



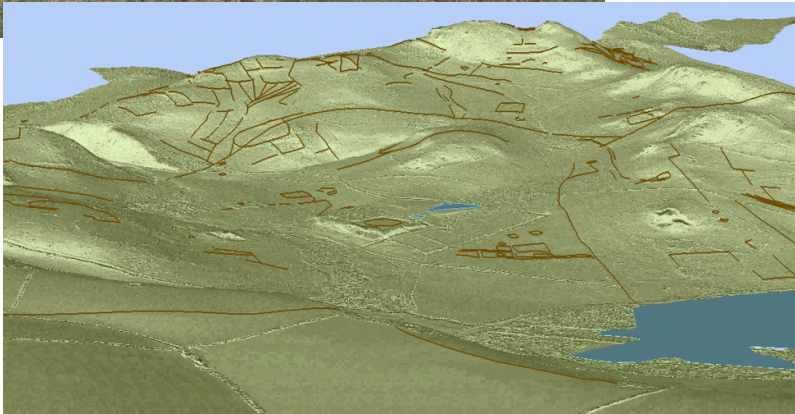
**University of  
Leicester**

**Archaeological Services**

**An Archaeological LiDAR study and Walkover Survey at  
Bradgate Park,  
Newtown Linford,  
Leicestershire.**

**NGR: SK 532 108 (centre)**

**Nick Hannon, Andrew Hyam  
& Matthew Beamish**



ULAS Report No.2014-076

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Bradgate Park, Newtown Linford,  
Leicestershire**

**NGR: SK 532 108 (centre)**

**N Hannon, A R Hyam and M G Beamish**

**For: Cookson and Tickner  
on behalf of the Bradgate Park Trust**

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ULAS Report Number 2014-076

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Accession Number X.A63.2014

## CONTENTS

Summary.....	6
Introduction.....	6
Background.....	6
The LiDAR study.....	7
Introduction.....	7
Section 1 - Methodology.....	8
Provision of LiDAR Data .....	8
LiDAR ASCII Data Processing .....	8
LiDAR LAS Data Processing .....	8
Aerial Photography .....	8
Digitisation of Newly Identified Features.....	9
Creation of Hillshade layers.....	9
Feature Identification.....	10
Principal Component Analysis .....	10
Sky-View Factor Analysis .....	11
Area Solar Radiation.....	11
Creation of Intensity Raster .....	11
Digital Resource.....	12
Section 2 - Results .....	12
Feature Type .....	12
Feature Dating.....	12
Feature Location .....	12
Focus Areas.....	12
Section 3 – Focus Areas.....	13
Focus Area Introduction .....	13
Thorn Spinney (Deer Sanctuary) .....	13
Bradgate House Gardens.....	13
East of Bradgate House.....	14
West of Hallgate Farm.....	14
West of Dale Spinney .....	14
Old John Tower.....	14
Tyburn.....	14
The Walkover Survey .....	22

Objectives .....	22
Methodology .....	22
Results .....	23
Area Sheet 1 .....	23
Area Sheet 2 .....	23
Area Sheet 3 .....	24
Area Sheet 4 .....	24
Area Sheet 5 .....	24
Area Sheet 6 .....	24
Area Sheet 7 .....	25
Area Sheet 8 .....	25
Area Sheet 9 .....	25
Summary of Results .....	36
Deer Meadow .....	37
Deer Sanctuary .....	37
Hallgates .....	38
High Park .....	38
Middle Park .....	38
The Low Park .....	39
Newtown Lawns .....	39
River Valley .....	40
Ruins Enclosure .....	40
Little Matlock .....	40
Significance .....	40
Erosion .....	42
Discussion .....	45
Publication .....	46
Acknowledgements .....	46
Bibliography .....	46
OASIS Information .....	47
Appendix 1: Walkover survey photos: .....	48
Appendix 2: Gazetteer of sites .....	74
	462

## FIGURES

Figure 1. Bradgate Park location .....	7
Figure 2: Showing LiDAR results, character areas, and LiDAR focus areas.....	13
Figure 3: Earthwork enclosure between Holly Plantation and Thorn Spinney. (Hillshade 225302 with false colour).....	15
Figure 4: Bradgate House Garden. Elevation data (above), Intensity data (below) revealing a possible circular feature signalled in the garden soils.....	16
Figure 5: Possible evidence of medieval settlement to the east of Bradgate House....	17
Figure 6: Ditch type features west of Hallgates Farm. (Hillshade 135/30/2 with false colour).....	18
Figure 7: Area of Pit type features west of Dale Spinney. PCA Altitude 30.....	19
Figure 8: Field systems, enclosures, and the line of the suspected 18th Century race-course around Old John (in yellow).....	20
Figure 9: In the south-west of the Park: the Pale in the east, Field Systems, Enclosures, Ridge and Furrow, and later drainage features. Hillshade 000302 with False colour.....	21
Figure 10: All features also showing location of sheets 1-9, with Hillshaded LiDAR data (false colour). LiDAR source: Environment Agency 2014.....	26
Figure 11 Area Sheet 1 with LiDAR interpretation. LiDAR source: Environment Agency 2014.....	27
Figure 12 Area Sheet 2 with LiDAR interpretation. LiDAR source: Environment Agency 2014.....	28
Figure 13 Area Sheet 3 with LiDAR interpretation. LiDAR source: Environment Agency 2014.....	29
Figure 14 Area Sheet 4 with LiDAR interpretation. LiDAR source: Environment Agency 2014.....	30
Figure 15 Area Sheet 5 with LiDAR interpretation. LiDAR source: Environment Agency 2014.....	31
Figure 16 Area Sheet 6 with LiDAR interpretation. LiDAR source: Environment Agency 2014.....	32
Figure 17 Area Sheet 7 with LiDAR interpretation. LiDAR source: Environment Agency 2014.....	33
Figure 18 Area Sheet 8 with LiDAR interpretation. LiDAR source: Environment Agency 2014.....	34
Figure 19 Area Sheet 9 with LiDAR interpretation. LiDAR source: Environment Agency 2014.....	35
Figure 20: Character Areas .....	37
Figure 21: Key sites as centre points .....	41

Figure 22: Path erosion across ditch and bank of undated enclosure (FL00447) to the north of Old John .....	43
Figure 23: MLE739 moated site (lodge?) Photo 3838 Looking NE .....	48
Figure 24: MLE 739 moated site (lodge?) Photo 3912 Looking N .....	48
Figure 25: MLE745 Bradgate House ruins Photo 3848 Looking NW.....	49
Figure 26: MLE745 ruins plus MLE746 chapel (on left) Photo 3849 Looking NE	49
Figure 27: MLE746 chapel Photo 3851 Looking SW.....	50
Figure 28: MLE747 fishpond Photo 3862 Looking E.....	50
Figure 29: MLE750 mill Photo 3970 Looking N.....	51
Figure 30: MLE756 possible remains of medieval settlement Photo 3901 Looking NW	51
Figure 31 :MLE9435 Late Upper Palaeolithic site Photo 3824 Looking NE .....	52
Figure 32: MLE9436 Mesolithic flint findspot Photo 3826 Looking SE .....	52
Figure 33: MLE14007 Garden wall Photo 3856 Looking SE.....	53
Figure 34: MLE14008 Tiltyard Photo 3853 Looking SE .....	53
Figure 35: MLE14009 Old John Tower Photo 3985.....	54
Figure 36: MLE14010 War memorial Photo 3987 .....	54
Figure 37: MLE18593 pheasantry Photo 3840 Looking NW.....	55
Figure 38: MLE18594 fishpond Photo 3863 Looking N.....	55
Figure 39: MLE18596 avenue of trees Photo 3870 Looking N.....	56
Figure 40: MLE18597 stables Photo 3845 Looking SE .....	56
Figure 41: MLE18598 dog kennels Photo 3842 Looking NE .....	57
Figure 42: MLE18599 gatehouse Photo 3897 Looking SE .....	57
Figure 43: MLE18600 gardens Photo 3860 Looking NW.....	58
Figure 44: MLE18601 watermeadow Photo 3910 Looking SE.....	58
Figure 45: MLE18602 deer barn Photo 3972 Looking SE .....	59
Figure 46: MLE18603 leat (adjacent to river) Photo 3830 Looking E .....	59
Figure 47: MLE18603 leat Photo 3831 Looking NE.....	60
Figure 48: MLE18603 leat Photo 3833 Looking E.....	60
Figure 49: FL00006 enclosure Photo 3867 Looking S .....	61
Figure 50: FL00009 small moated site Photo 3908 Looking W .....	61
Figure 51: FL00016 ditched enclosure Photo 3916 Looking SE.....	62
Figure 52: FL00018 enclosure Photo 4171 Looking N.....	62
Figure 53: FL00019 moat/building Photo 4165 Looking NW.....	63
Figure 54: FL00055 ditch Photo 3874 Looking S.....	63
Figure 55: FL00446/7 enclosure Photo 4021 Looking E.....	64

Figure 56: FL00451 square enclosure Photo 4037 Looking NE.....	64
Figure 57: FL00452 bank/terrace Photo 4035 Looking S.....	65
Figure 58: FL00454 pits Photo 3968 Looking NW .....	65
Figure 59: FL00483 ditch Photo 4176 Looking E .....	66
Figure 60: FL00490 bank Photo 4141 Looking SW .....	66
Figure 61: FL00534 bank Photo 4078 Looking W .....	67
Figure 62: FL00553 bank Photo 4147 Looking NE.....	67
Figure 63: FL00554 bank/stones Photo 4157 Looking S.....	68
Figure 64: FL00562 bank Photo 4113 Looking N .....	68
Figure 65: FL00593ditches Photo 4002 Looking W.....	69
Figure 66: FL00612 pale Photo 3880 Looking W .....	69
Figure 67: FL00619 bank Photo 4070 Looking SW .....	70
Figure 68: FL00635 enclosure Photo 3950 Looking NW .....	70
Figure 69: FL00639 pale Photo 3966 Looking W .....	71
Figure 70: FL00647 ditch Photo 3935 Looking W .....	71
Figure 71: FL00655 banks Photo 4025 Looking W.....	72
Figure 72: W005 sunken feature/saw pit? Photo 3890 Looking S.....	72
Figure 73: W007 bank/ditch Photo 3942 Looking E .....	73
Figure 74: W009 stables Photo 3980 Looking N.....	73

## TABLES

Table 1: User defined fields on BP_LiDAR_Features .....	9
Table 2: Hillshade parameters for the four basic hillshades used.....	10
Table 3: Classification of features (excluding ridge and furrow and racecourse features).....	12
Table 4: Details of the LiDAR focus areas.....	12
Table 5: Character Areas by Plan sheet .....	23
Table 6: No of Records per Character Area. Some records cross a number of character areas. ....	36
Table 7: Key sites.....	42
Table 8: Erosion areas noted during walkover survey and subsequently .....	44

## **An Archaeological LiDAR study and Walkover Survey at Bradgate Park, Newtown Linford, Leicestershire.**

**Leicestershire.**

Nick Hannon, Andrew Hyam and Matthew Beamish

### **Summary**

*An archaeological LiDAR study and walkover survey was carried out by the University of Leicester Archaeological Services (ULAS) at Bradgate Park, Newtown Linford, Leicestershire. Analysis of the LiDAR data flown in January 2014 identified over 250 potential earthwork sites that are not within official records. These features and the known archaeological sites within the park were visited during a walkover survey undertaken between the 2nd and 9th of April. Features investigated included the deer park Pale, earthwork enclosures some of which appear to predate medieval features, undated terrace systems, multiple hollow ways or gullies, a possible village-type earthworks, moated sites, an 18th Century racecourse and evidence suspected to stem from activity during the Second World War. Because of the non-intrusive method of investigation and recording many of the features are, as yet, undated.*

The archive will be deposited with Leicestershire Museums Service under Accession Number X.A63.2014

### **Introduction**

This document forms the report for a LiDAR study and an archaeological walkover survey carried out at Bradgate Park, Newtown Linford, Leicestershire, NGR SK 532 108 (centre). The surveys are part of a larger scheme which intends to better understand the varied ecology and heritage of Bradgate Park designed to enable the park to enter into High Level Stewardship (HLS) with Natural England. This survey aims to identify and validate a range of potential archaeological features identified by a recent LiDAR survey along with those already existing on the HER. This work has accompanied the test pit evaluation of a known Late Upper Palaeolithic site within the park by ULAS which is reported separately (Cooper & Harvey 2014 ULAS Report 2014-090).

The work has been commissioned by Cookson and Tickner on behalf of the Bradgate Park Trust.

### **Background**

Bradgate Park lies approximately 4km to the north-west of the City of Leicester (Figure 1). Bradgate Park is currently used as a popular recreational park and attracts a wide range of visitors throughout the year. It forms one of the key leisure destinations for the population of Leicester as well as attracting visitors from beyond the county boundaries.

The park covers an area of approximately 830 acres and has evidence of human activity extending as far back as the Upper Palaeolithic, with some material of Mesolithic date also found within the park. Records for prehistoric activity are otherwise absent from within the park, although there is some evidence for later prehistoric activity in areas surrounding the park, and some evidence of activity in the area in the Roman period. Bradgate Park was first enclosed to form a deer park in 1241 although the original boundaries have since evolved and changed to form the larger area now used as the park. During the medieval period the park formed part of the Manor of Groby and its larger estate. The well-known Grey family owned the manor in the mid-15th century and it was this family who commenced building an unfortified brick-built house in 1499. The house ruins, which were subsequently modified and extended, form a centre-piece to the park as it exists today. After 1719 the park was no longer used as a residence and began to be used exclusively as a sporting estate. Remnants of a horse racing track around Old John still survive from this period (Figure 8). Access to the park by the general public only



began in 1928 when a local industrialist, Mr Charles Bennion, purchased the park. He then presented the park, in trust, to be managed for the benefit of the people of Leicestershire and visitors to the county. It is suspected that during the Second World War part of the park was used for military exercises and training which has further added to its significant place in the history of Leicestershire although the extent and duration of this activity appears little researched.

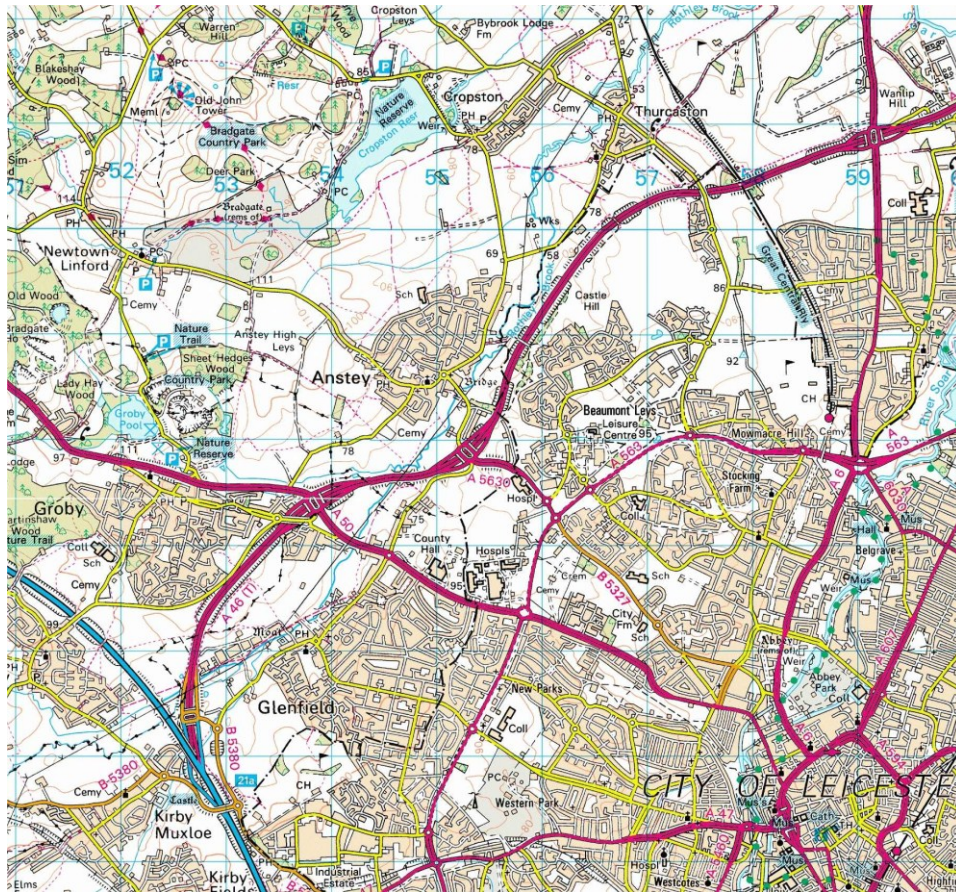


Figure 1. Bradgate Park location

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## The LiDAR study

### Introduction

An aerial LiDAR scan was commissioned from the Environment Agency by ULAS on behalf of the Bradgate Park Trust. It was anticipated that this survey would enable the confirmation of known and suspected sites (other researchers have been active within the park cf. Hartley and Squires forthcoming), and to aid in the identification of previously unrecognised sites within the area of the park. The LiDAR was flown in January 2014 and supplied to ULAS in April 2014. Following swift and intensive processing and analysis of the LiDAR data the walkover survey was undertaken to investigate and record each known record, and potential new sites identified by the LiDAR survey (Figure 10).

## ***Section 1 - Methodology***

### *Provision of LiDAR Data*

The LiDAR data was supplied by the Environment Agency electronically in ASCII file format and it consisted of two distinct types; HYBRID\_DTM.asc and .las. Both of these file types covered the same geographic area and in the case of the HYBRID\_DTM data had already been part-processed, gridded and geo-referenced by the EA. The HYBRID\_DTM.asc data was a digital terrain model (DTM) and the .las a point cloud file. The DTM, which was supplied at a resolution of 0.5m provides elevation information of the earth's surface but has been processed by remove obstructions such as buildings and vegetation and provide a 'bare-earth' model. If the removal of obstructions left gaps in the surface data then these were left as "no data" areas. The .las file was the original point cloud data and not only contained elevation information but also contained various other readings obtained during the LiDAR flight including intensity data. This data had not been gridded into a raster format by the EA.

For the purposes of this project the HYBRID\_DTM data was processed for its elevation values, as this is the most informative from an archaeological perspective, and the .las was interrogated for its *intensity* data which can give indications on the quality of the reflective surface.

### *LiDAR ASCII Data Processing*

Unless otherwise stated, all operations were conducted in Esri ArcMap10.1 SP1 build 3143.

The EA provided a single HYBRID\_DTM.asc file for the project area. This file was imported into ArcGIS using the ASCII to Raster function (System Toolboxes>Conversion Tools>To Raster>ASCII to Raster), the output data type was set to "Float" and the output raster filename was set to LiDAR\_05m\_2014. This file was placed in a newly created file geodatabase called "BP\_Data.gdb". The raster was already in a metre format so no further conversion was required.

### *LiDAR LAS Data Processing*

The EA provided a single .las file for the project area. This file was imported into ArcGIS using the Create LAS Dataset function (System Toolboxes>Data Management Tools>LAS Dataset>Create LAS Dataset). The .las file was set as the input file and the output file name was set as LiDAR\_05m\_2014\_LAS; all other settings left at default. This created a .lasd file in the ArcGIS folder within the User Documents folder.

Following the creation of the LAS dataset a new layer is automatically added to the TOC (Table of Contents window). The next stage of the process was to right-click on the layer in the TOC and set the filters (Layer Properties>Filters) as a bare-earth model was required "Ground" was chosen from the predefined Settings. To confirm this change "OK" was pressed.

Scheduled monuments were downloaded from English Heritage ([www.english-heritage.org.uk/professional/protection/process/spatial-data/](http://www.english-heritage.org.uk/professional/protection/process/spatial-data/)); this data was received in shapefile format and was imported into "BP\_Data.gdb" being called BP\_Scheduled\_Monument, this data covered an area greater than the survey area so was reduced to only contain information within the survey area using the clip function (Geoprocessing>Clip) using LiDAR\_05m\_2014 as the extent. The resultant shapefile was named Scheduled\_Monument\_Clip and saved to "BP\_Data.gdb"

Leicestershire County Council also provided a copy of HER in digital format via Cookson and Tickner. This was formed of three shapefiles, each name LeicsHER, one being a point file, one a line file and third a polygon file, these files were imported to "BP\_Data.gdb". Again the data covered an area greater than the survey area so was reduced to only contain information within the survey area using the clip function (Geoprocessing>Clip) using LiDAR\_05m\_2014 as the extent. The resultant shapefiles were named BP\_LeicsHER\_Clip and saved to "BP\_Data.gdb".

### *Aerial Photography*

A high quality, vertical aerial photograph was supplied by Cookson and Tickner which covered the vast majority of the project area; this was imported in to the file geodatabase called "BP\_Data.gdb" and added to the TOC, the original TIFF file was already geo-referenced so no further processing was required.

*Digitisation of Newly Identified Features*

The project required the digitisation of any feature believed to be of archaeological interest, to facilitate this a polyline shapefile was created called “BP\_LiDAR\_Features”, this had its spatial reference set to British National Grid and saved in “BP\_Data.gdb”. “BP\_LiDAR\_Features” was created with twelve additional fields (Table 1)

Table 1: User defined fields on BP\_LiDAR\_Features

Field Name	Data Type	Length	Default Value
Notes	String	50	N/A
Line_Feature_ID	String	50	N/A
X_Coord	Float	N/A	N/A
Y_Coord	Float	N/A	N/A
Start_X_Coord	Float	N/A	N/A
Start_Y_Coord	Float	N/A	N/A
End_X_Coord	Float	N/A	N/A
End_Y_Coord	Float	N/A	N/A
LiDAR_Domain	String	50	N/A
MONUID	String	10	N/A
Validated	String	3	No

Digitisation of newly identified features was achieved manually in a process detailed below. The Notes field was used to record a short description of the feature and was manually generated. The Line\_Feature\_ID was to record a unique ID for each identified feature, this was manually generated in an incremental fashion (e.g. FL00001, FL00002) as features were digitised.

X\_Coord and Y\_Coord were used to record the coordinates of the features midpoint; once all features were digitised these fields were populated using the “Calculate Geometry” facility on the attribute table, with the property field set to X or Y Coordinate of Midpoint as required. The Start\_X\_Coord, Start\_Y\_Coord, End\_X\_Coord and End\_Y\_Coord fields were populated in a similar fashion using the appropriate property setting in “Calculate Geometry”.

The LiDAR\_Domain field was used to identify which LiDAR flight the feature appeared within, where a feature appeared in more than one LiDAR flight the date of the newer flight was taken. Once all features were digitised this field was populated using the “Select By Location” function (Selection>Select By Location), with selection method set to “select features from”, the Target layer set to “LiDAR\_Features”, the Source layer set to each LiDAR flight individually using the outline shape files (e.g. LiDAR\_1m\_2011\_Outline) previously created, working from the newest to oldest, and the Spatial selection method set to “have their centroid in the source layer feature”. This selected features which appeared within each LiDAR flight, the selected features then had the LiDAR\_Domain field updated within the attribute table using the Field Calculator.

The “MONUID” field was included to mirror a similar field in the local authorities HER, during project this field was not populated and was included to allow the local authority to add a HER number once any given feature has been designated.

The “Validated” field was included to allow field observations to be recorded following the intended fieldwork which will commence once the LiDAR identification process is completed. During this project the field was left at its default value “NO”.

*Creation of Hillshade layers*

The main aim of the project was to identify archaeological features within the Bradgate Park study area. To aid feature identification, eight basic hillshade layers were generated for the LiDAR flight. Hillshades are a facility available in most GIS which allow an artificial sun to be shone from any

chosen compass bearing and from angle above the horizon onto a DEM. This process helps identify ground features by casting an artificial shadow behind changes in elevation, for a full discussion of the process see (Bewley et al 2005).

Each of these layers were created using the hillshade function (System Toolboxes>Spatial Analyst Tools>Surface>Hillshade). The input raster for each hillshade was LiDAR\_05m\_2014. Three basic parameters were utilised to generate the eight different hillshade views, the setting for which can be seen in table 3. Azimuth relating to the compass bearing, Altitude relating to the angle from the horizon and Z factor relating to the degree of exaggeration applied to the input DEM, with 1 indicating no exaggeration.

Table 2: Hillshade parameters for the four basic hillshades used

Suffix	Azimuth	Altitude	Z factor
_HS_000_30_2	000	30	2
_HS_045_30_2	45	30	2
_HS_090_30_2	90	30	2
_HS_135_30_2	135	30	2
_HS_180_30_2	180	30	2
_HS_225_30_2	225	30	2
_HS_270_30_2	270	30	2
_HS_315_30_2	315	30	2

Each output raster was named to preserve the original input DEM information and include the hillshade parameters (e.g. LiDAR\_05m\_2014\_HS\_315\_30\_2) and saved to “BP\_Data.gdb”. Once all eight hillshades were generated these were grouped within the TOC to aid navigation.

#### *Feature Identification*

Once the basic hillshade layers had been generated for each LiDAR flight, each OS 1km grid was systematically analysed for potential archaeological features, working from north to south and west to east. This was achieved cycling through each of the eight hillshade layers for each grid square individually. The shapefile layers containing both the HER and scheduled monument data were enabled to prevent re-identification of an already recorded archaeological feature. If a potential feature was identified this was then compared with both modern and historic OS information to see if a modern explanation could be established for each potential feature. If no modern explanation could be identified within the OS information then the area's aerial photography layer was viewed to see if this could help provide an explanation.

If a potential feature could not be explained using the above methods then it was recorded as potentially archaeological, this was achieved by adding it to the “BP\_LiDAR\_Features” layer by tracing the features outline. A short description was added to the “Notes” field and a “Feature\_Line\_ID” assigned. This method was used until all areas covered by the LiDAR data were interrogated.

#### *Principal Component Analysis*

Deveraux et al (2007) have demonstrated that the use of Principle Component Analysis (PCA) can be an effective method of identifying subtle archaeological features within LiDAR data. This process effectively combines hillshade layers, providing one overall view which highlights features only visible as parts from different lighting angles. Therefore following the principles detailed in their paper PCA were carried out for each of the focus areas.

The PCA was created using the Principal Components function (System Toolboxes>Spatial Analyst Tools>Multivariate>Principal Components). The PCA layer was generated using the project area hillshade layers detailed above as the input rasters. The “Number of Principal components” parameter was set at eight to mirror the number of input rasters used and the “Output multiband raster” was

named to preserve the identity of the input raster and indicate which altitudes were being combined (e.g.. LiDAR\_05m\_2014\_PCA\_Altitude\_30).

Following the creation of the PCA layer, bands 1-3 were again interrogated and potential features recorded in the same manner as is detailed above for the initial feature identification process. Each PCA's band can be changed by altering the layers band setting (Layer Properties>Symbology>Stretched>Band) generally only band 1-3 are useful for archaeological feature identification, although the number of bands created is set by the "Number of Principal components" parameter detailed above.

#### *Sky-View Factor Analysis*

An alternate to the PCA process detailed above is the use of Sky-View Factor (SVF) (Zakšek et al 2011). This method, instead of applying false shadows to a surface, calculates the volume of sky visible from a given position, a position at the bottom of a ditch affords a lower level of visibility to one atop a mound. This method produces a raster layer showing the volume of sky visible from each position within the raster which can highlight subtle archaeological features. SVF is not a function available in ArcMap, therefore a free to use version of the tool is available online (<http://iaps.zrc-sazu.si/index.php?q=en/svf>).

To utilise the tool the DEM for the project area was exported as a TIFF. This was achieved by right-clicking on the DEM layer within the TOC (Data>Export Data) selecting a destination for the TIFF file and leaving all other parameters at default. Once the TIFF had been exported the SVF tool was run. The exported TIFF was used as the input DEM and Search Radius was left at the default 10. The Vertical exaggeration was set to either 1, 2 or 3 and Direction set to either 16 or 32, multiple Sky-Views were run for each focus area using a range of values. The tool created an output TIFF file which reflected the name of the input DEM and settings used (e.g. LiDAR\_05m\_2014\_SVF\_d32\_r10\_ve3). This TIFF was then imported into ArcMap and added to the TOC

Following the creation of the SVF, these were again interrogated and potential features recorded in the same manner as is detailed above for the feature identification process.

#### *Area Solar Radiation*

A further method used to identify archaeological features within the focus areas was Area Solar Radiation (ASR). This method derives the volume of incoming solar radiation from an input raster surface and in a way similar to the previous two methods (Rich & Fu 2000). Although this method was not originally intended for archaeological research it can be an effective way of identifying subtle features.

The ASR were created using the Area Solar Radiation Tool (System Toolboxes>Spatial Analyst Tools>Solar Radiation>Area Solar Radiation), the focus areas DEM was used as the input raster and output rasters named to reserve the identity of the input DEM (e.g. LiDAR\_05m\_2014\_ASR), all user definable parameters were left at default.

Following the creation of the ASR layer, this was again interrogated and potential features recorded in the same manner as is detailed above for the feature identification process.

#### *Creation of Intensity Raster*

The above methods all utilised the elevation data gathered during the LiDAR to identify potential archaeological features. An alternative method is to utilise the LiDAR intensity data, this records the amount of light returned to the LiDAR receiver from each pulse emitted and can help identify area of differential vegetation growth and thus has the potential to identify areas of sub-surface archaeology (see Challis et al 2011)

The intensity raster was created using the LAS dataset to Raster function (System Toolboxes>Conversion Tools>To Raster>LAS Dataset to Raster). The input LAS dataset used was LiDAR\_05m\_2014\_LAS.las, the output raster was named LiDAR\_05m\_2014\_INT and saved in "BP\_Data.gdb". The Value Field was set to INTENSITY and Interpolation Type set to AVERAGE/NATURAL\_NEIGHBOR. Output Data Type was set as FLOAT and Sampling Type set as CELLSIZE. The Sampling size was set to 0.4, this is essentially the resolution of the layer, this need to be about 20% less than the resolution of the gridded LiDAR data used to create the hillshades above.

Following the creation of the Intensity layer, this was again interrogated and potential features recorded in the same manner as is detailed above for the feature identification process.

#### *Digital Resource*

All files discussed above are available in digital format via a file geodatabase compatible with ArcGIS10.1. The database is:

⑩ BP\_Data.gdb

There is also a map file which contains the TOC in the format discussed above, this is named Bradgate\_LiDAR.mxd: this is compatible with ArcGIS10.1.

## **Section 2 - Results**

#### *Feature Type*

No formal classification scheme was adopted for the project: the possible identity or interpretation of potential features was recorded in the notes field of the LiDAR\_Features shapefile. This is due to the difficulty in establishing the identity of the feature from LiDAR data alone and the need for first-hand validation (discussed below). However if the data is broken down into broad features types (Table 3) then it can be seen a large majority of the features are either banks or ditches.

Table 3: Classification of features (excluding ridge and furrow and racecourse features)

<b>Feature Type</b>	<b>Quantity</b>
Bank	166
Ditch	117
House Platform	18
Mound	8
Pit	35
Track	4
<i>Total</i>	<i>348</i>

#### *Feature Dating*

The assignment of dating to potential features through LiDAR data alone is notorious difficult and inaccurate, therefore during this phase of the project little attempt has been made to assign dates to any potential feature identified. However the assignment of broad time periods such as prehistoric or medieval has been applied in some cases and relative phases have been applied for examples where overlying phasing can be observed.

#### *Feature Location*

Potential archaeological features were identified throughout the Park, however their density became lower towards the parks centre (Figure 10). Notable areas of concentration were around the ruined house, around Old John Tower and Tyburn, although other smaller groups of features were also observed.

#### *Focus Areas*

Following the initial phase of feature identification, seven focus areas were chosen for further investigation. Greater time was taken to search these areas to aid fuller identification of the features within. A list of the focus areas and their locations and relevant character area can be seen in Figure 2 and Table 4.

Table 4: Details of the LiDAR focus areas

<b>Focus Area</b>	<b>Character Area</b>	<b>Location</b>
Old John	High Park	SK 525 112
Bradgate House Garden	Ruins Enclosure	SK 534 102
Tyburn	High Park/Middle Park	SK 524 105
West of Hallgate Farm	High Park	SK 539 114
Thorn Spinney	Deer Sanctuary	SK 533 098
East of Bradgate House	Low Park	SK 537 104

### Section 3 – Focus Areas

#### Focus Area Introduction

The following section contains a summary of the key features located within the focus areas detailed above. It provides examples of the types of evidence which can be gained through the use of LiDAR data. Each area is accompanied by a detailed illustration.

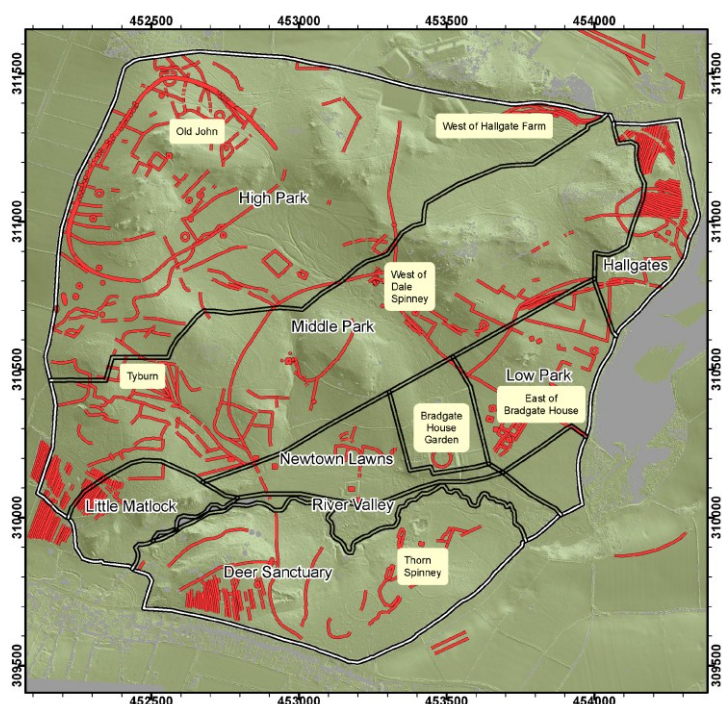


Figure 2: Showing LiDAR results, character areas, and LiDAR focus areas.

#### Thorn Spinney (Deer Sanctuary)

On a small hilltop between Holly Plantation and Thorn Spinney lies a large ditched enclosure measuring c.140m by c.55m (Figure 3). The irregular form of the enclosure would be entirely consistent with a late prehistoric date although the wide south-facing entrance is uncommon. The eastern portion of this enclosure is overlain by the avenue of trees representing the park's early main entrance (MLE18596) showing the enclosure's early origins. This enclosure had in part been observed during recent study of aerial photographs and field observations (Hartley & Squires forthcoming).

#### Bradgate House Gardens

Immediately to the east of the house ruins lies an area of formal garden. The LiDAR elevation data clearly details the 16th century parterres (Stevenson & Squires: 1999 30) which provide the garden's formal backbone (Figure 4). However analysis of the intensity data for this area has revealed a further pattern: concentric with the visible small circular area in the centre of the garden is a larger circle with what appears to be spokes radiating from the centre. This feature has no topography and only appears as an intensity response, therefore it may be the shadow of an earlier design of formal garden long since forgotten. Geophysical survey is planned to provide further information on this feature.

#### *East of Bradgate House*

To the east of the house ruins lies an area of rough grassland (Figure 5). When the LiDAR data for this area is examined an area of disturbance became apparent. Running north-west to south-east there is what appears to be a Holloway (a path or track that has become sunken through use) which now runs in to the reservoir. A T-junction is also present with a branch running south-west towards the house's gardens. To the west of this branch appear a number of roughly square enclosures which may form house platforms. This area is overlain by the latter avenue of trees (MLE18595) running east from the house so is of earlier origin. This complex of features may represent a Deserted Medieval Village, possibly the lost village of Bradgate, previously believed to have been under Cropston Reservoir (Stevenson & Squires 1999: 14). Alternatively this may be the location of builders lodgings associated with the construction of the house.

#### *West of Hallgate Farm*

In the eastern area of the park, immediately west of Hallgate Farm is a complex of sinuous east-west ditches (Figure 6). These have in part previously been identified during field observations (Stevenson \* Squires 1999 p72) but the full extent has now been revealed. A similar arrangement of previously unknown ditches can also be seen to the south of Coppice Plantation and these may well be associated. The function of these ditches is unknown, however no trace can be seen of the spoil removed during their cutting. Evidence of use of the park in the Second World War is starting to emerge, with the definite use of Bren Gun Carriers in June 1942, and it is possible that some earthworks result from activity at this time.

#### *West of Dale Spinney*

Towards the centre of the park are a number of circular pits measuring between 1m and 4m in diameter (Figure 7), the pits form four groups two clusters and two rows which appear to align to and post-date a long ditch and bank heading south-east from the site. The function of these features is unknown although suggestions have been made that they are prehistoric in origin (Hartley and Squires forthcoming) (see below p24).

#### *Old John Tower*

In the north of the park, in an area around Old John Tower the LiDAR analysis has revealed a complex field system radiating from the hilltop (Figure 8). This system comprises of a number of low banked boundaries and areas of terracing, in some places containing circular responses which may represent house platforms. This field system is related to an enclosure position to the north of the hill. This enclosure had previously been identified during field observations however the associated field boundaries had not been identified. The form of this field system suggests a prehistoric date. Encircling Old John, the route of an 18th Century racecourse has been identified. The route corresponds well with that shown on a 19th Century Estate Map (Ramsey 2011 p37).

#### *Tyburn*

Further south in the area between Tyburn and Elder Plantation lies a second area of field system (Figure 9). This area whilst almost adjoining the field system discussed above appear different in character, with more angular boundaries and a greater degree of terracing. The area at the centre of this system has been heavily disturbed by the fan of later land drains. The difference in form suggests a different phase from the more northerly system. The form of this system suggests a possible Iron Age date with similar examples being recorded at locations such as Skomer (Piggott 1981: 119 fig 21).



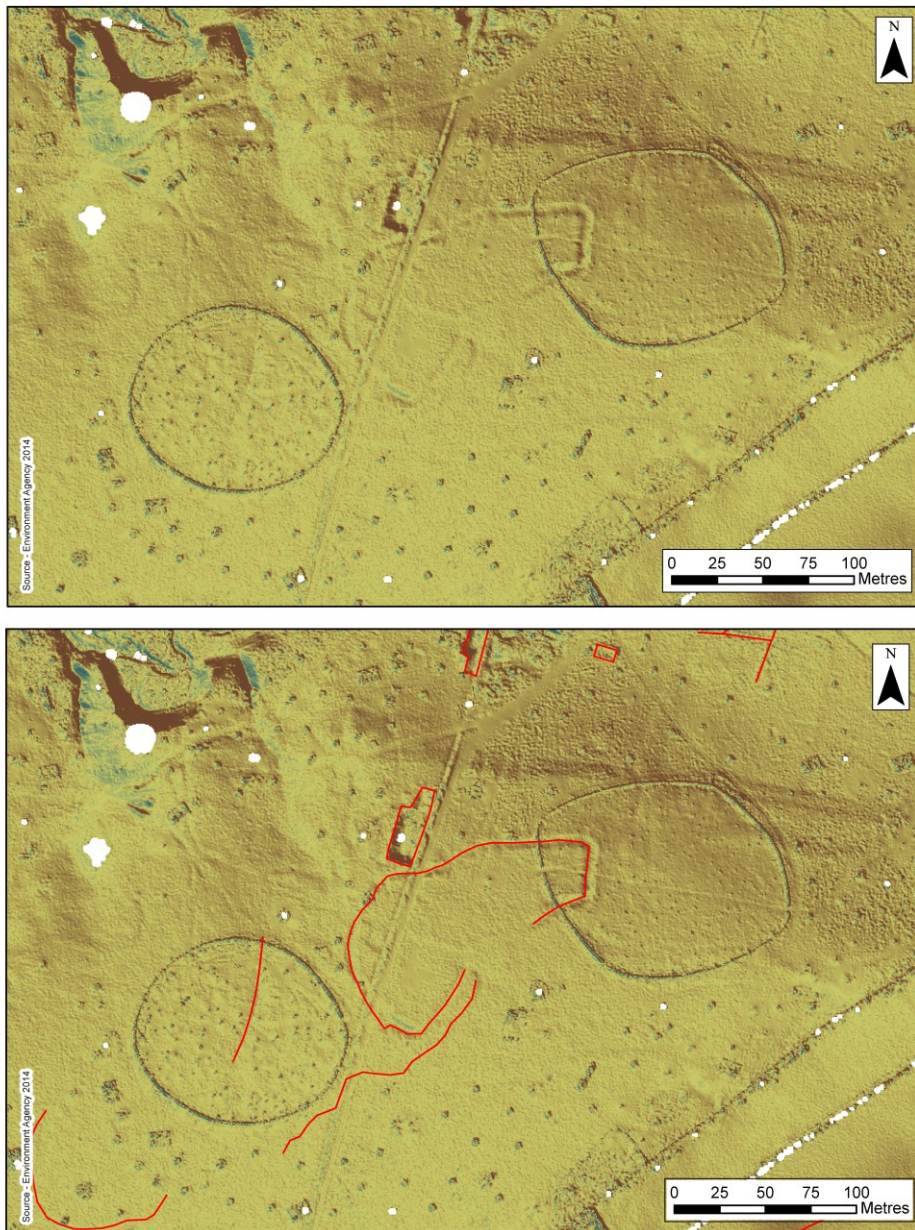


Figure 3: Earthwork enclosure between Holly Plantation and Thorn Spinney. (Hillshade 225302 with false colour)

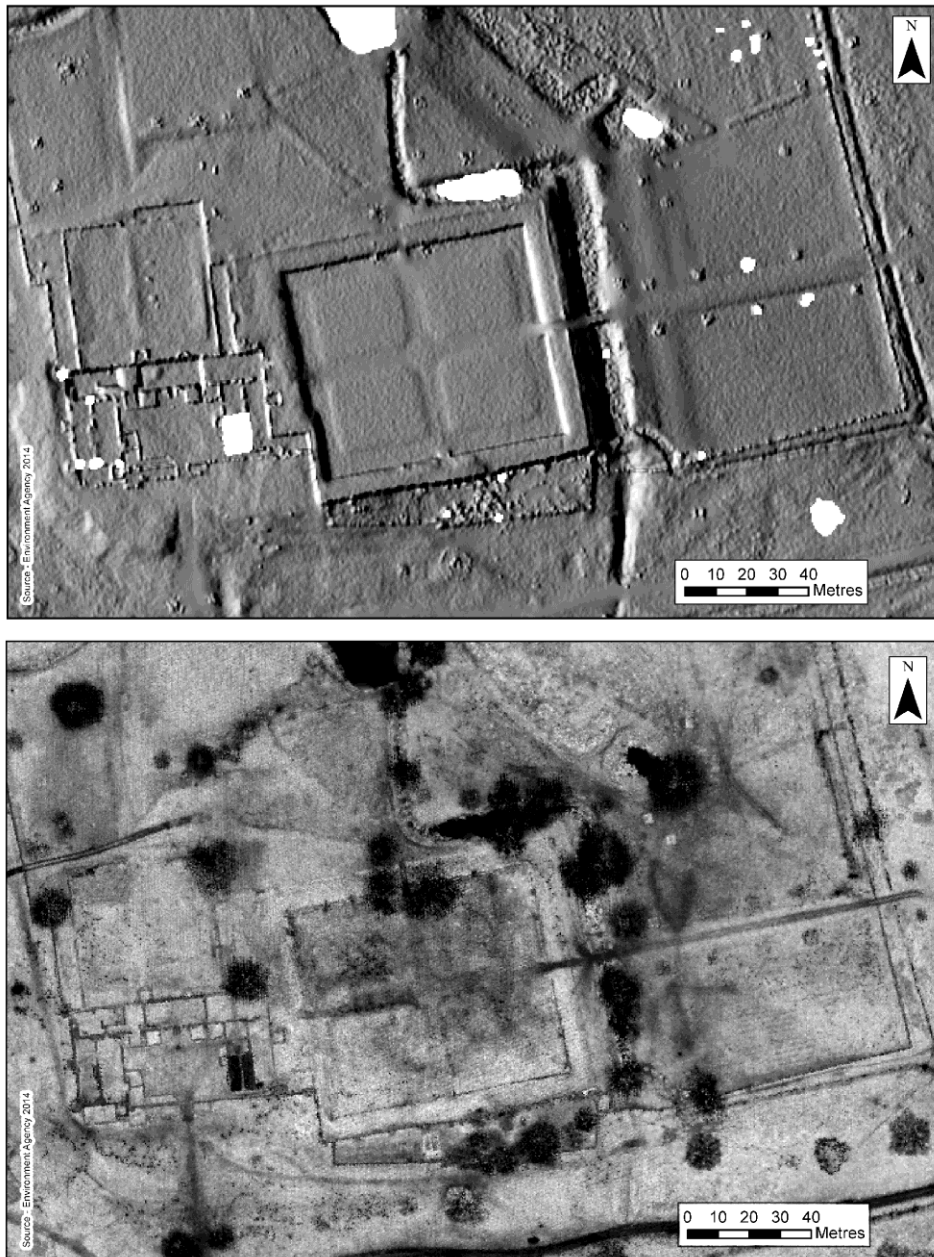


Figure 4: Bradgate House Garden. Elevation data (above), Intensity data (below) revealing a possible circular feature signalled in the garden soils.

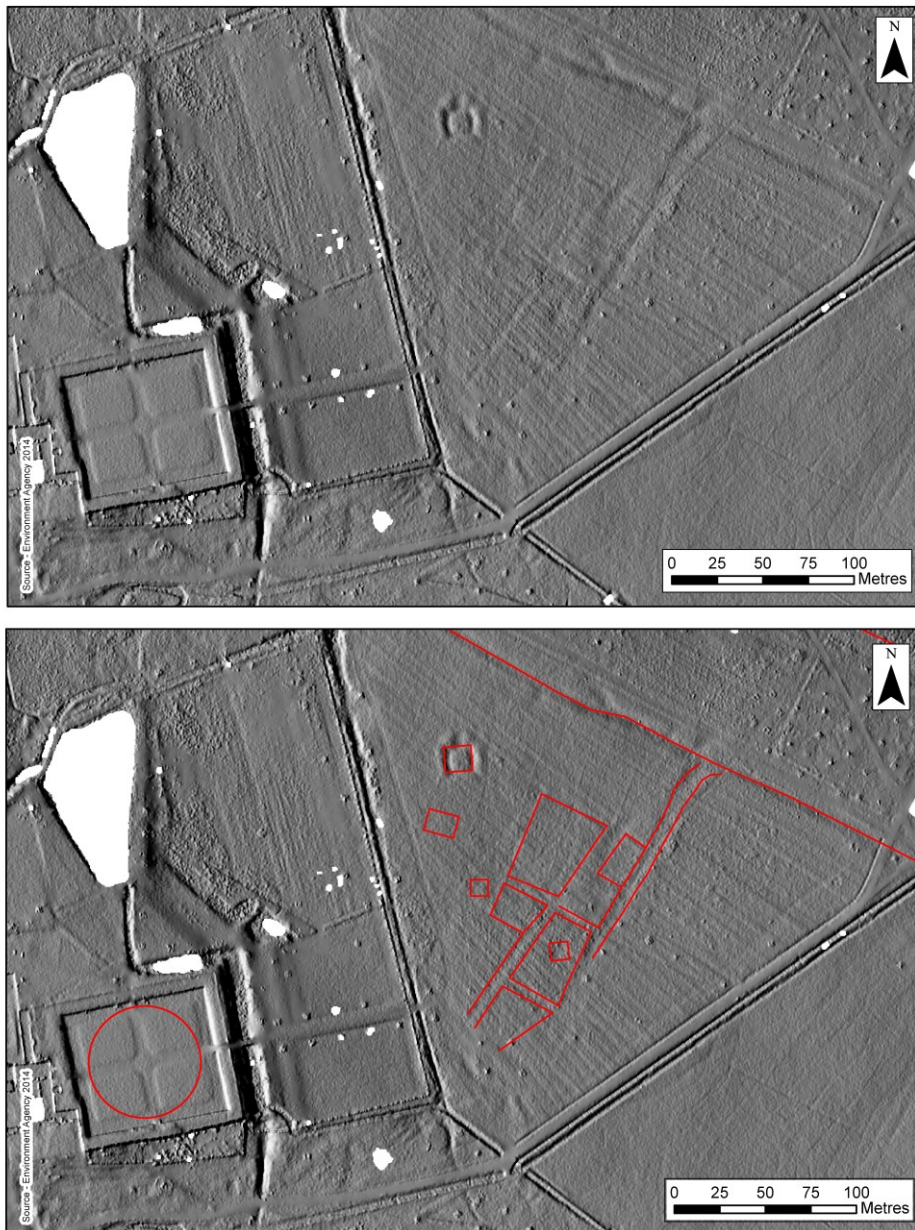


Figure 5: Possible evidence of medieval settlement to the east of Bradgate House

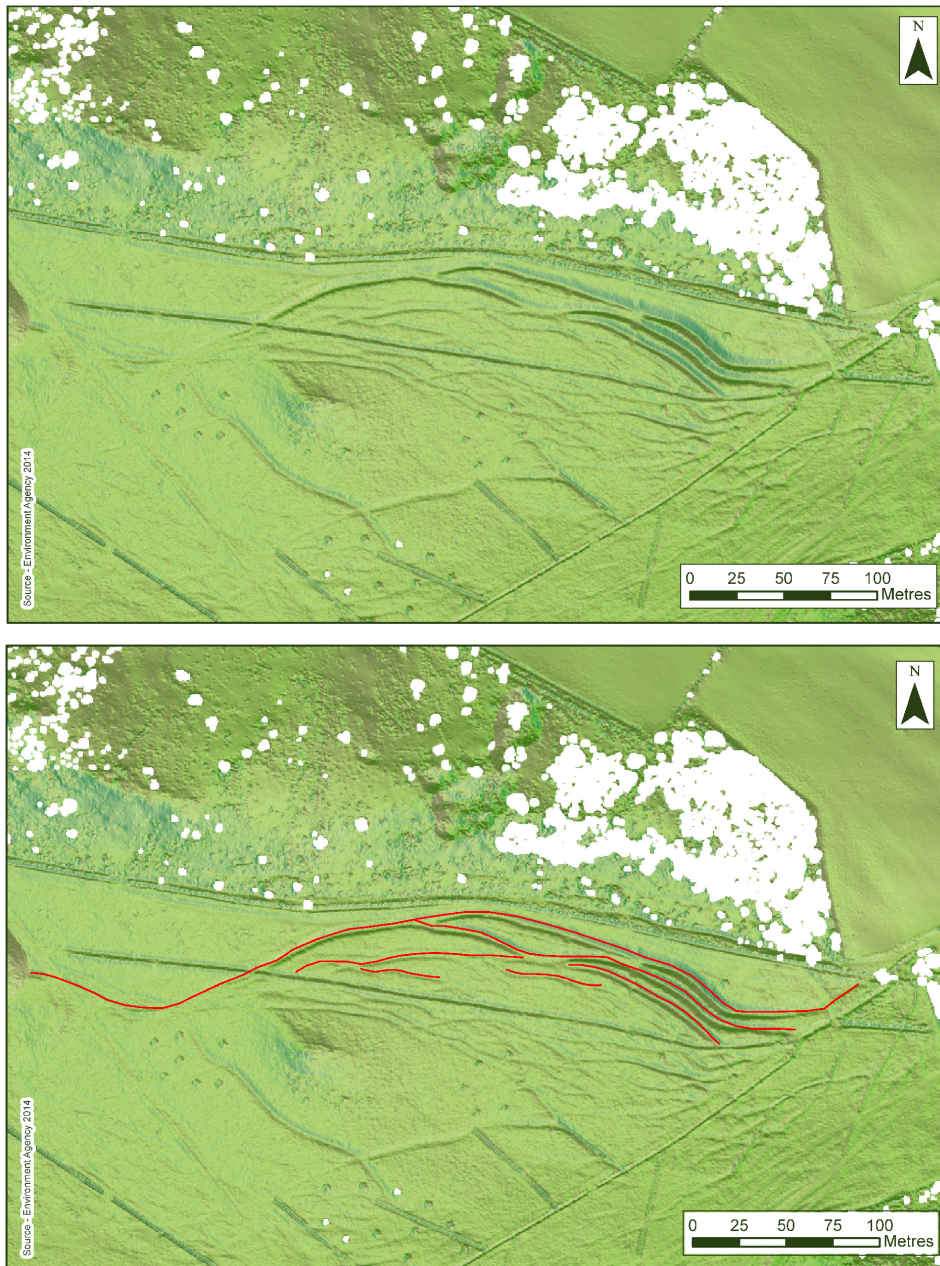


Figure 6: Ditch type features west of Hallgates Farm. (Hillshade 135/30/2 with false colour)

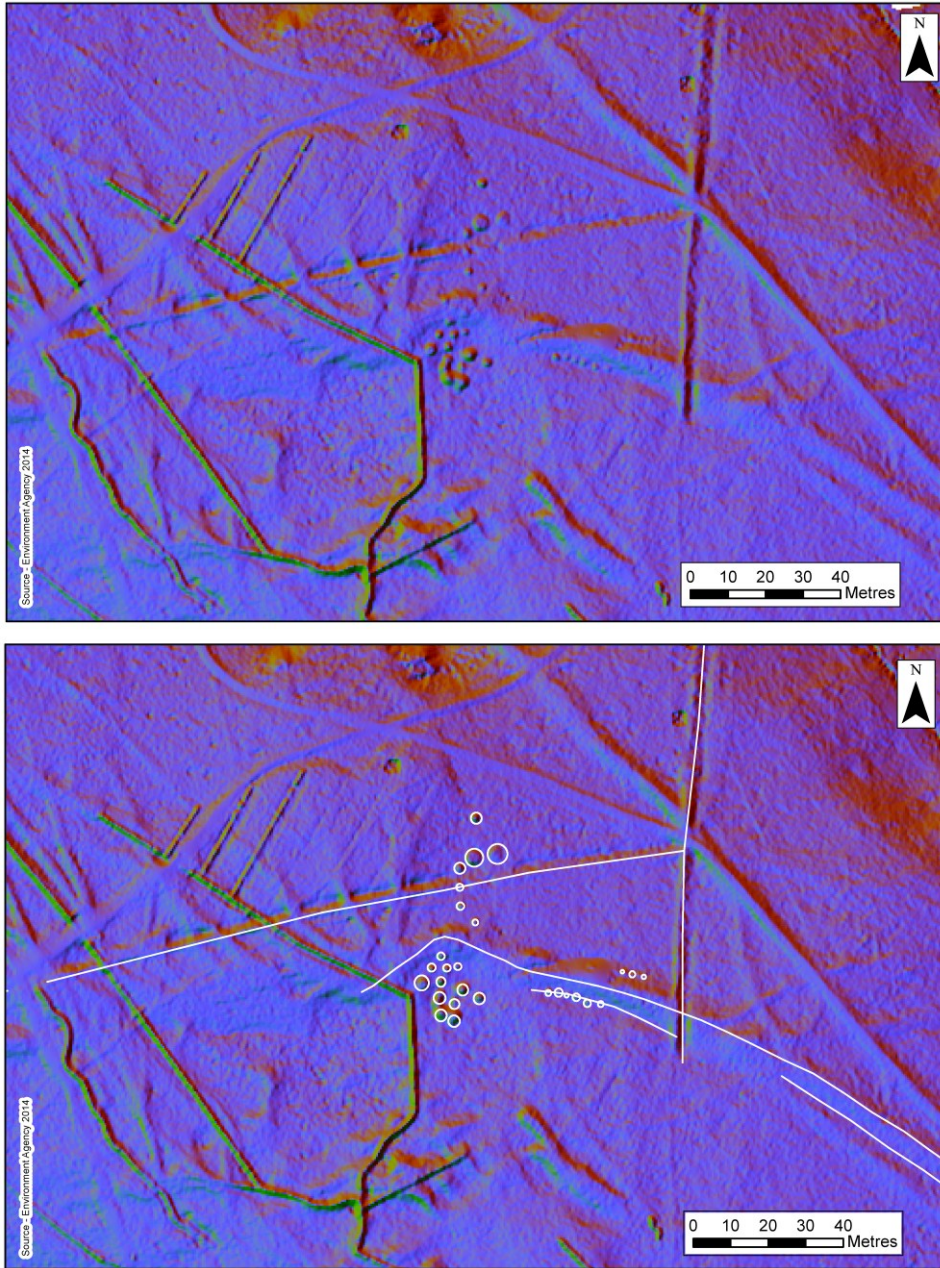


Figure 7: Area of Pit type features west of Dale Spinney. PCA Altitude 30.

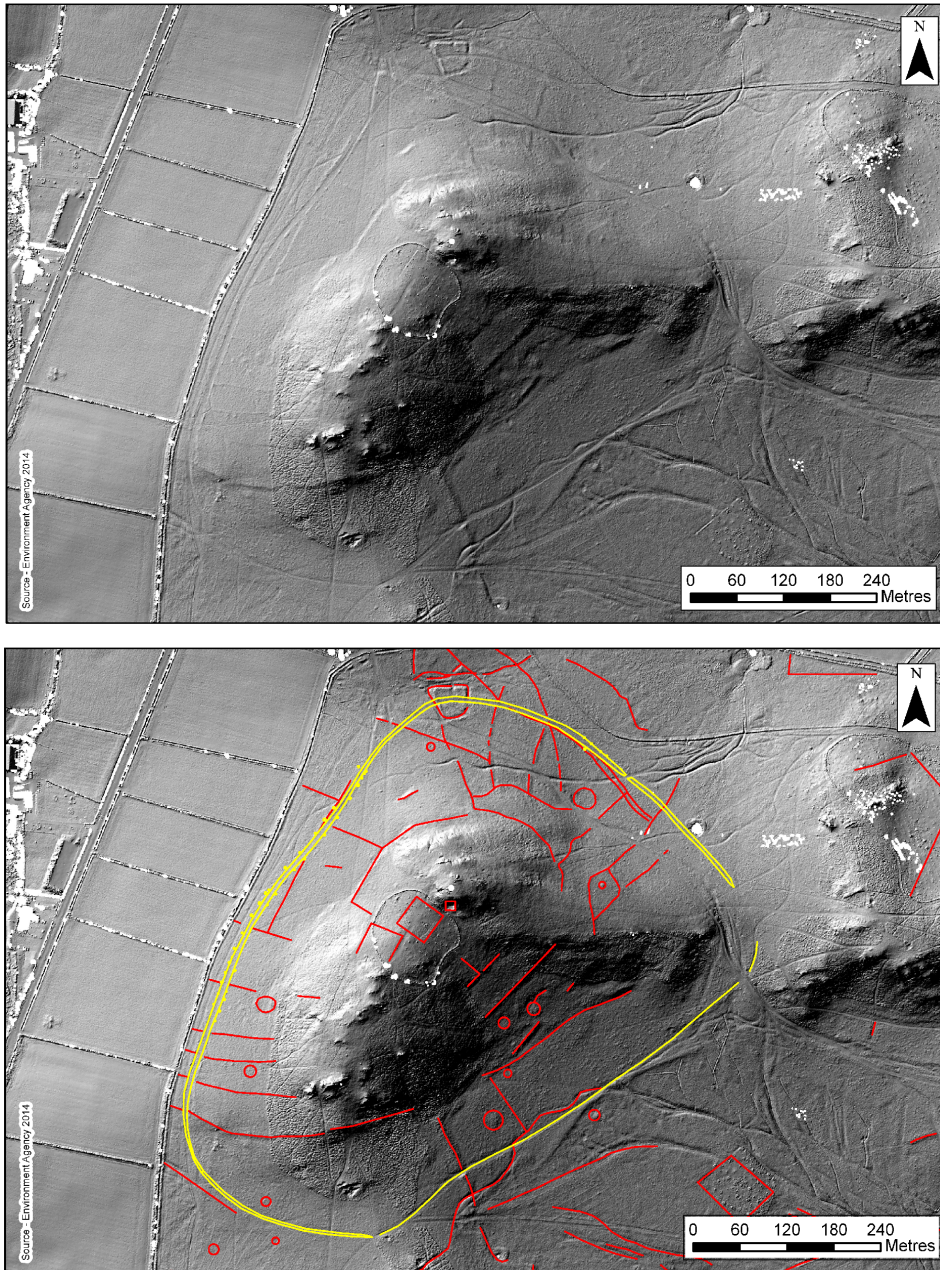


Figure 8: Field systems, enclosures, and the line of the suspected 18th Century race-course around Old John (in yellow).

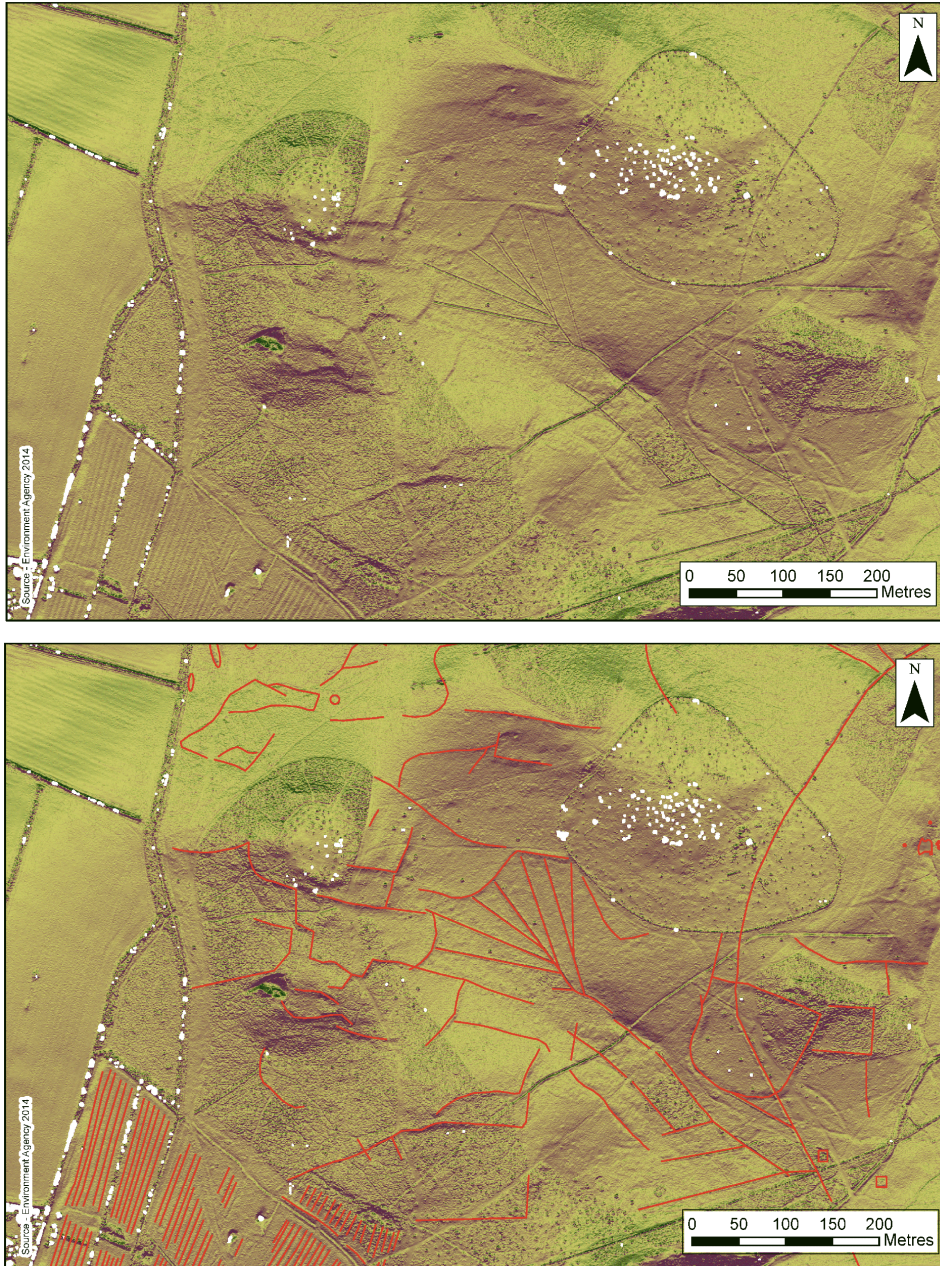


Figure 9: In the south-west of the Park: the Pale in the east, Field Systems, Enclosures, Ridge and Furrow, and later drainage features. Hillshade 000302 with False colour.

## The Walkover Survey

### *Objectives*

The objectives of this non-invasive survey were to provide current information on known archaeological remains within the park and investigate the features highlighted during the analysis of the LiDAR data. From this investigation and recording it is hoped that the results will provide information on the extent and nature of human activity within the area, and will allow informed decisions to be made on the future management of the site.

### *Methodology*

Designated records (Scheduled Monuments and Listed Buildings) Historic Environment Records and newly identified LiDAR features were all incorporated within a relational database (Access 2010). Pro-forma field recording sheets were prepared prior to the field survey. During the survey a significant number of additional features were identified and these are identified by the prefix *W*. As a guide to the location of each feature the annotated LiDAR survey converted from ESRI shapefile to Garmin IMG file and loaded onto a handheld GPS (Etrex 30) as custom backdrop mapping which was used throughout the walkover survey.

Potential archaeological features were located using the handheld GPS and recorded using photographs and the pre-printed record sheets. This record included a grid reference of the feature centre point and, should the feature be very large, a grid reference of where the photograph was taken. In some cases the earthwork was so slight that a fabric strop was used in the photograph to aid in the visual identification of any changes in height.

No invasive archaeological investigation was carried out as part of the walkover survey and archaeological recording. However, should any finds be discovered they would be bagged and labelled with their location and date and stored appropriately.

For ease of description, the park was divided into nine similarly sized areas which were printed out as nine separate sheets at 1:2500 on A3 starting with Area Sheet 1 in the south-western corner going up to Area Sheet 9 in the north-eastern corner (see Figure 10). This helped to group the features into manageable areas but in no way relates to any relationships which may or may not exist between them.



## Results

The walkover survey was carried out between the 2nd and 9th of April 2014. The weather varied from light mist to overcast with occasional sunny periods for most of the work.

Table 5: Character Areas by Plan sheet

<i>Character Areas</i>	<i>Plan Sheet</i>
Deer Meadow	2, 5
Deer Sanctuary	1,2
Hallgates	5,6,9
High Park	4,5,7,8
Little Matlock	1
Low Park	2,5
Middle Park	1,4,5,8,9
Newtown Lawns	1,2,4,5
River Valley	1,2
Ruins Enclosure	2,5

### *Area Sheet 1*

SW corner NGR SK 522 098

NE corner NGR SK 530 102

Area Sheet 1 covers the bottom south-west corner of the park which is characterised by the small rocky gorge through which the River Lin runs. The main tarmac road between the Newtown Linford and Hallgates car parks runs alongside the north bank of the river. To the south of the river is the deer sanctuary which is off-limits to the general public.

The most prominent earthworks in this area are the park Pale (FL00612 – 615) (Figure 66) running from north to south and the mill leat (MLE18603) (Figure 46, Figure 47, Figure 48) running from the river across to Bradgate House. Both are very well-defined but have been cut through by later tracks in many places. This area also includes the internationally significant Late Upper Palaeolithic site (MLE9435) (Figure 31) which is also suffering from path erosion and has recently been evaluated by test pit (Cooper & Harvey 2014). Another area that has produced worked lithics was also visited, with some erosion also apparent (Figure 32).

To the immediate east of the Pale, some 40m north of where Pale and Mill Leat intersect is a small rectangular ditched area (FL00019) (Figure 53)

### *Area Sheet 2*

SW corner SK 530 095

NE corner SK 540 102

Area Sheet 2 incorporates most of the area surrounding the Bradgate House ruins and mill (MLE 745, 746, 750, 14007, 14008) and the eastern half of the deer sanctuary including the Pheasantry.

The house ruins, mill, stables, dog kennels, gatehouse, associated structures, gardens and pheasantry have not been assessed in any detail, but were visited during the walkover and an overall note on condition made (see Figure 25, Figure 26, Figure 27, Figure 29, Figure 33, Figure 34, Figure 37, Figure 40, Figure 41, Figure 42, Figure 43). Other noteworthy features that are not designated or included in non-designated records include an irregularly shaped enclosure (FL00006) (Figure 49) which appeared to have been cut by later features associated with the house which might therefore suggest a relatively early date. A substantial moated site (FL00008/MLE739 Scheduled Monument 108813) (Figure 23, Figure 24) to the west of the house offers the potential of an earlier residence for the landowners, alternatively this has been identified as the parker's house. A possible rectangular area inside the enclosure may indicate a building. To the north of this site is another rectangular enclosure (FL00016) (Figure 51). South-west of Holly Plantation, the LiDAR revealed a curving ditch which is visible on the ground as an area of marshy ground (Figure 54). A pair of rectangular depressions (W005) tentatively described as saw pits appear to be rather too large for a single saw pit, and may perhaps be a timber processing area or clay pit (Figure 72).

To the north-east is an area of Water Meadow (MLE18601) (Figure 44).

#### *Area Sheet 3*

SW corner SK 540 095

NE corner SK 550 102

Most of Area Sheet 3 is to the south and east of Cropston Reservoir and is beyond the limits of the park. A number of HER sites are in this area but are outside the scope of this survey.

#### *Area Sheet 4*

SW corner SK 521 102

NE corner SK 530 110

Area Sheet 4, in the western part of the park slopes up to the north and is centred on Elder Spinney. There are a number of higher rocky outcrops especially along the western side. Much of the bracken in the area has been rolled but there are still significant areas which are partially obscured.

Of note in this area are a series of low banks or lips creating small terraces on a south-facing slope. This appears to be a deliberate creation of flat and open areas possibly for agricultural purposes (e.g. FL00490) (Figure 60) (FL00553) (Figure 62) (FL00554) (Figure 63) (FL00562) (Figure 64). A semi-circular ditched enclosure (FL00018) (Figure 52) gives the impression of a possible prehistoric feature. This feature may connect with others (e.g. FL00483) (Figure 59) although the LiDAR patterning was not as convincing on the ground as the Hillshade plots suggest.

The medieval Park Pale crosses the eastern side of this area curving slightly to the north (FL00639) (Figure 69). Modern, regularly spaced, drainage ditches run across the area as do a large number of small parallel ridges running across large parts of the area. The function of these ridges is not clear but their regular spacing and very straight lines suggest a relatively modern date. World War II activity is evidenced by a bank of bare earth caused by chemicals leaching out of numerous bullets which can still be seen on the surface (this bare earth feature has been identified within the LiDAR data as is numbered FL00786). A number of possible slit trenches can be seen to the south of this bank (centred on SK5298 1051). In the north-eastern corner of the area are a series of worn hollow ways and possible tracks leading north-westwards. These undated features have not been identified on the LiDAR survey.

#### *Area Sheet 5*

SW corner SK 530 102

NE corner SK 540 109

Area Sheet 5 forms a broad shallow valley behind the Bradgate House ruins where the fish pond remains (Figure 28). The valley slopes up to the north towards Old John.

To the east of Bradgate House gardens is an area of holloways and possible building platforms (FL00011-12 and MLE756) which may be the remnant of a Deserted Medieval Village (DMV) (Figure 30). Close to this on the north-east side is a curious moated site (FL00009) (Figure 50) which appears to be too small to contain a structure and is very well-preserved. It is possible that it has an association with the nearby gardens. A chain of fish ponds lies to the east of the house (MLE18594) (Figure 38). More eroded tracks and hollow ways can be seen across the area, most noticeably joining those noted in Area Sheet 4 and another series in the north-east (FL00643 – 645). Again the origin and date of these features is not clear. Well-preserved banks and ditches run across the area. The 18th Century approach to the house was a tree lined avenue depicted by Kiddiar, (MLE18596) (Figure 39), with the Deer Barn to the north (Figure 45). A small enclosed area may be the location of a building represented in the foreground of Kniffe's engraving (FL00635) (Figure 68). A sinuous bank not specifically identified in the LiDAR survey runs from the north-east of the Ruins Enclosure toward Hallgates (W007) (Figure 73). World War II activity can be seen as another bare bank (W008) with spent bullets in and a large number of what look like mortar or shell holes (FL00454 -481) (Figure 58). Many of these pit-like features intercut each other and have cut nearby banks and ditches. There is evidence of a possible bunker or trench at this point too.

#### *Area Sheet 6*

SW corner SK 540 102

NE corner SK 550 110

As with Area Sheet 3, much of this area is covered by the reservoir and is therefore outside the park boundaries.

Within the park there are a number of bank and ditch features and probable eroded tracks running into the park. Part of a group of immediately adjacent parallel features of unknown function can be found on the western side of the area (FL00647) (Figure 70).

#### *Area Sheet 7*

SW corner SK 521 107

NE corner SK 530 116

Area Sheet 7 is dominated by the two rocky outcrops on which sit Old John Tower (Figure 35) and the Leicestershire Yeomanry War Memorial (Figure 36).

More potential terrace-like features (FL00502) can be seen on the southern slope leading up to Old John although these are not as clear or extensive as elsewhere in the park. A well-preserved ditched enclosure site with a possible entrance (FL00446-447) can be seen near to the Hunts Hill entrance (Figure 55), with another possibly associated feature parallel to the north (FL00655) (Figure 71). Some localised erosion is noted where a track crosses the west side of the enclosure (Figure 22). Further terraces are visible on the west side of Old John e.g. (FL00452) (Figure 57) and (FL00534) (Figure 61). As with many of the features identified by LiDAR there is no clear indication of a date for this. The remains of the 18th century race track (FL00778, 779, 780, 781) running around Old John can be seen in the form of large boundary stones either side of a flat track (especially clear between SK 52438 11377 and SK 52363 11277) cutting the enclosure (FL00446/7) and another bank type feature (FL00619) (Figure 67). Adjacent to Old John are the remains of stables (Figure 74). Within Old John Spinney a square area (FL00451) is defined in the LiDAR, visible as clearly defined negative feature on the ground (Figure 56).

#### *Area Sheet 8*

SW corner SK 530 110

NE corner SK 540 114

Area Sheet 8 forms a wide sloping east to west valley which narrows down to a funnel at its east end near to Hallgates. Along its north end are a series of sinuous ditches (FL00593 – 598) winding up the slope towards the west (Figure 65). Similar, but not quite so deep, features can be seen on the southern side of the valley with may suggest eroded tracks rather than deliberate earthworks. The ditches almost appear to be respecting the stone walls although this may be simply preferential preservation. These features have been tentatively identified as prehistoric (Hartley and Squires forthcoming) although a modern military origin may in fact be their origin. Alternatively, there may be re-use of existing landscape features.

#### *Area Sheet 9*

SW corner SK 540 110

NE corner SK 550 116

Area Sheet 9 covers the north-east corner of the park around the Hall Gates car park. Much of this area has evidence of ridge and furrow which seem to respect a quarried outcrop of rock. Some banks and ditches can be seen beneath the ridge and furrow and these must be pre-medieval.

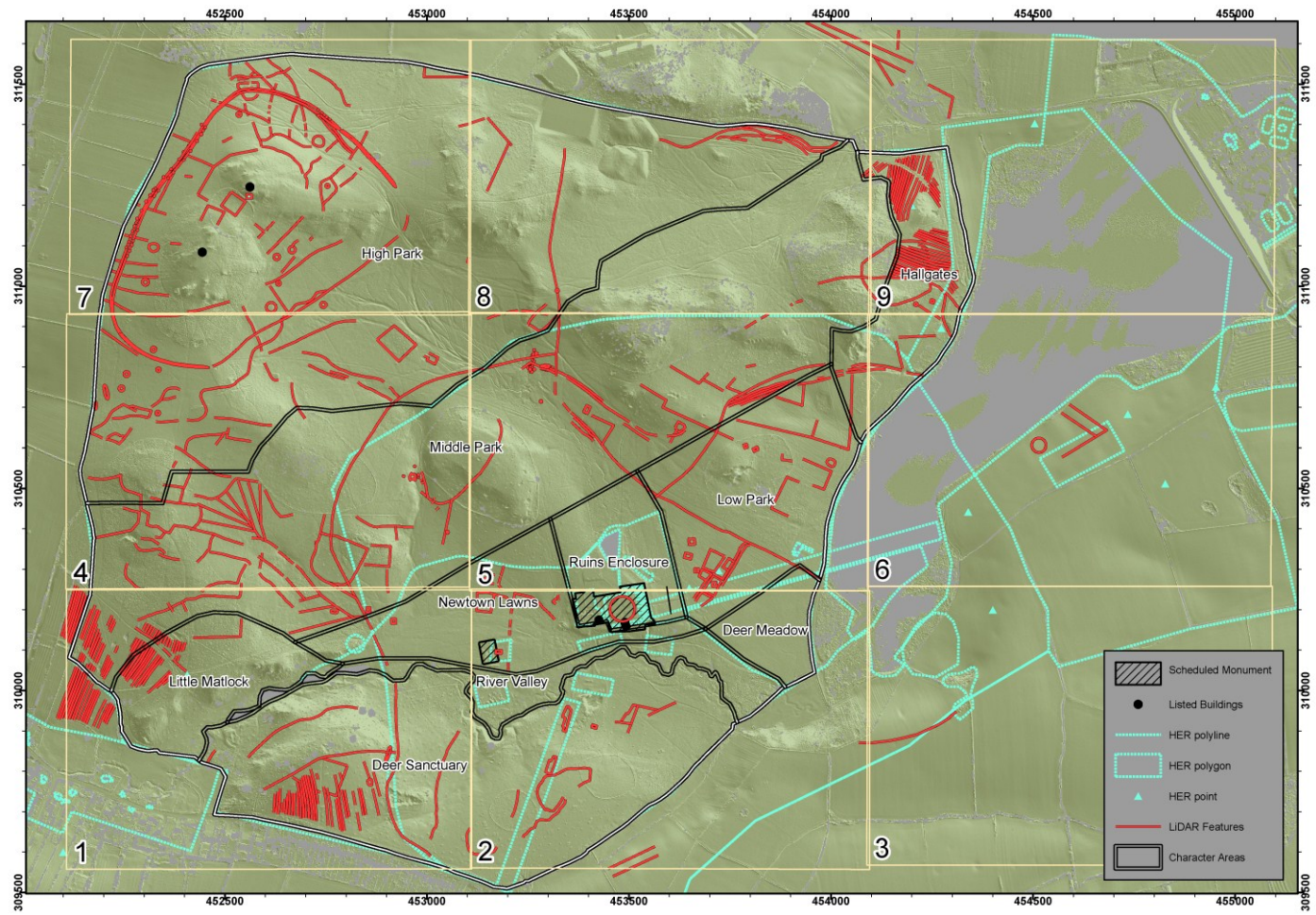


Figure 10: All features also showing location of sheets 1-9, with Hillshaded LiDAR data (false colour). LiDAR source: Environment Agency 2014

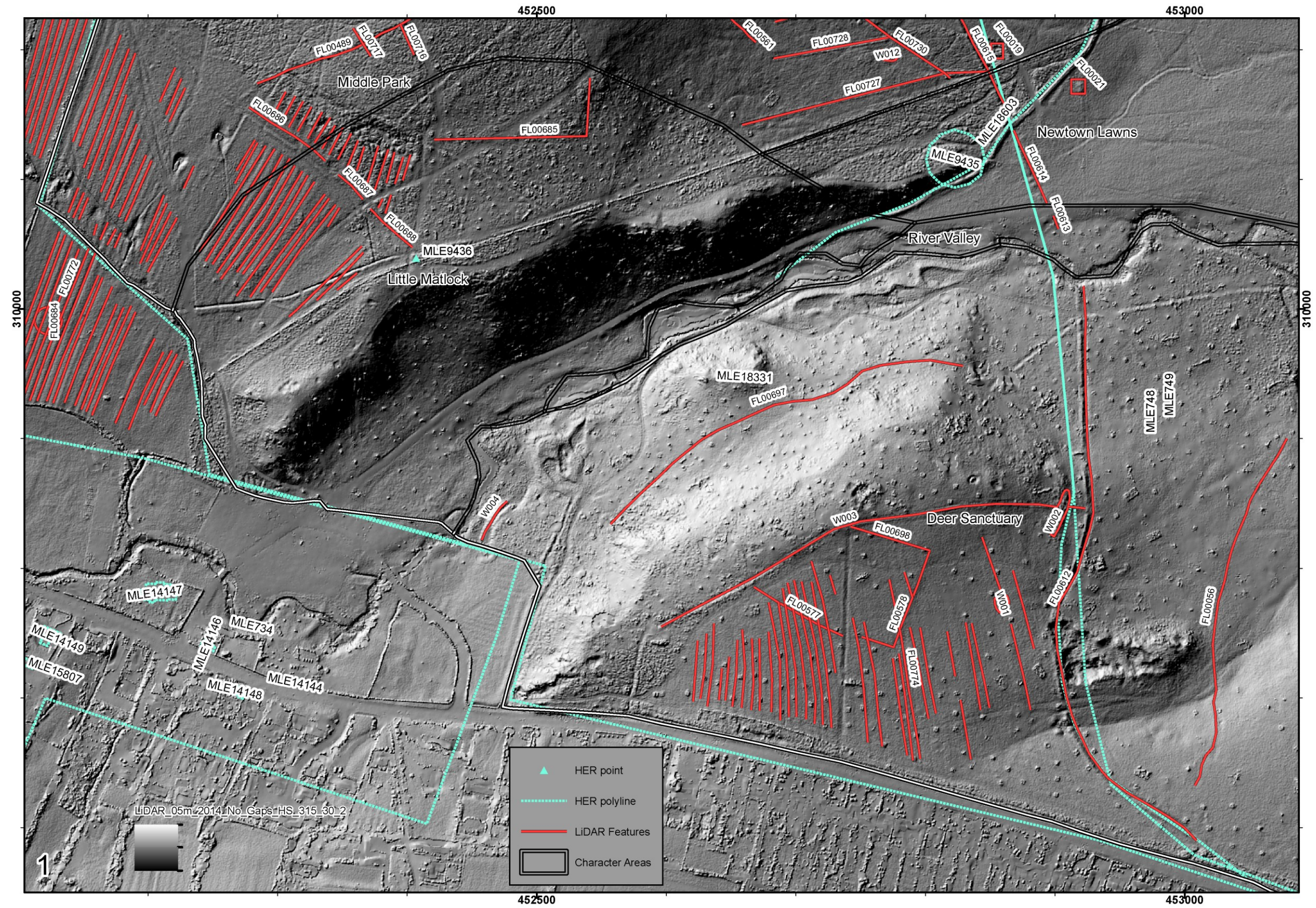


Figure 11 Area Sheet 1 with LiDAR interpretation. LiDAR source: Environment Agency 2014.

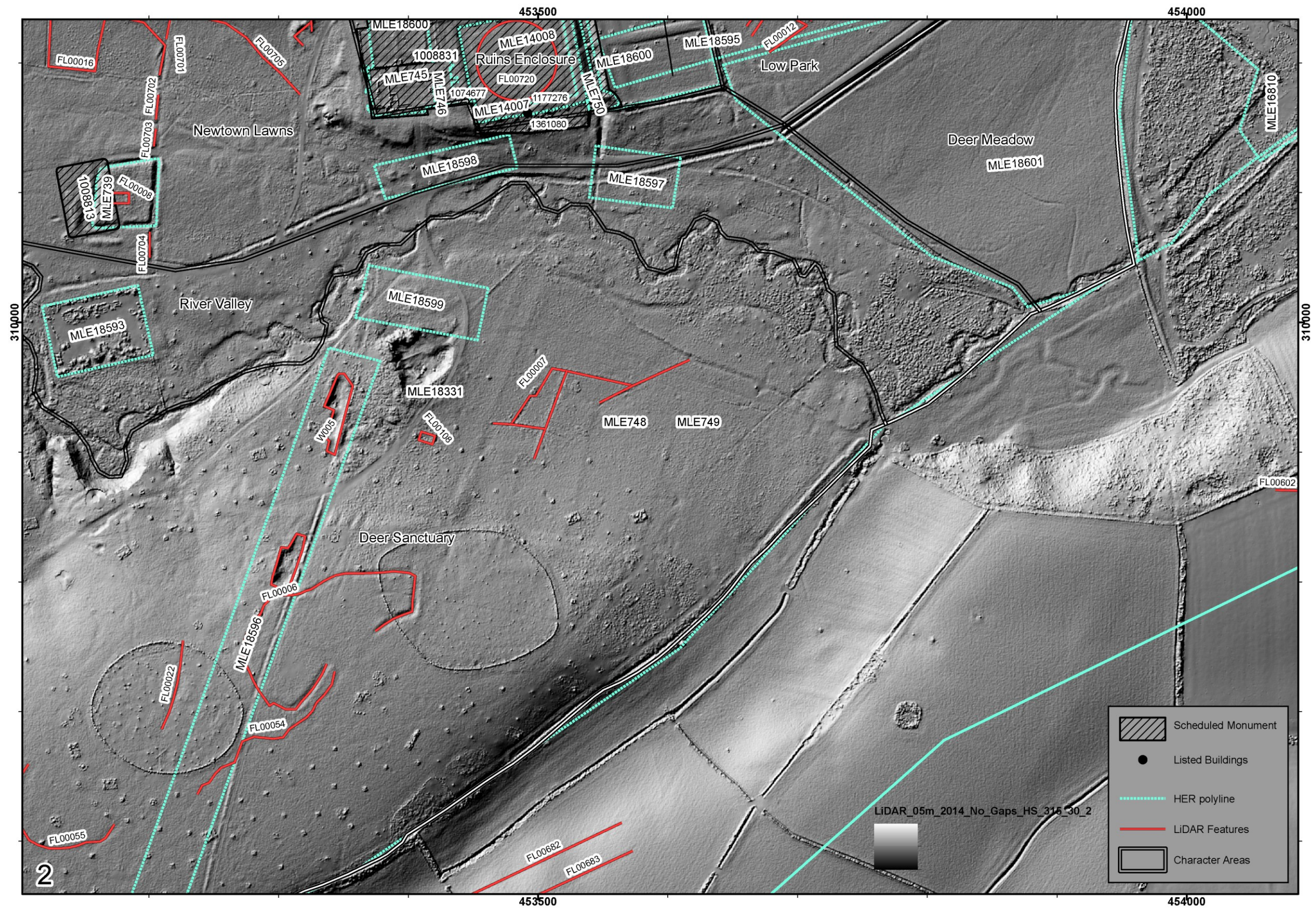


Figure 12 Area Sheet 2 with LiDAR interpretation. LiDAR source: Environment Agency 2014.

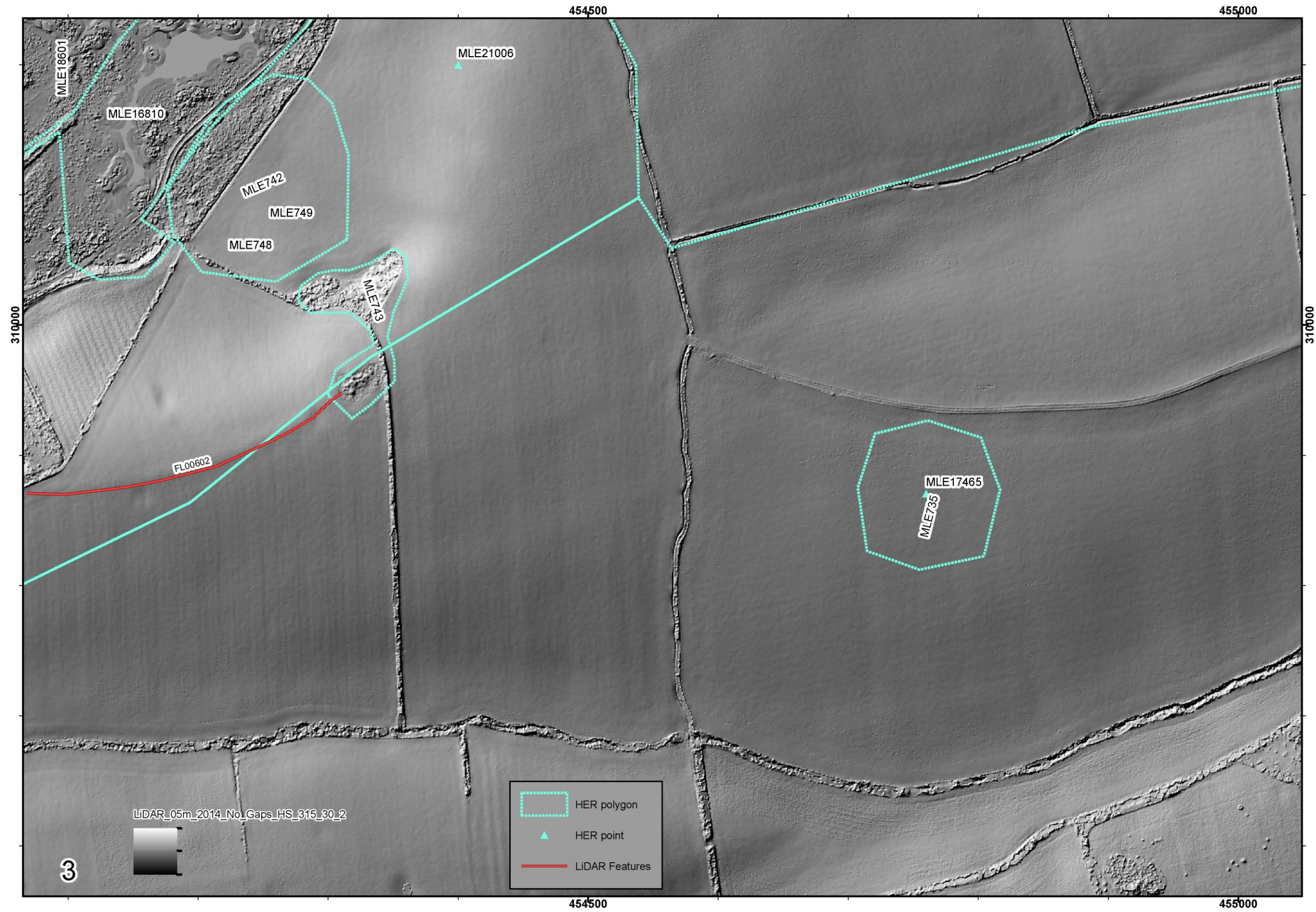


Figure 13 Area Sheet 3 with LiDAR interpretation. LiDAR source: Environment Agency 2014.

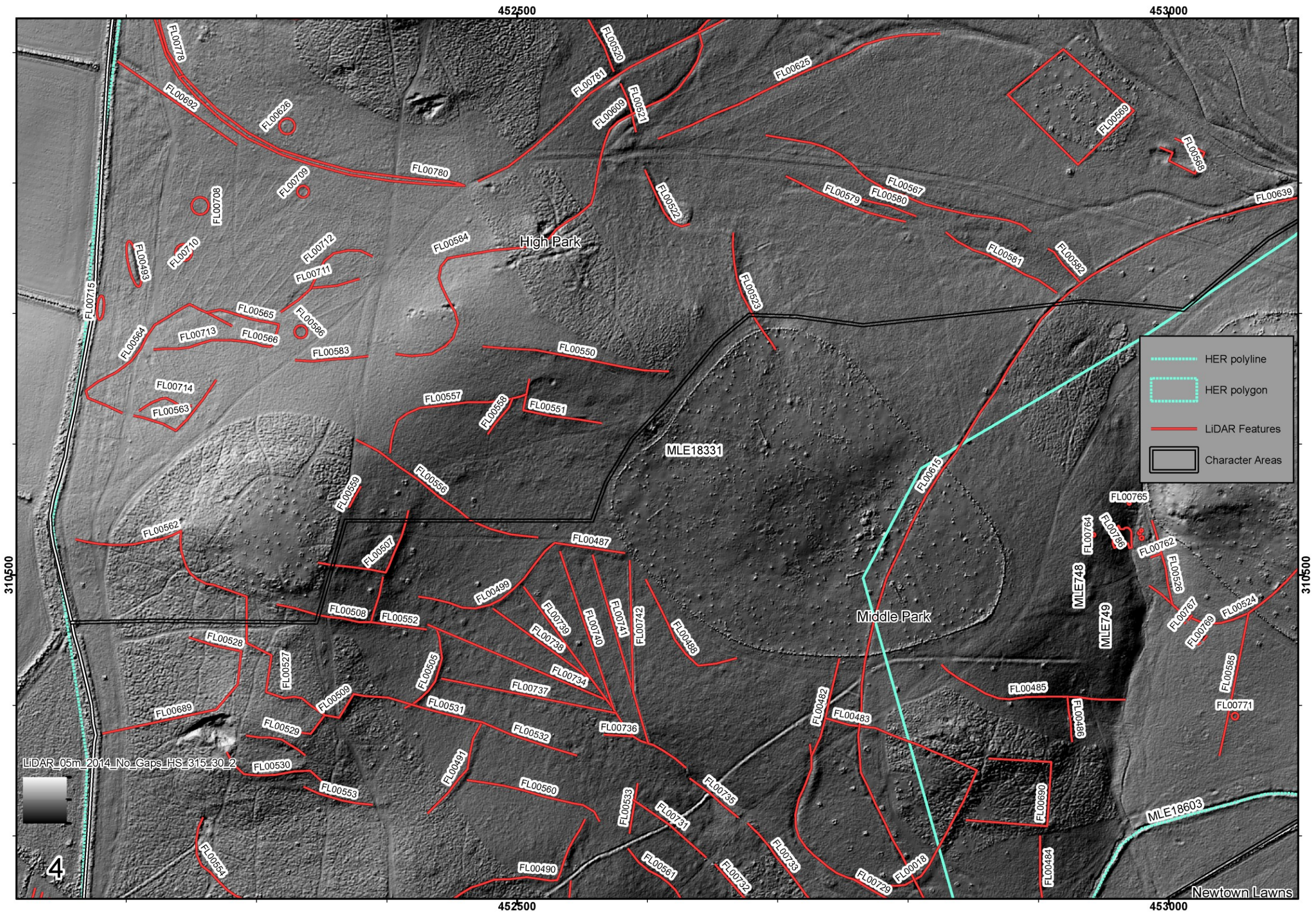


Figure 14 Area Sheet 4 with LiDAR interpretation. LiDAR source: Environment Agency 2014.



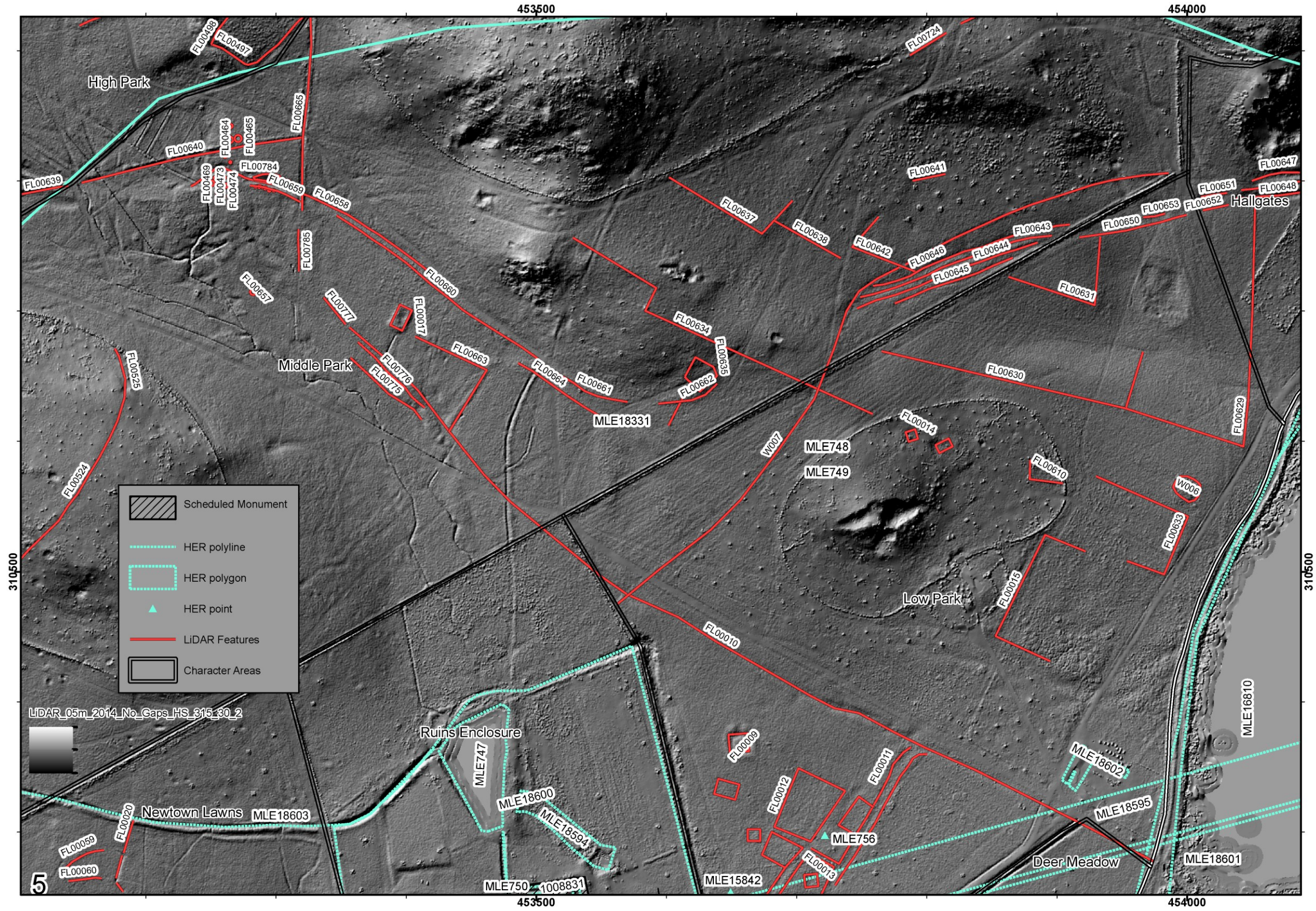


Figure 15 Area Sheet 5 with LiDAR interpretation. LiDAR source: Environment Agency 2014.

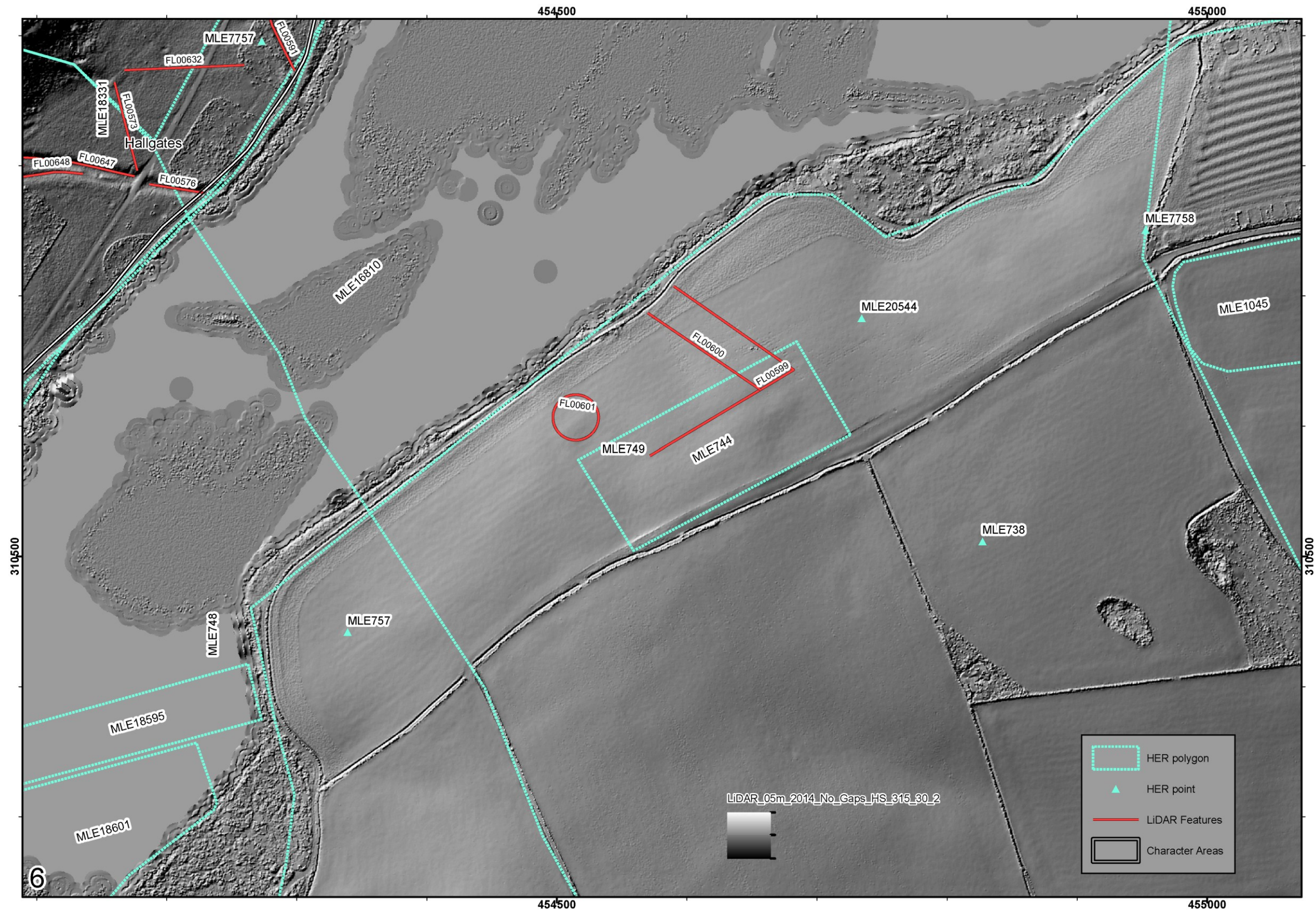


Figure 16 Area Sheet 6 with LiDAR interpretation. LiDAR source: Environment Agency 2014.

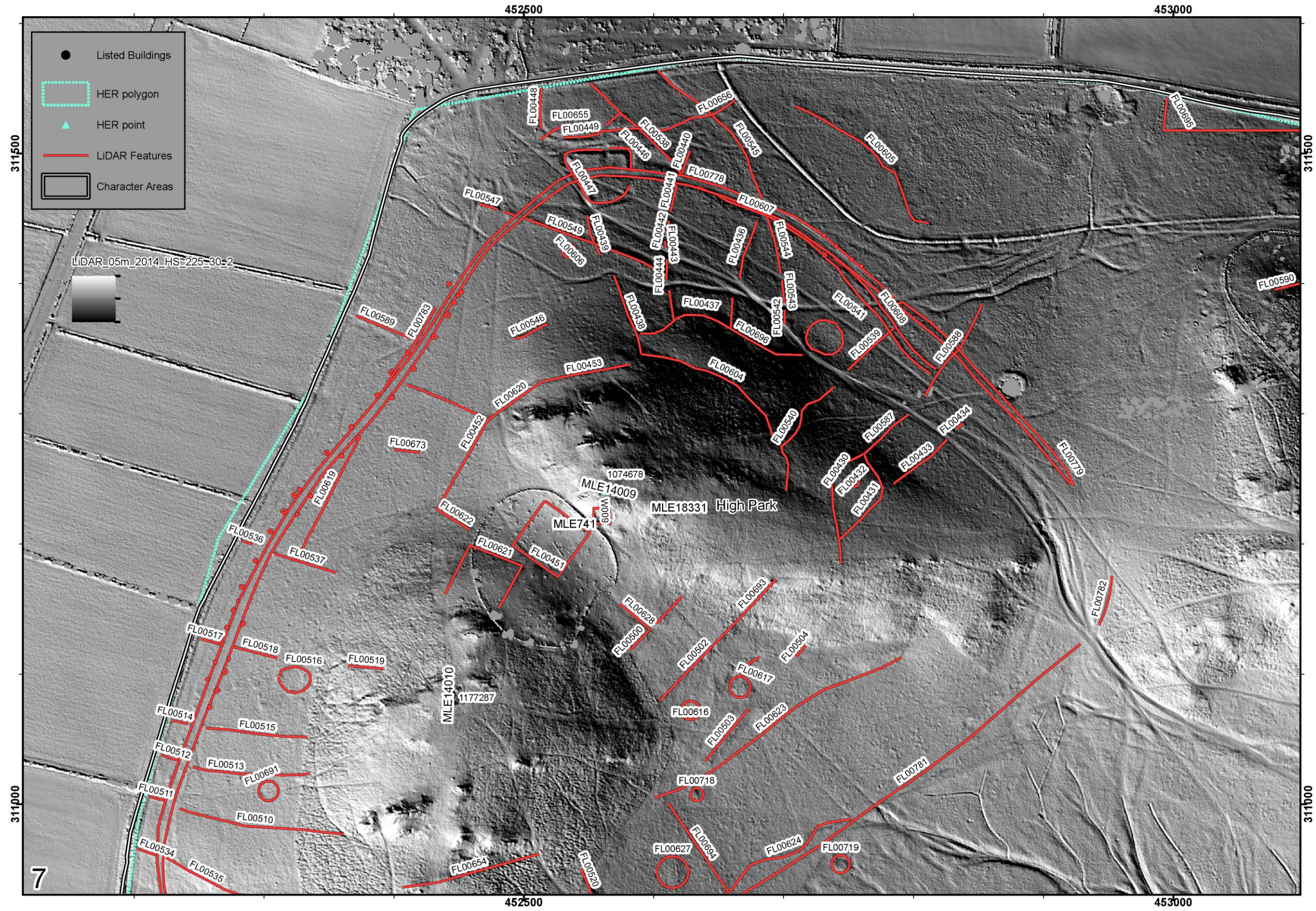


Figure 17 Area Sheet 7 with LiDAR interpretation. LiDAR source: Environment Agency 2014.

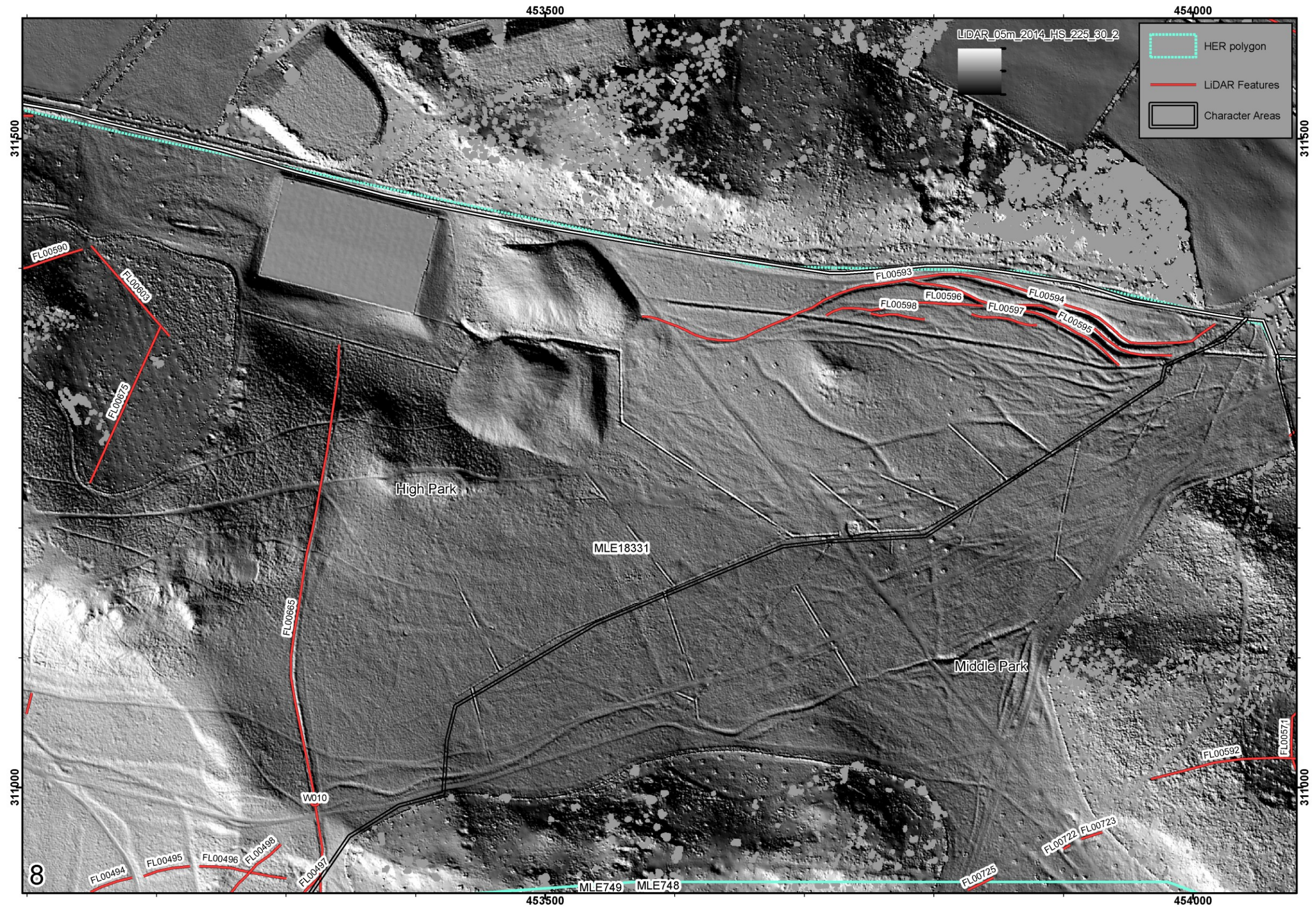


Figure 18 Area Sheet 8 with LiDAR interpretation. LiDAR source: Environment Agency 2014.

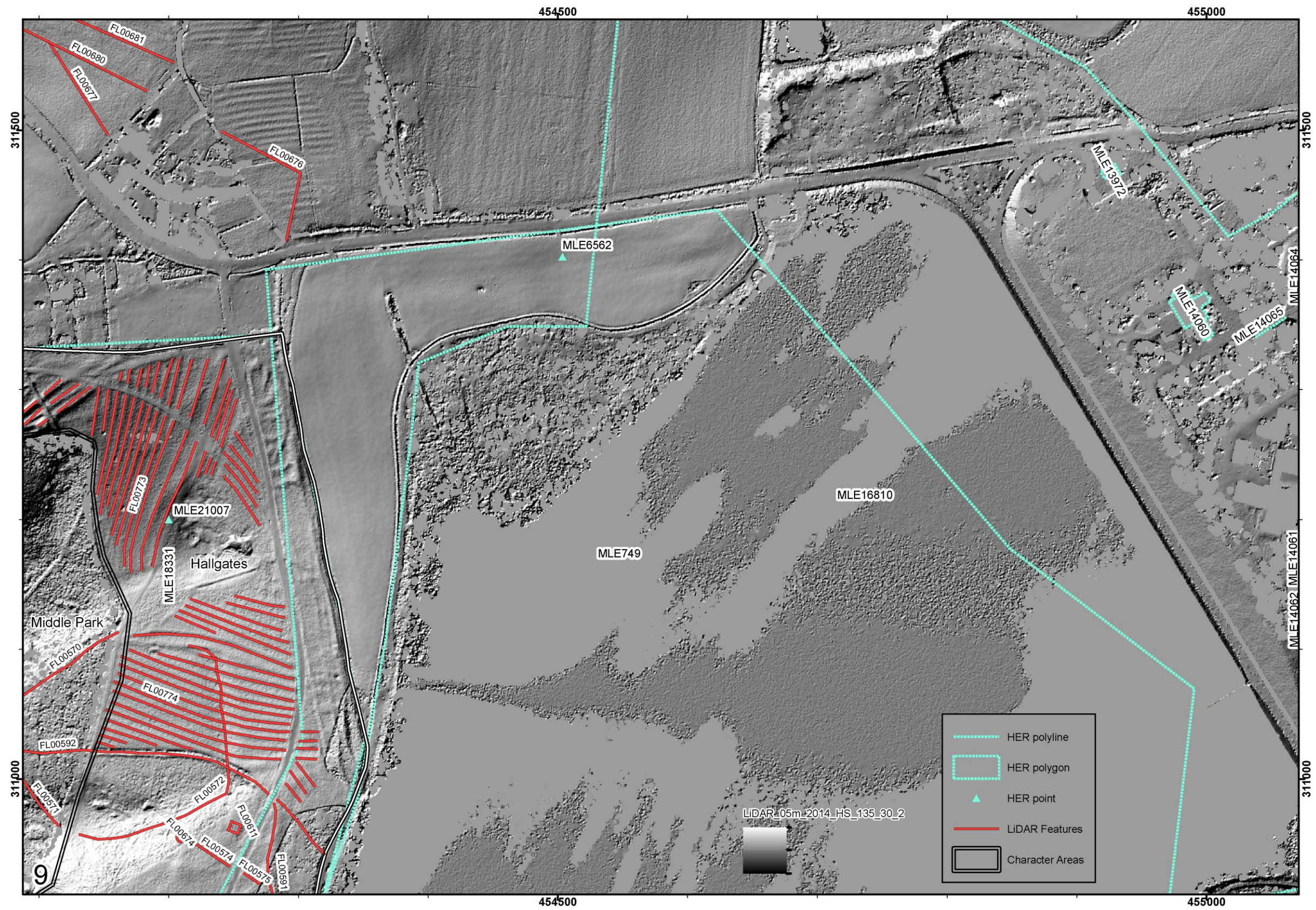


Figure 19 Area Sheet 9 with LiDAR interpretation. LiDAR source: Environment Agency 2014.

## Summary of Results

391 records are included in the Archaeological Assessment. These include 2 Scheduled Monuments, 5 Listed Buildings, 34 Leicestershire Historic Environment Records and 342 records resulting from analysis of the LiDAR data.

Significance of Assets is judged using criteria as set out in the Design Manual for Roads and Bridges (DMRB HA208/07, Annexes 5-7).

Table 6: No of Records per Character Area. Some records cross a number of character areas.

<i>Character Area</i>	<i>No of records</i>
Deer Meadow	4
Deer Sanctuary	18
Hallgates	23
High Park	158
Little Matlock	7
Low Park	21
Middle Park	138
Newtown Law ns	25
River Valley	7
Ruins Enclosure	15

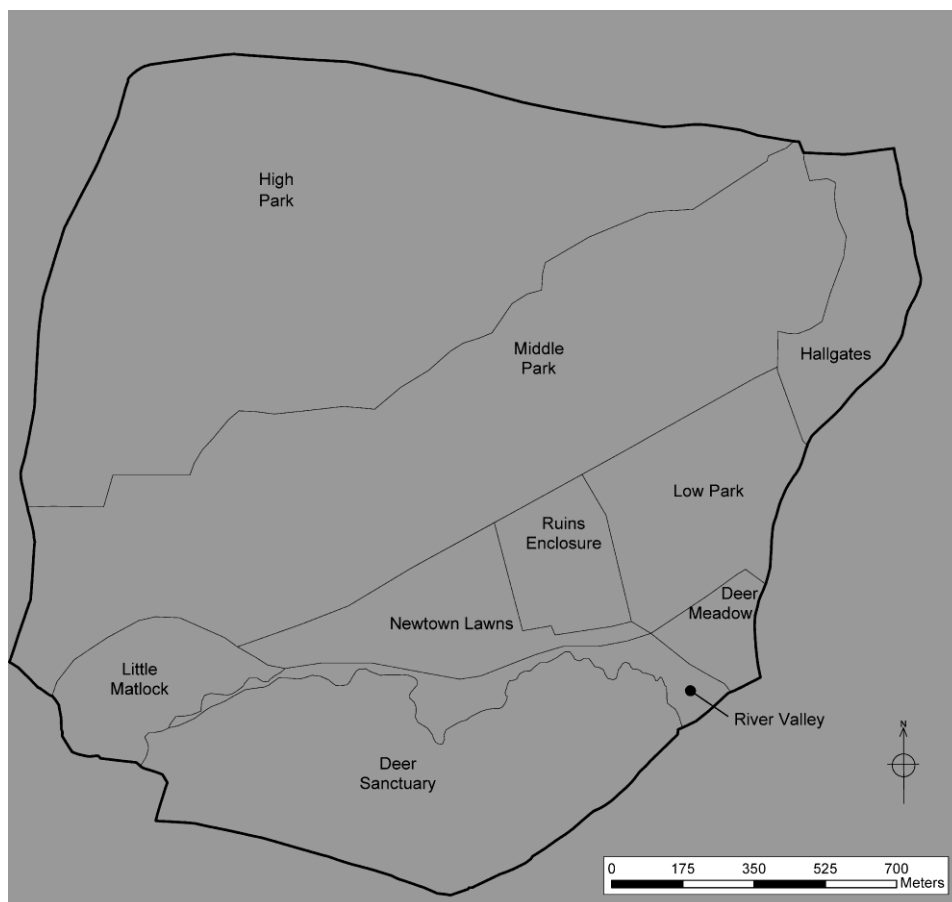


Figure 20: Character Areas

### ***Deer Meadow***

This is an area of Water Meadow (MLE18601) of Medium to High Significance on the basis of the rarity of water meadow survival. The eastern avenue of trees that marked one of the approaches to the house crosses the north-east of the area (MLE18595)

### ***Deer Sanctuary***

The southern approach to the house crosses the Deer Sanctuary (MLE18596). Few trees survive although side ditches are visible. An area of suspected gatehouse is visible in the north of the area. Part of the medieval Park Pale can be traced in this area, and is well preserved in places. An unknown enclosure of irregular shape 150m by 55m with entrance in the south has been identified running between Holly Plantation and Thorn Spinney. The ditch of this feature clearly survives as an earthwork; although this suggests the feature is perhaps medieval, the broad form would be consistent with a later prehistoric form and this would be of high significance. Nine further possible ditches have been identified in the LiDAR data in this area of which six have been identified on the ground. These features are undated and are of unknown significance.

This area contains medieval ridge and furrow earthworks at the western end which is of low significance but of interest in its relationship with the emparked area. The bank of another possible enclosure some 80m across has been identified 100m north of the park southern boundary.

### ***Hallgates***

Finds of Roman pottery and a coin have been made in this area. As isolated finds they are of low significance and should not be over-interpreted. It should also be noted that finds of Roman tile were recently made from the Lin in the Little Matlock gorge area (Dr Phil Mills pers comm.).

Areas of ridge and furrow cultivation can be traced in the north of the area, and these are bounded in the south by the line of the medieval Pale (FL00592). There may be two phase of Pale apparent on the eastern edge, with the lines diverging just to the east of the modern track with one line turning abruptly to the south.

Traces of a possible earthwork bank have been identified below the ridge and furrow (FL00572) and would be of high significance if of pre-medieval date. Traces of a curving bank and ditch have been identified within the Coppice Plantation which may be part of, or predate the medieval field system part of which lies to the east.

### ***High Park***

Dominated by Old John and the War Memorial to the Leicester Yeomanry other statutory records include the site of a post mill. Although no direct evidence of the post mill has been observed, this location also includes the remains of a small stable cut into the rock outcrop which is extant.

To the east, west, south west and north of Old John are series of banks and ditches that divide up the area into smaller blocks. On the basis of their form and that they do not clearly belong to later periods, it is suggested (Hartley & Squires forthcoming) that these are evidence of late Prehistoric or Romano-British field systems. Detailed study of the LiDAR data has led to the identification of possible platforms within terraces on the eastern side of Old John, and these may potentially be house platforms contemporary with the suggested field systems. To the north of Old John, a sub-square enclosure some 40m across survives. This appears to predate the racecourse (below) and could be of prehistoric or possibly medieval origin. If the interpretation of any of these remains as pre-medieval in date is correct, these features would be of high significance as they are regionally extremely rare as earthwork remains.

Evidence of a possible new phase of medieval enclosure has been identified in the LiDAR data between Sliding Stone enclosure and Dale Spinney. A north-south bank is abutted by a Park Pale boundary, and would appear to predate the Park Pale although this may be illusory. This feature can be traced north for over 500m . Detailed field observation is required to validate this observation before any interpretations can be confidently drawn.

Two probable Pillow mounds (Rabbit Warrens) of late Medieval or Early Post Medieval date can be identified in the extreme south-west of the area. The adjacent road is named Warren Hills.

The course of an 18th Century race track which encircled Old John can be traced with some confidence in the LiDAR data as the boundary stones which marked each side of the track can be identified on western and northern sides (Ramsey 2011). Within Old John Spinney, the remains of a square enclosure some 40mx40m are evidence of some previous structure.

In the extreme east of the area, a series of sharply incised sinuous ditches are visible just within the park's boundary. It has been suggested (Hartley & Squires forthcoming) that these may have a prehistoric origin but this is considered most unlikely. That they have resulted from wartime activity (which is now starting to emerge within the Park's recent history) is considered much more likely.

### ***Middle Park***

The Middle Park contains the majority of the northern area of the medieval deer park. The exact line of the Pale can be traced with accuracy from the LiDAR data, and the high degree of accuracy afforded by the LiDAR evidence shows some deviation from the recorded line.

Ridge and Furrow can be found in the extreme west of the area.

Further traces of terraces that are possible relict field systems can be identified to the south and to the east of Tyburn. Drainage features can be strongly identified in herringbone type configuration between Tyburn and Elder Plantation, and these are of 19th or 20th Century date. South of Elder Plantation, a sharply defined curving ditch may form the south-western part of a possible enclosure of around 1ha which is bisected by the medieval Pale. As this ditch is medieval or earlier, it is of medium or higher significance.



Between Bowling Green Spinney and Dale Spinney ditches and banks marking linear features crossing south-west to north-east may stem from medieval holloways crossing this area on the east side of the stream which is flowing down toward the fishpond area.

In places, the features appear in parallel lines, and this has led to an interpretation that a Bronze Age triple ditch boundary may survive in this area. Although this remains possible, the likelihood is that these remains relate to later occupation and they may be associated with the area of medieval settlement identified to the east of Bradgate House.

Evidence of a possible new phase of medieval park enclosure has been identified in the LiDAR data between Sliding Stone enclosure and Dale Spinney. A north-south bank is abutted by the known Park Pale boundary, and would appear to predate the Park Pale although this may be illusory due to truncation of the Pale to the east. This feature extends into the High Park and can be traced north for over 500m before it disappears where reservoir works start.

The Park Pale cannot be clearly traced to the east of this north-south feature although it can possibly be identified on the south-eastern edge of Dale Spinney and it is likely that rocky outcrop formed much of the park's boundary in this area.

To the south of the intersection of the known Pale and the newly identified north-south feature, 30 pits have been identified within an area 60m x 70m. The features which vary between 1.5 and 3m in diameter, are arranged in both clusters, and lines. Some appear to be intercutting, although most are discrete. It has been suggested that these features stem from a prehistoric pit alignment boundary and if this were to be the case, these would be of high significance for the survival of earthworks of this date (Hartley & Squires forthcoming). Although this remains an outside possibility, the features are immediately adjacent to an area of bare soil bank which contains visible ammunition/bullets. It is suggested that these features survive WWII training activity which is now being identified as part of the Park's history, as a training area and for the staging of a mock battle in 1942 (Leicester Mercury Supplement 1984).

A small rectangular mark associated with a possible track to the south of Dale Spinney may relate to the building showing in the foreground of the Knyffe illustration (1700).

In the south-east of the area, a series of parallel and sinuous ditch features have been identified. These appear superficially similar to those identified in the north-east of the High Park and may well have a similar military origin.

### ***The Low Park***

This area contains the continuation of the suggested north-west south-east trackway suspected to be of medieval date. To the south of Deer Park Spinney, a second trackway leaves at a right angle heading toward the south-eastern corner of the Ruins Enclosure. A series of rectangular parcels of land have been identified to the north of this trackway, and it is suggested that these may be the remains of medieval settlement.

To the north of this group is a strongly defined 14m square ditched enclosure. It is of unknown purpose and date, although it is assumed that it is contemporary with a phase of occupation of the house.

### ***Newtown Lawns***

This area contains an area of Late Upper Palaeolithic open occupation which is of High to Very High Significance, as this type and date of site is internationally rare.

A moated site (scheduled monument 108813) some 176m to the west of the house ruins has been sharply defined from the LiDAR data with some further detail on earthworks on the south-western side, and a suggestion of a building within the enclosure. This site is historically interpreted as a keeper's lodge. 75m to the north is a second rectangular enclosure of similar size to the moated site has been identified. This appears to be associated with a series of linear features which may be acting as water supplies to the moated site to the south.

The dog kennels MLE18598 to the south of the house ruins are in the east of the area. This area currently is disturbed ground with possible foundation stone visible due to some erosion.

Part of the area of stables that served the house fall within this area, and are visible as a ditch with some brickwork in places.

Other features include possible building footprints, and linear ditches in the east of the area.

### ***River Valley***

This area contains the Pheasantry, the Stables to the south of the house. It is crossed by the medieval park Pale.

The alluvial nature of this area will have resulted in the preservation of archaeological and environmental material within flood silt deposits from all periods.

### ***Ruins Enclosure***

This area includes the Scheduled remains of the House, Chapel and Mill, the Gardens, Tiltyard and Fishponds and Leat.

Analysis of the LiDAR intensity data for the site has revealed a circular feature within the walled garden. This may stem from a late medieval garden design and is of high archaeological significance.

### ***Little Matlock***

This area contains medieval ridge and furrow earthworks at the western end. Two bank of a possible enclosure of a rectangular enclosure have been identified but are not verified.

Pieces of Roman tile have recently been found in the bed of the Lin to the west of the Pheasantry (Dr. Phil Mills pers comm.)

## **Significance**

The historic emparking of the area and the consequence of extremely limited cultivation of much of the area has resulted in a landscape which retains a rich archaeological earthwork record providing evidence of earlier park and pre-park uses.

The most important site within the study area is the Late Upper Palaeolithic Site to the west of Newton Lawns (Figure 21, A), which has been confirmed through recent survey to be of international importance as a very rare discovery of an open air Creswellian flint-working site. This site, identified through chance discovery is associated with the Little Matlock Gorge which offered a rare topography which was attractive to hunters. Other hunting sites might be expected near to the Gorge either associated with rocky outcrops or sealed along with contemporary palaeoenvironmental deposits below alluvial sediments adjacent to the Lin (Cooper & Harvey 2014). It is emphasised that the discovery of the known site was effectively by chance and not the result of any systematic work. A fuller picture of the extent of these deposits could be achieved by structured archaeological and palaeoenvironmental survey.

Within extensive earthworks revealed across the park are newly identified banked and ditched enclosures (Figure 21, B & C), and possible terrace field systems which may stem from the later prehistoric periods (Figure 21, D & E). It is not possible to date these features without intrusive investigation, but should they be of prehistoric date, they would be of a high significance due to their rarity. Survival of pre-medieval field systems as earthwork features is rare nationally and would be exceptional regionally and these features would be very important assets within the park. In the north-east of the park in the Hallgates area are a series of deeply incised parallel ditches (Figure 21, K). A clear understanding of the dating of these substantial features is important in assisting their interpretation and future management.

Other earthworks that have a clearer medieval character are stretches of the medieval park Pale and the Scheduled moated house site (Figure 21, H) (which is by definition of national significance). Evidence of possible medieval occupation (Figure 21, G) to the east of the house ruins (Figure 21, J) is a significant discovery and with confirmation through further survey would extend the archaeological narrative for the development of Bradgate House. Later adaptation and use of the park through the Tudor era and beyond is also reflected in the archaeological record, with features including the possible sites of outbuildings and structures relating to the Tudor park. Further work is needed to refine our understanding of the structural remains in the vicinity of the house that stem from this period as there is probably a greater complexity to the surviving remains than can be interpreted from the documentary

evidence which is the source for the known building records in this area. Features relating to the estate's later 18th and 19th century use including the 18th century racetrack and the former stables below Old John. Evidence of a structure and enclosed area within the Old John Spinney may relate to this phase. Taken as a whole, the archaeology providing evidence of the development of the medieval and later phases of the park may be considered to be of national significance for their collective value.

The park also contains the distinctive remains of Bradgate House (Figure 21, C), built in brick as an early example of a non-defensive house c. 1500 by the 1st Marquess of Dorset. The house was abandoned in 1739 and gradually reduced to the romantic ruin, which remains today. The site of the house and immediate garden is a Scheduled Monument, whilst the park as a whole is included at grade II on English Heritage's Register of Parks and Gardens of Special Historic Interest, making them both of national importance. The archaeology of the gardens and immediate park remains legible with associated features such as fishponds also surviving, and the interest of these remains in reflecting an abandoned Tudor garden is such that it likely warrants extension of the Schedule designation to cover its entirety. New information contained in the LiDAR intensity data indicates that new facets of garden design may be revealed through the application of new methods and technologies. Earthworks to the west of the house including at least one moated site within which evidence of a building is emerging along with other enclosures and probable water bearing ditches add to the temporal and spatial complexity.

Old John Tower to the north, marking the site of a previous windmill within the park, and the adjacent Yeomanry War Memorial are both Grade II Listed buildings and of national significance.

A significant 20th century archaeological layer has been uncovered through recent survey which supported by some newspaper and photographic evidence has identified areas of possible WWII activity that has left its own archaeological signature which has consequently clouded some of the understanding of previous phases. These features are nevertheless of local significance, or possible regional collective significance in reflecting concerted wartime use. It is quite possible that pre-existing features were used in the modern military phase, and apparent second world war features do in fact have a much earlier origin.

**Comment [mgb31]:** From RC: Do the garden remains need the protection offered by scheduling or can they be addressed through strengthening understanding of the remains, inclusion in the management plan, and/or reconsideration of the HPG registration?

**Comment [mgb32]:** MGB requested info from WC.

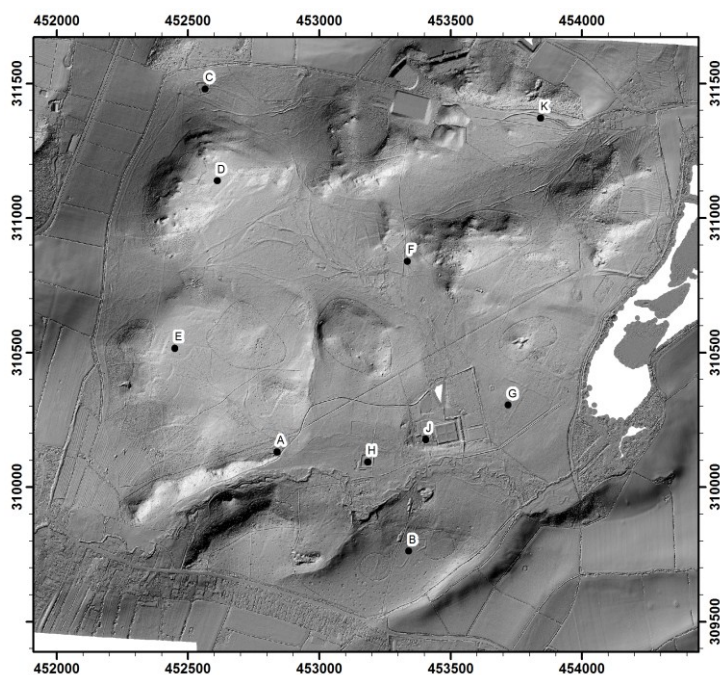


Figure 21: Key sites as centre points

LiDAR Source: Environment Agency 2014

Table 7: Key sites

Key	Name
A	Creswellian Site
B	Enclosure in Deer Sanctuary
C	Enclosure to north of Old John
D	Field Systems below Old John
E	Field Systems below Tyburn
F	Medieval Park Pale / Pit area
G	Earthworks to east of Bradgate House
H	Moated Site
J	Bradgate House and associated structures
K	Ditches in Hallgates area

## Erosion

Ongoing erosion of monuments was not widespread across the Park features.

Designated sites: Specific erosion problems were noted for the known Creswellian Upper Palaeolithic site (MLE9435) (which has been the subject of evaluative work reported separately) and also for another area where worked lithics have been recovered which have been dated to the Mesolithic (MLE9436).

The Mill Leat (MLE18603) is suffering ongoing erosion especially around NGR SK5287 1015, and there is also damage being caused to the Dog Kennels (MLE18598) where possible foundation stone is being exposed.

Near to the reported finding of a Roman coin (MLE21007), a footpath is exposing bare-earth.

Erosion has recently (May 2014) been noted on the west side of the newly identified enclosure to the north of Old John (FL00447) where several paths converge. This earthwork is currently undated but may be of later prehistoric date and measures to prevent further erosion of these features should be considered.



Figure 22: Path erosion across ditch and bank of undated enclosure (FL00447) to the north of Old John

The main threat to archaeology within the park is from localised erosion, due to visitor pressures in areas of high footfall and from deer in other localised areas. Evaluative test pitting of the Late Upper Palaeolithic site has provided information to enable an understanding of the site's condition, character and associated significance and, based on that, to inform management decisions regarding its future treatment. A number of earthwork features are also suffering from erosion, including stretches of medieval park Pale and the leat through Newtown Lawns.

Table 8: Erosion areas noted during walkover survey and subsequently

<i>PRN</i>	<i>Description</i>	<i>Visit Date</i>	<i>Character Area</i>	<i>Easting</i>	<i>Northing</i>	<i>Comment</i>
FL00534	Bank in Bradgate Park	09-Apr-14	High Park	452210.00	310963.00	Vehicle damage on a current track.
FL00535	Bank in Bradgate Park	09-Apr-14	High Park	452308.00	310928.00	Vehicle damage on a current track.
FL00614	Park Pale Bradgate Park to south of Mill Leat in West.	09-Apr-14	Newtown Lawns	452881.00	310110.00	There is a boggy area where the Mill Leat, and Medieval Pale intersect, and both Pale and Leat are suffering ongoing erosion. There is a Vehicle track running south-north through gap in wall, and several human/deer tracks running west-east on the north side of the wall.
FL00617	House Platform in Bradgate Park	08-Apr-14	High Park	452666.00	311082.00	There is evidence of erosion in the past, but this is now grassed over, and not a management problem.
FL00635	Enclosure in Bradgate Park	04-Apr-14	Middle Park	453638.00	310653.00	Vehicle damage on a current track.
MLE18598	Dog kennels south of Bradgate House; KENNELS	02-Apr-14	Newtown Lawns	453429.22	310120.09	The modern roadway crosses on the southern side of the Kennels area.
MLE9435	Creswellian site at Bradgate Park; SITE:	02-Apr-14	Newtown Lawns	452609.88	310069.34	Footpath is causing erosion especially through area of rocky outcrop.
MLE18603	Leat from the Lin to Bradgate House; LEAT, DAM	02-Apr-14	Little Matlock, Newtown Lawns, Ruins Enclosure	453002.84	310312.41	There is a boggy area where the Mill Leat, and Medieval Pale intersect, and both Pale and Leat are suffering ongoing erosion. There is a Vehicle track running south-north through gap in wall, and several human/deer tracks running west-east on the north side of the wall.
MLE9436	Mesolithic flints from Bradgate Park; SITE	02-Apr-14	Little Matlock	452406.88	310039.41	Pedestrian traffic erosion
MLE21007	Roman coin from near Hallgates entrance to Bradgate Park; FINDSPOT	05-Apr-14	Hallgates	454200.00	311200.00	Vehicle damage on a current track.
FL00447	Earthwork enclosure	18-May-14	High Park	452540	311482	Footpaths are causing erosion of earthwork banks (Figure 22).

## Discussion

The LiDAR survey has succeeded in identifying a large number of earthwork features, some of which were known from previous studies but many of which are new. Many of the earthworks are clearly associated with the park boundaries, i.e. the park Pale, and are presumed to be of medieval date. However, others, such as a series of probable terrace systems seen in the western and northern parts of the park are harder to date although would appear to be of pre-medieval date.

The preservation of pre-medieval field systems as earthwork features in Leicestershire is extremely rare and the two clear areas of identified system in the vicinity of Old John, and Tyburn, the former with a possibly associated enclosure, both require a more detailed understanding for their significance to the Park and the wider area to be better understood. If these features were to be proved to be of prehistoric or perhaps Romano-British date they would be highly significant and would attain great importance within the park.

The possible evidence of medieval occupation to the east of Bradgate House appears to be quite extensive and if the date and character of these remains can be demonstrated would greatly expand the understanding of the development of the park in the medieval period prior to the construction of Bradgate House. The moated site and the other earthwork and structural remains in its vicinity also form part of this picture. The curious small moated feature on the north-west side of Bradgate House may be part of the house garden complex.

Surviving ridge and furrow near to the Hall Gates entrance shows the agricultural uses of the park area outside the original hunting park boundaries. The multiple parallel ridges seen in the north-western part of the park appear to be quite late as they cut most other features. Their origin is not, as yet, clear but might be associated with drainage or ground management.

The large numbers of multiple hollow ways seen most especially towards the north-east areas of the park are difficult to date. Those given LiDAR numbers (FL00593-598) are the most well-defined with fairly crisp edges and could give the impression of being deliberately dug. They could therefore be boundary ditches as suggested by Squires (Stevenson and Squires 1999 p72). They could also be track ways possibly associated with the Broad Gate route. However, similar, less deep, features can be seen nearby which could be interpreted as eroded tracks. Are FL00593-598 simply deeper tracks with the same origin? It is known that that parts the park was used for military training during the Second World War which included the use of tracked vehicles capable of causing widespread erosion. A series of Bren Gun carriers from the 48th Division are pictured in mock action and also giving rides to an audience of munitions workers and general public who were witnessing war-gaming in June 1942 (Leicester Mercury 1984). Anecdotal evidence also suggests that motorcycle despatch rider training also took place there which might easily create a number of single meandering gullies of the type seen here.

Second World War activity is clearly seen in the two shooting butts areas where the large number of spent bullets eroding out of a bank continues to kill the vegetation. Investigation of the possible trenches and bunker may yield further information about this area. The potential mortar and shell craters attest to an interesting period in the history of the park. Should any future work be carried out here it should be borne in mind that there is the potential for unexploded ordnance.

During the survey a number of additional features were noted and others pointed out by Rob Clough. These would warrant further inspection of the LiDAR results and further inspection and interpretation on the ground.

This archaeological study which has combined the generation, analysis and interpretation of LiDAR data evidence along with a walkover survey has enabled the identification and interpretation of numerous possible new sites, and this has thrown an objective light upon the known archaeological record of the park which can be used to validate all previous assumptions of the park's development. This can include for example the phasing and development of the park Pale, features which may be prehistoric or in fact relate to WWII activity, or the preserved circuit and boundary markers of the 18th Century racecourse.

A number of discoveries have posed more questions than have been answered. Some opportunity to address some of these questions may be provided through the University of Leicester's planned field

school in the coming years although other mechanisms enabling the investigation of targeted archaeological deposits will need to be found to answer all the questions raised. Although professional expertise would be essential in the direction, interpretation and analysis of results, community archaeology groups (e.g. the recently formed Groby Group and the current Charnwood Roots project) offer potential for the engagement of people from a variety of sectors in this work and for a variety of models to be used in response to the archaeological issues identified.

The recent identification of earthwork features in the park prior to the LiDAR survey (Hartley and Squires forthcoming) was made possible by the bracken rolling programme which was expanded in the spring of 2012. Continued bracken management across the park is required to maintain the visibility of the earthworks both for interpretation and for further study. Some of these terraced areas are still partially obscured by bracken and further survey with continuing management of the bracken would yield results.

## Publication

A summary of the work will be submitted for publication in the Transactions of the Leicestershire Archaeological and Historical Society in due course. A record of the project will also be submitted to the OASIS project. OASIS is an online index to archaeological grey literature.

## Acknowledgements

The project was managed by M Beamish. The bulk of LiDAR analysis and interpretation was by N. Hannon with further analysis by M. Beamish. The walkover survey was carried out by A Hyam. Thanks are due to Rob Clough, Park Ranger, for invaluable assistance during the survey and for a range of background information. Thanks to Environment Agency staff (and in particular Louise Hurst) for the fast turnaround of Flight data and for the supply of the Intensity data without further cost to the project. Thanks are also due to all those involved in commissioning the project and to all the Staff at Bradgate Park for their interest and assistance during the work.

## Bibliography

Bewley, R.H., Crutchley, S.P. & Shell, C.A. 2005.	New light on an ancient landscape: LiDAR survey in the Stonehenge World Heritage Site. <i>Antiquity</i> (79) 636-647.
Bradgate Park website	<a href="http://bradgatepark.org/">http://bradgatepark.org/</a> accessed 28.4.14
Challis, K., Carey, C., Kinsey, M. & Howard, A.J. 2011.	Airbourne LiDAR and Intensity and Geoarchaeological Prospection in River Valley Floors. <i>Archaeological Prospection</i> (18) 1 13
Cooper, L & Harvey, J .2014	An Archaeological Test Pit Evaluation at Bradgate Park, Newtown Linford, Leicestershire (SK 5280 1010) ULAS Report 2014-090
Devereux, B.J., Amable, G.S. & Crow, P. 2007.	Visualisation of LiDAR terrain models for archaeological feature detection. <i>Antiquity</i> (82), 470-479
Leicester Mercury Supplement .1984	<i>The Battle of Bradgate</i> , June 1942
Hartley, R.F. & Squires, A.E., forthcoming	<i>Ancient Earthworks Discovered in Bradgate Park, Transactions of the Leicestershire Archaeological and Historical Society</i>
Piggott, S. 1981.	<i>Early Prehistory</i> . Cambridge: CUP.
Ramsey, D. 2011	The Tower upon John Hill in Bradgate Park – dispelling the myths. <i>The Leicestershire Historian</i>



	<i>2011 Vol 47 p37-40</i>
Rich, P.M. & Fu, P. 2000.	Topoclimatic Habitat Models. <i>Proceedings of the Fourth International Conference on Integrating GIS and Environmental Modelling.</i>
Stevenson, J. & Squires, A. 1999.	<i>Bradgate Park, Childhood Home of Lady Jane Grey.</i> Leicester: Kairos Press.
Zakšek, K., Oštir, K. & Kokalj, Ž. 2011	Sky View Factor as a Relief Visualisation Technique. <i>Remote Sensing</i> 2011(3), 398 415.

## OASIS Information

Project Name	LiDAR Study and Walkover Survey of Bradgate Park
Project Type	Non-intrusive survey
Project Manager	M Beamish
Project Supervisor	N Hannon & A Hyam
Previous/Future work	None
Current Land Use	Park
Development Type	None
Reason for Investigation	Part of a wider project
Position in the Planning Process	n/a
Site Co ordinates	SK 532 108 (centre)
Start/end dates of field work	2.04.14 – 9.04.14
Archive Recipient	LCC
Study Area	850 acres

**Appendix 1: Walkover survey photos:**



Figure 23: MLE739 moated site (lodge?) Photo 3838 Looking NE



Figure 24: MLE 739 moated site (lodge?) Photo 3912 Looking N



Figure 25: MLE745 Bradgate House ruins Photo 3848 Looking NW



Figure 26: MLE745 ruins plus MLE746 chapel (on left) Photo 3849 Looking NE



Figure 27: MLE746 chapel Photo 3851 Looking SW



Figure 28: MLE747 fishpond Photo 3862 Looking E



Figure 29: MLE750 mill Photo 3970 Looking N



Figure 30: MLE756 possible remains of medieval settlement Photo 3901 Looking NW



Figure 31 :MLE9435 Late Upper Palaeolithic site Photo 3824 Looking NE



Figure 32: MLE9436 Mesolithic flint findspot Photo 3826 Looking SE



Figure 33: MLE14007 Garden wall Photo 3856 Looking SE



Figure 34: MLE14008 Tiltyard Photo 3853 Looking SE



Figure 35: MLE14009 Old John Tower Photo 3985



Figure 36: MLE14010 War memorial Photo 3987





Figure 37: MLE18593 pheasantry Photo 3840 Looking NW



Figure 38: MLE18594 fishpond Photo 3863 Looking N



Figure 39: MLE18596 avenue of trees Photo 3870 Looking N



Figure 40: MLE18597 stables Photo 3845 Looking SE



Figure 41: MLE18598 dog kennels Photo 3842 Looking NE



Figure 42: MLE18599 gatehouse Photo 3897 Looking SE



Figure 43: MLE18600 gardens Photo 3860 Looking NW



Figure 44: MLE18601 watermeadow Photo 3910 Looking SE



Figure 45: MLE18602 deer barn Photo 3972 Looking SE



Figure 46: MLE18603 leat (adjacent to river) Photo 3830 Looking E



Figure 47: MLE18603 leat      Photo 3831      Looking NE



Figure 48: MLE18603 leat      Photo 3833      Looking E

Newly identified features



Figure 49: FL00006 enclosure Photo 3867 Looking S



Figure 50: FL00009 small moated site Photo 3908 Looking W



Figure 51: FL00016 ditched enclosure      Photo 3916      Looking SE



Figure 52: FL00018 enclosure      Photo 4171      Looking N





Figure 53: FL00019 moat/building

Photo 4165

Looking NW



Figure 54: FL00055 ditch

Photo 3874

Looking S



Figure 55: FL00446/7 enclosure Photo 4021 Looking E



Figure 56: FL00451 square enclosure Photo 4037 Looking NE



Figure 57: FL00452 bank/terrace Photo 4035      Looking S



Figure 58: FL00454 pits      Photo 3968      Looking NW



Figure 59: FL00483 ditch      Photo 4176      Looking E



Figure 60: FL00490 bank      Photo 4141      Looking SW



Figure 61: FL00534 bank Photo 4078 Looking W



Figure 62: FL00553 bank Photo 4147 Looking NE



Figure 63: FL00554 bank/stones Photo 4157 Looking S



Figure 64: FL00562 bank Photo 4113 Looking N



Figure 65: FL00593ditches Photo 4002 Looking W



Figure 66: FL00612 pale Photo 3880 Looking W



Figure 67: FL00619 bank Photo 4070 Looking SW



Figure 68: FL00635 enclosure Photo 3950 Looking NW





Figure 69: FL00639 pale Photo 3966 Looking W



Figure 70: FL00647 ditch Photo 3935 Looking W



Figure 71: FL00655 banks Photo 4025 Looking W



Figure 72: W005 sunken feature/saw pit? Photo 3890 Looking S



Figure 73: W007 bank/ditch Photo 3942 Looking E



Figure 74: W009 stables Photo 3980 Looking N

## **Appendix 2: Gazetteer of sites**

The Gazetteer has been compiled in a relational database and exported into this document in PDF format. Designated, Un-designated and records of newly identified features are all listed in numerical order, in the order of Scheduled Monuments, Listed Buildings, Historic Environment Records, Features identified through LiDAR analysis and from walkover survey.

Broad descriptions, classifications and period information are included in the top of each page. Individual observations and interpretations are listed below along with initials. Hence observations from the walkover survey are by Andrew Hyam and are initialled 'AH', interpretations offered by R.F. Hartley and A. Squires in a forthcoming publication on the Park have been incorporated and are initialled 'RFH & AS' and observations by Matthew Beamish are initialled 'MGB'.

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