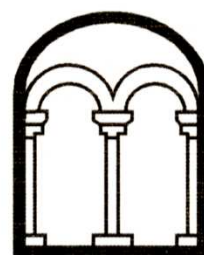


**RIDGE AND FURROW
IN
BEDFORD BOROUGH**

FINAL REPORT



Albion
archaeology



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IN
BEDFORD BOROUGH

FINAL REPORT**

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Preface

All statements and opinions in this document are offered in good faith. Albion Archaeology cannot accept responsibility for errors of fact or opinion resulting from data supplied by a third party, or for any loss or other consequence arising from decisions or actions made upon the basis of facts or opinions expressed in this document.

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Key Terms

Throughout this document the following terms or abbreviations are used:

BBC	Bedford Borough Council
CIfA	Chartered Institute for Archaeologists
HER	Historic Environment Record
HET	Historic Environment Team of Bedford Borough Council (BBC)



Non-technical Summary

During the 1990s, a number of projects undertaken through the English Heritage Monuments Protection Programme investigated survival and loss of medieval and post-medieval agricultural earthworks in the English Midlands, including for Bedfordshire as a whole. The combined results of these projects were published as 'Turning the Plough' (TTP1 hereafter) (Hall, 2001). TTP1 included a gazetteer of 40 parishes (associated with 43 'townships') where the most significant surviving earthworks had been identified.

Around fifteen years later, the survival of these earthworks was reassessed and recorded data brought up-to-date using specially commissioned aerial photos taken in 1999 and again in 2011, as part of 'Turning the Plough 2' (TTP 2012, hereafter) (Gloucestershire County Council, 2012). There was no reassessment of 'non-priority' townships i.e. those not amongst the original 43 'priority townships' where the most significant earthworks had been identified. Consequently, ridge and furrow within Bedford Borough was not re-examined, given its lack of 'priority' townships.

The only data held prior to this current project on ridge and furrow within the borough, resulted from the initial TTP1 data-gathering exercise, which simply recorded the then surviving ridge and furrow identified from photos taken in 1996 as a total percentage calculated from each parish acreage. This spreadsheet data (held by Central Bedfordshire Council) was accompanied by a basic GIS dataset showing the location of each ridge and furrow parcel identified but no other information (GIS once held by both English Heritage and Northamptonshire County Council but since deleted by both organisations; Bedford Borough Council is believed to have the only surviving copy).

So in 2016, it was decided to update and supplement this minimal data with freshly gathered information ('the survey', driven by the particular purpose of informing the Bedford Borough Local Plan 2035 Sites & Allocations process, as well as to aid future conservation of the borough's ridge and furrow through informed development management decision-making, and input into countryside stewardship schemes, and in some instances, through putting forward sites for Scheduling as Scheduled Monuments.

This report examines the degree of survival of ridge and furrow within the borough today, by contrasting its presence on the 2014-2015 vertical aerial photos (held by the Council within the Bedford Borough Historic Environment Record) with that recorded in the mid-1990s by TTP1 and furthermore, by 'ground-truthing' initial conclusions through a number of site visits. The report was commissioned by Bedford Borough Council's Planning Policy Team and is a collaboration between Bedford Borough Council's Historic Environment Team and Albion Archaeology, a commercial archaeological organisation based in Bedford. It aims to provide an up-to-date quantification of the survival and percentage loss of ridge and furrow within each parish, and an overall assessment of condition, typology, chronology/phasing (where possible), associations and significance.

The TTP1 data somewhat crudely based its individual parish estimates for ridge and furrow survival in the mid-1990s on a percentage calculation of the original extent of ridge and furrow coverage, which was taken to be the same as the total acreage for each modern parish. However, modern parishes could contain more than one township, the latter being the smallest unit containing a complete field system and in the East Midlands



many townships were characterised by having a large proportion of arable land, which yet in some areas only reached 90% of a township.

Nonetheless, within the confines of the current project, this is the only comparative data available for the purposes of determining whether there has been ongoing loss to ridge and furrow within Bedford Borough over the last two decades. Whilst the percentage total for survival of ridge and furrow within each parish can only be taken as broadly indicative, the updated figures can at least demonstrate more accurately, further/ongoing loss.

The survey found since the collection of the TTP1 data in the mid-1990s, c.26% of all ridge and furrow identified at that date has been wholly or partially lost, predominantly to agricultural cultivation but also to the construction of housing and playing fields, the latter mainly in the parishes in and around Bedford. The average survival across Bedford Borough parishes has reduced by 0.55% from 2.08% by parish (based upon a calculation from the total parish acreage) in the mid-1990s to 1.53% by parish presently.

The survey also identified a significant number of 'new' areas of ridge and furrow, i.e. sites not previously identified by the mid-1990s TTP1 project. However, the earlier project appears to have been biased towards 'higher quality' ridge and furrow where there was no question over survival and/or interpretation, and condition was favourable, whereas the current project has recorded all visible and probable ridge and furrow, irrespective of condition; this probably accounts for the condition of much of this newly recorded ridge and furrow being recorded as poor. Consequently, whilst c.26% of ridge and furrow identified in the mid-1990s has been lost subsequently, coupled with the addition of newly identified sites this actually equates to an overall loss of 13%.

Whilst the small amount of surviving ridge and furrow within Bedford Borough is subject to ongoing reduction and 54% of the newly calculated total acreage of ridge and furrow is in poor or uncertain condition, 46% is in moderate to good condition and worthy of consideration for preservation.



1. INTRODUCTION

1.1 *General introduction and project background*

The project has been undertaken by the Bedford Borough Historic Environment Team (Archaeology) in collaboration with Albion Archaeology, a commercial archaeological organisation based in Bedford, and funded by Bedford Borough Council Planning Policy Team in order to enhance the primary historic environment evidence base for the borough and inform the Bedford Borough Local Plan 2035 Sites and Allocations process alongside development management decision-making, input into countryside stewardship schemes, and consideration of sites for scheduling under the Ancient Monuments and Archaeological Areas Act, 1979.

The primary project outputs are Geographical Information System (GIS) shapefile mapping of ridge and furrow polygons, together with associated record or 'attribute' tables. For the TTP1 project undertaken in the mid-1990s within Bedford Borough, the available shapefile, 'Ridge+Furrow_Region' contains a single column of metadata in the attribute table recording ridge and furrow areas as simply, 'Certain' or 'Probable', with individual polygons mapped accordingly. As part of the current project, this data has been supplemented (within a new shapefile entitled, 'Ridge_Furrow1990' - having copied over the existing data) with additional fields of current information including 'condition'; 'association'; 'components', type etc. of ridge and furrow. The TTP1 data has also been updated to reflect whether those areas of ridge and furrow originally recorded in the mid-1990s survive to the present day, with any changes to area mapped, and any loss calculated in a separate spreadsheet based upon ArcGIS's auto-generated area (m²) for each polygon ('redrawn' polygons compared against the original data).

A separate GIS shapefile, 'Ridge_Furrow2016' has been created for ridge and furrow 'newly' identified from the 2014-15 vertical aerial photos in 2016. The data structure behind its attribute table mirrors that of the attribute table associated with the updated 'Ridge_Furrow1990' shapefile, in that for example, attributes such as 'condition', 'components', type etc. are recorded via pre-set choices in drop-down boxes. Each new area of ridge and furrow has also been mapped as a polygon, with its area (m²), auto-generated.

This report is intended to serve as a technical summary of the 2016 survey, describing project methodology and outputs, with broad conclusions drawn as to the extent of ridge and furrow survival within Bedford Borough, its loss over the last two decades since TTP1 was undertaken in the mid-1990s, its varying degree of condition, and particular sites which should be considered for preservation. Only one immediate example worthy of scheduling has been identified – Rookery Farm, Cotton End, Eastcotts.

This report includes initial analysis using the statistical results for the entire survey area ('the borough'), drawn up with the aim of informing further research and facilitating decision making regarding the future management of the most significant groups of medieval agricultural earthworks. This is followed up by



some detailed analysis at parish level (Table 2). The preservation or management of sites is discussed in Section 3.2.9.

The archaeological background to the survey is detailed in the project brief (Bedford Borough Council, 2016) and TTP1 (Hall, 2001). In summary, the 1990s Midland Open Fields Project (more frequently known as TTP1) used the latest aerial photography to examine loss and survival of medieval and later agricultural earthworks in the Inner and East Midland sub-provinces, largely as defined by Roberts and Wrathmell (2000). This early work was funded by the English Heritage Monuments Project Protection Programme (MPP) with the results published in full by Hall (2001) and in summary by Anderton and Went (2002).

A major output of TTP1 was the identification of 43 priority ‘township’ field systems within 40 civil parishes across the East Midlands, representing the best surviving examples from the c.2000 townships initially examined; none were identified within Bedford Borough. Aerial reconnaissance of these ‘best’ surviving township field systems in 1999, suggested loss and damage to ridge and furrow was actively ongoing. By 2003, Historic England (formerly English Heritage) was suggesting, 94% of East Midlands ridge and furrow had already been lost. TTP2, a review of TTP1 undertaken in 2012, demonstrated a further 4.24% loss to ridge and furrow had occurred within the priority townships in the intervening 13 years between projects (Gloucestershire County Council, 2012, p.59).

This project examines and records the survival, loss, condition and significance of agricultural ridge and furrow earthworks at a local level, within Bedford Borough - an area lacking in ‘best’ East Midlands examples of township field systems according to TTP1 and TTP2 - but nonetheless seemingly affected by the general trend of declining survival.

The results will inform the Bedford Borough Local Plan 2035 evidence-base and Sites and Allocations process, and heritage advice in response to planning applications and other land use proposals. It is hoped to add the results of the project into the Natural England (SHINE) database in the near future to assist in the making of appropriate management decisions in areas under consideration for entry into Countryside Stewardship Schemes.

1.2 Definition of the study area

The project survey area is defined as the administrative area of Bedford Borough. Its extent, boundaries and civil parishes are shown on Figure 1.

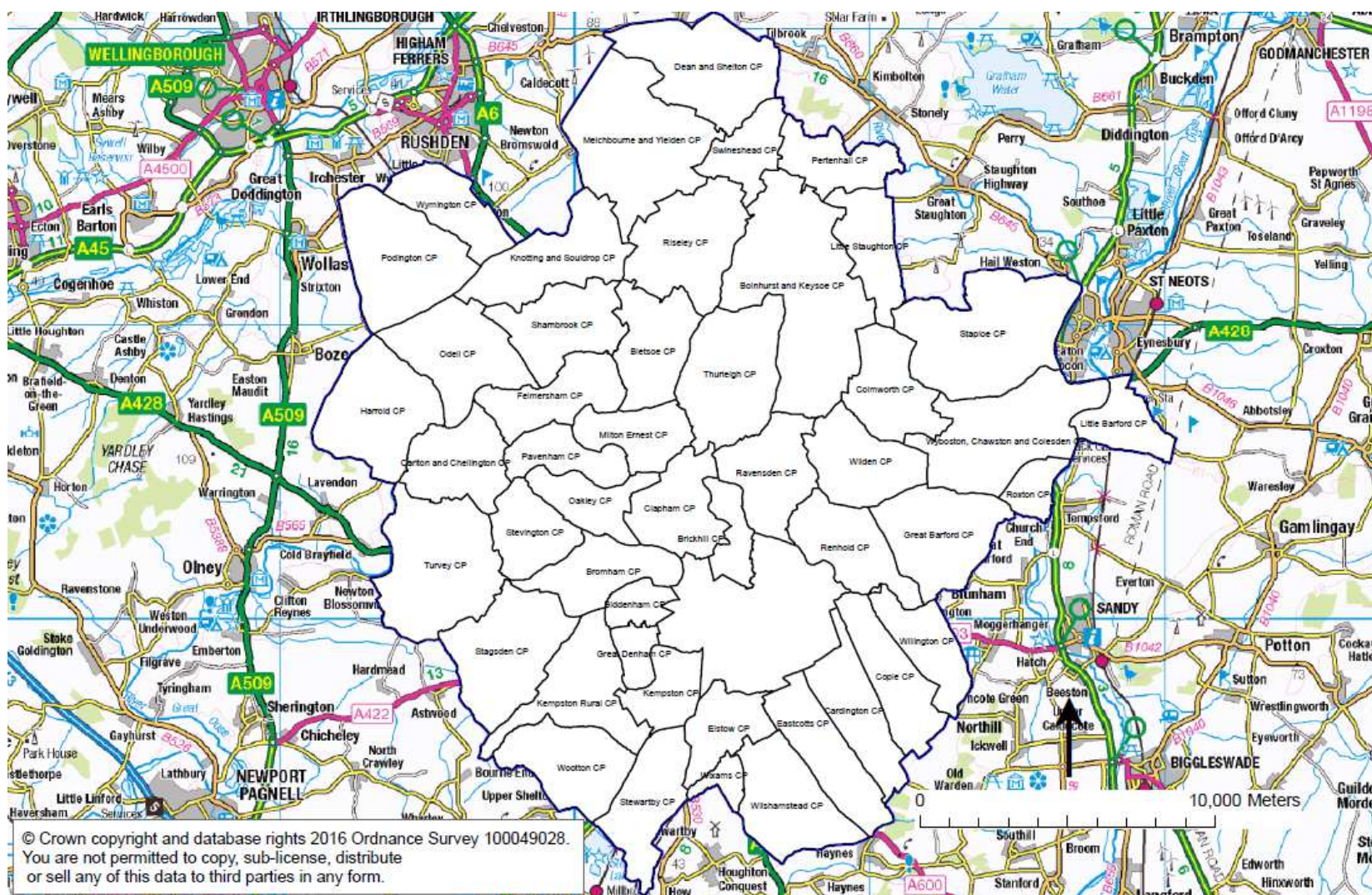


Figure 1: Location of Turning the Plough civil parishes



1.3 Aims

Project aims were set out in the brief (Bedford Borough Council, 2016):

‘The primary aim of the work set-out in this brief is to provide an over-arching context for ridge and furrow in the borough, suitable to underpin the heritage assessment of individual ridge and furrow sites as part of the Local Plan 2035 Sites and Allocations process, as well as for planning applications’.

It continues:

‘The project will aim to quantify the current survival of ridge and furrow within Bedford Borough, in order to determine whether the previous trajectory of loss suggested by the 1990s Midlands Open Field Project has continued since then or has been ameliorated by initiatives such as Countryside/Environmental Stewardship’.

‘The project will also aim to identify ‘new’ ridge and furrow sites. A number of areas of ridge and furrow which appear to have high survival and/or research value (as examples of historic agricultural and social systems), and community/amenity value, are apparent on the Borough Council’s latest aerial photos dating from 2014-2015 but were not previously identified by the 1990s Midland Open Fields survey’.

And:

‘To systematically and rapidly collect preliminary data through site visits to ground-truth and expand upon the results of the aerial photographic analysis’.

1.4 Objectives

Project objectives were to provide:

- an up-to-date quantification of the survival/percentage of loss of ridge and furrow in the Borough;
- identification of new ridge and furrow sites that were not recorded by *Turning the Plough* (Hall 2001);
- a qualitative assessment of the overall condition, typology, chronology/phasing, associations and significance of the surviving ridge and furrow, focussing on visiting a minimum of eight key sites.



2. METHODOLOGY

2.1 General

This project was undertaken in accordance with the Bedford Borough brief (2016). The proposed methodology was set out in detail in the project design, prepared prior to undertaking the survey (Albion Archaeology 2016), and subsequently amended through verbal discussion at the commencement of the project and in its early stages. The established method is detailed below:

- Systematic review of the original 1990s TTP1 GIS shapefile 'Ridge+Furrow_Region' (including attribute table) covering Bedford Borough. Utilising historic and recent aerial photographic data, alongside Lidar data. The reviewed, updated and amended data to be recorded on a new shapefile called 'Ridge_Furrow1990'.
- Record the presence or absence in 2014-15, of ridge and furrow parcels previously identified by the TTP1 GIS shapefile, on the new GIS shapefile 'Ridge_Furrow1990'. Amend shapefile polygons where ridge and furrow parcels have reduced in size/changed shape and record attribute data on condition, associations, components, types, and reasons for any loss.
- Where ridge and furrow recorded on the TTP1 GIS shapefile is no longer present, do not delete from the original 'Ridge+Furrow_region' GIS shapefile, but under the field column 'Presence/Absence' in the attribute table of the new shapefile 'Ridge_Furrow1990' record as 'No'.
- Create a GIS shapefile (and attribute table) for previously unrecorded ridge and furrow identified on the 2014-15 vertical aerial photos held by the Council and/or Environment Agency Lidar. To be called 'Ridge_Furrow2016'.
- Compare the historic data for each modern civil parish – the 'parish acreage' as recorded by the TTP1 project in the 1990s (taken to be broadly the same as the area originally covered by ridge and furrow in the medieval and post-medieval periods – see below) and the extent of surviving ridge and furrow recorded at that time, against the new data collected through aerial photographic analysis of the 2014-15 vertical aerial photos and/or Environment Agency Lidar data. Undertake statistical comparison to inform discussions regarding the current survival of ridge and furrow in Bedford Borough.
- However, the original extent of ridge and furrow for each civil parish as provided by the TTP1 project appears to have been crudely based upon the entire parish acreage rather than any detailed map regression and/or documentation study to ascertain the likely extent of the former Great Open Fields or private (non-communal) fields of ridge and furrow which are known to have existed in the borough. Nonetheless, calculations based upon these figures i.e. the estimated percentage survival of ridge and



furrow in the mid-1990s (based upon the parish acreage) can still be compared against the figures for survival today, allowing conclusions to be drawn as to the degree of decline over the intervening c.20 years. To use historic aerial photos (held by the Council) dating from the 1940's onwards, up-to-date photography and Lidar data hill-shaded and lit from different directions to double-check any uncertainties over the presence of and degree of survival of ridge and furrow within the Borough.

- Visit a 20% sample of ridge and furrow sites previously recorded by the 1990s TTP1/Midlands Open Field survey to ground-truth the updated data produced from analysis of the 2014-15 vertical aerial photos.
- Visit a 20% sample of ridge and furrow sites newly identified by analysis of the 2014-15 vertical aerial photos to ground-truth the initial data recorded.
- Attributes of each parcel of ridge and furrow to be recorded by one individual to introduce consistency into the data recording. Site visits to be undertaken by same individual. Sample of data to be checked by Project Team.

2.2 Sources consulted for the project

2.2.1 Data provided by Bedford Borough Council

- GIS shapefiles (and attribute tables) of the 1990s 'Midlands Open Field Survey' land parcel data for the borough (TTP1) called 'Ridge+Furrow_Region';
- Statistical data/Spreadsheet calculations of the percentage survival of ridge and furrow compared to its original likely extent, calculated for each civil parish in the mid-1990s for Bedford Borough (and available from Central Bedfordshire Historic Environment Record);
- 1:10,000 digital Ordnance Survey base mapping;
- Vertical aerial photography dating from 1940's through to 2014-2015;
- Environment Agency digital LIDAR;
- Online sources of aerial photographs: Google Earth, Bing etc.

2.2.2 Images

Interpretation of the vertical aerial photography, particularly the 2014-15 photographic coverage, was augmented by the use of Environment Agency Lidar (in the form of a GIS mosaic of hill shaded .tif files) and Google Earth. The Lidar was available for most of the study area and was useful in confirming areas of ridge and furrow. Both it and Google Earth were frequently useful in providing the recent history of a field and the reasons for any degradation and/or loss to ridge and furrow areas.



2.2.3 Turning the Plough data

GIS shapefiles were provided by Bedford Borough Council in 2016, which delineated the ridge and furrow recorded by the (TTP1) Midlands Open Field project within Bedford Borough in the mid-1990s. Unfortunately, the original digital data had been deleted from the Historic England archives and this shapefile data was obtained from Northamptonshire County Council, from which the data also now appears to have been deleted. The only metadata recorded was whether or not the presence of the ridge and furrow was thought to be 'Certain' or 'Probable'. Discrepancies were also found between the extent of the ridge and furrow surviving in the mid-1990s as shown by the GIS shapefiles and the surviving acreage listed on the accompanying spreadsheet.

2.2.4 Map Sources

The project used Ordnance Survey 1:10000 MasterMap mapping provided to Bedford Borough Council under a licence agreement with the former.

2.2.5 Mapping: GIS Shapefiles

The project mapping and records were produced almost entirely in GIS (including attribute table) format. Parcels of ridge and furrow were plotted (or amended) as closed polygons onto the Ordnance Survey map database in ArcGIS 10.1. The mapping produced falls into three categories:

- The original 1990s TTP1/Midlands Open Field Survey shapefiles of areas of ridge and furrow called 'Ridge+Furrow_Region'.
- The amended version (called 'Ridge_Furrow1990') of the TTP1/Midlands Open Field Survey shapefiles, reflecting changes to the original mid-1990s data through loss of or reductions to areas of previously recorded ridge and furrow. Additional attributes have been recorded above the single category present in the original TTP1 data, including type, components, association etc.
- Previously unrecorded ridge and furrow present on the 2014-15 vertical aerial photos recorded as a separate GIS shapefile and attribute table called 'Ridge_Furrow2016', so as to separate it from the amended/updated 1990s data, for ease of statistical analysis.

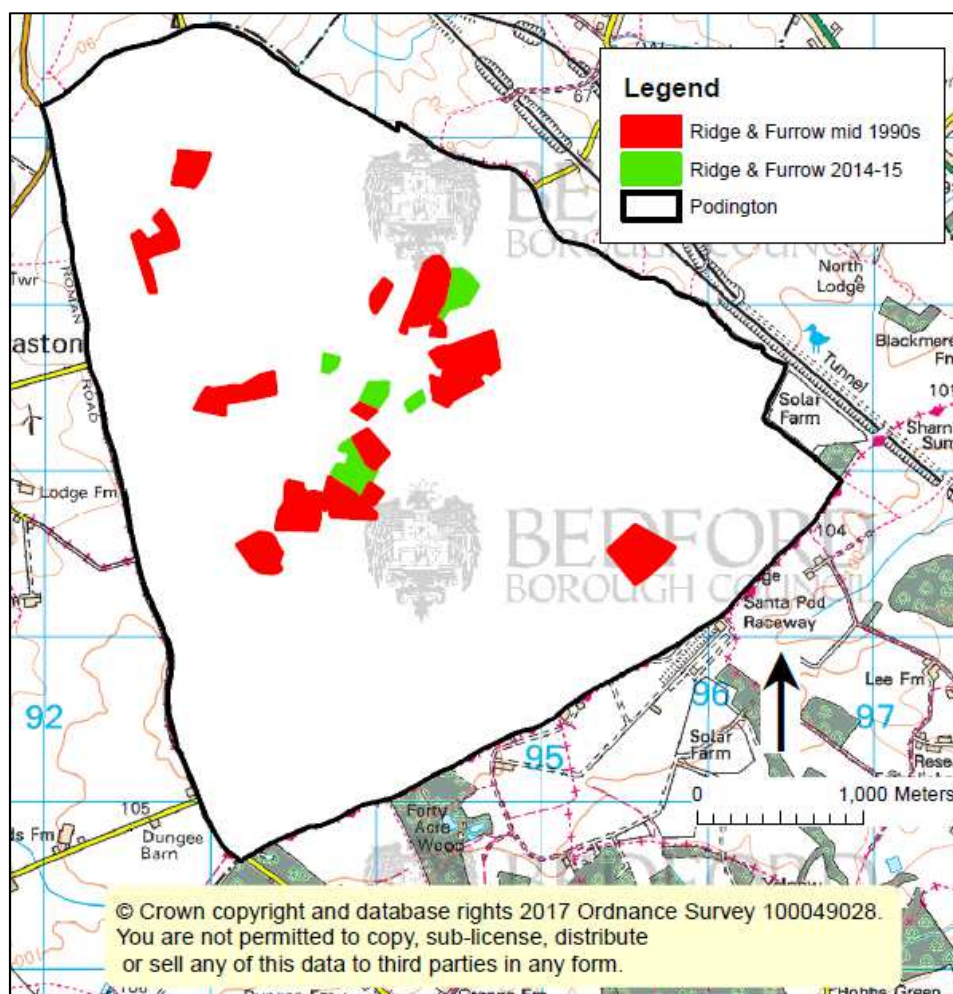


Figure 2: Example of Mid-1990s and 2014-15 Project mapping at Podington

2.7 Object data/attribute tables

Polygons of ridge and furrow were either newly mapped or if already existing (i.e. from the 1990s TTP1 data), amended where necessary, with required information entered on the associated ArcGIS attribute table. All attribute tables record Object ID, parish, quality, presence/absence, condition, association, components, shape length, shape area, type, reasons for loss, comments, site visit if undertaken, and site visit comments where applicable. The database tables and the attributes they record are given in the Appendix (Section 7.1).

The 'Quality' of ridge and furrow parcels was described as 'Probable' in cases where areas were obscured by trees and scrub, or, in areas where Lidar data was absent, where it was not clear whether ridge and furrow detectable on aerial photographs survived as cropmarks only. In most cases the quality of the earthworks was identifiable with a good degree of confidence. In each case a best estimate of whether any earthworks survive has been employed, unless the site was subsequently subject to a visit where presence or absence was able to be clarified in most instances.

2.8 Site Visits & Photos

A c.20% sample (42 out of 230 sites) of ridge and furrow sites previously recorded by the 1990s Midlands Open Field survey (TTP1) were visited to



ground-truth the data produced from analysis of the 2014-15 vertical aerial photos. This was followed by visits to a c.20% sample (10 out of 52 sites) of ridge and furrow sites newly identified from the 2014-15 vertical aerials. All sites were photographed.

Whilst the sample of sites visited in both instances, were as systematic across the borough as could be (Figure 3), these were largely governed by the location of sites being considered as part of the Bedford Borough Local Plan 2035 Sites and Allocations process, and those additional sites which could be reached by Public Right of Way (PROW). Even so, there were still a number of the latter, where not all areas of the ridge and furrow could be viewed from the PROW.

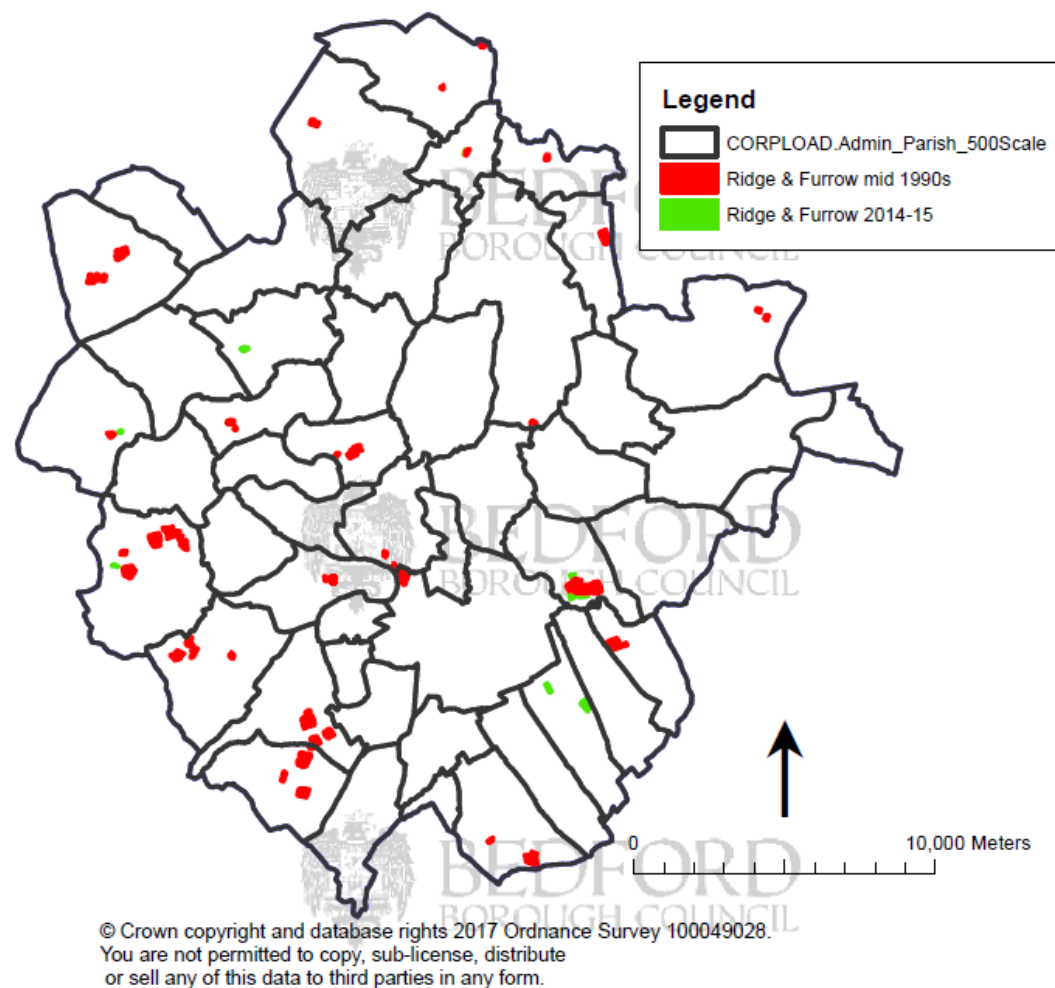


Figure 3: Site Visit Coverage for sites in Bedford Borough

52 ridge and furrow sites in total were visited within Bedford Borough from a total of 282 sites identified by the two surveys.



3. RESULTS

3.1 Introduction

The project brief (Bedford Borough Council 2016), method statement (Albion Archaeology 2016) and Project Team discussions informed the production of comparative statistical tables and pie charts derived from the original TTP1 spreadsheet data available from Central Bedfordshire Council, the GIS mapping, attribute tables and site visits.

The original mid-1990s spreadsheet data gave total acreage values for each Bedford Borough parish (based on modern civil parishes) against the acres of surviving ridge and furrow, and percentage of survival by parish at that time. This is directly compared to the data generated by analysis of the 2014-15 photos.

As part of this project, the 1990s acreage for surviving ridge and furrow for each parish as given on the TTP1 spreadsheet was double-checked against the acreage of the original GIS polygon. In some cases there was a discrepancy, however, the margin of error was found to be so small (less than 0.5%), that the original TTP1 spreadsheet totals were used for the comparative calculations with the new totals, in order to be consistent.

The main statistical tables and pie charts presented in this report are as follows:

Table 1	Total area of ridge and furrow (all conditions) recorded in mid1990s and 2014-15
Figure 5	Condition of 'new' ridge and furrow recorded on the 2014-15 photos
Figure 7	Present condition of ridge and furrow originally recorded in the mid-1990s
Figure 9	Ridge and furrow present in mid-1990s but absent or heavily degraded in 2014-15 by reason
Figure 12	Ridge and furrow surviving in 2014-15 (i.e. mid-1990s plus 'new') by condition
Table 2	The proportion of the area of each parish containing good quality ridge and furrow
Table 3	Local Plan Sites by condition/degree of preservation.



Table 1: Total area of ridge and furrow (all conditions) recorded in mid1990s and 2014-15

Parish	Parish_acres	R & F recorded mid 1990's (acres)	% Survival of R&F recorded in 1990's (from parish acreage)	1990's R&F present in 2014-15 (acres)	% Survival of 1990's R & F in 2014-15 (%)	New' R & F present 2014-15 (acres)	Total R & F present 2014-2015 (acres)	Overall % of original parish acreage
Bedford	5957	65	1.09	35.28	54	0.00	35.28	0.59
Biddenham	1309	0	0.00	0.00	0	0.00	0.00	0.00
Bletsoe	2239	30	1.34	27.96	93	0.00	27.96	1.25
Bolnhurst and Keysoe	6193	40	0.65	25.72	64	3.53	29.25	0.47
Bromham	2009	34	1.69	29.29	86	14.53	43.82	2.18
Cardington	2106	4	0.19	0.00	0	21.83	21.83	1.04
Carlton and Chellington	2165	64	2.96	40.09	63	0.00	40.09	1.85
Clapham	2068	17	0.82	15.69	92	0.00	15.69	0.76
Colmworth	2139	8	0.37	7.68	96	0.00	7.68	0.36
Cople	2128	24	1.13	0.00	0	0.00	0.00	0.00
Dean and Shelton	3406	50	1.47	44.44	89	15.71	60.15	1.77
Eastcotts	2304	23	1.00	16.35	71	0.38	16.73	0.73
Elstow	1483	6	0.40	5.27	88	0.00	5.27	0.36
Felmersham	1981	82	4.14	57.58	70	0.00	57.58	2.91
Great Barford	2862	10	0.35	10.02	100	0.00	10.02	0.35
Harrold	3227	57	1.77	44.67	78	2.13	46.80	1.45
Kempston	1321	35	2.65	7.52	21	0.00	7.52	0.57
Kempston Rural	3390	99	2.92	101.85	103	7.36	109.21	3.22
Knotting and Souldrop	2801	128	4.57	123.63	97	0.00	123.63	4.41
Little Barford	1258	51	4.05	50.52	99	13.63	64.16	5.10
Little Staughton	1734	39	2.25	39.35	101	1.22	40.56	2.34
Melchbourne & Yelden	4650	56	1.20	35.67	64	3.87	39.54	0.85
Milton Ernest	1593	66	4.14	34.03	52	0.00	34.03	2.14
Oakley	1464	16	1.09	11.08	69	0.00	11.08	0.76
Odell	2895	13	0.45	13.25	102	0.00	13.25	0.46
Pavenham	1370	28	2.04	23.74	85	2.30	26.05	1.90
Pertenhall	1612	35	2.17	15.72	45	0.00	15.72	0.98
Podington	3504	161	4.59	115.79	72	28.55	144.34	4.12
Ravensden	2689	57	2.12	11.60	20	0.00	11.60	0.43
Renhold	2181	128	5.87	108.87	85	50.72	159.59	7.32
Riseley	3089	17	0.55	16.62	98	4.59	21.21	0.69
Roxton	4700	52	1.11	48.51	93	0.69	49.20	1.05
Sharnbrook	2413	52	2.15	48.61	93	5.32	53.93	2.24
Stagsden	3283	72	2.19	52.52	73	0.00	52.52	1.60
Staploe	4652	9	0.19	0.00	0	4.74	4.74	0.10
Stevington	1670	17	1.02	12.49	73	12.25	24.74	1.48
Stewartby	1599	9	0.56	0.00	0	0.00	0.00	0.00
Swineshead	1349	5	0.37	4.97	99	12.80	17.77	1.32
Thurleigh	3404	11	0.32	0.00	0	0.00	0.00	0.00
Turvey	4017	264	6.57	221.73	84	76.03	297.76	7.41
Wilden	2256	27	1.20	21.21	79	0.00	21.21	0.94
Willington	1653	33	2.00	0.00	0	0.00	0.00	0.00
Wilshamstead	3115	117	3.76	58.91	50	17.76	76.66	2.46
Wootton	2425	159	6.56	128.40	81	0.00	128.40	5.29
Wymington	1710	44	2.57	42.10	96	0.00	42.10	2.46
TOTAL (ACRES) /AVERAGE %	111416	2314	2.08	1708.72	73.84	299.93	2008.65	1.80



3.2 Statistics

3.2.1 Stat A: Total area of ridge and furrow (all conditions) recorded in mid1990s and 2014-15

The results indicate that a greater than expected amount of ‘new’ ridge and furrow was recorded in 2014-15, which was not noted in the mid-1990s (Figure 4: Ridge & furrow recorded in Mid-1990s & 2014-15: Project mapping at Turvey, Carlton & Chellington, and Stevington parishes; Table 1). For example, within Turvey parish, c.76 acres of ridge and furrow were newly identified. The result is that whilst the amount of ridge and furrow known has increased with previously unrecorded sites being identified from the 2014-15 photos and/or areas of the known 1990s ridge and furrow being enlarged (e.g. in Turvey up from 264 to 298 acres), the survival of that originally recorded in the mid-1990s has continued to decrease from an already low starting point, so that the total amount of ridge and furrow surviving today is mostly less for each parish than that in the mid-1990s (whilst only 84% of ridge and furrow identified in the 1990s in Turvey survives the unusually high amount of new ridge and furrow makes this parish an exception in having a higher amount of ridge and furrow surviving today on paper than in the 1990’s). There is overall a continuing decline in the survival of ridge and furrow with on average less than 2% of the original coverage of a parish surviving.

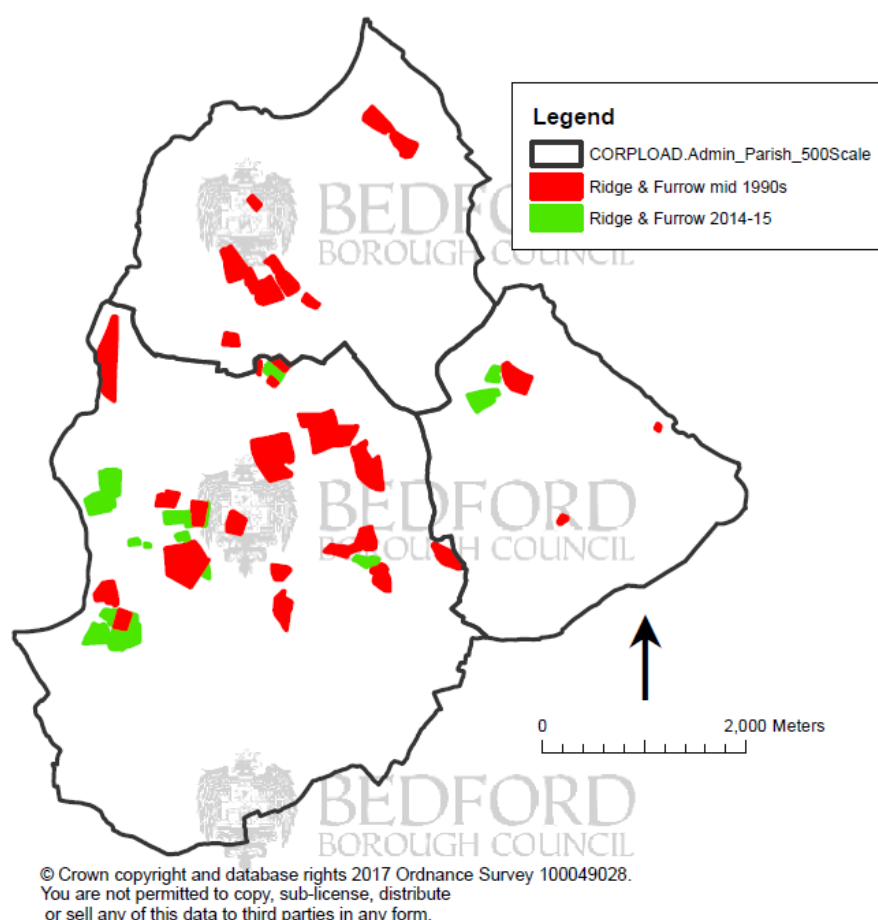


Figure 4: Ridge & furrow recorded in Mid-1990s & 2014-15: Project mapping at Turvey, Carlton & Chellington, and Stevington parishes



3.2.2 Stat B: Condition of ‘new’ ridge and furrow recorded on the 2014-15 photos

Further analysis (Figure 7) clearly shows that much of the ‘newly’ identified ridge and furrow (from the 2014-15 photos) is in less than perfect condition. The smallest amount is in good condition (15 acres or 5%) with the largest amount (145 acres or 48.33%) in poor condition. 89 acres or 29.67% is in moderate condition and without a site visit, c.51 acres or c.17% is in uncertain condition.

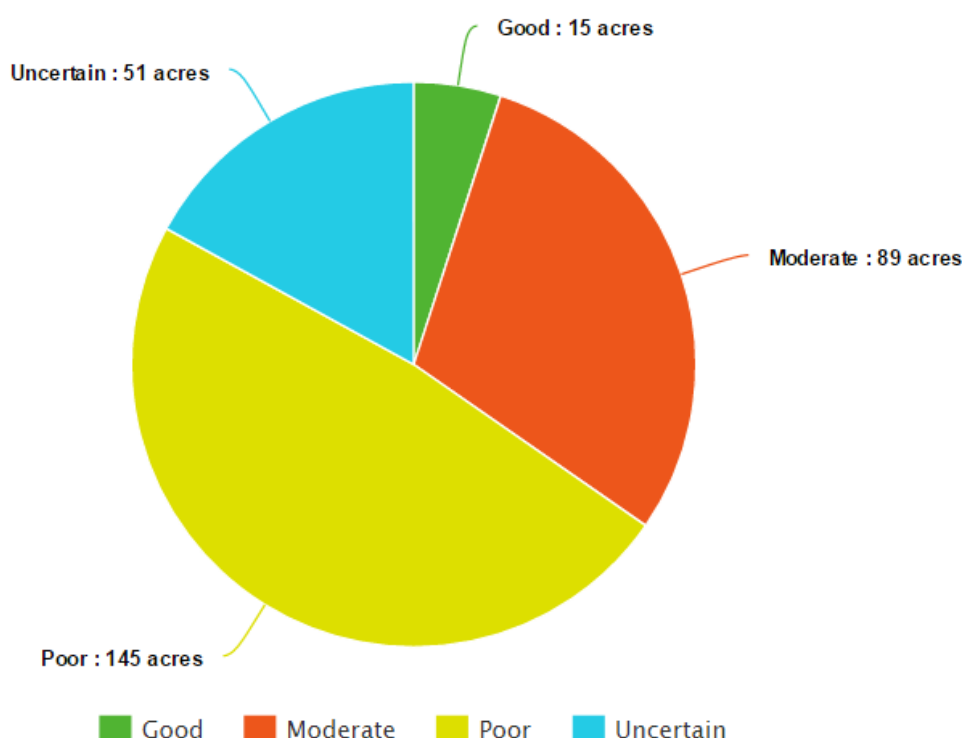


Figure 5: ‘New’ Ridge and furrow recorded from the 2014-15 photos by condition/degree of preservation

Although not clearly stated anywhere in the Turning the Plough (TTP1) report (Hall 2001) or in the paperwork accompanying the spreadsheet data obtained from Central Bedfordshire Council, it would seem, as the authors of the Turning The Plough 2 (TTP2) report surmised, a decision must have been taken to record only the most convincing or less degraded examples of ridge and furrow in the mid-1990s (Gloucestershire County Council 2012, p.29). The ‘new’ examples recorded from the 2014-15 photos are arguably less well preserved overall as a group, or not as convincing. However, there are examples where sites had not been previously recorded in the 1990s, and preservation was found to be good upon visiting, for example, at Land North of Howbury Hall (Figure 6).

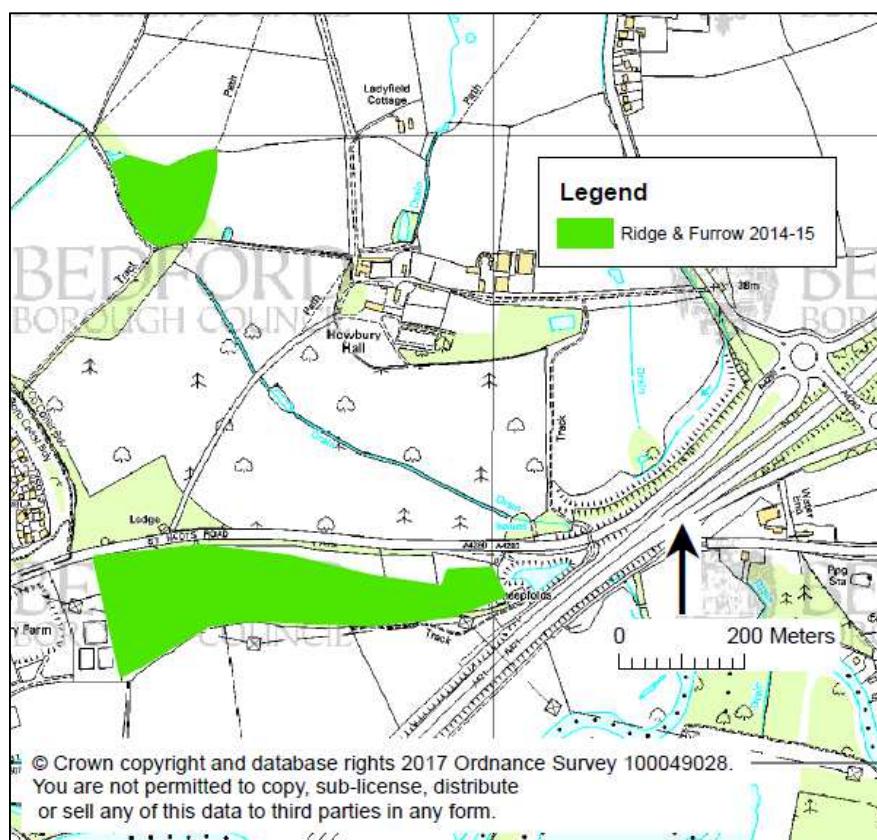


Figure 6: 'New' Ridge & furrow recorded from 2014-15 photos at Land North and South of Howbury Hall, Renhold

3.2.3 Stat C: Present condition of ridge and furrow originally recorded in the mid-1990s

In order to assess the current (2014-15) survival and condition of ridge and furrow originally recorded in the mid-1990s, additional attributes were recorded in the '1990s Ridge and Furrow' GIS shapefile. This included the degree of preservation. Statistical analysis clearly shows the largest amount of this ridge and furrow is considered to be in moderate condition (779 acres or 33.65%), followed by 484 acres (20.91%) in poor condition, closely followed by 445 acres (19.22%) in good condition (Figure 7).

289 acres (12.48%) of the ridge and furrow surviving in the mid-1990s has been completely lost since and a further 318 acres (13.74%) has been partially lost (or so significantly degraded as to be unidentifiable from aerial photographs or lidar) from larger areas which continue to survive. This indicates that 52.87% of the ridge and furrow recorded in the mid-1990s remains potentially worthy of preservation ('good' and 'moderate' survival today) but that 26.22% ('complete loss' or 'partial loss') of the already small amount surviving at that date has since been lost or badly damaged. This has reduced the average survival of the original extent of ridge and furrow identified by the TTP1 survey within each civil parish from 2.08% in the mid-1990s to 1.53% today (this increases to an overall total of 1.80% when 'new ridge and furrow' identified from the 2014-15 photos is included). Figure 8 shows the condition of ridge and furrow survival within Knotting and Souldrop ranging from 'good' to 'poor' (no new sites were identified in Knotting and Souldrop).

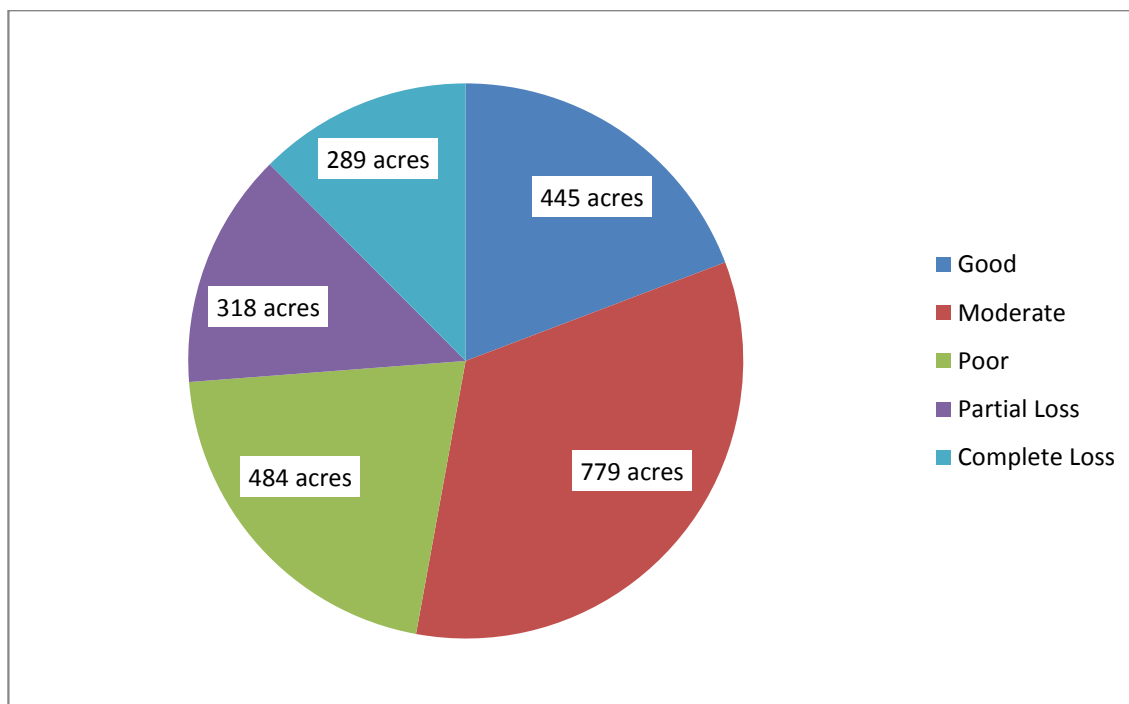


Figure 7: Condition in 2014-15 of ridge & furrow within Bedford Borough originally recorded in the mid-1990s

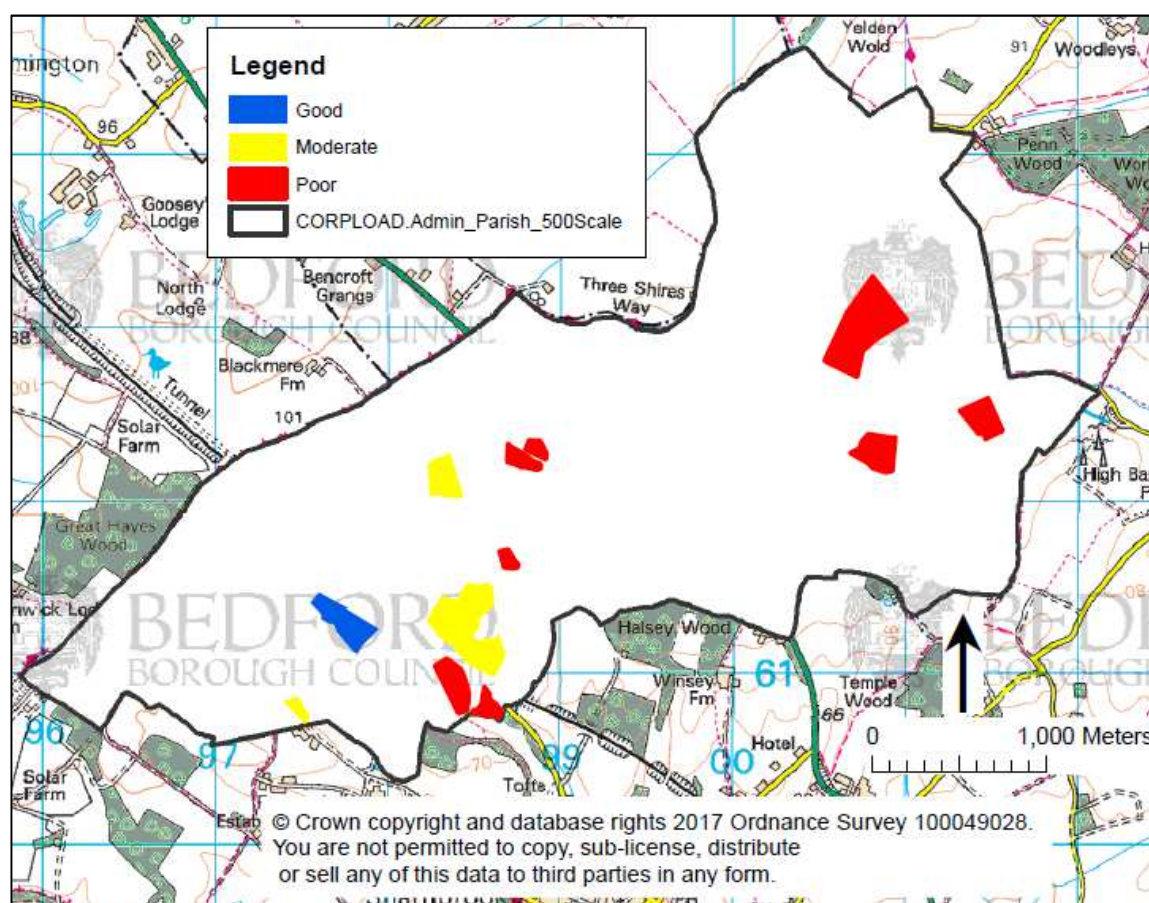


Figure 8: Ridge & furrow originally recorded in the mid-1990s at Knotting & Souldrop, surviving in 'good', 'moderate', & 'poor' condition in 2014-15



3.2.4 Stat D: Reasons for ‘Complete’ or ‘Partial Loss’ to Ridge and Furrow Recorded in the mid-1990s.

The biggest reason for complete loss of or significant damage to ridge and furrow originally recorded in the mid-1990s, has, as anticipated, been its ploughing-up which has accounted for the loss of 36.77% of ridge and furrow sites since the mid- 1990s (Figure 10). This is the greatest identified threat to ridge and furrow within the Bedford Borough area, followed by building development (16.72% loss). A further c.31.53% of sites have been experiencing loss for unidentified reasons; the causes for this could be numerous, even though ploughing is again most likely in the majority of cases but could not be proven.

A not insignificant amount of ridge and furrow (c.5.75%) has been affected by leisure activities, i.e. playing fields and golf courses. In one case at Hinwick (ID 6, Fig. 30) horse paddocks were responsible for further loss (c.11 acres, which accounts for 1.78%). Tree and scrub growth accounts for 7.09% (42.99 acres).

The percentages for causes of partial loss are similarly distributed with one site in Renhold having partially disappeared due to “extraction” (2.10 acres or 0.35%).

Figure 11 shows ridge and furrow loss since the mid-1990s is fairly evenly distributed across Bedford Borough. As might be expected, loss from building development and leisure activities tends to be distributed across the southern more densely populated parts of the area whilst loss through ploughing is more frequent in the more rural northern parts. It should be noted that the second largest single cause of loss has not been identified (Figures 9 & 10, ‘none identified’); although the distribution of these sites in mostly rural areas suggests the loss can likely be attributed to ploughing events which have occurred and then ceased in between aerial photographic survey dates.

Figure 9: Reasons for total and partial loss of Ridge & furrow (acres)

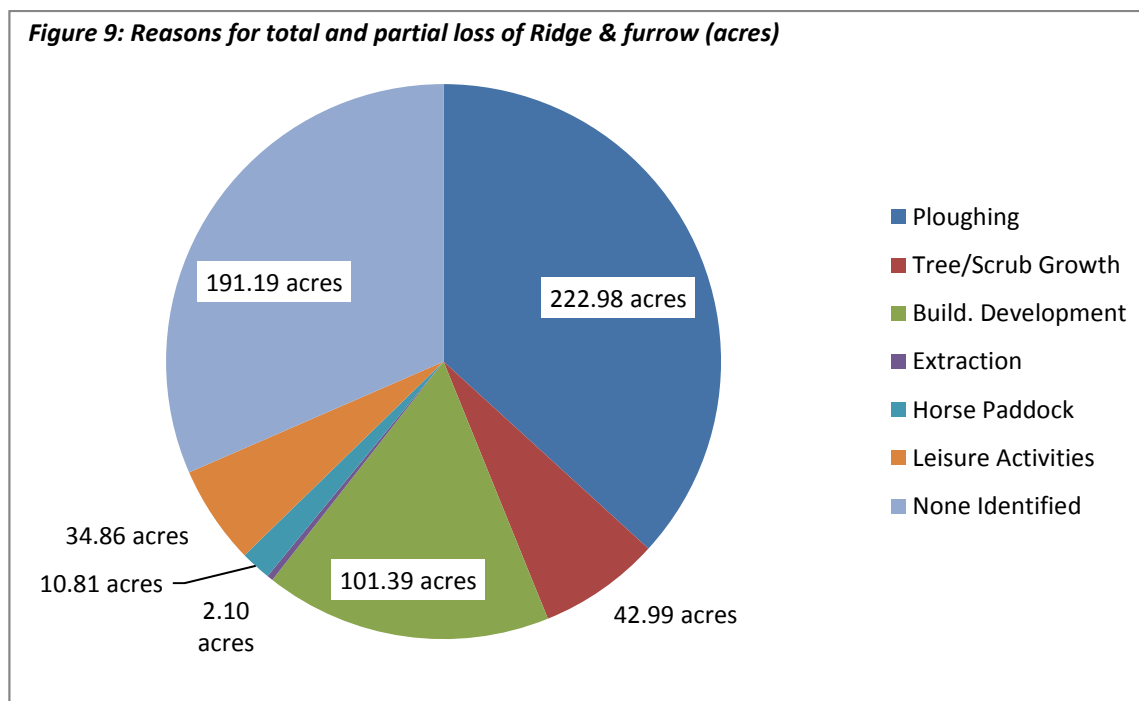




Figure 10: Reasons for total and partial loss of Ridge & furrow (%)

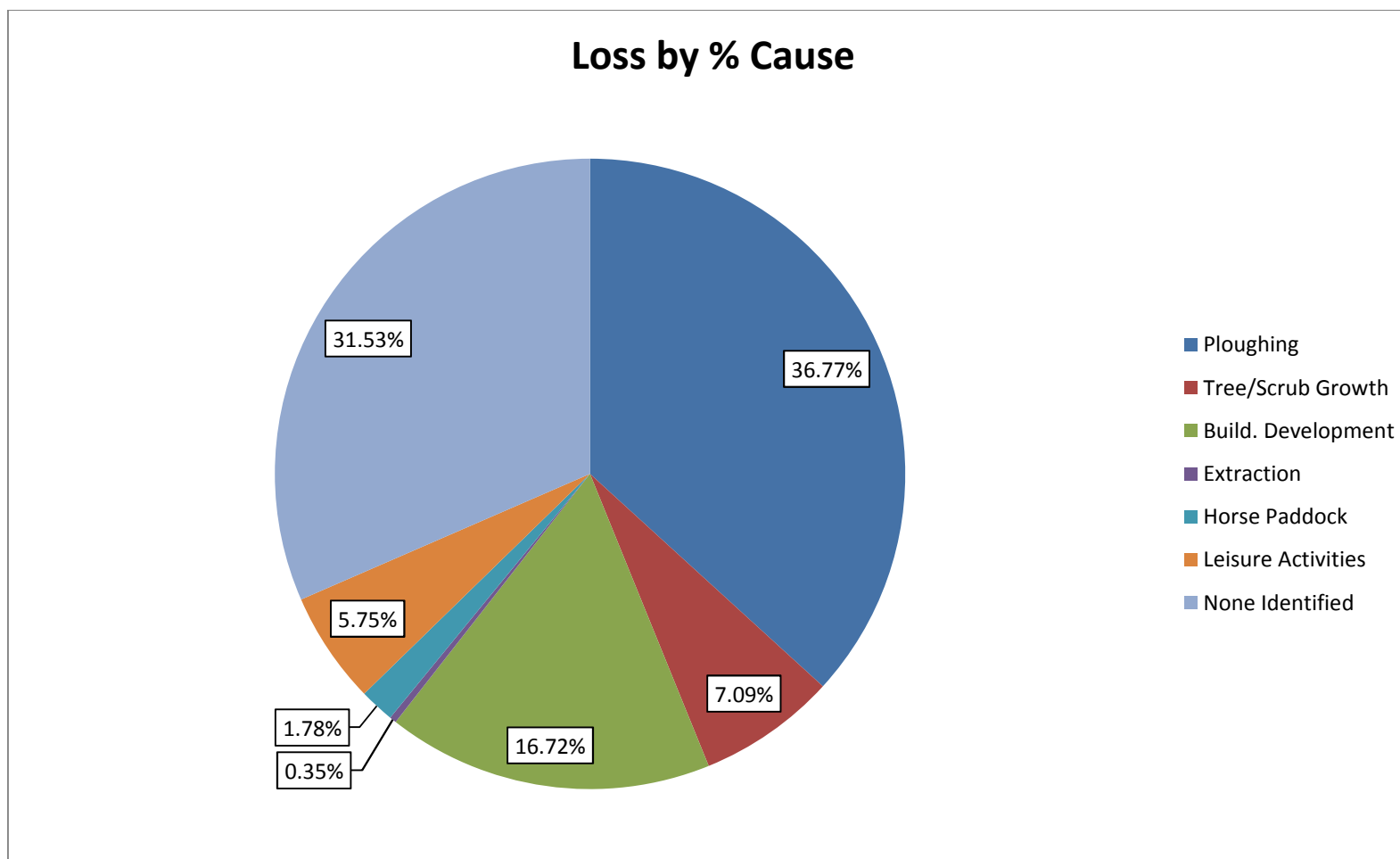
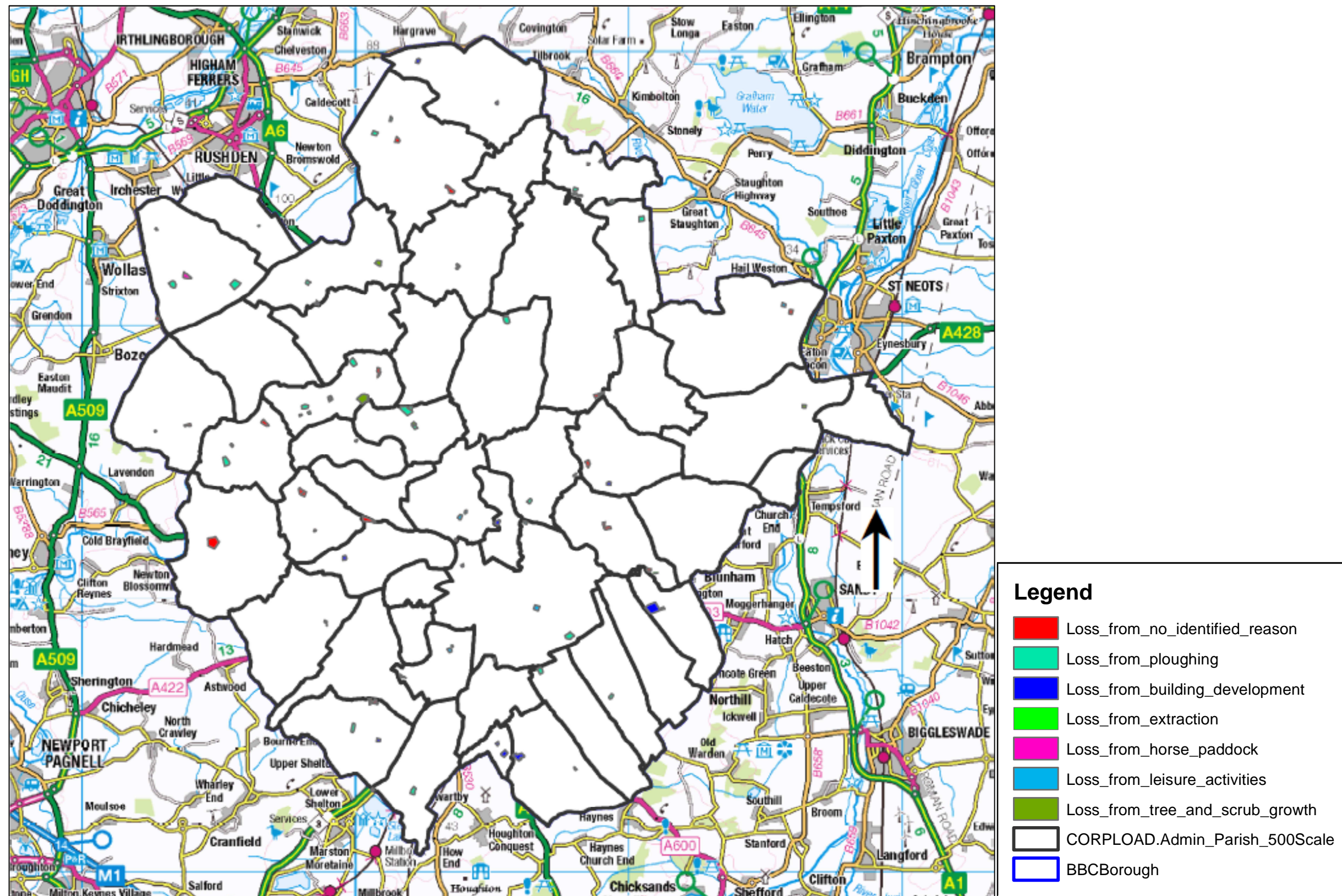


Figure 11: Ridge and Furrow Loss by Reason across Bedford Borough



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3.2.5 Stat E: Ridge and furrow surviving in 2014-15 (i.e. mid-1990s plus ‘new’) by condition.

It became apparent reasonably early on in the survey that some areas of ridge and furrow evident on the 2014-15 photos hadn’t been noted in the mid-1990s. Table 1 shows the amount of ‘new’ ridge and furrow identified in each civil parish within the Borough; Figure 5 shows its present (2014-15) condition.

Figure 12 shows an aggregate of the present (2014-15) condition of both the ridge and furrow originally assessed in the mid-1990s and that newly identified in 2014-15. This indicates, despite much of the newly identified ridge and furrow being recorded as in ‘poor’ condition (Figure 5: 48.33%), 46% of the total surviving ridge and furrow is in moderate to good condition and is potentially worthy of preservation.

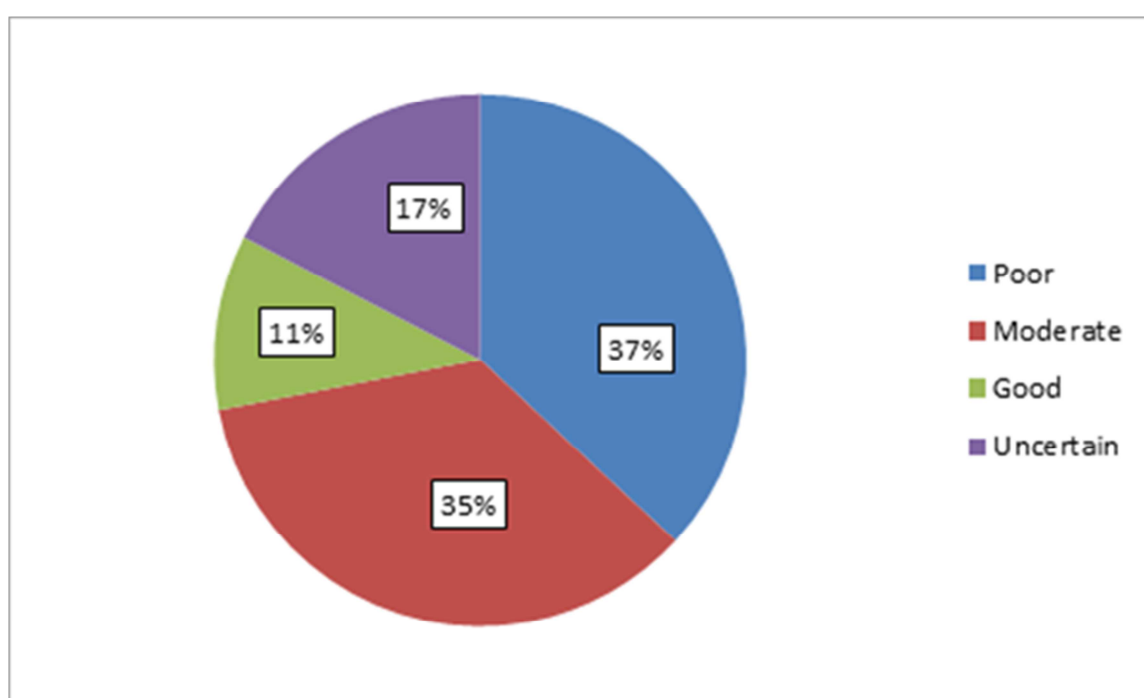


Figure 12: Surviving ridge & furrow within Bedford Borough (i.e. Mid-1990s plus 2014-15) by present condition

3.2.6 Stat F: The proportion of each civil parish containing ‘good’ quality ridge and furrow.

Table 2 shows the percentage of each civil parish within Bedford Borough with surviving ridge and furrow in good condition. This ranges from Turvey which has the highest percentage survival (2.56%), followed by Wootton (2.44%), Sharnbrook (1.65%) and Renhold (1.54%), to 26 parishes that contain no surviving ridge and furrow classified as being in ‘good’ condition.

**Table 2: Percentage of parish with surviving ridge and furrow in good condition**

Parish	Ridge and furrow in 'good condition' (acres)	Area of civil parish	% parish containing r&f in 'good' condition
Bletsoe	0	2239	0
Bolnhurst & Keysoe	0	6193	0
Bromham	5.42	2009	0.27
Cardington	0	2106	0
Carlton & Chellington	0	2165	0
Clapham	0	2068	0
Colmworth	0	2139	0
Dean & Shelton	0	3406	0
Eastcotts	0	2304	0
Felmersham	0	1981	0
Harrold	0	3227	0
Kempston	0	1321	0
Kempston Rural	46	3390	0
Knotting & Souldrop	13.5	2801	0.48
Little Barford	0	1258	0
Little Staughton	24.31	1734	1.4
Melchbourne & Yelden	0	4650	0
Milton Ernest	0	1593	0
Oakley	0	1464	0
Odell	0	2895	0
Pavenham	8.35	1370	0.61
Peternhall	0	1612	0
Podington	43	3504	1.23
Ravensden	7.29	2689	0.27
Renhold	33.52	2181	1.54
Riseley	8.33	3089	0.27
Roxton	36.45	4700	0.78
Sharnbrook	39.77	2413	1.65
Stagsden	0	3283	0
Staploe	0	4652	0
Stevington	0	1670	0
Stewartby	0	1599	0
Swineshead	0	1349	0
Thurleigh	0	3404	0
Turvey	102.73	4017	2.56
Willington	0	1653	0
Wilstead	15.58	3115	0.5
Wootton	59.23	2425	2.44
Wymington	0	1710	0

3.2.7 Figure 15 (p.30) shows the distribution of ridge & furrow within Bedford Borough recorded in both the mid-1990s & 2014-15, by number of components & type. The vast majority of ridge and furrow sites across Bedford Borough contain no complete components suggesting they comprise of incomplete furlongs only (62%; labelled as 'None' – Fig.13). Sites comprising three or more components are rare (5%), with those at Wootton (Fig.14) and Turvey appearing to be the most extensive examples.

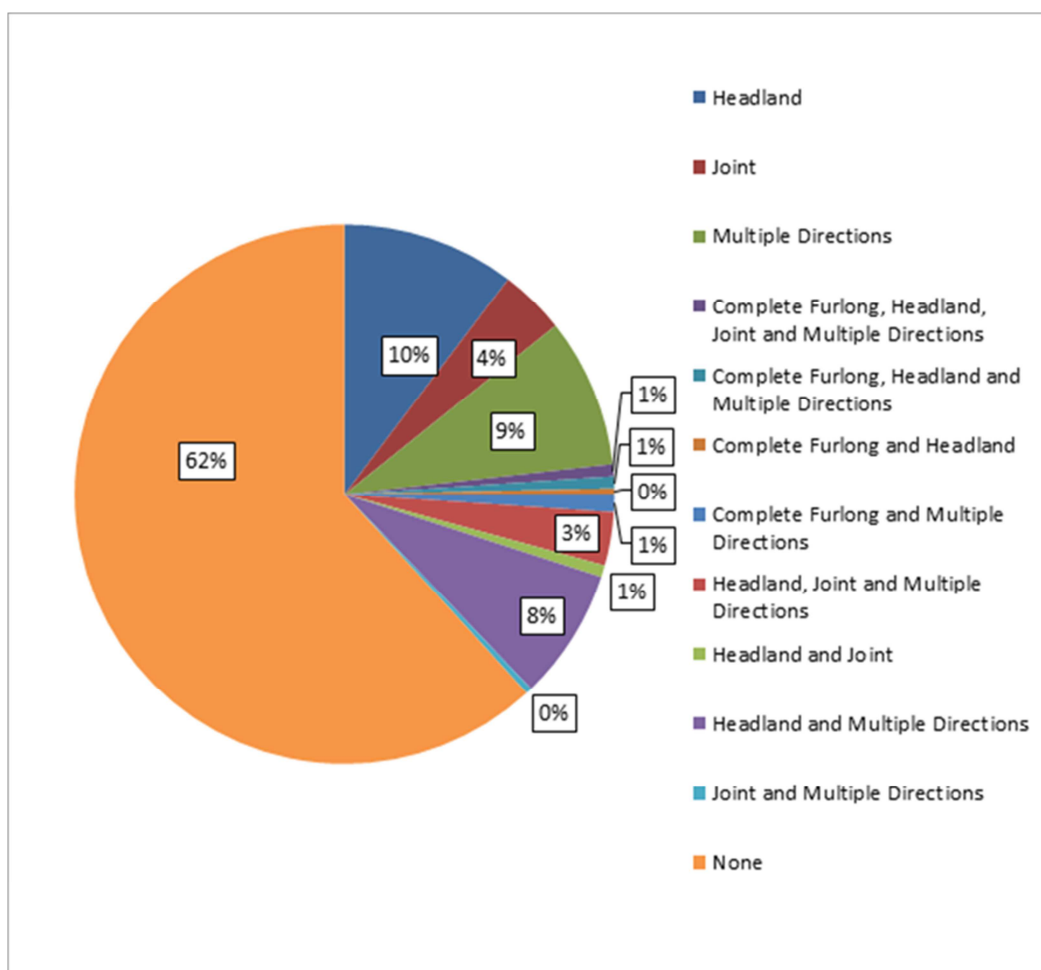


Figure 13: Distribution of ridge & furrow within Bedford Borough recorded in both mid 1990s & 2014-15, by number of components & type (%)



Figure 14: Surviving ridge & furrow with multi-components at Wootton (I.D. 64; Call for Sites no.315)

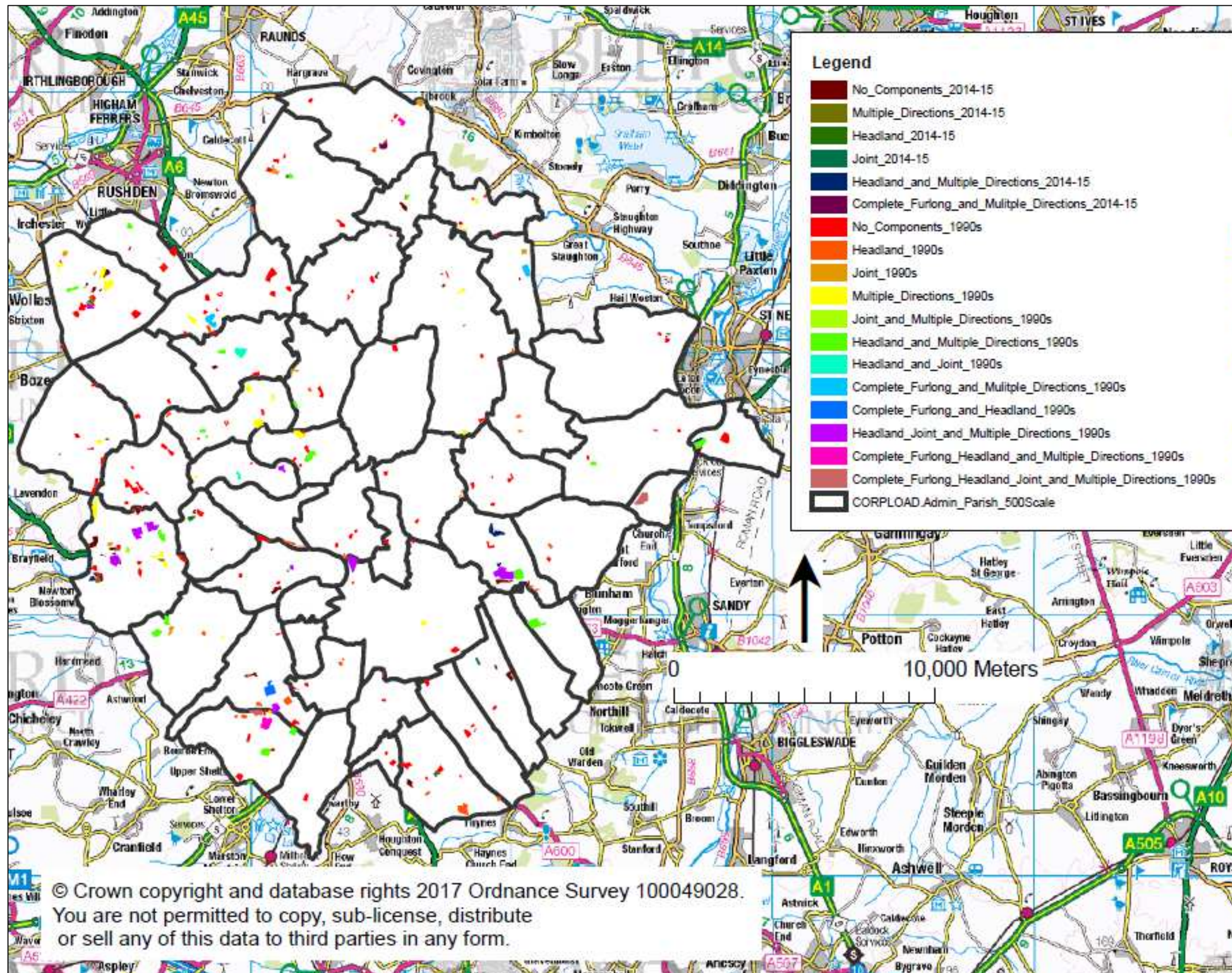


Figure 15: Distribution of ridge & furrow within Bedford Borough recorded in both mid 1990s & 2014-15, by number of components & type.



3.2.8 Stat G: Local Plan Sites

A not insignificant number of sites put forward as part of the Bedford Borough Local Plan 2035 Call for Sites & Allocations process in 2016 included ridge and furrow. 8 sites which contain ridge and furrow have subsequently been identified as ‘preferred’ options by the Council, and so were prioritised for site visits; 6 of 8 visits were undertaken (Table 4). After visiting these 6, 20 additional sites were selected for ground-truthing from all the sites submitted through the Sites & Allocations process. The selection of individual sites was based on ease of access via Public Rights of Way (PROWs).

A further 26 (at least partially) publicly accessible sites (via PROWs’s) were also visited which had not been submitted as part of the Sites & Allocations process. Added together, with the 26 ‘Call for Sites’ sites referred to above, c.20% of all ridge and furrow sites recorded in the 1990’s and 2016 have been visited. Not all sites could be visited within the project resources.

The condition of ridge and furrow on all sites submitted as part of the Call for Sites & Allocations process where ‘good’ or ‘moderate’ (whether visited or not), is shown in Table 3 below.

Table 3: Condition of Ridge and Furrow where ‘good’ or ‘moderate’ on Sites Selected as Part of the Call for Sites & Allocations Process (sites in bold were visited)

No.	Parish	Site Ref.	Ridge and Furrow 1990 ObjectID/*2016 I.D.	Condition
0	Turvey	462	36	Moderate
1	Wootton	463	67	Good
2	Wilstead	648	167	Good
3	Turvey	631	*12	Moderate
4	Roxton	530	200	Good
5	Great Barford	670	204	Moderate
6	Sharnbrook	622	48	Moderate
7	Wyboston	659	199	Moderate
8	Wilden	683	99	Good
9	Clapham	78	222	Moderate
10	Kempston Rural	149	70	Good
11	Kempston Rural	151	71	Good
12	Kempston Rural	152	68	Good
13	Milton Ernest	160	106	Moderate
14	Ravensden	189	215	Moderate
15	Ravensden	191	215	Moderate
16	Ravensden	194	213	Good
17	Renhold	199	205	Moderate-Good
18	Riseley	216	80	Good
19	Sharnbrook	238	*11	Not surviving
20	Wootton	311	67	Good



No.	Parish	Site Ref.	Ridge and Furrow 1990 ObjectID/*2016 I.D.	Condition
21	Wootton	318	65	Moderate
22	Bromham	414	110	Moderate
23	Bromham	414	228	Good
24	Knotting and Souldrop	157	152	Good
25	Souldrop	449	152	Good
26	Bedford	486	221	Moderate
27	Harrold	606	146	Moderate
29	Great Barford	670	94	Moderate
30	Ravensden	185	213	Good
31	Renhold	199	205	Moderate
32	Renhold	199	95	Good
33	Wilstead	648	167	Good

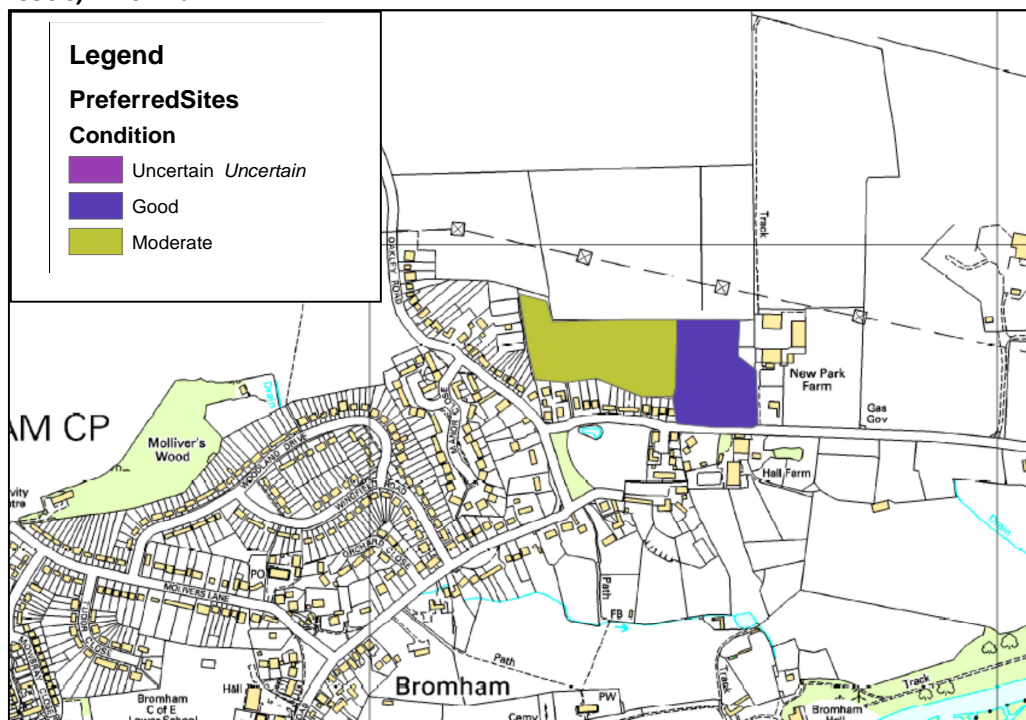
The survival of ridge and furrow recorded as 'good' (good survival of earthworks with several components) from all sites visited ('Call for Sites' and otherwise) was 19 out of 52 sites in total. Out of the 26 'Call for Sites' sites visited 7 survived in 'good' condition. 18 of the 52 total sites visited had 'moderate' survival ('moderate' survival of earthworks with one or two surviving components), with 8 of the 26 'Call for Sites' sites in 'moderate' condition. Poor survival or loss was characterised by very low and near invisible earthworks and not more than one component – numbering 14 of the 52 sites visited in total. Only on one site was the survival of ridge and furrow uncertain due to obscuration by very long grass and shrub growth.

The condition of ridge and furrow for all preferred sites is shown in Table 6 below. The ridge and furrow may not necessarily be extensive across all parts of the site and may survive in only one or two areas. Similarly, this is true for all Call for Sites 'sites' where good or moderate ridge and furrow survives. Detailed GIS mapping has been created to show the likely condition of ridge and furrow within such sites and its indicative location (available to view on request) (Example: Fig.16).

Table 4: All Conditions of Ridge and Furrow on 'Preferred' 'Call for Sites' sites (sites in bold were visited)

No.	Parish	Site Ref.	Ridge and Furrow 1990 ObjectID/*2016 Ridge and Furrow	Condition
1	Wilstead	648	167	Good
2	Turvey	631	*12	Moderate
3	Great Barford	670	204	Moderate
4	Kempston Rural	149	70	Good
5	Sharnbrook	238	*11	Not surviving
6	Harrold	606	146	Moderate
7	Clapham	75	223	Poor
8	Sharnbrook	622	48	Moderate

Figure 16: Condition of Ridge and Furrow on Call for Sites 'site' 414 (Object I.D. 110 – 1990's) - Bromham



3.2.9 All site visits & examples of the condition of ridge and furrow recorded

Site visits were able to verify and confirm the quality of ridge and furrow recorded from aerial photographs and Lidar data. There was a very good correlation between the quality assessed on the ground and from remote data, and no changes had to be made to the database after the ground-truthing visits.

3.2.10 Preservation and management of ridge and furrow sites

Ridge and furrow sites in Bedford Borough range from 'poor' to 'moderate' with several good examples of sites surviving which have well-preserved earthworks associated with other heritage assets and multiple surviving components. All of these sites serve to illustrate the historic dimension of the landscape and are examples of historic agricultural systems. It could be argued that the larger sites, which have multiple components and associations with heritage assets like settlement earthworks or existing modern settlements that grew out of a medieval core, also illustrate historic social systems, set within our wider knowledge of the use and organisation of medieval strip fields.

According to Historic England's Scheduling Section Guide for Agriculture (English Heritage 2012) in the past scheduling was not generally seen as an appropriate mechanism for the protection of extensive systems of ridge and furrow as they are often located in still farmed areas. Scheduled examples are often associated with contemporary settlement remains. However, according to the guide, given the "enormous losses of ridge and furrow to agricultural intensification since the 1970s, protection of more examples may well be warranted" (EH 2012, 16).



One site immediately identified upon visiting as suitable as a potential candidate for Scheduling, is Rookery Farm, Cotton End, Eastcotts CP (Survey Object I.D. 57). Whilst, the survival of ridge and furrow across the site varies from 'poor-moderate, its clear association with well-preserved shrunken medieval settlement remains including buildings platforms, a moat & holloway, makes it a good candidate for scheduling (Figure 29). Areas of ridge and furrow at both Chellington and Milton Ernest are already scheduled.

All ridge and furrow sites within Bedford Borough need careful management through national and local planning policies and legislation to continuously assess and protect their significance in accordance with National Planning Policy Framework 2012. Most of the areas of ridge and furrow are recorded as heritage assets in the Historic Environment Record (HER).

Below are listed a number of sites which have good preservation and/or multiple components and associations with other heritage assets. These sites serve to illustrate the historic agricultural and social organisation of the landscape. Positive management of these sites in particular is encouraged.

- Sites (Object I.D.'s 1990's) 28 and 33 in Turvey parish, which both have multiple components and are associated with deserted medieval settlement earthworks at Great Oaks Farm;
- (Fig.17) Site 67 (Call for Sites Object I.D. 463 – 1990's) in Wootton, which has a good survival of multiple components and was part of the fields and setting of Wootton village (now encroached upon by modern development). As a site it also has good amenity value, accessibility and potential for education and display;
- (Fig.18) Site 74 (Object I.D. 1990's) in Little Staughton, which has multiple components and is associated with the medieval settlement and part of the setting of Little Staughton parish church;
- Site 119 (Object I.D. 1990's) in Podington, parts of which have exceptionally good earthworks and the site is close to Podington medieval castle.
- (Fig.20) Site 84 at Wood End, Pertenhall. One field with ridge and furrow of multiple directions and a good headland survives with good preservation (quality given as 'moderate' as not a very large area survives). Part of the setting of hamlet of Wood End.



Figure 17: Local Plan 2035 Call for Sites & Allocations Site 463/Survey Object I.D. (mid 1990s) 67 – Land South of Keeley Lane Wootton - An Example of Good Survival of Ridge and Furrow

The ridge and furrow is in good condition and clearly visible, with multiple components including complete furlongs, headlands, and multiple directions.



Figure 18: Survey Object I.D. (mid 1990s) 74 – East of Spring Lane, Little Staughton - An Example of Good Survival of Ridge and Furrow comprising complete furlongs and multiple directions, associated with the existing medieval settlement



Figure 19: Local Plan 2035 Call for Sites & Allocations Site 199/Survey Object I.D 205 (mid 1990s) Howbury Hall, Renhold - An Example of Moderate Survival of Ridge and Furrow
The ridge and furrow covers a large area of parkland with multiple components including headland, joints and multiple directions. However survival is variable across site, with lower surviving ridge height to the east, reducing visibility and legibility.



Figure 20: Survey Object I.D. (mid 1990s) 84– Wood End, Pertenhall - An Example of Moderate-Good Survival of Ridge and Furrow
The ridge and furrow is associated with the existing settlement of Pertenhall and survives very well, with multiple directions and headlands.



Figure 21: Local Plan 2035 Call for Sites & Allocations Site 75/Survey Object I.D. (mid 1990s) 223 – Land North of Clapham - An Example of Poor Survival of Ridge and Furrow

The ridge and furrow is associated with the existing settlement of Clapham. However, it does not appear to survive very well comprising low eroded earthworks only visible at certain angles.

3.3 Discussion of vulnerabilities

The results of the survey (aerial photographic analysis ground-truthed in some instances by site visits) demonstrate the variety of reasons for recent loss of ridge and furrow within Bedford Borough (see Section 3.2.4 and Fig.11), which directly inform its future vulnerabilities.

3.3.1 Ploughing

Ploughing is by far the largest single identified factor in the disappearance or reduction of ridge and furrow within Bedford Borough, being 37% of the reasons for loss of ridge and furrow since the mid-1990s (Fig.10). This contrasts with the results of TTP2 where although arable cultivation was also the biggest identifiable reason for piecemeal degradation and loss across the East Midlands priority townships, it stood at 63% of all reasons given (Catchpole and Priest 2012, p.45); however, if you include the sites where no reason was identified for ridge and furrow loss in Bedford Borough, the figure arrived at would be broadly similar to that given for TTP2.

In contrast to Bedford Borough, the total loss of (acreage) identified by TTP2 (Gloucestershire County Council, 2012) due to ploughing of ridge and furrow between TTP1 and TTP2 in the East Midlands stood at 4.18% whereas in Bedford Borough it stood at 37%. This was attributed to the TTP2 study parishes in the East Midlands being those already identified (by TTP1) as containing the most significant ridge and furrow ('priority townships'), and accordingly many of the sites had been preserved for example, through Countryside Stewardship schemes.

It is likely that in Bedford Borough ploughing will remain one of the main threats to ridge and furrow earthworks in the future.



Figure 22: Reduction of ridge and furrow due to ploughing at Hawkswell Farm, Felmersham – Survey Object I.D. (mid 1990s) 22. Original extent in mid 1990s (purple) and as surviving in 2014/15 (yellow). The field in the east is clearly under arable cultivation

3.3.2 Building development and leisure activities

The second highest reason for (further) loss of ridge and furrow between the mid-1990s and 2014-15 has been development and leisure activities (22.47% of all sites lost). Leisure activities include the construction of playing fields and golf courses. Many of the sites which experienced a total or partial loss of ridge and furrow over this period due to this reason were located in Bedford and its surrounding parishes (Kempston, Wilstead, Clapham, Wootton, Willington and Bromham) i.e. in the more urbanised areas of the Borough.

Development and leisure activities will remain a significant threat to surviving ridge and furrow, particularly to those sites close to urbanised areas.



Figure 23: Chapel End (Chapel Lane), Cardington – Survey Object I.D. (2014-15) 63: ridge & furrow affected by building development

Ridge and furrow (foreground) with a warehouse in the background. Its construction had levelled the ridge and furrow in the western part of the field.

3.3.3 Other factors

There are a multitude of factors which can lead to partial loss or degradation of ridge and furrow, rather than the total loss that can often be the result of ploughing and building development. These factors can introduce adverse ‘creeping’ change to ridge and furrow, leading to a considerable loss of significance.

A not inconsiderable number of ridge and furrow sites were recorded as being damaged by tree/scrub growth between the mid-1990s and 2014-15 (7.09% of all sites lost or partially lost), including through mature tree growth in parks or gardens, shrub land growth, and sites becoming ‘wild’, i.e. overgrown rather than being optimally maintained under pasture (Figs.24-26).



Figure 24: Land South of Felmersham Rd, Felmersham – Survey Object I.D. (mid 1990s) 115. Degradation of ridge & furrow due to tree/scrub growth

Site heavily degraded since c.2002 due to creation of small paddocks and uncontrolled shrub growth. Ridge and furrow is still visible in the westernmost field.



Figure 25: Local Plan 2035 Call for Sites & Allocations Site 238/Survey Object I.D.11 (mid 1990s) – Yelow Lane Sharnbrook: Degradation of ridge & furrow due to tree/scrub growth



Figure 26: Site 6 (mid 1990s) - Hinwick: Degradation of ridge & furrow due to mature tree growth



Figure 27: Survey Object I.D. 16 (mid-1990s) - Ridge & Furrow Site Northeast of Grange Farm, Stagsden: Moderate Survival under Optimum Management of Pasture
Anthills signify old unimproved pasture.



Figure 28: Survey Object I.D. 59 (mid 1990s) - Ridge & Furrow under Optimum Management of Pasture Grazed by Sheep to the West of Wilstead



In some cases, areas of ridge and furrow were identified by the survey as being used for pony/horse grazing but this was largely not recorded as the main factor of loss or degradation. Only one site in Hinwick had a c.50% direct loss (11 acres) due to the creation of horse paddocks (Fig.30).



Figure 29: Survey Object I.D. (mid 1990s) 57 - Ridge & Furrow Site at Rookery Farm Cotton End: Horse-Jumps Sited on Ridge & Furrow but otherwise in Moderate Condition at this particular location within site



Figure 30: Survey Object I.D. 6 (mid 1990s) - Hinwick. Original extent of ridge and furrow (purple) and current extent (yellow)

In centre left is a small stable with horse paddocks in the southern part of the field. The site visit showed that the southern part of the field accommodated many more horse-related buildings than shown on the aerial photograph.



For a number of sites where it was evident ridge and furrow had been lost between the mid-1990s and 2014-15, the reason could not be identified from either the aerial photography or follow-up site visit, where the latter occurred (31.53% of sites lost).

4 CONCLUSIONS

The main aims of the survey - to provide an over-arching context for ridge and furrow in Bedford Borough suitable to underpin the heritage assessment of individual ridge and furrow sites in the future, the quantification of the survival of ridge and furrow and an assessment of loss since the mid-1990s, and the ground-truthing of the results of the aerial photographic analysis through a number of site visits, have been achieved.

The original TTP1 shapefile (and attribute table), from which the majority of qualitative data had been lost/was never entered, has been updated with information on the overall presence or absence, condition, typology, associations and components of the ridge and furrow originally defined, and a new shapefile (and attribute table) has been created recording newly discovered areas of ridge and furrow. Quantitative analysis on the percentage of loss, reasons for loss and quality of survival has been undertaken. This information was verified through visits to a total c.20% sample of sites originally recorded respectively in the mid-1990s and newly from the 2014-15 aerial photos.

Since the mid-1990s c.26.22% of ridge and furrow earthworks recorded in the mid-1990s has been lost in total, predominantly to agricultural cultivation (36.77%) but also to the construction of housing (16.72% of sites) and playing fields (part of 'leisure activities' and 5.75% of sites), the latter mainly in the parishes in and around Bedford. The average survival of the original extent of ridge and furrow within each civil parish has reduced from 2.08% per parish in the mid-1990s to 1.53% per parish today (1.80% per parish when 'new ridge and furrow' identified from the 2014-15 photos is included), indicating a continuing decline.

The largest amount of surviving ridge and furrow originally identified in the mid-1990s is considered to be in moderate condition (779 acres or 33.65%), followed by 484 acres (20.91%) in poor condition, closely followed by 445 acres (19.22%) in good condition. Much of the 'newly' identified ridge and furrow (from the 2014-15 aerial photographs) is in less than perfect condition. Despite this, 46% of all ridge and furrow recorded on the 2014-15 photos in 2016 (both newly recorded and that originally recorded in the 1990's) is in moderate to good condition and is worthy of consideration for preservation.

52.87% of the ridge and furrow recorded in the mid-1990s remains potentially worthy of preservation ('good' and 'moderate' survival today) but 26.22% ('complete loss' or 'partial loss') of the already small amount surviving at that date has since been lost or badly damaged.



5. DIGITAL ARCHIVE

The following files have been generated as survey output:

- Original TTP1 project shapefile, 'Ridge+Furrow_Region';
- Ridge and Furrow shapefile 'Ridge_ Furrow1990' – update of the TTP1 project shapefile
- Ridge and Furrow shapefile 'Ridge_ Furrow2016' – containing new sites identified from 2014-15 aerial photographs and Lidar;
- Call for Sites shapefile 'Call for Sites' – containing all good and moderate ridge and furrow sites;
- Excel spreadsheet: 'master data spreadsheet';
- Excel spreadsheet: 'total area of ridge and furrow' in the mid-1990s and 2014-2015
- Digital survey report;
- Ridge and Furrow Survey Photographs.



6. BIBLIOGRAPHY

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7. APPENDICES

Appendix 1 – Attribute table

Table 5: GIS database attributes for "Ridge_Furrow1990" and "Ridge_Furrow2016" shapefiles

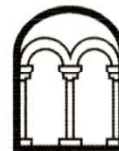
Attribute	Example Data/Explanation
1. ObjectID	Automatically generated by ArcGIS.
2. Parish	As listed on the TTP1 spreadsheet.
3. Quality	Presence 'Certain' or 'Probable' as recorded on the TTP1 spreadsheet in the 1990s.
4. Presence/Absence	Survival on the 2014-15 photos and Lidar.
5. Condition	<p>On the 2014-15 photos and Lidar</p> <p>Good Moderate Poor</p> <p>Poor: 1-2 surviving components (usually furrows and headland), usually fragmentary survival of components, low to non-existent height of earthworks with poor legibility.</p> <p>Moderate: 2-3 surviving components, moderate height of earthworks with moderate legibility. OR: fewer components but more complete survival over a greater extent.</p> <p>Good: 2 or more surviving components surviving over a large area, good height of earthworks with good legibility of earthworks and field system and components. OR: Very good height of earthworks but with fewer components and of a lesser complexity.</p>
6. Association	<p>Existing (historic) settlement (Historic) Settlement Earthworks More than one association</p>
7. Components	<p>Complete Furlong Headland Joint Multiple Directions Complete Furlong, Headland, Joint & Multiple Directions Complete Furlong, Headland & Joint Complete Furlong, Headland & Multiple Directions Complete Furlong, Joint & Multiple Directions Complete Furlong & Headland Complete Furlong & Joint</p>



	Complete Furlong & Multiple Directions Headland, Joint & Multiple Directions Headland & Joint Headland & Multiple Directions Joint & Multiple Directions
8. Shape Length	Automatically generated by ArcGIS.
9. Shape Area	Automatically generated by ArcGIS.
10. Type	Straight S-Curve
11. Reasons for Loss	Ploughing Tree scrub/growth Building development Extraction Livestock Damage Horse Paddock Pipeline Leisure Activities None identified
12. Comments	Free Text box for additional comments
13. Site Visit	Yes No
14. Site Visit Comments	Free Text box for additional comments

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