AFFIDAVIT OF JAMES W. BRODE

JAMES W. BRODE, being first duly sworn, deposes and says as follows:

1. I am a practicing professional hydrogeologist with over 23 years of experience. I am employed as a Senior Hydrogeologist by Fishbeck, Thompson, Carr and Huber, Inc. I am a Certified Professional Geologist by the American Institute of Professional Geologists.

2. I have been involved in investigation of the soils, groundwaters, and surface waters at and in the vicinity of the Gelman Sciences Inc. (n/k/a Pall Life Sciences, Inc. ("PLS")) facility in Scio Township, Ann Arbor, Michigan, since 1986. This work was done by me in my professional capacity on behalf of Gelman Sciences and, more recently, PLS.

3. Numerous investigations of the soils, groundwaters, and surface waters at and in the vicinity of the PLS facility have been conducted since 1986. I performed many of these investigations personally. Other investigations were performed under my direct supervision. These include investigations conducted in the Evergreen System.

Reason for the Recent Shut Down of AE-3

4. AE-3 is no longer able to maintain the minimum flow rate (25 gallons per minute ("gpm")) approved by the Michigan Department of Environmental Quality ("DEQ") as being sufficient to capture the leading edge of the Evergreen Plume. AE-3 has lost its capacity for two key reasons: 1) fouling of the well screen, and 2) water level declines in the aquifer being remediated.

5. Well screens foul (plug) due to physical and/or biological processes. AE-3, and its predecessor AE-1, have required significant maintenance (well development) in order to clean the screens and maintain their capacity. AE-3, which was installed in April 2004, has been shut down repeatedly for rehabilitation or maintenance work. The three purge wells installed in the

Allison Street area have required significantly more maintenance than any other PLS extraction wells.

6. AE-3 is completed in a poorly producing aquifer with low transmissivity. Wells completed in aquifers with a low transmissivity, such as AE-3, typically have a low specific capacity (volume of water produced per unit of drawdown). Additionally, wells completed in poorly producing aquifers can be prone to well fouling, because the screens used in these aquifers typically have higher entrance velocities (which promotes mineral precipitation during pumping), and because there is less pore space in the material surrounding the well screen, making it prone to becoming plugged.

7. Water level declines in the area of AE-3 have significantly contributed to the loss of well capacity. As shown on hydrographs attached as Exhibit 1, water levels have declined approximately 6 to 7 feet in this area. This decline has reduced the available drawdown and thus the capacity of wells in the Allison Street area. In addition, lower water levels increase the likelihood that air will be drawn into the well as pumping levels are lowered to the pump intake. This process encourages the growth of bacteria and bio-fouling of the well screen. These conditions plug the well screen and must be removed with powerful chemicals (see below). The decline in the water levels is likely attributable to PLS' aggressive remedial activities in hydraulically upgradient areas, although longer-term natural trends may also be a contributing factor.

Potential Options for Regaining Purging Capacity

8. Additional maintenance of AE-3 will not restore the capacity of the well to its original capacity or to a condition capable of sustaining a flow rate of 25 gpm. It is typical of wells to not regain their full capacity once capacity is lost. For instance, PLS recently attempted an aggressive development of AE-3 in late April. This development was only briefly successful

in restoring the capacity enough to sustain 25 gpm. It is unlikely that further rehabilitation of this well will restore significant well capacity.

9. The DEQ has suggested installing multiple wells along Allison Street as a potential solution for maintaining the Allison Street extraction at the required 25 gpm. Although no design specifics were offered by the DEQ, it is assumed that such a system would involve the installation of wells in a north-south row (perpendicular to groundwater flow). The wells would be hydraulically linked together through a header type system. The combined flow rates from the wells would be at least 25 gpm.

10. The possible advantage of such a system would be the potential to reduce plugging in any individual well. If plugging were reduced, the wells could potentially operate for longer periods of time (as compared to a single well) between maintenance events. But there are far too many variables to conclude that the maintenance events with multiple wells would be less than experienced during the operation of AE-1 and AE-3 without actually installing and operating such a complicated system. It should be noted that a previous attempt to increase the reliability of the system by installing AE-2 to serve as a backup well for AE-1 was unsuccessful. Because of the variability of the aquifer conditions and flow patterns, AE-2 failed to yield any significant concentrations of 1,4-dioxane. Such difficulties in placing and maintaining a purge well would be multiplied if PLS were required to install a multi-well system.

11. There are several other disadvantages to the proposed system:

a. Access - Access to the proposed well sites is very difficult. Available space for drilling wells is very limited in the area where the wells would be installed. Access would be needed from either the City of Ann Arbor or private property owners. Installation of multiple wells on private property, including connecting piping and process controls, would be very disruptive to a property owner. Installation of wells in the

right-of-way would also be disruptive and may not be possible, depending on the extent of utilities in the area and the willingness of the City of Ann Arbor to install such infrastructure in their right-of-way and along utility corridors.

b. Neighborhood Disruption - Because there are multiple wells and more complex piping requirements, the installation time will be significant (estimated between six to ten weeks). This will cause significant disruption to the neighbors. There will also be the ongoing need to maintain these wells (see next item – Safety Issues). This will result in a continued disruption to the neighborhood and ongoing damage to private property or the right-of-way resulting from trucks driving on lawns.

c. Safety Issues - Maintaining the operation of the wells will require the wells to be periodically developed. The development process involves chemical and physical washing of the well screens (intake). This work, which must be done by an experienced drilling company, involves heavy equipment (drilling rigs and trucks) and the use and storage of dangerous chemicals. Chemical development involves the use of acids and oxidizers (chlorine). These chemicals are introduced into the wells and eventually pumped back out. This process involves the handling and temporary storage of very dangerous chemicals. More wells means more chemicals and longer timeframes required for this work. As such, the risk of an accident/injury is increased and far exceeds the risk associated with trace levels of 1,4-dioxane in the groundwater.

Likelihood of Plume Migrating Past AE-3

12. AE-3 is currently running at reduced flow rates. Although the rates have been below the required flow rate of 25 gpm, it does not mean that such rates are not adequate to capture the plume at AE-3.

13. The likelihood that 1,4-dioxane has migrated past AE-3 at concentrations above 85 micrograms per liter (µg/L) during the time flow rates at the well have been below 25 gpm is extremely low. There are several factors that determine the likelihood that 1,4-dioxane would have migrated past AE-3 at concentrations above 85 µg/L. Two key factors include: a) the magnitude of 1,4-dioxane concentrations in the vicinity of AE-3, and b) the hydraulic gradients (a factor controlling groundwater flow) around AE-3. Each of these factors is discussed below:

a. In order for the plume (concentrations greater than 85 µg/L) to migrate beyond AE-3, there would need to be sufficient 1,4-dioxane concentrations to sustain expansion of the plume. 1,4-Dioxane concentrations at AE-3 have been below 85 µg/L since July, 2005. There is only one well in the vicinity of AE-3, 593 Allison, where 1,4-dioxane concentrations are currently being detected above 85 µg/L. Such low concentrations at and around the well significantly reduce the potential that 1,4-dioxane at concentrations above 85 µg/L have migrated or will migrate past AE-3 while it was or is shut off or operating under reduced flow conditions.

b. Even under a reduced flow condition, the hydraulic gradient (slope of the groundwater surface) in the area of AE-3 is very flat. This is due to the aggressive pumping at LB-1 and LB-3, which "cuts off" the flow of groundwater toward AE-3. Groundwater flow velocity is proportional to the hydraulic gradient. That is, the lower the hydraulic gradient, the lower the groundwater velocity.

14. On June 18, 2007, there was a 0.21 foot difference in head between 593 Allison Street and MW-47d, with MW-47d being slightly lower (suggesting a slight potential for flow to the east). This equates to a hydraulic gradient of 0.0006 foot between the AE-3 area (as measured at 593 Allison Street) and the downgradient monitoring well cluster. The groundwater velocity under this hydraulic gradient can be calculated using the following formula:

$$V = \frac{K \times i}{n}$$

Where,

K = Hydraulic conductivity (conservatively estimated at 50 ft/day for the material around AE-3)
i = Hydraulic gradient (measured to be 0.00057 ft/ft on June 18, 2007)
n = Porosity (25%, estimate)

Using this formula, the groundwater velocity between AE-3 and the downgradient monitoring well cluster MW-47s/d is calculated to be approximately 0.11 foot/day, or slightly over an inch per day. At this rate, it would take over eight years for groundwater to migrate from AE-3 to the nearest downgradient monitoring wells. The plume (i.e., concentrations above 85 µg/L) would take even longer to reach these wells, assuming it did not dissipate before reaching these monitoring wells.

15. Consequently, there is little if any immediate risk that the "plume" in the vicinity of AE-3 will migrate beyond the capture zone of this well, even under the current reduced conditions.

16. Moreover, to the extent a plume of contamination above 85 ppb were to migrate past AE-3, this small area of contamination would, if it did not dissipate to levels below 85 ppb, migrate a short distance (about 500 feet) and then enter the existing Prohibition Zone. This remnant would eventually merge with the existing Unit E plume in the area of Maple Road (well below the 2800 ppb threshold PLS is required to capture at this location by the Unit E Order.) The approximate pathway of this plume segment is shown on Exhibit 2.

The Relationship Between Unit D_2 and Unit E

17. The Unit D_2 plume has historically been interpreted to be a distinct plume that migrated into the Evergreen Subdivision within the D_2 aquifer from the southwest. Recent investigations have focused on better understanding the relationships between the Unit D_2 plume

and the Unit E plumes (specifically the upper portion of the Unit E that is sometimes referred to as E_1). The ability to conduct such investigations has been made possible by the continued collection of data by PLS in association with the investigations of the Unit E plume.

18. The capture zone of LB-1 and LB-3 encompasses the entire width of the Evergreen System plume. This extensive capture zone is stopping the Evergreen System plume from migrating past (east of) these wells. PLS has demonstrated with various DEQ-approved capture zone analyses ("CZA") that it has been capturing the entire width of the D_2 plume at the LB location since LB-1 was re-started in 1996, after PLS obtained permission to dispose of its treated groundwater via the City sanitary sewer. Operation of the LB wells has prevented any additional groundwater contamination above 85 ppb from migrating past the LB capture zone toward the AE location since that time. In fact, the capture zone is currently so extensive, it is capturing a portion of the Unit E plume to the south. Data suggest the capture zone of LB-1 and LB-3 may even include the area of AE-3 under current pumping conditions.

19. Based on these data, it is clear that operation of the Evergreen System has resulted in a portion of the Unit E plume being pulled north toward the Evergreen Subdivision area and into capture zones of the operating Evergreen System extraction wells (LB-1, LB-3, and AE-3). The following lines of evidence support this opinion:

a. Hydraulic Depression – The groundwater extraction in the Evergreen Area has resulted in an extensive hydraulic depression around LB-1 and LB-1. Groundwater elevations of Unit D_2 in the Evergreen Subdivision have been mapped on numerous occasions. Exhibit 3 is a groundwater contour map (potentiometric surface map) for the Evergreen System area. The Evergreen System extraction wells were operating at the time these data were collected. The potentiometric surface map shows a significant hydraulic depression in the area of LB-1 and LB-3. It also shows a steep hydraulic

gradient from south to north, along the southern flank of the Evergreen System area. This steep gradient has been routinely observed in water level data for this area. Geological interpretations have demonstrated that there is no geological separation between portions of the Unit D_2 and Unit E plumes. As such, the two plumes can hydraulically communicate in areas where they are not physically separated. Therefore, there is nothing to physically stop the Unit E plume from migrating north toward the hydraulic depression created by the Evergreen System extraction wells.

b. Concentration Levels – The 1,4-dioxane concentrations at the Evergreen Extraction Wells have not been declining as anticipated. 1,4-Dioxane concentration trends of groundwater samples from LB-1, LB-2, and LB-3 (LB-series extraction wells) have not fallen since peak concentration was reached at these locations in approximately mid-2000. LB-1 is actually still increasing and is near its all-time-high concentration. 1,4-Dioxane trend graphs for the LB wells are provided as Exhibit 4. These observations are not consistent with the fact that 1,4-dioxane concentrations in the upgradient portion of the D_2 plume have been declining since 2000 or earlier. Exhibit 5 shows trends for D_2 wells positioned upgradient of LB-series extraction wells. Although 1,4-dioxane concentrations at LB-1 and LB-2 did have a temporary peak/decline trend in mid-2000, the downward trend reversed. The best explanation as to why there has not been a steady decline in 1,4-dioxane concentrations at the LB-series wells is the contribution from the Unit E plume.

c. Concentrations in Southern Portion of Evergreen Subdivision – The 1,4-dioxane concentrations in wells located in the southern portion of the Evergreen Subdivision closest to the Unit E plume have steadily increased even though operation of the LB purge wells has cut off the source of 1,4-dioxane within the D_2 aquifer since 1996.

Wells along Clarendon Street, on the south side of the Evergreen System extraction wells, are believed to be in the pathway of the Unit E plume as it migrates northward toward the Evergreen System extraction wells. Supporting evidence that the Unit E plume has been pulled north is manifest in increased 1,4-dioxane concentrations at wells along Clarendon Street, specifically 456 and 440 Clarendon Street. The timing of this increase corresponds to the pumping of the Evergreen System extraction wells. 1,4-Dioxane trend graphs for 456 and 440 Clarendon Street are provided as Exhibit 6. Interpretations of available water level data and a groundwater flow model prepared for the Evergreen area both predict a portion of the Unit E will migrate through the Clarendon Street area toward the Evergreen System extraction wells.

d. Mass Removed From AE Wells – Approximately 60 pounds of 1,4-dioxane was present in the D_2 aquifer east of the LB well location when LB-1 was restarted in 1996. Restarting LB-1, combined with the subsequent installation of LB-2 (later replaced by LB-3) and the increase in the combined purge rate of these wells, has continually prevented additional contamination from migrating east past the LB location since that time. Nevertheless, PLS has removed approximately 100 pounds of 1,4-dioxane from the AE wells to date. Despite removing more 1,4-dioxane than was present when PLS cut off the only known source of contamination, concentrations in the immediate area of the AE wells have remained slightly above the cleanup criterion. The most plausible explanation for this discrepancy is a significant contribution from the Unit E plume.

Justification for Reducing Flow Rates at LB-1 and LB-3

20. If flow rates at LB-1 and LB-3 are not reduced, the following should be expected: 1) a portion of the Unit E plume will continue to be pulled into the capture zone of the Evergreen System wells; 2) the migration direction of a portion of the Unit E plume will be altered, creating an expansion of the Unit E plume to the northeast in the area south of Valley, west of Maple Road, which will cause the Unit E plume to track closer to and beyond the northern PZ boundary; 3) more energy will be used to operate the LB-series extraction wells; and 4) there will be excessive wear on the pipelines leading from the Evergreen System to the treatment facility.

FURTHER, AFFIANT SAYETH NOT.

JAMES W. BRODE

Subscribed and sworn to before
me this 6 day of July, 2007.

Tonya L. Chartrand

Notary Public, Kalamazoo County, MI
My commission expires: 8-22-2010

TONYA L. CHARTRAND
NOTARY PUBLIC, STATE OF MI
COUNTY OF KALAMAZOO
MY COMMISSION EXPIRES Aug 22, 2010
ACTING IN COUNTY OF Kalamazoo

EXHIBIT 1

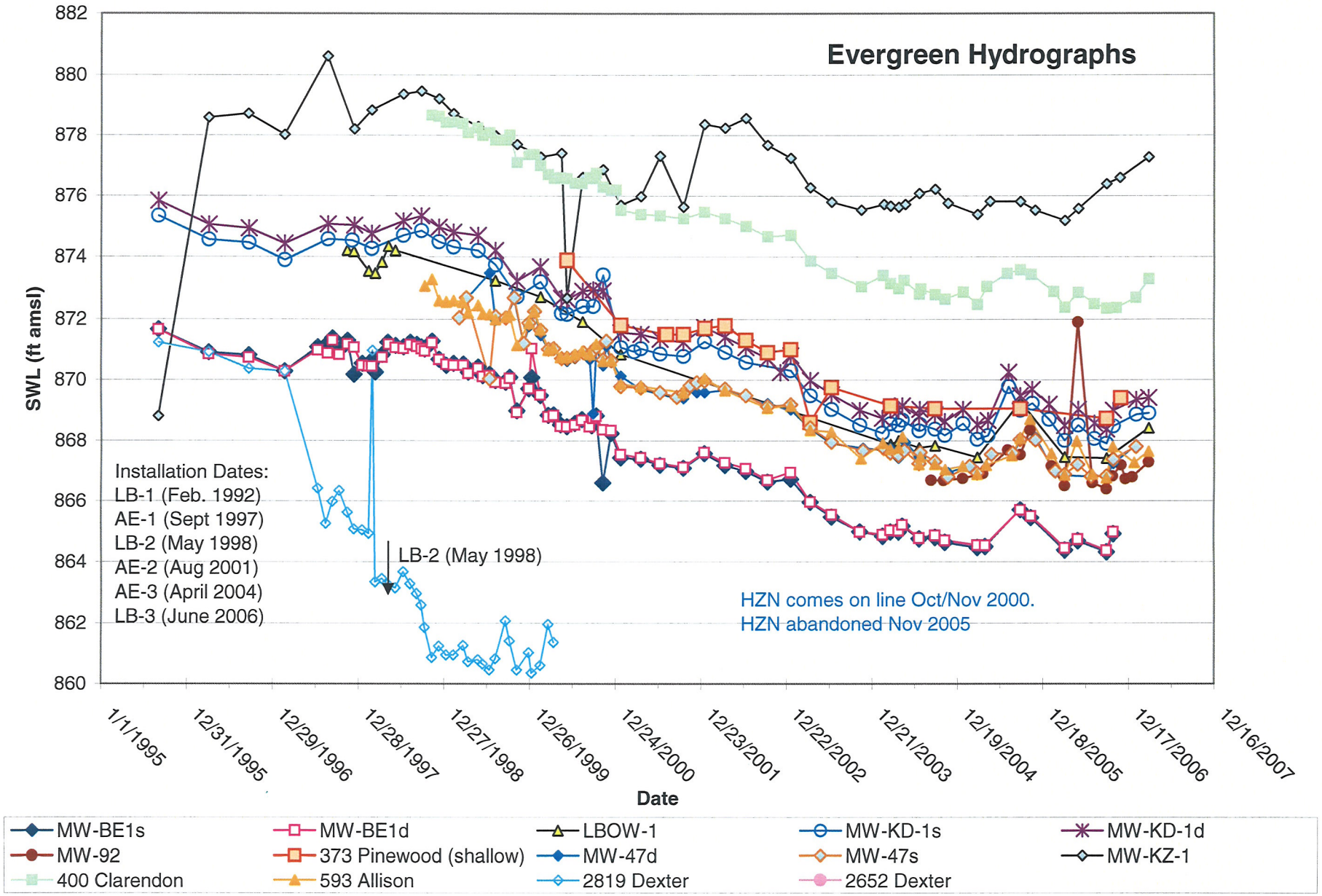
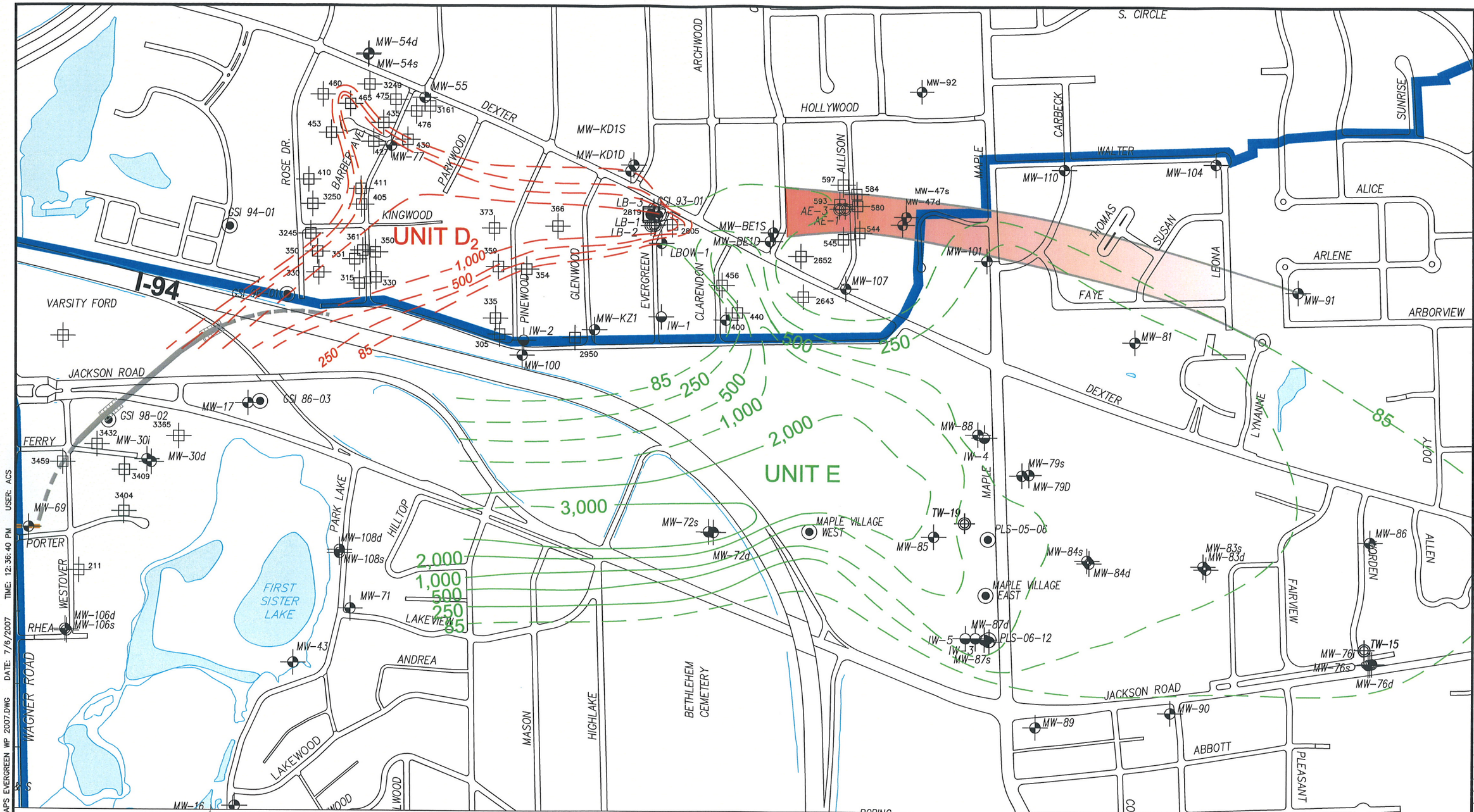

Evergreen Hydrographs
SWL (ft amsl)
882
880
878
876
874
872
870
868
866
864
862
860
Installation Dates:
LB-1 (Feb. 1992)
AE-1 (Sept 1997)
LB-2 (May 1998)
AE-2 (Aug 2001)
AE-3 (April 2004)
LB-3 (June 2006)
LB-2 (May 1998)
HZN comes on line Oct/Nov 2000.
HZN abandoned Nov 2005
1/1/1995
12/31/1995
12/29/1996
12/28/1997
12/27/1998
12/26/1999
12/24/2000
12/23/2001
12/22/2002
12/21/2003
12/19/2004
12/18/2005
12/17/2006
12/16/2007
Date
MW-BE1s
MW-BE1d
LBOW-1
MW-KD-1s
MW-KD-1d
MW-92
373 Pinewood (shallow)
MW-47d
MW-47s
MW-KZ-1
400 Clarendon
593 Allison
2819 Dexter
2652 Dexter

EXHIBIT 2



LEGEND

- MONITOR WELL
- RESIDENTIAL WELL
- PURGE WELL
- HYDROGEOLOGIC TEST BORING
- UV/OX. TREATMENT SYSTEM
- TEMPORARY PURGE WELL
- SURFACE WATER ELEVATION POINT
- 1,4-DIOXANE ISOCONCENTRATION CONTOUR (ug/L) – UNIT D_2 (October 2006 – January 2007)
- 1,4-DIOXANE ISOCONCENTRATION CONTOUR (ug/L) – UNIT D (October 2006 – January 2007)
- PROHIBITION ZONE BOUNDARY
- MIGRATION PLUME PATHWAY

NORTH

0 500 1000

Scale: 1" = 500'

PROBABLE DOWNGRADIENT MIGRATION PLUME PATHWAY OF REMNANT PORTION OF UNIT D_2 & E PLUME

fr&h
engineers
scientists
architects
constructors
fishbeck, thompson, carr & huber, inc.

Hard copy is intended to be 11"x17" when plotted. Scale(s) indicated and graphic quality may not be accurate for any other size.

Pall Life Sciences
Scio Twp., Washtenaw County, Michigan

Brode Affidavit

PROJECT NO.
F96502B

EXHIBIT
2

EXHIBIT 3

MW-54d
MW-54s
DEXTER
3249
460
871.70
465
475
MW-55
870.43
3161
476
435
453
427
430
MW-77
871.31
ROSE DR
PARKER AVE.
PARKWOOD
KUEHNLE
410
411
3250
405
KINGWOOD
871.81
3245
GSI 94-01
350
361
331
350
330
315
330
GSI 96-01
(868.90)
MW-KD1S
869.40 MW-KD1D
DELLWOOD
ARCHWOOD
CENTER
866
LB-3
GSI 93-01
861.37
2819
LB-1
LB-2
2805
869.60
373
366
359
354
PINEWOOD
GLENWOOD
EVERGREEN
865.24
MW-BE1S
2690
MW-BE1D
(865.35)
LBOW-1
868.42
2652
DEXTER
456
CLAREMOON
2643
335
305
IW-2
2950
MW-KZ1
877.28
IW-1
440
400
873.30
VALLEY
MW-100
DUANE
LOUISE
HOLLYWOOD
867.28
MW-92
HAISLEY
ALLISON
597
584
867.63
593
AE-3
AE-1
580
867.97
MW-47s
867.94
544
545
MW-47d
867.67
WALTER
MW-
866.5
MW-101
867.42
MW-107
868.82
MAPLE
868
I-94
876
874
872
GSI 86-03
MW-17
871.40
W-30d
873.10
3.20
872
PARK LAKE
868.71
MW-88
IW-4
868.73
MW-79s
MW-79
TW-19

LEGEND

- MONITOR WELL
- RESIDENTIAL WELL USED FOR MONITORING
- PURGE WELL
- HYDROGEOLOGIC TEST BORING
- TEMPORARY PURGE WELL
- SURFACE WATER ELEVATION POINT

- UNITS D2 & E POTENTIOMETRIC SURFACE CONTOUR (Feet amsl)
883.05 - POTENTIOMETRIC SURFACE ELEVATION (Feet amsl)
(883.05) - DATA NOT CONTOURED
- PROHIBITION ZONE BOUNDARY

NORTH

0 300 600
Scale: 1" = 300'
Contour Interval = 2.0'

UNIT D_2 & PORTIONS OF UNIT E AQUIFERS POTENTIOMETRIC SURFACE CONTOUR MAP - March 13, 2007

fr&h
engineers
scientists
architects
constructors
fishbeck, thompson, carr & huber, inc.

Hard copy is intended to be 11"x17" when plotted. Scale(s) indicated and graphic quality may not be accurate for any other size.

Pall Life Sciences
Scio Twp., Washtenaw County, Michigan

Brode Affidavit

PROJECT NO.
F96502B

EXHIBIT
3

EXHIBIT 4

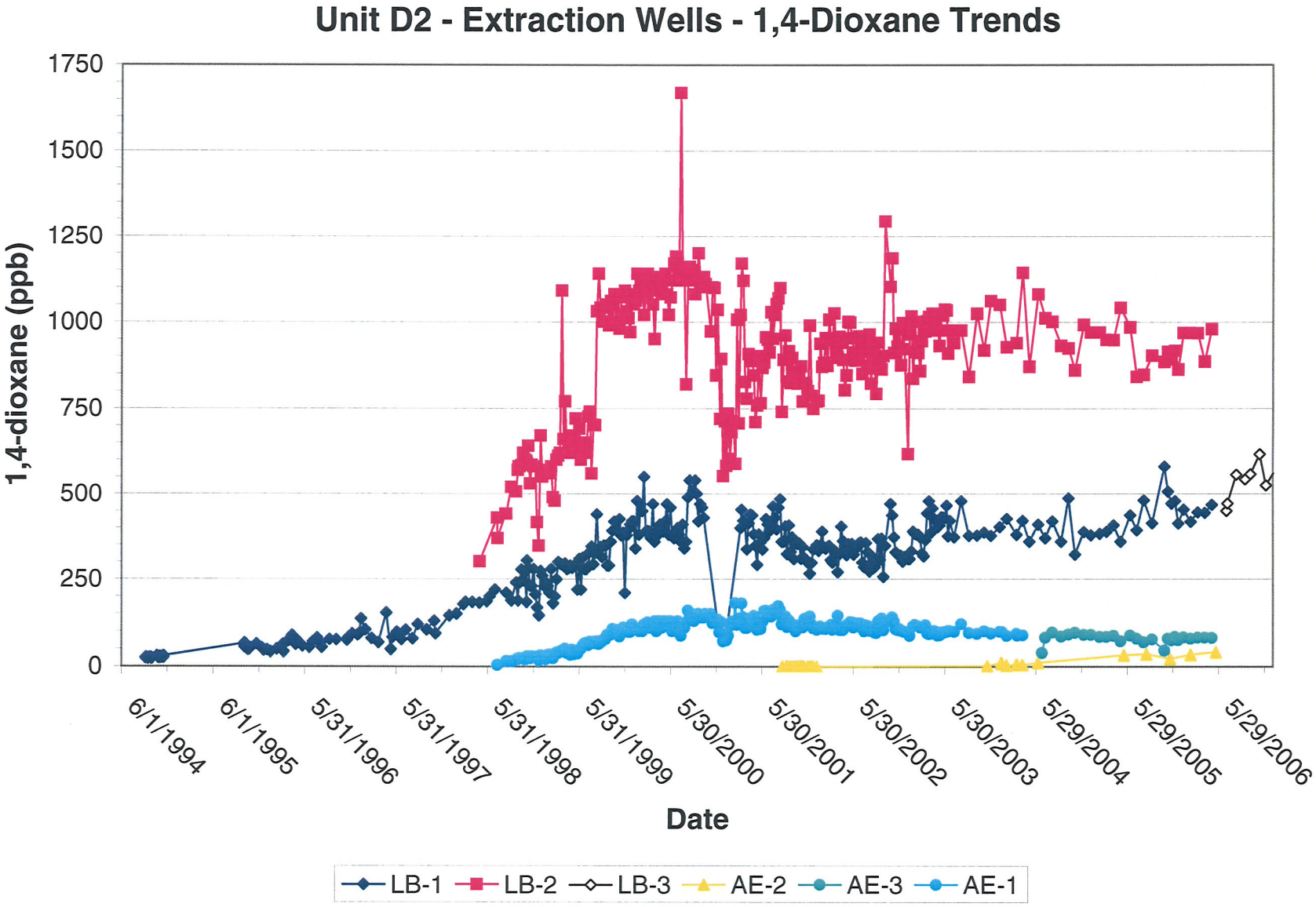
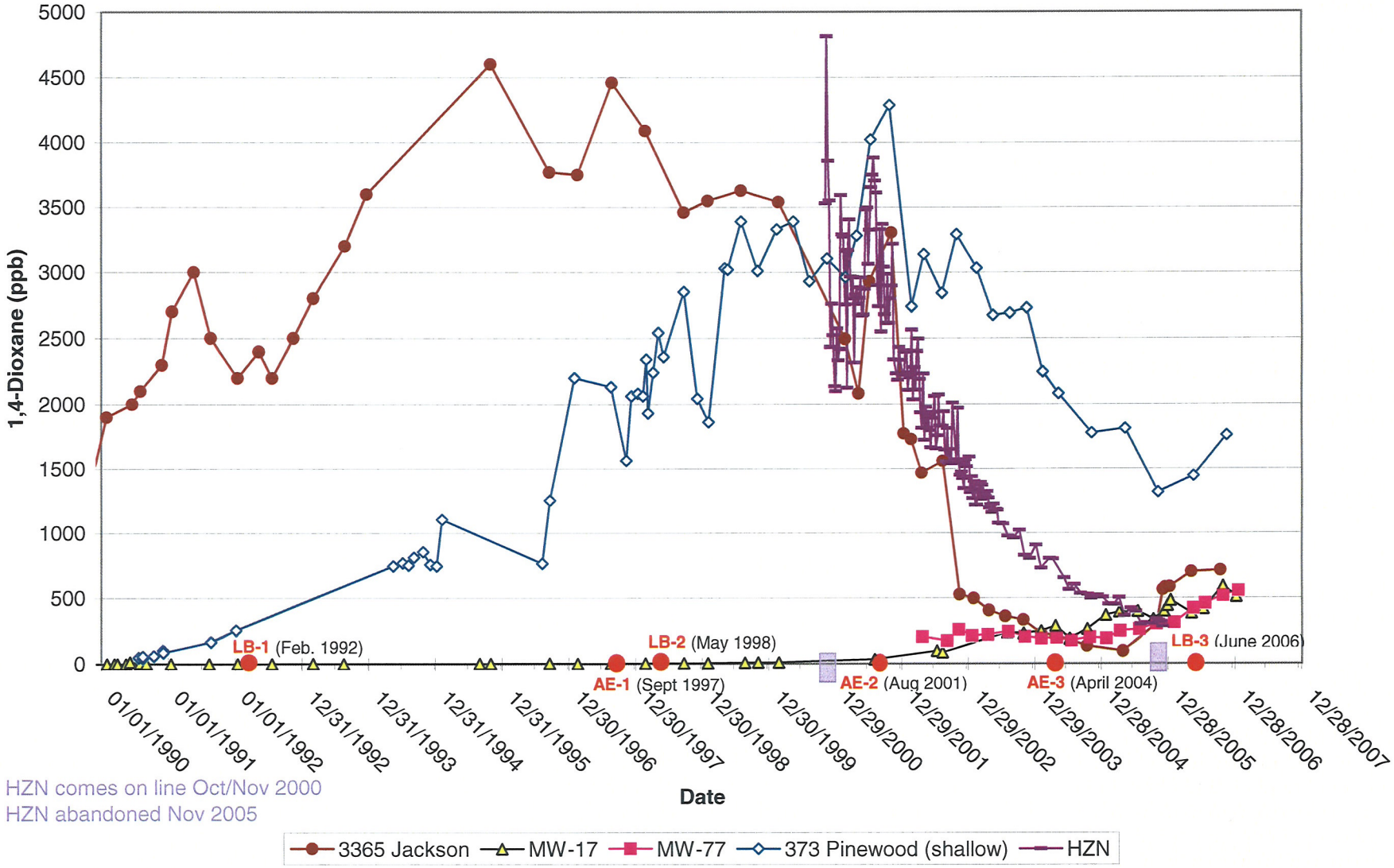

Unit D2 - Extraction Wells - 1,4-Dioxane Trends
1,4-dioxane (ppb)
1750
1500
1250
1000
750
500
250
0
6/1/1994
6/1/1995
5/31/1996
5/31/1997
5/31/1998
5/31/1999
5/30/2000
5/30/2001
5/30/2002
5/30/2003
5/29/2004
5/29/2005
5/29/2006
Date
LB-1
LB-2
LB-3
AE-2
AE-3
AE-1

EXHIBIT 5

Representative Wells Upgradient of LB Extraction Wells - 1,4-Dioxane Trends



HZN comes on line Oct/Nov 2000
HZN abandoned Nov 2005

EXHIBIT 6

Clarendon Wells - 1,4-Dioxane Trends