Bosworth Field Investigation

Additional Soil Survey Reports 2007 & 2008 & 2009

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Additional Report 2007

INTRODUCTION

The soil survey work in 2007 had two foci:

1. A request was made to assess the soils of another potential site for the battlefield in the Brownheath area around Foxcovert Farm (Grid Ref. SP 380974), one to two kilometres west of Stoke Golding (Figure 1), in particular with respect to the distribution and thickness of alluvium and peat.
2. An area known as 'Fen Meadow' and identified as a potential site for 'the Marsh' north of Fenn Lanes (SP 391986) required an additional soil/geological investigation and interpretation.

Methodology was that described earlier in Burton (2006), Work Package (WP) B, but excluding resistivity and pH assessment. Fieldwork around Foxcovert Farm was undertaken on 21 and 22 March 2007 and in parts of two adjacent fields at Fen Meadow on 17 April 2007.

Results of the two new surveys are presented for each specific area. Additional data have been added to the soil datasets created during the earlier part of the project and GIS maps have been updated for three relevant topics – distribution of soil types, location of soil survey investigation sites and thickness of alluvium at investigation sites.

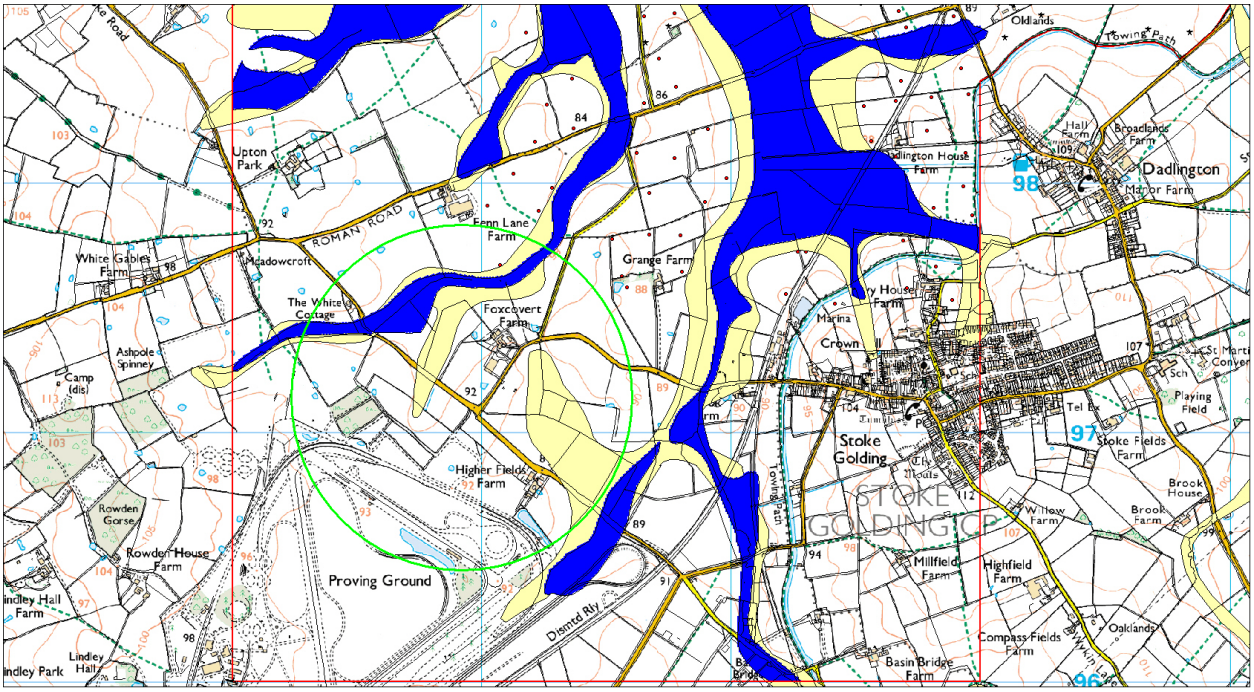

Figure 1. The additional survey area around Foxcovert Farm is indicated by the green circle. The published extent of alluvium is shown; yellow is the larger extent mapped by the British Geological Survey, and blue that mapped by the Soil Survey as Fladbury Series in 1976.

Foxcovert Farm area

The area identified for additional soil investigation in 2007 lies within the green circle in Figure 1. Terrain considered to have a cover of riverine alluvium is indicated according to the source. A total of 22 sites were investigated for soil profile characteristics.

Figure 2 is an updated map showing the distribution of alluvium for the surveyed area. It differs from the old (1976) soil map and is less extensive than the geological map implies. Existing thematic maps, both soil and geological, tend to be approximations of ground conditions depending upon the frequency of observations and the purpose of the work, whether general or specific to one interest. Differences between interpretations by the two earth science disciplines are largely caused by the classification systems used to delineate map units. Revisions using a denser network of observations and targeting a specific goal are likely to improve the accuracy of the line work on the map and the description of the map unit contents.

In nearly every investigation bore the alluvium proved to be quite thin – indicated by the blue number for thickness in cm beside the circled bullet point. Nowhere did I find any peat, on, within or below the alluvium. The alluvium looked as it does everywhere else in the vicinity of the Battlefield – a greyish matrix colour with ochreous mottles.

In the narrow valley immediately north and west of Foxcovert Farm the alluvium is not laterally extensive, and no alluvium was proved in the shallow tributary valley extending south towards the Proving Ground.

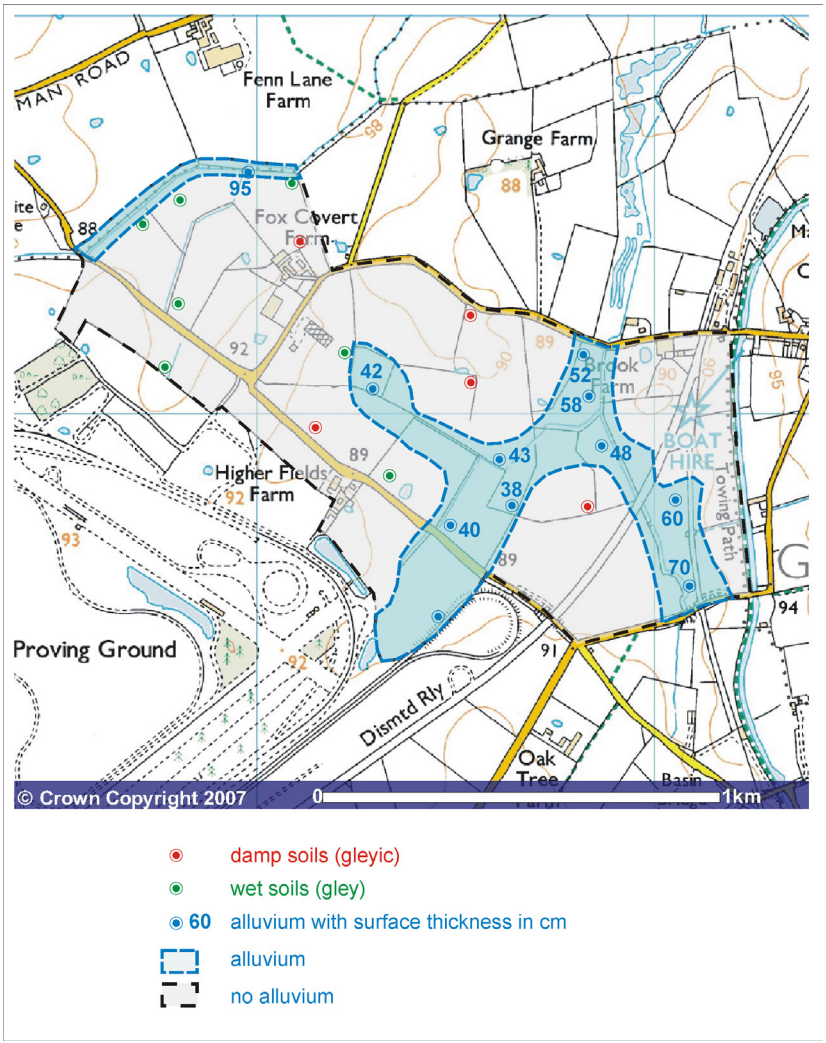

Figure 2. Soil survey extension around Foxcovert Farm, west of Stoke Golding, Leics, with distribution and thickness of alluvium indicated.

Also indicated with the green bullet are bores which had wet (gley) soils – waterlogged in winter but with unknown condition in summer originally. Wet soils certainly extend through the nursery and on the land just to the south (from evidence of ruts in arable fields). On the MIRA restricted Proving Ground I was able to confirm that alluvium certainly extends southwest along the valley parallel to the Dismantled Railway; although not allowed to auger, I was able to see distinctive alluvial subsoil ploughed up on the surface. Less wet (gleyic) soil has a red bullet point for the location where this condition was found.

In Heath Wood (SP 374971) I observed some water-filled pits in boulder clay indicating wet gley soils.

All soils in the area are potentially acid (I found a few tiny chalk stones at depth in 'Chalky Boulder Clay' in one bore only) and they would become more so with time unless limed.

Conclusions: The distribution of wet gley soils is indicative of the likely waterlogged conditions during winter and early spring before modern drainage for agricultural improvement. However, the summer conditions in 1485 are unlikely to be wet underfoot except in receiving sites for water draining from adjacent slopes, *i.e.* in valley bottoms where alluvium accumulates, or unless the summer was similar to the 2007 one!. These sites have been identified with more accuracy during this survey but the main conclusion is that there is no area with special conditions that set it apart from the general conditions found in the district, to be a good candidate for the site of the Battle.

'The Marsh' (Fen Meadow)

Coring results of further survey work by Birmingham University, Glenn Foarde and Richard Mackinder were made available and the latter two had identified a 1 hectare area straddling two adjacent fields with significant deposits of peat. This target area for further investigation and correlation is about 175 m long by 80 m broad.

A transect of eight cores was made through the southern field parallel with the dividing hedgerow (cores 1–8); a further two cores (10 & 11) were taken in the northern field. Figures 3 and 4 illustrate the findings; Figure 4 also includes results of corings taken earlier (120, 28 & 30). In the diagrams the profile layers are colour-coded to aid interpretation but even with cores at 7-m interval (5, 6 & 7) continuity is difficult to interpret. Ground surface elevations are approximate.

The transects reveal a complex stratigraphy variable over short distances. The 'peats' are commonly detrital and mixed with mineral material – either clayey or silty alluvium, or sand and very small stones near the base. The thin, diverse layers within the profile columns indicate a wide range of wetland/river conditions over the centuries. These organic remains are good candidates for radiocarbon dating, however care in sample selection is required as tiny inclusions of alluvium may have an ageing effect and pieces of wood within the deposit may be more modern tree roots and could have a younging effect.

All of the organic sequences have a capping of the ubiquitous silty clay alluvium. What was once an open, perpetual, very wet fen with some alluviation with fine particles at times, was swamped by overall (winter) flooding of the broader valley and deposition of a very uniform spread of alluvium. Where there is clayey alluvium, one would expect winter flooding when the alluvium is laid down but in summer when the stream flow is less the area might be drier and used for grazing, hence alluvium itself does not offer a suitable site for 'the Marsh' at the time of the battle in August. I didn't notice any macro-stratigraphy (*i.e.* visually obvious) within the alluvium, except for more mottling near the top and more organic near the base, nothing to suggest any depositional regime changes during the period of its deposition. A date for the onset of this more general alluviation would be interesting as would its cause. Trenching would be better than cores to see the stratigraphy and to take samples from, however the water table was quite high at the time of survey at between 32 and 60 cm in the central part.

The most significant factor of the work is believed to be the proving and recognition of 'sand geology' in the base of cores 2, 3 & 4. The base of core 1 is formed by reddish-coloured (7.5YR4/3) Wolston Clay, a calcareous lake-bed sediment formed beneath a pro-glacial lake (Lake Harrison). Immediately to the west the basal material is similarly coloured (7.5YR4/3 passing down to 5YR4/2) but a firm loamy sand (LS). This is interpreted as being Wolston Sand which formed in lake deltas between upper and lower Wolston Clay lithological units (Burton 2006, Table 1). The firmness of the material is an indication of its age; drifts of Devensian age and Holocene colluvium tend to be less compacted. If this interpretation is correct, **this sand layer could form an aquifer supplying water to this part of the valley as a spring line, keeping it wet even in summer**.

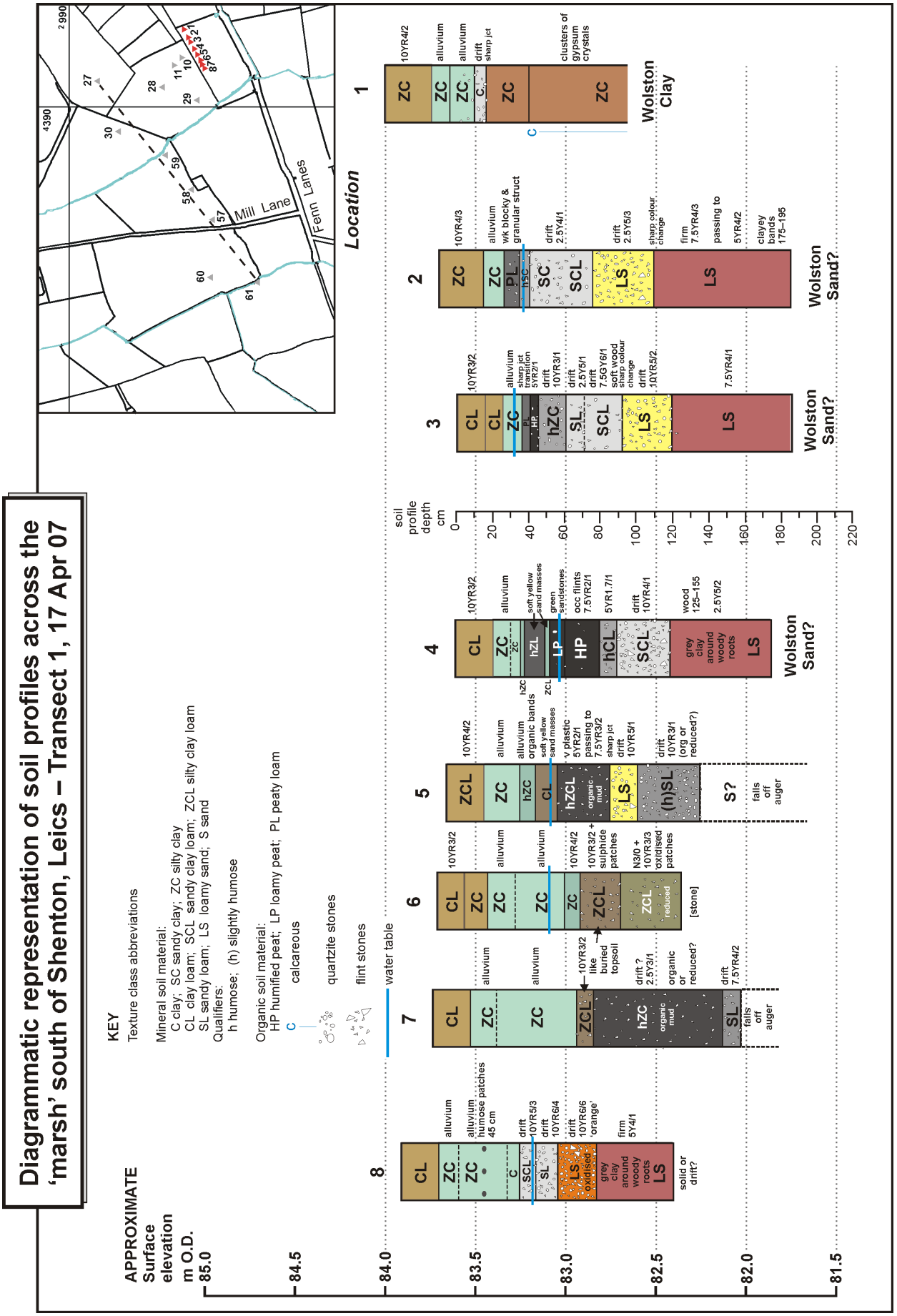
Diagrammatic representation of soil profiles across the 'marsh' south of Shenton, Leics – Transect 1, 17 Apr 07
KEY
Texture class abbreviations
Mineral soil material:
C clay; SC sandy clay; ZC silty clay
CL clay loam; SCL sandy clay loam; ZCL silty clay loam
SL sandy loam; LS loamy sand; S sand
Qualifiers:
h humose; (h) slightly humose
Organic soil material:
HP humified peat; LP loamy peat; PL peaty loam
C calcareous
quartzite stones
flint stones
water table
APPROXIMATE Surface elevation m O.D.
85.0
84.5
84.0
83.5
83.0
82.5
82.0
81.5
soil profile depth cm
0
20
40
60
80
100
120
140
160
180
200
220
Location
Mill Lane
Fenn Lanes
Wolston Clay
Wolston Sand?

Figure 3.

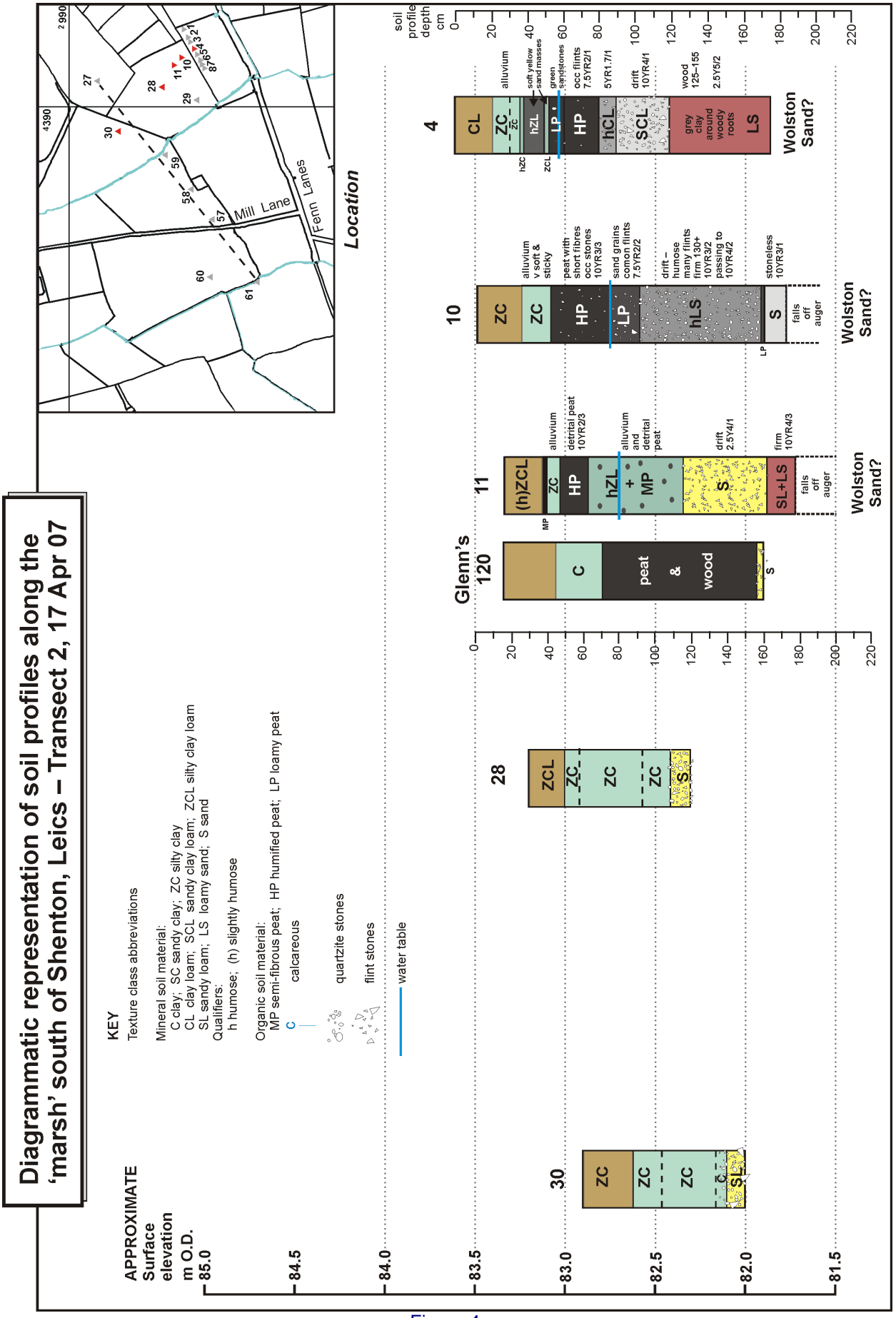
Diagrammatic representation of soil profiles along the 'marsh' south of Shenton, Leics – Transect 2, 17 Apr 07
Location
Mill Lane
Fenn Lanes
KEY
Texture class abbreviations
Mineral soil material:
C clay; SC sandy clay; ZC silty clay
CL clay loam; SCL sandy clay loam; ZCL silty clay loam
SL sandy loam; LS loamy sand; S sand
Qualifiers:
h humose; (h) slightly humose
Organic soil material:
MP semi-fibrous peat; HP humified peat; LP loamy peat
c calcareous
quartzite stones
flint stones
water table
APPROXIMATE Surface elevation m O.D.
soil profile depth cm
Glenn's
4
10
11
28
30
Wolston Sand?

Figure 4.

Further support is given to the importance of these sand deposits by the presence of sand pits located each side of the Roman Road (Fenn Lanes), as shown on late 19th century Ordnance Survey maps (Figure 5), to the field name 'Sand Pit Close' to the south of the road, and to the name 'Sandeford' where it is argued by Foss (1998) that the Roman Road crossed the stream – "*The name … suggests a fording-place or crossing associated with sand in the geology.*" (p.38). The stream now follows the western side of the valley floodplain but originally flowed further to the east through the area of peaty deposits.

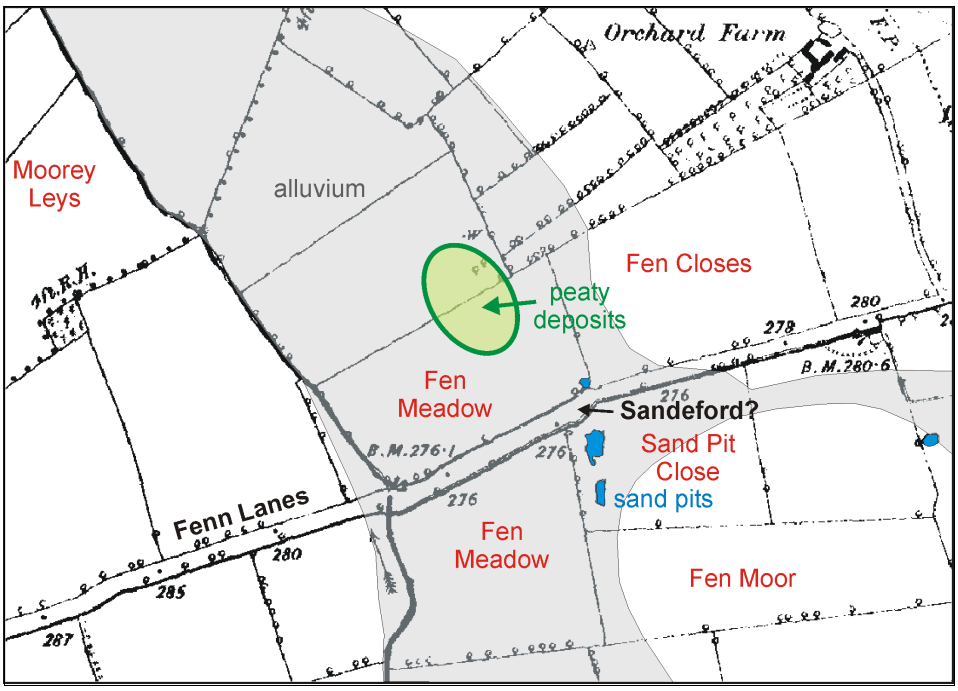

Figure 5. Position of the concentration of peaty deposits described in the transect diagrams, field names and location of sand pits from the late 19th century OS map in the valley crossed by Fenn Lanes.

Conclusions: Based on physical evidence personally seen while studying the soils and landscape of the Battlefield area, and in particular with reference to the stratigraphy of the unique area of peaty deposits (Figure 5), this area beside Fenn Lanes fits most closely the historical evidence for the location of 'The Marsh', and supports the case for the location there of Sandeford. Supporting evidence from micro- and macro-fossil analysis and from radiocarbon dating is awaited.

The presence of a seam of possibly Wolston Sand along this very gently sloping valley side, acting as an aquifer and feeding a spring line in this location, would seem to be a key factor in maintaining the all-year wetness that would support fen vegetation and create the unique peat deposits, as opposed to the more common broad spread of floodplain alluvium derived from soil erosion and mainly winter flooding.

Soil datasets

The soil datasets of borehole information have been updated to incorporate the details of the 2007 soil investigations. They are presented digitally as a series of Excel worksheets in two spreadsheets (Table 1) and as ArcView shapefiles (Table 2). Additionally, the main elements are presented here; the distribution of soil types (Figure 6), location of the complete set of soil survey investigation sites used in the analysis (Figure 7), and thickness of the alluvium measured at the investigation sites (Figure 8).

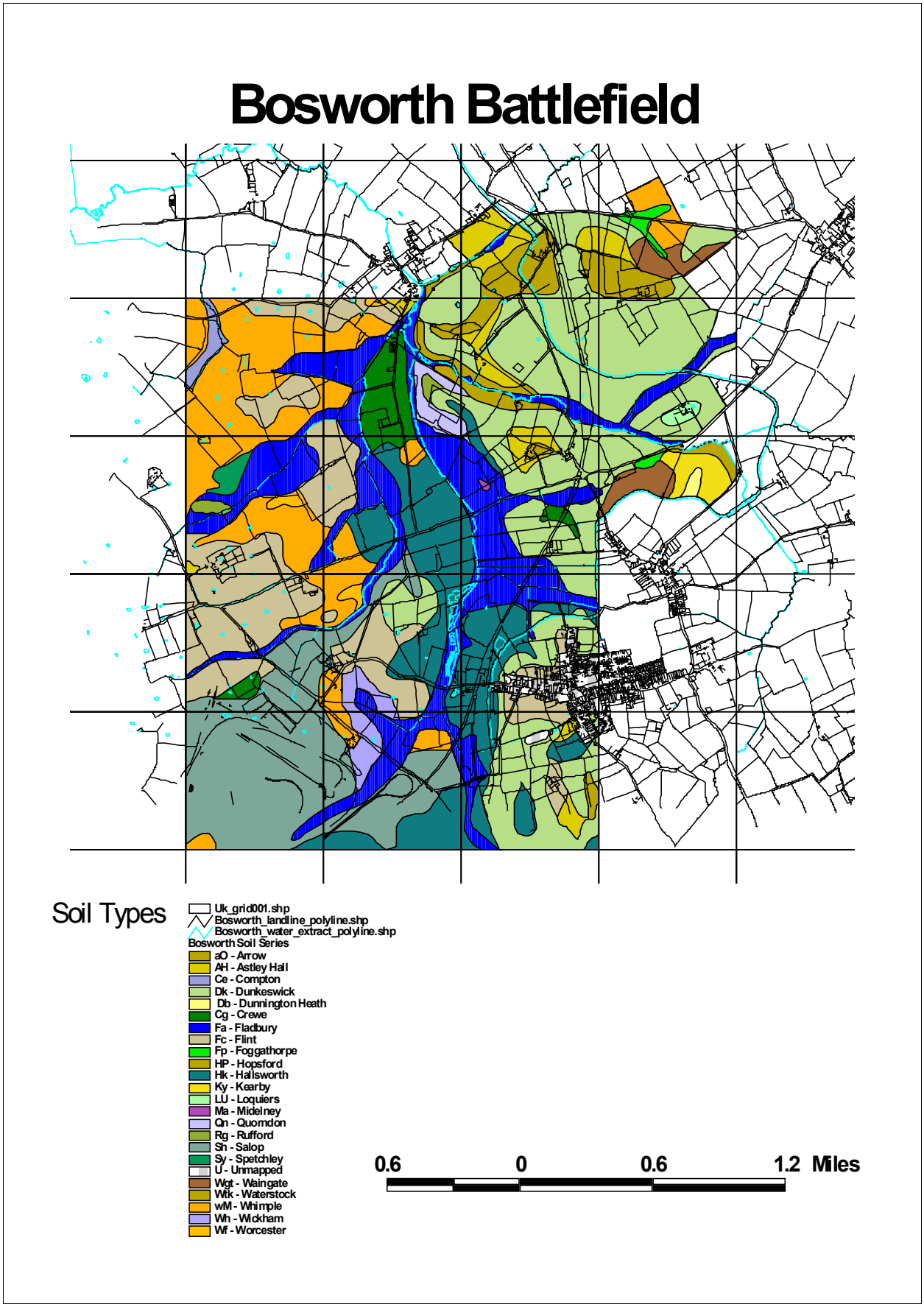

Figure 6. Updated soil series map incorporating data obtained in 2007.

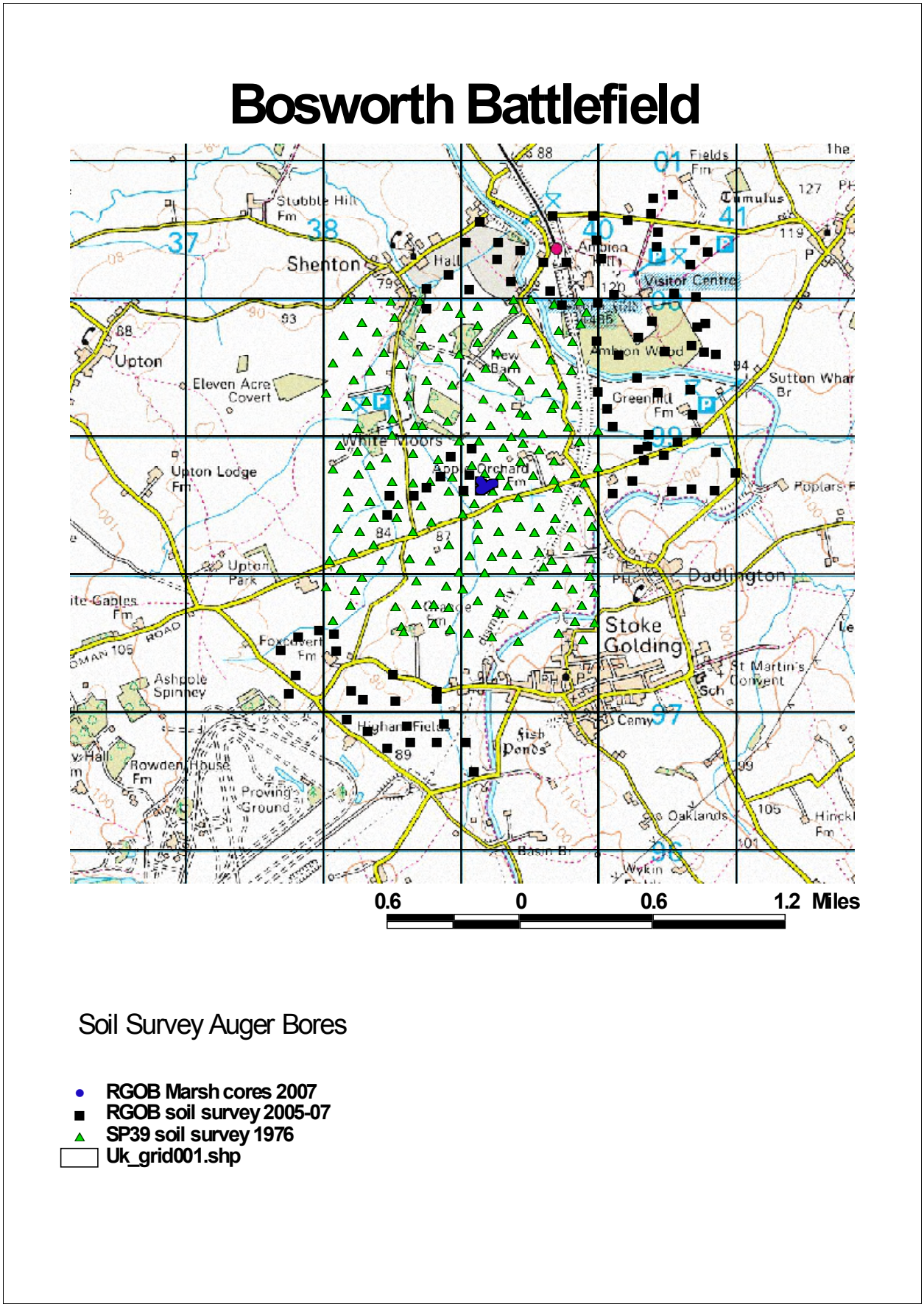

Figure 7. Location of soil survey auger bores from the surveys of 1976 and 2005–07.

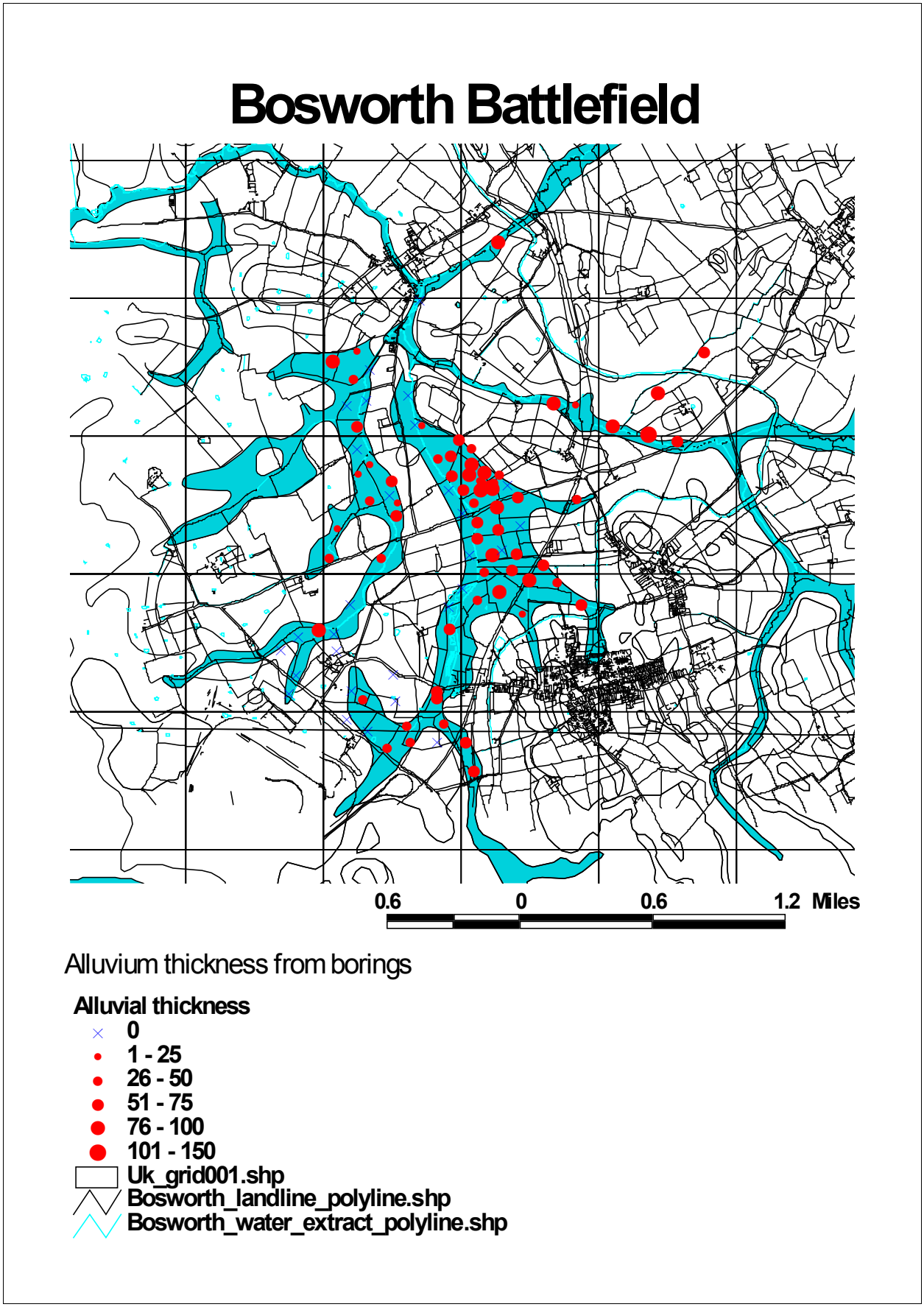

Figure 8. Thickness of alluvium in cm from soil survey investigations. Distribution of alluvium (blue areas) is taken from the geological map, although actual distribution differs from this.

Table 1. Updated digital datasets provided for the project as spreadsheets (.xls).

Dataset	Digital Excel file	Worksheets	Content
All soil survey profile data updated	soil_survey_2005_06_07.xls	Auger bore details Auger for GIS Topsoil Topsoil_reddish Auger summary Topsoil pH EC raw data EC res Resistivity summary	soil profile characteristics ditto suitable format for use in GIS characteristics of topsoil layers only topsoils which have reddish colours series symbol and subgroup for bores pH values of topsoils (limited data) electrical conductivity raw data results table summary table for use in GIS
Thickness of alluvium in cm	alluvium_thickness.xls	Alluvium thickness	thickness of alluvium at key bores for GIS

Table 2. Updated digital datasets provided for the project as ArcView shapefiles (.shp) and legends (.avl).

Dataset	Digital file	Legend (for shapefiles)	Legend field
Soil map updated, coloured by series	Bosworth_soil_map.shp	soil_series2.avl	mapsymbol
Soil map updated, outline	Bosworth_soil_map.shp	soil_series_outline.avl	mapsymbol
Undrained soil wetness class	Bosworth_soil_map.shp	wetness_class.avl	wetness_cl
Thickness of alluvium classified	alluvial_thickness.shp	alluv_thickness.avl	alluv_cm
Reddish topsoil distribution	reddish_topsoil.shp	red_topsoil.avl	
Topsoil texture	topsoil_texture_2005_06_07.shp	texture_2005.avl	texture

NOTICE

REFERENCES

Burton, R.G.O. (2006). *Bosworth Field Investigation. Soil Survey Report*. Cranfield University Report to The Battlefields Trust.

Foss, P.J. (1998) *The Field of Redemore; the Battle of Bosworth, 1485*. Second Edition. Kairos Press, Leics.

Additional report 2008

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May 2008

INTRODUCTION

The soil survey work in May 2008 had a main focus:

A request was made to assess the soils and geology of another potential site for the battlefield in the '*Segwelle hamm*' area, near the parish boundary between Dadlington and Stoke Golding parishes, north and west of Crown-hill Field, Stoke Golding, in particular with respect to the distribution and thickness of alluvium and peat.

Methodology was that described earlier in Burton (2006), Work Package (WP) B, but excluding resistivity and pH assessment. Fieldwork on pasture fields on Ivy House Farm was undertaken on 2 May 2008.

Additional data have been added to the soil datasets created during the earlier part of the project and this will enable the updating of the various GIS maps, including location of soil survey investigation sites and thickness of alluvium at investigation sites.

Studied were the soils and geology of two tributary valleys of the Sence Brook – a valley extending east-west from between Dadlington and Stoke Golding (Grid Ref. SP 397978 to 391980), and a valley running south-north west of Stoke Golding (SP 390974 to 391980) (Figure 1). The former has been associated with 'Segwelle hamm', '*a meadow bordering the wetland between Stoke Golding and Dadlington … where fen sedge would have grown*' (Foss 1988, p.32). '*…a water-meadow adjacent to marshland, and of a spring or even a pool formed by the issues and fringed by sedge.*' (Foss 1998, p.35). '*The 'well' itself may refer to a small freshwater mere that existed between the two hills … and which was later called the 'bath' on eighteenth-century maps of the locality. This gave its name to the Bath Meadows on the edge of Dadlington and Stoke parishes. Local records refer to 'fenn holes' in various places between areas of heathland in the valley to the north and west of Stoke Golding.*' (Foss 1988, p.32).

SUMMARY OF FINDINGS

Both the north-south aligned valley with a tributary from the east are very uniform in terms of soil and geology. They are flat-bottomed, floored by impermeable Wolston Clay (Lake Harrison glaciolacustrine deposits); above this is a thin layer of 'sand and gravel', thicker near to the brook in the west.

Alluvium fills the valley to a proven thickness of 65 to 110 cm (Sites 94–100, 102–105 & 109). Site 99, with a typical sequence of deposits, was cored to research an area of lush green growth showing on the air photo (Figures 2 and 3). Nowhere was found any peat, either a body sufficient in size to represent a 'marsh' with soft terrain, or forming a thin seam at the base of the alluvium, as was found in a limited number of locations in other valley sections. I walked the fields where I didn't bore and the surface looked similar throughout.

Three sites were located on areas of ridge and furrow (Sites 101, 106 & 108) as a check on the alluvial extent. Here the soil profiles have an upper subsoil of clayey drift (either Head or till) over Wolston Clay.

In isolation, the deposits of alluvium, Head, till and Wolston Clay, of quite different age and mode of formation, have similarities that may confuse the investigator; all are clayey and distinctly mottled with varying amounts of grey. The alluvium and Wolston Clay are normally stoneless, except near their lower and upper contacts, respectively. Layers of Head and till are thin, non-calcareous and usually contain a few stones, more common at the lower contacts. Wolston Clay has reddish-brown hues (Munsell 7.5YR) and below a decalcified upper part is usually calcareous with soft concentrations of secondary carbonate.

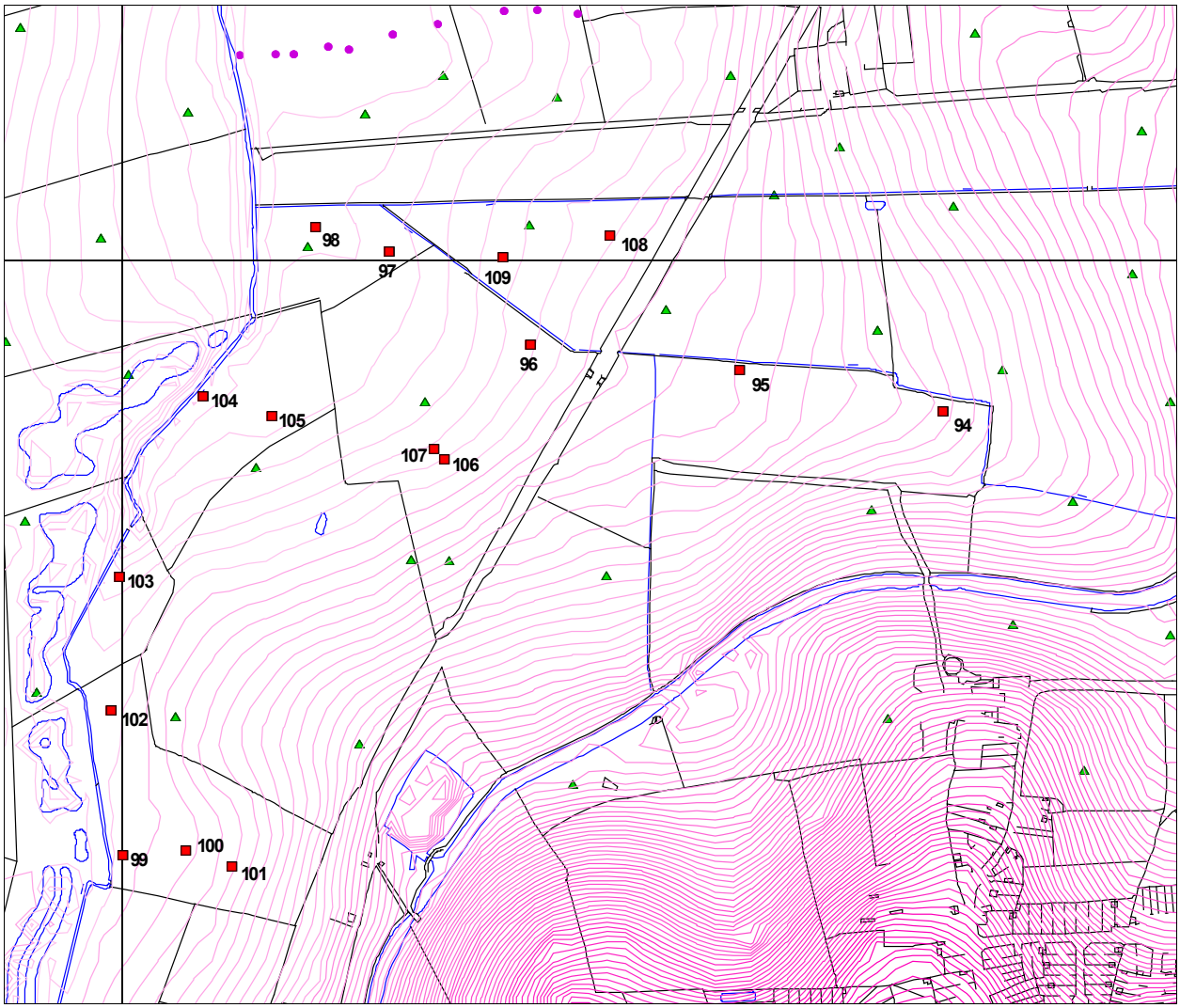

Figure 1. Location of the numbered investigation sites (square symbols, 94–109) on a contour and field-boundary base map. Corings by Birmingham University in the north are represented by circles and those of the original 1976 soil survey by triangles.

The Flandrian (post-glacial) sequence: Burton (2006, p.7) noted that the mapped boundaries of the deposits of alluvium on geological maps changed between the 1932 and later (digital) versions. A branch of alluvium from the Sence Brook near Greenhill Farm extending north-eastwards past the corner of Ambion Wood towards Sutton Cheney, shown on the 1932 paper map, has been omitted in the later maps. Additionally, the alluvium in the valleys studied here is considerably less extensive than shown on the later geological maps (BGS 1982 and 2005) and a little less extensive than on the Soil Survey map (Whitfield and Beard 1980). It is considered that some of the 1976 soil survey attributions to soil parent materials are incorrect, based on difficult recognition in widely spaced bores. However, the extent of alluvium for the valleys studied here is well represented by the 1932 geological map, and by **the lower limits of the ridge and furrow**, as mapped by Hall for this project.

The furlongs are difficult to detect in the field. The land is flat, the ridge and furrow has been flattened by modern ploughing, and the change from ridge and furrow to valley alluvium is practically imperceptible at the ground surface. However, the three bores I did in the 'open fields' part had different soils formed in drift over Wolston Clay. The edge of the alluvium was noted, for example, half-way between Sites 100 and 101 based on surface appearance and coring.

Figure 2. An area of lush green growth was targeted in the search for peat. Sites 99, 100 and 101 (see Figure 1) extended from west to east from the alluvium onto the former ridge and furrow (Source: Google Earth).

Figure 3. The soil profile at Site 99. Alluvium extends to 104 cm, over clay with sand patches and a few stones to 147 cm depth, over Wolston Clay to 162 cm depth.

Of great interest, but not relevant to the Battlefield location quest, is a small enclosed depression within the area of ridge & furrow (at 439287E 297825N, Site no. 107), about 6 x 12 m in size (Figure 4). Below a dark topsoil it contains 151 cm of recent alluvium, over 30 cm of grey alluvium with numerous bands of organic mud over Wolston Clay at 181 cm depth (Figure 5). In my opinion, it represents a pond that has been infilled naturally; the clay with organic bands may be Late-glacial (*i.e.* Windermere Interstadial) or Post-glacial in age. The organic material is a fine mud suggesting settling-out under water (*i.e.* in a pond) rather than peat forming in a fen. It looks to be an excellent palaeo-environmental record for the locality.

Figure 4. The enclosed depression site within the ridge and furrow area, with obvious elevation and vegetation differences. Site 107 is located in the centre of the depression.

Figure 5. The retrieved core between 125 and 187 cm depth, with organic-rich grey alluvial clay between upper recent alluvium and firm Wolston Clay below.

The new bore records (94 to 109) have been added to the spreadsheet for all my corings and I have changed the file name by adding _08 to the end, *i.e.* Soil_Survey_2005_06_07_08.xls. The worksheets I have amended are given in Table 1. I have also amended the spreadsheet Alluvium_thickness.xls, which if imported as a table into GIS using the legend file (.avl in ESRI) will show the relative thicknesses of alluvium in the district (as before, but now extended into this valley).

Table 1. Updated digital datasets provided for the project as spreadsheets (.xls).

Dataset	Digital Excel file	Worksheets	Content
All soil survey profile data updated	soil_survey_2005_06_07_08.xls	Auger bore details Auger for GIS Topsoil Topsoil_reddish (*) Auger summary Topsoil pH (*) EC raw data (*) EC res (*) Resistivity summary (*)	soil profile characteristics ditto suitable format for use in GIS characteristics of topsoil layers only topsoils which have reddish colours series symbol and subgroup for bores pH values of topsoils (limited data) electrical conductivity raw data results table summary table for use in GIS
Thickness of alluvium in cm	alluvium_thickness.xls	Alluvium thickness	thickness of alluvium at key bores for GIS

(*) not updated after this survey

RECOMMENDATIONS

Although there isn't a high density of bores, each one is fully described, recorded and photographed, but I cannot see there being any peat deposit in this part of the valley system. Therefore, I do not think it would be of any value to undertake further coring in these fields, unless it was to map the accurate extent of the alluvium with rapid, minimally recorded bores.

NOTICE

REFERENCES

British Geological Survey (1932) *Geology, Map Sheet 155 (Atherstone), Drift, scale 1:63,360*.

British Geological Survey (1982) *Digital Geology, Map Sheet 155 (Coalville), Bedrock and Superficial Deposits*. Keyworth, Notts.

British Geological Survey (2005) *Digital Geology, Map Sheet 155 (Coalville), Bedrock and Superficial Deposits. version 2*. Keyworth, Notts.

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Foss, P.J. (1998) *The Field of Redemore; the Battle of Bosworth, 1485*. Second Edition. Kairos Press, Leics.

Whitfield, W.A.D. and Beard, G.R. (1980) *Soils in Warwickshire IV: Sheet SP29/39 (Nuneaton)*. Soil Survey Record No. 66. Harpenden.

Additional report 2009

New Battlefield – soil information update
Rodney Burton

With the proposed new Bosworth Battlefield site being moved westwards, a review of additional soil information available was made. Soil data from the 1976 survey had been transcribed and mapped as far west as Easting 38 previously. Most of this area had not been visited by Rodney Burton during field investigations from 2005-08.

Further field notes and a field sketch map are available from which the spreadsheet for SP39 has been updated to cover the new Battlefield area. Bore-by-bore analysis is required to allow a remote assessment of the terrain. The new and amended worksheets are listed in Table 1.

The soil map for the whole study area (coloured by series and outline), the undrained soil wetness map and maps showing alluvium thickness, topsoil texture and distribution of reddish topsoils based on individual auger bores have been redrawn, as detailed in Table 2, and are presented as .jpg graphic files.

Table 1. Updated digital datasets provided for the project as spreadsheets (.xls).

Dataset	Digital Excel file	Worksheets	Content
Soil survey profile data for published soil map SP39 updated from fieldsheets and notes for 1x1km grid square 3798 and part of 3799	SP39_bores.xls	37 98 (new) 37 99 (new) SP39 (amended) SP39_Topsoil (amended) SP39_Red_Topsoil (amended) all other worksheets unchanged	soil profile characteristics for 1x1km sq soil profile characteristics for part of sq ditto in format for use in GIS for all SP39 characteristics of topsoil layers only topsoils which have reddish colours
Distribution of reddish coloured topsoils (redder than 10YR Munsell hue)	Reddish_topsoil.xls	Reddish_topsoil	auger bore locations of reddish topsoils
Thickness of alluvium in cm	Alluvium_thickness.xls	Alluvium_thickness	thickness of alluvium at key bores for GIS

Table 2. Updated digital datasets provided for the project as ArcView shapefiles (.shp) and legends (.avl).

Dataset	Digital file	Legend (for shapefiles)	Legend field
Soil map updated, coloured by series	Bosworth_soil_map.shp	soil_series2.avl	mapsymbol
Soil map updated, outline	Bosworth_soil_map.shp	soil_series_outline.avl	mapsymbol
Undrained soil wetness class	Bosworth_soil_map.shp	wetness_class.avl	wetness_cl
Thickness of alluvium classified	Alluv_thickness.shp	alluv_thickness.avl	alluv_cm
Reddish topsoil distribution	red_topsoils.shp	red_topsoil.avl	
Topsoil texture	sp39_topsoil.shp	texture_sp39.avl	texture

Conclusions

Figure 1 shows the updated (2009) Soil Series Map. Evidence from 1976 field notes shows an 'island' of till (Fc Flint soil series) that occurs in the broad valley in 1x1 km square 3798, shown on the geology map (as bedrock) but not on the published soil map. David Hall has some strips on the 'island'. No remaining peat is recorded in the vicinity.

The Soil Wetness Class map shows that most of the terrain (in its undrained state) is less poorly drained (Class 3 moderate) than further east; only the alluvium is Class 5 (poorly drained) with two soil units marginal to the valley (Sy Spetchley and Rg Rufford soil series) imperfectly drained, Class 4.

The classified thickness of alluvium map for individual bores gives a picture of the more significant occurrence of thicker alluvium (larger circles), and the absence of alluvium (crosses) where alluvium might have been expected. The thicker the alluvium, the longer or more severe the seasonal (*i.e.* winter to early spring) flooding is expected to have been.

The reddish topsoil distribution map shows much of the land flanking the main valley in square 3798 has Munsell hues redder than 10YR (mainly 9YR and 7.5YR). This may have some relevance to use of the name 'Redemore', as has been previously suggested.

The topsoil texture map shows that there are more light loamy (SZL) and medium loamy (CL, MCL) soils in this area, with clayey topsoils (C) being confined to the alluvium.

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Figure 1. Updated soil series map incorporating field data added for the 1976 survey, squares SP 3798 and 3799 – note donut shape of Fc, Flint series, added to alluvium in square 3798.