FMD 2007 EPIDEMIOLOGY REPORT

Situation at 12:00 Sunday 30 September 2007. Day 58

Executive Summary

1. Three further cases of Foot and Mouth Disease (FMD) have been confirmed within the Protection Zone established around the third, fourth and fifth cases, in Surrey. The location of the new IPs and their temporal relationship to previous cases are shown in Figures 1 and 2.
2. The new cases are within the existing Protection Zone and the timing of their infection and the investigations carried out to date indicate that they derived from the IPs in that zone therefore additional surveillance measures were implemented in the area. More recently the premises in the immediate vicinity, on which animals are most likely to have been exposed, have been depopulated as Dangerous Contacts following an epidemiological assessment.
3. A review of the likelihood that animals moved from the counties affected by the epidemic (i.e. included within the Surveillance Zone) to other parts of the country, based on the movements made in 2006), concluded that the majority of movements off holdings in this area are to slaughter. The

remainder are predominantly to other counties in the south-east of England. Surveillance and tracing work is in progress to validate this assessment.

4. Further investigations to establish the source and the method of transmission of FMD to IP5 are in progress. To date the only potential link that has been identified suggests fomite transmission from the Pirbright site through lorry and personnel movements, however investigations continue.
5. This report provides additional information about IPs 6, 7 and 8, and recently instituted surveillance for FMD. Full details about the epidemiology of the earlier cases can be seen at www.defra.gov.uk/animalh/diseases/fmd/latest-situation/index.htm

Descriptive Epidemiology FMD2007/0004 (IP4) - CORRECTION

6. There was an error in the last Epidemiology Report, which reported events up to 21 September, relating to the identification of IP4. This case was identified as a result of the owner noticing and reporting suspicion of disease in the cattle, and not as previously reported. We apologise for this error.
7. All other information about IP4 presented in the last report is correct, to the best of our knowledge.

Descriptive Epidemiology FMD2007/0006 (IP6)

8. This was a small pedigree, beef suckler, herd with a total of 34 cattle (cows and calves). All the cattle were grazing on one site except for one cow and calf that were moved to the home premises (IP6A) for veterinary treatment on Tuesday 04 September. Both parts of this farm were within the PZ current at the time.
9. Evidence of FMD was first detected as a report case by the owner, who reported one animal salivating and uncomfortable on its feet. The case Veterinary Officer suspected disease in one animal. The age of lesions was estimated to be four days old by staff from IAH, Pirbright when the first detected cases were culled on Friday 21 September 2007. The cull of the remainder of the herd was delayed until the next day (Saturday 22 September) as a result of the fading light causing potential health and safety problems. Only one other animal was detected with lesions that were aged at three days old during the completion of the cull.
10. Laboratory examination of samples from the cattle on IP6A and 6B at slaughter showed that 2/32 cattle on IP6B were PCR positive, indicating the presence of FMD virus. Neither of the cattle on IP6A were PCR positive. None of the cattle on IP6A and IP6B had seroconverted to FMD, indicating that infection in the herd was recent (seroconversion is usually detectable from 6 days after infection).
11. Key dates for IP6**:**

a. Most likely source window: 3 Sep to 15 Sep
b. Most likely spread window: 16 Sep to 23 Sep
c. Most likely date of 1st lesion: 17 September (+/- 1 day).
d. FMD confirmed: 21 September 2007.
e. Cull status: Report case slaughtered on 21 September, remainder of herd slaughtered 22 September
f. Preliminary C & D completed: 23 September 2007.

12. Source and Spread Investigations: The source window lies within the spread windows of IPs 3B, 3C, 4 and 5. There were a number of personnel tracings, and three vehicle tracings that are being followed up.

Descriptive Epidemiology FMD2007/0007 (IP7)

13. This was a small pedigree beef suckler herd with a total of 16 cattle. These cattle were semi-wild in that they had rarely been handled as there were minimal handling facilities at the site..
14. Evidence of FMD was first detected on 24 September as part of the intensive area surveillance programme, when 11 to 12 animals were observed salivating and six were found to be lame.
15. At slaughter on Monday 24 September, 14 out of 16 animals had lesions that were aged at that time (by staff from IAH, Pirbright) as ranging from 1 to 4 days.
16. Examination of the cattle on IP7 at slaughter showed that 14 of the 16 cattle had FMD lesions. Laboratory examination of samples from the cattle on IP7 showed that 1/16 cattle were seropositive, these were cattle whose lesions were aged at an estimated 4 days, and their age was therefore revised to 5 days. Fifteen of the 16 cattle on IP7 were PCR positive, indicating the presence of live virus. The PCR-negative animal was seropositive.
17. Key dates for IP7**:**
    a. Most likely source window: 5 Sep to 17 Sep
    b. Most likely spread window: 18 Sep to 25 Sep
    c. Most likely date of 1st lesion: 19 September (+/- 1 day)
    d. Cull status: Cattle ‘slaughtered on suspicion’ on 24 Sep
    e. FMD confirmed: 24 September 2007.
    f. Preliminary C&D completed: 25 September
18. Source and Spread Investigations: The source window lies within the spread windows of IPs 3B, 3C, 4, 5 and 6B. There are two personnel tracings that are being followed up.

Descriptive Epidemiology FMD2007/0008 (IP8)

19. This was an extensively kept, recently established, beef suckler herd with winter housing at premises IP8B, and grazing at 8B, 8C and 8D. The owner kept 16 sheep with no cattle at the home premises, IP8A. Cattle at premises 8C and 8D were examined and sampled on Friday 28 September, when there was no clinical evidence of FMD.

20. Evidence of FMD was first detected on Saturday 29 September when the cattle at premises IP8B were examined as part of the intensive surveillance underway in the Intensive Patrol Area in the Protection Zone (PZ) (see 'Surveillance' section of report below). The cattle had previously been inspected by VOs, most recently on 27 September. They had not previously been closely examined due the lack of handling facilities at this premises, which therefore required a specific facility to be built on site.

21. One of the 54 cattle had lesions typical of FMD, and early examination suggested these were 3 days old; lesions that were not typical of FMD were seen in seven other cattle. All cattle with lesions were slaughtered on 29 September, and the cull of the remainder of the herd was completed on Sunday 30 September. Laboratory examination of samples taken post mortem has confirmed infection with FMD in the animal with typical lesions, but is still in progress on samples from the remaining animals. The timeline of infection for IP8 indicated below and in Figure 2 is subject to minor changes following a complete review of the findings in this herd.

22. Susceptible stock on premises 8C and 8D were slaughtered on 30 September; there were 17 and 64 cattle on these premises respectively. No lesions were seen in any of these cattle. The 16 sheep on premises 8A were slaughtered on 30 September. No lesions were seen in these sheep.

23. The samples from the affected animals were positive for FMD virus. The complete laboratory results for all of the animals sampled from all of the premises are pending.

24. Key dates for IP8:

    a. Most likely source window: 12 Sep to Monday 24 Sep
    b. Most likely spread window: 25 Sep to Monday 01
    c. Most likely date of 1st lesion: 26 September (+/- 1 day).
    d. Cull status: The cull of cattle on IP8B was completed on Sunday 30 September.
    e. FMD confirmed: Sunday 30 September 2007.
    f. Preliminary C&D completed: Monday 01 October 2007

25. Source and Spread Investigations: The source window lies within the spread windows of IPs 3B, 3C, 4, 5, 6B and 7. No significant livestock, personnel, equipment or vehicle tracings have been identified so far, although this work is still in progress.

Overview of new cases in the context of those previous

26. The six IPs that have occurred in September are all contained within a small geographic area approximately 16 km north of the Pirbright site, and within an area about 6km in diameter. The epidemiology of these is still being analysed, however evidence considered to date suggests that one of these (IP5) derived from the original epidemic in August, either from the Pirbright site itself, or from one of the first two IPs.

27. The epidemiological evidence to date for the other five cases, including the latest three cases, is consistent with secondary spread from IP5 and/or each other. Spread is 'local' and the mechanism of transmission cannot be firmly verified, however evidence from meteorological modelling and epidemiological investigations of the IPs show that aerosol and/or fomite transmission were possible between these premises.

28. The temporal association between all of the IPs in 2007 is shown in the 'timeline' in Figure 2. The hypothetical links between the cases are shown in Figure 3. The number of cattle on each IP starting clinical signs each day in August and September is shown in Figure 4.

Genomic Sequencing

29. The results of full genome sequencing by colleagues at IAH Pirbright indicate the viruses isolated from IP 3B, IP3C, IP4B, IP6, IP7 and IP8 are descendants of the isolate from IP5

Review of potential for further cases or spread of FMD

Within the Protection and Surveillance Zones

30. The new cases raise concern that others may arise, as the evidence from recent IPs, some of which, despite close inspection, have had 4 day old lesions at disclosure, indicate that early disease is not easy to diagnose without confinement and examination of the cattle.

31. Due to the intractable behaviour of the animals as a result of the husbandry methods in this area an adequate clinical examination is not possible on every premises or in individual animals to detect early lesions, 1 to 2 days old. This poses the risk that disease has already affected a large proportion of the herd before diagnosis which in turn increases the risk of further dissemination of the virus and continuation of the epidemic.

32. Epidemiological review of the recent cases (in particular IPs 3B and 4B, where the lesion ages suggest that there has been more than one generation of cases) shows an average incubation period of 3 – 4 days. This is consistent with our understanding of FMD Type O1 BFS, and emphasises the need to detect and control disease within a very few days of infection. By the time lesions are 2 days old, there has been the opportunity for spread on the 4 previous days.

33. Where infection is introduced into a single animal, as is likely with fomite transmission, then the weight of virus in the environment will become significant after the first generation of disease, i.e. 3 - 4 days after first infection. It is on this basis that it is important to examine all cattle within

the PZ at least every 2 days. This is being done in the southern part of the PZ and daily visits are being made to the cattle herds in the northern part of the PZ where the risk of infection is greater. This more frequent examination is important if aerosol transmission occurs as several cattle might be infected in the first generation.

34. Increased frequency of inspection together with enhanced enforcement and awareness of biosecurity is being implemented (see section on surveillance below)..

35. Therefore the possibility that some farms may already have been exposed to infection was considered, and the seven remaining holdings with cattle in the Intensive Patrolled Area (IPA, defined further in the 'Surveillance' section of this report, below) of the PZ were being assessed for this possibility (i.e. consideration given as to whether they are 'contact premises' within the legislation) when IP8 (one of these seven) was discovered. Premises with cattle in the newly defined PZ have been reassessed and those very likely to have been exposed to infection have been designated contact premises and have been depopulated. The remaining premises in the IPA remain under the intensive surveillance.

36. Livestock on the four premises that were designated as contact premises were examined at slaughter and showed no clinical evidence of FMD. Laboratory tests are still in progress, however all preliminary test results are negative for FMD. These findings provide reassurance that disease has not spread from these premises, and the cull has reduced the risk that the FMD epidemic may be propagated by spread from IP8.

Wildlife

37. The current active cluster of cases lies north of the first phase of the outbreak, within 3 km of Windsor Great Park. The Park holds a large number of red deer in which FMDV infection may be mild and inapparent, behaving in the same way epidemiologically as the infection in sheep. Although red deer will graze freely amongst cattle, they are not permitted to co-graze with the stock belonging to the Crown Estate or the two tenant farmers in the Park. Some areas of the Park fall within the PZ and have been closed to the public. The role of wildlife in this outbreak remains under review.

Investigation into the source of IP5

38. Investigations into source for IP5 are ongoing. This premises was largely self-contained and there are no streams or footpaths across the premises, and no susceptible livestock on adjacent premises. However the premises is next to a busy road, and the access road to the premises is used by a number of different businesses. Thus there is opportunity for fomite transmission from vehicles.

39. Investigations to date have revealed that a site used both as a depot for overnight parking, and as a landfill site, by contractors who also worked on

the Pirbright site is located close to IP5. There is also evidence that there was personnel contact between IP5 and this site.

40. Investigations into IP1 and IP2 as the possible source for IP5 are ongoing, however no epidemiological links have been identified to date.

Could FMD virus be outside the PZ/SZ?

41. If FMD is outside the current affected area (i.e. PZ and SZ), it would have been carried there by live animals or on fomites. The half life of FMD on fomites ranges from a few days to a some weeks; expert opinion suggests that fomites from the original virus release from Pirbright are unlikely to still contain infectious virus. Therefore the possibility for FMD outside the area lies with infected animal movements from the currently identified IPs or from undisclosed IPs.

42. Assessment of this risk has been carried out in two ways.

    a. The pattern of movements of susceptible species out of the five counties that contribute to the SZ during July, August and September 2006 has been analysed (movements to slaughter were excluded).

    b. All holdings in the PZ and SZ are being contacted and details of livestock movements captured.

43. Analysis of the movement data (other than moves to slaughter) for the three months July – September 2006 (i.e. the most pessimistic prediction of movements that may have taken place in the risk period in 2007) shows a consistent picture of:

    a. Low numbers of movements (100's rather than 1,000's)

    b. 30-50% of animal movements to other premises within Surrey

    c. Less than 20% of movements to gatherings (and most of these to gatherings in Kent and Oxfordshire)

    d. Low numbers of animals moved (1,000's rather than 10,000's);

    e. Of the animals that went to gatherings, about 46% of onward movements were to premises in East Sussex (12%), Kent (11%), Somerset (8%), Wiltshire (8%) and Dorset (7%).

    f. No direct movements of animals to Scotland from the PZ and SZ or Surrey

    g. Very small numbers of movements and numbers of animals to Wales

44. Tracing and surveillance information captured to date have confirmed the 2006 pattern of movements between premises described above, but indicate that there were very few movements to gatherings (markets). All the stock that have been identified to date as having been moved have been traced, and if moved other than to slaughter, have been restricted and tested, with negative results for FMD.

45. The most recent changes to the PZ and SZ may have revealed further premises that have not been previously included in this surveillance, and capture of data on movements from these is in progress. However it is unlikely that these will identify holdings at risk of FMD in other parts of the country than those areas identified as the 'Risk Area' defined by the risk analysis conducted using 2006 data.

Surveillance

Protection Zone - Cattle

46. Additional intensive surveillance has been introduced for cattle in the Protection and Surveillance Zones in response to the finding of two further IPs on which clinical disease had been present in cattle for 4 days and 5 days respectively. Such a duration means that there was potential for spread from these premises by aerosol or fomite transmission for 5 and 6 days respectively.

47. This period exceeds the incubation period of 3 - 4 days currently estimated for cases in this phase of the epidemic. This is being addressed in two ways; firstly by implementing enhanced biosecurity protocols and raising public awareness of the need for biosecurity, in the PZ. This should mitigate the risk of fomite transmission.

48. Secondly increasing the frequency and level of surveillance so that it is shorter than the incubation period and so likely to detect disease at Day 0 or Day 1, significantly reducing the opportunity for aerosol spread and the creation of fomites.

49. The plan for enhanced surveillance by means of an Intensive Patrolled Area (IPA) and Enhanced Surveillance Areas (ESAs) has two purposes: The primary objective is to reduce the time to detection of detection of recently infected cattle herds, as described above. A secondary objective is to mitigate the risk that there are other cattle herds with older infection present, that may have escaped detection in the same way as occurred for IP5.

50. Two levels of surveillance will be carried out, one to detect recent and older disease, and the second seeking only to detect older disease. In order to implement this, the current SZ and PZ has been divided into six areas (see Figure 5).

51. The details are as follows:

    a. The Intensive Patrolled Area (IPA): This area is bounded to the south by the M3 motorway and to the north by the September Protection zone (see Figure 5). All cattle in this zone (approx. 450) This involves intensive surveillance to detect any missed infected cattle premises and recently infected cattle herds. Cattle are being visited every day for clinical examinations and blood sampled every other day. The samples from the first sampling were examined serologically and by PCR. The samples from the subsequent visits are being examined by PCR only.

b. Enhanced Surveillance Areas (ESA) 1, 2, 3A & 3B: These areas are within the August SZ and current PZ and SZ and are shown in Figure 5. The area has been subdivided in order to prioritise and manage resources. The objective of this surveillance is to detect cases of disease in cattle that might have escaped clinical detection due to the difficulties associated with the clinical examination of the cattle kept in this area. Surveillance will consist of one round of serological testing of cattle for all premises with only cattle (with or without pigs) in ESAs 1 and 2 and for all premises with cattle in ESA 3A and B. There are about 2000, 450 and 2000 cattle in these areas respectively. This surveillance commenced on 1 October.

c. ESA 4: Surveillance for old disease as defined for ESAs 1,2, 3A & 3B will be carried out in cattle herds (and sheep flocks) identified in an area to the west of the September SZ considered to be at risk from lorries which were driven within the August SZ and September SZ.

52. Within the IPA there were originally 12 premises/parcels of land with cattle owned by 9 individuals and comprising some 400 cattle. One farm (IP7) and cattle on one of three parcels of land with cattle under the same ownership (IP) developed clinical disease before sampling for laboratory testing began. Between 24 and 30 September a total of 365 cattle had been tested at least once serologically and by RT-PCR, with a total of 721 PCR tests completed. Serological testing was only conducted on the initial sampling The results of the sampling are summarised in Table 1 below, all PCR and serological results were negative up to 30 September.

Farm /premises ID	**No cattle**	**TEST DATE**						
		24/9	25/9	26/9	27/9	28/9	29/9	30/9
IPA1	3	3		3				
IPA2	34	21	7	16	7			
IPA3	119	119			119			
IPA4	48			48	36	48	36	
IPA5	33		33		33			
IPA6	6			6	5	1		
IPA 7	41					41		41
IPA8C	17				17		17	
IPA8D	64						64	
IPA8B*	54							
Samples tested		143	40	73	217	90	117	41

* Cattle on this premises were observed to have lesions on 29 September and became IP8

Table 1. Intensive Patrol Area: Numbers of cattle tested by PCR by date and premises

53. As indicated above, it proved impossible to blood sample cattle on the farm IPA8B which was detected as IP8 by the clinical inspection of the cattle on 29 September. This was unfortunate, but indicates the difficulties in the handling and examination of the cattle kept under the management system for beef cattle that is prevalent in the area.

Protection Zone - Other premises

54. Surveillance has continued of all other premises and susceptible stock in the PZ. Of the 87 premises in the PZ the 78 premises have been visited. Samples have been taken from sheep and goats on 53 of the 62 premises with these species. All results have been negative.

Report Cases

55. From 2 August 2007 to mid-day on 28 September 2007, suspicion of FMD had been reported on 169 holdings, across Great Britain, with most suspect cases reported in the counties shown in Table 2 below. The map at Figure 7 shows the locations of suspect cases of FMD reported during this period.

County	Number
Surrey	40
Somerset	9
Berkshire	9
Somerset	9
Devon	8
Kent	7
Other (39 counties)	87
TOTAL	**169**

Table 2 Distribution of suspected cases of FMD reported to Defra since 2 August 2007

56. This indicates that the current level of awareness of FMD in livestock keepers is high and shows that surveillance for FMD is being carried out outside of the PZ and SZ.

57. Report case locations have been considered, as they are an indicator of awareness amongst livestock keepers and, once negated, also show where disease is absent.

58. Figure 6 shows the temporal distribution of report cases for which the possibility of FMD has been investigated since 3 August 2007.

ACKNOWLEDGEMENTS

58. The views expressed in this report are those of the National Emergency Epidemiology Group. However we would like to express our thanks to a number of colleagues for their assistance in providing the results of various investigations and their specialised expertise. They are Drs David Paton and staff at the Institute for Animal Health, Pirbright , particularly Nick Knowles, Jemma Wadsworth, Eleanor Cottam, Don King, Eoin Ryan and Ryan Waters and John Gloster and colleagues at the Meteorological Office

National Emergency Epidemiology Group
Defra

02 October 2007

Figure 1. Location of Infected Premises, Protection & Surveillance Zones

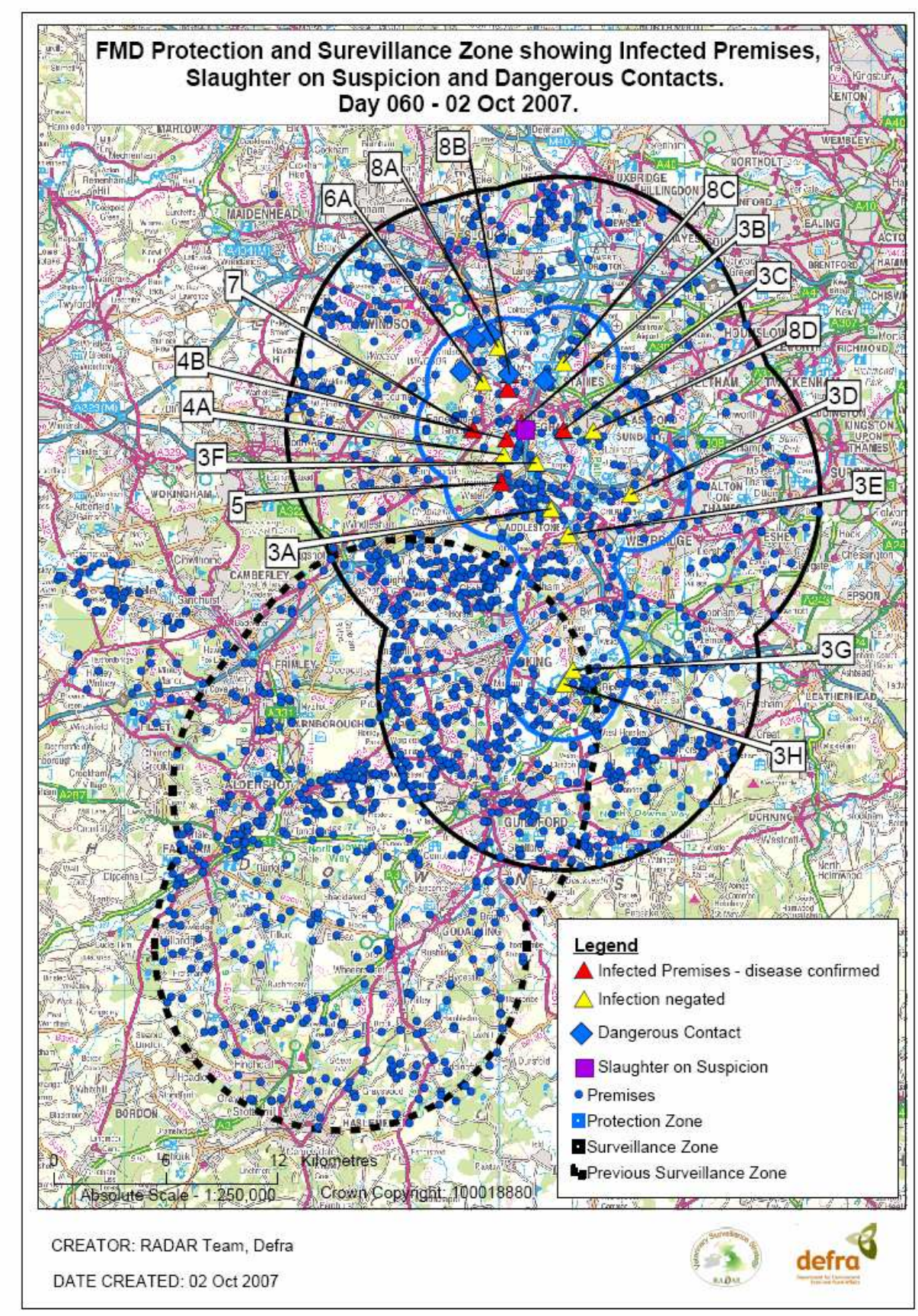

Figure 2. Timeline diagram to show the temporal relationship of infection on the September Infected Premises

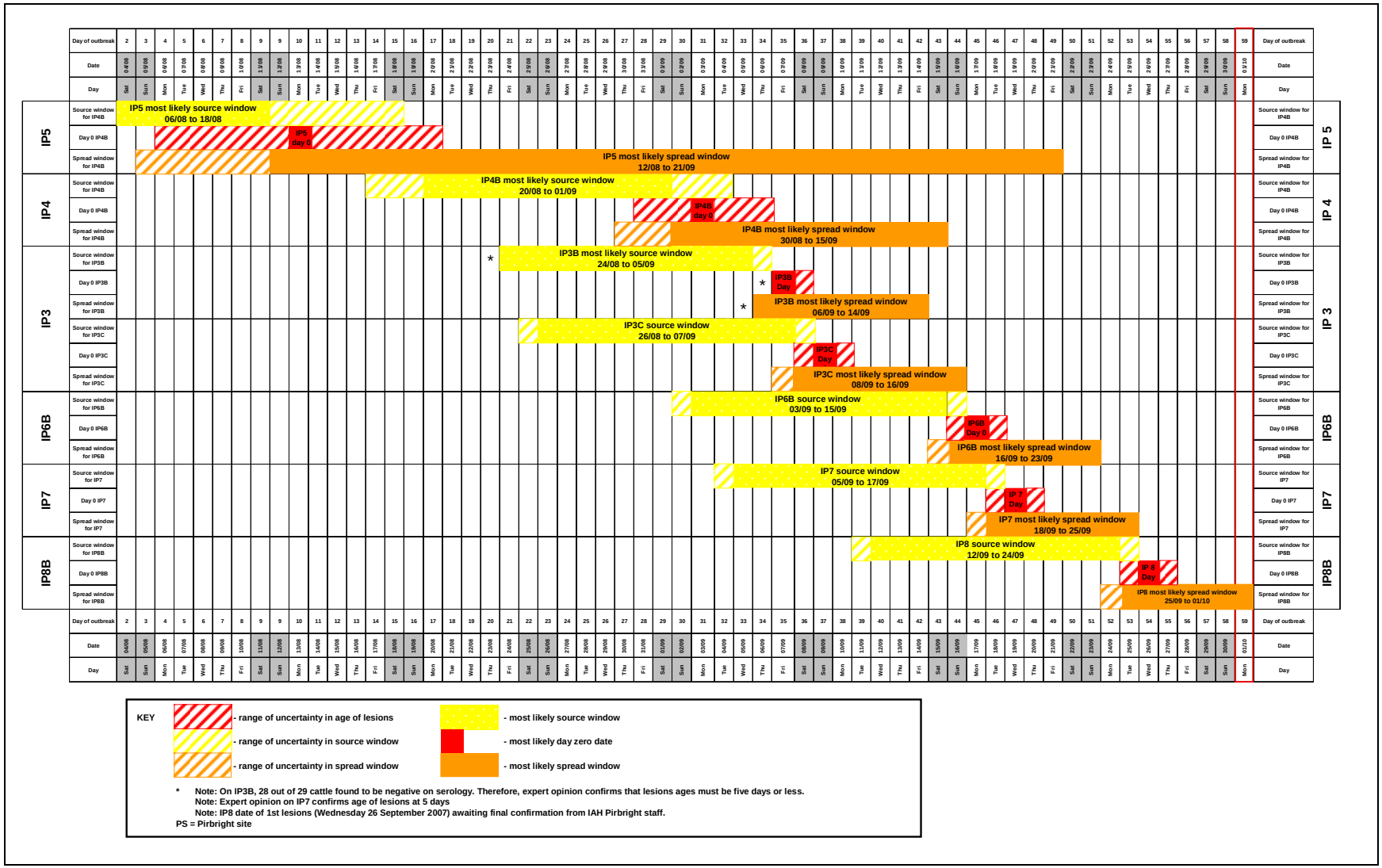

Figure 3: Hypothetical epidemiological links between infected premises

Interpretation of evidence as at mid-day, Thursday 27th September

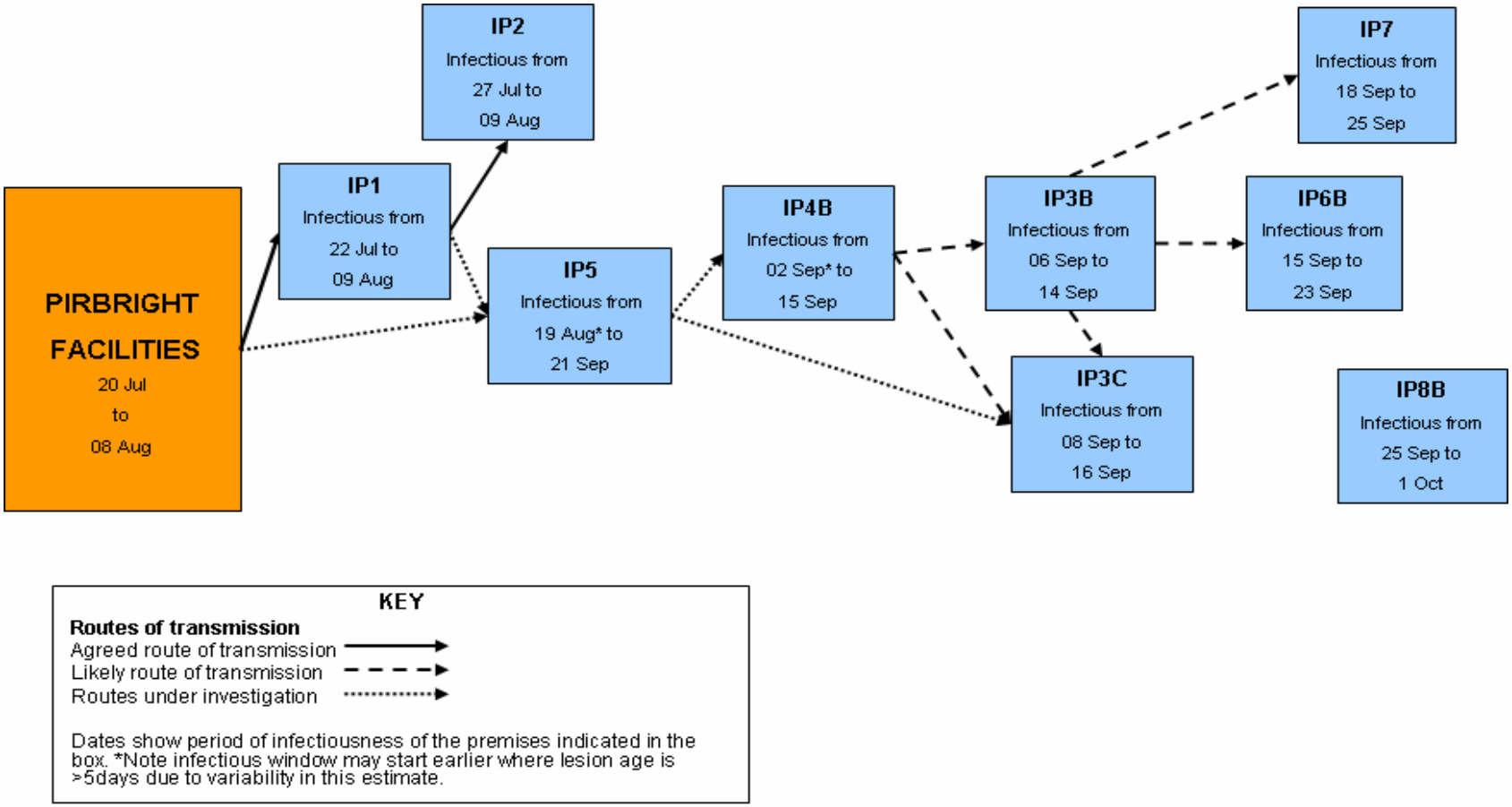

Figure 4: Distribution of Day 0 lesions on the September IPs

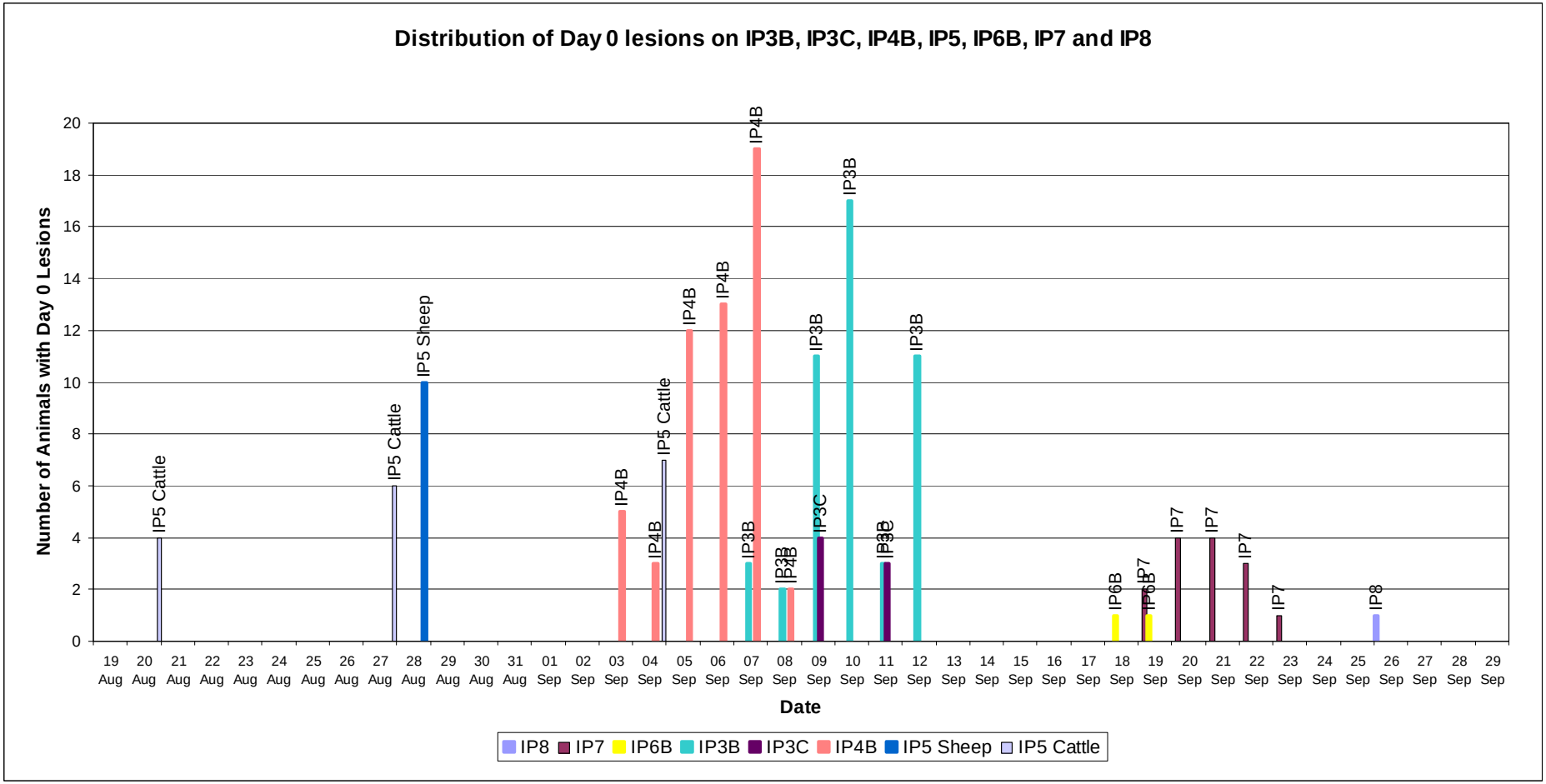

Figure 5. Map of Intensive Patrol Area and Enhanced Surveillance Areas

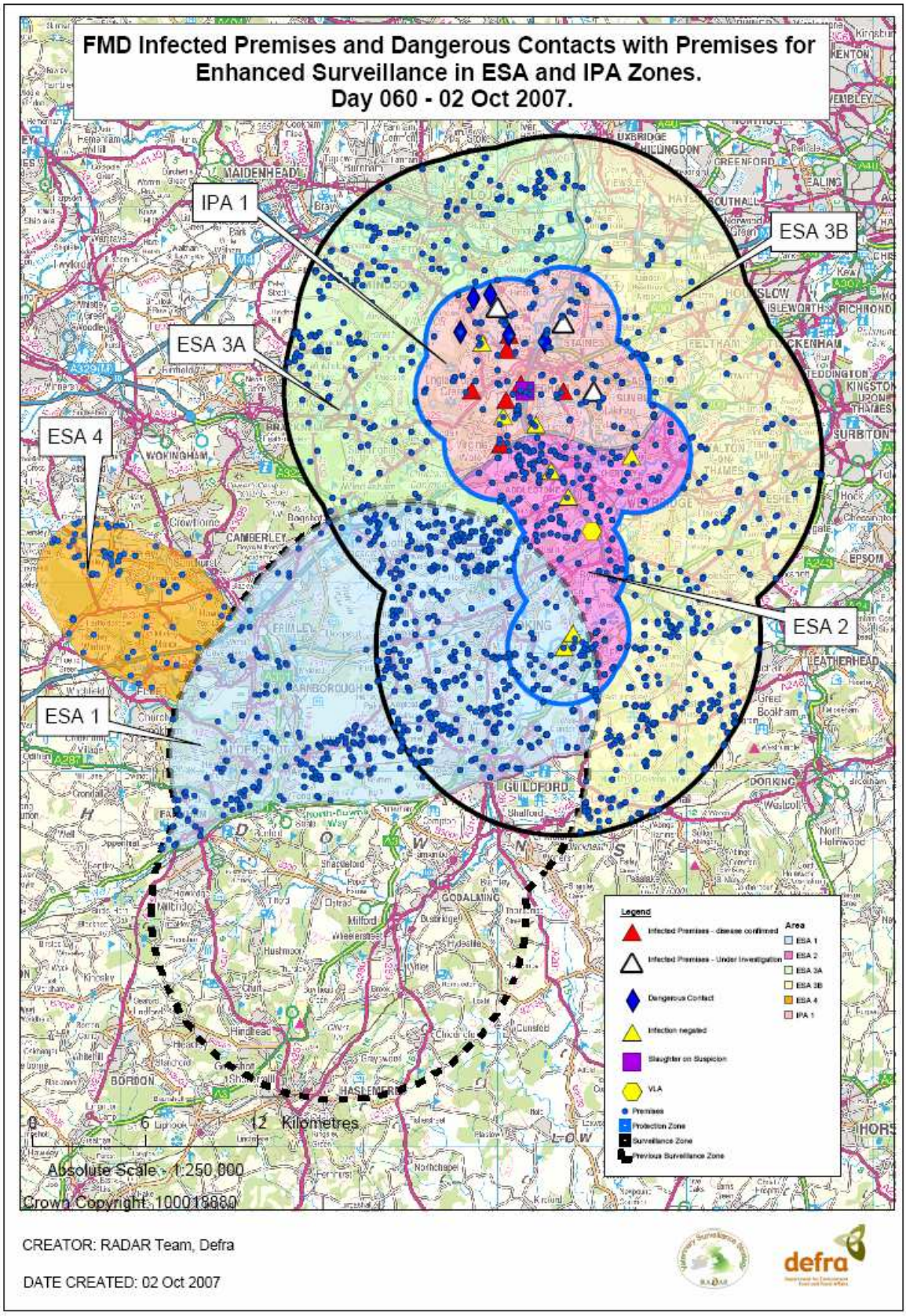

Figure 6. 'Epidemic curve' to show daily number of report cases up to 28 September

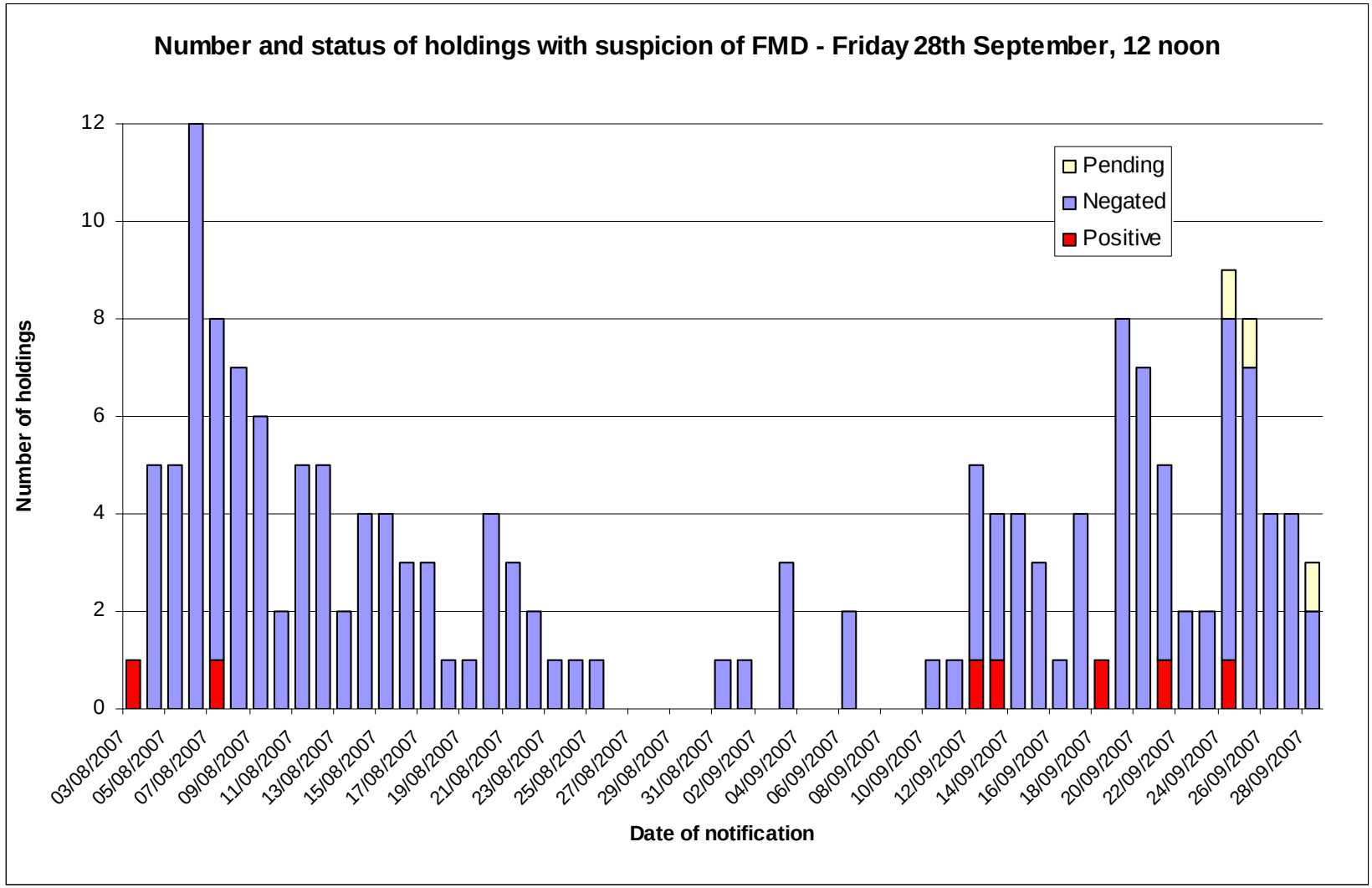

Figure 7. Location of suspect cases of FMD notified to Defra since 3 August 2007