown below. More onsite data were collected to prepare this map. It is clear that groundwater flow in Unit E, in the area of TW-11, is to the east. From extensive drilling along Wagner Road, including the recent MW-118 where 1,4-dioxane was below 85 ug/L in the Unit E, it is clear that the axis of the plume from the site area cross Wagner Road south of MW-118, consistent with a path predicted by the potentiometric surface shown below. There is no data that indicate that 1,4-dioxane proximate to TW-11 flows directly northwest toward the Dupont Circle area. This hypothesis is in fact contradicted by the data from MW-118 and a correct interpretation of potentiometric surface/groundwater flow direction data.*

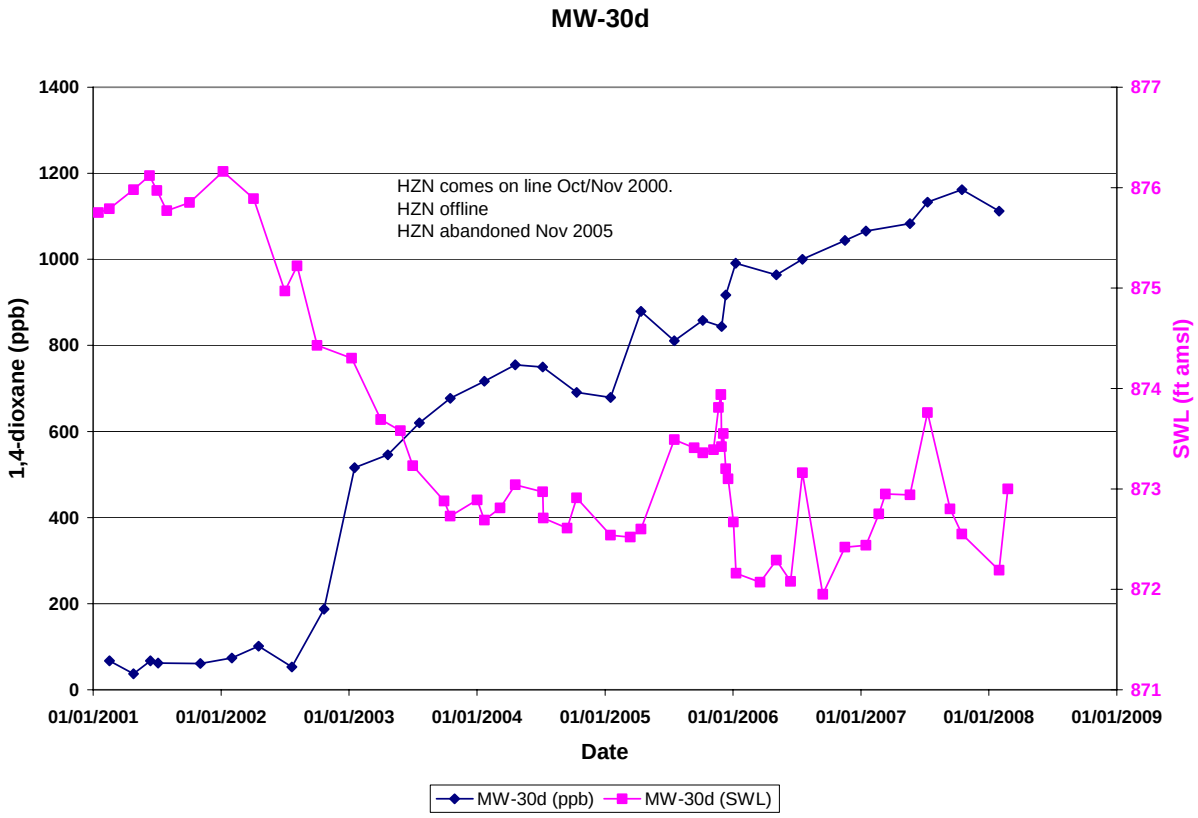


A more logical explanation for the contamination in the Dupont Circle area is that, prior to the operation of TW-18 deeper 1,4-dioxane moving across Wagner Road to the east migrated into the Sisters Lake area, then north toward the Dupont Circle area. This flow pathway is consistent with the flow pathway shown on Figure 8 of the Dupont report. The hydrogeological connections that allow for this migration are shown on the cross section below (Cross Section 08-11). Note the extensive sand bodies at GSI-86-01 and GSI-96-01. We know that 1,4-dioxane extends to bedrock in the Wagner Road area, allowing 1,4-dioxane to travel from the Wagner Road area north-northeast into this sand body. This cross section also demonstrates how the same sand body connects to 373 Pinewood (shallow) and then the LB area.



The fact that 1,4-dioxane above 85 ug/L was detected at MW-30d after that level was detected in the Dupont Circle area does not contradict this interpretation. PLS is not suggesting that MW-30d is in the direct path of 1,4-dioxane migrating to the Dupont Circle area. The MW-30d well nest is interpreted to be more on the western side of this plume. PLS believes the axis of the northward migrating plume lies between MW-30d and MW-108s/d. Higher levels of 1,4-dioxane (deep and shallow) are certainly present at MW-108s/d. Indeed, the migration of higher 1,4-dioxane levels to MW-30d beginning in the fall of 2002 may have occurred at that time because of changes in the aquifer conditions. The horizontal well, which began operating two years earlier, may have pulled 1,4-dioxane from the area south of MW-30d into the MW-30d area. There is also an inverse relationship between water levels and 1,4-dioxane concentrations in MW-30d As water levels decreased (in part due to pumping of the horizontal well), 1,4-dioxane concentrations increased. A graph of 1,4-dioxane and water level data from MW-30d is shown below.

The combimation of these two charges and the regional flow directions show that the "source" of the 1,4-Dioxane in MW-30d is already identified, and is not in some hypothetical cross-flow direction.



The Dupont Circle area investigations continue to support the interpretation that this plume falls under the hydraulic influence of the Evergreen System extraction wells. There are no data to date that indicate 1,4-dioxane in the Dupont area migrates northeast beyond the MW-54d MW-55 area, northwest toward the Rose Drive area, as MDEQ hypothesizes.

The vertical profiling data from newly installed monitoring well MW-118 (Ferry Street and Wagner Road), may not be representative of 1,4-dioxane concentrations west of Wagner Road. Additional investigation, north of TW-11, is needed to define the extent of contamination to 85 ug/l, and determine if there is hydraulic communication between the deep or shallow intervals proximal to TW-11, and the western area of the Evergreen Subdivision.

PLS Response *– See above.*

PLS concludes that monitoring wells MW-54d and MW-55 are properly located to monitor expansion of the 1,4-dioxane plume to the north. These wells were not vertically profiled to bedrock to determine whether they are screened at the correct depth. Also, the distance between MW-55 and the nearest vertically profiled monitoring well to the east, MW-113, is approximately 1,250 feet. Additional investigation may be needed north of MW-55 and west of MW-113 to verify that no 1,4-dioxane is migrating to the north in this area. The need for additional monitoring wells north and east of MW-55 will be contingent on the results from the investigation west of Dupont Circle.

PLS Response *– The lack of VAS data from these MDEQ-approved monitoring wells does not mean that they are not reliable monitoring points. PLS will continue to rely on the MDEQ's*

prior approval of these wells unless the MDEQ can identify new data or provide a new interpretation that supports its recent assertion that these wells are useless. Data have been routinely provided to the MDEQ that document that MW-54d and MW-55 are completed at a depth similar to MW-77 and 465 Dupont. The MDEQ's recent concerns in this regard also ignore the fact that MW-77, located approximately 500 feet from MW-55, was vertically profiled. The VAS data from MW-77 also demonstrate that the highest concentrations in the aquifer are at the same depth as MW-54d and MW-55. Finally, data from MW-113, which was profiled down to bedrock, also demonstrate that the highest 1,4-dioxane concentrations in the aquifer are at the same depth interval that MW-54d and MW-55 are screened. Consequently, PLS continues to believe that MW-54d and MW-55 are properly located to monitor any possible expansion of the plume to the north.

The vertical and horizontal extent of 1,4-dioxane contamination has not been defined in the western portion of the Evergreen Subdivision. Assumptions regarding the effectiveness of the purge system capture can not be verified until the full vertical and horizontal extent of 1,4-dioxane contamination has been determined, and groundwater flow paths evaluated.

PLS Response *– Data collected by PLS, including recent data from the Rose Drive area, continue to support that 1,4-dioxane in the Dupont Circle area is moving toward the Evergreen extraction system, and are not migrating northeast, toward MW-54d or MW-55, or northwest, toward the Rose Drive area. The latter is also supported by water quality data collected from residential wells in the area by the MDEQ.*