

HAREWOOD CASTLE, HAREWOOD,
WEST YORKSHIRE

ARCHAEOLOGICAL AND ARCHITECTURAL
CONDITION SURVEY

VOLUME 3: APPENDICES



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Report no: 1999/97.R01
Version: Final
Date: November 2008
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HAREWOOD CASTLE, HAREWOOD, WEST YORKSHIRE
ARCHAEOLOGICAL AND ARCHITECTURAL CONDITION SURVEY

CONTENTS OF VOLUME 3 (APPENDICES)

- 1 HAREWOOD CASTLE: THE CASTLE AND ITS LANDSCAPE by Peter Goodchild,
University of York
- 2 HAREWOOD CASTLE ECOLOGICAL SURVEY by Dr Madeline Holloway, EINC
- 3 HAREWOOD CASTLE, WEST YORKSHIRE: LICHENS SURVEY AND REPORT by
Peter Gouldsborough, University of York
- 4 THE GEOLOGY AND BUILDING STONES OF HAREWOOD CASTLE by Philip
Murphy, University of Leeds
- 5 SHIELDS OF ARMS AT HAREWOOD CASTLE by Dr David Neave
- 6 LISTED BUILDING DESCRIPTION
- 7 EDAS PROJECT DESIGN

APPENDIX 1

THE CASTLE AND ITS LANDSCAPE

by Peter Goodchild

HAREWOOD CASTLE :
The castle and its landscape

A REPORT

By : Peter Goodchild

For: Ed Dennison Archaeological Services

Project: 'Archaeological and Architectural Survey of Harewood Castle.'

Date: 21 December 2000.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

1.0 INTRODUCTION

- 1.1 The purpose of this report.
- 1.2 Harewood Castle.

2.0 LANDSCAPES AND HAREWOOD CASTLE

- 2.1 The word 'landscape'.
- 2.2 The boundary of the core area.
- 2.3 The relationships and differences between the various territories.

3.0 A BASIC CHRONOLOGY FOR HAREWOOD CASTLE

- 3.1 Three main phases.
- 3.2 Period A, up to c.1366.
- 3.3 Period B, c.1366-1600.
- 3.4 Period C, from 1600.
- 3.5 Period C1, 1600-1657.
- 3.6 Period C2, 1657-1738.
- 3.7 Period C3, 1738 to the present.

4.0 ATTITUDES AND TREATMENT OF THE CASTLE AND ITS LANDSCAPES

- 4.1 Period B, c.1366-1600.
- 4.2 Period C, during the time of Edwin Lascelles (1712-1795).
- 4.3 Period C, during the time of Edward, 1st Earl of Harewood and his son, Edward, Viscount Lascelles (1764-1814).
- 4.4 The Otley to Tadcaster Turnpike Road.
- 4.5 Ivy.

5.0 SOME IDEAS FOR FURTHER CONSIDERATION

- 5.1 The historical dimension.
- 5.2 The core area.
- 5.3 The display of the castle and its surroundings to visitors.
- 5.4 Some topics on which further information and research is needed.

6.0 SOURCES OF INFORMATION

APPENDIX: THE ILLUSTRATIONS

The illustrations are given in chronological order with their short titles for reference. The short titles are provided in Part 6.0, The Bibliography.

Illustration.

- 1.0 The view of Harewood Castle and its landscape setting from the plan of c.1698 - 99. (HAR: Map 33).
- 2.0 Part of the 1698-99 plan showing Harewood Castle and its immediate surroundings and the area of the Castle Park (HAR: Map 33).
- 3.0 A view Harewood Castle published by S Hooper in 1787 (Hooper 1787).
- 4.0 A view of Harewood Castle published by S Hooper in 178? (Hooper 178?).
- 5.0 Part of Teal's survey plan of 1796 showing the area that was to become the Castle Park and the Castle Pleasure Grounds (Teal 1796).
- 6.0 Part of the survey plan of c.1810 showing the Harewood Castle and the area of Castle Park and the Castle Pleasure Grounds (HAR: Map 50).
- 7.0 Part of the Ordnance Survey plan of 1851 showing Harewood Castle, Castle Park and the Castle Pleasure Grounds (OS 1851).
- 8.0 A photograph of Harewood Castle taken c.1900 (Anon c.1900).

1.0 INTRODUCTION

- 1.1 The **purpose of this report** is to provide an analysis and assessment of aspects of the landscapes of which Harewood Castle is a prime feature. It aims to give information and provide a context of ideas that are relevant to the understanding of the castle and the treatment that is to be proposed for it as a result of the current archaeological and architectural survey.
- 1.2 **Harewood Castle** is usually identified as the existing standing masonry but the original was likely to have been much more extensive than this and to have included such things as a boundary structure of some kind, around the perimeter of the castle precinct; a main entrance with an intended main approach to the main building and the service areas; outbuildings; areas for different activities such as enclosures for animals, gardens etc. Everything within the precinct may be considered as being part of the castle. The earthwork survey carried out by Steve Moorhouse in the 1970's and early 1980's (Moorhouse 1985, Moorhouse 1989), and that undertaken by Ed Dennison in 2000 for the present study, indicate that these other elements were present at Harewood, even if there remain questions about how to interpret the existing evidence provided by the earthworks and items that are now below ground level.
- 1.3 In interpreting the castle there is also the question of whether it should be thought of as having been built primarily for military purposes or whether it was, in fact, mainly a grand residence with a castle-like appearance. Informed contemporary opinion thinks the latter is the case (Emery 1999).

2.0 LANDSCAPES AND HAREWOOD CASTLE

- 2.1 Another point of clarification that needs to be made, is that of what is meant by **the word landscape**. At one level it seems very simple, but it represents one of those concepts that is actually much more complicated than it appears. Briefly, and for the purpose of this report, a "landscape" is taken to be everything that the observer sees from an individual location or from a series of linked locations. It also includes all the feelings, ideas and knowledge that the observer connects with what he or she can see. The individual locations (or stations) may be linked by being points along a particular route or within the boundary of a particular area. In the latter case, the area within the boundary can be referred to as the "core area" and any land beyond the core which is visible from the core, or which makes a significant contribution to its character, can be referred to as the "setting" (i.e. the setting of the core area).
- 2.2 In the case of Harewood Castle **the boundary of the core area** can be in different places depending on whether the core area is taken to be the castle precinct, the township of Harewood, the Manor of Harewood, the parish of Harewood, the Harewood estate, the designed ornamental landscape associated with Harewood House, the Wapontake or Leeds District, or it might be the whole or part of Wharfedale, etc. All of these have an historical or current validity and even if, as territories, they have areas of land in common with each other, they do represent different contexts within which to see Harewood Castle and within which to appreciate the range of relationships that it or its occupiers and owners, had with the landscape and all that went on in the landscape. Harewood Castle is not, of course, an isolated phenomenon and this has to be taken into account in understanding it and producing proposals for its future treatment.

2.3 The following pieces of information are given by way of illustrating some of **the relationships and differences between these various territories:**

- a) Moorhouse (1985, pp10-11) shows that the medieval manor of Harewood and the ecclesiastical parish shared the same boundary. Within the manor and parish were seven townships plus a small part of the township of Wike. Of these, two were north of the river Wharfe (Weeton and Dunkeswick), and five were to the south of it (Weardley, Harewood, East Keswick, Alwoodley and Wigton).
- b) Within the Township of Harewood, Moorhouse (1985, pp10-11) also identifies the general location of seven settlements that existed or may have existed in medieval times. These include: a possible predecessor of the present Harewood village, to the west of the castle; Newhall to the east of the castle; Stockton to the east of Newhall; Gawthorpe, to the south of the present Harewood House; Towhouses, by the Gawthorpe Beck, well to the south of Gawthorpe; Lofthouse, to the east-north-east of Towhouses and around the present Lofthouse Gate into the park; and Hollin Hall to the east-north-east of Lofthouse.
- c) Gawthorpe was a separate estate, and perhaps a separate manor, within the township of Harewood. It came into the possession of the Gascoyne family in about the mid 12th Century (Jones 1859, 52 and 199). The last male descendant of the Gascoynes of Gawthorpe was William Gascoyne whose sole heir was his daughter, Margaret. She married Thomas Wentworth around 1580 (?) (Jones 1859, 73), and through her the Wentworths acquired Gawthorpe. It was their son, William Wentworth, who bought the manor of Harewood (see below) and their grandson who became the famous 1st Earl of Strafford.
- d) In Harewood church is a very fine set of six medieval chest tombs with life-size figures, of carved alabaster, laying on top of them. These figures represent members of the Ryther, Redman (Redmayne) and Gascoyne (of Gawthorpe) families. They date from the early 15th century to the early 16th. Here in the church, former owners of Harewood Castle and Gawthorpe Hall have been brought together, as later in history were their estates. By the association of ideas, the church and its tombs provide an historical, antiquarian and physical link between the present Harewood House and the castle. This link was not lost on the creators of the Northern Pleasure Grounds in the 18th and early 19th centuries. In the imagination, the church serves as a romantic mausoleum or as a place where one is brought face to face with life-like images of people who lived in what, until the building of Harewood House in the 18th century, were the two main seats in the parish of Harewood.

3.0 A BASIC CHRONOLOGY FOR HAREWOOD CASTLE

3.1 Three Main Phases

The history of Harewood, for convenience, may be broken down into three main phases:

Period A. The period before the building of the present castle, i.e. up to c.1366, when William de Aldeburgh was granted a licence to crenellate "the

dwelling-place of his manor of Harewood" (Faull and Moorhouse 1981, 387).

Period B. The period from the building of the present Harewood Castle c.1366, to its sale by the Ryther family in 1600 and its abandonment as a main residence.

Period C. The period from its sale by the Rythers in 1600, to the present and beyond.

3.2 Period A, up to c.1366

In the 13th century the administrative centre of the manor of Harewood was **Rougemont Castle** in the township of Dunkeswick, in the parish and manor of Harewood (Faull and Moorhouse 1981, 360). The site of Rougemont Castle is on the north bank of the river Wharfe, about one mile west of Harewood Bridge.

Moorhouse (1989, 7) as a result of a field survey, concluded that the site on which **Harewood Castle** was built, had been occupied in the 12th and 13th centuries and that this suggests that the new castle was a "remodelling of an already occupied site". He goes on to say that "The accounts of Isabell de Fortebus show that a substantial manorial complex with stone buildings lay somewhere within Harewood township during the late 13th century and the area of the castle" (i.e. Harewood Castle) "seems the most likely site". If this is so, it would seem to follow that the administrative centre of the manor of Harewood had moved to this site by then and was no longer at Rougemont Castle. The question of whether the present structure of Harewood Castle incorporates earlier masonry is discussed in the Architectural Survey prepared by Ed Dennison (Dennison 2000).

3.3 Period B, c.1366-1600

The building of Harewood Castle is attributed to Sir William de Aldeburgh who held the manor of Harewood from 1364 until his death in 1388 (Emery 1996, 339). His son who succeeded him, died shortly after, in 1391, and the manor was then inherited by Sir William's two daughters. It was through their marriages, one with Sir William Ryther and the other with Sir Richard Redmayne, that Harewood Castle and manor were brought into these two families (Jones 1859, 37). The two daughters, Sibyll and Elizabeth, and their respective husbands are commemorated by chest tombs and alabaster effigies in Harewood church.

The end of Period B came in the early 17th century. James Ryther (c.1535/6-1595) came to live at Harewood in 1563, after his father's death (Craig 1984, 96). In 1574, with a partner (William Plompton of Plompton), James Ryther bought out the Redman family interest in Harewood (Craig 1985, 125). He finished his days in the Fleet Prison in London in December 1595. Robert Ryther and his sisters, the children of James, sold the castle and the manor of Harewood at Easter 1600 to clear their father's debts and it was at this point that the Ryther family connection with Harewood was broken (Craig 1984, 98).

Two interesting items relating to the history of Harewood Castle during this period are:

- the will, written and proved in 1391, of Margaret, the wife of Sir William de Aldeburgh (the builder of Harewood Castle). According to Jones (1859, 139) this provides much information about "...the internal economy of the castle, its furniture, plate, &c....".
- a collection of nine letters from July 1587 to August 15, addressed to William Cecil, Lord Burghley by James Ryther (c.1535/6-595) of Harewood Castle. These included a long, and what might be the earliest account of Yorkshire written by a resident. It is dated 3 January 1588 (Craig 1984, 99 and 100).

3.4 Period C, from 1600

This is the period after the sale of the castle and manor by the Ryther family. The sale probably marks the point at which Harewood Castle ceased to be considered as a main residence. It soon became a ruin and has remained as such to the present day.

Period C can be subdivided, like others, according to periods of ownership and management by different individuals and families. In the case of Period C, these correspond to the following:

- C1 1600-1657. The combined estate of Harewood and Gawthorpe, with the castle, is sold by the Rythers and bought by the Wentworths who sold it in 1657.
- C2 1657-1738. The estate was in the possession of Sir John Cutler and his relatives. Sir John died in 1693. His daughter, Elizabeth, Lady Radnor, died in 1696, and John Boulter, a relative of Sir John's, died in 1738 (Jones 1859, 95). On the death of John Boulter the Trustees of his son were obliged to sell the estate to settle John's debts (Jones 1859, 66).
- C3 1738 onwards. The estate was purchased by Henry Lascelles in 1738 and it has remained associated with the Lascelles family since then. In 1987, the House, its contents and the gardens and grounds within the vicinity of the House were leased to an educational charity, The Harewood House Trust, which now has primary responsibility for them. They provide the historical core to the Estate.

3.5 Period C1, 1600-1657

The sale of Harewood by the Rythers gave **Sir William Wentworth** (of Gawthorpe) the opportunity to unite it with Gawthorpe, which he proceeded to do. His decision to acquire it was made by 1607 and a payment of £11,000 was eventually made on 16 February 1616 (Craig 1984, 98). In all likelihood the Wentworths continued to reside at Gawthorpe which, after all, was the family home of Sir William's mother. So the main centre of administration of the Harewood estate may have moved to Gawthorpe around 1607-1616. **Thomas Wentworth** (1593-1641, the 1st Earl of Strafford) was apparently using Gawthorpe as a residence by 1627 as he wrote a letter from there on 1st May that year (Jones 1859, 264).

3.6 Period C2, 1657-1738

The Wentworths were obliged to sell Harewood and Gawthorpe and in November 1656 the castle was described in a Bill of Sale, as follows: “**the castle of Harewood is decaied**, yet the stones thereof being much ashler, and the timber that is left fit for the building of an hansom new house, &c.....”. From this description it is possible to infer that by 1656, the castle had already had some of its timber removed and perhaps other elements as well. Jones (1859, 150) states that Sir John Cutler who purchased the estate from the Wentworths “is charged with having aided its demolition, by removing both stones and timber for the erection of cottages elsewhere”. Sir John held the estate from 1657 to his death in 1693. But perhaps the Wentworths had played a part in the dismantling of the castle. However, Jones (1859, 149) states that “one account says positively that it (the dismantling) was done in the civil wars”.

3.7 Period C3, 1738 to the present

During Period C3, the **three main members of the Lascelles family** who need particular acknowledgement in relation to the castle and its landscape are:

- **Edwin Lascelles, Lord Harewood (1712-1795)**, who established the present Harewood House and was probably responsible for naming it “Harewood” rather than “Gawthorpe” House. He was also responsible for transforming the landscape setting of the new house. This landscape provides the basis of the present layout. He was created Baron, or Lord Harewood, in 1790. Although his father, Henry, who bought the estate in 1738, did not die until 1753, it would seem likely that Edwin had taken on the running of it by 1749. This is suggested by the starting date of both an account book between Edwin and his Steward, Samuel Popplewell, and a ledger (WYAS Leeds HAR Accounts 225 and 269).
- **Edward, 1st Earl of Harewood (1740-1820)**, cousin to Edwin Lascelles. During his ownership of the estate, major additions were made to the layout of the landscape on the eastern side of the park. These included incorporating the ruins of the castle into an extension of the Northern Pleasure Grounds.
- **Edward, Viscount Lascelles (1764- 1814)**, the eldest son of the 1st Earl. He died before his father and so never inherited the Earldom or the estate. Nevertheless, he may well be an important figure in the development of the landscape at Harewood House. He is a well known connoisseur and is recorded as having directed the contrivance of the Rock Arch in the Northern Pleasure Grounds. The significance of this is that it was, and is, a major feature along the walks in the pleasure ground from Harewood Church to Harewood Castle. It is about half way between the two and helps to establish and maintain a romantic and rustic picturesque mood in the interval between them.

4.0 ATTITUDES AND THE TREATMENT OF THE CASTLE AND ITS LANDSCAPE

4.1 Period B: c.1366-1600

Were it not for the trees that now surround it, one would be very much more conscious of the **wonderful views of Wharfedale** that are available from the castle. Presumably the castle or fortified manor house, as it should more properly be called, was intentionally sited to take advantage of these either for reasons of security or for the sheer aesthetic pleasure that they gave, or both. The castle was designed so that the views could be obtained from some of the rooms as well as from the rooftop walks, the evidence for which is still visible. To judge from the estate plan of 1698/9 (WYAS Leeds HAR Map 33) and an illustration of the castle that is incorporated into it, the castle was not then surrounded by trees and enjoyed open views to the west, north and east, as perhaps, it always had done before then.

4.2 Period C: during the time of Edwin Lascelles(1712-1795)

To date, the present author has only located two views of the castle that date from Edwin Lascelles time (Hooper 1787; Hooper 178?). These are from an as yet unidentified publication which would seem to be of an antiquarian nature. The images are concerned with recording the general appearance of the building rather than with creating a romantic or picturesque effect. The two views were published by S Hooper. One shows the east side of the castle, the other shows the west. One, the eastern side, is titled "Harwood Castle, Yorkshire" and was engraved by J Newton. It is dated February 28th 1787. The other is titled "Harwood Castle, Yorkshire. Pl 2". It was made by Sparrow and published on May 12th 178?; the final digit of the year is missing. Again, the castle is shown as being in the open with grassy humps and bumps beside it and one or two trees nearby.

The fourth edition of Hargrove's "The History of Knaresborough", published in 1789, provides a **description of Harewood Castle** because it was one of the acknowledged attractions of the area around Knaresborough. As part of the description he says that "The extent of the castle, when entire, must have been very considerable; for we now observe near an acre of ground, around the remaining building, covered with half buried walls, and fragments of ruins". Hargrove was aware of the views over Wharfedale and conjured up a romantic interpretation of the castle which includes an extract from Ossian (Hargrove 1789, 160-161). Hargrove's work is, in fact, a guide book which was revised from time to time and issued as a new edition. The sixth edition published in 1809 has a revised description of the castle but the quotation given above is repeated and a romantic and antiquarian mood is maintained (Hargrove 1809, 185-193).

A little way to the west of Harewood church and in the Northern Pleasure Grounds is a **rotunda** which was built in 1785 (Hay 1993, 32-3). In his "The Tourists Companion or the History and Antiquities of Harewood", John Jewell includes the "Rotondo" in his tour of the "Gardens and Pleasure Grounds". It comes just before the church. The first edition of this work was published in 1818 and the second in 1822. From the Rotunda he says that there are two views (possibly straight vistas) that are created by openings in the plantings; one is to Almscliff, a crag on the northern horizon, the other is to Harewood Castle. Although he was writing in the 1st Earl's time this view was presumably available in Edwin Lascelles' when the Rotunda seems to have been

on the very edge of the Northern Pleasure Grounds and there was no plantation to the north of it (Teal 1796).

Edwin Lascelles attitude to the castle remains to be explored further, but in the meantime it can be noted, for example, that his new house was called “Harewood” and not “Gawthorpe” House, but by that time Harewood was the main settlement, giving its name to the manor, township and parish.

In the archives (HAR Buildings Plans 1) there are three drawings, two plans and a section, showing **the castle as a malting house** with living accommodation, the latter being on the top floor. There is no obvious evidence at the castle today to suggest that this conversion was made, so it would seem likely that it was a proposal that was not executed. However, it presumably reflects a policy or attitude towards the castle by the owner. From the style of the drawings, it would seem quite likely that they were produced in John Carr’s office presumably for Edwin Lascelles. If this is so, it at least indicates a desire to find a use for the existing structure perhaps to protect it from further decay on the exterior. But it doesn’t suggest a highly developed antiquarian, picturesque or romantic sensibility, at least by later standards. John Jewell refers, in the 1822 edition of his guide book to Harewood, to a draw-well in the north-west corner of the castle for supplying the castle with water. Apparently it was cleaned out in 1771 to a depth of 18 feet. It was discovered to be of no use and was then back filled (Jewell 1822, 66). Might this incident be related to the idea of converting the castle into a malting house and dwelling?

Also in the Harewood archives at Sheepscar, are two drawings of elevations for a mansion at Gawthorpe showing the “**Castle Idea**” (HAR Acc 4306). A possible explanation for this is that it was a thought that was entertained by Edwin Lascelles at one point during his deliberations about the new house that he was to build at Harewood. At present the architect for the proposal seems not to have been identified. Perhaps it represents a desire to perpetuate the idea of Harewood being presided over by a castle, as in the past.

It may not be irrelevant that during Edwin Lascelles’ time, **the church** at Harewood was incorporated as a feature into the Northern Pleasure Grounds (long before the Castle Pleasure Grounds were created). The connection with the castle is that the church has some very splendid medieval monuments to people who once owned the castle.

The Rotunda, in the Northern Pleasure Grounds, which has been discussed above and from which there was a view of the castle, was built in Edwin Lascelles’ time. In this way **the castle was called into view and into mind** within the vicinity of the House and near the church. It was, however, Edwin’s wife, Lady Fleming, who led this initiative (Hay 1993, 32-3).

4.3 Period C: during the time of Edward, 1st Earl of Harewood (1795-1820) and his son Edward, Viscount Lascelles (1764-1814)

It was in the 1st Earl’s time that the ruins of the castle were actually incorporated into what may be called **the Castle Pleasure Grounds**. This was achieved by means of creating a long new pleasure ground on the north side of Church Lane. The western extremity was, and is, opposite the turning off Church Lane to the churchyard and the eastern limit was, and is, the present Leeds to Harrogate Road on the east side of the

castle. It included the construction of the Rock Arch and its associated rocky dell. The castle was taken into the new pleasure grounds, in the year 1813, (the year before Edward, Viscount Lascelles died) and in the same year, in the centre of the main building of the castle, some ash trees were planted (Jewell 1822, 66 and 70). Jewell's description of 1822, remains antiquarian and romantic but there seems to be a greater emphasis on the picturesque and scenic elements.

The creation of the Castle Pleasure Grounds would seem to reflect an interest in **the rustic picturesque** in the Earl's family. Whether this was led by the Earl or his eldest son, Viscount Lascelles, or someone else, is not clear at present. In this context, the rustic picturesque is the form of the pictorial and naturalistic approach to the appreciation and laying out of landscapes that focuses on wildly natural effects rather than tamed ones and on the vernacular rather than the polite. Its main champions in the late 18th and early 19th centuries were Richard Payne Knight and Sir Uvedale Price. The debate about the application of the rustic as opposed to the polite picturesque, was a very topical one at the time. The polite picturesque was the style of Capability Brown and Humphry Repton both of whom advised at Harewood. The appearance of the rustic picturesque at Harewood raises an interesting question about whether there is any relationship between the commissioning of views of Harewood from **J M W Turner, Thomas Girtin and John Varley** and landscaping activities on the ground. Turner made sketches and paintings of the castle in 1797, 1798 and 1808, and Varley in 1803 (Hill 1995, 20, 25, 26 and 48). I have not yet had an opportunity to see Turner's painting of 1808 but those of 1797 and 1798 show the castle in a vernacular rural landscape and not part of the designed ornamental landscape that was soon to be created in this area. In Varley's view of 1803, the fore and middle ground are shown as being quite park-like in character, even if the plantations of the Castle Pleasure Grounds are not indicated (probably because they were not there at that date).

On the Ordnance Survey map of 1851 (OS 1851) both **the North Park and the Castle Park** are named. They are situated between the Northern Pleasure Grounds, which is on their south side, and the present Leeds to Otley road which is on their northern side. The boundary between the two is not indicated but the North Park is to the west of West End Wood and the Castle Park is to the east of it and extends up to the castle. Interestingly, when Humphry Repton was asked to advise at Harewood in 1799-1800, he did not suggest any proposals for the castle, so possibly the taking of it into the pleasure grounds was not then under discussion, or at least it was not discussed with him. He was, however, aware of a deer park to the north of "the North Terrace" (presumably this was the Northern Pleasure Grounds to the north of the House, or a part of them) but he did not make specific proposals for this deer park (HAR Estate (Buildings) Box 1). No part of what was to become the North Park is indicated as being parkland on the 1796 Estate map which was completed in the year after Edwin Lascelles' death. The creation of the North Park and the reestablishment of the Castle Park do, however, seem to have been part of a desire in the 1st Earl's family to have a rustic picturesque and romantic area within the parkland at Harewood. The castle was evidently an important feature of the eventual scheme.

At present, I have not been able to clarify **the origins of Castle Park** except that they are medieval and at some point, perhaps from the beginning, it is directly associated with the castle. It does not seem to have been of large extent and is indicated on Figure 4 of Volume 2 of the Draft Management Plan of October 1997 for Harewood, as occupying an area within a rounded square of land that is bounded by Bondgate on

the south side, West End Wood on the west, and the river Wharfe on the north (Landscapes and Gardens 1997).

The name "**West End Wood**" raises the question of whether it was so-called because it was at the west end of the park, either within or outside it. It is clearly shown and named on the 1698/99 estate plan (HAR Map 33). It is still shown and named on the 1851 OS map but it has evidently been reduced in size. Currently the area it occupied is part of a much larger plantation that extends westwards from the castle and is partly bounded by the Leeds to Harrogate Road, i.e. the current Forestry Compartment 7 (Landscapes and Gardens 1997, Vol 2, Fig 28).

Within West End Wood, Jewell, in 1822, says that there was "an open space, of about an acre, called **Chasne-plain**, which was kept cleared of trees, from a very remote period, but is now planted. It has been said that this was the place where about the year 963, Earl Athelwold fell a sacrifice to the resentment of his royal master, King Edgar, he forgot his duty to his prince, his benefactor, and his friend". This story which involves the very beautiful Elfrida who was eventually to marry **King Edgar**, was examined by John Jones and in his book of 1859, Jones declared that in fact the Yorkshire Harewood had no claim to the story (Jones 1859, 11-13). Jones also says that some writers have erroneously associated this story with Harewood Castle and he refers to "Elfreda", the play by the Rev William Mason (1725-1797, Canon and Precentor of York Minster) which he describes as "one of the most beautiful dramatic compositions in our language". The interesting point about this association with King Edgar is not whether it is true or not, but that it was made, presumably to support or enhance the perceived romantic character of Castle Park and the castle. The question that remains is when was this association made and by whom?

There is an **estate plan** that was drawn up at an unusually large scale (HAR Map 50). It appears to have been prepared before the allotment gardens at Bondgate were laid out. The first Earl "apportioned a considerable quantity of good pasture and arable land to the cottagers for gardens" in 1814 (Jewell 1822, 13). It is not certain, but it would seem likely that these were the allotments or part of them. Map 50 also seems to have been made before the Rock Arch was constructed and before the Castle Pleasure Grounds were decided upon. The map has provisionally been given the date of c.1810. Looking at the pattern of field boundaries in the area of what was to become **the North and Castle Parks**, it would seem possible that these parks were in the process of being formed. The "North Park" of the c.1810 plan is, however, much less extensive than that of the 1851 OS map.

Jewell, in his guide book of 1822, repeats Hargrove's description of the nature of **the area around the main castle building**. He says that "we now observe a great quantity of ground around the remaining building, covered with half-buried walls, and fragments of ruins" (Jewell 1822, 64). He even reinforces the point by saying that Dr Story, when he visited Harewood in 1790, had "pointed out many places which had been adjoining, but now in ruins and buried in the grass." (Jewell 1822, 64-65). This character of the ground adjoining the main castle building is exactly in line with a taste for the rustic picturesque and the question has to be asked as to when the half-buried walls disappeared from view.

On the question of when were **the Castle Pleasure Grounds** first planted, it can be said that it was probably sometime around 1810-1816. The first date is that of Map

50. The outline of the pleasure grounds seems to have been added to the map after it was originally drawn up. The second date is that of the visit paid by the Grand Duke Nicholas of Russia on 16 December 1816 when “the Earl of Harewood conducted the whole assemblage through the beautiful village and pleasure grounds to the ancient castle and church; at which his Imperial Highness expressed his most unqualified approbation and delight” (Jones 1859, 188-190). It would seem likely that a circular route was taken which took the party through the Castle Pleasure Grounds. The latter were presumably in a suitable state to be presented to the Grand Duke. In between these two dates, in 1814, Edward Viscount Lascelles had died. He had been directly involved in the construction of the **Rock Arch** and perhaps in other aspects of the Castle Pleasure Grounds (Jewell 1822, 62).

The layout of the Castle Pleasure Grounds was relatively simple, as far as can be judged from the 1851 OS plan. Looked at as a whole, it can be divided into three sections. Starting at the west end, opposite to the turning to the church off Church Lane, the **western section** ends at the former quarry which extends across the full width of the pleasure grounds as a rocky dell. At the south end of the dell is the north entrance, or exit, of the Rock Arch. The **central section** stretches from the dell to the sunken lane that passes from Bondgate to Castle Well (see OS 1851). This lane has a foot bridge over it that enables people in the pleasure grounds to cross over the sunken lane. The **eastern section** runs from the sunken lane to the castle and the Leeds to Harrogate Road. This eastern section is shown as having an upper path, a middle path and a lower path. The central section has an upper and a lower path. The western section only has a lower path and this joins a track in the North Park that leads northwards to the church and southwards to Harewood Bridge. The upper path in the central section has a branch that connects to a path in the pleasure grounds on the south side of Church Lane.

The well that is called “**Castle Well**” on the 1851 OS map is referred to by Jewell, in 1822, as “**Vicar-well**”. Of it he says that it took its name from “rising in the friar’s close, in Bondgate, now enclosed in the park. This well is of great utility to the inhabitants; it is on the outside of the pleasure grounds, in the north park and a long subterraneous passage under an arch, made for the purpose” (Jewell 1822, 69). He also mentions a “**Pigeon-well**” which “rises first out of the side of the hill, in the pleasure ground, and is conducted to a stone trough, by the road side, leading to Harrogate” (Jewell 1822, 69).

Immediately adjacent to the castle and soon after the taking of the castle, in 1813, into the new pleasure grounds, “**the castle-garden**, where the cross walks were very plain to be seen, was planted; likewise the high bank that goes around it.” (Jewell 1822, 70). There would seem little doubt that this is the still very evident platform and banks on the south side of the castle. The wording used by Jewell suggests that the garden earthworks were already existing in 1813 but this does not answer the question of when they were originally made. Were they made when the castle was occupied, or later? At present, I cannot rule out either possibility.

4.4 The Otley to Tadcaster Turnpike Road

Another major alteration that may have been connected to the making of the North and Castle Parks, was the realignment of the Otley to Tadcaster Road, a part of the old York to Lancaster Road. On the 1698/9 estate map, this section of the York to Lancaster Road is shown as passing directly on the north side of Harewood church.

In 1773-74 it was realigned further north onto the line of the present Church Lane. It was moved again in 1796-1800 onto the line of the present Leeds to Harrogate Road as far as the turning to Harewood Bridge and continuing as the Leeds to Otley Road from there. This new road line swept close to the castle and cut through part of the medieval precinct. It also provided the north boundary of the North and Castle Parks.

4.5 Ivy

So far, the earliest indication of there having been ivy on the castle, is the engraving published by Hooper in 1787. The character of the vegetation is somewhat transmogrified, but it seems reasonable to interpret it as ivy. It is much more evident on the views by Turner of 1797 and 1798, and on the Varley view of 1803 (Hill 1995, 25, 27 and 43). The ivy is also a major feature of an as yet anonymous photograph of the castle which, to judge from the clothes worn by the two figures in the picture, would seem to be of around 1900.

5.0 SOME IDEAS FOR FURTHER CONSIDERATION

Within the limit of the time that has been available for research, for the purposes of this report, it has been possible to put together at least an initial outline of the history of the relationships between Harewood Castle and its landscapes. From this it is possible to formulate some ideas for further consideration. Those that, in particular, occur to me are as follows:

5.1 The Historical Dimension

It is clear that the historical dimension of the landscapes, of which Harewood Castle is a key feature, is of considerable interest. From a visual point of view, the contribution of the castle to these landscapes is much diminished because it is very heavily screened by the trees that surround it and because its immediate surroundings, where its precinct and its park were located, are to a large extent covered by plantations. The remains of the precinct are evident only to the specialist and the discerning eye. Similarly, the fact that it was once a leading element in a very interesting example of a late 18th and early 19th rustic picturesque landscape as well as being part of an early 19th century pleasure ground, are very difficult to appreciate.

5.2 The Core Area

The amount of land that should be considered as part of the scheme for conserving and displaying the castle, could be made up of various components, giving a smaller or larger area. Whatever size is agreed upon after discussion with the different interested parties, it must be remembered that it is not an isolated patch but part of a series of larger areas and the links with these need to be maintained or improved, whether the links are physical, visual or in the mind.

The areas that need to be given particular consideration for inclusion in the core area are;

- the main surviving structure of the castle.

- the earthworks that are associated with the castle and are within the Castle Pleasure Grounds. The ha-ha to the north of the castle can be considered as the northern boundary of these pleasure grounds.
- the eastern section of the Castle Pleasure Grounds (see part 4.3 of this report). This is part of Forestry Compartment 6.
- the earthworks and other remains of the castle precinct that are to the north and east of the Castle Pleasure Grounds, in Forestry Compartment 7 and on the other side of the Leeds to Harrogate Road.
- the area that was once covered by the medieval Castle Park and West End Wood.
- the area covered by the area known as castle park in the 19th century.
- to these might be added the area known as the North Park in the 19th century.

5.3 The Display of the Castle and its Surroundings to Visitors

The object of this section is to pick out some of the issues that relate to the treatment of the castle and its surroundings as a landscape. A key issue in this respect is covered by part 5.3 above, i.e. the extent of the core area. Other points include:

- to what extent can views to and from the castle be opened up? Does this have any security implications?
- to what extent can the remains of the castle and its precinct that are not visible or obvious, be exposed or made more evident?
- what kind of vegetation or planting should be established in the core area and how is it to be managed or maintained?
- to what extent can a rustic picturesque approach be adopted and maintained in the core area (assuming that further research supports this approach)? Harewood Castle has so far escaped the tidying up and smoothing out that has affected so many ruins. Much of the precinct has been cultivated as a forestry plantation but this has not entirely destroyed the irregularity of the surface. There is, at Harewood, a genuine opportunity to adopt another and an historically valid (and important) effect.
- to what extent can wildlife and habitats for wildlife be encouraged?
- to what extent can, or should, the existing ground level of internal area of the castle building be retained? It is one aspect of the rustic picturesque character of the ruin.
- whatever the eventual size of the core area, the question of how and by what route visitors reach it and the castle, will need to be sorted out. The approach will be a very important part of the visitors experience and needs to be thought

through at an early stage. The options include, for example, going through the Northern Pleasure Grounds, through the western and central sections of the Castle Pleasure Grounds, or through the North Park.

- Are there ways in which the impact of the Leeds to Harrogate Road can be reduced, for example through carefully designed new or existing planting?

These issues need to be addressed as part of a properly integrated approach to the display and presentation of the castle.

5.4 Some Topics on which Further Information and Research is Needed

- the activities and interests of the 1st Earl of Harewood and his son, Edward, Viscount Lascelles, in relation to landscapes and landscaping.
- the appearance of the castle precinct, including the details of the ground surface, before much of it was converted to a plantation.
- a more complete list of pictures and photographs showing the castle and its surroundings.
- the original date of construction of the Castle Garden and its subsequent history.
- the routes followed by the original paths in the Castle Pleasure Grounds and any details of the original planting.
- further information about other aspects of the history of the area covered by the Castle Precinct, The Castle Park (medieval and later), West End Wood, The Castle Pleasure Grounds, the North Park.
- a detailed survey and plan showing the location of trees, wildlife habitats and archaeological remains in the eventual core area.

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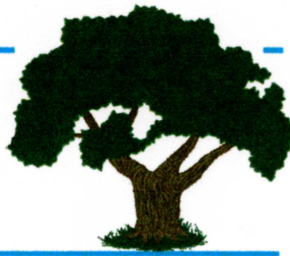
Peter H Goodchild.

APPENDIX 2

ECOLOGICAL SURVEY

by Madeline Holloway

EINC
Ecological Information
Network Consultants



**HAREWOOD CASTLE
ECOLOGICAL SURVEY**

**Author: Madeline Holloway
Date: 2000**



HAREWOOD CASTLE ECOLOGICAL ASSESSMENT

CONTENTS

1	EXECUTIVE SUMMARY	1
2	INTRODUCTION	2
3	METHODOLOGY.....	2
4	RESULTS.....	4
5	EVALUATION	11
6	FUTURE MANAGEMENT	13
7	REFERENCES.....	16

FIGURES

Figure 1	Feeding bat samples
Figure 2	Sonogram of an echolocation call by the FM/CF bats <i>Pipistrellus pipistrellus</i> (Common Pipistrelle)
Figure 3	Sonogram of an echolocation call by the FM/CF bats <i>Pipistrellus pygmaeus</i> (Soprano Pipistrelle)
Figure 4	Quadrat samples and location of ancient trees
Figure 5	Woodland and grassland communities at Harewood Castle
Figure 6	Sonogram of an echolocation call by the FM/CF bats <i>Ncytalus noctula</i> (Noctule)
Figure 7	Sonogram of an echolocation call by the FM/CF bats <i>Ncytalus lesleri?</i> (Leisler's bat?)
Figure 8	Location of bat droppings at Harewood Castle

TABLES

Table 1	Summary of Time Expansion and Heterodyne records for Bats at Harewood Castle
Table 2	Summary of the proportion of each species within the Total sample
Table 3	Recommended timings for the works

HAREWOOD CASTLE ECOLOGICAL ASSESSMENT

1 EXECUTIVE SUMMARY

- 1.1 An ecological report has been produced by EINC on behalf of EDAS to assess Harewood Castle, Leeds, Yorkshire. The aims of the report were:
- To identify and evaluate all the major vegetation zones (and larger trees) within an approximate 100 metre radius of the castle according to National Vegetation Classification standards (2.5 ha approximately).
 - To undertake a systematic survey of all the accessible parts of Harewood Castle for roosting bats and to assess the site as a foraging area for feeding bats.
 - To provide general ecological advice on woodland and grassland management and the specialist requirements of bats (a protected species).
- 1.2 An evaluation of the habitats within the vicinity of Harewood Castle was based on ecological survey work undertaken between May and June 2000. This data was supplemented by information acquired from a desk-top study and consultees are acknowledged in the text wherever appropriate.
- 1.3 The plantations in the immediate vicinity of Harewood Castle are not considered ancient and therefore do not merit SSSI, SEGI or LNA status. Nonetheless the combination of very old sweet chestnut and pedunculate oak adjacent to the castle walls, the potential affinities of plantations to W8, W10, W13 and W14 woodland types, and the open sward of small tussocky grasses representative of U1 acid grassland, provide a mosaic of habitat types. These are together considered to be of parish ecological value. The locations and extent of all the identified habitats are shown in Figure 5.
- 1.4 All bats and their roosts are fully protected by the Wildlife and Countryside Act 1981 and a temporary summer bat roost was identified in the castle buffet (Figure 8).
- 1.5 Pellitory-of-the-wall *Parietaria judaica* was identified on both the external and internal surfaces of the castle walls. This native plant is a very rare occurrence of old walls and rocks in West Yorkshire, recorded only once or twice in recent years. The record of this rare plant is considered to be of district ecological importance.
- 1.6 For the future management of Harewood Castle a list of recommendations are presented. These provide advice and guidelines on the timing of restoration works to protect and enhance the site for bats, and measures to preserve the presence of Pellitory-of-the-wall.
- 1.7 Other recommendations include further survey work for bats within Harewood Castle when safe access is available and the production of a comprehensive management plan for the woodland areas in the vicinity of Harewood Castle together with the rest of the woods on the Estate.

HAREWOOD CASTLE ECOLOGICAL ASSESSMENT

2 INTRODUCTION

2.1 EINC was commissioned by EDAS in October 1999 to undertake an ecological assessment of Harewood Castle, Leeds, Yorkshire. The aims of the survey were:

- to identify and evaluate all the major vegetation zones (and larger trees) within an approximate 100 metre radius of the castle according to National Vegetation Classification standards (2.5 ha approximately);
- to undertake a systematic survey of all the accessible parts of Harewood Castle for roosting bats and to assess the site as a foraging area for feeding bats;
- to provide general ecological advice on woodland and grassland management and the specialist requirements of bats (a protected species).

3 METHODOLOGY

Flora

3.1 Available information was collected from Leeds City Council and an initial site visit in January 2000 established the scope of the survey. This allowed for a rapid assessment of the vegetation within a 20 metre radius of the castle to ensure that vegetation clearance to be undertaken for photogrammetric work could proceed. The botanical fieldwork was then undertaken between May and June 2000.

3.2 The method of data collection was designed to enable analysis using the National Vegetation Classification which has become the standard tool for vegetation recording (Rodwell 1991). Quadrats (sampled areas) were located within stands which appeared to be structurally and floristically homogenous. Woodland quadrats were approximately 25m by 25m for the canopy and shrub layer (with one at 50m by 10m), and 10m by 10m for the ground flora. Grassland quadrats were 1m by 1m. Figure 4 shows the locations of the quadrats.

3.3 Plant species present were recorded on a standard sheet and their abundance within the quadrat estimated using the Domin scale, which measures percentage cover. This information was supplemented by a brief description of the stand in which the sample was located, together with details of vegetation height, total cover, slope and aspect. Plant nomenclature follows that used by Stace (1991).

3.4 In addition the separately commissioned topographical (earthwork) survey recorded the position of all the larger trees and the juxtaposition of canopy vegetation with open areas. The ages of trees were estimated from the approximate relationship between the tree's growth (measured as the diameter or circumference of the trunk at 1.5m above ground level), and its age. In this report Mitchell's guide (1984) of an inch girth growth per year was used to estimate the approximate age of trees. This assumes that the trees were initially not growing in dense woodland conditions.

HAREWOOD CASTLE ECOLOGICAL ASSESSMENT

Fauna

- 3.5 A systematic daytime inspection of Harewood Castle was undertaken for bats on 25th May 2000. This is the month (together with June - August) that bats are most active and when they are most likely to be detected. The inspection searched for bat droppings beneath potential bat roost sites such as any small spaces between the stonework of the castle walls. Existing information from Leeds City Council regarding summer bat roosts within a 1 km radius of the castle was collected and assessed.
- 3.6 Further bat survey was undertaken to assess the site as a foraging area for feeding bats. Methods that are solely reliant on the use of narrow-band heterodyne detectors to assess the foraging habitats used by bats have recently come under criticism. Such methods are likely to miss those bats calling outside the tuned frequency range and their success rate in bat identification cannot be quantified by sonographic analysis. Also in habitats where many bats are present, identification of species is extremely difficult (Vaughan *et. al.* 1997). To avoid similar limitations the methods used in this survey employed both narrow band (heterodyne) and broad band (time expansion) techniques to assess the foraging value of habitats within the grounds of Harewood Castle. The latter retain accurate time and frequency information of bat echolocation calls as well as harmonics.
- 3.7 Ten sampling points were selected to represent the range of habitats within the immediate vicinity of the castle. The locations of each sampling point are given in Figure 1 and descriptions of the main habitats are given in Appendix 3. As far as possible the habitats were representative of both 'good' and 'poor' foraging habitats as indicated by the results of the national survey of bats summarised in Appendix 1 (Walsh and Harris 1996).
- 3.8 Ideally each sampling point should be sampled once a month during the months of May, June, July and August. These are the months that bats are most likely to be active and where any changes in feeding patterns (for example Leisler's bats may switch from maybugs in spring to dung beetles in autumn), can be monitored. However due to unavoidable time restrictions the feeding survey was only undertaken during the months of May and June. Each sampling point was systematically recorded for any bat activity during a period of five minutes by a Tranquility II time expansion bat detector held in the hand. All detected calls were recorded onto a Sony Semi-Professional tape recorder with the time switch set to 40ms. The latter is the playback time range (0.4 seconds) and, although complete social calls will not be recorded if the bat is transmitting for longer than 40ms, it is very unlikely that any bats will be missed during such a short playback period. Further guidelines for the required Tranquility II time expansion bat detector settings are given in Appendix 2.
- 3.9 The Tranquility II time expansion bat detector is a much more accurate and less subjective method of detection than a heterodyne bat detector. A limitation of the former, however, is that it has a relatively narrow angle beam of detection compared to the heterodyne bat detector. To overcome this limitation a hand-held heterodyne bat detector was also switched on during each five-minute

HAREWOOD CASTLE ECOLOGICAL ASSESSMENT

period. The additional advantage of the latter is that because it has a relatively wide angle beam of detection bats in the vicinity can be recorded which may otherwise be missed by the more accurate Tranquility II bat detector. All five minute periods were recorded approximately 40 minutes after sunset and continued for another 1-2 hours when bat activity is at a peak.

- 3.10 A sound analysis computer software package (Grams) was used to produce sonographic representations of each bat call (frequency against time). Four parameters were measured from each bat call, or echolocation pulse. These were the minimum frequency (kHz), the maximum frequency (kHz), the duration of the call (ms), and the interpulse interval, which is the time measured from the start of one pulse to the start of the next pulse (ms).
- 3.11 The time and frequency parameters for each species were compared to those found in baseline research by Vaughan et. al. (1997) and summarised in Appendix 4. The minimum frequency is particularly useful as it is diagnostic of all the bats that produce a mix of frequency modulated (FM) and constant frequency (CF) echolocation calls. For example it is from this measurement that '45 kHz' and '55 kHz' pipistrelles (common pipistrelle *Pipistrellus pipistrellus* and soprano pipistrelle *Pipistrellus pygmaeus*) got their temporary name (Figures 1 and 2). The high frequency information is not as informative as it suffers more from attenuation. However the duration and inter-pulse interval can also give an indication of the habitat.

Other fauna

- 3.12 Notes were made on other species seen on site, including any tracks or signs of mammals, and all birds were recorded. The potential of the site as foraging and/or breeding areas for protected species such as badgers, amphibians, water voles etc. was also examined during the above surveys. Existing information from Leeds City Council fauna records within a 1 km radius of the castle was collected and assessed.

4 RESULTS

Habitat survey

Woodland

- 4.1 Eight samples of the wood's vegetation were recorded at the locations shown on Figure 4 (Quadrats 1, 3-8, and 10), in order to obtain a reasonable cross-section of the wood's flora. A further 4 samples were taken in the open grassland area to the north of the castle (Quadrats 2, 2A, 9 and 9A). The species recorded in each sample, and the Domin value for each, are listed in Appendix 3. The following description is based on these records, additional field notes, and the information obtained from Leeds City Council.
- 4.2 Distinct stands of broadleaved, coniferous and mixed broadleaved/coniferous woodland surround the castle with a small area of open acid grassland occurring to the north-west of the ha-ha. The steep slopes adjacent to the north-eastern

HAREWOOD CASTLE ECOLOGICAL ASSESSMENT

edge of the castle (south of the ha-ha), are co-dominated by semi-mature sycamore *Acer pseudoplatanus* and ash *Fraxinus excelsior*. These trees, together with occasional semi-mature sweet chestnut *Castanea sativa*, beech *Fagus sylvatica*, pedunculate oak *Quercus robur* and silver birch *Betula pendula* extend southwards along the varied topography of the alternately steep and gentle slopes adjacent to the walled boundary of the site which follows the A61 Harrogate Road. A small finger of this woodland is also discernible along the north western edge of the flat area behind the castle known as the bowling green, and extends beyond the bowling green in a west, south-west direction. It is only on the steep slopes north-east of the castle, however, where several huge and ancient sweet chestnut trees (with very occasional very large-girthed pedunculate oak), can be found.

- 4.3 Semi-mature sweet chestnut trees tend to dominate the canopy within the depressions and hollows left from the former quarried area to the east of the castle. This grades to a mixed canopy of larch and sweet chestnut on the flat bowling green, and stumps of very large old sweet chestnut trees are evident along the old green's boundaries. However, most of the gentle north-facing slopes to the south and west of the castle are dominated by an even-aged larch *Larix* sp. plantation.
- 4.4 In contrast a dense block of yew occupies the steep slopes opposite the south-western edge of the castle. This is replaced by a belt of mixed beech and Scot's pine *Pinus sylvestris* plantation adjacent to the northern edge of the ha-ha. Shallow water emerges from a culvert located approximately 20 metres east of the gateway in the roadside wall. Mostly this is fringed by nettles *Urtica dioica*, but occasional hydrophillic plants include sweet-grass *Glyceria* sp., bittersweet *Solanum dulcamara* and common duckweed *Lemna minor*. Acid grassland fringes the mixed plantation and this open habitat extends in a north-westerly direction towards the track which lies parallel to the ha-ha further north.
- 4.5 The field layer is generally species-poor and most of the ground is covered by leaf litter and/or brash from previous timber operations. However patchy carpets of dog's mercury *Mercurialis perennis* and bluebell *Hyacinthoides non-scripta* together with more occasional spikes of Lord's-and-Ladies *Arum maculatum* occur where the canopy is co-dominated by ash and sycamore. Indeed very small areas of bluebell can be seen throughout the field layer, as can the occasional frond of broad buckler fern. Grasses tend to be absent except under the mixed beech and Scot's pine plantation where Yorkshire fog *Holcus lanatus* together with broad buckler fern *Dryopteris dilatata* and bramble *Rubus fruticosus* are relatively frequent.

Castle environs

- 4.6 A total of 7 semi-mature ash, 3 semi-mature sycamore and several hawthorn *Crataegus monogyna* and elder *Sambucus nigra* bushes were felled within a 10 metre radius of the castle walls to facilitate the photographic survey. The majority of trunks and branches were left on-site to provide wildlife habitats and from tree ring counts their ages ranged between 30 to 45 years old. The field and ground layers beneath the felled canopy and understorey remained largely

HAREWOOD CASTLE ECOLOGICAL ASSESSMENT

unaffected and on the steep slopes to the north-west these consisted of a mix of exposed soil and carpets of mosses. The latter included *Dicranella heteromalla*, *Mnium hornum*, *Eurhynchium praelongum*, *Pseudotaxiphyllum elegans* and *Atrichum unulatum*. A similar array of mosses adorn the ground between the south-eastern edge of the castle walls and the adjacent old Bowling Green. Additional mosses identified on the steps leading towards the old Bowling Green were *Rhizomnium punctatum* and *Hypnum cupressiforme*.

- 4.7 In contrast occasional woodland herbs and ferns are located towards the base (north-west), top (south-east) and north-east of the castle walls. These include bluebell, dog's mercury, lords-and-ladies and broad buckler fern. However at the base of the castle these woodland species are almost completely replaced by a dense stand of nettles *Urtica dioica*, and nettles are also a frequent component, together with dog's mercury and the liverwort *Lophocolea heteromalla*, on the steep slopes north-east of the walls.
- 4.8 An interesting flora has colonised the castle itself. For example extensive carpets of moss, including *Eurhynchium praelongum* and *Brachythecium rutabulum*, cover most of the fallen masonry. In addition the thin soil between the fallen stones are dominated by the liverwort *Marchantia polymorpha ssp. ruderalis*. Ferns are also frequent and three ferns, ladies fern *Athyrium filix-femina*, male fern *Dryopteris filix-mas* and broad buckler fern, were identified on the kitchen floor.
- 4.9 Of especial interest, however, is the widespread occurrence of Pellitory-of-the-wall *Parietaria judaica* on both the external and internal surfaces of the castle walls, particularly around the edges of the old windows, doors, fireplaces, towers and other openings all the way up the elevations of the castle remains. They are softly hairy perennials, 30-60cm tall, with cylindrical, much-branched, reddish stems which are usually procumbent to ascending. The stalked and alternate, oval-lanceolate, untoothed leaves can be up to 7cm long. The small flowers (approximately 3mm across), occur in clusters around the stem and leaf axils. Each flower has a greenish-red-tinged, four-toothed calyx (Rose 1981; Stace 1991).

Grassland

- 4.10 A short sward of acid grassland has developed over the clear-felled area sandwiched between the access track and the mixed plantation north of the ha-ha. Tree stumps are scattered throughout and the area is now co-dominated by common bent *Agrostis capillaris*, Yorkshire fog *Holcus lanatus*, sheep's sorrel *Rumex acetosella* and heath bedstraw *Galium saxatile*. In wetter hollows taller, hydrophilic vegetation has developed including species such as tufted hair-grass *Deschampsia cespitosa* and soft rush *Juncus effusus*.

HAREWOOD CASTLE ECOLOGICAL ASSESSMENT

Habitat analyses

Woodland

- 4.11 It is very difficult to classify the woodland communities found in the vicinity of Harewood Castle according to NVC standards. This is because their canopies and understoreys have been highly modified by previous silvicultural treatment and, in most cases, the field layer has also become impoverished. Nevertheless scattered plants of Lords-and-Ladies *Arum maculatum* together with more extensive patches of dog's mercury *Mercurialis perennis* and bluebell *Hyacinthoides non-scripta* in the area currently co-dominated by ash *Fraxinus excelsior* and sycamore *Acer pseudoplatanus* (described in paragraph 3.1.2), indicate that it is a much modified example of W8 *Fraxinus excelsior* - *Acer campestre* - *Mercurialis perennis* woodland. Such modifications include the fact that maple *Acer campestre* and hazel *Corylus avellana*, understorey species normally associated with this woodland type, are both absent, and it can only be surmised that these may have been removed during previous silvicultural treatments.
- 4.12 An impoverished and almost bare field and ground layer beneath the ancient sweet chestnut *Castanea sativa* and pedunculate oak *Quercus robur* trees give few clues to their history and hence classification. There is little doubt, however, that they were deliberately planted in distinct periods during the 19th century since they are fairly regularly disposed along the slopes and are morphologically similar. These characteristics give the canopy great structural uniformity and the dense shade has impoverished the field layer. The location and estimated age of these trees are given in Figure 4 and Appendix 5 respectively. Five trees appear to be between 95-105 years old, nine trees between 120-150 years old and a further four trees between 160-190 years old.
- 4.13 Moving towards the former quarried area, the bowling green and the even-aged larch plantation (described in paragraphs 3.1.3), the generally much lower incidence of dog's mercury, absence of Lords-and-Ladies, and presence of bramble *Rubus fruticosus* indicate a shift towards a modified W10 *Quercus robur* - *Pteridium aquilinum* - *Rubus fruticosus* woodland category. Of particular significance is the prominence of sweet chestnut, which is much more strictly confined to the *Quercus-Pteridium-Rubus* woodland (Rodwell 1991). This tree, which has a Sub-Mediterranean distribution in Europe is almost certainly an introduction to Britain (Godwin 1975 and Rackham 1980), but it is eminently successful on the moister soils over which this community occurs. In the past this tree has been strongly selected as a coppice crop to supply poles and stakes, although there is no evidence to suppose that this was the case within the grounds of Harewood Castle.
- 4.14 There are, however, several elements in the vegetation which are anomalous for a W10 woodland type. The severely impoverished field layer (1-10% cover) is much lower than that published for this type of woodland (69-88%); hazel *Corylus avellana*, recorded as the commonest shrub of W10 woodland types, is absent; and bracken *Pteridium aquilinum* is also absent from the field layer. Nonetheless further evidence to support the W10 categorisation is that it is a well-known

HAREWOOD CASTLE ECOLOGICAL ASSESSMENT

practice for interplanting to have occurred within these stands, or for the complete replacement of the canopy with softwoods such as larch (Rodwell 1991). Indeed Rodwell (1991), recommends that stands of species such as larch are best incorporated, on general ecological grounds, within this community.

- 4.15 Further difficulty is encountered on attempting to categorise the belt of mixed beech *Fagus sylvatica* and Scot's pine *Pinus sylvatica* plantation described in paragraph 3.1.4. However the higher plants and bryophytes within the field and ground layers respectively indicate that it has similar characteristics to a W14 *Fagus sylvatica-Rubus fruticosus* woodland. For example within the field layer there are tussocks of common bent *Agrostis capillaris* and Yorkshire fog *Holcus lanatus* as well as scattered fronds of broad buckler fern *Dryopteris dilatata*. In addition the ground layer mosses include species such as *Mnium hornum*, *Pseudotaxiphyllum elegans*, *Polytrichum formosum* and *Dicranella heteromalla*. It should be noted that although this plantation is relatively young (probably at most 50 years old), with traditional management this type of woodland community has provided some of the best examples of wood pasture elsewhere in Britain, and can be evocative reminders of an earlier landscape.
- 4.16 Finally the dense yew *Taxus baccata* plantation located on the steep slopes west of the castle shares many of the characteristic typical of natural W13 *Taxus baccata* woodlands. These include very gloomy and bare field and ground layers. However natural stands of this community are typically associated with moderate to very steep limestone slopes carrying shallow, dry rendzinas and are mostly confined to the Chalk of south-east England and the Durham Magnesium Limestone.
- 4.17 None of the woodland within a 100m radius of the castle is listed in the 1989 West Yorkshire Inventory of Ancient and Semi-Natural Woodlands. Such woodlands are considered to be ancient if they have had a continuous cover of trees since at least 1600. Although some of the individual sweet chestnut and pedunculate oak trees in the immediate vicinity of the castle are estimated to be between 150-190 years old the existing woodlands are not considered to be ancient. The highly modified canopy and understorey, as well as the very species-poor field layer, of the existing woodlands suggest that they are secondary plantations of recent origin i.e. are less than 50 years old. Indeed it is likely that many of the trees within a 100 metre radius of the castle have either been planted, or have self-seeded, since the severe gales of 1962, recorded to have uprooted 20,000 trees within the Harewood Estate (Henderson and Seaward 1976). The location and extent of each woodland community identified is summarised in Figure 5.

Grassland

- 4.18 The open sward of small tussocky grasses and short herbs sandwiched between the mixed plantation north of the ha-ha and the access track further north can be categorised as U1 *Festuca ovina-Agrostis capillaris-Rumex acetosella* grassland (Figure 5). Although sheep's fescue *Festuca ovina* was not identified in the quadrats many of the other common elements of this community were present. This includes abundant common bent *Agrostis capillaris*, heath bedstraw *Galium*

HAREWOOD CASTLE ECOLOGICAL ASSESSMENT

saxatile and sheep's sorrel *Rumex acetosella*, as well as frequent early hair-grass *Aira praecox* and more occasional mosses such as *Polytrichum juniperinum* and *Pohlia nutans*.

- 4.19 This type of grassland is characteristic of base-poor, oligotrophic and summer-parched soil, with grazing and disturbance often very important contributory factors in maintaining the typical aspect of the vegetation. Indeed it is likely that disturbance evident from previous clear felling activities initially created the open ground available for development of the community. In addition abundant rabbit droppings provide evidence of current grazing activities, and deer have also been noted in the vicinity.
- 4.20 Taller, hydrophilic plants such as tufted hair-grass *Deschampsia cespitosa* and soft rush *Juncus effusus* occupy the former ponds associated with a medieval village located nearer the access track and towards the adjacent mixed plantation. Other wetland plants within the adjacent W14 woodland include those fringing the shallow water that emerges from a culvert located approximately 20 metres east of the gateway in the roadside wall. These include sweet-grass *Glyceria sp.*, bittersweet *Solanum dulcamara* and common duckweed *Lemna minor*.

Bat Survey

Inspection of Harewood Castle

- 4.21 The position and number of bat droppings found at Harewood Castle are shown in Figure 8. One bat (probably a Pipistrelle *Pipistrelle sp*) was seen in the crack between the roof of the buffet on 25th May 2000 and about 20 fresh droppings were recorded in the buffet space below. However the bat was not present on another inspection undertaken on 7th June and no new bat droppings were recorded. The results indicate that the buffet area of the castle is used as a temporary summer roost.
- 4.22 Only a few bat droppings were recorded mostly on the window ledges of the basement and ground floor levels of the castle. One dropping was also found on the window ledge of the first floor (above the buffet area) but no droppings were found within the fireplaces, ovens and windows at the first floor level above the kitchen. The results indicate that bats do not use the castle as either a winter or summer roost, other than use of the buffet area as a temporary summer roost. This conclusion must be treated with caution, however, since many areas within the first, second and third level floors of the castle are currently inaccessible for survey and therefore may be used by bats. For example Common Pipistrelles *Pipistrellus pipistrellus* were regularly seen and heard foraging high up around the inner surfaces of the castle walls. This is, perhaps, an indication of a bat roost high up in a presently inaccessible location.

Feeding survey

- 4.23 Information from the 10 sample sites recorded within the vicinity of Harewood Castle during the months of May and June is summarised in Table 1, and their

HAREWOOD CASTLE ECOLOGICAL ASSESSMENT

locations are shown on Figure 1. A total of 213 echolocation calls were recorded from the ten sampling points during the months of May and June (total recording time of 3 hours). Table 2 summarises the proportion of each species identified within the total sample.

Tranquility II time expansion bat records for Harewood Castle

- 4.24 Common and Soprano Pipistrelles (*Pipistrellus pipistrellus* and *P. pygmaeus* respectively), and Noctules (*Nyctalus noctula*) were clearly distinguished from one another on analyses of the sonograms for these species. These were identified from the minimum (or end) frequencies given for each echolocation (or pulse), which were reliable diagnostic measurements (Figures 2, 3 and 6).
- 4.25 Less easy to distinguish were the calls from Leisler's *Nyctalus leisleri* and Noctules *N. noctula*. This is because of the considerable overlap in the end frequencies, duration and interpulse measurements between these species (Appendix 4). Nevertheless an example of calls which were thought to be from Leisler's rather than Noctules is shown in Figure 7. By far the hardest bats to distinguish are the FM calls made by *Myotis spp.* which are very similar in structure (Appendix 4). However no *Myotis spp.* were recorded in either sample.

Heterodyne bat records for Harewood Castle

- 4.26 The results using the heterodyne bat detector are summarised in Table 1. These results supplement those recorded with the time expansion bat detector and the table shows that the wide angle beam of the heterodyne detector picked up bats that the narrow angle beam of the time expansion bat detector missed. However the table also indicates that several bats were missed when bats called outside the tuned frequency range of the heterodyne bat detector and that identification of species was not as reliable. For example it was often not possible to distinguish between Pipistrelle 45 and 55 bats, or to distinguish between Leisler's and Noctules. Similar to the time expansion bat detector the hardest bats to distinguish are the FM calls made by *Myotis spp.* and these were therefore grouped together.

Other records

- 4.27 Only two bat records within a 1 km radius of the castle are held by Leeds City Council. These are a Pipistrelle *Pipistrellus sp.* at Grid Reference SE 320452 (30th June 1992), and a Brown Long-eared bat record *Plecotus auritus* at Grid Reference SE 308453 (9th August 1988).

Other fauna

- 4.28 Several rabbit burrows were noted throughout the area, and droppings were particularly prevalent amidst the acid grassland. A deer (species unidentified) was also recorded in the woodland north of the access track, several bank voles *Clethrionomys glareolus* were recorded in the dense brash under the semi-mature sweet chestnut trees east of the old Bowling Green, and grey squirrels were noted in the larch plantation.

HAREWOOD CASTLE ECOLOGICAL ASSESSMENT

4.29 The following birds were seen and/or heard during May and June 2000:

Blackbird
Blackcap
Bluetit
Chiffchaff
Chaffinch
Coal tit
Dunnock
Goldcrest
Greater Spotted Woodpecker
Greenfinch
Jackdaw
Kestrel
Song Thrush

4.30 Seven species of invertebrates are recorded on the Invertebrate Site Register for Harewood Park (Leeds City Council 2000). These are *Aphthona nigriceps*, *Anthribus nebulosus*, *Gaeruca tanacetii*, *Longitarsus ochroleucus*, *Derephysia foliacea*, *Carpophilus sexpustulatus* and *Cerylon histeroides*. However due to the age of the survey (undertaken in 1986), Leeds City Council advise that some - or all - of these species may no longer be present. It is also unclear whether any of them are present in the immediate vicinity of Harewood Castle.

5 EVALUATION

Habitat

5.1 Within the plantations of Harewood Park four woodland areas are identified in the 1989 Ancient Woodland Inventory. These are Carr Wood, High Wood, Piper Wood and West End Wood and all have been designated as Leeds Nature Areas (LNA's) by the City Council's Planning and Development Committee through the Unitary Development Plan (Leeds Nature Conservation Strategy 1991). The nearest wood (West End Wood), is approximately 300 metres west of the castle and, because of its history of continuous woodland cover since at least 1600, it is considered to be of parish - district ecological value.

5.2 The plantations in the immediate vicinity of Harewood Castle, however, are not considered ancient and therefore do not merit SSSI, SEGI or LNA status. Nonetheless the combination of very old sweet chestnut and pedunculate oak adjacent to the castle walls, the potential affinities of plantations to W8, W10, W13 and W14 woodland types, and the open sward of small tussocky grasses representative of U1 acid grassland, provide a mosaic of habitat types. These are together considered to be of parish ecological value. The locations and extent of all the identified habitats are shown in Figure 5.

Harewood Castle

5.3 All bats and their roosts are fully protected by the Wildlife and Countryside Act 1981. The temporary summer bat roost identified in the castle buffet should

HAREWOOD CASTLE ECOLOGICAL ASSESSMENT

therefore not be disturbed for restoration purposes during the months May-September inclusive i.e. at any time during the period that bats may use it as a summer roost in any year.

- 5.4 Although a few droppings were recorded elsewhere within the castle (e.g. scattered along the window ledges), there was no evidence of any additional bat roosts. However the higher levels of the castle were inaccessible for survey and therefore the recommended action for restoration of the castle should proceed with caution. Should a bat be found in any part of the castle during the restoration legislation requires that all work must be stopped immediately and English Nature consulted.
- 5.5 The widespread identification of Pellitory-of-the-wall *Parietaria judaica* on both the external and internal surfaces of the castle walls is also of particular note. This native plant is a very rare occurrence of old walls and rocks in West Yorkshire, recorded only once or twice in recent years. One such record is on the old walls of Hill Top road, Ledwick, Wadefield (Lavin and Wilmore 1994). The record of this rare plant is therefore of district ecological importance.

Habitat for bats

- 5.6 Criteria for the evaluation of habitats for foraging bats were based on the results of a national survey of bats and their habitats in Britain carried out over three consecutive summers from 1990 to 1992 (Walsh and Harris 1996). Despite the wide variation in distribution and habitat composition between different parts of Britain (e.g. upland and lowland geographical regions), the results showed a high degree of uniformity in preferred foraging habitats. Their results are summarised in Appendix 1 and indicate that bats show a far stronger preference for woodland edge and all water bodies than for any other habitat type. On the other hand bats tend to avoid the more exposed and more intensively managed habitats such as arable land and poor, semi-improved pastures.
- 5.7 One of the main objectives of the work was to assess the importance of localised habitats (such as the clumps of ancient sweet chestnut and pedunculate oak trees, the even-aged larch plantation and the acid grassland), for foraging bats within the immediate vicinity of Harewood Castle. Bats were recorded in a diverse range of habitats but the results in Table 1 indicate that they preferred to forage in the vicinity of the castle itself, around the ancient sweet chestnut trees, and all the woodland edge habitats (Samples 1-3, and 5-8). On the other hand the bats tended to avoid feeding in the open acid grassland (Sample 9), and in the middle of both the mixed and coniferous woodland areas (Samples 4 and 10).
- 5.8 In conclusion the results tend to support the findings of published data on the foraging habitat preferences of vespertilionid bats in Britain (Walsh and Harris 1996 - Appendix 1). Common Pipistrelles *Pipistrellus pipistrellus* constituted a large proportion of the identified sample (86.3%). This was followed by the Soprano Pipistrelle *Pipistrellus pygmaeus* (5.2%) and together the two species accounted for 91.5% of the identified sample (Table 2). The implication is that the habitat preferences described in paragraph 4.3.1 are particularly pertinent to

HAREWOOD CASTLE ECOLOGICAL ASSESSMENT

P. pygmaeus and *P. pipistrellus*. A limitation of the survey is therefore that the detailed habitat requirements for some of the rarer species in the vicinity of Harewood Castle may be masked by this analysis. For example species from the larger genus *Nyctalus* may more commonly be seen flying above parkland and open fields (Russ 1999).

- 5.9 A second limitation is that the survey was restricted to the months of May and June and feeding records for the months of July and August (the other months of peak activity) were missed. This could be remedied by undertaking a further survey for foraging bats during all four months of peak activity in another year. Finally no attempt was made to identify actual bat roosts in trees because these require sustained survey work between May-August to locate. Nevertheless cracks and hollows within the ancient sweet chestnut and pedunculate oak trees on the steep slopes east of the castle clearly provide important potential areas for maternity and hibernation bat roosts. This is particularly important for the more scarce and larger *Nyctalus spp.* bat species, several of which were recorded feeding in the vicinity.

Other fauna

- 5.10 There is no evidence of any other protected species in the wood (e.g. badgers, otters, water voles, great crested newts). This was confirmed by records held at Leeds City Council of badgers elsewhere on the estate and water vole records on the nearby River Wharfe.

6 FUTURE MANAGEMENT

Introduction

- 6.1 In this section the management of woodland and grassland habitats in the vicinity of Harewood Castle (and including the castle itself), both to further their own ecological potential and the conservation of bats are described.

Woodlands

- 6.2 Most management for existing woodlands can be conveniently grouped under three headings - regeneration, thinning and harvesting. Their planning is a major factor in achieving conservation aims. If a diverse bat, bird and/or any other wildlife community is to be achieved and maintained it is necessary to keep an appropriate amount of each regeneration stage of the woodland at all times and the planning of treatments should be scheduled to achieve this. However a comprehensive management plan for the woodland areas in the vicinity of Harewood Castle is beyond the scope of this report and it is therefore strongly recommended as a future commission with the rest of the woods on the Estate.
- 6.3 As a general principle existing woodlands should be managed to develop a diverse age of trees and shrubs, display a species diversity appropriate to the locality and include dead standing and fallen timber. Any landscape woodland planting should be made up of species which are not only native to Britain, but are appropriate to the locality and preferably grown from seed of local

HAREWOOD CASTLE ECOLOGICAL ASSESSMENT

provenance. This has clearly not been the case in the vicinity of Harewood Castle. For example nearly all the woodland blocks have relatively even-aged trees, and in some cases have been wholly replaced by softwoods such as larch. Another ubiquitous feature of all the woodland is the very poor representation of any understorey or field layer.

- 6.4 An important ecological objective would therefore be to actively manage all the existing woodland blocks, as far as possible, towards attaining the main characteristics of their natural counterparts. These are identified in this report as W8, W10, W13 and W14 National Vegetation Classification woodland communities respectively, and are described in detail by Rodwell (1991). This is also especially important for bats since published data indicate that these mammals prefer semi-natural broadleaved woodland and that the edges of such woodlands are particularly important foraging areas.
- 6.5 To achieve this objective parts of the even-aged larch plantation would need to be substantially thinned or even clear-felled in parts. This process should leave standing very occasional mature larch and leave undisturbed any regenerating native saplings and seedlings. Any fallen timber and the products of logging should be left in situ or relocated to more convenient positions and left to decay, so providing further invertebrate habitats. It is important that felled timber is not removed or burned. Recommended timings for any work to avoid direct disturbance to bats and birds are shown in Table 3.
- 6.6 Natural colonisation of cleared and/or thinned areas is preferable to planting for the creation of new native woodlands. This is because it should result in a more natural matching of trees and shrubs to local conditions and consequently a more irregular structure and natural appearance. In this case, however, some planting is necessary to re-introduce native species such as hazel *Corylus avellana* to the understorey. A general recommendation here, then, is that any tree and shrub planting for the establishment of new native woodland should be guided by the National Vegetation Classification (Rodwell and Patterson 1994).
- 6.7 Similarly most of the Scot's pine should be removed from the mixed beech and Scot's pine plantation, parts of the elder thinned from the understorey, and species such as hazel and holly *Ilex aquilinum*, re-introduced to the understorey. As open water areas are highly preferred foraging habitats for bats (Walsh and Harris 1996), it may also be an opportune moment to clear some of the undergrowth beside the shallow water emerging from a culvert located approximately 20 metres east of the gateway in the roadside wall.
- 6.8 Another general recommendation is that re-growth from any proposed woodland and scrub management should be monitored to assist planning of follow-up management. This can be achieved by counting a sample of cut stumps in a marked plot and recording for each species the number showing re-growth in the first and subsequent years. Within each marked plot the species-richness and cover of the field and ground layers should also be monitored to assess any beneficial or deleterious effects of the management.

HAREWOOD CASTLE ECOLOGICAL ASSESSMENT

- 6.9 Finally it is recommended that all the ancient sweet chestnut, pedunculate oak and ash trees identified on Figure 4 be retained. Although the dense shade cast by their canopy precludes the development of rich understorey, field and ground layers, the cracks and crevices of the old crowns and decaying branches provide good potential roosting habitats for bats. In addition the dry dead wood offers ideal habitats for saproxylic invertebrates. General measures to mitigate for the loss of potential bat roosts in trees felled elsewhere can be implemented by placing artificial roosting sites for bats on the remaining mature trees (including some of the ancient sweet chestnut and pedunculate oak trees). This would generally encourage more bats to roost in the area.

Grassland

- 6.10 It is recommended that the short-turf community representative of U1 acid grassland is maintained by continuing the existing grazing pressure exerted from the current rabbit and deer population. Should the sward undergo vegetation change in the future, resulting in the development of coarser, long grasses or shrub invasion, it is recommended that the area be shallowly rotavated.

Harewood Castle

- 6.11 It is recommended that wherever possible during the restoration works a number of gaps of 20 mm are deliberately left unfilled along horizontal sections of mortar between some of the old stones. This is particularly important in the area above the buffet where a bat was seen roosting in the cracks between the roof slabs. Elsewhere such gaps would provide potential bat entry points for roosting purposes.
- 6.12 If possible the widespread occurrence of Pellitory-of-the-wall *Parietaria judaica* on both the external and internal surfaces of the castle walls, particularly around the edges of the old windows, doors, fireplaces, towers and other openings within the castle should be preserved. The strategies by which this plant regenerates are uncertain, although it is likely that the seeds are dispersed to new places by means of adhering to animals (Grime 1988). Nevertheless it is apparent that once seeded in a favourable area (such as a particular crack within one of the castle walls), it is able to thrive and exploit similarly favourable niches in the nearby locality. Should it not be possible to preserve all locations of Pellitory-of-the-wall it is nevertheless likely to survive in the long term if at least some areas where it is presently thriving are left untouched.

Summary of recommendations

- 6.13 The following key points should be borne in mind in the preparation of a conservation plan for Harewood Castle, and its subsequent execution:
- Timing of all future work should take into account the periods that both birds and bats are most vulnerable. Recommended times to start new work are spring and late autumn.

HAREWOOD CASTLE ECOLOGICAL ASSESSMENT

- Wherever possible during the restoration works a number of gaps of 20 mm should be deliberately left unfilled along horizontal sections of mortar between some of the old stones. This would provide potential bat entry points for roosting purposes.
- Should it not be possible to preserve all locations of Pellitory-of-the-wall within Harewood Castle it is recommended that a minimum of four areas where it is presently thriving be left untouched.
- A future commission should include a comprehensive management plan for the woodland areas in the vicinity of Harewood Castle together with the rest of the woods on the Estate. An important ecological objective would be to manage all the existing woodland areas towards attaining the main characteristics of their natural counterparts.
- A general recommendation is that any proposed habitat management should be monitored in the first year and thereafter on a regular basis (initially perhaps every five years), to assist planning of follow-up management. In particular the placement of artificial roosting sites for bats on trees would encourage more bats to roost in the area.
- When safe access is available the bat survey should be extended to the upper levels of the walls.
- A foraging bat survey of the castle and its immediate surroundings should be undertaken during all four months of peak activity (May, June, July and August), in another year. At present only two months of peak foraging activity have been recorded.

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Table 1: Summary of Time Expansion and Heterodyne records for bats at Harewood Castle

No.	Habitat Description	Bat Species	Time expansion		Heterodyne	
			May	June	May	June
1	Harewood castle (high up on the inner sides of the castle walls)	Pipistrelle (45) Pipistrelle	136 -	48 -	- H	- H
2	Edge of dense stand of yew; very spare field and ground layers	Pipistrelle	-	-	M	-
3	Ash and sycamore plantation with bluebell and dog's mercury in field layer	Myotis sp.	-	-	L	L
4	Middle of an even-aged larch plantation; sparse ground flora		-	-	-	-
5	Mixed plantation of sweet chestnut and larch plantation; sparse ground flora	Myotis sp.	-	-	L	-
6	Edge of ancient, old sweet chestnut tree; very sparse field and ground layer	Pipistrelle (55) Pipistrelle Noctule	9 - 2	- - -	- L -	- - -
7	Edge of ash and sycamore plantation with bluebell, dog's mercury and Lords-and-Ladies	Myotis sp. Noctule	- -	- 9	L -	- -
8	Edge of mixed beech and Scot's pine plantation	Myotis sp. Leisler's ?	- -	- 7	L -	L -
9	Middle of acid grassland		-	-	-	-
10	Middle of mixed beech and Scot's pine plantation		-	-	-	-

Key:

Pipistrelle	Either Pipistrelle (45) (Common Pipistrelle <i>Pipistrellus pipistrellus</i>) or Pipistrelle (55) (Soprano Pipistrelle <i>Pipistrellus pygmaeus</i>) – recorded on Heterodyne Detector
<i>Myotis sp.</i>	Either Brandt's <i>Myotis brandtii</i> , Whiskered <i>M. mystacinus</i> , Natterer's <i>M. nattereri</i> or Daubenton's <i>M. daubentonii</i>
Leisler's?	Probably Leisler's <i>Nyctalus leisleri</i>
L	A few echolocations / five minutes
M	Several echolocations / five minutes
H	Many echolocations / five minutes

Table 2: Summary of the proportion of each species within the total sample

<i>Species</i>	<i>Total no of echolocation calls</i>	<i>Proportion of each species</i>
Pipistrelle (45)	184	86.3%
Pipistrelle (55)	11	5.2%
(Combination of 45 and 55)	(195)	(91.5%)
Leisler's?	7	3.3%
Noctule	11	5.2%

Table 3: Recommended timings for the works

<i>Species</i>	<i>Sensitive period</i>	<i>Recommended time for works</i>
Bats	Summer and/or winter	Only work on trees or buildings during spring or autumn when bats will be able to feed during most nights but will either have not started or will have finished breeding. Late autumn work is recommended since this also avoids impact to breeding birds.
Birds	April - late July	Avoid felling during this period to avoid any impact to birds such as breeding kestrel, an amber list bird of medium conservation importance (Gibbons et. al. 1996).

SURVEY NOTES

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 GRID Local Plane Metric Aligned North.
 LEVELS Metric Relative to Ordnance Datum, Newlyn
 BENCH MARK Located On Wall At Entrance To Car Park
 Value 64.517m



APPROX. DIRECTION OF NORTH

- KEY**
- BM Bench Mark
 - EP Electricity Pole
 - PH Fire Hydrant
 - GS Gas Valve
 - G Gully
 - IC Inspection Cover
 - IL Invert Level
 - LP Land Level
 - MM Manhole
 - Survey Station
 - SK and V Vent Pipe
 - TP Telegraph Pole
 - UP Up to Wall Level
 - WL Water Level

- Top of Batter
- Bottom of Batter
- Edge (General)
- Edge (Top)
- Edge (Bottom)
- Overhead Line
- Edge of Paving
- Overhead Cables

FIGURE 1
Feeding Bat
Samples

PROJECT TITLE
HAREWOOD
CASTLE

DRAWING TITLE
TOPOGRAPHICAL
SURVEY

benchmark

LAND SURVEYS
 7 Bleasheim Terrace
 Leeds LS2 9HZ
 Tel 0113 2268 66;
 Fax 0113 2260 65

FILE NAME	SCALE	DRAWN	CHECKED	DATE
1022	1:500	RL	DK	20/04/00
DATE	20/04/00	REVISION	DATE	
DRAWING	BM1022/01			

Feeding
Bat Sampling
Point

KEY

X

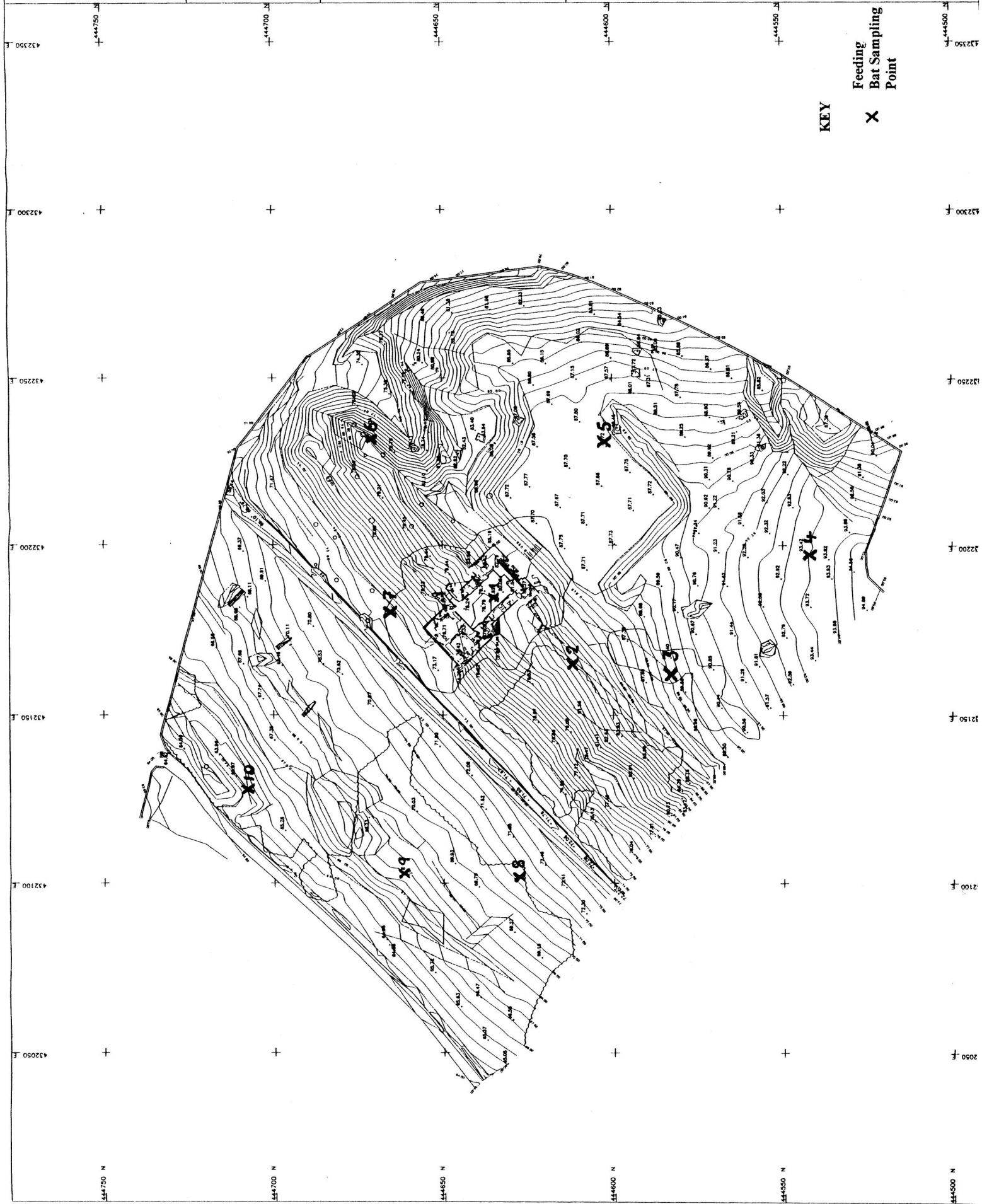
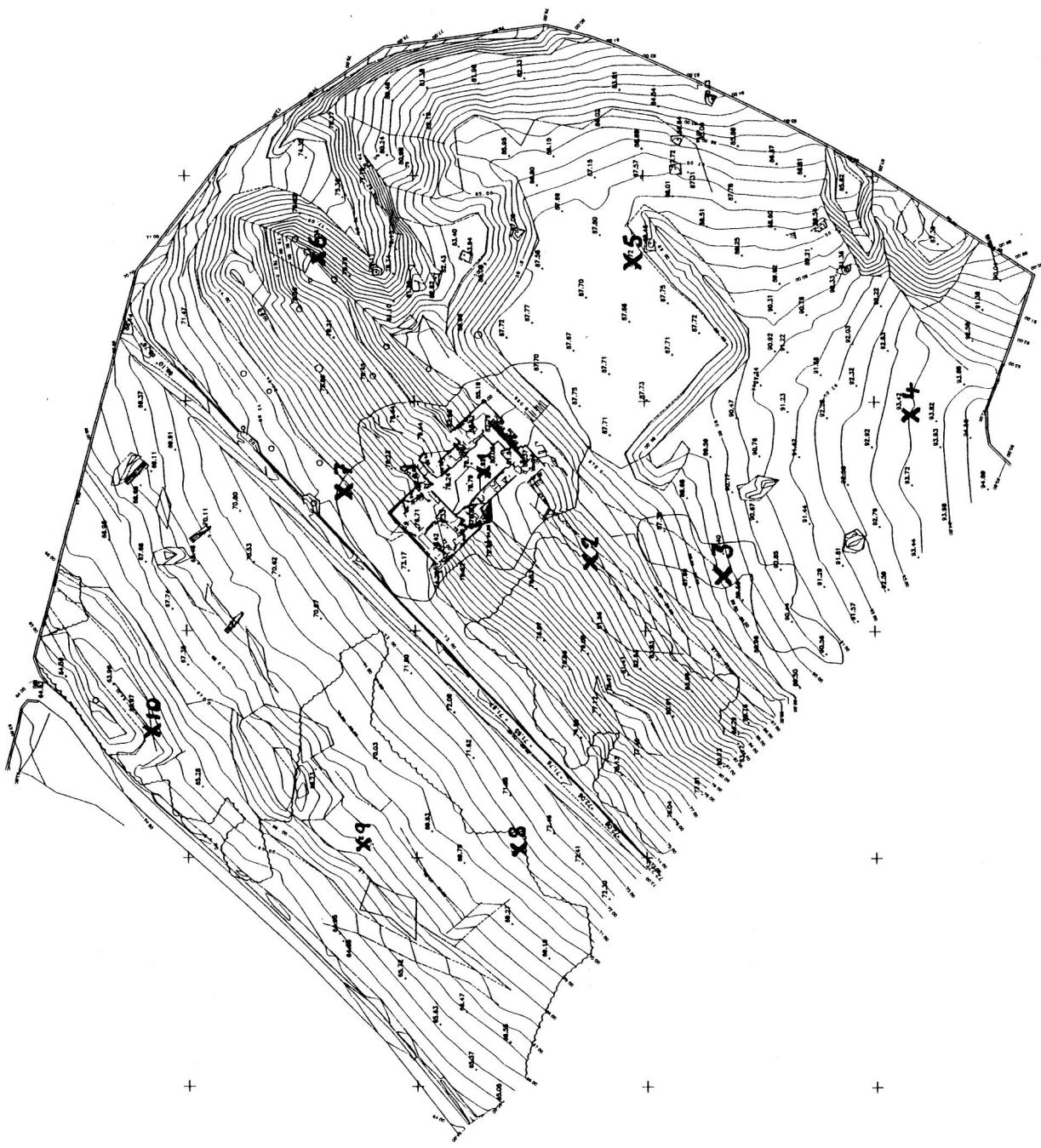
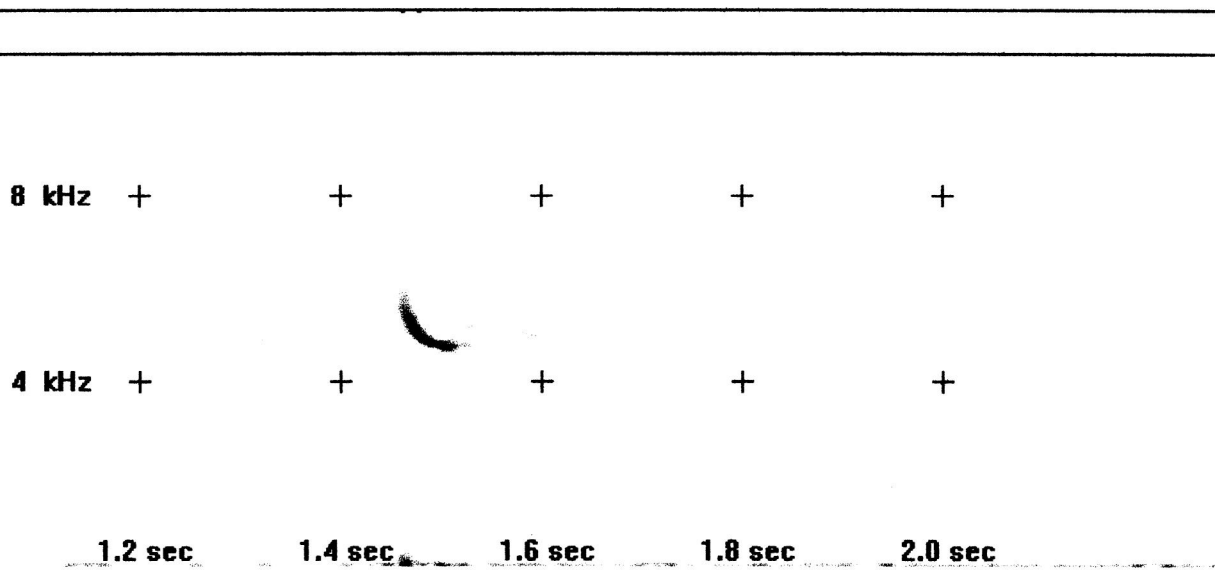
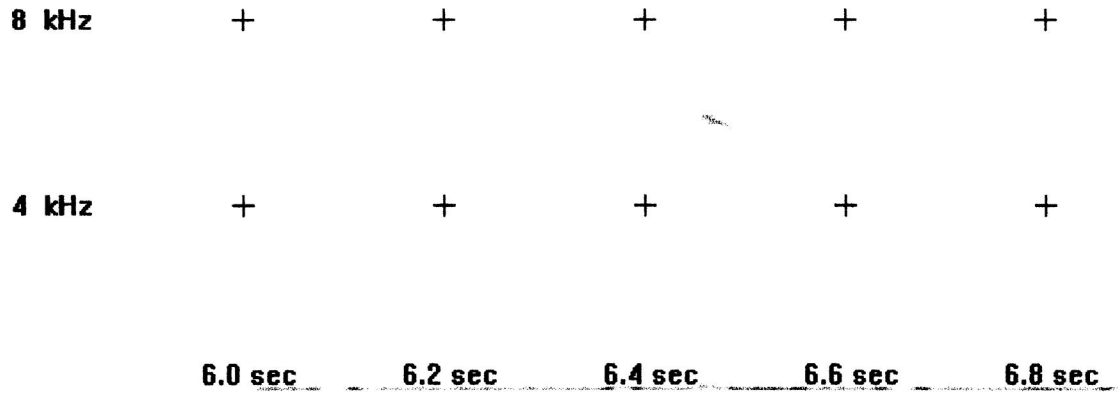


Figure 2 Sonogram of an echolocation call by the FM/CF bats *Pipistrellus pipistrellus* (Common Pipistrelle)



Habitat: Harewood Castle (Sample No. 1, May 25th 2000)
Duration: 5.6ms; Start frequency 59.2kHz; End frequency 46.7kHz.

Figure 3 Sonogram of an echolocation call by the FM/CF bats *pipistrellus pygmaeus* (Soprano Pipistrelle)



Habitat: Edge of ancient, old sweet chestnut (Sample No. 6, May 25th 2000)
Duration: 3.0ms; Start frequency 59.2kHz; End frequency 56.6kHz.

SURVEY NOTES

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GRID Local Plane Metric Aligned North.

LEVELS Metric Relative to Ordnance Datum, Newlyn

BENCH MARK Located On Wall At Entrance To Car Park Value 84.517m



KEY

- BH Bench Hole
 - BM Bench Mark
 - FP Free Hydrant
 - FH Fire Hydrant
 - FMS Fire Hydrant Sign
 - FAS Gully Valve
 - G Gully
 - GP Gate Post
 - GC Gate Cover
 - IL Invert Level
 - KL Kerb Level
 - KD Kerb Duct
 - LP Landmark
 - STN Survey Station
 - SV Stop Valve
 - SP Stop Valve Post
 - TP Telegraph Pole
 - V Top of Wall Level
 - VBL Ver Level
-
- Top of Bridge
 - Bottom of Batter
 - Edge (General)
 - Fence
 - Fence
 - Driveway
 - Driveway
 - Driveway
 - Driveway
 - Driveway
 - Driveway

FIGURE 4
Quadrat Samples and Location of Ancient Trees

PROJECT TITLE
HAREWOOD CASTLE

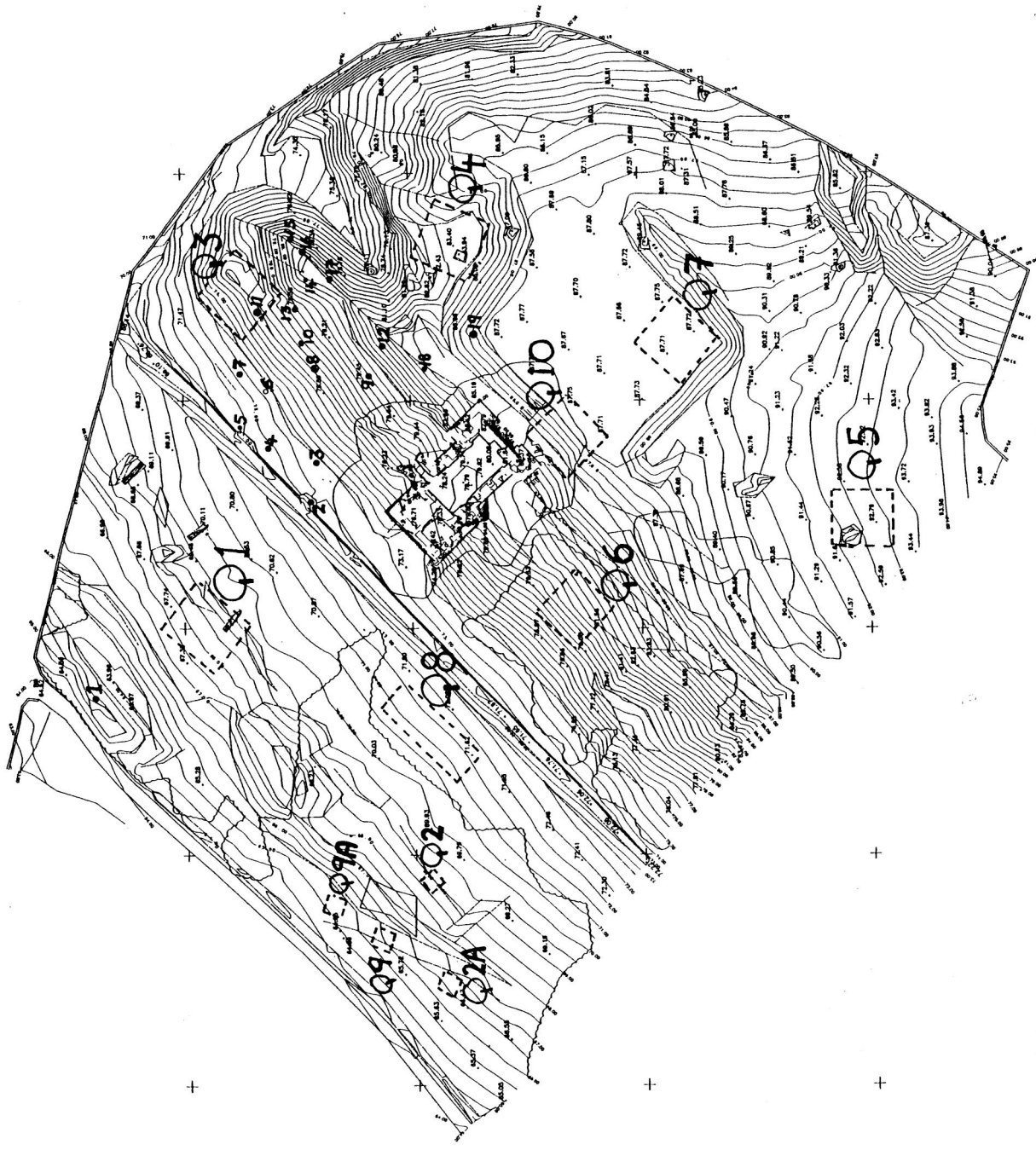
DRAWING TITLE
TOPOGRAPHICAL SURVEY

benchmar
LAND SURVEY
7 Blenheim Terrace
Leeds LS2 9PL
Tel: 0113 22 0113 22
Fax: 0113 22 0113 22

FILE NAME	SCALE
1022	1:500
DRAWN	CHECKED
RL	DK
20/04/00	20/04
ISSUED	REVISION
BM1022/01	

KEY

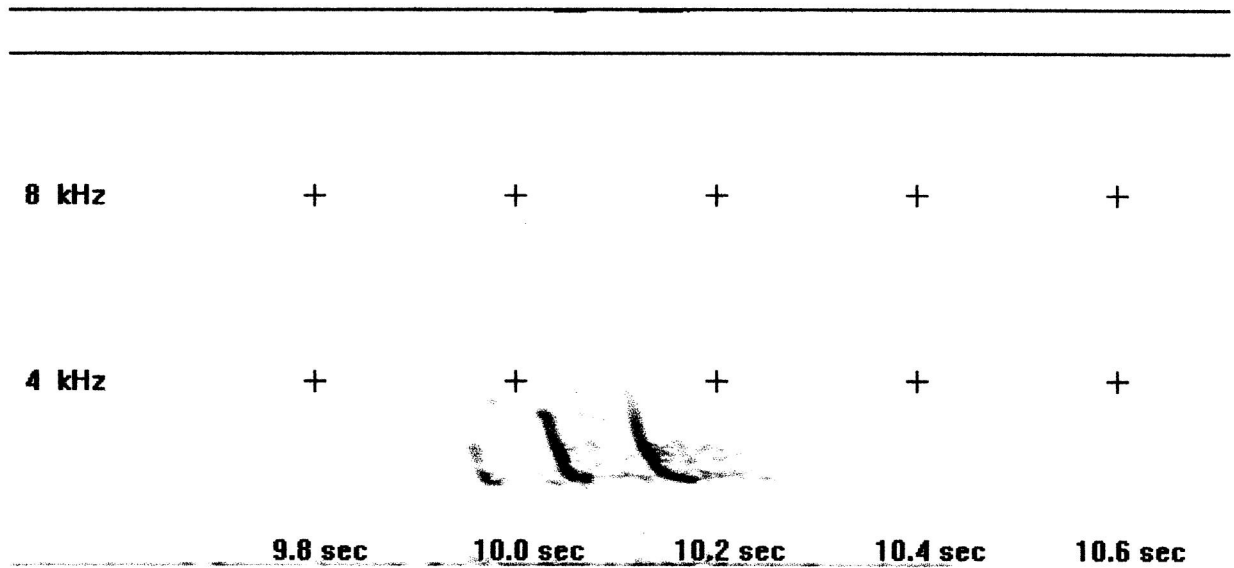
- Q Quadrat Sample
- 3 Number given to ancient tree



432050 E 432100 E 432150 E 432200 E 432250 E 432300 E 432350 E

444750 N 444700 N 444650 N 444600 N 444550 N 444500 N

Figure 6 Sonogram of echolocation calls by the FM/CF bats *Nyctalus noctula* (Noctule)



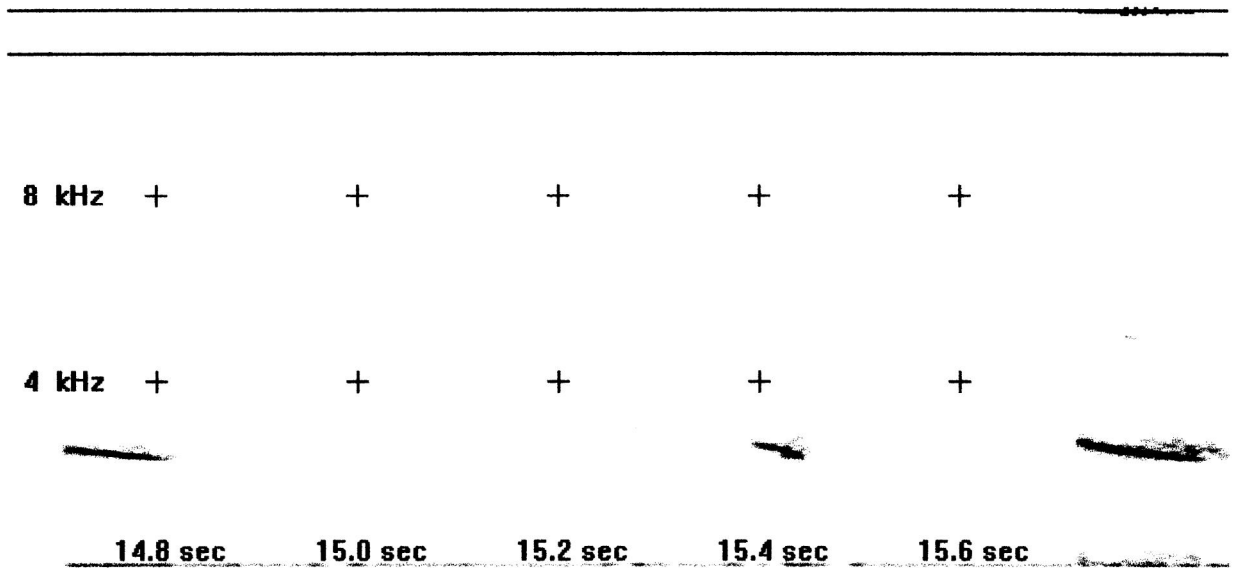
Habitat: Ash and sycamore plantation with bluebell, dog's mercury and Lords- and-Ladies in field layer (Sample 7, June 7th 2000)

1st bat call
 Duration: 3.0ms
 Start frequency: 26.9kHz
 End frequency: 17.9kHz

2nd bat call
 Duration: 5.3ms
 Start frequency: 33.4kHz
 End frequency: 18.3kHz
 Interpulse interval: 6.6ms

3rd bat call
 Duration: 7.2ms
 Start frequency: 37.3kHz
 End frequency: 18.3kHz
 Interpulse interval: 8.6ms

Figure 7 Sonogram of echolocation calls by the FM/CF bats *Nyctalus lesleri?* (Leisler's bat?)



Habitat: Edge of mixed beech and Scot's pine plantation (Sample 8, June 7th 2000)

1st bat call
 Duration: 10.6ms
 Start frequency: 25.2kHz
 End frequency: 23.0kHz

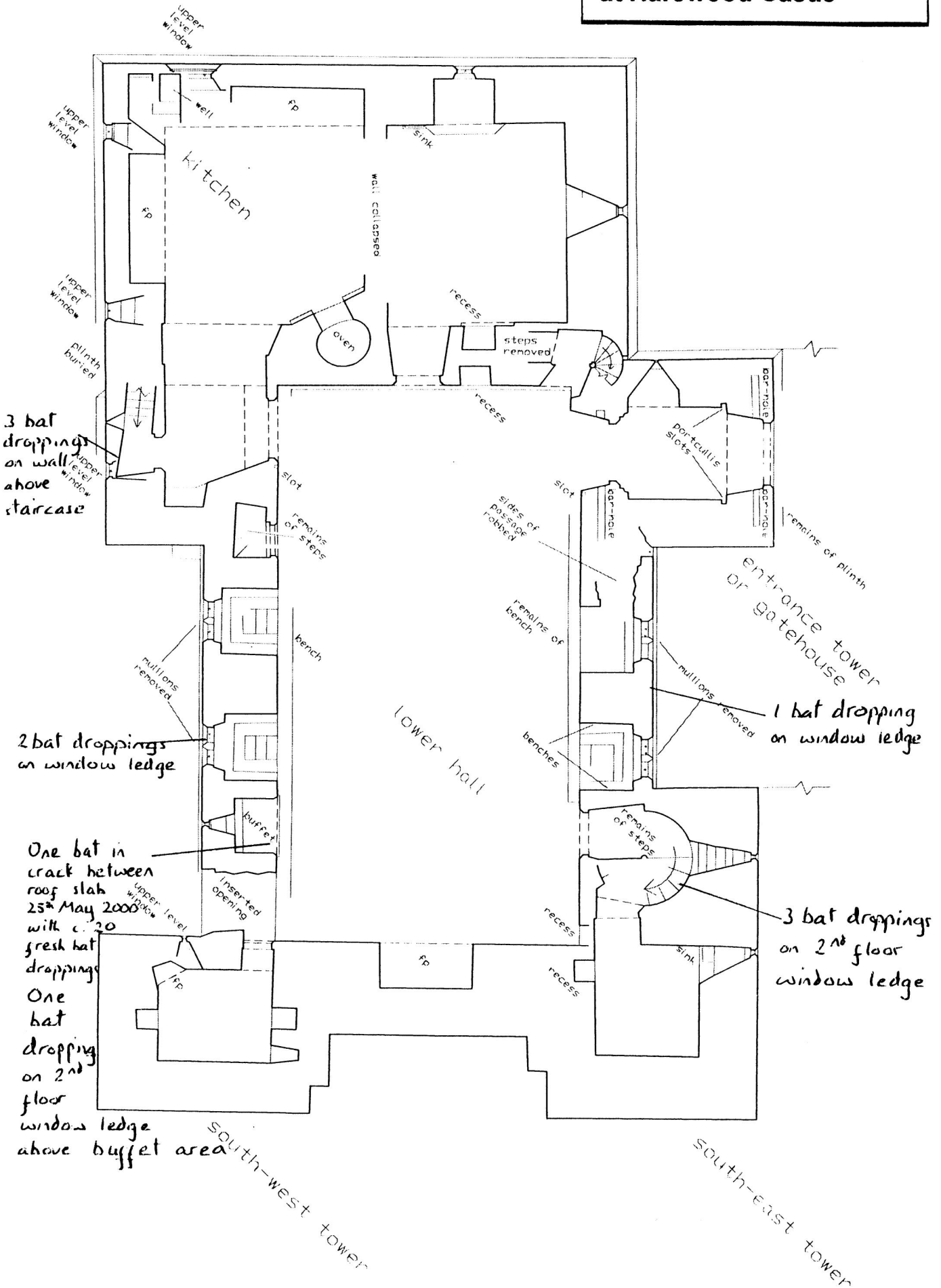
2nd bat call
 Duration: 5.0ms
 Start frequency: 26.9kHz
 End frequency: 23.5kHz
 Interpulse interval: 68.2ms

3rd bat call
 Duration: 13.2ms
 Start frequency: 26.9kHz
 End frequency: 23.0kHz
 Interpulse interval: 32.4ms

FIGURE 8

Location of bat droppings at Harewood Castle

HAREWOOD CASTLE: GROUND FLOOR PLAN (PROVISIONAL)
NOT TO SCALE 2/6/00



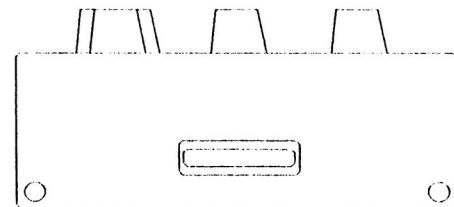
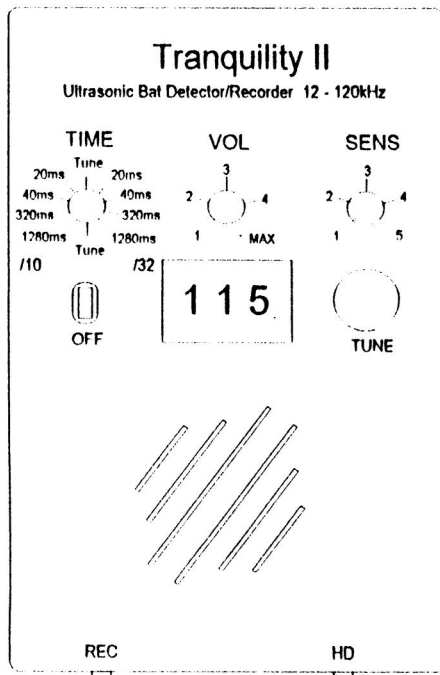
APPENDIX 1 SUMMARY OF HABITATS SIGNIFICANTLY SELECTED BY BATS – data from Walsh *et. al.* 1996

Summary of habitats significantly selected, used in proportion to availability or avoided in 19 discrete land classes. All tests of significance used 90% Bonferroni confidence intervals. The proportion of land classes in which each habitat was selected (+ P_S) or avoided (- P_A) is shown together with the number of land classes for which a test was conducted (n)

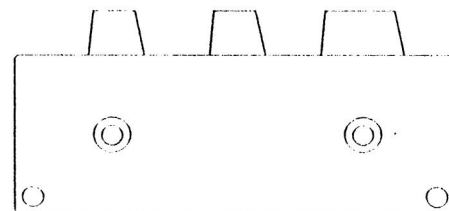
Group (i)	Group (ii)	Group (iii)	Group (iv)	Group (v)
Selected in all land classes + $P_S = 1.00$ n = 19	Selected in some land classes, never avoided + $P_S(n)$	Selected in some and avoided in other land classes + $P_S(n)$ - P_A	Avoided in some land classes, never selected - $P_A(n)$	Avoided in all land classes - $P_A = 1.00$ n = 19
Treeline	Hedgerow + 0.83 (18)	Open ditch + 0.20 (10) - 0.30	Improved grassland - 0.84 (19)	Arable
Broadleaved woodland edge	Stream + 0.84 (19)	Covered ditch + 0.07 (14) - 0.39	Semi-improved grassland - 0.84 (19)	Moorland
Lake and reservoir	Coniferous woodland edge + 0.67 (12)	Stone wall + 0.15 (13) - 0.69	Lowland unimproved grassland - 0.42 (19)	Upland unimproved grassland
	Mixed woodland edge + 0.81 (16)	Coniferous woodland opening + 0.40 (10) - 0.20		
	Broadleaved woodland opening + 0.50 (18)	Scrub + 0.05 (19) - 0.63		
	Mixed woodland opening + 0.50 (6)	Parkland + 0.13 (16) - 0.25		
	Felled woodland + 0.50 (6)	Urban land + 0.42 (19) - 0.05		
	River and canal + 0.88 (8)			
	Pond + 0.82 (11)			
Good habitats				Poor habitats

APPENDIX 2 USER GUIDE FOR THE TRANQUILITY II TIME EXPANSION BAT DETECTOR

The Tranquility II is a new second-generation bat detector/recorder. It combines a heterodyne type detector, tuneable over the range 12kHz to 120kHz, and a time expansion detector, that can record up to 1.28 seconds of bat calls. The digital display is only illuminated when a **tune** position is selected, and indicates the tuned frequency. It also indicates a bat present situation when the tens digit decimal point flashes.



Front View



Rear View

Controls on the Tranquility II

OFF: This is used to switch the detector ON or OFF. To switch the detector to ON move the indented slide switch away from the OFF position.

VOL: The control that sets the sound volume to the internal loudspeaker (or headphones if used)

TIME: Used to select the mode of operation of the detector. There are two **tune** positions and when either is selected, the detector behaves as a tuneable heterodyne receiver. On either side of the tune positions are time-expansion selections.

They are 20ms, 40ms, 320ms and 1280ms. These indicate the length of record time. If the right hand times are selected the play back is at a speed 32 times slower than the recorded speed. If the left hand times are selected the play back is at a speed 10 times slower than the recorded speed.

When playing back at 32 times slower, the played back bat calls are within human hearing range.

The 10 times slower speed is selected for computer analysis.

SENS: This is the sensitivity control, and sets up the threshold sensitivity for a bat call during time expansion working only. It can be set up as follows :- Switch the TIME switch to **tune** and turn the SENS control fully clockwise. The tens LED decimal point will be illuminated. Turn the SENS control anticlockwise until the LED just extinguishes. Of course the control must be set up without any ultrasonic source such as a bat call being

APPENDIX 3 Description of habitats within quadrats 1 - 10

NVC record sheet

Location	Grid reference	Region	Author
HAREWOOD CASTLE	SE 32154570	LEEDS	M.H.
Site and vegetation description		Date	Sample no.
<p>Even-aged plantation dominated by beech with occasional Scots pine (density 0.2 trees/10m²). The diameters of the semi-mature beech trees within the quadrat varied from 17-34 cm (c. age range 21-42 yrs old). The understorey is dense in patches and dominated by unmanaged thickets of alder. A species-poor field layer dominated by <i>Haleus lanatus</i> with frequent <i>Dryopteris dilatata</i>.</p>		24/5/00	1
		Altitude	Slope
		67 m	10-15 °
		Aspect	Soil depth
		North-west °	cm
		Stand area	Sample area
m x m	25 m x 25 m		
		Layers: mean height	
		15 m	3.5m
		50cm	20mm
		Layers: cover	
		55%	40%
		70%	16%
		Geology	
Species list		Soil profile	
<p>Canopy in 25 x 25m <i>Fagus sylvatica</i> (7) <i>Pinus sylvestris</i> (4) Understorey in 25 x 25m <i>Sambucus nigra</i> (5) <i>Fagus sylvatica</i> sapling (1) <i>Rosa</i> sp. (1)</p>		<p><i>Juncus epirurus</i> (1) <i>Cerastium fontanum</i> (1) <i>Urtica dioica</i> (3) <i>Rumex acetosella</i> (1) <i>Stellaria media</i> (1) <i>Stellaria alba</i> (1)</p>	
<p>Field layer in 10 x 10m <i>Dryopteris dilatata</i> (5) <i>Digitalis purpurea</i> (2) <i>Rubus fruticosus</i> (3) <i>Poa annua</i> (1) <i>Haleus lanatus</i> (3) <i>Galium saxatile</i> (2) <i>Quercus ? rubra ?</i> seedling (1)</p>		<p>Ground layer in 10 x 10m <i>Dicranella heteromalla</i> (1) <i>Mnium hornum</i> (1) <i>Brachythecium rutabulum</i> (4) <i>Eurhynchium praelongum</i> (4) <i>Pseudotaxiphyllum elegans</i> (1)</p>	

NVC record sheet

Location	Grid reference	Region	Author
HAREWOOD CASTLE	SE 3212 456 7	LEEDS	MH
Site and vegetation description		Date	Sample no.
The rather uneven ground is covered by a short sward of acid grassland co-dominated by <i>Agrostis capillaris</i> , <i>Holcus lanatus</i> , <i>Rumex acetosella</i> and <i>Galinium saxatile</i> . Tree stumps is scattered throughout the field indicate that it was once wooded.		27/6/2000	2
		Altitude	Slope
		69 m	10-15 °
		Aspect	Soil depth
		North-west	cm
		Stand area	Sample area
		m x m	1 m x 1 m
	Layers: mean height		
	m m	10 cm	20 mm
	Layers: cover		
	% %	100 %	1 %
	Geology		

Species list	Soil profile
<p>Field layer in 1x1m</p> <p><i>Rumex acetosella</i> (5)</p> <p><i>Galinium saxatile</i> (4)</p> <p><i>Poa pratensis</i> (4)</p> <p><i>Holcus lanatus</i> (7)</p> <p><i>Agrostis capillaris</i> (4)</p> <p><i>Aira praecox</i> (3)</p> <p>Ground layer in 1x1m</p> <p><i>Pohlia nutans</i> (1)</p> <p><i>Eurhynchium praelongum</i> (1)</p>	

NVC record sheet

Location	Grid reference	Region	Author
HAREWOOD CASTLE	SE 3211 4567	LEEDS	M.H.
Site and vegetation description		Date	Sample no.
Same as Sample No. 2		27/6/2000	2A
		Altitude	Slope
		66.5 m	10-15 °
		Aspect	Soil depth
		North-west °	cm
		Stand area	Sample area
		m x m	(m x) m
Layers: mean height			
m m 10 cm 20 mm			
Layers: cover			
% % 100 % 10 %			
Geology			
Species list		Soil profile	
Field layer in 1x1m			
Rumex acetosella (5)			
Galium saxatile (7)			
Hibiscus lanatus (7)			
Aira praecox (4)			
Agrostis capillaris (4)			
Ground layer in 1x1m			
Polytrichum juniperinum (4)			
Hypnum jutlandicum (4)			

NVC record sheet

Location

HAREWOOD CASTLE

Grid reference

SE32214562

Region

LEEDS

Author

M.H.

Site and vegetation description

The lower parts of these steep slopes are covered by semi-mature broadleaved woodland co-dominated by sycamore and ash. The diameters of the ash ranged from 15-34cm (age range c. 19-42 yrs old). The diameters of the sycamore were generally smaller - between 16-23cm (age range c. 20-29 yrs old). The quadrat included one huge sweet chestnut with a trunk diameter of 115cm (approximate age 142 yrs old). The understorey/shrub layer is very sparsely occupied by a single elder bush and sapling *Quercus robur*. The field layer is dominated by *Mesicriclis perennis* interspersed by extensive patches of leaf litter.

Date

24/5/66

Sample no.

3

Altitude

74 m

Slope

40 °

Aspect

north-west °

Soil depth

cm

Stand area

2 m x m

Sample area

25 m x 25 m

Layers: mean height

16 m 4 m 30cm 20 mm

Layers: cover

80 % 5 % 65 % 9 %

Geology

Species list

Canopy in 25x25m

Acer pseudoplatanus (7)

Fraxinus excelsior (7)

Quercus robur (1)

Castanea sativa (4)

Understorey in 10x20m

Sambucus nigra (4)

Field Layer in 10x10m

Dryopteris dilatata (4)

Mesicriclis perennis (3)

Rubus fruticosus (1)

Silene dioica (1)

Hyacinthoides non-scripta (1)

Ground Layer in 10x10m

Leaf litter (7)

bare soil (5)

Eurhynchium praelongum (3)

Hypnum jutlandicum (2)

Rhytidiadelphus squarrosus (2)

Lophocolea bidentata (2)

Soil profile

NVC record sheet

<p>Location HAREWOOD CASTLE</p>	<p>Grid reference SE 3224 4564</p>	<p>Region LEEDS</p>	<p>Author M.H.</p>
<p>Site and vegetation description Sweet chestnut dominates the north east-facing slopes adjacent to the eastern edge of the bowling green; occasional beech also occurs (density 0.3 trees per 10m²). The diameters of the sweet chestnut varied from 22-43 cm (approx. age range 27-53 yrs old). Regenerating sweet chestnut saplings together with colonising sycamore saplings provide a very sparse understorey. Equally sparse is the field layer containing occasional <i>Hyacinthoides non-scripta</i>, <i>Oxypteria dilatata</i> and <i>Digitalis purpurea</i>. Leaf litter and brash dominate the field and ground layers. 3 huge sweet chestnut stumps within the quadrat provide evidence of previous silvicultural operations. Other trees in the general vicinity include <i>Betula pedunculata</i>.</p>		<p>Date 24/5/00</p>	<p>Sample no. 4</p>
		<p>Altitude 83.9 m</p>	<p>Slope 20 °</p>
		<p>Aspect north-east 0</p>	<p>Soil depth cm</p>
		<p>Stand area m x m</p>	<p>Sample area 25 m x 25 m</p>
		<p>Layers: mean height 16m 7m 30cm 20mm</p>	
<p>Layers: cover 50% 4% 6% 8%</p>			
<p>Geology</p>			
<p>Species list</p> <p>Canopy in 25 x 25m <i>Castanea sativa</i> (7) <i>Fagus sylvatica</i> (5)</p> <p>Understorey in 25 x 25m <i>Castanea sativa</i> (2) <i>Acer pseudoplatanus</i> (2)</p> <p>Field layer in 10 x 10m <i>Oxypteria dilatata</i> (2) <i>Digitalis purpurea</i> (1) <i>Hyacinthoides non-scripta</i> (2)</p> <p>Ground layer in 10 x 10m Leaf litter and brash (10) bare soil (3) <i>Orthodontium lineare</i> (4)</p> <p><i>Pseudotsia phyllon elegans</i> (4) <i>Hypnum cupressiforme</i> (4)</p>		<p>Soil profile</p>	

NVC record sheet

<p>Location HAREWOOD CASTLE</p>	<p>Grid reference SE 3217 4554</p>	<p>Region LEEDS</p>	<p>Author M.H</p>
<p>Site and vegetation description The gentle, north-facing slopes are covered by even-aged larch plantation. Very occasional other trees include <i>Betula pubescens</i>. Density of trees is c. 0.2 trees/10m². The diameters of the larch varied between 20-37cm (approximate age range 25 - 46 yrs old). Occasional sycamore saplings and scattered elder bushes provide a sparse understorey. The field and ground layers are dominated by leaf litter and brash. Herbs within the field layer include very occasional <i>Hyacinthoides non-scripta</i>, <i>Dryopteris dilatata</i> and <i>Rubus fruticosus</i>. The presence of c. 18 tree stumps within the quadrat is indicative of previous wetland management.</p>		<p>Date 24/5/00</p>	<p>Sample no. 5</p>
		<p>Altitude 92.7 m</p>	<p>Slope north-facing °</p>
		<p>Aspect 10-15 °</p>	<p>Soil depth cm</p>
		<p>Stand area m x m</p>	<p>Sample area 25 m x 25 m</p>
		<p>Layers: mean height 16 m 5 m 40cm 20cm</p>	
		<p>Layers: cover 50% 6% 10% 15%</p>	
		<p>Geology</p>	
<p>Species list</p> <p>Canopy in 25 x 25m <i>Larix</i> sp (7) <i>Betula pubescens</i> (4)</p> <p>Understorey in 25 x 25m <i>Acer pseudocornus</i> sapling (4) " " (sucker) <i>Sambucus nigra</i> (2)</p> <p>Field layer in 10 x 10m <i>Digitalis purpurea</i> (3) <i>Rubus fruticosus</i> (1) <i>Acer pseudocornus</i> (sucker) (1) <i>Chamaenerion angustifolium</i> (1) <i>Hyacinthoides non-scripta</i> (2) <i>Dryopteris dilatata</i> (2) <i>Betula pubescens</i> (sapling) (2)</p>		<p>Soil profile</p> <p>Ground layer in 10 x 10m leaf and brash (8) exposed soil (5) <i>Dicranella heteromalla</i> (4) <i>Pseudotaxiphyllum elegans</i> (4) saplings recorded outside the quadrat include <i>Ilex aquifolium</i></p>	

NVC record sheet

Location

HAREWOOD CASTLE

Grid reference

SE 3215 4561

Region

LEEDS

Author

M.H.

Site and vegetation description

These steep slopes are occupied by a dense stand of *Ulex* ^(0.4 trees/10m²) within the stand are very occasional beech, sycamore and *Quercus robur* (all semi-mature); also within the stand is a very large sweet chestnut tree stump - indicative of previous woodland management. An understorey is largely absent apart from very occasional sycamore and beech saplings. A field layer is also virtually absent beneath the deep shade. Bare soil and leaf litter account for most of the ground layer

Date

27/6/00

Sample no.

6

Altitude

81.5 m

Slope

40 °

Aspect

north-west

Soil depth

cm

Stand area

m x m

Sample area

25 m x 25 m

Layers: mean height

9 m 5 m 10 cm 10 mm

Layers: cover

90% 4% 1% <1%

Geology

Species list

Canopy in 25 x 25 m

Taxus baccata (9)

Fagus sylvatica (4)

Acer pseudoplatanus (4)

Quercus robur (1)

Understorey in 25 x 25 m

Fagus sylvatica sapling (2)

Acer pseudoplatanus (2)

Field Layer in 10 x 10 m

Taraxacum sp (1)

Ground Layer in 10 x 10 m

Leaf litter (7)

Exposed soil (7)

Atrichum undulatum (1)

Dicranella heteromalla (1)

Soil profile

NVC record sheet

<p>Location HAREWOOD CASTLE</p>	<p>Grid reference SE 3222 4552</p>	<p>Region LEEDS</p>	<p>Author M.H</p>		
<p>Site and vegetation description Mixed plantation of larch and sweet chestnut occupy this part of the Bowling Green (density 0.1 trees/10m²). The diameters of the larch varied between 27-41cm (age range c. 33-51 yrs); the diameters of the sweet chestnut ranged from 24-42⁴⁵cm (age range c. 36-56 yrs). Sapling sycamore provide a sparse understorey. The field layer is species-poor with very occasional Hyacinthoides non-scripta and seedling sweet chestnut. The ground layer is dominated by leaf litter and brash. Two huge sweet chestnut stumps within the quadrat are indicative of previous woodland management.</p>		<p>Date 27/6/00</p>	<p>Sample no. 7</p>		
		<p>Altitude 87.1 m</p>	<p>Slope - 0</p>		
		<p>Aspect - 0</p>	<p>Soil depth cm</p>		
		<p>Stand area m x m</p>	<p>Sample area 25m x 25m</p>		
		<p>Layers: mean height 17m 7m 20cm 20mm</p>			
<p>Layers: cover 45% 11% 6% 2%</p>					
<p>Geology</p>					
<p>Species list</p> <table border="1" style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> <p>Canopy in 25 x 25m Larix sp (5) Castanea sativa (5)</p> <p>Understorey in 25 x 25m Acer pseudoplatanus (5)</p> <p>Field Layer in 10 x 10m Digitalis purpurea (3) Hyacinthoides non-scripta (1) Galium saxatile (1) Castanea sativa seedling (2)</p> <p>Ground Layer in 10 x 10m Exposed soil (3) Leaf litter & brash (10)</p> </td> <td style="width: 50%; vertical-align: top;"> <p>Molinia horneum (2) Pseudotsia phyllon elegans (2)</p> </td> </tr> </table>		<p>Canopy in 25 x 25m Larix sp (5) Castanea sativa (5)</p> <p>Understorey in 25 x 25m Acer pseudoplatanus (5)</p> <p>Field Layer in 10 x 10m Digitalis purpurea (3) Hyacinthoides non-scripta (1) Galium saxatile (1) Castanea sativa seedling (2)</p> <p>Ground Layer in 10 x 10m Exposed soil (3) Leaf litter & brash (10)</p>	<p>Molinia horneum (2) Pseudotsia phyllon elegans (2)</p>	<p>Soil profile</p>	
<p>Canopy in 25 x 25m Larix sp (5) Castanea sativa (5)</p> <p>Understorey in 25 x 25m Acer pseudoplatanus (5)</p> <p>Field Layer in 10 x 10m Digitalis purpurea (3) Hyacinthoides non-scripta (1) Galium saxatile (1) Castanea sativa seedling (2)</p> <p>Ground Layer in 10 x 10m Exposed soil (3) Leaf litter & brash (10)</p>	<p>Molinia horneum (2) Pseudotsia phyllon elegans (2)</p>				

NVC record sheet

<p>Location HAREWOOD CASTLE</p>	<p>Grid reference SE 3213 4564</p>	<p>Region LEEDS</p>	<p>Author M.H.</p>	
<p>Site and vegetation description Even-aged mixed plantation of closely spaced beech and Scots Pine (density 0.5 trees/10m²). The diameters of the beech varied between 22-38 cm (i. age range 27-47 yrs). An understorey is absent apart from a single elder bush. The field layer is dominated by grasses such as <i>Agris capillaris</i> and is generally species-poor. Frequent patches of leaf litter and brash occupy the ground layer. 28 tree stumps were recorded in the quadrat indicative of previous woodland management.</p>		<p>Date 27/6/00</p>	<p>Sample no. 8</p>	
		<p>Altitude 71.9 m</p>	<p>Slope 10 °</p>	
		<p>Aspect North-west</p>	<p>Soil depth cm</p>	
		<p>Stand area m x m</p>	<p>Sample area 50 m x 10 m</p>	
		<p>Layers: mean height 17m 2m 30cm 25mm</p>		
<p>Layers: cover 65% 1% 70% 16%</p>				
<p>Geology</p>				
<p>Species list</p> <table border="1"> <tr> <td data-bbox="81 1160 619 2101"> <p>Canopy in 50 x 10m <i>Fagus sylvatica</i> (7) <i>Pinus sylvestris</i> (5)</p> <p>Understorey in 50 x 10m <i>Sambucus nigra</i> (1)</p> <p>Field layer in 10 x 10m <i>Juncus effusus</i> (3) <i>Rubus fruticosus</i> (4) <i>Dryopteris dilatata</i> (5) <i>Agris capillaris</i> (8) <i>Rumex acetosella</i> (4) <i>Chamaeris angustifolium</i> (1) <i>Galium saxatile</i> (3) <i>Potentilla erecta</i> (1)</p> </td> <td data-bbox="619 1160 1173 2101"> <p><i>Helios helios</i> (1) <i>Aulus lanatus</i> (1)</p> <p>Ground layer in 10 x 10m Exposed soil (4) Leaf litter/brash (5) <i>Polytrichum formosum</i> (2) <i>Dicranella heteromalla</i> (4) <i>Mnium hornum</i> (4) <i>Eurhynchium proslongum</i> (4) <i>Hypnum jutlandicum</i> (3)</p> </td> </tr> </table>		<p>Canopy in 50 x 10m <i>Fagus sylvatica</i> (7) <i>Pinus sylvestris</i> (5)</p> <p>Understorey in 50 x 10m <i>Sambucus nigra</i> (1)</p> <p>Field layer in 10 x 10m <i>Juncus effusus</i> (3) <i>Rubus fruticosus</i> (4) <i>Dryopteris dilatata</i> (5) <i>Agris capillaris</i> (8) <i>Rumex acetosella</i> (4) <i>Chamaeris angustifolium</i> (1) <i>Galium saxatile</i> (3) <i>Potentilla erecta</i> (1)</p>	<p><i>Helios helios</i> (1) <i>Aulus lanatus</i> (1)</p> <p>Ground layer in 10 x 10m Exposed soil (4) Leaf litter/brash (5) <i>Polytrichum formosum</i> (2) <i>Dicranella heteromalla</i> (4) <i>Mnium hornum</i> (4) <i>Eurhynchium proslongum</i> (4) <i>Hypnum jutlandicum</i> (3)</p>	<p>Soil profile</p>
<p>Canopy in 50 x 10m <i>Fagus sylvatica</i> (7) <i>Pinus sylvestris</i> (5)</p> <p>Understorey in 50 x 10m <i>Sambucus nigra</i> (1)</p> <p>Field layer in 10 x 10m <i>Juncus effusus</i> (3) <i>Rubus fruticosus</i> (4) <i>Dryopteris dilatata</i> (5) <i>Agris capillaris</i> (8) <i>Rumex acetosella</i> (4) <i>Chamaeris angustifolium</i> (1) <i>Galium saxatile</i> (3) <i>Potentilla erecta</i> (1)</p>	<p><i>Helios helios</i> (1) <i>Aulus lanatus</i> (1)</p> <p>Ground layer in 10 x 10m Exposed soil (4) Leaf litter/brash (5) <i>Polytrichum formosum</i> (2) <i>Dicranella heteromalla</i> (4) <i>Mnium hornum</i> (4) <i>Eurhynchium proslongum</i> (4) <i>Hypnum jutlandicum</i> (3)</p>			

NVC record sheet

Location

HAREWOOD CASTLE

Grid reference

SE 32114568

Region

LEEDS

Author

M.H.

Site and vegetation description

Slightly damper ground to the east of the short sward described in quadrats 2 and 2A has allowed a mesotrophic grassland to develop

Date

27/6/00

Sample no.

9

Altitude

65.7 m

Slope

10 °

Aspect

0

Soil depth

cm

Stand area

m x m

Sample area

1 m x 1 m

Layers: mean height

m m 40 cm 30 mm

Layers: cover

% % 100 % 20 %

Geology

Species list

Field layer 1x1m

Holcus mollis (9)

Juncus effusus (2)

Galium saxatile (2)

Agrostis capillaris (4)

Dryopteris dilatata (2)

Luzula campestris (1)

Ground layer 1x1m

Hypnum cupressiforme (4)

Unidentified moss (4)

Soil profile

NVC record sheet

<p>Location HAREWOOD CASTLE</p>	<p>Grid reference SE 3212 4569</p>	<p>Region LEEDS</p>	<p>Author M.H.</p>
<p>Site and vegetation description Same as sample 9</p>		<p>Date 27/6/00</p>	<p>Sample no. 9A</p>
		<p>Altitude 64.95 m</p>	<p>Slope 0</p>
		<p>Aspect 0</p>	<p>Soil depth cm</p>
		<p>Stand area m x m</p>	<p>Sample area 1 m x 1 m</p>
		<p>Layers: mean height m m 45cm - mm</p>	
		<p>Layers: cover % % 100% - %</p>	
		<p>Geology</p>	
<p>Species list</p> <p>Field layer 1x1m</p> <p>Rubus fruticosus (4)</p> <p>Juncus effusus (4)</p> <p>Cirsium palustre (4)</p> <p>Stellaria graminea (4)</p> <p>Holcus mollis (5)</p> <p>Agrostis capillaris (3)</p> <p>Poa pratensis (3)</p> <p>Deschampsia cespitosa (5)</p>		<p>Soil profile</p>	

NVC record sheet

Location	Grid reference	Region	Author		
HAREWOOD CASTLE	SE 3219 4561	LEEDS	M.H.		
<p>Site and vegetation description</p> <p>Moving towards the old castle the mixed plantation described in Sample 7 grades to broadleaved plantation: co-dominated by ash and sweet chestnut with occasional pedunculata oak (density 0.1 trees/10m²). The understorey is dominated by sycamore, (occasional) ash and sweet chestnut saplings with occasional elder. Seedling sweet chestnut and elder are colonising the field layer together with occasional Hyacinthoides non-scripta, Urtica dioica and Dryopteris dilatata. A carpet of mosses dominate the ground layer - especially thick on the banking green banks and steps. Once again an old, huge sweet chestnut stump is located at the edge of the green.</p>		Date	Sample no.		
		27/6/00	10		
		Altitude	Slope		
		87 m	20 °		
		Aspect	Soil depth		
		north-west	cm		
Stand area	Sample area				
m x m	25 m x 25 m				
Layers: mean height		16m	8m	40cm	30mm
Layers: cover		30%	15%	15%	70%
Geology					

Species list	Soil profile
<p>Canopy in 25x25m</p> <p>Fraxinus excelsior (5)</p> <p>Castanea sativa (5)</p> <p>Quercus robur (1)</p> <p>Understorey in 25x25m</p> <p>Acer pseudoplatanus (5)</p> <p>Castanea sativa (2)</p> <p>Sambucus nigra (4)</p> <p>Fraxinus excelsior (1)</p> <p>Field Layer in 10x10m</p> <p>Hyacinthoides non-scripta (2)</p> <p>Urtica dioica (4)</p> <p>Castanea sativa (seedling) (2)</p> <p>Sambucus nigra (2)</p>	<p>Pseudotsaphyllum (5) elegans</p> <p>Sereis 'jacobae (1)</p> <p>Dryopteris dilatata (3)</p> <p>Burdock (2)</p> <p>Poa annua (2)</p> <p>Sagina procumbens (2)</p> <p>Taraxacum sp. (1)</p> <p>Oxalis acetosella (1)</p> <p>Ground Layer in 10x10m</p> <p>Exposed soil (5)</p> <p>Atrichum undulatum (5)</p> <p>Dicranella heteromalla (5)</p> <p>Anthurum hornum (5)</p> <p>Brachythecium rutabulum (5)</p>

APPENDIX 4

TIME EXPANSION CALLS OF BATS - data from Vaughan et. al. 1997

Time and frequency parameters of echolocation calls made by all British bat species except *P. austriacus*. One call per bat was analysed. Table shows mean \pm standard deviation (minimum-maximum) of parameters for the bat sample sizes given (*n* bats = number of bats; *n* locs = number of locations or roosts). S = call structure; CF = constant frequency, FM = frequency modulated. For definitions of parameters, see 'Materials and Methods'.

Bat species	S	<i>n</i> bats	<i>n</i> locs	Duration (ms)	Interpulse interval (ms)	Peak frequency (kHz)	Start frequency (kHz)	End frequency (kHz)	Centre frequency (kHz)
<i>R. ferrumequinum</i>	FM/CF/FM	21	3	49.4 \pm 13.3 (26.7-69.1)	83.0 \pm 18.9 (33.8-106)	82.3 \pm 1.05 (80.8-84.4)	69.3 \pm 3.15 (64.4-77.6)	70.3 \pm 5.25 (62.8-80.8)	82.1 \pm 1.62 (80.0-84.4)
<i>R. hipposideros</i>	FM/CF/FM	24	1	45.7 \pm 8.98 (23.9-63.9)	82.4 \pm 12.3 (54.4-118)	109 \pm 2.13 (106-113)	98.2 \pm 6.09 (85.6-108)	96.1 \pm 8.47 (84.0-110)	109 \pm 2.18 (106-112)
<i>M. brandtii</i>	FM	42	2	3.06 \pm 0.83 (1.50-5.00)	88.0 \pm 18.3 (56.9-168)	47.9 \pm 8.29 (38.0-78.4)	85.5 \pm 13.3 (59.2-123)	33.7 \pm 3.78 (26.8-41.6)	54.9 \pm 6.06 (44.8-70.4)
<i>M. mystacinus</i>	FM	25	5	2.23 \pm 0.92 (0.30-4.00)	87.8 \pm 23.8 (47.5-140)	47.5 \pm 5.91 (38.8-65.2)	80.3 \pm 12.1 (56.0-102)	32.2 \pm 3.35 (26.8-38.8)	52.4 \pm 4.79 (44.0-61.6)
<i>M. bechsteinii</i>	FM	7	2	2.54 \pm 0.53 (1.60-3.00)	96.4 \pm 13.1 (79.4-120)	51.0 \pm 3.13 (45.6-55.2)	111 \pm 22.3 (65.6-131)	33.8 \pm 3.90 (28.4-38.8)	68.8 \pm 10.1 (51.2-83.2)
<i>M. nattereri</i>	FM	67	5	2.29 \pm 1.10 (0.50-5.30)	76.8 \pm 24.8 (24.4-150)	51.2 \pm 11.3 (26.8-81.2)	98.5 \pm 19.6 (57.2-146)	22.5 \pm 5.10 (14.8-47.2)	57.7 \pm 11.9 (32.8-89.6)
<i>M. daubentonii</i>	FM	61	6	2.91 \pm 0.95 (1.30-5.80)	78.6 \pm 22.6 (44.4-171)	46.2 \pm 4.48 (30.4-54.8)	81.4 \pm 13.1 (49.2-110)	29.4 \pm 3.74 (22.4-40.4)	51.7 \pm 5.39 (35.2-64.0)
<i>B. barbastellus</i>	FM?	1	1	4.40	63.8	36.8	46.0	28.4	38.4
<i>P. auritus</i>	FM	38	5	1.48 \pm 0.60 (0.50-2.50)	71.3 \pm 25.0 (20.0-140)	43.3 \pm 9.16 (30.4-74.8)	60.5 \pm 15.9 (42.8-100)	28.5 \pm 5.41 (20.4-43.2)	41.6 \pm 10.2 (28.8-64.0)
<i>P. nathusii</i>	FM/CF	14	4	6.12 \pm 1.24 (3.00-7.70)	134 \pm 55.9 (87.5-246)	39.3 \pm 1.00 (37.2-40.8)	49.8 \pm 6.76 (40.0-66.8)	36.7 \pm 1.02 (35.2-38.4)	39.7 \pm 1.98 (38.4-44.8)
45 kHz <i>P. pipistrellus</i>	FM/CF	60	3	4.81 \pm 1.25 (2.60-7.30)	98.2 \pm 32.1 (54.4-185)	46.0 \pm 1.81 (41.6-50.8)	71.3 \pm 14.0 (53.6-119)	43.3 \pm 1.78 (38.8-48.4)	46.8 \pm 2.30 (41.6-51.2)
55 kHz <i>P. pipistrellus</i>	FM/CF	59	3	4.10 \pm 0.88 (2.20-6.60)	95.2 \pm 27.5 (58.1-198)	53.8 \pm 1.70 (49.2-57.6)	81.9 \pm 9.37 (65.2-114)	50.6 \pm 1.91 (45.2-54.4)	54.9 \pm 2.14 (51.2-60.8)
<i>N. leisleri</i>	FM/CF	36	3	8.01 \pm 2.66 (4.10-15.0)	177 \pm 71.6 (86.3-338)	28.2 \pm 3.00 (21.6-34.8)	44.0 \pm 12.6 (24.8-80.0)	25.3 \pm 2.33 (19.2-29.2)	29.8 \pm 4.07 (21.6-38.4)
<i>N. noctula</i>	FM/CF	26	3	19.6 \pm 4.38 (10.9-33.5)	336 \pm 138 (140-900)	20.3 \pm 2.01 (16.8-26.0)	25.9 \pm 7.16 (18.8-52.8)	18.2 \pm 2.12 (15.2-24.4)	20.9 \pm 2.70 (16.0-28.8)
<i>E. serotinus</i>	FM/CF	55	2	5.22 \pm 2.08 (1.60-11.7)	116 \pm 26.2 (63.8-155)	32.3 \pm 3.67 (25.6-42.4)	57.4 \pm 7.96 (39.2-78.0)	27.7 \pm 1.85 (22.4-32.0)	36.0 \pm 3.41 (28.0-44.8)

APPENDIX 5 Estimated age of ancient trees

SPECIES	LABEL ON FIGURE 4	DIAMETER (cm)	ESTIMATED AGE (to nearest interval of 5 years)
<i>Quercus robur</i>	1	85	105
<i>Castanea sativa</i>	2	140	175
<i>Castanea sativa</i>	3	95	120
<i>Quercus robur</i>	4	118	145
<i>Castanea sativa</i>	5	103	130
<i>Castanea sativa</i>	6	86	105
<i>Fraxinus excelsior</i>	7	60	75
<i>Castanea sativa</i>	8	116	145
<i>Castanea sativa</i>	9	114	140
<i>Castanea sativa</i>	10	87	110
<i>Castanea sativa</i>	11	140	175
<i>Castanea sativa</i>	12	110	135
<i>Castanea sativa</i>	13	80	100
<i>Quercus robur</i>	14	77	95
<i>Castanea sativa</i>	15	97	120
<i>Castanea sativa</i>	16	112	140
<i>Castanea sativa</i>	17	130	160
<i>Castanea sativa</i>	18	109	135
<i>Castanea sativa</i>	19	152	190

APPENDIX 3

LICHENS SURVEY AND REPORT

by Peter Goldsborough

HAREWOOD CASTLE
WEST YORKSHIRE

SURVEY AND REPORT ON THE LICHEN SPECIES

for

Ed Dennison Archaeological Services Ltd

by

Dr Peter F Gouldsbrough

21 April 2000

HAREWOOD CASTLE WEST YORKSHIRE LICHEN SURVEY**CONTENTS**

INTRODUCTION	page 2
THE SURVEY	page 4
Method	page 3
OBSERVATIONS	page 5
Species location	page 5
Species list	page 6
Appearance	page 8
ANALYSIS	page 9
Notes on the data	Page 9
Lichen distribution in Yorkshire	page 10
Species stability	page 12
Habitat and substratum	page 13
Atmospheric sulphur dioxide pollution	page 14
Air quality and weathering of the monument	page 17
Comparison with previous survey	page 17
Lichen conservation and ecology	page 20
SUMMARY AND CONCLUSIONS	page 21
Significance of the lichen flora	page 21
Species distribution	page 21
Air quality	page 21
Lichen conservation	page 22
Monument conservation	page 22
Appearance	page 23
Weathering	page 23
Management	page 23
EXECUTIVE SUMMARY	page 24
APPENDIX	page 25
Species location by elevation	page 25
REFERENCES	page 27

INTRODUCTION

Lichens are specialised plants: an association between an alga and a fungus (Smith 1973). They are slow-growing, specific to particular substrata, and are sensitive to environmental changes. They can vary in size from less than a millimetre, to many centimetres across, but they can be extremely difficult to identify. In some species positive identification can only be achieved with the aid of chemical tests (Hale 1983), or by microscopic examination, and so they are often a relatively neglected area of study in the context of historic buildings. They can, however, provide us with a great deal of information about themselves, the historic surface on which they are growing and the environmental conditions affecting the historic property (Seaward 1977).

Lichens are sensitive to atmospheric pollution, and by species mapping at any particular site it is possible obtain an insight into changing patterns of air quality (Hawksworth and Rose 1976). Lichens, despite their apparently passive existence, can play a significant role in the ecology of any particular site; furthermore, lichens because of their longevity, can be used as a tool in the dating of historic surfaces on which they are found, and far from being passive, they should therefore be considered as an active component in the conservation and management of any historic building.

The aim of this report is to record the lichen flora of Harewood Castle, to assess its significance in terms of lichen ecology, regional distribution, lichen conservation and, particularly, its significance in relation to the proposed conservation of the Castle.

This report comprises a brief description of the methodology of the survey, a list of the species recorded, together with a drawing showing their location on the monument, and illustrations of the general and particular appearance of some of the species. An assessment of the significance of the species recorded is then followed by a summary and conclusions.

THE SURVEY

The survey was carried out on 18 April 2000 with Don Smith, a member of the British Lichen Society, who identified the species found. The photographic survey was carried out on 21 April 2000.

Method

The surfaces of the walls were examined, for lichen species, from ground level. The external elevations were surveyed, along with the internal elevations of the main volume of the castle. Areas which proved inaccessible were not examined. Species examination was aided by the use of hand lenses of 10x and 15x magnification. Where identification confirmation was required chemical spot tests involving potassium hydroxide, calcium hypochlorite and paraphenylenediamine were utilised. For a discussion of this methodology see Hawksworth and Rose (1976 p.48) and Dobson (1992 p.9). Where a positive identification remained unclear, the most probable species has been given, followed by a question mark. For the sake of simplicity, rather than the full taxonomic authority for the botanical names of the lichens recorded, only the genus and species names are given in this report. For example:

Acarospora Massal. *fuscata* (Shrader) Th. Fr. is shortened to *Acarospora fuscata*.

In the following tables 1a to 1e, the species are listed in the order in which they were recorded, following the survey sequence anti-clockwise around the exterior, and clockwise around the interior:

- The north elevation;
- the west elevation;
- the south elevation;
- the east elevation;
- the internal elevations.

Many of the species occur in more than one area, and in order to aid their location and study in the future they are noted on each section of wall on which they were found. Their characteristic appearance is described in the tables against their first occurrence, and is based on Dobson (1992).

An estimation of the frequencies of the various species is also included in this report, derived from subsequent correspondence from Don Smith (pers. comm., 23 April 2000) and is incorporated into table 3.

OBSERVATIONS

Species location

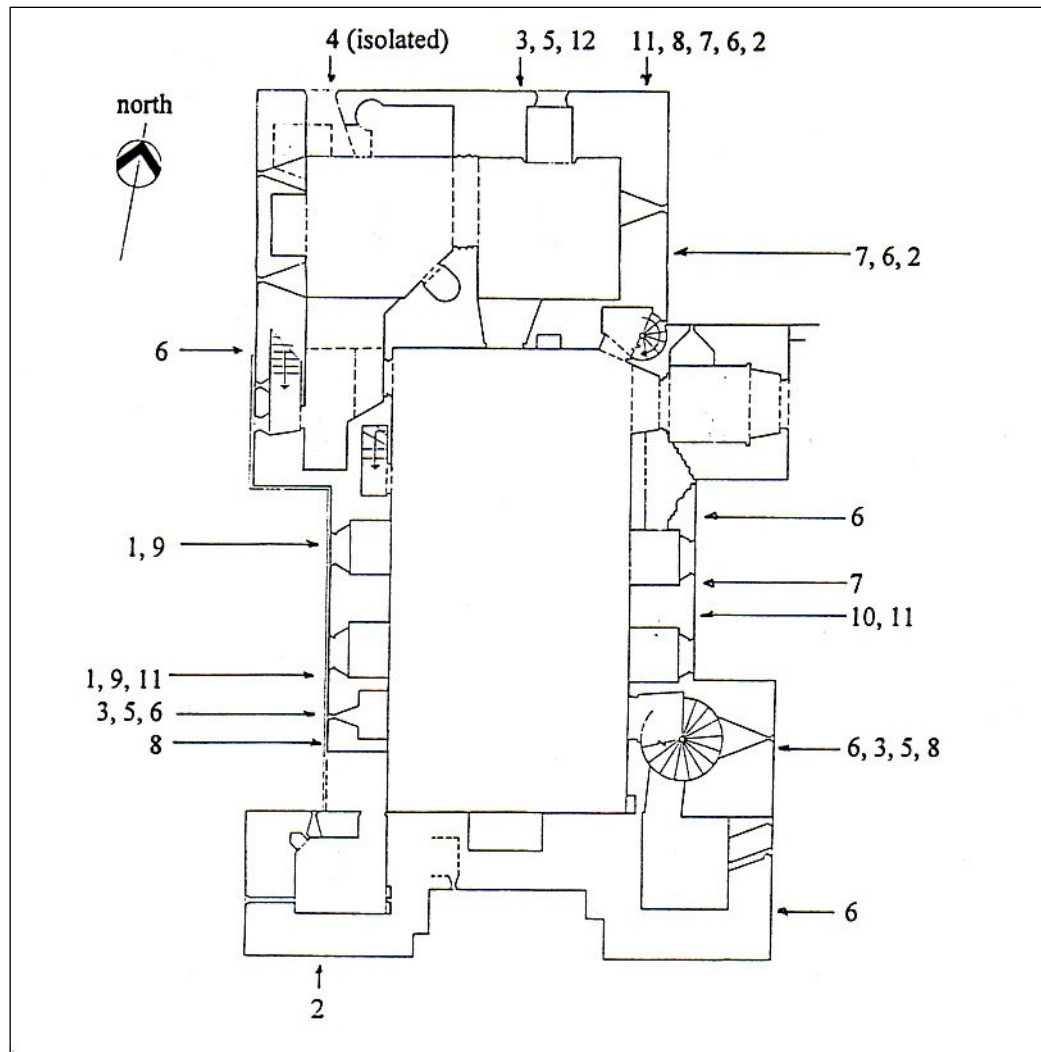


Figure 1 Harewood Castle ground floor plan: key to Tables 1a to 1e not to scale

Plan based upon a drawing by Derek Latham and Associates, January 1989, for English Heritage

Species lists

Species	Characteristic appearance (after Dobson (1992))
<i>Opegrapha calcarea</i> *	white, with elongated, black fruits, often in heaps
<i>Caloplaca citrina</i>	yellow, powdery
<i>Lepraria incana</i>	green/grey, 'fluffy' granules with no distinct margin
<i>Leproloma vouauxii</i>	green-white, puffed-up crust, with distinct margin
<i>Xanthoria calcicola</i>	deep orange, contorted lobes,
<i>Dirina massiliensis f. soreliata</i>	white to brownish-grey, with light-brown rim
<i>Lecania erysibe</i>	yellowish-grey to brown, granular, or cracked surface
<i>Lecanora albescens</i>	closely packed fawn fruits with white rim; white thallus
<i>Verrucaria nigrescens</i>	black, fissured crust

Table 1a Species recorded on the north elevation

* This species has been recently renamed, and was previously known as *Opegrapha saxatilis*. The use of the name *Opegrapha saxatilis* is now taxonomically incorrect, but it will still be found in many books, and in literature under that name.

Species	Characteristic appearance
<i>Lepraria incana</i>	
<i>Baeomyces rufus</i>	greenish-grey, granular
<i>Phlyctis argena</i>	thin, creamy-grey
<i>Verrucaria nigrescens</i>	
<i>Lecanora albescens</i>	
<i>Opegrapha saxatilis</i>	

Table 1b Species recorded on the west elevation

Species	Characteristic appearance
<i>Caloplaca citrina</i>	

Table 1c Species recorded on the south elevation

Species	Characteristic appearance
<i>Lepraria incana</i>	
<i>Dirina massiliensis f. sor</i>	
<i>Opegrapha calcarea</i>	
<i>Lecanora albescens</i>	
<i>Verrucaria nigrescens</i>	
<i>Leproloma vouauxii</i>	
<i>Verrucaria macrostoma</i>	[chestnut brown], larger fruits than <i>V. nigrescens</i>
<i>Caloplaca citrina</i>	

Table 1d Species recorded on the east elevation

Species	Characteristic appearance
<i>Opegrapha calcarea</i>	
<i>Leproloma vouauxii</i>	
<i>Lepraria incana</i>	

Table 1e Species recorded on the internal elevations

Reference	Species
1	<i>Baeomyces rufus</i>
2	<i>Caloplaca citrina</i>
3	<i>Dirina massiliensis f. sor</i>
4	<i>Lecania erysibe</i>
5	<i>Lecanora albescens</i>
6	<i>Lepraria incana</i>
7	<i>Leproloma vouauxii</i>
8	<i>Opegrapha calcarea</i>
9	<i>Phlyctis argena</i>
10	<i>Verrucaria macrostoma</i>
11	<i>Verrucaria nigrescens</i>
12	<i>Xanthoria calcicola</i>

Table 2 Consolidated species list

The reference numbers given to each species will be used in the Analysis section.

It is worth noting that wall tops of ruins often provide habitat for lichen species which may not thrive on wall-faces: such habitats can have a higher moisture content, and higher nutrient level than the remainder of the wall. It was noted during this survey that there is an abundance of lichens growing on wall-faces towards the tops of the walls, particularly visible in the north-east corner of the castle. It is recommended, therefore, that all high-level areas should be inspected and lichen species recorded when suitable, safe, access becomes available.

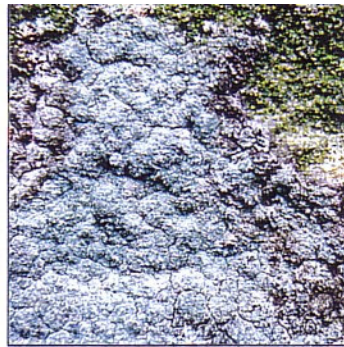
Appearance

Illustrated on the following page are some of these species.

The following illustrations show the general and detailed appearance of the most common, most conspicuous, and most infrequent species found.



a *Lepraria incana*



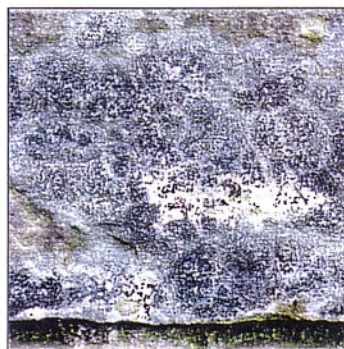
b *Lepraria incana*



c *Verrucaria nigrescens*



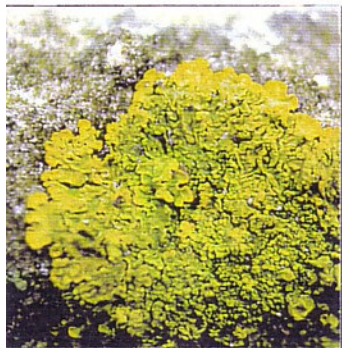
d *Opegrapha calcarea*
Dirina massiliensis



e *Opegrapha calcarea*



f *Opegrapha calcarea*
Xanthoria calcicola



g *Xanthoria calcicola*



h *Caloplaca citrina*



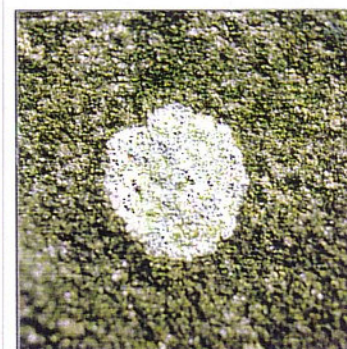
i *Leproloma vouauxii*



j *Lecanora albescens*



k *Verrucaria macrostoma*



l *Phlyctis argena*

Plates 1a to 1l

ANALYSIS

The aims of this section of the report, are to investigate the significance of the lichens of Harewood Castle in the regional context:

- by relating the species recorded to the known species distribution in Yorkshire;
- by identifying any species recorded which are known to be in decline or at risk of becoming extinct;
- by relating the species recorded to known zones of atmospheric pollution;
- by investigating the correlation between the frequency of the species recorded at Harewood Castle and their pollution tolerance.

Notes on the data

The data upon which the analysis will be carried out is contained within table 3. The data under the heading **Distribution**, is taken from Seaward (1994). The first number indicates the number of 10km x 10km grid-squares in Yorkshire in which the species has been found. The number in brackets indicates the number of 10km x 10km grid-squares from which the species has disappeared (there are 195 such grid-squares covering Yorkshire). This data has been compiled by Seaward (1994) from published and unpublished records from the mid-nineteenth century onwards. The most common species found in Yorkshire, appearing in 170 or more of the 195 10Km grid-squares, are indicated in bold on a grey background.

The frequency data in the column headed **Fr.** was provided by Don Smith (pers. comm. 23 April 2000), and indicates the estimated frequency of occurrence of the various species on Harewood Castle. The numbers have the following meaning:

4	abundant/dominant
3	frequent
2	occasional
1	rare – one, or two isolated individuals

The column headed **Habitat** indicates the normal habitat in which the species is found (Dobson 1992). The abbreviations have the following meaning:

- A on acidic substrates (pH < 7)
 B on basic substrates (pH > 7)
 B+ on substrates tending towards basic
 Ca on calcareous rocks
 N on nutrient-enriched substrates
 Si on siliceous rocks
 T on trees

The substratum on which the species were found appears in the column headed **Substr.**, where this differs from its normal **habitat**.

Ref.	Distribution	Fr.	Substr.	Habitat	zone	Species
1	86 (12)	2		Si	4	<i>Baeomyces rufus</i>
2	191 (1)	3		Ca	2	<i>Caloplaca citrina</i>
3	37 (0)	2	Si	Ca	?	<i>Dirina massiliensis f sor</i>
4	130 (2)	1	Si	Ca+N	3	<i>Lecania erysibe</i>
5	141 (11)	2	Si	Ca	5	<i>Lecanora albescens</i>
6	193 (0)	4		Si	2	<i>Lepraria incana</i>
7	35 (0)	3	Si	Si, Ca	?	<i>Leproloma vouauxii</i>
8	58 (8)	4	Si	Ca	?	<i>Opegrapha calcarea</i>
9	79 (1)	2	Si	T+N, B+	5	<i>Phlyctis argena</i>
10	4 (5)	1	Si	Ca	3	<i>Verrucaria macrostoma</i>
11	165 (0)	3			3	<i>Verrucaria nigrescens</i>
12	110 (2)	1	Si	Ca+N	4	<i>Xanthoria calcicola</i>

Table 3 Data

Lichen distribution in Yorkshire

Figure 2 indicates the relationship between the numbers of species recorded in this survey, and their wider distribution across Yorkshire. For the purposes of the mapping of lichen distribution, Yorkshire is divided into 195 10km x 10km grid-squares, but in figure 1 intervals of twenty grid-squares are considered. The numbers of species recorded on Harewood castle are then related to their wider distribution. For example: two of the species identified have been found in more than 180 grid-squares in Yorkshire, whereas one of the species has been found in less than twenty grid-squares in Yorkshire.

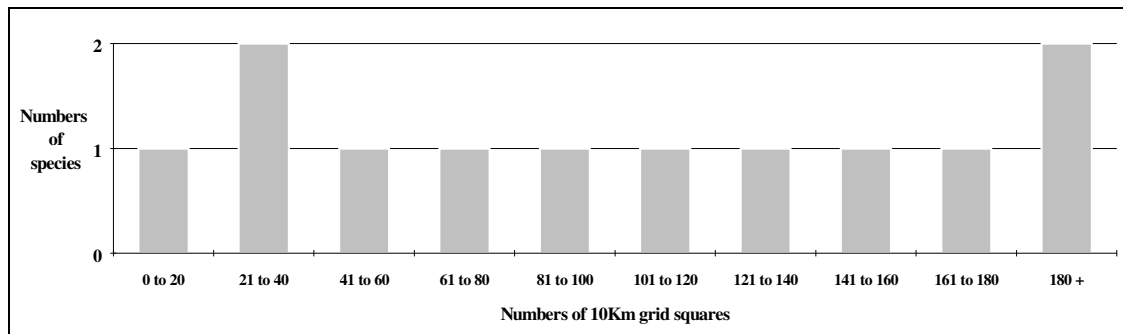


Figure 2 Frequency of species per 10km x 10km grid square, in Yorkshire

Figure 3 relates the species, indicated by their reference number, to their distribution in Yorkshire. The vertical scale of the chart relates directly to the species frequency in Yorkshire. In order to obtain the best ‘visual’ relationship between the two sets of data, the numerical values of the ‘frequency’ of the Harewood Castle species has been multiplied by a factor of forty-five.

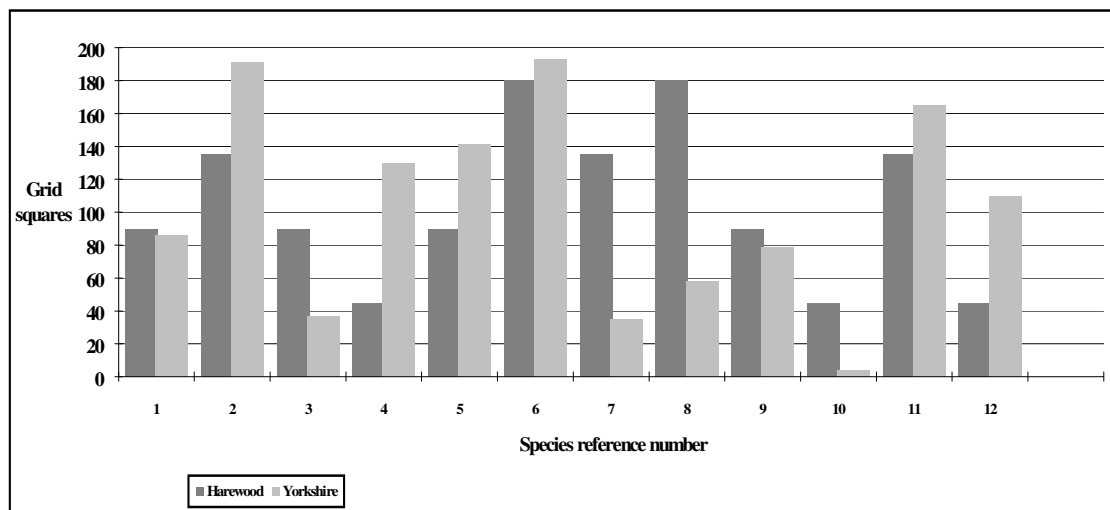


Figure 3 Frequency of the lichens recorded, and their frequency in Yorkshire

It can be seen that the best correlation between the frequency of the species recorded in this survey and their wider distribution in Yorkshire is for species reference 1 (*Baeomyces rufus*), 6 (*Lepraria incana*), and 9 (*Phlyctis argena*). Species 7 (*Lepruloma vouauxii*) and 8 (*Opegrapha saxitalis*) are far more frequent at Harewood Castle than would be expected, while species 2 (*Caloplaca citrina*), 4 (*Lecania erysibe*), 5 (*albescens*) and 12 (*Xanthoria calcicola*) are significantly under-

represented. Species 10 (*Verrucaria macrostoma*), rare in Yorkshire, has a greater frequency than would be expected.

Species stability

Figure 4 shows the species recorded, and their stability or decline in the wider geographical area of Yorkshire. It is a graphical representation of the data contained in column two **Distribution** of table 3. If a species is in decline it will have disappeared from more grid-squares than stable species. However, what is important is the relationship between the number of grid-squares from which a species has disappeared, to the number of grid-squares in which it can still be found. For example: *Ramalina fraxinea* (not found in this survey) has disappeared from thirty grid-squares, and is now only found in five (Seaward 1994 p.111). It could therefore be considered to be in danger of becoming extinct. By comparison, *Lepraria incana* (recorded in this survey) is found in 193 grid-squares, and has disappeared from none. It can therefore be considered as being both common, and stable in this region.

Of the species recorded at Harewood Castle, the three recorded in the fewest 10km x 10km grid-squares in Yorkshire are species **Ref.** 3, 7 and 10: *Dirina massiliensis*, *Leproloma vouauxii* and *Verrucaria macrostoma* respectively. Of those three species, only *Verrucaria macrostoma* has been noted to have disappeared from grid-squares; it has been recorded in four, and has disappeared from five. Only a few individuals were recorded in this survey: in one location on the east elevation.

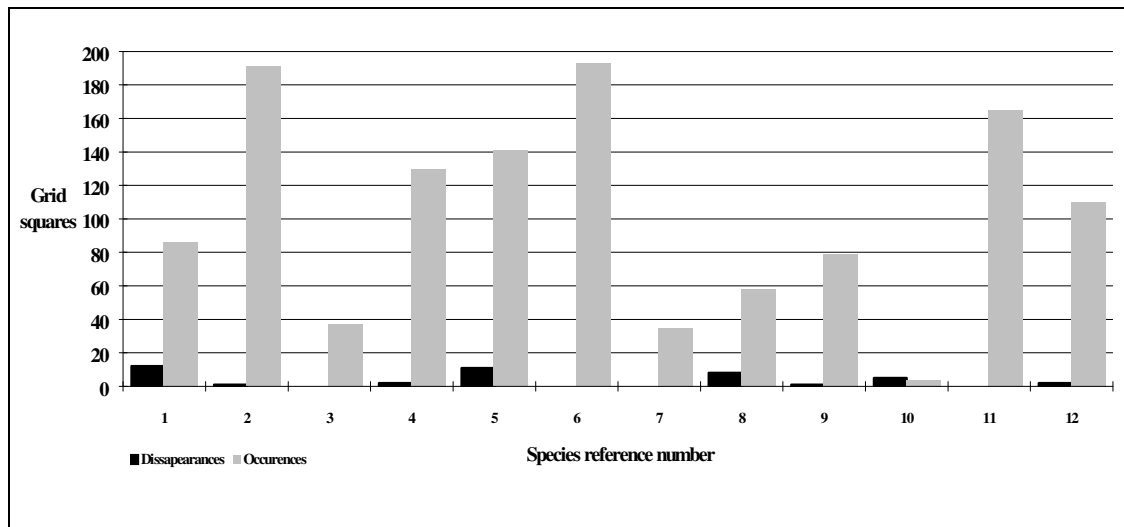


Figure 4 Species distribution and species decline

Figure 5 shows the number of species recorded in relation to the number of grid-squares in Yorkshire from which they have disappeared. It can be seen that four of the species recorded have not disappeared from any grid-squares, but two of those species, 3 (*Dirina massiliensis*), and 8 (*Opegrapha calcarea*) are relatively scarce in Yorkshire. What is significant for this study is that *Opegrapha calcarea* is one of the two dominant species at Harewood Castle. *Verrucaria macrostoma* (reference 10), on the other hand, is both scarce regionally, and could be considered to be in decline.

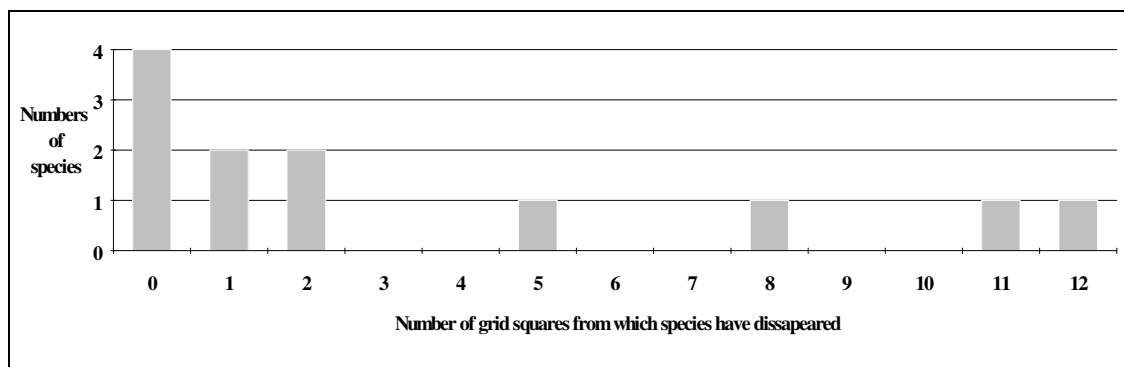


Figure 5 Species stability

Habitat and substratum

The stone from which Harewood Castle is built is Millstone Grit. Gritstones tend to have a lower surface pH than limestones. Lichens are known to be sensitive to substratum pH levels, some preferring alkali surfaces, and others preferring, or tolerating, a more acidic environment. Lichens will grow on a variety of substrata, including trees, shrubs, mosses, soil, and, rocks and stone. Of the species which normally colonise stone, some will thrive on sandstone, and others on limestone. This

is so, provided that other critical factors, such as air quality and illumination levels are at an optimum for the species concerned.

It is worth noting, therefore, based on the data in Dobson (1992), that of the twelve species recorded in this survey, over half of them are normally associated with calcareous substrata; they normally occur on limestone. Only two, *Baeomyces rufus* and *Lepraria incana*, are normally associated with acidic substrata. A further two, *Lecanora albescens* and *Leproloma vouauxii* will live on acid, or alkali substrata. In the absence of pH levels measured for the stone of Harewood Castle, one possible explanation is that the natural acidity of the stone has been neutralised by run-off from the lime mortar used to bed and joint the stone. Lime mortar 'cures' to calcium carbonate which binds the aggregate, usually sand. Calcium carbonate is relatively soluble in water (Drever 1994), and, in solution, can be absorbed into the pore-spaces of the sandstone. A brief summary of the chemistry involved in this process is described later under the heading 'Air quality and weathering of the monument'.

The result is that Harewood Castle provides habitat for species of lichens which would not be expected to occur on naturally occurring rock and stone in this region.

Atmospheric sulphur dioxide pollution

The species of lichen which thrive in any particular location is influenced, partly by levels of atmospheric sulphur dioxide, and other pollutants such as particulates, ozone and nitrogen compounds, fluorides and aromatic hydrocarbons (Richardson 1992). Some species of lichens are tolerant of such pollutants, and others are not. Hawksworth and Rose (1976), based upon earlier work by Gilbert (1968), have established the link between lichens and atmospheric sulphur dioxide pollution, and have identified the degree of tolerance of 'indicator' species. A series of pollution zones for Britain has been established based on their findings. The levels of sulphur dioxide which the Hawksworth and Rose pollution zones represent are set out below:

Pollution zone	Mean winter sulphur dioxide level
1	>170 $\mu\text{g}/\text{m}^3$ SO ₂
2	about 150 $\mu\text{g}/\text{m}^3$
3	about 125 $\mu\text{g}/\text{m}^3$
4	about 70 $\mu\text{g}/\text{m}^3$
5	about 60 $\mu\text{g}/\text{m}^3$
6	about 50 $\mu\text{g}/\text{m}^3$
7	about 40 $\mu\text{g}/\text{m}^3$
8	about 35 $\mu\text{g}/\text{m}^3$
9	< 30 $\mu\text{g}/\text{m}^3$
10	pure

(Hawksworth and Rose 1976, pp. 30-31)

Several authorities on the subject have pointed out that as pollution levels rise the pollution-tolerant species tend to colonise substrata previously populated by pollution-sensitive species. Also, the pollution-sensitive species may colonise substrata with a higher buffering capacity than their normal habitat: species which normally live on tree bark or acid rocks tend to colonise more basic substrata, or may colonise substrata previously uncolonised. A typical example is the colonisation of concrete and asbestos-cement, surfaces with high pH, by *Lecanora muralis*. Now, it is often not only ubiquitous in some urban areas, but frequently represent a single-species colonisation due to the lack of competition in polluted environments (Richardson 1992; Brightman 1977; Hawksworth and Rose 1976).

Although most pollution monitoring in the past has been carried out by recording lichens on trees, rather than on rocks or man-made structures, the importance of understanding the changing habitat preferences of certain species, particularly the change from acid to alkali substrata is well recognised (Hawksworth and Rose 1976; Richardson 1992).

In figure 6 the numbers of species recorded in this survey are shown in relation to the pollution zones, established by Hawksworth and Rose, with which they are normally associated. Harewood lies within zones 0-2, based on the Hawksworth and Rose zone map prepared in 1976.

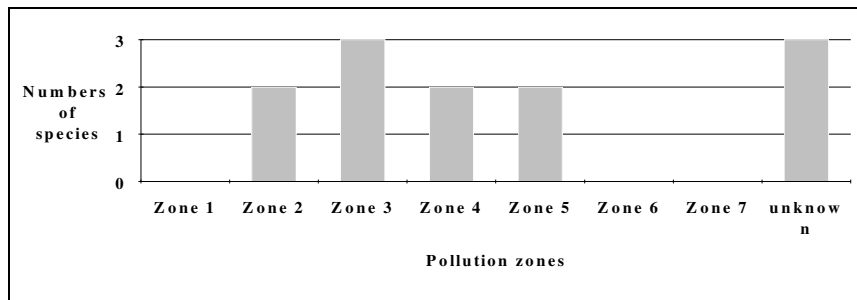


Figure 6 Number of species per pollution zone

There is no pollution zone data available for three of the species recorded, and it may be statistically unjustified to draw any inferences from pollution zoning indicated from the remaining nine species. But a fall in air pollution levels might be expected since 1976 and this would be indicated by a zone shift from 2, to 3, or 4. The significance of this for the stone of Harewood Castle is that a declining level of atmospheric sulphur dioxide could result in a reduced risk of damage by soluble sulphates.

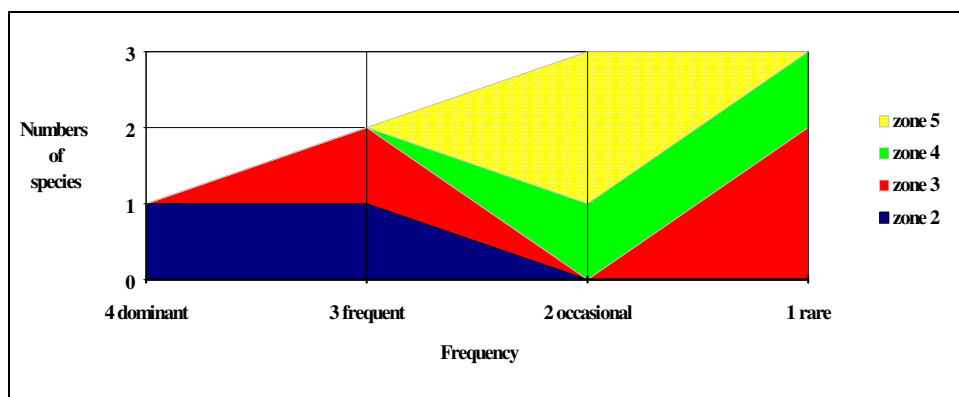


Figure 7 Species/frequency and pollution zones

It can also be seen from figure 7 that the frequent/dominant species recorded in this survey are associated with pollution zones 2 and 3, with the occasional/rare species associated with zones 4 and 5. Those species which were recorded as isolated individuals are associated with zone 5. In other words, the most frequently occurring species are those most tolerant of higher levels of atmospheric sulphur dioxide, and the rarest ones are the least tolerant.

Air quality and weathering of the monument

Harewood castle is built of locally occurring, porous, Millstone Grit. It has been shown that this type of stone is particularly susceptible to attack by soluble salts (Price 1994). Soluble salts can originate from the ground, from the stone itself, or, most commonly, indirectly from the atmosphere from chemical reactions involving sulphur dioxide.

Sulphur dioxide, either wind-blown, or in the form of acid rain, can react with calcium carbonate, in this case in the mortar joints, to form gypsum. Calcium sulphate is more soluble in water than calcium carbonate, and can migrate into the pore structure of sandstone where the expansive forces exerted as it crystallises can exceed the tensile strength of the stone (Price 1994). Examples of such damage to sandstone can often be seen where rainwater run-off from limestone onto sandstone below occurs. Paradoxically, this is also the process, touched on earlier, which can alter the pH of the stone and provide a less acidic substrata, which has, in this case, enabled *Opegrapha saxitalis*, one of the two dominant species at this site, to flourish.

In any event, lichen species which are tolerant to sulphur dioxide pollution may, in fact, be giving a measure of protection to the monument by helping to maintain a relatively constant moisture content in the stone, preventing soluble salts from crystallising; however, it has yet to be proved whether lichens have a significant influence on the moisture content and moisture movement in, and out of, stones on which they grow (Gouldsborough 2000).

Comparison with previous survey

A lichen survey of the Harewood Estate was carried out in 1976 (Henderson and Seaward, 1976) in which lichens on and around the castle were mentioned. This was not, however, a lichen survey of the castle, but more an extension of previous investigations (Seaward 1975) into the lichen flora of the West Yorkshire conurbation related to increasing urbanisation, and changes in air quality.

The survey noted sixteen species on stones and rubble in a ditch to the north of the castle, and on stones nearby, but only four species were noted as growing on the castle itself (Henderson and Seaward, 1976, p.63). These species are listed in table 4 below.

Distribution	Habitat	zone	Species on rubble in ditch & nearby
86 (12)	Si	4	<i>Baeomyces rufus</i>
0 (1) to 97 (3) ¹		?	<i>Bacidea</i> spp.
191 (1)	Ca	2	<i>Caloplaca citrina</i>
195 (0)		?	<i>Lecanora conizaeoides</i>
192 (0)	Ca	1	<i>Lecanora dispersa</i>
175 (4)	B+N	2	<i>Lecanora muralis</i>
169 (2)	Si	5	<i>Lecanora polytropa</i>
9 (3)		?	<i>Lecidea erratica</i> ²
?		?	<i>Lecidea semipallens</i> ³
169 (0)	Si+A	4	<i>Lecidea tumida</i> ⁴
156 (0)	Si	5	<i>Lecidella scabra</i>
32 (0)		?	<i>Micarea denigrata</i>
?		?	<i>Micarea violacea</i> ⁵
125 (0)		?	<i>Rhizocarpon obscuratum</i> var. <i>reductum</i>
139 (7)		4	<i>Trapelia coarctata</i>
163 (3)	Ca	3	<i>Verrucaria muralis</i>
			Species on the castle walls
		2?	<i>Cladonia conistea</i>
58 (8)		?	<i>Opegrapha confluens</i> ⁶
110 (2)	Ca+N	?	<i>Xanthoria aureola</i> ⁷
182 (3)		4	<i>Xanthoria parietina</i>

Table 4

1. Generally rather rare; sixteen of the twenty-two species listed by Seaward have been found in no more than ten grid-squares (Seaward 1994).
2. now renamed *Micarea erratica* (Smith 2000b)
3. not in 1980 nor 1993 checklist (Smith 2000b), nor in Seaward's *Checklist of Yorkshire Lichens* (Seaward 1994)
4. now renamed *Porpidea tuberculosa* (Smith 2000b)
5. not in 1980 nor 1993 checklist (Smith 2000b), nor in Seaward's *Checklist of Yorkshire Lichens* (Seaward 1994)
6. now renamed *Opegrapha calcarea* (Smith 2000b)
7. now renamed *Xanthoria calcicola* (Smith 2000b)

Of the above species, taking into account changes in taxonomy, only three were recorded in this survey: *Baeomyces rufus*, *Caloplaca citrina* and *Verrucaria nigrescens*. In addition, from the species list in Henderson and Seaward (pp.67-70), it can be calculated that 33% of the species recorded on the castle on 19 April 2000 were not recorded anywhere on the estate in 1976. Furthermore, Henderson and Seaward note that *Opegrapha* species had not, up until 1976, been recorded in this area this

century (Seaward, 1975, p.195); *Opegrapha calcarea*, normally associated with basic substrates is, on this acid sandstone monument, one of the two dominant species recorded in April 2000.

Clearly, there are changes in the composition of the lichen communities at Harewood, but with so few species noted on the castle walls in 1976, and incomplete data with which to work, a direct comparison with the 2000 survey would be speculative rather than analytical. The species recorded on stones and rubble in the drainage ditch, although only 100 meters or so from the castle, is a completely different habitat from the castle walls, and cannot be considered to be part of the lichen flora of the castle. What is significant, however, is the number of species recorded in the April 2000 survey, but not recorded anywhere on the estate twenty-four years ago.

It is interesting that Henderson and Seaward noted that the Estate has long been influenced by air pollution originating from the industry of Leeds, to the south. Winter Mean daily sulphur dioxide levels had fallen from 450 to 200 micrograms per cubic meter during the period from 1962 to 1972 (Henderson and Seaward, 1976, pp.65-66). This, on the Hawksworth and Rose scale, still indicates pollution levels in zone 1 ($>170 \mu\text{g}/\text{m}^3$). They conclude, from their survey data, that the dominant lichens which were found on trees and timber structure were representative of zones 2 and 3 on the Hawksworth and Rose scale, while those on rocks, stones and walls suggest a significantly lower level of pollution (Henderson and Seaward, 1976, p.67). They further suggest that lichen species on trees are indicators of past levels of air pollution, but lichen species which have a preference for rocks, stones and walls, with their superior powers of recolonisation, are indicative of more recent levels. Of the species noted in April 2000, the frequent/dominant species are associated with pollution zones 2 and 3, and the occasional/rare species associated with zones 4 and 5 (Figure 7). This does not suggest the reduction in air pollution which might have been expected over the past twenty-four years. But, the loss of some species, and the appearance of new, suggests dynamic environmental factors which have affected the species composition. These factors may be climatic, or micro-climatic influenced by tree cover, or vehicle emissions. The changes may also be due to a natural succession of species, but these are considerations beyond the scope of this report.

Lichen conservation and ecology

Oliver Gilbert, in Seaward (1977), stated the aims of the British Lichen Society in 1972, when they reported to the Nature Conservancy Council (now English Nature), on why research and conservation of lichens was important. The main points were:

1. Lichens cannot at present be permanently cultured, grown in botanic gardens, stored in seed banks, or be artificially maintained for long periods. The only way of ensuring their survival is under natural conditions, in the field.
2. Lichen conservation in Britain is of international importance due to the diversity of species; the strong Atlantic element, of which only fragments survive in industrialised north-west Europe is well represented in Britain.
3. Lichen-rich sites generally show a high correlation with areas of general ecological interest, not necessarily rich in other forms of plant life.
4. No organism lives alone; there is a 'tangled web' of inter-relationships, and lichens form part of that 'tangled web'.

Although there has been increasing recognition of the ecological value of historic sites and buildings since the beginning of this decade, the above four points are still valid, particularly in relation to the lichen flora on historic buildings. It is well recognised that often, the stonework of buildings provides habitat for lichen species which may be extinct in the surrounding countryside (Gilbert, in Seaward 1977 p.422).

During the course of the survey, difficulty was encountered with the identification of several of the species found. Two of the characteristics of lichens which are used in their identification are: the size, form, distribution and colour of the fruits and the form of the perimeter margin. Both of these areas of the lichen seem to be particularly appetising to molluscs, and the absence of these features make identification, except by chemical means, almost impossible. Such grazing of the lichen flora confirms the place of some of the species in the food chain, and reinforces the points made by Oliver Gilbert.

SUMMARY AND CONCLUSIONS

Significance of the lichen flora

Seaward (1994) made the point that there had been many recent publications on British lichen flora, but mostly comprising ecological and distribution studies relating to atmospheric pollution in urban areas, including ongoing studies in the West Yorkshire conurbation. Seaward goes on to highlight the fact that non-urban habitats in Yorkshire have been covered in far less detail, and that ecological studies of the diverse habitats [including historic properties] afforded by Britain's largest county are few and far between (Seaward 1994 p.89). The use of the database *Recorder* by English Heritage, along with botanical and biological surveys of historic properties which have provided raw data, has begun to rectify the deficiency highlighted by Seaward.

The data generated by this survey will contribute to existing knowledge of lichen distribution and ecology, particularly on historic properties in Yorkshire, and has provided important information about the following:

Species distribution

It has been possible to relate the species list for Harewood to the regional distribution of lichens across Yorkshire. It has been demonstrated in this report that far from being lichen deserts, historic properties, such as Harewood Castle provide an unique habitat for some lichen species which are unlikely to be encountered in the natural environment of this part of the county.

Air quality

The work of Hawksworth and Rose in 1976 is now almost twenty-four years old, but it established a relationship between lichen flora and levels of atmospheric pollution which has been referred to by more recent authors (Richardson 1992; Dobson 1992). This work is still being consolidated and its scope extended by researchers such as Seaward, at the institute of Terrestrial Ecology at Bradford University.

In many urban areas regular environmental monitoring for atmospheric pollutants is carried out by the Environmental Health Department of the Local Authority. In Leeds,

for example, regular monitoring of sulphur dioxide levels has been carried out since 1993 (Anon 2000). Due to the method of air sampling, the figures currently available for Leeds are not readily comparable with the figures of mean winter sulphur dioxide level on the Hawksworth and Rose scale. It has not been possible, therefore, in this report to determine whether the lichen flora on Harewood Castle are an accurate predictor of the present broad level of atmospheric sulphur dioxide.

Lichen conservation

This survey has revealed that although Harewood Castle supports only a modest lichen flora, it provides important habitat for species which are relatively scarce in Yorkshire, and also, species which may not occur on natural stone outcrops of the same type of stone in the surrounding countryside. Despite the modest number of species recorded, it may well be that, in the future, with the clearance of trees in the immediate vicinity of the castle and the consequent increase of illumination levels, more species may flourish.

Monument conservation

Appearance

The appearance of buildings can be seriously affected by biological growths, including lichens. *Candelariella aurella* and *Lecanora dispersa* have been identified as being responsible for the discoloration of light-coloured buildings, both new and freshly cleaned, in urban areas (Brightman and Seaward 1977, in Seaward 1977). On the other hand, it could be argued that lichen cover, along with other forms of plant life on Ancient Monuments, particularly ruins, enhances the monument and gives an added sense of age, and of time passing (Piper 1948; Macaulay 1977). Under these circumstances, it can be argued that the value of lichens exceeds any intrinsic value from a botanical, ecological or nature conservation point of view, and 'adds' value to the historic monument, and their presence should be positively encouraged.

Harewood Castle supports a modest number of lichen species, but the appearance of some areas of the monument is due to its lichen cover; however, a balance has to be struck between maintaining the appearance due to lichen cover and conservation of

the monument, particularly where there is evidence of damage to masonry by lichens. No such evidence could be found during this survey.

The ivy at the north-west corner deserves mention. It is a significant visual feature of this castle, and an increasingly rare feature of Ancient Monuments, despite the potential ecological value of mature stands. The opportunity should be made, when access is available, for a thorough examination of the ivy growth to be made, including recording, and understanding the effects which it may be having on the masonry. This is a rare opportunity to examine in detail something which, in the recent past, has been so frequently considered to be of no value.

Weathering

Lichens have often been implicated in the weathering processes of stone by causing physical damage at their points of attachment, and by chemical damage due to their acid secretions (Sykes and Iskander 1973). But, by comparison, rather than acting on a near-geological time-scale, atmospheric pollution has been shown to induce weathering of some types of stone, on a human time-scale.

This report has highlighted the relationship between lichen flora and air quality, but it has not been possible to identify any particular pollution-synthesised weathering agent at the Harewood Castle site. One possibility has been highlighted, but the question “Do lichens protect the monument, or do they accelerate its decay?” remains unanswered, for the time being at least.

Management

The aim of this report was to record the lichen flora of Harewood Castle and to assess its significance. It is hoped that it has demonstrated the ways in which the lichen flora is of significance in relation to management and conservation of historic properties as well as of intrinsic value from an environmental and ecological perspective. The objective must now be to persuade those responsible for the management of the monument that its lichen flora is a valuable resource from the several points of view discussed. It should be managed in a positive manner by being taken into consideration at all stages of conservation of the monument; it too warrants a

conservation policy. The individual stones of the monument can be replaced when they are no longer able to fulfil their intended function. The lichen flora, however, is irreplaceable!

EXECUTIVE SUMMARY

The following key points should be borne in mind in the preparation of a conservation plan for Harewood Castle, and its subsequent execution:

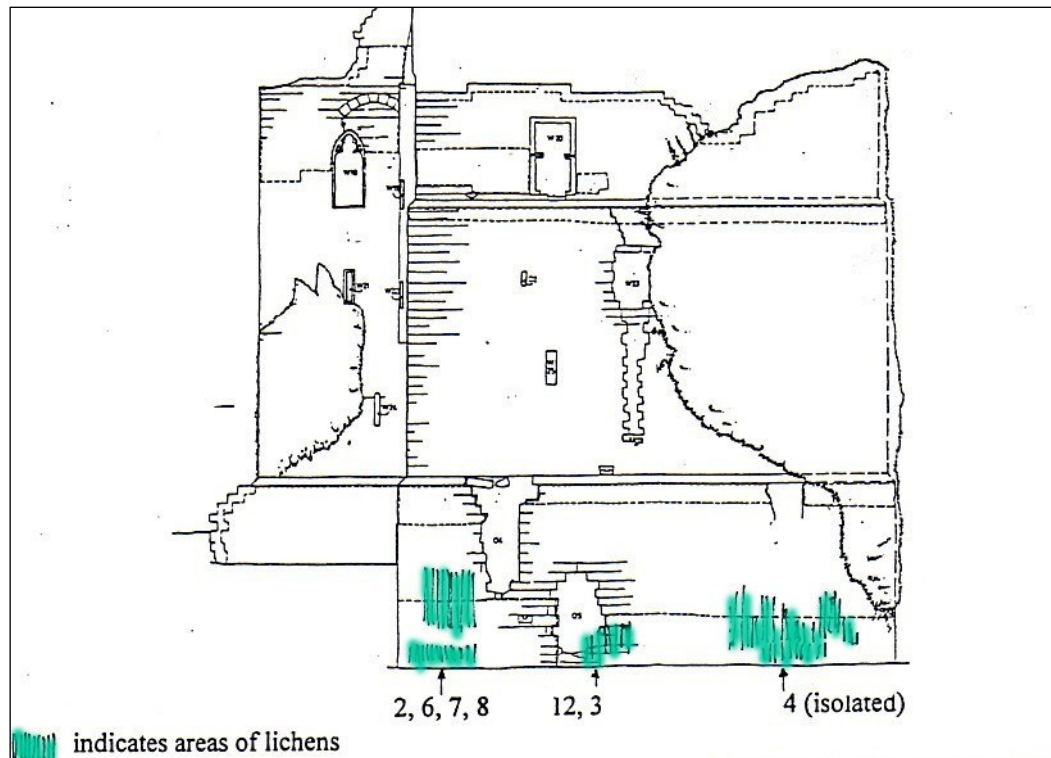
- Care should be taken during conservation, and consolidation work to preserve the existing lichen flora, and any other ecologically significant flora found on the walls;
- steps should be taken to preserve the lichen habitat:
 - by the use of lime mortar for any stonework pointing, in order to preserve the pH of the lichen substratum;
 - by designing conservation and consolidation work to avoid, where possible, changes in the patterns of rainwater run-off from the stonework, so as to maintain its current pattern of moisture content and moisture movement;
- when safe access is available, this survey should be extended to the upper levels of the walls - the lichen flora of the wall-tops may be significantly different to that recorded in this survey;
- the lichen, and other flora present should be re-surveyed on a regular basis, say every ten to fifteen years, in order to facilitate the environmental monitoring of this site;
- a full investigation of the ivy cover should be made, including the recording of any physical and chemical effects on the masonry.

Peter F Gouldsbrough
27 June 2000

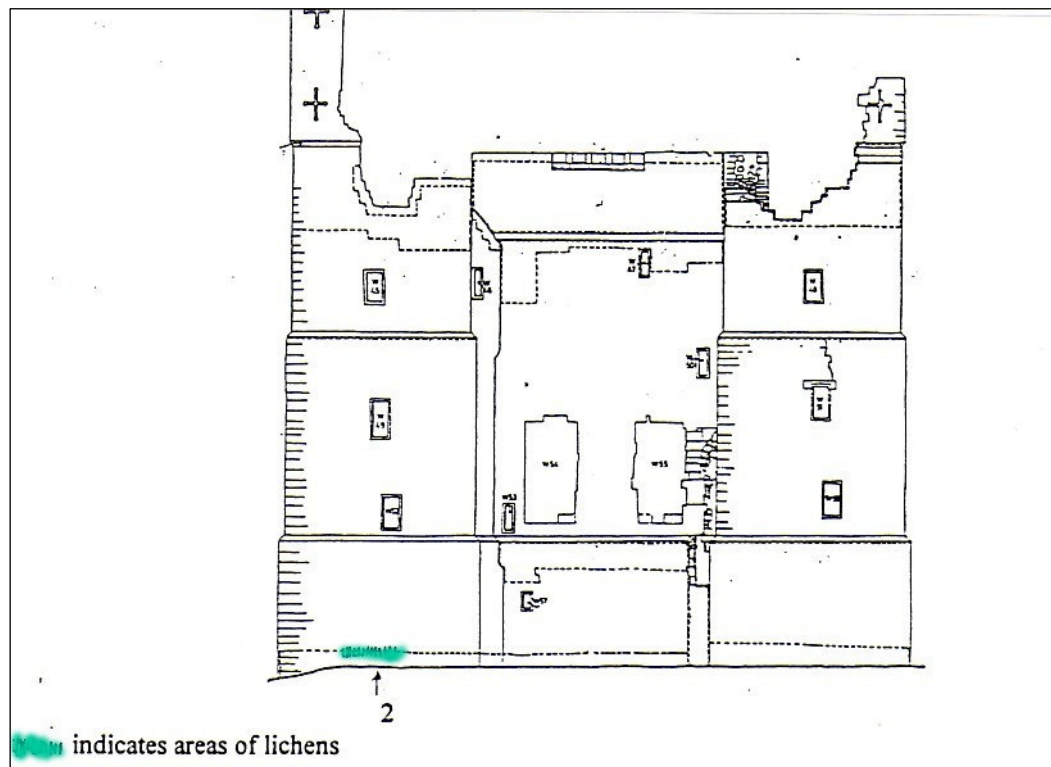
APPENDIX

Species location by elevation see Table 2, page 6, for key to species reference numbers

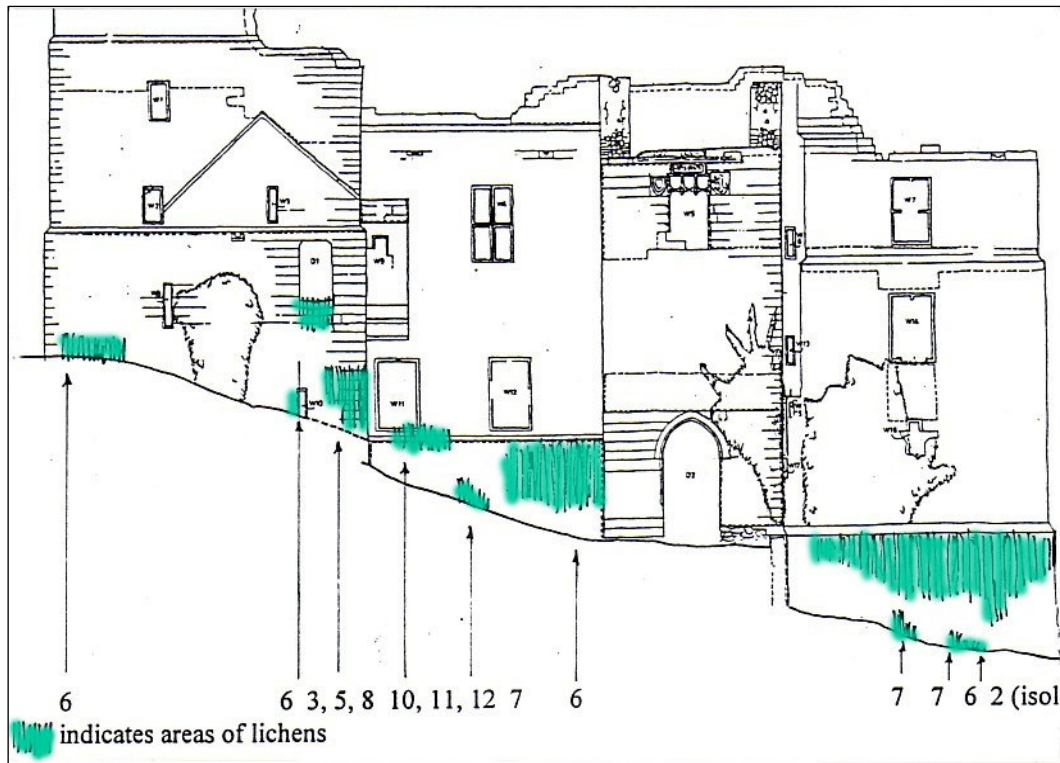
Drawings based upon drawings by Derek Latham and Associates, January/February 1989, for English Heritage



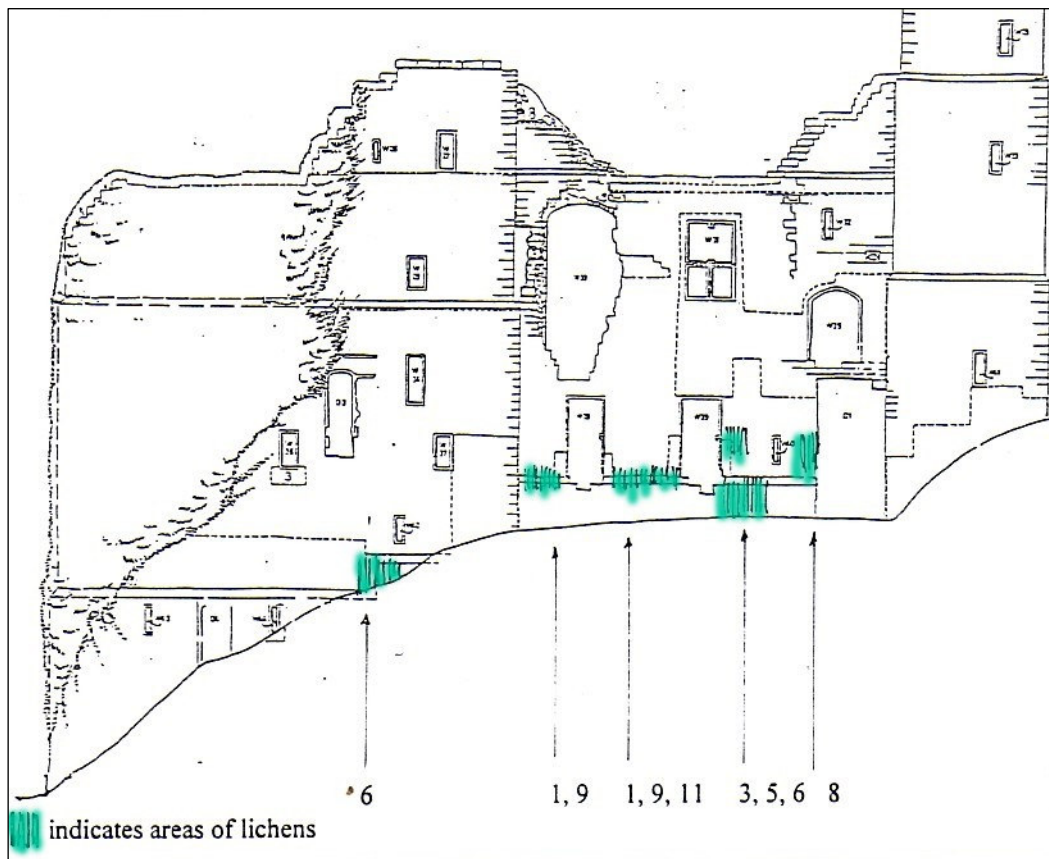
North elevation not to scale



South elevation not to scale



East elevation not to scale



West elevation not to scale

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APPENDIX 4

THE GEOLOGY AND BUILDING STONES OF HAREWOOD CASTLE

by Philip Murphy

The geology and building stones of Harewood Castle

P.J. Murphy

Harewood Castle is situated on the south side of the glaciated valley of Wharfedale. The bedrock beneath the structure is the medium to coarse feldspathic sandstone of the Lower Follifoot Ridge Grit, a sandstone (gritstone) unit in the Millstone Grit series of late Carboniferous age. The beds strike approximately east-west and dip to the south at 5 degrees. The south side of the valley consists of a series of steep gritstone escarpments whereas the north side of the valley is a much gentler dip slope. The Lower Follifoot Ridge Grit has a true thickness of 35 m in the Harewood area but rapidly diminishes to zero 5 km to the west. To the east it has a much more consistent outcrop forming the southern flank of the Wharfe valley for 6 km. The sediments which now form the Millstone Grit originated from a metamorphic terrain somewhere to the north of northern England and pebbles of a variety of metamorphic rock types are found as lag deposits within the sandstone formations. The occurrence of such pebbles appears to be relatively uncommon in the Lower Follifoot Ridge Grit. The sandstones of the Millstone Grit were deposited in the outwash fans and channels of a very large delta system. The floor of the Wharfe Valley consists of glacial and fluvio-glacial deposits from the Pleistocene glaciations and at Castley 5 km to the west is the site of a retreat moraine of the late Devensian Wharfe Valley glacier.

The southern flank of the Wharfe Valley has been badly affected by large rotational slope failures. The building of the castle on the outcrop of the Follifoot Grit would not only mean the building stone could easily be sourced from nearby but also the castle would be sited on one of the few parts of the valley side that had not been affected by land slip and thus capable of supporting the castle structure. A north east-south west oriented fault has caused the down throw of the lower margin of the Lower Follifoot Ridge Grit. The geomorphological result of the faulting has produced a 'shoulder' on the valley side. This means as well as being sited on competent bedrock the castle has open views in both the up (westerly) and down (easterly) valley directions.

The building stone forming the main walls of the castle structure are large (up to 50 cm deep) blocks of medium to coarse grained poorly sorted, sub angular micaceous sandstone. Depositional textures including cross bedding are picked out in the face of the blocks where they have been subjected to wind erosion. The details stand out due to the variable cementation of the stone and the 'nobly' appearance of some blocks is also due to variations in cementation. This stone is typical of material sourced from the sandstone beds within the Millstone Grit. Slightly finer grained plane – bedded blocks are used preferentially for the corner stones of the building but again sourced from the Millstone Grit (Figure 1) .

Millstone Grit typically has a low tensile strength and is not a good choice of material for use as lintels. Often when used in this way it is accompanied by a strain relieving arch in the wall above the opening but no such structures accompany lintels here. Examples of the failure of lintel can be seen in the fire places in the south east tower and in slabs used to form the stairs on spiral stair cases (Figure 2). Any larger openings are topped by arches rather than lintels.

The blocks are all placed so as to be flat bedded with the notable exceptions of one block on the outside of the south wall which has spalled badly (Figure 3) and fire place mantels. The placing of the mantels deliberately in a face bedded mode is probably to avoid upward failure of the lintel caused by repeated heating and cooling. This would be enhanced in Millstone Grit due to its high porosity allowing the presence of moisture into the stone. Problems caused by the porosity are well illustrated on the west wall of the castle where algae can be seen growing in the pore network of the weathered outer layer of the building stones (Figure 4).

No metamorphic pebbles typically found in the Millstone Grit are seen in the blocks of the castle walls. They do occur in the material used as fill between the blocks where the central structure of the walls is exposed. Other material used as fill includes both weathered pebbles and small angular blocks of coarse sandstone and limestone (Figure 5). This material could have been sourced from the superficial deposits covering the flat ground above or from the fluvial gravels of the valley floor to the north. The occurrence of some very angular fragments within the fill material suggests it was sourced from the glacially derived deposits to the south of the castle site described as

boulder clay by Edwards et al (1950) which in places can be dominated by the coarser fragments. This suggests as well as rock quarries there was also a gravel pit being worked during the time of building the castle.

The builders of the castle were clearly very familiar with the properties (and shortcomings) of the Millstone Grit sandstones as shown by the preferential use of plane bedded blocks for corner stones, the use of face bedding for fire place mantels and the presumably deliberate avoidance of blocks containing coarser material (pebbles). One surprising feature of the castle is the use of Millstone Grit for carving. The coarse grain size and variable cementing typical of these rocks does not provide an ideal material for carving.

An overgrown and part filled depression aligned along the strike of the beds to the east of the castle is interpreted as disused quarry within the Lower Follifoot Ridge Grit. The bed rock is exposed on the northern side of the depression and, though very heavily covered by lichen and moss, is a sandstone consistent with that used for construction of the castle (Figure 6). The widely spaced bedding planes seen in the outcrop mean blocks of the size used in the castle could have been sourced from this site and no metamorphic pebbles can be seen at the outcrop. The southern limit of this depression is a ridge of much finer bedded sandstone indicating the coarser bedded material was being specifically targeted by the excavation (Figure 7). The Lower Follifoot Ridge Grit was quarried extensively between 1759 and 1771 to provide the building stone for Harewood House though these quarries are believed to have been positioned to the south of the castle closer Harewood House than those adjacent to the castle site (Dimes and Mitchell 1996). The quarries nearer Harewood House are presumably the ones referred to by Edwards et. al. (1950) as producing “ a massive, well bedded rock..quarried in Harewood Park, providing good building stone”.

The only part of the castle not built of Millstone Grit sandstone is high up on the east wall where a new fire place has been inserted (Figure 8). The material used for this work which clearly post dates the main construction phase is too thinly bedded to be sourced from the same place as the rest of the building stone but was not accessible at the time of writing this report.

To the north of the castle a ha-ha runs across the valley side. The wall of this structure is constructed of medium grained sandstone blocks which are much smaller than the blocks used in the castle construction. These blocks are again probably sourced from a sandstone within the Millstone Grit but not from the same place as the coarser, less well bedded material used in the castle. This means the material was not removed from the castle structure to build the ha-ha.

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Figure 1. View towards main gate from central space. The use of plane bedded blocks on the corner contrasts with the blocks showing cross-bedding used in the rest of the wall.



Figure 2. Failure of a slab forming a step in the north east spiral staircase.



Figure 3. The single block on the exterior walls placed face-bedded. The block is spalling badly.



Figure 4. Heavy algal growth in the porous outer layer of the lower two courses has resulted in a green appearance. The 'nobby' texture in the upper two courses is a result of different degrees of cementation of the sandstone being picked out by erosion.



Figure 5. The gravel fill including metamorphic pebbles derived from the Millstone Grit.



Figure 6. Exposure of coarsely bedded Lower Follifoot Ridge Grit in depression to the east of the castle.



Figure 7. Finer bedded material left as an upstanding ridge forming the southern limit of the depression to the east of the castle. The rock face pictured in Figure 6 can be seen in the background.



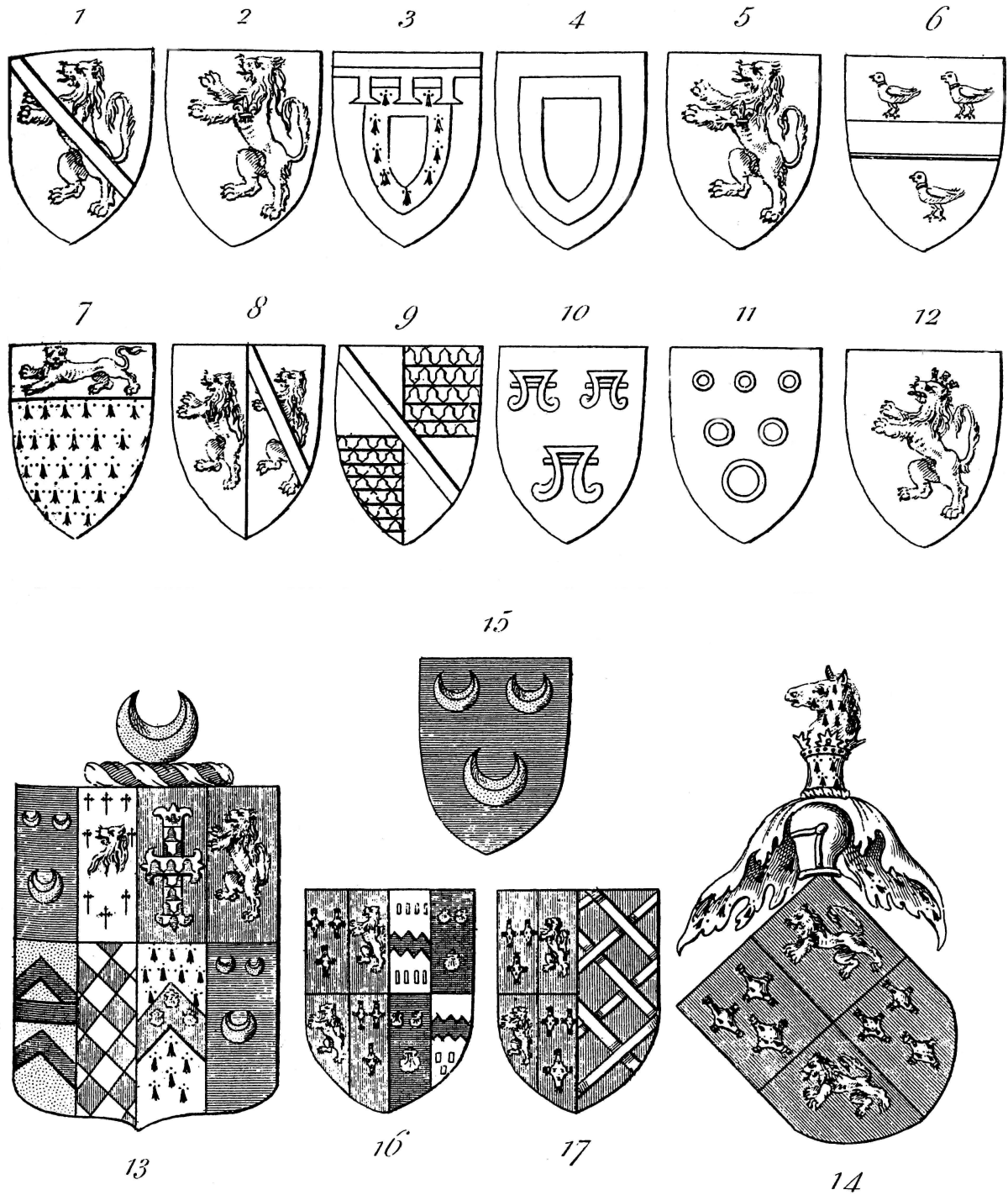
Figure 8. The much thinner bedded and finer grained stone used in this fire place on the east wall contrasts with the large blocks sourced from the Millstone Grit used in the rest of the picture.

APPENDIX 5

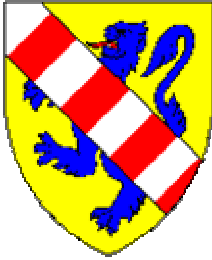
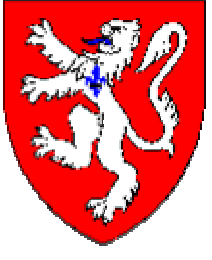

SHIELDS OF ARMS AT HAREWOOD CASTLE

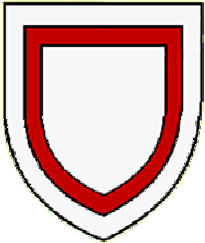
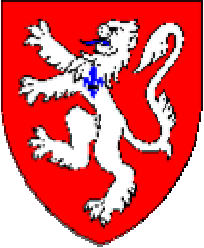
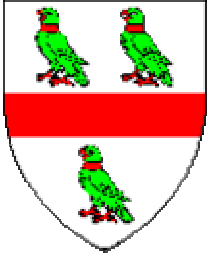

by David Neave

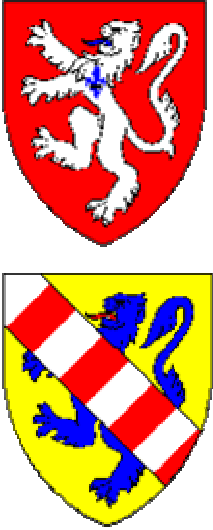
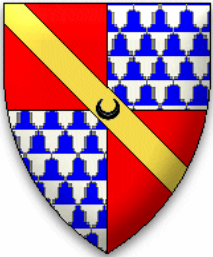
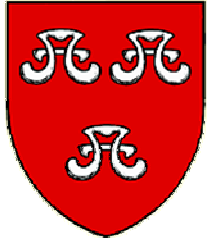
SHIELDS OF ARMS AT HAREWOOD CASTLE
 By David Neave

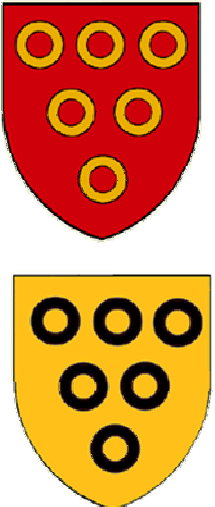
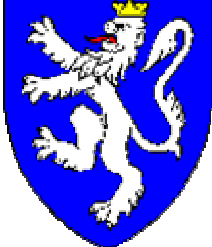
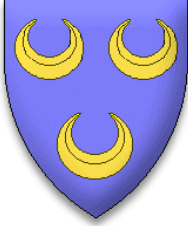


Shields of Arms as depicted by King (1782, plate XLVI, page 335).

King No.	Shield	Description	Notes	Location in Castle
1		SUTTON Or a lion rampant azure debruised by a bend compony argent and gules.	Sir William Aldeburgh, son of Sir William Aldeburgh and Elizabeth de L'Isle, married Margaret (d.1391), widow of Peter de Mauley, daughter and heiress of Sir Thomas Sutton of Bransholme Castle, Sutton. Jones 1859, no 7. Glover notes that this shield was "cut in stone" (Foster 1875, 467 & 8).	Chapel: north internal face, above window (W18) left (24E).
2		ALDEBURGH Gules a lion rampant argent charged with a fleur-de-lys azure.	Sir William Aldeburgh (d.1388) married Elizabeth de L'Isle, daughter of John de Lisle, 2nd Baron, (c.1356) (Clay 1913, 2-3). In 1364 Sir Robert de L'Isle of Rougemont granted (enfeoffed) Sir William Aldeburgh and his wife the manor of Harewood. In 1366 Sir William Aldeburgh was granted a licence to crenellate his manor house there. Jones 1859, nos 3 & 8. Glover notes that there were two of these shields were in the chapel, another was "cut in stone", and another "graven in stone on the walles in the chapel" (Foster 1875, 467 & nos 4, 6, 9 & 12).	Numerous. i) Above main entrance (right) (4A). ii) Above entrance to chapel (left and right) (21A & 21C). iii) Chapel: above window (W17), left and right (23A & 23C). iv) Chapel: arch above window (W18), centre (24A). v) Chapel: right of arch above window (W18) (24D). vi) Chapel: north internal face, above window (W18), centre (24F). vii) Above entrance to chapel (D8), centre (26A). viii) Chapel: possibly centre of arch over window (W15) (25C).
3		BALLIOL (Ingram de Balliol) Gules an orle ermine (NB: at Harewood there was a label for difference).	The label has three points, indicating the eldest son. Jones 1859, no 9. Glover notes that this shield was "cut in stone" (Foster 1875, 467 & no 10).	North internal face of chapel, above window (W18), right (24G).

4		<p>BALLIOL Argent an orle gules.</p>	<p>Sir William Aldeburgh was a member of the household of Edward Balliol, king of Scotland, and a close associate of Balliol. He was the king's messenger in 1354. This is why there are Balliol shields displayed at Harewood. Sir William's daughter-in-law Margery (nee Sutton) bequeathed a tapestry bearing the Balliol arms in 1391.</p> <p>Jones 1859, nos 4 & 10. Glover notes that this shield was "graven in stone on the walles in the chapel" (Foster 1875, 467 & 11).</p>	<p>Several. i) Above main entrance (left) (4B). ii) Above entrance to chapel (centre) (21B). iii) Chapel: above window (W17), centre (23B).</p>
5		<p>ALDEBURGH Gules a lion rampant argent charged with a fleur-de-lys azure.</p>	<p>As above.</p>	<p>As above.</p>
6		<p>THWENG Argent a fess gules between three popinjays vert (according to Burke's Armory they should be "...collared and membered gules").</p>	<p>Elizabeth Redman apparently married Marmaduke Thwenge of Kilton Castle but not found any record of this. A Marmaduke Thweng married Isabel daughter of William de Ros of Ingmanthorpe in 1273.</p> <p>Jones 1859, no 12. Glover notes that this shield was "graven in stone on the walles in the chapel" (Foster 1875, 467 & 13).</p>	<p>Chapel: south internal face, far left (25A).</p>
7		<p>? GIFFARD (Osbern Giffard) Ermine two bars on a chief gules a lion passant gardant or.</p>	<p>No known connection.</p> <p>Jones 1859, no 13. Glover notes that this shield was "graven in stone on the walles in the chapel" (Foster 1875, 467 & 14).</p>	<p>Chapel: south internal face, left (25B).</p>

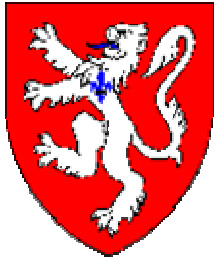
8		ALDEBURGH impaling SUTTON (see above)	As above. Jones 1859, no 14. Glover notes that this shield was "graven in stone on the walles in the chapel" (Foster 1875, 467 & 15).	Chapel: south internal face, above window (W15) (25D).
9		CONSTABLE of FLAMBOROUGH Quarterly, gules and vair, over all a bend or. (NB: The crescent in centre should be excluded).	Katherine, daughter of Sir Robert Constable of Flamborough and sister of Sir Marmaduke Constable (1443-c.1530), married Sir Ralph Ryther (d.1520). Jones 1859, no 15. Glover notes that this shield was "graven in stone on the walles in the chapel" (Foster 1875, 467 & 16).	Chapel: arch above window (W18), right (24B).
10		ROS/ROSS Gules three water bougets argent.	Lucy de Ros married Sir William Ryther (b.c.1250, d1309-1312) as her second husband, c.1280. Jones 1859, no 16. Glover notes that this shield was "graven in stone on the walles in the chapel" (Foster 1875, 467 & 17).	Chapel: arch above window (W18), far right (24C).

11		<p>Either VIPONT Gules six annulets or.</p> <p>Or LOWTHER Or six annulets sable.</p>	<p>No known connection with either family.</p> <p>Jones 1859, no 17. Glover notes that this shield was "graven in stone on the walles in the chapel" (Foster 1875, 467 & 18).</p>	Above entrance to chapel (D8), right (26B).
12		<p>GALLOWAY (also Gerard in Gilling Castle) Azure a lion rampant argent crowned or.</p>	<p>Dervorguilla de Balliol, lady of Galloway (d.1290), daughter and heiress of Alan, Lord of Galloway, was the wife of John Balliol (d.1268) of Barnard Castle and mother of John Balliol (c.1248-1314), king of Scots.</p> <p>Jones 1859, no 18. Glover notes that this shield was "graven in stone on the walles in the chapel" (Foster 1875, 467 & 19).</p>	
13 Ryther shield	 No image	<p>i) RYTHER Azure three crescents or.</p> <p>ii) TOTHEBY / TOTHBY of Lincolnshire. Azure (blue), a lion's head erased Argent (silver), within an orle of eight crosses crosslet or (gold).</p>	<p>William Ryther (d.1563) almost certainly erected this shield between 1544 and 1563. See below.</p> <p>Jones 1859, no 19. Glover notes that this shield was "in the Great Chamber at Harewood castle" (Foster 1875, 467 & 20).</p> <p>Robert Ryther married Margaret Totheby, daughter and heir of Sir William Totheby in Lincolnshire c.1365.</p>	



iii) ALBEMARLE
(Aumale)
Gules a cross patonce
vair.

Sybil Aldeburgh (see below) was daughter and co-heiress of Sir William Aldeburgh and his wife Elizabeth de Lisle, granddaughter of Robert de Lisle (d.1344), heir of Isabel, Countess of Albemarle (Aumale) (d.1293).



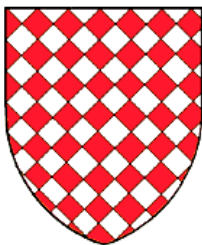
iv) ALDEBURGH
Gules a lion rampant
argent charged with a
fleur-de-lys azure.

Sir William Ryther (c.1360-1426), the son of Robert Ryther and Margaret Totheby, married the heiress Sybil Aldeburgh c.1379. Sybil's sister and coheir married Richard Redman.



v) De L'ISLE
Or a fess between two
chevrons sable.

Sybil Aldeburgh (see above) was daughter and co-heiress of Sir William Aldeburgh and his wife Elizabeth de L'Isle.



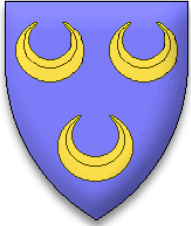

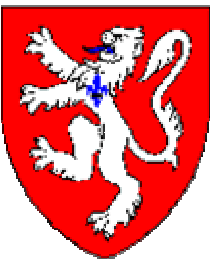

vi) FITZWILLIAM
Lozengy argent and
gules.

Sir William Ryther (c.1408-1475) married Eleanor daughter of Sir John Fitzwilliam of Sprotborough c.1437.

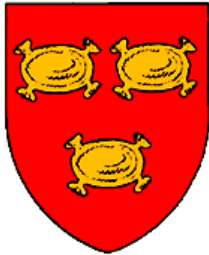
No image

vii) GROVE
Ermine, on a chevron,
gules, three escallops,
argent+.

George Ryther (d. before 1543) married a daughter of John Grove of Greenhythe, Kent c.1515. Their son William Ryther (b.c.1516, d.1563) succeeded his cousin Henry Ryther at Harewood in 1544.

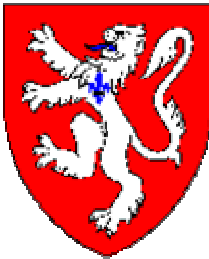
		viii) RYTHER Azure three crescents or.	Sir William Ryther (d.c.1426) married Sybil Aldeburgh (c.1367-1439), daughter and co-heir of Sir William Aldeburgh of Harewood, c.1379.
14	 	REDMAN quartering ALDEBURGH Redman: Gules three cushions or. Aldeburgh: Gules a lion rampant argent charged with a fleur-de-lys azure.	Richard Redman (d.1426) married Elizabeth Aldeburgh (1364-1417), daughter and co-heir of Sir William Aldeburgh of Harewood, c.1394. Elizabeth was previously married to Sir Brian Stapleton.
15		RYTHER Azure three crescents or.	Sir William Ryther (d.c.1426) married Sybil Aldeburgh (c.1367-1439), daughter and co-heir of Sir William Aldeburgh of Harewood, c.1379. Jones 1859, no 6. Glover notes that this shield was in the chapel (Foster 1875, 467 & no 7).

16

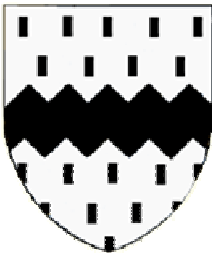


REDMAN quartering
ALDEBURGH
impaling DAINCOURT
quartering
STRICKLAND of
Sizergh.

Redman: Gules three
cushions or.



Aldeburgh: Gules a
lion rampant argent
charged with a fleur-
de-lys azure.



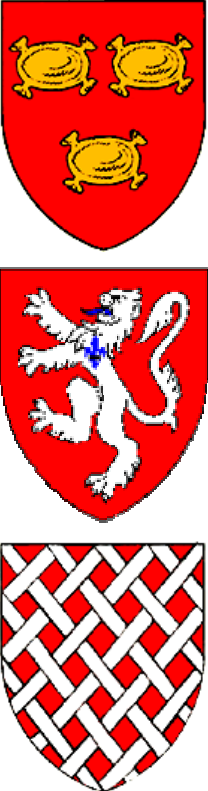
Daincourt /D'Eyncourt:
Argent billetty and a
fess dancetty sable.



Strickland: Sable, two
escallopes argent.

Around 1436 William Redman married Cecilia Strickland, daughter of Sir Thomas Strickland (d.1455) of Sizergh, Westmorland (not the later Stricklands of Boynton). Sir Thomas's great-great grandfather Sir William Strickland (d.1305) had inherited the Sizergh estate on marrying the heiress Elizabeth D'Eyncourt.

Jones 1859, no 16.

17		<p>REDMAN quartering ALDEBURGH impaling HUDDLESTON</p> <p>Redman: Gules three cushions or.</p> <p>Aldeburgh: Gules a lion rampant argent charged with a fleur-de-lys azure.</p> <p>Huddleston: Gules fretty argent.</p>	<p>Edward Redman (c.1454-c.1515) son of Matthew Redman, married Elizabeth Huddleston of Millom Castle, Cumberland.</p> <p>Jones 1859, no 2, separate.</p>	
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King, E 1782 "Sequel to the Observations on Ancient Castles". *Archaeologia* vol 6, 231-375

The coats of arms are taken from:

"Armorial of Families associated with Fortified Sites within Yorkshire"
<http://yorkshirehistory.com/Gallery/all;>

"European Rolls of Arms of the Thirteenth Century"
http://perso.numericable.fr/~briantimms/era/early_rolls_of_arms.htm

"Heraldry in Gilling Castle"
<http://www.nyron.org/university/heraldry/www.demon.co.uk/apl385/gilling/heraldry.htm>

Historical information is taken from Linley & Jim Hooper's family history pages
<http://www.linleyfh.com/oursecondsite-p/>

APPENDIX 6

LISTED BUILDING DESCRIPTION

LISTED BUILDING DESCRIPTION

IoE Number: 423419

Location: HAREWOOD CASTLE, HARROGATE ROAD (west off), HAREWOOD, LEEDS, WEST YORKSHIRE

Date Photographed: 13 November 2007

Date listed: 30 March 1966

Date of last amendment: 30 March 1966

Grade: I

Large tower house (ruin). Mid C14 by William de Aldburgh who obtained license to crenellate in 1366. Large, dressed, locally-quarried millstone grit, lacks roof. A single self-contained keep-like structure rectangular on plan with corner projections, that to north-east angle containing entrance; with another oblong attached beyond on north-side containing kitchen. Entrance, Great Hall with Solar above; at lower level, kitchen and buttery with cellars under; Chapel over portcullis chamber, towers housed bedchambers and garde-robes. 2-storey hall-range, 3-storey service-range, south-east and south-west projections 4-storey towers over 100' high carried up above the roof of the main block, other projections formerly had towers. East entrance front: 5 bays. 5th bay projecting tower has pointed-arched doorway with chamfered surround with above, at 3rd-floor level, remains of traceried window to chapel flanked by shields with the coat of arms of Aldburgh and of Edward Balliol, the former puppet King of Scotland whom he had served with, set above, inscription "VAT SAL BE SAL" (WHAT SHALL BE SHALL) in high relief. Flanking bays have chamfered cross-mullioned windows one surviving with mullions. First 2 bays are projection of wing with 2 bays of arrow slits, one lighting stair. Rear of hall range has 3 bays of former cross-windows with narrow chamfered light set between first 2 windows to light internal buffet (see Interior). Right-hand return: northern service range, on steep slope, 3 diminishing stages with chamfered band carried round 3 sides, scattered fenestration. Interior: the entrance is defended by 2 pairs of doors and a portcullis the groove for which remains. It leads directly to the former screen's passage at the north end of the hall, the upper end of the hall has a raised curbstone for a dais on which is set the fireplace in the south wall (lacks surround). The hall windows are raised up to a high level and the seats in the reveals are approached up a short flight of steps in the wall thickness. They have segmental-arched heads. Along the side walls of the main body of the hall are remains of stone wall benches. On the west wall and on the dais is the principal feature of the room, an elaborate recess with a richly-cusped arch, crocketed ogee gable lit by a small window at the back. It is almost certainly a buffet or sideboard for the display of plate. Large corbels formerly supported the floor to the solar above. The weathering for the steep pitched roof can be seen on the north and south walls. The south wall has joist holes for a gallery approx. 10' above the solar floor with a plain fireplace under and another, mostly destroyed, on the east wall. Centrally-placed at north end of hall is an arched doorway to an unheated room, probably the buttery. Opposite entrance is arched-doorway to a lobby which leads to the kitchen and may have been a servery with a mural-stair cut in the west wall to the cellar/basement with remains of barrel vault with large ribs. Above, the kitchen has 2 large fireplaces and an oven. In the tower over the entrance is a portcullis chamber and above that, the chapel, with a display of heraldic shields on the walls, entered from the solar. The towers contain one small room on each floor mostly provided with fireplaces, garde-robes and wall cupboards. There has been little structural alteration to the castle since it was built and in spite of its ruined condition it is probably the best example in Yorkshire of a C14 fortified tower-houses. The primary historical interest of it is an example of medieval domestic planning and not as military architecture. Edward Balliol, King of Scotland, is reputed to have taken refuge here when driven from his Kingdom. It was later the home of the Redmaynes and the Rythers. It was

known to be inhabited in 1630 but was derelict in 1656 when it was sold to Sir John Cutler. Scheduled Ancient Monument. N. Pevsner, *Yorkshire West Riding* (1974) p245. P. F. Ryder, *Medieval Buildings of Yorkshire*, (1982) p99-100. R. Wade, *Vat Sal Be Sal*, (booklet 1982) p9-10.

Source: Images of England website (www.imagesofengland.org.uk)

APPENDIX 7

EDAS PROJECT DESIGN

CONDITION SURVEY AND CONSERVATION PLAN, HAREWOOD CASTLE, HAREWOOD, WEST YORKSHIRE

PROJECT DESIGN

1 INTRODUCTION

- 1.1 This project design sets out the work that Ed Dennison Archaeological Services (EDAS) consider to be appropriate to carry out an architectural and archaeological survey of Harewood Castle, near Leeds, West Yorkshire, and to prepare an appropriate Conservation Plan for the site.
- 1.2 The aims of the project will be to provide an accurate and up-to-date pre-intervention condition survey of the castle and its immediate environs, and to produce recommendations for its future management, consolidation and/or repair. In brief, the work will involve the collection and collation of existing information and the production of a detailed architectural, archaeological and ecological survey, augmented by a detailed descriptive and photographic record, and report. Using the information presented in this survey, a separate Conservation Plan will be prepared to the requirements of the Heritage Lottery Fund and English Heritage.
- 1.3 The design and format of this project design follows the specific advice published by English Heritage (1991). It has been prepared by EDAS in the light of several visits to the site, and after discussions with English Heritage, the Harewood Estate (Mr C Ussher and Mr I Copeland), the Harewood House Trust Limited (Mr T Suthers), Mr Peter Pace (architect), and other sub-consultants. The information and co-operation provided by the Harewood Estate and Mr Peter Goodchild during the preparation of this document is gratefully acknowledged.

2 BACKGROUND INFORMATION

Location

- 2.1 Harewood Castle is located at NGR SE32184564 (centred), approximately 700m north of Harewood village and some 12km to the north of Leeds city centre, in West Yorkshire. The site is dramatically situated on a steep north facing slope overlooking the Wharfe valley.
- 2.2 The castle lies within a sharp right-angled bend of the A61 Leeds-Harrogate road, in the north-east corner of the walled Harewood Estate (see figure 1). The ruined structure is surrounded by conifer plantations to the north and west, and by uncultivated scrub and grass and the remnants of older plantations to the east and south (see plate 1). There are extensive earthworks of former quarries to the east and north-east, with smaller features representing the sites of buildings, ponds and gardens to the south, west and north; some of the latter extend beyond the walled estate into fields on the south and east sides of the A61.

Ownership and Access Arrangements

- 2.3 The site is owned by the Harewood Estate, who have initiated the survey and have given permission for the work to be carried out. The main castle complex is owned "in hand" while the area beyond the A61 is let to tenants as part of the Stockton Grange Farm holding.

- 2.4 EDAS and their various sub-contractors will access the site via a locked gate in the Estate boundary wall adjacent to the A61 road. The Estate have agreed to provide EDAS with a key for the duration of the project, and EDAS will liaise with Estate security and gamekeepers to avoid any potential conflict with other estate activities such as shooting days. Cars and other vehicles will be parked just within the gate, in an area of hardstanding already provided.
- 2.5 There is no vehicular access to the castle itself, and pedestrian access from the car parking area is hampered by a water-filled ditch and ha-ha. An appropriate temporary form of bridge, utilising stepping stones and fallen wood, will be constructed to ensure minimal damage or erosion to the ditch and ha-ha wall.

Existing Site Designations

- 2.6 The castle and the majority of the earthworks are scheduled as an Ancient Monument by the Department for Culture, Media and Sport (monument WY127), and the ruins are listed as being of Special Architectural or Historic Interest, Grade 1; in the case of these double listings, the Ancient Monument legislation takes precedence. The site is also listed on the West Yorkshire Sites and Monuments Record (site number 1429) and the National Archaeological Record (NMR number SE34NW10). The castle complex is included within the area designated by English Heritage as a Grade 1 registered historic park and garden.

3 ARCHAEOLOGICAL AND ARCHITECTURAL INTEREST

- 3.1 The following information has been taken from a variety of sources, including Black (1968), Moorhouse (1989) and Emery (1996, 339-344), and from observations made during site visits in October and November 1999.
- 3.2 Harewood Castle is one of the best examples of a vertical fortified house in the region. Although it could be defended, it is not a tower house in the true sense of the word, and it is much more important for its particularly interesting and complete domestic plan; it illustrates the movement towards balanced frontages and the late medieval enthusiasm for intricate floor levels. The main hall is of considerable style and the window openings are at the forefront of contemporary design.
- 3.3 The castle appears to have been built by Sir William Aldeburgh who held the manor of Harewood from 1365 to 1391. He obtained a licence to crenellate in 1367 and his arms, together with those of Edward Balliol, appear on both the exterior and interior of the castle. The structure itself is constructed of large blocks of locally-quarried stone, and it appears to be of a single build although a large, segmental arched window in the west wall of the upper hall may be a later addition. Archaeological investigations have shown that the castle was surrounded by a precinct which contained domestic and agricultural buildings, terraced gardens and fishponds. Excavations suggest that some stone and timber buildings pre-date the main structure.
- 3.4 The castle was still occupied in 1630 but it was then abandoned in favour of the now demolished Gawthorpe Hall which was built around 1640; it was rendered uninhabitable by an order issued in 1646 after the Civil War. Harewood Castle was described as being derelict in 1656, and it was noted that the ruins would provide an excellent source of building material although little seems to have been taken. During the 19th century the castle was incorporated into the landscaped gardens of Harewood House and a bowling green was established to the south of the ruins, probably on the site of earlier gardens; the scheme appears to have

been in the rustic picturesque style, a style that is associated with the writings of Richard Payne Knight and others (pers comm Peter Goodchild). During the Second World War the area was used as a tank testing ground and the majority of the trees which now surround the castle were planted during the last 50 years.

- 3.5 In brief, the castle consists of a rectangular block measuring approximately 17m by 10m with a turret in each corner and a service wing attached to the north side (see plate 1). A terraced track, possibly starting at a detached forebuilding to the east, leads up to the main entrance which is located in the north-east angle turret. The gate was protected by two sets of double doors and a portcullis, and the upper floor of the turret contains a chapel. The two southern turrets each contain five private chambers, nearly all containing fireplaces and garderobes; these towers were raised high above the solar roof to provide lookouts with arrow loops.
- 3.6 The main body of the castle contained the hall, solar or upper hall, and other apartments within a two-storey block. The gate opened directly into the screens passage at the north end of the lower hall and the beam slots for the timber screen can still be seen. The south end of the hall contained a massive fireplace, with a raised dias in front, and there is an elaborately carved buffet in the west wall and stone benches along the side walls. To the south-east, a broad spiral staircase led up to the solar, a more private hall of similar dimensions to that below but with the lower and upper ends reversed. Surprisingly, this room was heated by two small plain fireplaces, and it is possible that it was divided into two unequal halves by a screen. Access into the chapel in the north-east turret was from the north end of the room.
- 3.7 The ground falls away naturally to the north, so that the attached service wing is of four storeys. It was entered via the basement level into a vaulted storage room and a staircase in the north-west turret led up into the kitchen and buttery at the level of the hall. The position of a second basement room, near the gatehouse tower, suggests that it was a guardroom. The upper two levels of north wing contain two principle chambers with side rooms; the lower room is thought to have been occupied by the Steward of the household, as it was approached from the screens passage and it gave access to the portcullis machinery housed over the entrance, while the upper room, which led off the solar, is of superior character having generous mullioned and transomed windows which give spectacular views over the Wharfe valley.
- 3.8 Today the structure is unroofed and no internal floors remain within the main rectangle, but the walls survive for the most part to eaves height. Comparison with 19th century illustrations suggest relatively little recent decay, and the presence of some iron banding around the south-west tower provides some evidence of previous repair. However, several of the window, door and fireplace openings are deteriorating, and a large window in the centre of the west elevation is in danger of imminent collapse. The remains of the south-west tower also appear to be in a precarious condition. Most of the spiral stairs are fallen, although that in the north-east tower does provide access to roof level.
- 3.9 Some parts of the ruins are overgrown with ivy, particularly in the north-west corner, and there are some small trees and brambles growing in the interior and on the wall tops. Externally, parts of the castle are surrounded by scrub and trees of varying age, and there could be some damage if windthrow becomes a problem. Some of the earthworks to the west and north-west have also recently been planted, and much of the detail is now obscured.

4 SUMMARY OF EXISTING SURVEYS AND INFORMATION

- 4.1 The castle is well known, both regionally and nationally, and it is noted and summarised in many of the general accounts dealing with the history and architecture of Yorkshire castles (e.g. Grainge 1855, 86-99; Illingworth 1938, 139-140; Pevsner 1967, 245). There are also several specific papers or descriptions of the castle dating from the 19th century (e.g. Jewell 1819, 51-54; Jones 1864; Kitson 1913; Black 1968), and the most recent is that produced by Emery (1996, 339-344). The manorial history of the area has also been summarised by Parker (1913) and Faull and Moorhouse (1981, 386-387), and Wheeler (1888, 100-101) includes some information relevant to the condition of the castle in the late 19th century.
- 4.2 Some information also exists in relation to the historic landscape of the Harewood Estate (eg. Moorhouse 1985; 1999 Estate Management Plan), and other research has concentrated on the development of the 19th century park and pleasure grounds (eg. Clarke 1963; Hay 1993; Goodchild 1994). A Phase 1 ecological survey has also been undertaken over the whole estate, as part of the Estate Management Plan.
- 4.3 A certain amount of detailed archaeological and architectural survey has also been undertaken at the castle site itself. The earthworks immediately surrounding the castle were surveyed in 1986 and a plan and interpretation has been published (Moorhouse 1989). This work was undertaken under the auspices of the Harewood Landscape Project, and there is likely to be a certain amount of unpublished research and other material held by members of this group, such as Moorhouse, Weaver and Redyhoff. Some of the earthworks to the north were also investigated through small-scale excavation, and this confirmed the presence of several stone and timber buildings which pre-dated the castle structure (Moorhouse 1990).
- 4.4 A survey of the castle's fabric was previously commissioned by English Heritage, and this was undertaken in March 1988 by Derek Latham and Associates. This work involved the production of outline elevation drawings and ground and basement floor plans at 1:50 scale, with a resulting discussion of the condition of the stonework and a recommended schedule of repair; the latter was divided into urgent and essential repairs, and provisional cost estimates were prepared. Two reports were actually produced, one in May 1988 which dealt with emergency repairs, and another in March 1989 which provided a wider view and discussion together with some recommendations for presentation and future management (Goom and Cunningham 1988; Derek Latham and Associates 1989). A further structural report was produced by English Heritage in 1994 (Hume 1994).
- 4.5 It has not, as yet, been possible to determine how the 1988 elevation drawings were produced (they are presented in the above reports as A3 fold-out drawings), but they seem to be reasonably accurate representations of the fabric and were presumably done using standard surveying techniques. It also appears that other condition surveys and reports have been commissioned (pers comm J Keiley, English Heritage), but these have not yet been located. As far as can be determined, no detailed photogrammetric survey work has been undertaken at the castle and it would seem that the existing information and recommendations are not of the standard now required and expected.

5 REASONS AND CIRCUMSTANCES FOR THE PROJECT

- 5.1 The castle is of considerable national importance, a fact recognised by the Scheduled Ancient Monument and Grade 1 listed building designations. The site also has a significant landscape value and the tops of the ruined towers are visible from some distance, although recent coniferous plantations do obscure the majority of the structure.
- 5.2 The condition of the castle has continued to deteriorate in recent years through natural erosion, and a number of major structural and other defects are apparent. Both the Harewood Estate and English Heritage, as well as other interested parties, believe that remedial works are desirable and necessary to prevent increasing losses to the structure through natural erosion. There appears to be little evidence for deliberate vandalism, probably due to the fact that the castle is located within the walled estate which is inspected at regular intervals by estate workers and security staff.
- 5.3 Prior to any consolidation works, it would be necessary to have a thorough architectural and archaeological survey of both the castle and the surrounding area, in order to provide a detailed understanding of the site and to identify any priorities for repair.

6 AIMS AND OBJECTIVES

6.1 The aims of the project can be defined as:

- to produce an accurate and up-to-date pre-intervention condition survey of the castle complex, including the standing masonry, foundations and all surrounding earthworks;
- to provide recommendations for a phased programme of consolidation and stabilisation of the standing structure and foundations;
- to provide appropriate outline recommendations for the future long-term management, conservation and enhancement of the complex, through the production of a separate Conservation Plan.

6.2 Secondary objectives are:

- to provide a historical context for any future repairs;
- to provide a base level of information and survey data for any future interpretation proposals.

7 SCOPE OF WORK

7.1 The nature of the architectural and archaeological remains of the site means that the survey work will be carried out at a variety of levels.

Documentary Research

7.2 A basic documentary survey for the site will be undertaken, utilising material held in local record offices and archives, libraries, and other repositories of archaeological and architectural information. This work will extend to include any recent surveys and investigations on the site.

Historical Context

- 7.3 The relationship of the castle to the historic landscape of the Harewood Estate as a whole will be examined, specifically with regard to its role in the development of the 19th century park and pleasure grounds.

Ecological and Related Surveys

- 7.4 An ecological survey for the site will be undertaken to identify any features of interest which might be worthy of specific attention, or which might constrain or impact on any subsequent survey, management or consolidation work. Related work would extend to a lichen survey of the castle fabric, and a bat and other fauna survey.

Topographical Survey

- 7.5 A general topographic survey of the castle complex will be carried out at or near ground level to record the position of all upstanding architectural and archaeological features, including earthworks. The survey will conform to Level 4 of the RCHME's guidelines for recording archaeological field monuments (RCHME 1999) as far as is practicable.

Architectural Survey

- 7.6 A detailed architectural survey of the remains of the castle will be carried out, using a combination of photogrammetric plots from stereo photographs and hand measurement. This information will provide an understanding of the history and development of the castle, and will provide a basis for the condition survey and consolidation proposals. The survey will conform to Level 4 of the RCHME's guidelines for recording historic buildings (RCHME 1996) as far as is practicable.

Condition Survey and Recommendations for Consolidation

- 7.7 A full condition survey of the castle complex will be produced, which will describe its current state and identify any potential threats and problems. Recommendations for a phased programme of consolidation and remedial conservation work will also be presented.

Conservation Plan

- 7.8 A separate Conservation Plan will be produced, which will summarise the results of the survey work and outline recommendations for the future long-term management, conservation and enhancement of the site.

8 METHODOLOGY

- 8.1 There are a number of methodologies available for the survey of the castle, particularly concerning the architectural recording. The preferred option given in this project design is that considered by EDAS to be the most appropriate, given financial constraints and the current condition of the monument. The methodologies set out below have been discussed and approved in outline by English Heritage, and they have been used by EDAS on other similar recording projects.

- 8.2 Discussions held as part of the preparation of this project design have determined that the detailed survey work should be confined to an area measuring approximately 2.5 hectares, centred on the ruined castle (see figure 1).

Documentary Research

- 8.3 A basic documentary survey for the castle complex will be undertaken. This will comprise searches in national and regional databases and depositories, and in local libraries and record offices, and is likely to cover appropriate archaeological and architectural information including aerial photographs, antiquarian literature and illustrations, and documentary and cartographic material. It should be noted that only readily available or published sources will be considered, and that no original medieval documentary research will be carried out.
- 8.4 Research undertaken for the production of this project design has established that relevant documentary, cartographic, photographic and illustrative material is held by a number of organisations, namely the Harewood Estate, the Harewood House Trust, the West Yorkshire Archives (Sheepscar office), the Yorkshire Archaeological Society, Leeds City Council, the Institute of Advanced Architectural Studies at the University of York, and the West Yorkshire County Sites and Monuments Record. Information held by English Heritage in the National Archaeological Record and the National Buildings Record will also be obtained, as well as other relevant material held by local and regional libraries. A wide range of consultations is planned, specifically with those who have, or are presently, working in the area; such consultees will include members of the Harewood Landscape Project, Mr S Moorhouse, Ms A Matthews and Mr J Reddyhoff.
- 8.5 Any recent studies or investigations of the site will be examined, and searches will also cover the history of repair and other interventions, and any subsequent re-use or alteration to the building, both historic and recent. The existing 1989 condition survey and associated photographs (Derek Latham and Associates 1989), as well as any other survey reports which come to light, will be useful in determining any recent erosion or damage to the fabric of the castle. It has been determined that Derek Latham and Associates, based in Derby, hold some archive material from their 1989 survey, and this will be consulted and copied as appropriate, subject to copyright permissions; English Heritage do not apparently hold any of the original survey drawings (pers comm D Parker, English Heritage).
- 8.6 The documentary research will extend to the examination of any readily-available late 18th and 19th century engravings and paintings which show the ruined castle largely devoid of vegetation and surrounding trees. These will include Turner's c.1795 paintings which are hung in Harewood House, and some 1786-87 engravings held by the National Archaeological Record and the Sheepscar Record Office; it is to be expected that other material will come to light as the survey work progresses. Advance notice of the survey has also been publicised in the *Harewood Times*, the Estate newspaper, and it is hoped that some oral history relating to the more recent phases of the castle can be obtained.
- 8.7 All the above will be collated and utilised in the final survey report to provide a thorough background and understanding of the castle complex.

Historical Context

- 8.8 The relationship of the castle to the historic landscape of the Harewood Estate as a whole will be examined, specifically with regard to the castle's role and influence

in the development of the 19th century park and pleasure grounds, and its associations with other ornamental and designed landscape features such as the Rock Arch, the rock-lined access tunnels, and carriage drives and paths. This work will build on existing research such as that undertaken by Moorhouse (1985), Hay (1993) and Goodchild (1994).

Ecological and Related Surveys

- 8.9 It should be noted that some of the ecological survey work set out below will be constrained by the practicalities of existing access. As a result, some elements of the work, for example the completion, refinement and/or enhancement of the bat and lichen surveys, may have to be undertaken during the subsequent consolidation programme when scaffolding is in place. Any such work will be recommended in the condition survey, but would be covered by a separate specification and costs.

Botanical Survey

- 8.10 An initial ecological survey will be carried out in advance of any vegetation clearance or other survey work on site (see below), to identify any features of ecological importance which should be retained and protected during subsequent recording work. This work will use the standard recording methodology devised by English Nature (1993) and information will be available in the form of target notes to provide detailed descriptions of species composition and structure.
- 8.11 This work will be combined with a brief desk-top ecological survey to collect and collate all existing ecological survey data, such as the Phase 1 habitat survey done for the Harewood Estate by the City of Bradford Ecology Advisory Service in 1997 as part of the Estate Management Plan. Other consultees at this stage will include the Nature Conservation Section of Leeds District Council, the local bat group, and any other relevant naturalist groups.
- 8.12 Information from both the above will be supplemented by a National Vegetation Classification (NVC) survey of the approximately 2.5 hectare study area. This is the standard tool for vegetation recording and requires homogenous areas within the site to be sampled via a series of quadrats to determine the composition of canopy, shrub and ground flora communities. Any open grassland and marshland communities will be similarly surveyed. Vegetation communities will be mapped using standard alphanumeric codes augmented by reference to topographic and substrate features where vegetation is not the dominant component of the habitat. The position of the larger trees and major vegetation zones will also be identified and mapped, and the information collated with the topographical survey (see below). Significant trees will be tagged and identified according to species to assist with the preparation of detailed management prescriptions.

Bats

- 8.13 A systematic daytime inspection of the castle will be undertaken for bats between May and June; these are the months, together with July and August, that bats are most active and when they are most likely to be detected. The inspection would search for droppings beneath potential roost sites, augmented by a hand-net survey for species identification and roost counts; the latter would be subject to access practicalities.

- 8.14 Further survey work will be undertaken to assess the site as a foraging area for feeding bats. Ten sampling plots representative of the NVC communities identified in the botanical survey will be selected, and these will be systematically recorded for any bat activity for a period of five minutes by a Tranquillity II Time Expansion Bat Detector. All detected calls will be recorded onto a Sony Semi-Professional tape recorder and a sound analysis computer software package (Grams) would be used to produce sonographic representations of each bat call (frequency against time). The use of this equipment provides a much more accurate and less subjective method of detection compared to a heterodyne bat detector, and it enables a quantitative analysis of the site as a foraging area for bats to be undertaken. Ideally, each sampling plot should be recorded once a month during May, June, July and August but, due to the project timetable, they will be sampled at least once in both May and June.

Other fauna

- 8.15 Notes will also be made on other species seen on site, including any tracks or signs of mammals, and all birds would be recorded. The potential of the site as foraging and/or breeding areas for protected species such as badgers, amphibians, water voles etc would also be examined during the above surveys.

Lichens

- 8.16 A detailed lichen survey will be undertaken of those parts of the castle which can be easily reached. Survey work would incorporate the use of hand-lenses and the application of spot chemical tests. A full list of species present will be recorded and their distribution will be noted on plans and elevations produced by the architectural survey (see below), and this data will be digitised back into the survey data to create a complete digital record. Photographs of the most notable species will also be taken.
- 8.17 Results will be analysed in relation to known zones of atmospheric pollution, and will assess their significance for the weathering of the masonry. Identified species will also be related to their wider geographical distributions, and any which may be in decline or at risk of becoming extinct will be noted. Some observations regarding the ecological significance of the species present will also be made.

Detailed Topographical Survey

- 8.18 The proposed topographical survey area will be centred on the ruined castle, but will extend to some 2.5 hectares to include the adjacent earthworks previously identified and interpreted by Moorhouse (1989). It was noted in paragraph 3.9 above that there has been some overplanting, erosion and degradation of these earthworks since the previous survey, and so this new survey will provide an accurate record of the features as they currently exist. Comparisons between the two surveys can then be made to assess and illustrate any recent damage.
- 8.19 The survey will be carried out using Nikon DTM A20 total station equipment with data logged into an HP 100CX palmtop computer using a FMX 700 data software package. Data would be processed using a combination of CivilCad and AutoCad software. The survey will be integrated into the Ordnance Survey national grid and levelled to heights AOD using the bench mark located adjacent to the entrance to the site (211.67m AOD). A temporary bench mark will be established and left on site using an appropriate permanent ground marker positioned in a non-sensitive location. Control points will be observed through trigonometric intersection from

survey stations on a traverse around and through the site, and the maximum error in the closure of the traverse would be less than +/- 10mm. The locations, descriptions and values of bench marks and survey control points will be stated in the final survey data and report.

- 8.20 The survey will record the position at ground level of all upstanding buildings and other structures, wall remnants, foundations, earthworks, leats, paths, spoil and erosion scars, stone and rubble scatters, floors, wooden structures and timbers, ironwork, and any other features considered to be of archaeological, architectural and/or historic interest. Sufficient spot-heights will be taken to enable a detailed contour model of the site to be produced. The survey will also record any differences in habitat types over the site at the time of the survey, as well as any major concentrations of trees and shrubs; individual tagged trees will be recorded as appropriate. Sufficient information will be gathered to allow the survey area to be readily located through the use of surviving walls, wall junctions, and other topographical features.
- 8.21 The survey data will be plotted at 1:500 or other appropriate scales, and will be re-checked in the field as a separate operation and amendments made as necessary; any additions or amendments will be digitised back into the survey data to create a complete digital record. Brief field notes will also be made to expand the drawn record. The final survey plan will be presented as an interpretative hachure drawing using conventions analogous to those used by the RCHME (1999). The plan of the footprint of the castle and any other foundations would be plotted at 1:50 scale, to aid the detailed architectural survey (see below).
- 8.22 As well as the more traditional survey drawings and plots, the survey data will also be presented in a digital form, in either Microstation or AutoCad formats as requested by the client, for potential re-use in any future interpretation package.

Architectural Survey

- 8.23 A detailed architectural survey of the remains of the castle will be carried out. The survey work will conform to Level 4 of the RCHME's guidelines for recording historic buildings (RCHME 1996) as far as is possible given the existing state of the monument, and will include photographic, drawn, and written elements.
- 8.24 Problems over access will provide a major constraint to the architectural recording, as access to the upper parts of the castle will not be practical or safe without full scaffolding. This is not considered to be cost-effective for recording purposes alone but additional survey work would be recommended and undertaken as appropriate during the subsequent consolidation programme when scaffolding is in place. This later work would be recommended in the condition survey and would be covered by a separate specification and costs.
- 8.25 The current state of the monument means that some vegetation clearance will need to be undertaken in and around the castle in advance of the architectural survey. This work will be undertaken after an initial ecological assessment to prevent inadvertent damage or destruction of important habitats (see botanical survey above). Clearance will concentrate on a small number of trees and shrubs growing within a 10m wide zone of the castle, and the woody and scrub vegetation growing against the external and internal walls and within the interior of the hall and north wing will be carefully cut, cleared and removed from site. Other selective branch-logging may also be required. Given the condition of some of the fabric, it is not proposed to remove any of the ivy which is adhering to the wall faces

(especially to the north-west corner) at this stage; this will be done and any recording undertaken during the subsequent consolidation programme. A small amount of rubble will also be moved from within the interior of the castle to allow for the use of a scaffolding tower. Vegetation and rubble clearance will be undertaken by the Harewood Estate, under direct archaeological supervision at all times.

- 8.26 In addition to the hand-drawn and computer-generated plans and drawings outlined below, all final survey data will be presented in a digital form, in either Microstation or AutoCad formats as requested by the client, for potential re-use in any future interpretation package.

Plans

- 8.27 A plan of the castle at a scale of 1:50 will be made at ground floor and basement level, and at higher levels where accessible from stairs and ladders. These will be based on the digital information captured by topographical survey (see above), and it will be significantly enhanced by hand measurement. The plan will show all significant details such as inserted, blocked or unblocked openings, fireplaces, and fittings. The plan would also be tied into the general site survey for ease of reference.

Elevations

- 8.28 Elevation drawings will be produced using colour stereo-photography as far as is possible, augmented by hand measurement where necessary.
- 8.29 All external and internal elevations of the castle would be photographically recorded using a Zeiss UMK camera. Each of the four main exterior elevations and associated seven returns will be photographed, together with the main interior elevations to the hall and north wing, and the four interior elevations of the north-east (gatehouse) tower. The remaining tower interiors will not be photographed, and the window and doorway reveals will not be covered by specific photography. A scaffolding tower would be utilised for the internal elevations but ground conditions make this impossible for the external elevations. The external photography will therefore be taken from the ground and the resulting camera tilt will mean that there will be some areas of detail missing at the higher levels, especially in recesses and above protruding features; this detail will be added by hand at a later date, when scaffolding is in place.
- 8.30 The total area of the elevations is approximately 2,900 square metres, and it is estimated that 140 stereo pairs will be produced. Photo-control will be achieved using standard 40mm square plastic targets, or points of architectural detail (eg on window dressings) where access is a problem; approximately 300 photo-control points are envisaged. These will be surveyed with the same total station equipment used for the topographical survey and heights AOD will be obtained by reference to the temporary bench mark provided by the topographical survey.
- 8.31 The stereo photography will be used to produce computer-generated 1:50 scale elevation drawings. Given the characteristics of the fabric, it has been determined that full stone-by-stone drawings are not required, although it should be noted that the photographic coverage would allow this to be done at later stage if required. The elevation drawings will show all significant architectural detail, stones around openings, masonry types, construction details (eg. putlog holes, mason's marks, building lifts, etc), any modifications to the principal period of construction (eg.

blocked openings, inserted doorways and windows, etc), and areas of previous repair and/or consolidation. Revealed corework will be shown only in outline. All elevations will be levelled in to Ordnance Datum and their locations accurately identified on a copy of a site plan. The layering of the digital data will be as per English Heritage requirements, and all appropriate polygons will be closed.

- 8.32 It is envisaged that some areas of fabric will be obscured by vegetation and protruding surfaces, and this detail will be added by hand where access permits. Additional hand measurement will also take place on those parts of the fabric not covered by the photography, such as door and window reveals, stairways, and the lower internal elevations of the remaining three corner towers; some of these latter areas may not be able to be surveyed until scaffolding is in place.
- 8.33 The photogrammetric plots will be checked on site as a separate operation and any missing or obscured detail, such as significant areas of weathering or erosion, ferrous cramp damage, movement fractures, and other eroded or damaged parts will be added as appropriate. All new, additional or amended data will be digitised back into the photogrammetric drawing files, to allow for a final and complete digital product.

Section drawings

- 8.34 Vertical section drawings of the castle will be produced as appropriate. The accuracy and detail of these will be restricted by the access difficulties described above, and in some cases they will rely on estimated measurements.

Recording of architectural details

- 8.35 More detailed recording, either by hand or photographic techniques, of important decorative features will be carried out where access is possible. Further representative mouldings and profiles will also be recorded at an appropriate scale.

Description and analysis

- 8.36 All the above survey data will be collated and used to produce a detailed architectural description of the castle, together with an appropriate level of analysis and interpretation which will lead to an understanding of the form, function, history and development of the building complex. Although the castle is thought to be of a single phase, attention will be paid to any subsequent repairs or alterations which might have originated during the 19th century landscaping of the area. This work will then provide a basis for the subsequent condition survey and the provision of consolidation, management and interpretation proposals (see below).

Photographic Survey

- 8.37 In addition to the detailed archaeological and architectural surveys, a general photographic survey of the castle will be carried out for recording and illustrative purposes, together with detailed photography of significant features, using a 35mm and/or medium format camera. Coverage will be in black and white with some 35mm colour slide views for presentation purposes. A maximum of 40 shots is envisaged.

Condition Survey and Recommendations for Consolidation

- 8.38 Using the information obtained from the various survey elements described above, a full descriptive and illustrated condition survey of the site complex will be produced. In addition to discussing the current state of the castle and surrounding earthworks, any potential threats or problems will be identified, and comments relating to the general stability of the structure and the condition of the fabric will be provided.
- 8.39 It has already been determined that the castle should be consolidated and repaired using traditional techniques and materials, and it is intended that the consolidated ruins will retain the character of a romantic ruin, with the existing flora and fauna being retained wherever possible. Under this general philosophy, and in consultation with the project architect, outline recommendations for a phased programme of consolidation and remedial conservation works will be produced, based on current practise and professional expertise, together with suggestions for any further recording or investigative work which might be required prior to, during, or following such works. These recommendations will be prioritised according to need, and broad, outline proposals for the general nature and extent of remedial works will be presented. As part of this process, any constraints identified by the topographical and ecological surveys, including bats and lichens, will be discussed and suggested mitigation measures put forward.

Conservation Plan

- 8.40 In addition to the Condition Survey, a separate Conservation Plan for the castle complex will be produced. Although there will be some repetition of the material contained within the condition survey, the production of a compact, integrated and holistic conservation plan will enable the results of the work to be easily and more widely disseminated, and this document can be used to attract external funding for future management and presentation proposals. The design and format of the document will follow advice given by the Heritage Lottery Fund (1998) and other bodies.
- 8.41 The conservation plan will summarise the results of the survey work and make outline recommendations for the future long-term management, conservation and enhancement of the site. Assessments of significance and heritage merit will be made and issues such as vulnerability, condition and fragility will be defined and discussed. Areas of potential conflict, such as between the preservation of lichen communities and/or bat roosts and the consolidation of the fabric, and between areas of ecological and archaeological interest, will be discussed and resolved. As well as providing detailed archaeological and architectural conservation policies, management prescriptions for the surrounding woodland and any specialist requirements for the protection of specific species will be presented, together with appropriate after-care monitoring and maintenance programmes. Existing management and conservation policies, which are outlined in the Estate Management Plan, will be examined to ensure that any new proposals are compatible with established Estate-wide aims and objectives.
- 8.42 It should be noted that interpretation and presentation options for the castle complex will not be presented as part of this project, but the information contained in the Condition Survey and accompanying Conservation Plan will be sufficient to allow for any such options to be easily drawn up.

Modifications

- 8.43 The programme of recording work may be modified in accordance with the professional judgement of the recording staff undertaking the work, insofar as the overall provisions and objectives of this project design are not changed. Any variations in the project will be discussed and agreed in advance with English Heritage and the Harewood Estate.

9 THE ARCHIVE

- 9.1 The full archive, comprising paper, magnetic and plastic media, relating to the project will be ordered and indexed according to the standards set by the National Archaeological Record.
- 9.2 The full archive will be deposited with the Harewood House Trust on completion of the project. If required, a microfilm copy of the archive will be deposited with the National Monuments Record, but this is presently not part of the project design.
- 9.3 It is expected that the archive will consist of the following:
- Copies of relevant documentary material arranged in date sequence.
 - Appropriate survey control information including digital survey data.
 - Field and ink drawings. The detailed survey ink drawings will be produced as wet ink plots on standard "A" size matt surface stable polyester film sheets (minimum thickness 75 microns) with appropriate grid marks, height values, compass points and information panel incorporating title, drawing number, keys, credits, dates etc. Line thicknesses and point sizes will be chosen to allow for ease of duplication and reduction.
 - Photographic material, namely negatives, stereo-photogrammetric contact and full size prints, and other colour and black and white negatives, contact prints, prints and slides. Each photograph will be clearly numbered and cross referenced to a list detailing the subject, orientation, date taken, photographer's name, film and negative numbers. All photographic film will be exposed and processed to manufacturer's standard to ensure high quality definition. Processing will be to archival standards in accordance with manufacturer's specifications.
 - Computer discs or CD ROMS containing all digital survey data and text, in either Microstation or AutoCad formats as requested by the client.
 - Structured catalogues and indices of all documentary material, field and ink drawings, and photographs.
 - Project management records, including a copy of the approved project design and details of any departures from that design.

10 THE REPORTS

- 10.1 The copyright of all survey, archive and other material gathered as part of this project will pass to the Harewood Estate on payment of final invoices. However, it is accepted that EDAS and the various sub-contractors undertaking the work will be acknowledged as the originating body and/or individual authors.

- 10.2 One draft consultation copy of each report will be submitted to the Harewood Estate for comment. Three final copies of each report will be produced, incorporating any comments or suggestions received as necessary. Additional copies, without full-scale drawings, will be deposited with the County Sites and Monuments Record and the National Monuments Record with the approval of relevant bodies. Extra copies of the reports may be provided at cost, subject to the approval of those parties involved.

Condition Survey Report

- 10.3 The condition survey report will take the form of an illustrated and typed standard A4 bound document. It will assemble and summarise the available evidence for the architectural and archaeological features of the site in an ordered form, synthesise the data, comment on the quality and reliability of the evidence, and show how it might need to be supplemented by further work. It will also contain an account of the current condition of all site elements, and it will include recommendations for a phased programme of remedial conservation and consolidation works.

- 10.4 Specifically, it is expected that the report will include:

- A contents list, and lists of plates and figures.
- An executive summary.
- An account of the project plan, research objectives, survey methodology, procedures and equipment used.
- An account of the historical, archaeological and architectural background to the site, to include antiquarian descriptions, plans and illustrations, and repairs and other conservation works.
- Detailed written archaeological and architectural descriptions of the castle, the earthworks, and any other features identified on the site.
- An account of the overall form and development of the site and the evidence supporting any interpretation, including information from documentary sources.
- A condition survey and recommendations for a phased programme of consolidation and remedial conservation works, together with suggestions for any further recording or investigative work which might be required prior to, during, or following such works.
- Preliminary discussions and conclusions, including an assessment of the importance of the findings in relation to the site and in the region.
- A bibliography.
- Any acknowledgements.
- Copies of selected black and white bromide prints of the site and features of interest.

- Reduced A4 or A3 copies of appropriate figures.
 - Appropriate appendices, to include a copy of the approved project design (together with the details of any departures from that design), a list of the sources consulted, and the locations, descriptions and values of the Bench Mark and survey stations.
- 10.5 All drawn records will be produced at full size (ie 1:50 or 1:500 scale) as an appendix to the main report; reduced A4 or A3 size paper copies will be included within the body of the report.

Conservation Plan Report

- 10.6 The Conservation Plan Report will contain a summary of all the material contained in the Condition Survey Report, together with outline proposals for the long-term management, preservation and enhancement of the site.

11 RESOURCES AND PROGRAMMING

Staffing

- 11.1 The project will be undertaken by EDAS using sub-contractors where appropriate. EDAS are on West Yorkshire County Council's list of approved archaeological contractors and have completed similar English Heritage-funded projects at Ayton Castle near Scarborough and Sheriff Hutton near York; proposals for a similar project at Slingsby Castle (Castle Howard Estate) are currently being considered by English Heritage. EDAS is an archaeological organisation registered with the Institute of Field Archaeologists (IFA), and is a Registered Heritage Advisor to the National Heritage Memorial Fund in relation to Archaeological Sites and Historic Buildings.
- 11.2 The project director for the work will be Ed Dennison, Director of EDAS, and he will have overall supervision and responsibility for the project. Mr Dennison is a member of the IFA, and has some 15 years experience of architectural and archaeological survey. He will be assisted by Stephen Haigh, a freelance buildings archaeologist sub-contracted by EDAS for numerous similar projects in the past.
- 11.3 The detailed topographic survey work will be sub-contracted to Benchmark Surveys of Leeds, who have considerable experience in archaeological survey and have worked with EDAS on numerous archaeological projects in the past. Mr Dennison and Mr Haigh will be involved with both the on-site survey recording and the subsequent checking of survey data.
- 11.4 The photogrammetric survey will be undertaken by Photarc Surveys of Harrogate, an established specialist company in this field who have undertaken numerous similar projects commissioned by English Heritage. The historical analysis will be undertaken by Peter Goodchild of the University of York, who is currently working with the Estate on this subject.
- 11.5 The bulk of the ecological survey work will be undertaken by Madeline Holloway, of Ecological Information Network Consultants (EINC), an agency which specialises in ecological impact statements, and community and environmental research. EINC is a full Member of the Institute of Ecology and Environmental Management (MIEEM), and Madeline Holloway has a wide range of experience in this type of work and is a specialist in barn owl and wader surveys, badger surveys, bat

handler's license, BMWP freshwater invertebrate sampling, and providing advice on other protected species. The lichen survey will be undertaken by Peter Goldsborough. He is presently undertaking doctoral research at the University of York on the botanical aspects of the conservation of ruined abbeys and castle in North Yorkshire, and he has undertaken similar lichen survey work for English Heritage on Cliffords Tower and Richmond Castle.

- 11.6 Information and advice relating to the outline consolidation recommendations and the phasing of the remedial work will be provided by Mr Peter Pace, Project Architect to the Harewood Estate. To date, the need for any specialist geological input has not been identified, but this can be provided on a daily basis if required.
- 11.7 Additional inputs and advice will be sought from members of the Harewood House Trust and the Harewood Estate, members of the Harewood Landscape Project, Mr S Moorhouse, Ms A Matthews and Mr J Reddyhoff as appropriate.

Health and Safety, and Insurances

- 11.8 EDAS will comply with the Health and Safety at Work Act of 1974 while undertaking the project. A full copy of their Health and Safety Policy is available on request.
- 11.9 EDAS and the various sub-consultants working on the project will indemnify the Harewood Estate in respect of their legal liability for physical injury to persons or damage to property arising on site in connection with the survey, to the extent of their Public Liability Insurance Cover. This will be to a minimum of £2,000,000, although EDAS are covered to £5,000,000.

Project timetable

- 11.10 A project timetable for the Condition Survey has already been discussed and drawn up with the Harewood Estate and English Heritage. It is envisaged that work will start in January 2000 and that it will be completed by July 2000. Four separate progress meetings with the client, English Heritage and other interested bodies have been allowed for during the period. Additional meetings, if required, would be charged on a pro rata basis.
- 11.11 It is envisaged that the various surveys will take place in the following order, subject to weather and access conditions:
- January: initial ecological survey and vegetation clearance around the base and interior of castle;
 - late January/February: topographical survey and photogrammetric survey;
 - late April onwards: main ecological survey;
 - May/June: bat survey;
 - June/July: condition survey and report production;
 - Intermittent throughout project: documentary research and historical analysis.

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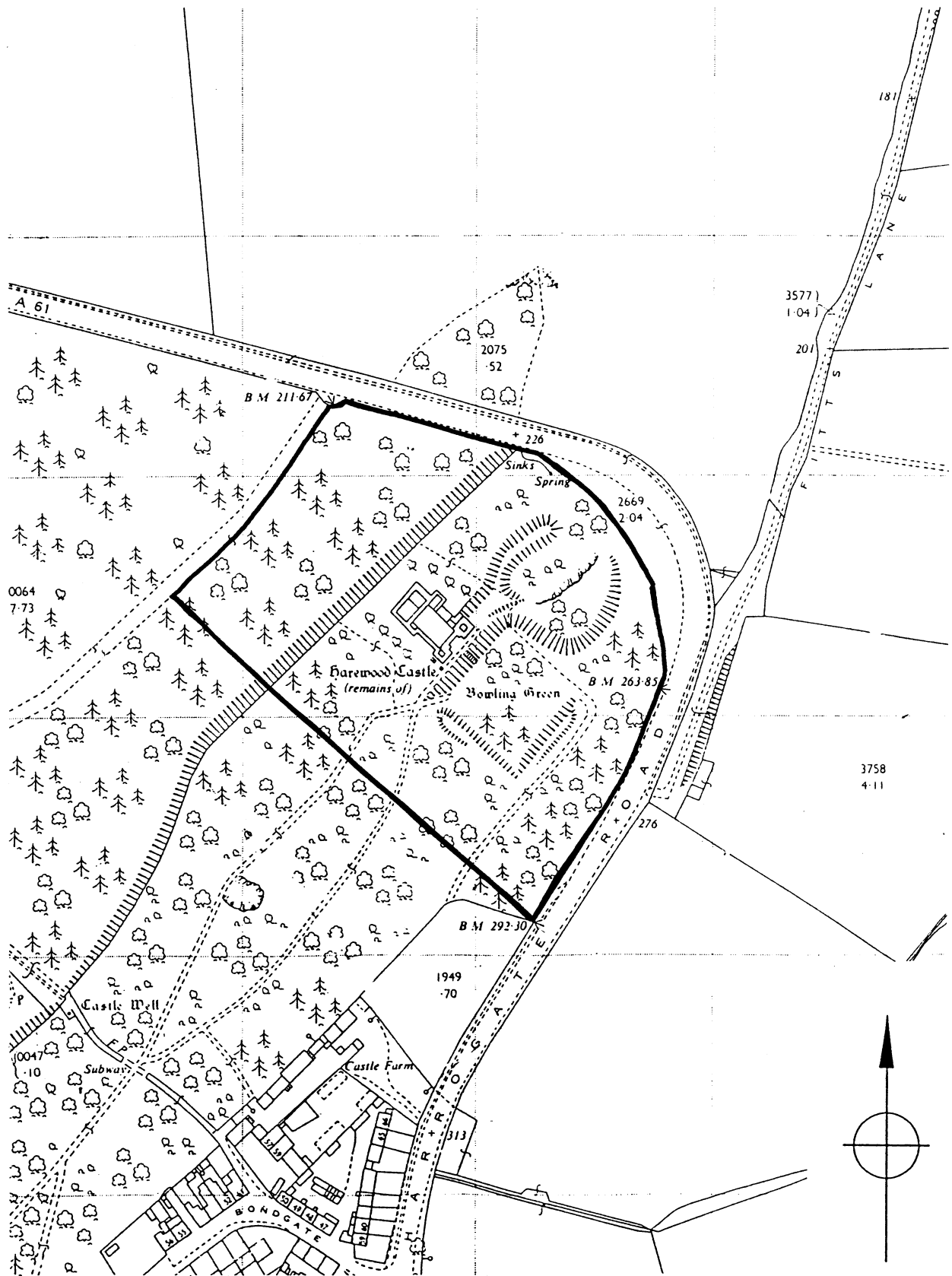
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	SCALE 1:2,500	PROJECT HAREWOOD CASTLE, WEST YORKSHIRE	EDAS
	DATE NOV 1999	TITLE AREA OF SURVEY	FIGURE 1