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Kent, OH 44240, U.S.A.
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Wellhead LEL records in Bainbridge residential water wells

Wellhead LEL records in Bainbridge residential water wells

All the wellhead records used in the following report were taken from the Ohio Department of natural Resources (ODNR) Division of Mineral Resources Management (DMRM) website

Wellhead LEL records in Bainbridge residential water wells

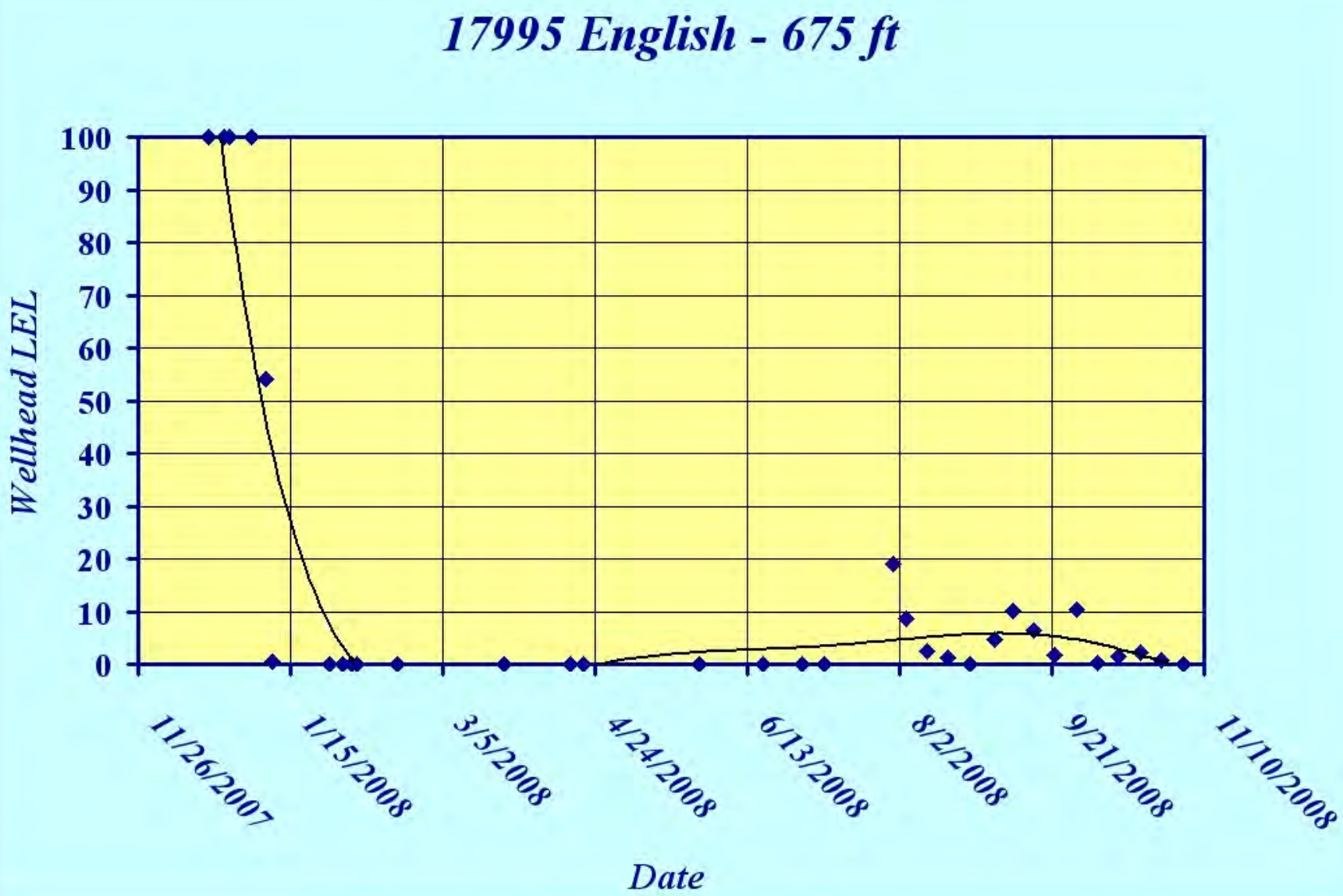
The records are arranged in groups indicating different time-pattern of the occurrence of gas in the wellheads of the residential water wells. The trend-line superimposed on each record is a sixth-order polynomial. Such high-order polynomial minimizes the influence of outlier points (possible results of imprecise or erroneous measurements) and amplifies the effect of points clustering in tight groups. This is important, as the records contain LEL monitoring conducted on different dates by different persons with different instruments.

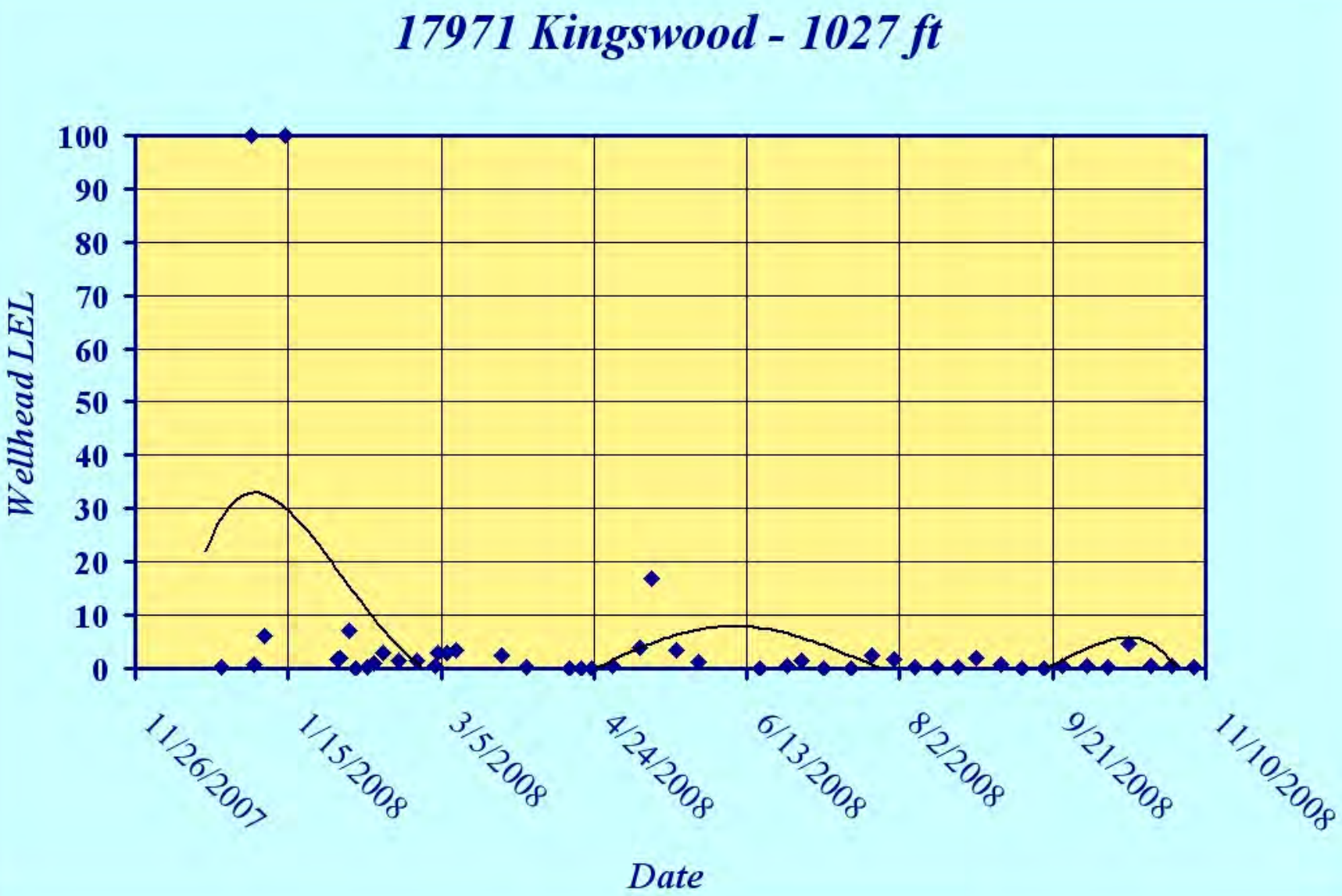
Wellhead LEL records in Bainbridge residential water wells

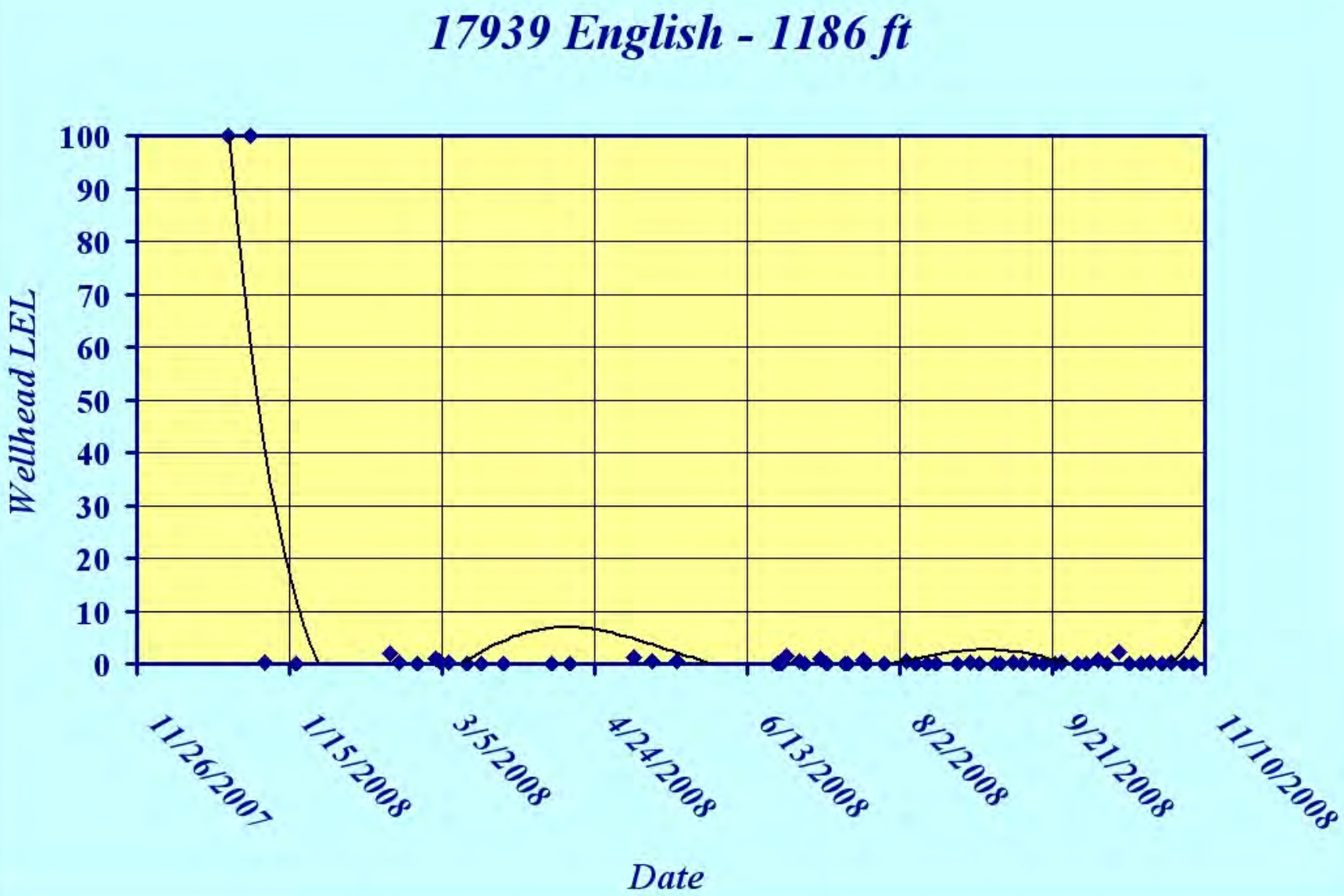
The following records clearly indicate that the occurrence of gas in wellhead of the residential water wells is not a function of the distance from the English1 gas well (the distance in feet is indicated at the heading of each time-record). Such random occurrence of high LEL readings in the residential water well wellheads can occur only as a result of gas being channeled through fractures developed in the bedrock by the overpressuring of the annulus of English 1 gas well. While some of the records indicate direct connection to the English 1 annulus, other records points to direct communication between the shallow aquifer and the gas producing formation.

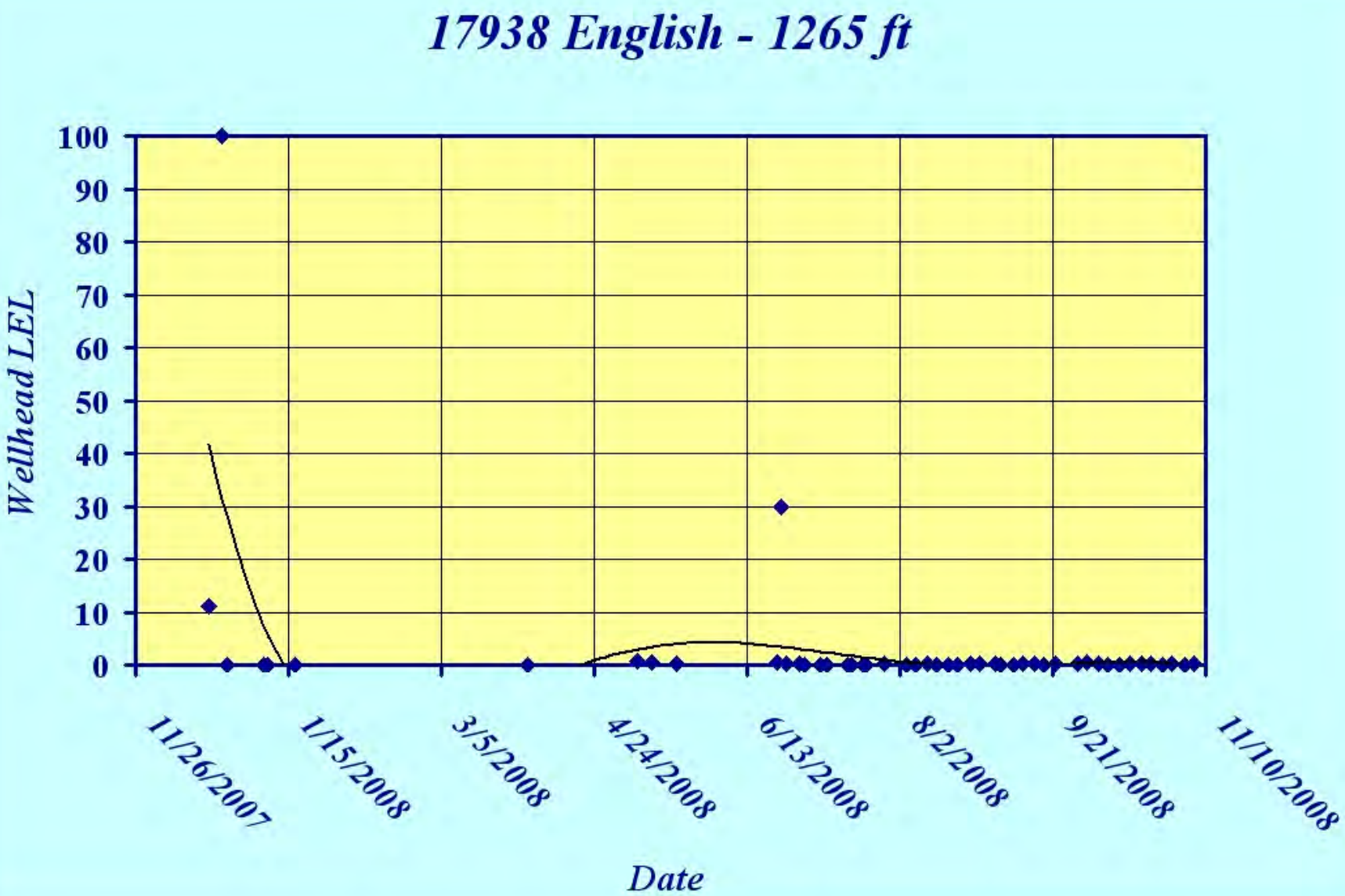
Wellhead LEL records in Bainbridge residential water wells

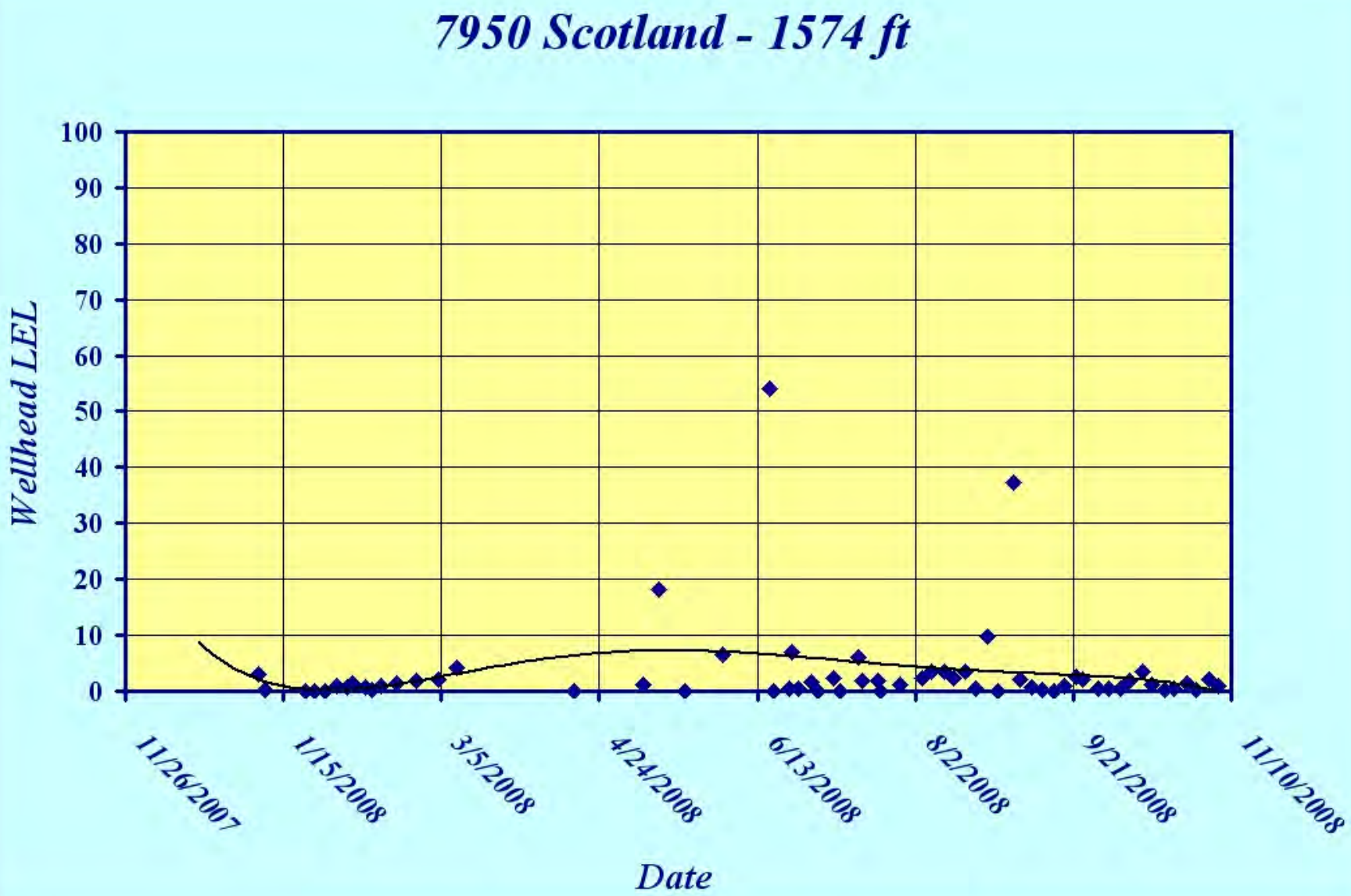
The following are wells that were affected by the initial penetration of the gas, but improved with the "squeeze job" at English 1 gas well. These are wells located at fractures fed with gas directly from the English 1 annulus.

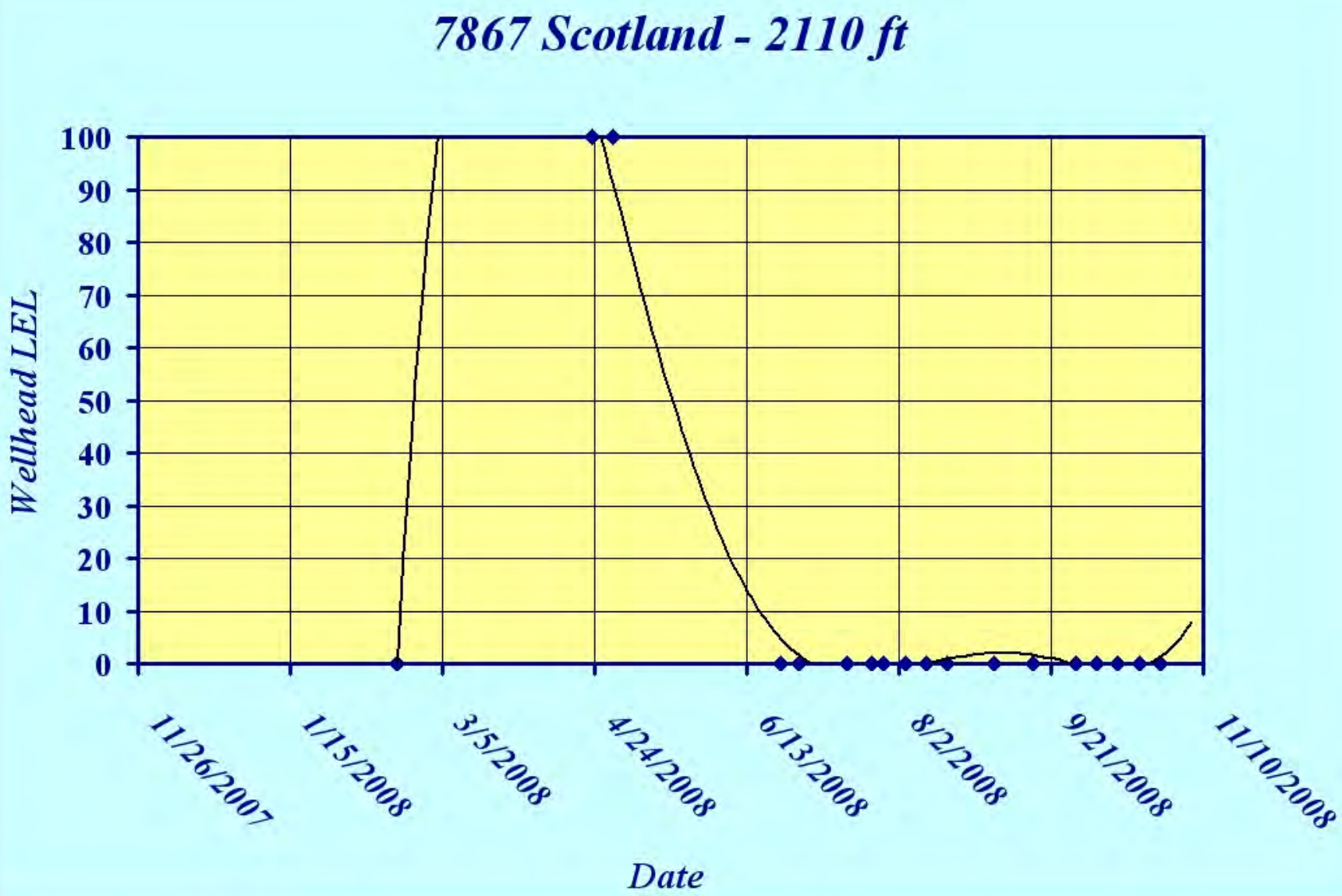

17995 English - 675 ft
Wellhead LEL
100
90
80
70
60
50
40
30
20
10
0
11/26/2007
1/15/2008
3/5/2008
4/24/2008
6/13/2008
8/2/2008
9/21/2008
11/10/2008
Date


17971 Kingswood - 1027 ft
Wellhead LEL
100
90
80
70
60
50
40
30
20
10
0
11/26/2007
1/15/2008
3/5/2008
4/24/2008
6/13/2008
8/2/2008
9/21/2008
11/10/2008
Date


17939 English - 1186 ft
Wellhead LEL
100
90
80
70
60
50
40
30
20
10
0
11/26/2007
1/15/2008
3/5/2008
4/24/2008
6/13/2008
8/2/2008
9/21/2008
11/10/2008
Date

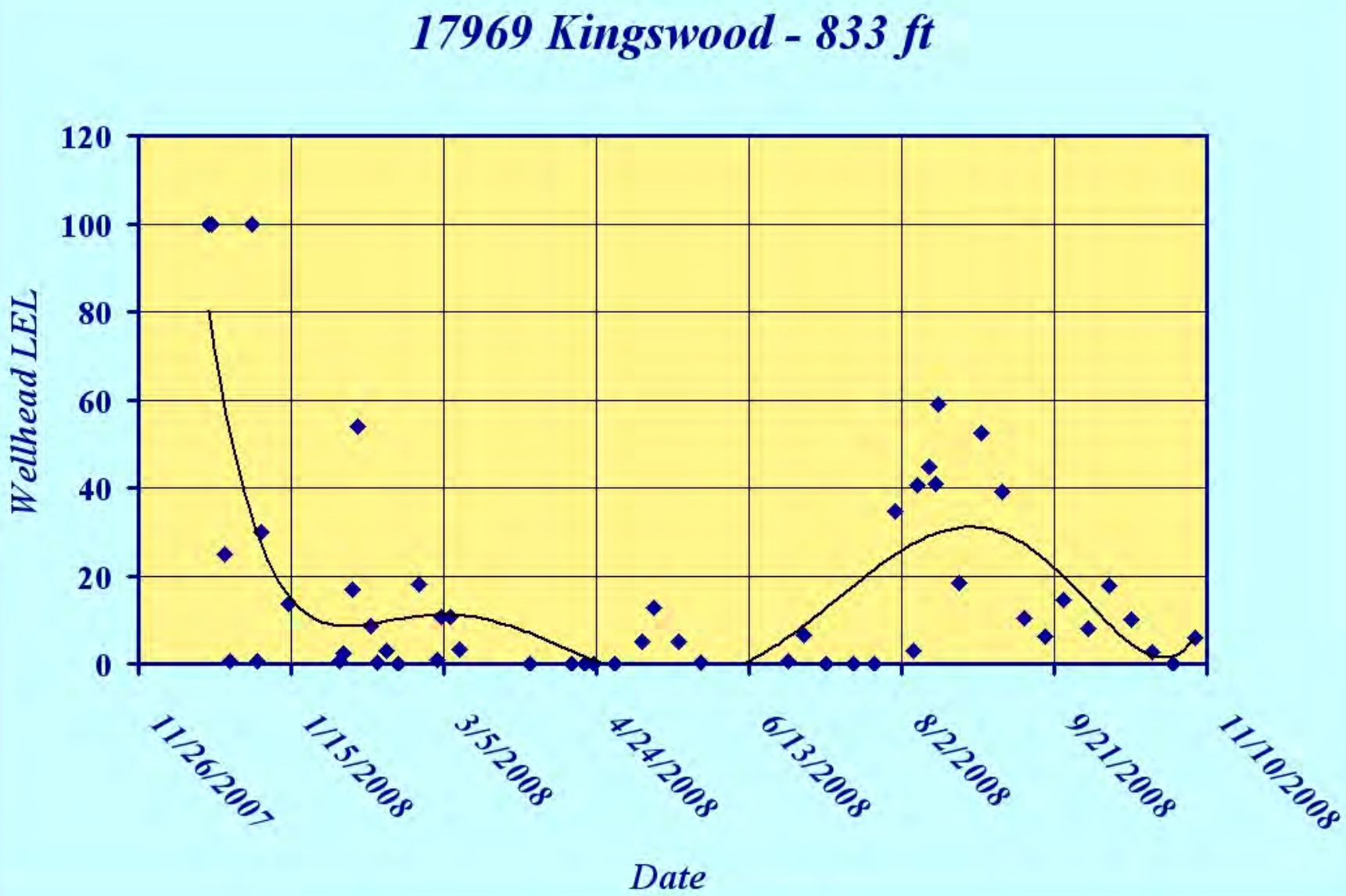

17938 English - 1265 ft
Wellhead LEL
100
90
80
70
60
50
40
30
20
10
0
11/26/2007
1/15/2008
3/5/2008
4/24/2008
6/13/2008
8/2/2008
9/21/2008
11/10/2008
Date

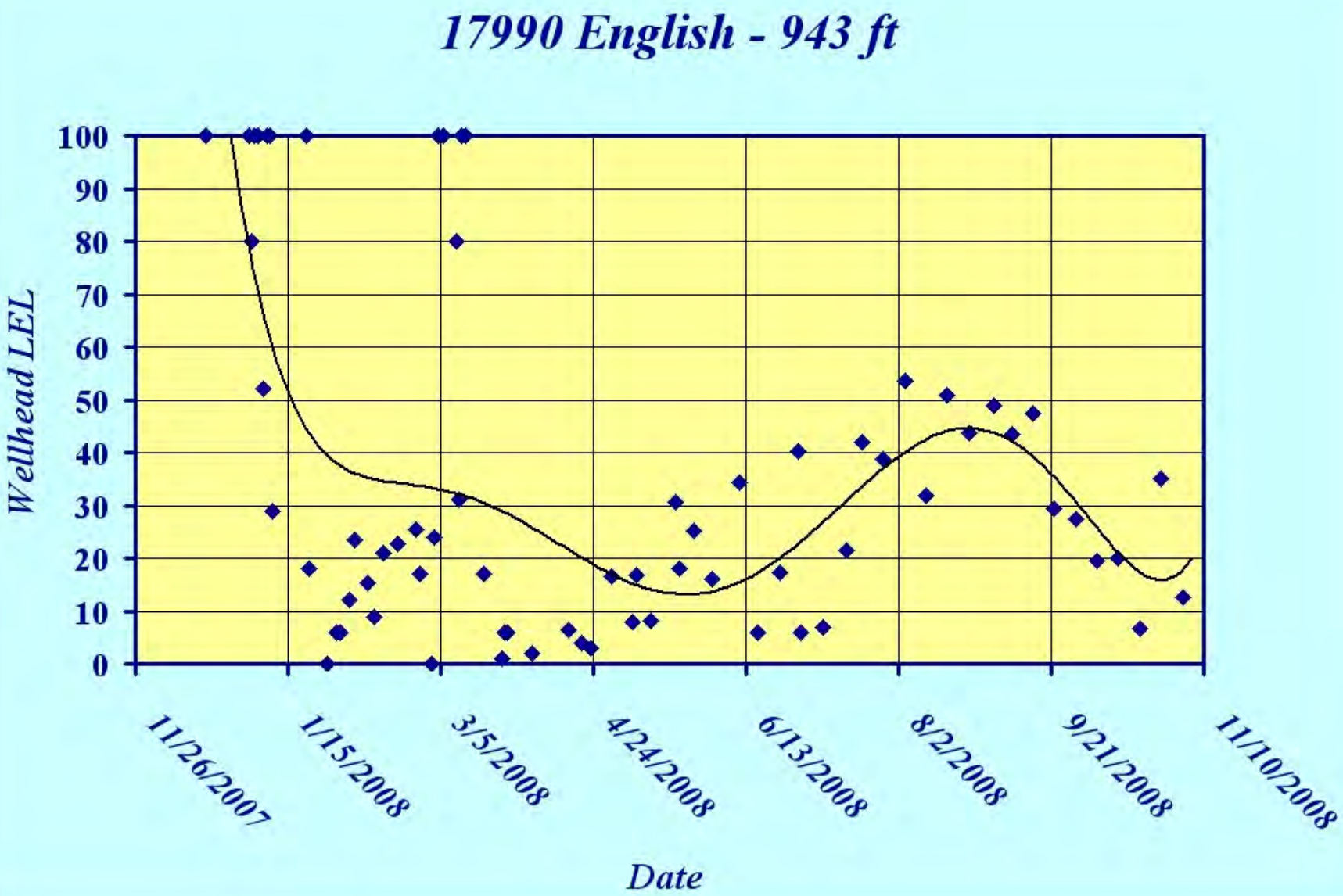

7950 Scotland - 1574 ft
Wellhead LEL
100
90
80
70
60
50
40
30
20
10
0
11/26/2007
1/15/2008
3/5/2008
4/24/2008
6/13/2008
8/2/2008
9/21/2008
11/10/2008
Date

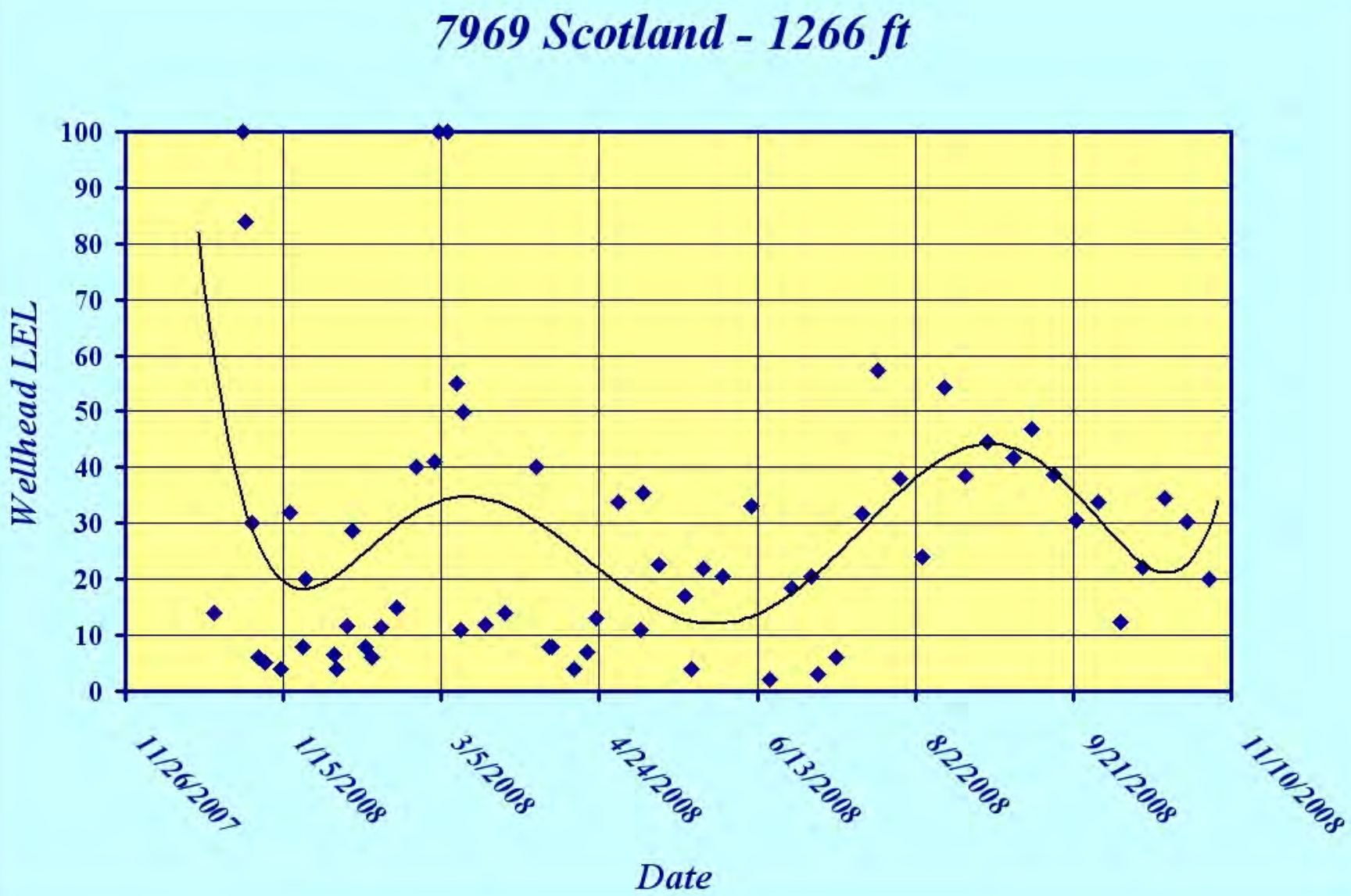

7867 Scotland - 2110 ft
Wellhead LEL
100
90
80
70
60
50
40
30
20
10
0
11/26/2007
1/15/2008
3/5/2008
4/24/2008
6/13/2008
8/2/2008
9/21/2008
11/10/2008
Date

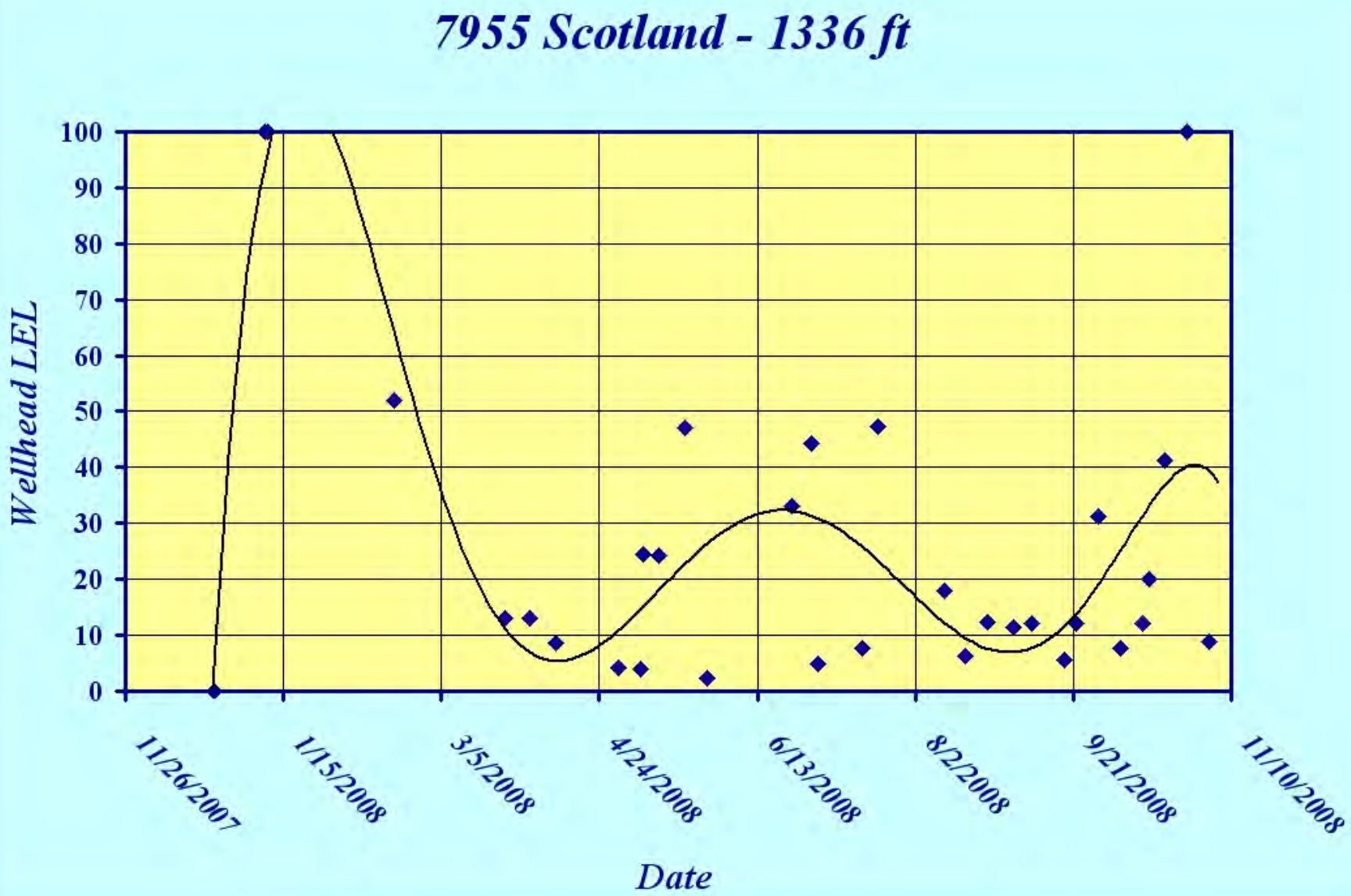
Wellhead LEL records in Bainbridge residential water wells

The following are wells that were affected by the initial penetration of the gas, and improved with the "squeeze job" at English 1 gas well, alas insignificantly. These are wells located at fractures developed as a result of overpressuring of the gas-producing formation during the English 1 annulus overpressuring. They currently continue to be affected by moderate gas content (15%<LEL<75%) from fractures that are not physically connected to English 1 gas well.


17969 Kingswood - 833 ft
Wellhead LEL
120
100
80
60
40
20
0
11/26/2007
1/15/2008
3/5/2008
4/24/2008
6/13/2008
8/2/2008
9/21/2008
11/10/2008
Date

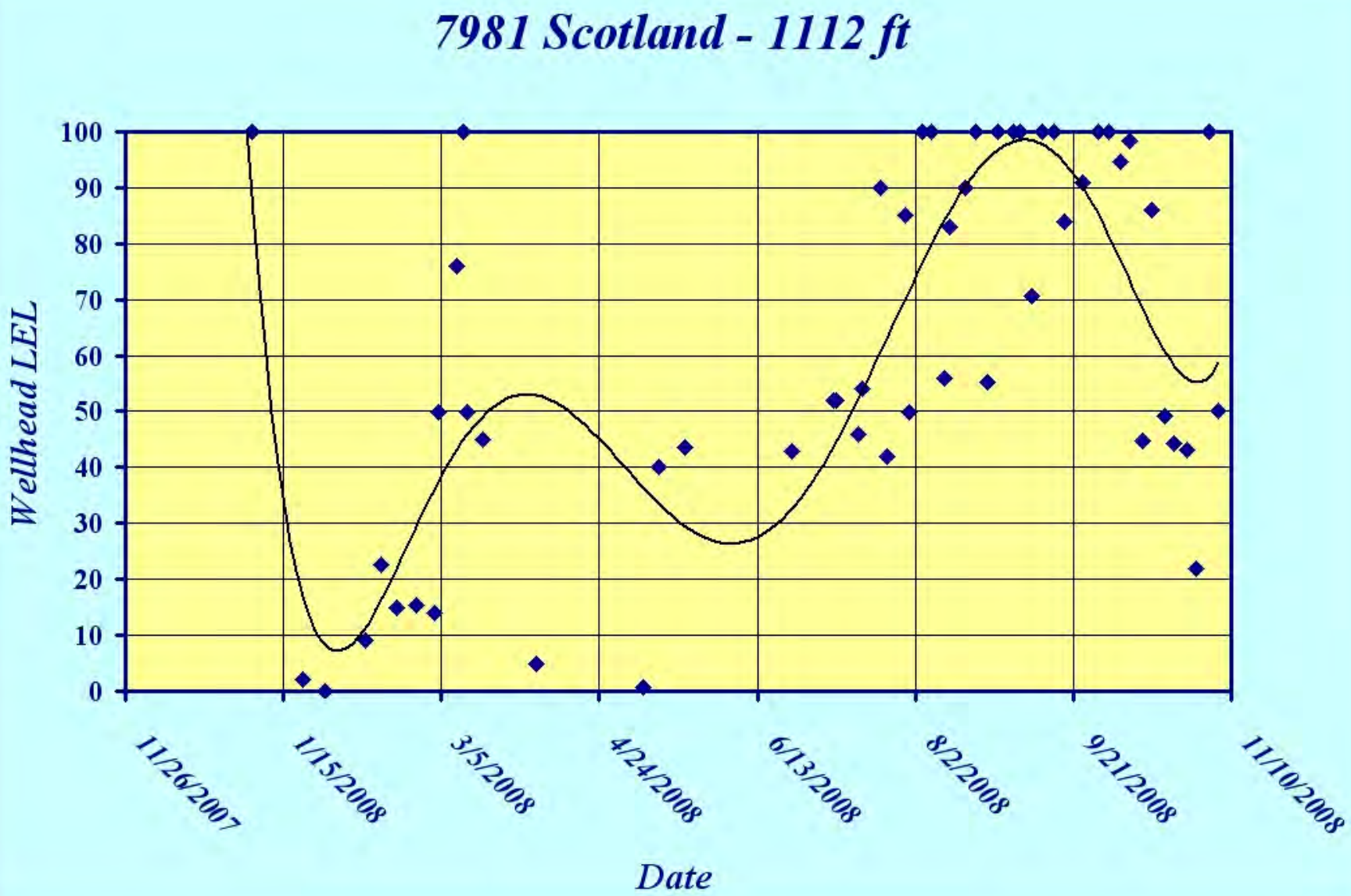

17990 English - 943 ft
Wellhead LEL
100
90
80
70
60
50
40
30
20
10
0
11/26/2007
1/15/2008
3/5/2008
4/24/2008
6/13/2008
8/2/2008
9/21/2008
11/10/2008
Date

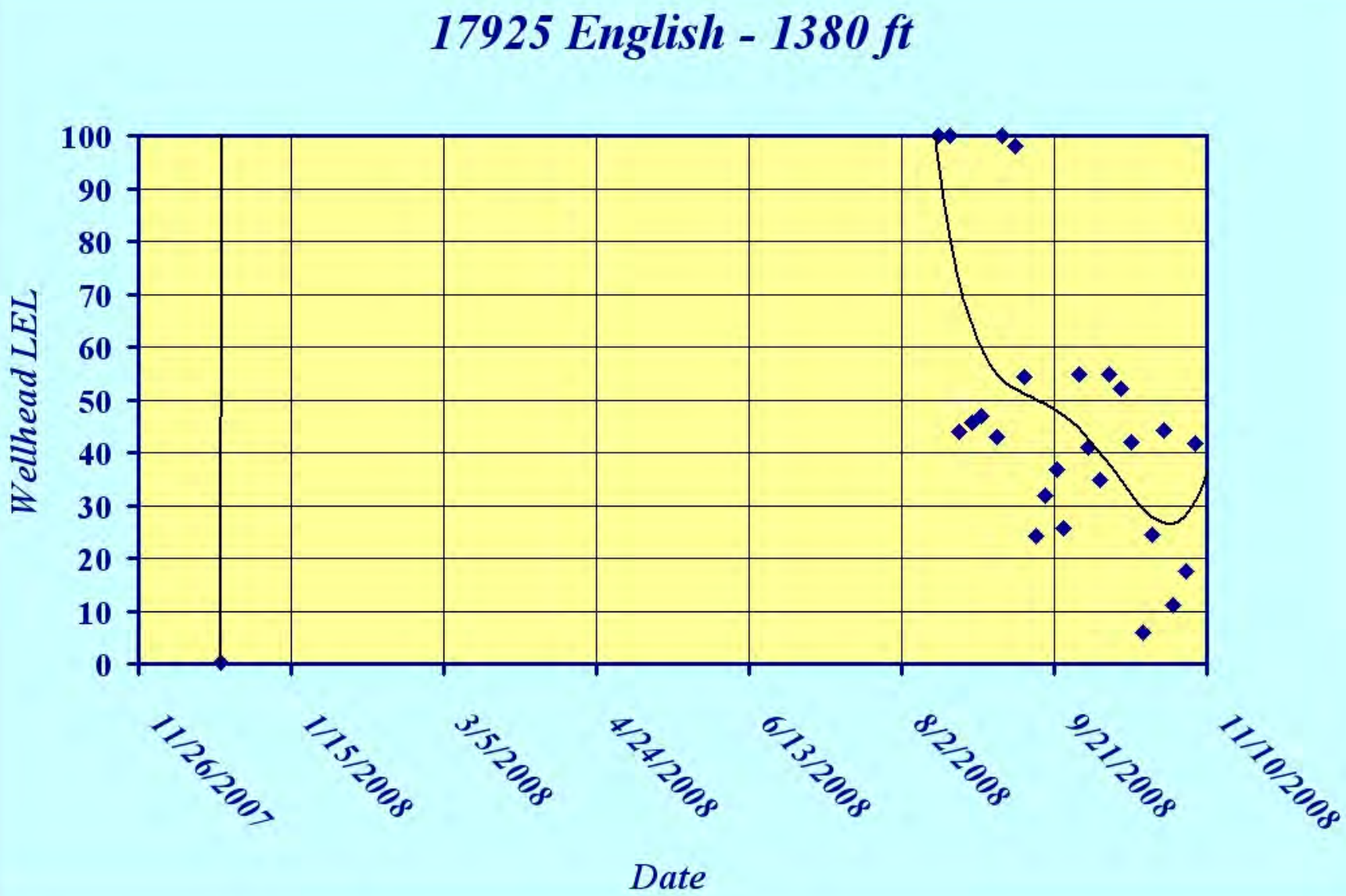

7969 Scotland - 1266 ft
Wellhead LEL
100
90
80
70
60
50
40
30
20
10
0
11/26/2007
1/15/2008
3/5/2008
4/24/2008
6/13/2008
8/2/2008
9/21/2008
11/10/2008
Date

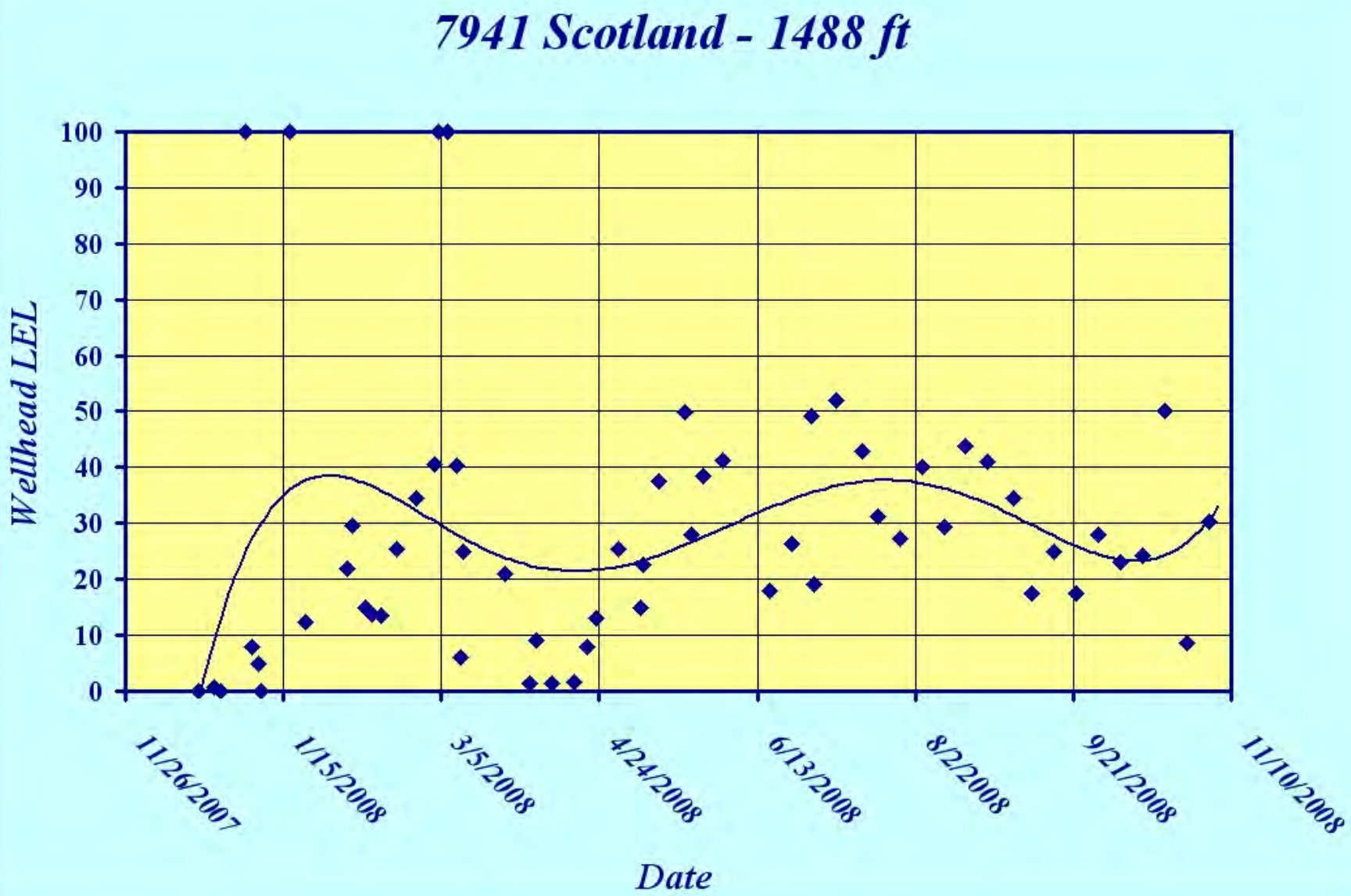

7955 Scotland - 1336 ft
Wellhead LEL
100
90
80
70
60
50
40
30
20
10
0
11/26/2007
1/15/2008
3/5/2008
4/24/2008
6/13/2008
8/2/2008
9/21/2008
11/10/2008
Date

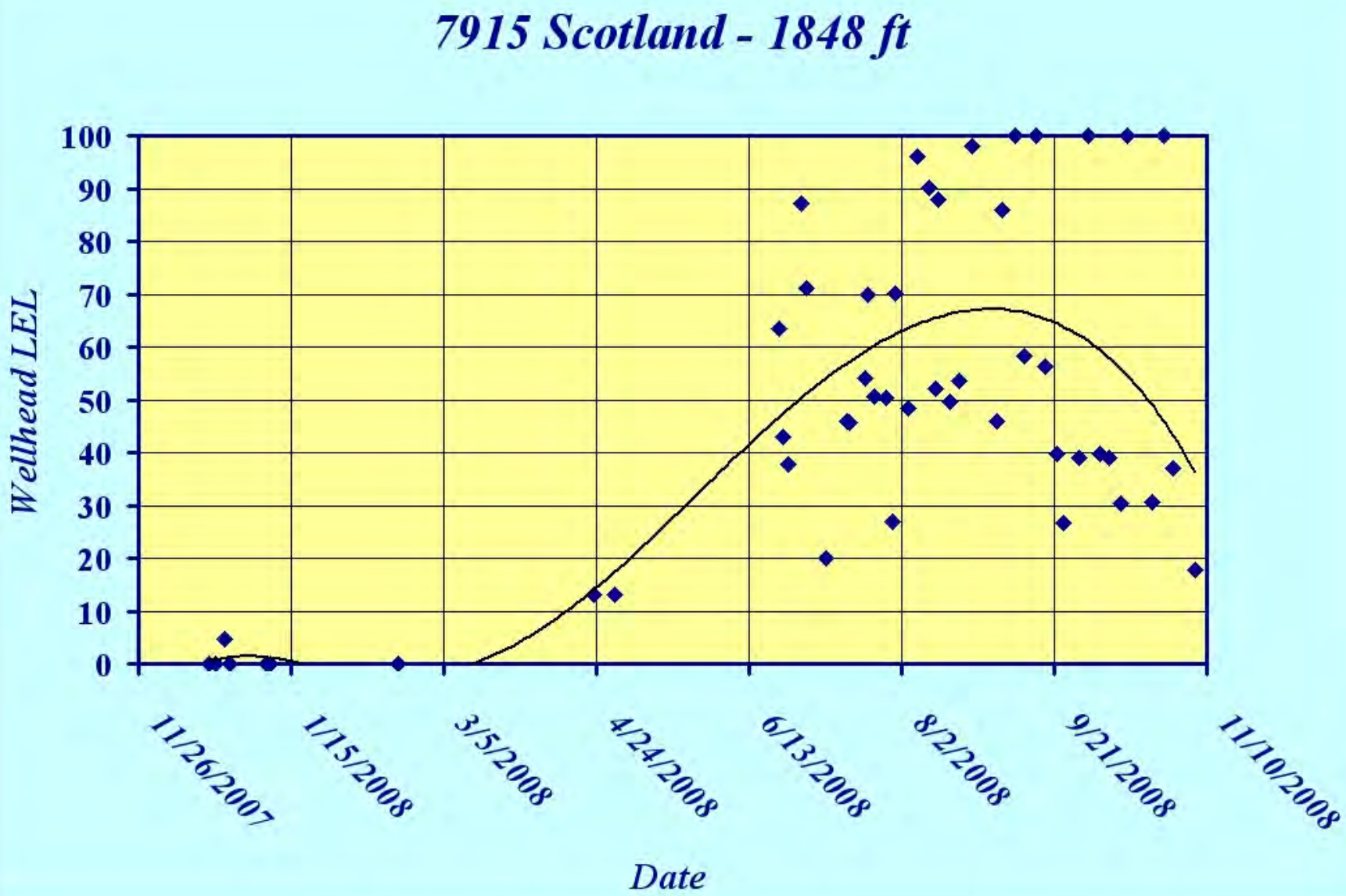
Wellhead LEL records in Bainbridge residential water wells

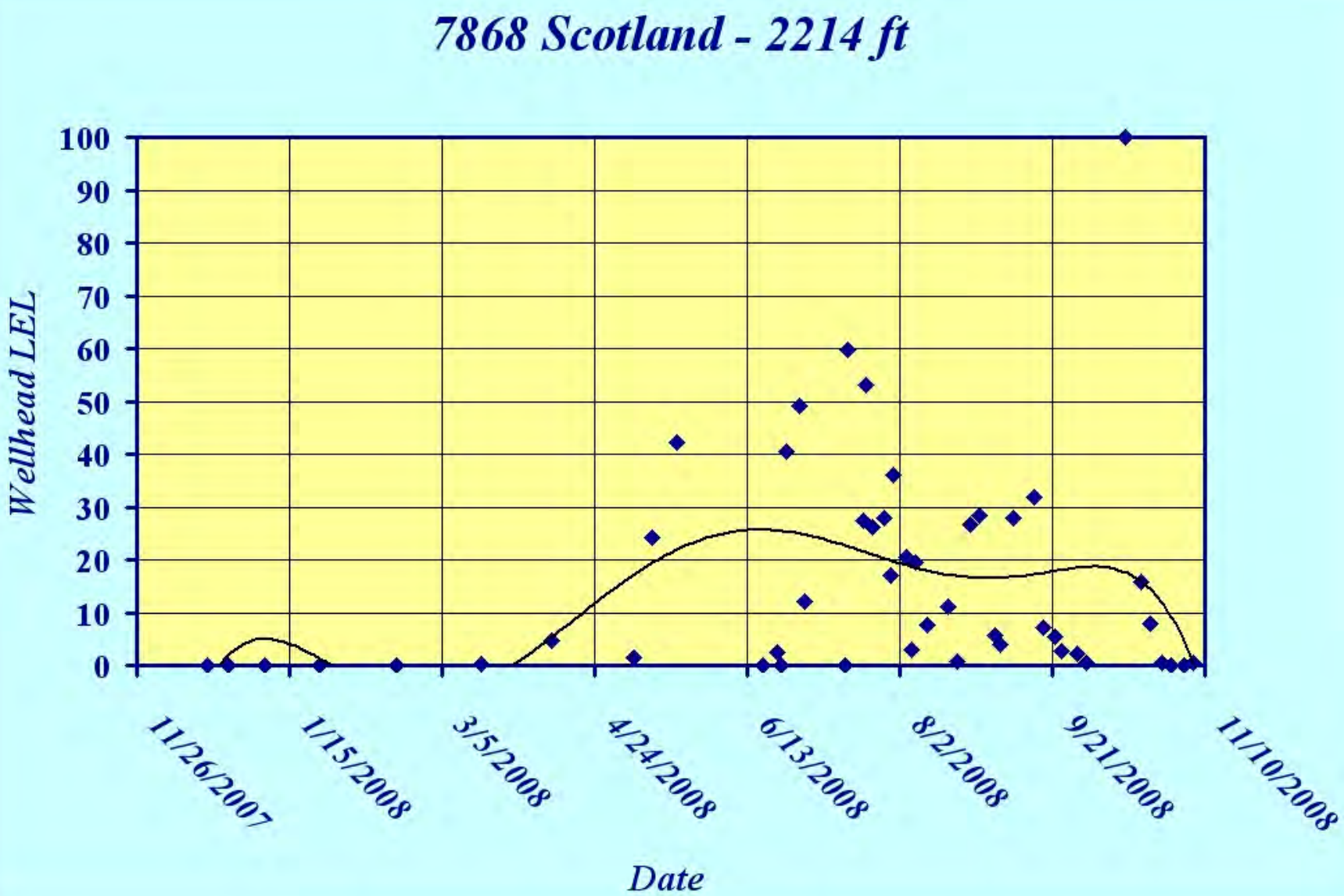
The following are wells that were affected by the initial penetration of the gas, but did not improve with the "squeeze job" at English 1 gas well. These are wells located at fractures developed as a result of deep fracturing of the bedrock during the English 1 annulus overpressuring, down to gas-producing formation. They currently continue to be affected by high gas content (LEL>75%) from fractures that are not physically connected to English 1 gas well.

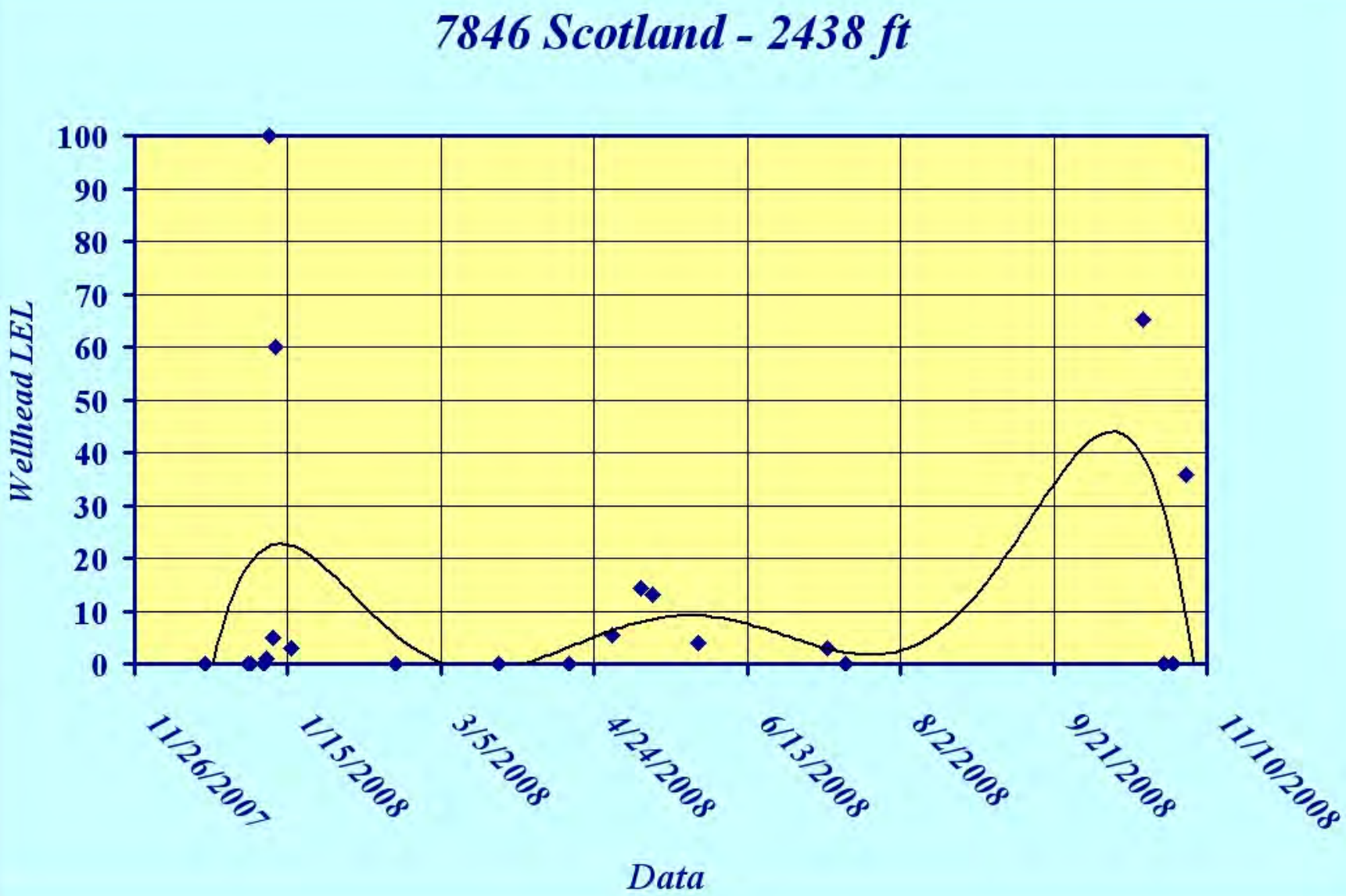

7981 Scotland - 1112 ft
Wellhead LEL
100
90
80
70
60
50
40
30
20
10
0
11/26/2007
1/15/2008
3/5/2008
4/24/2008
6/13/2008
8/2/2008
9/21/2008
11/10/2008
Date


17925 English - 1380 ft
Wellhead LEL
100
90
80
70
60
50
40
30
20
10
0
11/26/2007
1/15/2008
3/5/2008
4/24/2008
6/13/2008
8/2/2008
9/21/2008
11/10/2008
Date


7941 Scotland - 1488 ft
Wellhead LEL
100
90
80
70
60
50
40
30
20
10
0
11/26/2007
1/15/2008
3/5/2008
4/24/2008
6/13/2008
8/2/2008
9/21/2008
11/10/2008
Date


7915 Scotland - 1848 ft
Wellhead LEL
100
90
80
70
60
50
40
30
20
10
0
11/26/2007
1/15/2008
3/5/2008
4/24/2008
6/13/2008
8/2/2008
9/21/2008
11/10/2008
Date


7868 Scotland - 2214 ft
Wellhead LEL
100
90
80
70
60
50
40
30
20
10
0
11/26/2007
1/15/2008
3/5/2008
4/24/2008
6/13/2008
8/2/2008
9/21/2008
11/10/2008
Date


7846 Scotland - 2438 ft
Wellhead LEL
100
90
80
70
60
50
40
30
20
10
0
11/26/2007
1/15/2008
3/5/2008
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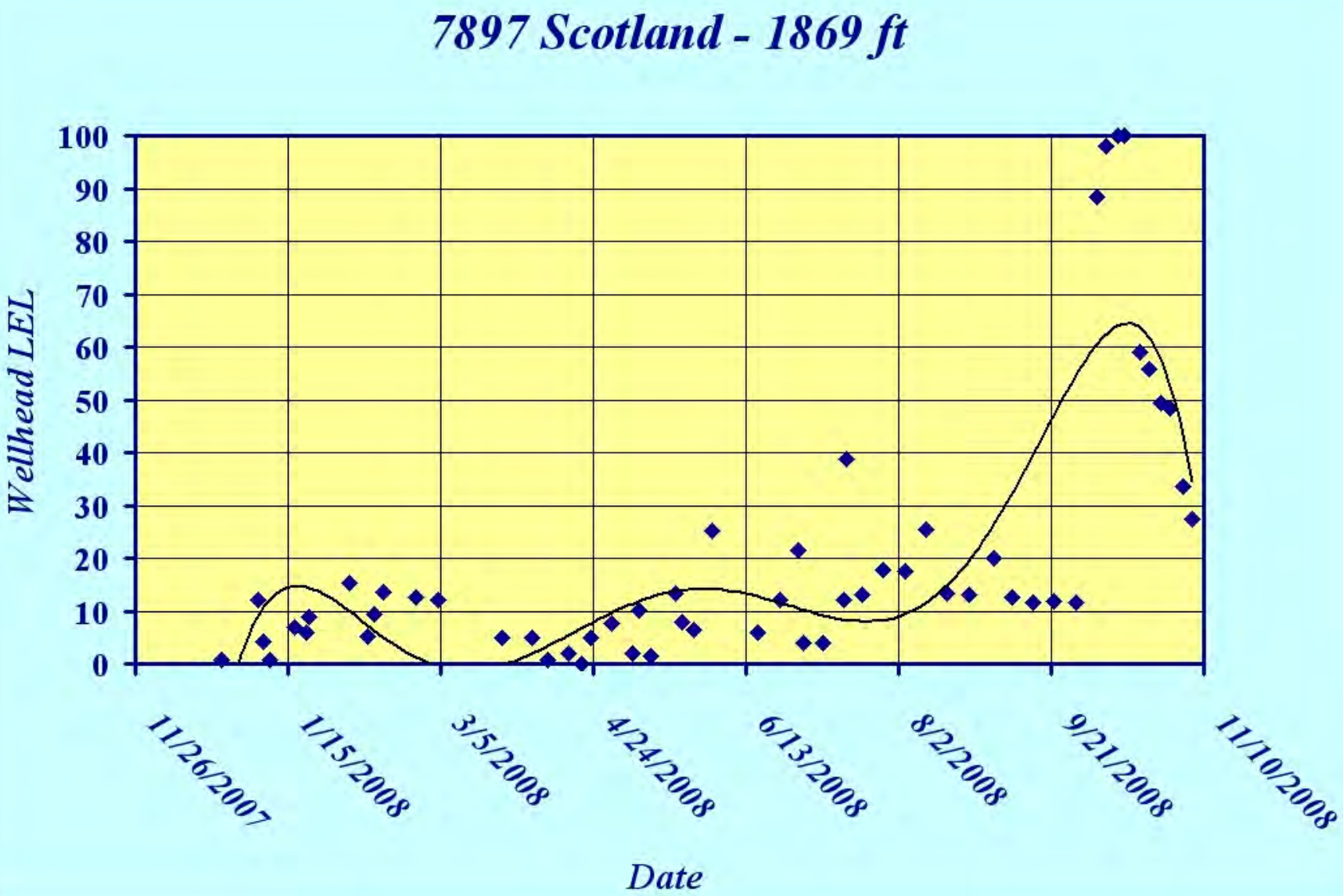
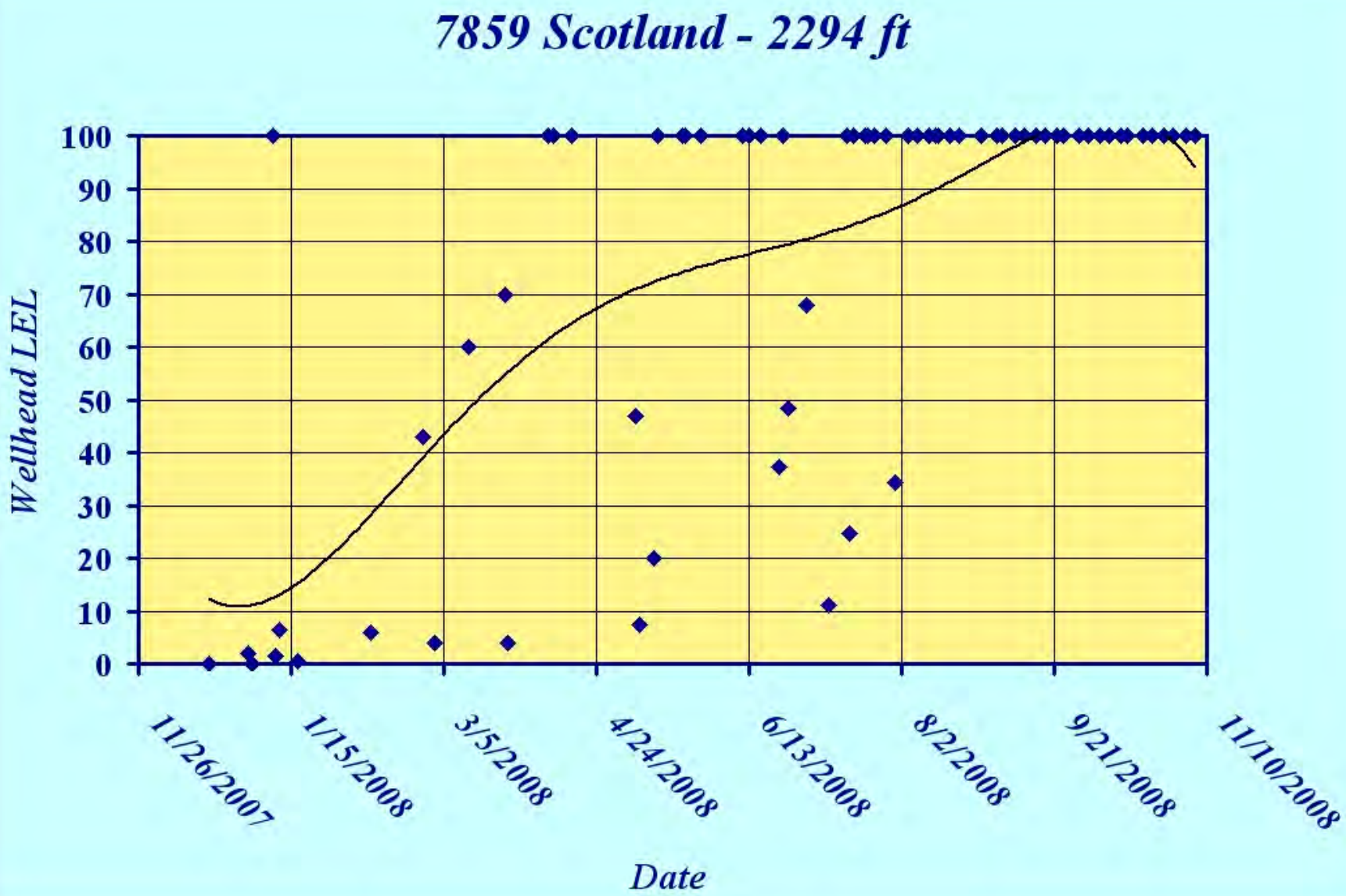
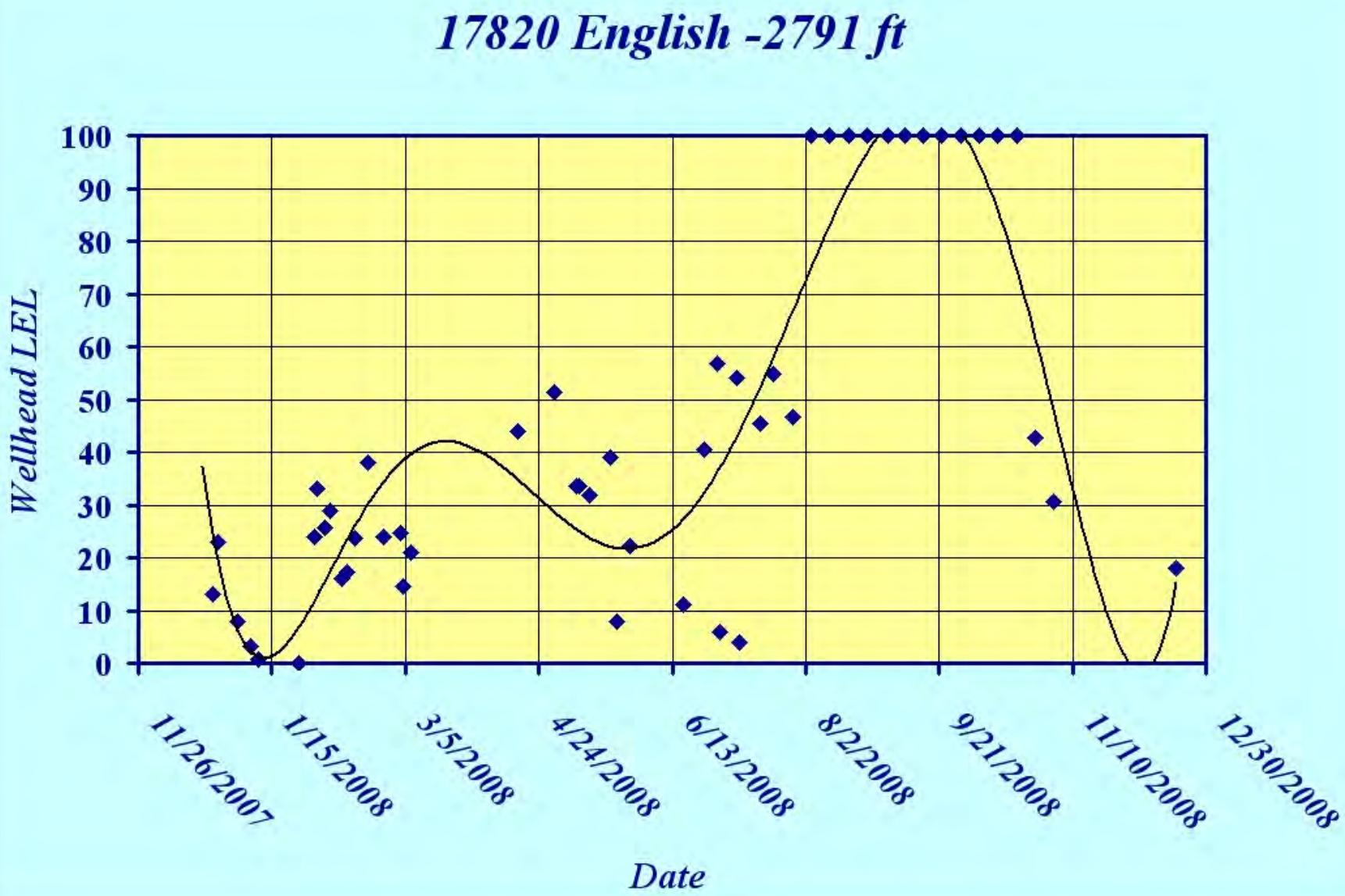
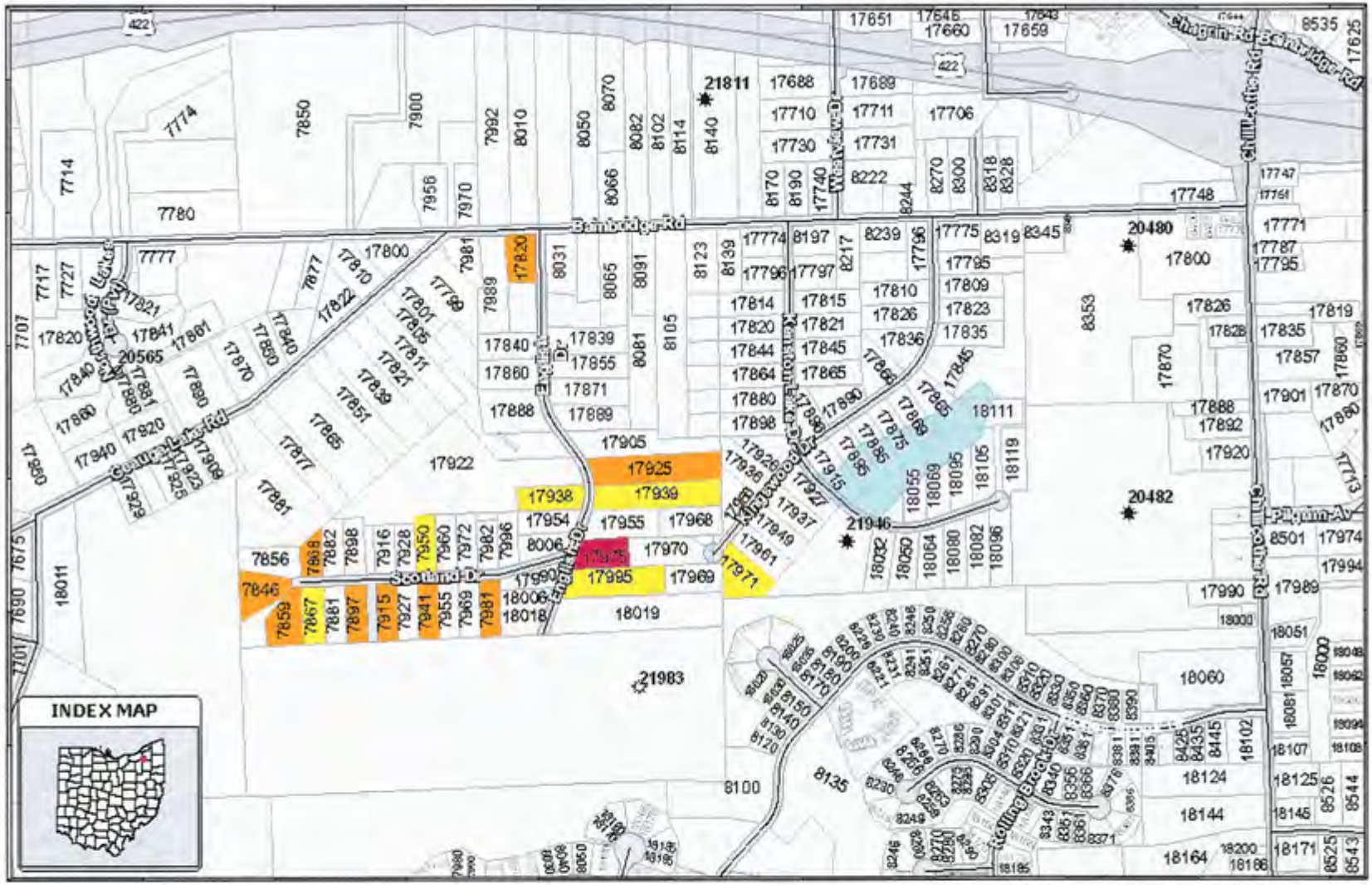
6/13/2008
8/2/2008
9/21/2008
11/10/2008
Data


7897 Scotland - 1869 ft
Wellhead LEL
100
90
80
70
60
50
40
30
20
10
0
11/26/2007
1/15/2008
3/5/2008
4/24/2008
6/13/2008
8/2/2008
9/21/2008
11/10/2008
Date


7859 Scotland - 2294 ft
Wellhead LEL
100
90
80
70
60
50
40
30
20
10
0
11/26/2007
1/15/2008
3/5/2008
4/24/2008
6/13/2008
8/2/2008
9/21/2008
11/10/2008
Date


17820 English -2791 ft
Wellhead LEL
100
90
80
70
60
50
40
30
20
10
0
11/26/2007
1/15/2008
3/5/2008
4/24/2008
6/13/2008
8/2/2008
9/21/2008
11/10/2008
12/30/2008
Date

The following map shows the distribution of the water wells of declining and persistently high wellhead LEL readings



Geauga County
Bainbridge Township

Well Symbols

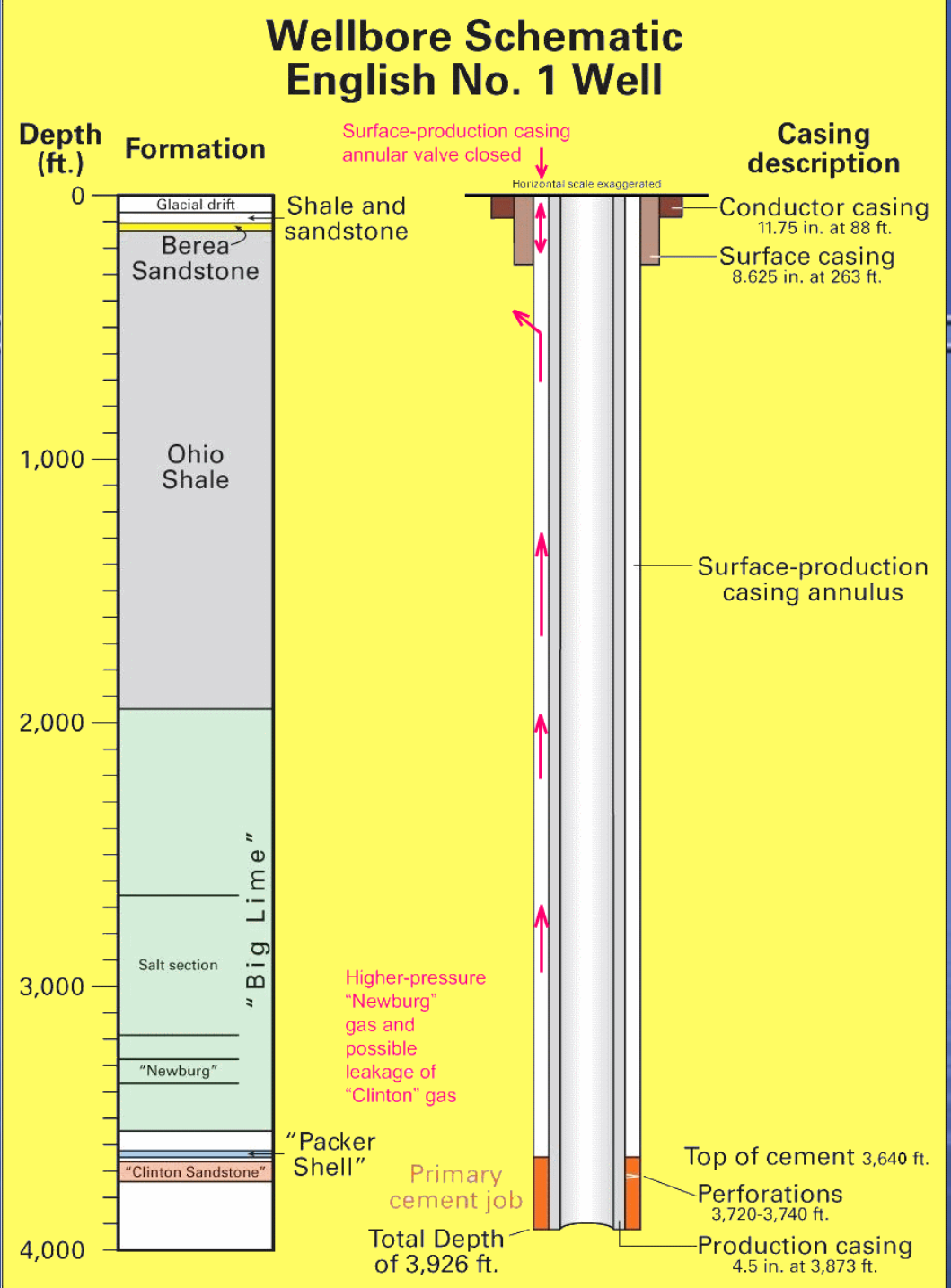
- Expired Permit
- Gas
- Oil and Gas
- Permitted Location

LEGEND

Water wells with declining wellhead LEL following the two "squeeze jobs" in English 1 gas well

Water wells with still high wellhead LEL readings one-year after the "squeeze job" in English 1 gas well.

0 250 500 1,000 1,500 Feet



ODNR DMRM interpretation

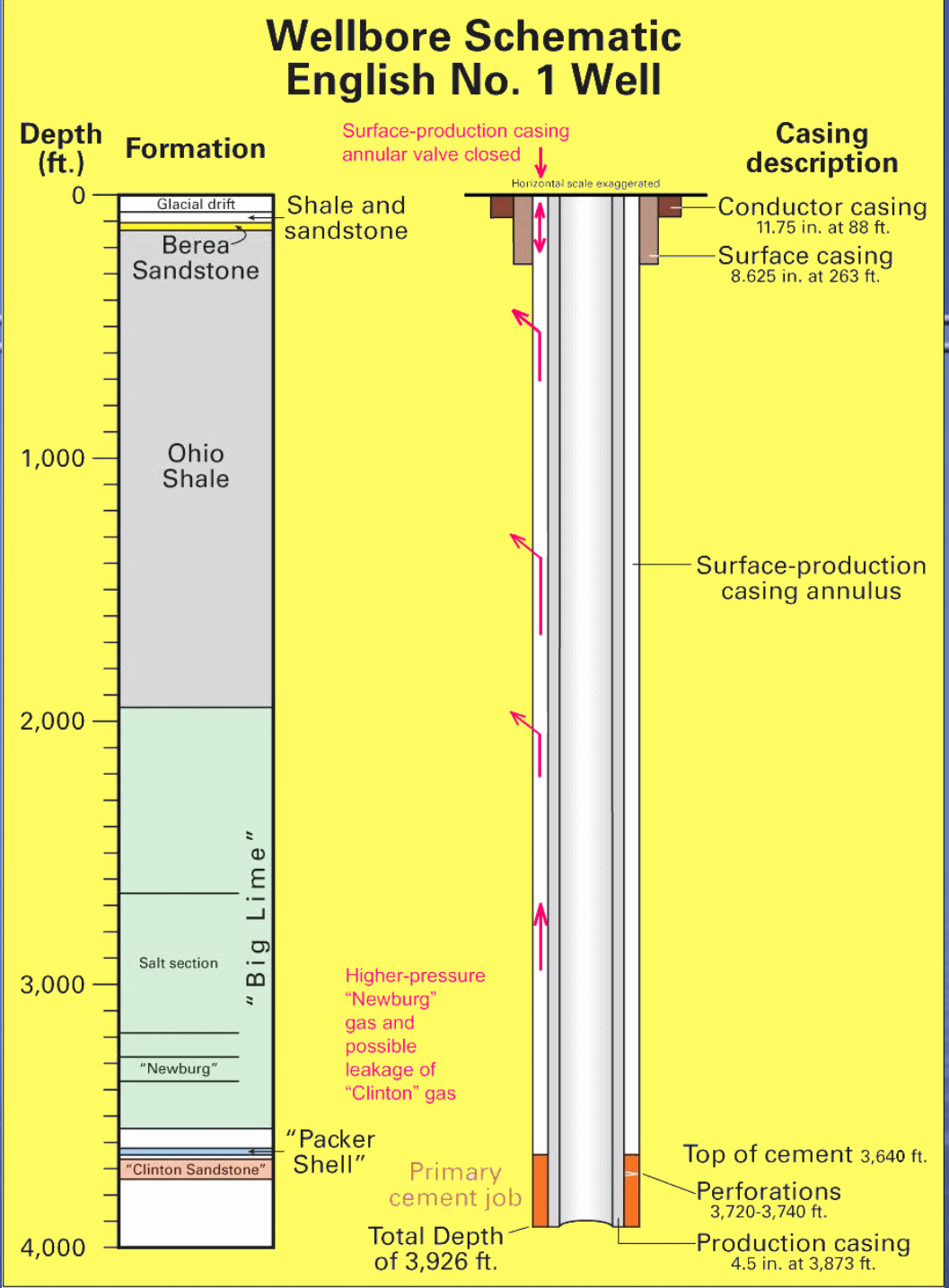
Gas in the overpressured annulus of the English 1 gas well generated fractures only in the shallow portion of Ohio Shale

Comments on ODNR DMRM interpretation

The gas pressures that reportedly developed (360-380 psi) within the sealed annulus of the English 1 gas well are high enough to generate fractures in the Ohio Shale as well as in large portions of the "Big Lime", thus providing far-reaching conduits for gas migration from the deep bedrock. In fact, ODNR DMRM report presence of odor of "sour gas" in a number of water wells or residences during the initial period after the English 1 mishap, which indicates gas characteristic for the Newburg Formation.

Comments on ODNR DMRM interpretation

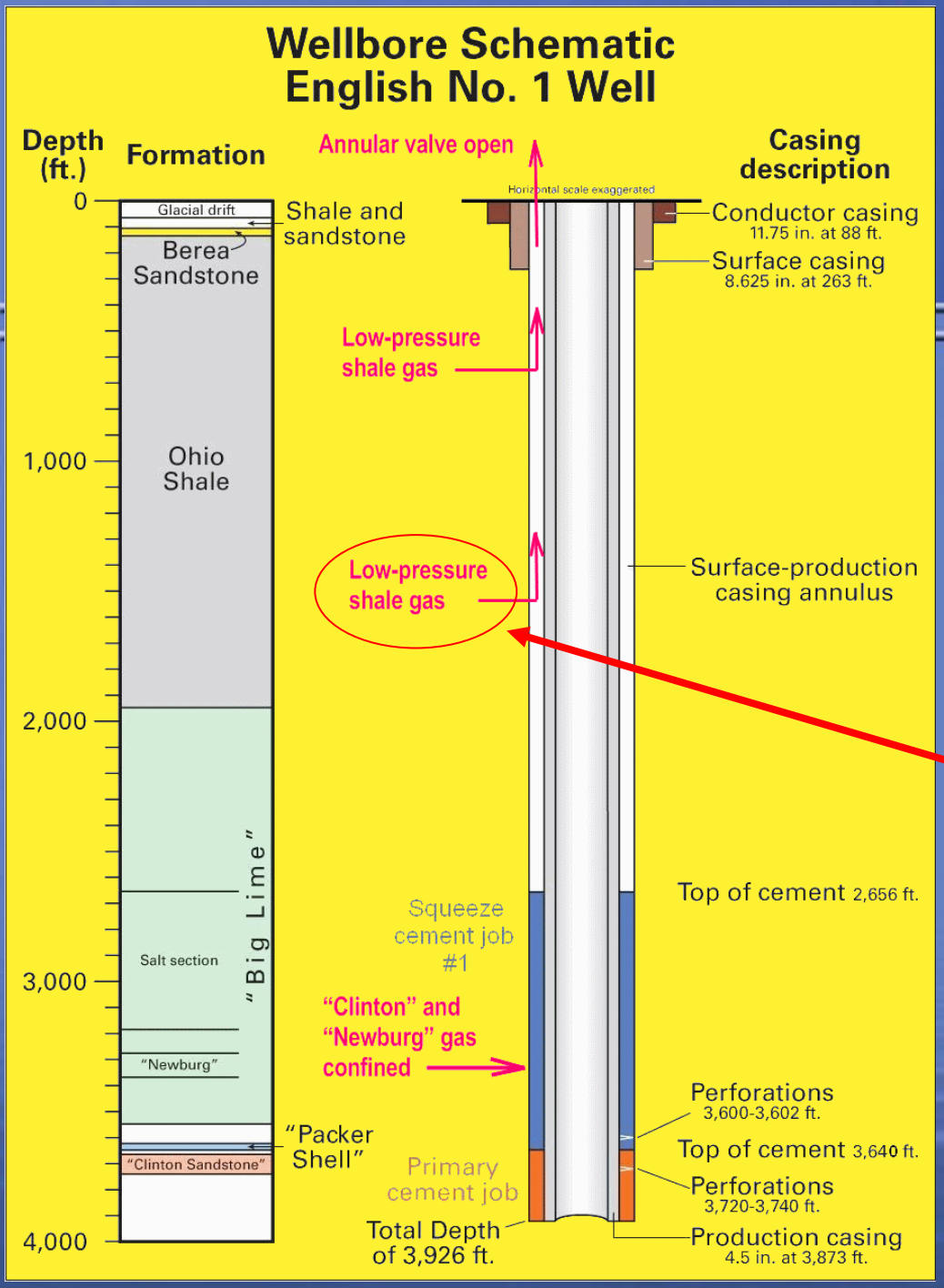
Ohio Shale (between Berea Sandstone) and the Big Lime is known to produce non-commercial low-pressure quantities of gas. However, development of fracture system in the formation would enhance gas production. Such deep- and far-reaching fractures can serve as a long-term source of gas penetrating into the shallow aquifer. Water wells penetrating the shallow aquifer (above the Berea Sandstone) were not known to produce gas prior to the English 1 mishap. The fact that these wells currently show high wellhead LELs indicates that that the English 1 mishap caused such deep- and far-reaching fractures into the Ohio Shale and the Berea Sandstone



Other probable interpretation

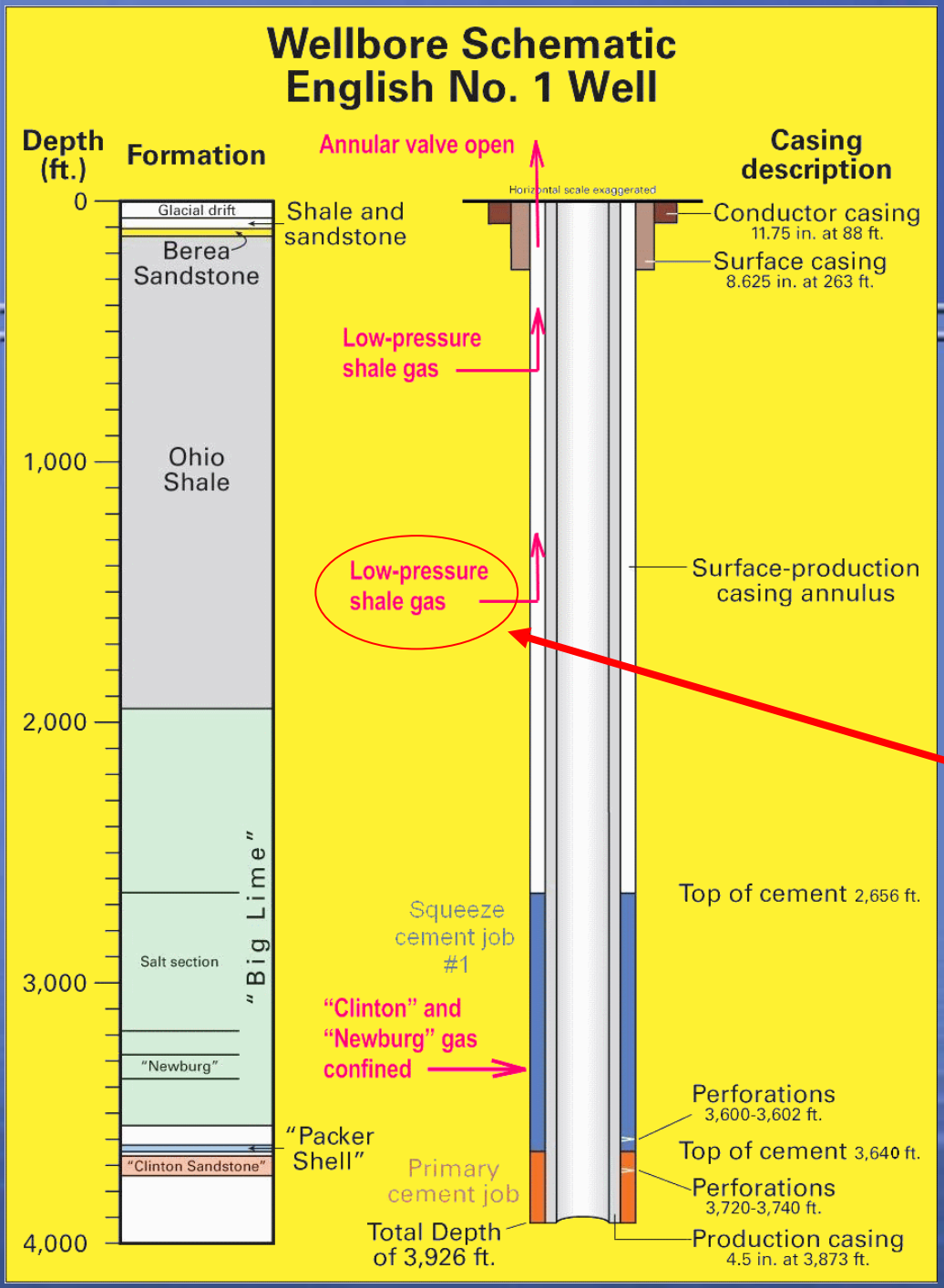
Gas in the overpressured annulus of the English 1 gas well generated fractures through the large, or entire section of Ohio Shale

Other probable interpretation



In fact, the ODNR DMRM implicitly agreed with this alternative interpretation, by drawing on their Figure 23 "low-pressure shale gas" entry into the well annulus from the lower section of Ohio Shale

Other probable interpretation



Therefore, if the "low-pressure" gas can enter into the well annulus from the lower section of Ohio Shale, certainly, when the annulus was under 360-380 psi it provided for enhancing the system of fractures in the same lower section of Ohio Shale.

Unexplained problem

Yet, inexplicably, during the second "squeeze job" the channelized cement was extended to the depth of ~550 feet, thus sealing the gas entry into the annulus from the lower portions of Ohio Shale, and thus potentially eliminating gas release from the deeper sections of this formation.

Water Well Log and Drilling Report

Ohio Department of Natural Resources
Division of Water
Phone: 614-265-6740 Fax: 614-265-6767

Well Log Number: 878058

View Image of Original Well Log

ORIGINAL OWNER AND LOCATION

Original Owner Name: *EDWARD POKORNY*
County: *GEAUGA* **Township:** *BAINBRIDGE* **Section Number:**
Address: *7950 SCOTLAND DR* **Lot Number:**
City: *Chagrin Falls* **State:** *OH* **Zip Code:** *44023-2214*
Location Number: **Location Map Year:** **Location Area:**
Latitude: *41.380036* **Longitude:** *-81.35801*

CONSTRUCTION DETAILS

Borehole Diameter: 1: *8 in.* **2:** **Borehole Depth: 1:** *150 ft.* **2:** **Depth to Bedrock:**
Casing Diameter: 1: *5 in.* **2:** **Casing Length: 1:** *152 ft.* **2:** **Casing Thickness: 1:** *0.21 in.* **2:**
Casing Height Above Ground: *2* **Aquifer Type:** *SANDST & SHALE*
Date of Completion: *7/9/1998* **Total Depth:** *195 ft.* **Well Use:** *DOMESTIC*
Driller's Name: *AYERS WELL DRILLING*

Screen Diameter: **Slot Size:** **Screen Length:**
Type: **Material:**
Set Between:

Gravel Pack Material/Size: **Vol/Wt Used:**
Method of Installation: **Placed:**

Grout Material/Size: **Vol/Wt Used:**
Method of Installation: **Placed**

WELL TEST DETAILS

Static Water Level: *99 ft.* **Test Rate:** *5 gpm* **Associated Reports**
Drawdown: *999 ft.* **Test Duration:** *NONE*

COMMENTS: *NONE*

WELL LOG

Formations	From	To
TOP SOIL	0	3
SOFT SANDSTONE	3	18
SHALE	18	148
BEREA SANDSTONE	148	178
SANDSTONE & SHALE	178	195

Water well drilled in 1998 through Berea Sandstone into Ohio Shale. No gas reported, clear water and negligible production rate, suggesting no fractures.

There are 26 well logs of water wells drilled prior to the English 1 mishap at Scotland Drive posted on the ODNR website.

None reported occurrence of gas.

Additional problem

- Many residential water wells began following the English 1 gas well incident to yield water with varying amounts of black suspended particulate matter. Chemical analysis of the particles conducted at the laboratories of geology departments of the Akron University and Kent State University indicate that the suspended particles consist of variety of heavy metals, including toxic ones, e.g. lead, copper, etc.
- The following map presents water wells yielding water with the black suspended particulate matter.
- Seemingly, the gas penetrating the shallow aquifer entrains the black particulate matter from the likely source in the Ohio Shale formation.

Geauga County
Bainbridge Township

Well Symbols

- Expired Permit
- Gas
- Oil and Gas
- Permitted Location

LEGEND

Residential water wells producing water with suspended black particulate matter

0 250 500 1,000 1,500 Feet

There are 26 well logs of water wells drilled prior to the English 1 mishap at Scotland Drive posted on the ODNR website.

None reported occurrence of gas or black suspended matter.

Wellhead LEL records in Bainbridge residential water wells

Conclusions

- The overpressuring of the English 1 annulus produced fractures throughout the bedrock of Ohio Shale and berea Sandstone.
- The Ohio Shale is known to contain low-pressure non-commercial quantities of natural gas.
- The bedrock fractures developed during overpressuring of the English 1 annulus spread laterally and downwards far away from English 1 gas well, and they continue to introduce gas to the shallow aquifer.

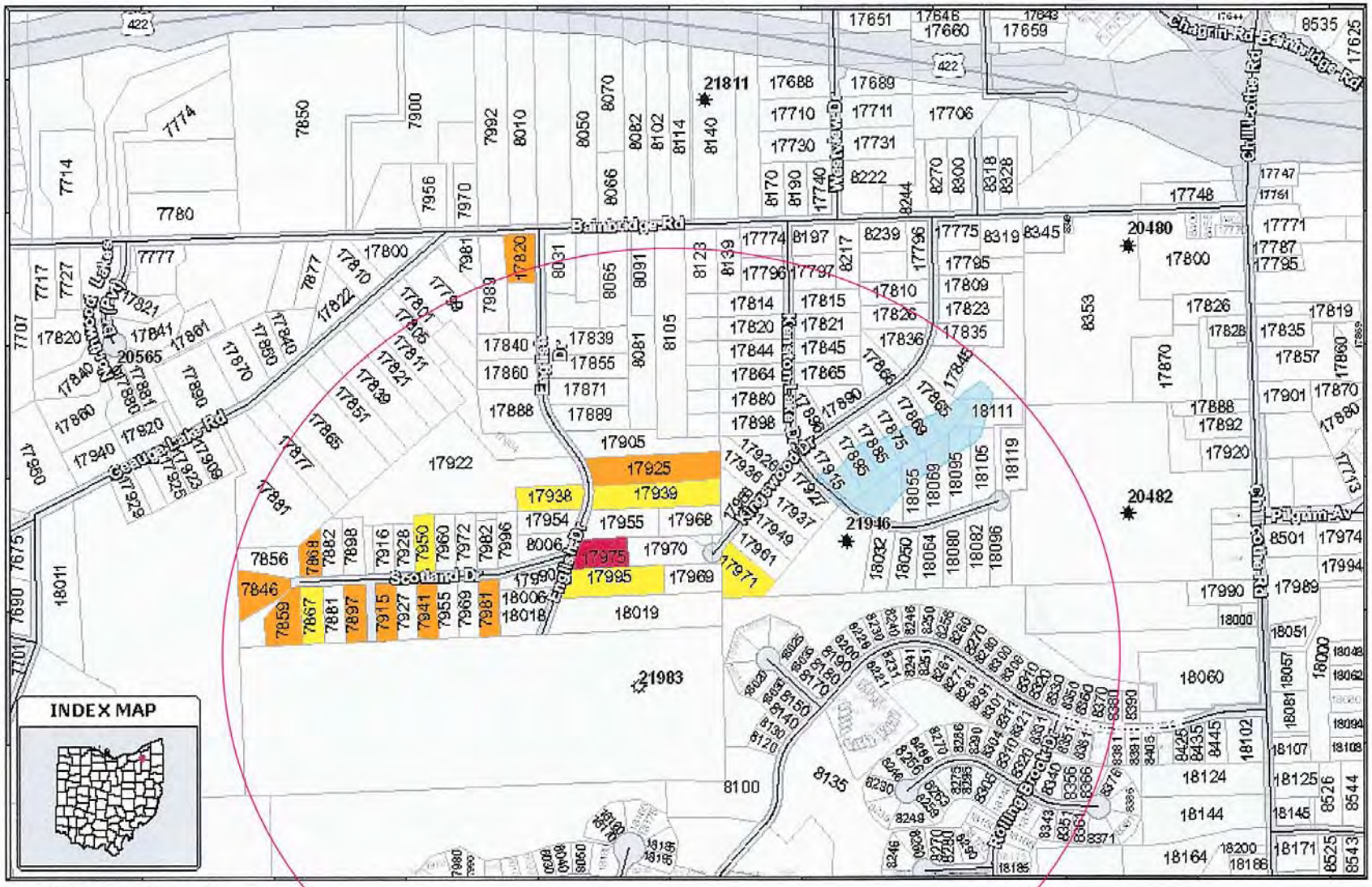
Wellhead LEL records in Bainbridge residential water wells

Conclusions (cont'd)

- The "squeeze job" in English 1 gas well has eliminated gas flow only through fractures directly connected to the English 1 annulus. It did not have any effect on the deeper, and farther away from English 1 bedrock fractures developed between the gas producing Ohio Shale and the shallow aquifer.
- Gas will continue to flow from the bedrock fractures into the shallow aquifer, presenting continuous danger of igniting upon possible penetration into basement of the residences in the area for an unestimable period of time.

Additional question:

Is there a "radius of influence" around English 1 gas well?



Geauga County
Bainbridge Township

Well Symbols

- Expired Permit
- Gas
- Oil and Gas
- Permitted Location

LEGEND

Water wells with declining wellhead LEL following the two "squeeze jobs" in English 1 gas well

Water wells with still high wellhead LEL readings one-year after the "squeeze job" in English 1 gas well.

N

0 250 500 1,000 1,500 Feet