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Managing Landscape Change

Stage 1 Technical Report



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1. Introduction and Terms of Reference

Introduction

- 1.1 Pressure on the environment from the extraction of surface minerals, particularly aggregates, in North Yorkshire has created an urgent need for a high quality, mapped environmental dataset to assess environmental sensitivities and capacity, and to underpin informed decision-making and management of the environmental resource in areas of past, present and future mineral extraction. Such management will help ensure that key environmental issues are factored into minerals strategy development in a balanced way alongside a range of economic and social considerations. Outputs generated by the project will contribute to the production of a robust, credible yet proportionate evidence base to underpin spatial strategy development for minerals in North Yorkshire. Adequate evidencing of spatial strategies helps ensure that these strategies are rational, widely accepted by stakeholders and focused on delivery of meaningful outcomes.
- 1.2 Understanding of the capacity of an asset to accept change and the possibility of mitigation against negative aspects of change is an important tool for decision making, particularly where there are competing demands for the preservation or development of an asset. The results of this study will inform new policy and decision making and will also provide a case study of how such policies can be created and used in other areas where a multi-disciplinary approach can be used to address complex problem.

Aims and Objectives

- 1.3 The principal aim of this project, as set out in Section 1.2 of the Invitation To Tender (ITT), is thus to develop an environmental evidence base and to assess environmental sensitivities and capacity to inform a spatial planning strategy for the extraction of minerals within North Yorkshire.
- 1.4 The more detailed objectives of the contract, as set out in Section 1.3 of the ITT, are to:
- i. define mineral specific Areas of Surface Mineral Resource Potential (ASMRP) within the overall minerals resource area for North Yorkshire through the identification of the relevant geologies and their spatial extent;
 - ii. collate in GIS format available environmental data for the mineral resource areas to be studied, including historic environment, biodiversity and landscape data;
 - iii. analyse the current state of knowledge about, and sensitivity of, the environment of each area of surface mineral resource potential;
 - iv. undertake detailed environmental studies of indicative sample area(s) for each area of surface mineral resource potential, to include desk-based research, land-

use study, landform classification and descriptions of environmental associations;

- v. assess the capacity for change within each area of surface mineral resource potential and provide a strategic assessment of the degree of impact that mineral extraction would have on each;
- vi. produce a short and focused research framework for each ASMRP to guide environmental evaluation and mitigation works associated with future minerals applications; and to
- vii. produce a report and prepare a digital archive resulting from the project results, suitable for web-access.

1.5 By addressing these aims and objectives, it is intended that the project will:

- provide an improved environmental evidence base for the development of the North Yorkshire Minerals Core Strategy and to help ensure that environmental considerations can be considered on an equal basis with social and economic considerations;
- inform the development of a spatial planning strategy for the extraction of minerals within North Yorkshire;
- inform the assessment of environmental constraints and potential of areas and sites under consideration within the Minerals and Waste Development Framework (MWDF) for future mineral working;
- inform the identification of appropriate development management policies relating to mineral extraction and the environment, including policies and approaches to mitigate the impacts of mineral working;
- inform the preparation of potential Supplementary Planning Documents or other informal planning advice to guide implementation of environmental policy within the MWDF, including post-quarry restoration strategies; and
- enhance the understanding of the environment of areas of surface minerals resource potential within North Yorkshire amongst the minerals industry and the public.

The Scope of this Report

1.6 This report covers Stage 1 of the project: ***Environmental Mapping and Characterisation***. This work has involved eight key tasks, as follows:

Task 1(i): Mapping of spatial extent of Areas of Surface Mineral Resource Potential (ASMRP) – reported here in **Chapter 2**;

Task 1(ii): Historic environment data concordance – reported here in **Chapter 3**;

- Task 1(iii):* Strategic environmental mapping – reported here in **Chapter 4**;
- Task 1(iv):* Define key environmental characteristics of each ASMRP – reported here in **Chapter 5**;
- Task 1(v):* Identify and describe relationships and interactions between key characteristics of each ASMRP at a strategic level – reported here in **Chapter 6**;
- Task 1(vi):* Identify, map the spatial extent of, and describe/justify up to 12 sample areas from within the ASMRPs for further detailed study – reported here in **Chapter 7**;
- Task 1(vii):* Production of updated project design – reported separately; and
- Task 1(viii):* Production of Stage 1 Highlight Report – reported separately.
- 1.7 Output files from the Geographic Information System (GIS) analyses carried out as part of this work are presented separately.

2. Areas of Surface Mineral Resource Potential

Introduction

- 2.8 For the purposes of this analysis, the various mineral resources potentially available for future extraction by surface quarrying within North Yorkshire have been identified as '**Areas of Surface Mineral Resource Potential**' (ASMRPs). Separate ASMRPs have been defined for each of 14 types of mineral resource, as described below, and their outlines are taken directly from the digital, 1:50,000 scale, mineral resource mapping produced by the British Geological Survey (BGS).
- 2.9 In the case of the relatively recent 'superficial deposits' (those dating from or since the various ice ages of the Quaternary Period), the outlines correspond to the surface outcrops of potential resources, as mapped by the BGS. In the case of the older 'bedrock' geological formations, the outlines represent either surface outcrops or their positions beneath any overlying superficial deposits. For this reason, the two types of resource (superficial and bedrock) frequently overlap.
- 2.10 Due to differences in the level of detail at which the BGS have been able to map the resources in different areas, the accuracy of the mapping varies, especially for superficial deposits. In particular, areas in which the former Industrial Minerals Assessment Unit of the BGS carried out sand & gravel resource assessments tend to be mapped in greater detail than elsewhere. As a consequence, there are often abrupt changes in the portrayed outcrop pattern of sand & gravel deposits at the margins of these assessment sheets. This occurs primarily within the Vale of York, where the main concentrations of commercially viable sand & gravel resources are found.
- 2.11 It should be emphasised that neither the identification of ASMRPs in this report and accompanying GIS files, nor the portrayal of resources on the BGS 1:50,000 resource maps, should be taken to imply that commercially viable resources exist in those areas. Nor should it be assumed that the future exploitation of resources in any of these areas would be environmentally acceptable. Commercial viability depends on a wide range of factors and can change over time. Similarly, environmental acceptability depends on many different factors including potential impacts, public perception and the scope for mitigation. The ASMRPs merely represent areas in which viable mineral resources *may* exist. They are used in this study as a basis for examining the broad environmental sensitivity and capacity for landscape change in each area, so that these factors can be taken into account, at a strategic level, when developing plans and policies within the North Yorkshire Minerals and Waste Development Framework (MWDF).
- 2.12 Throughout this report, the term 'environmental' is used to encompass the historic environment and landscape, as well as the natural environment.

ASMRP Categories

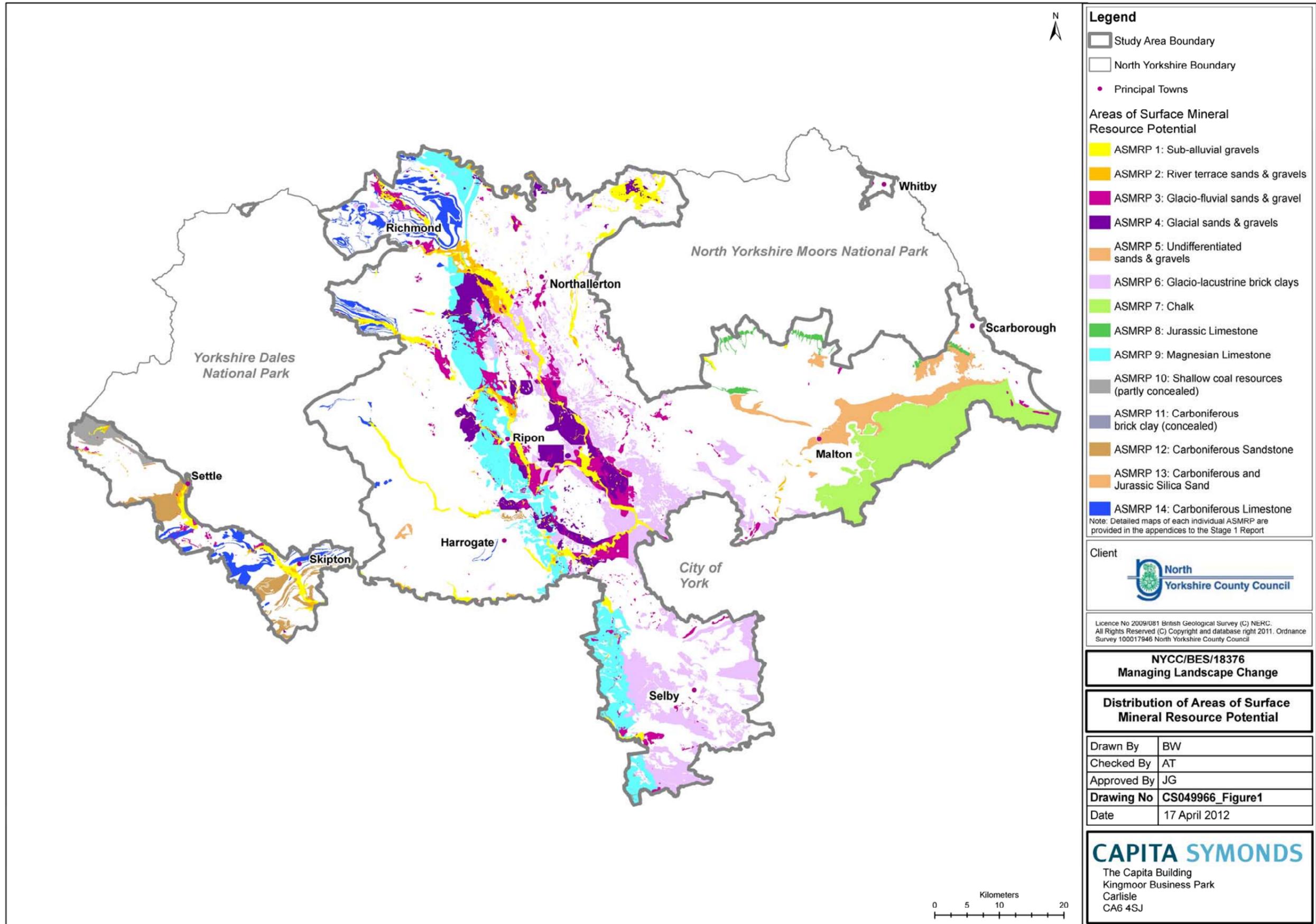
2.13 Areas of Surface Mineral Resource Potential have been defined for each of the minerals that are currently exploited by surface quarrying within the county, or which have been in the past. In sequential order of the age of the deposits (most recent first), these comprise:

- Quaternary Sand & Gravel Resources - *subdivided into*
 - sub-alluvial gravels (**ASMRP 1**),
 - river terrace deposits (**ASMRP 2**),
 - glacio-fluvial deposits (**ASMRP 3**),
 - glacial deposits (**ASMRP 4**), and
 - undifferentiated sand & gravel (**ASMRP 5**);
- Quaternary Brick Clay Resources (**ASMRP 6**), *comprising glacio-lacustrine clays and silts*;
- Cretaceous Chalk Resources (**ASMRP 7**);
- Jurassic Limestone (**ASMRP 8**);
- Permian 'Magnesian' Limestone (**ASMRP 9**);
- Carboniferous Shallow Coal Resources (**ASMRP 10**);
- Carboniferous Brick Clay Resources (**ASMRP 11**), *comprising mudstones and 'fireclay' seams associated with shallow coal*;
- Carboniferous Sandstone Resources (**ASMRP 12**);
- Carboniferous and Jurassic Silica Sand Resources (**ASMRP 13**); and
- Carboniferous Limestone Resources (**ASMRP 14**).

Please refer to **Figure 1**, CS049966_01_001_Rev1 – Areas of Surface Mineral Resource Potential, on page 10.

2.14 Each of the ASMRPs is described in further detail below but, first, it is useful to understand the geological terms which are necessary to distinguish between the different resources, and the links between these and the most common end uses for the materials concerned.

Figure 1 Areas of Surface Mineral Resource Potential



Geological Terminology and Overview of Commercial End Uses

- 2.15 The terms Quaternary, Cretaceous, Jurassic, Permian and Carboniferous refer to the specific periods of Earth history in which the deposits were laid down.
- 2.16 The **Quaternary** deposits (less than 2.6 million years old) are the youngest in this sequence. The most recent of these are the **sub-alluvial** gravels - sediments deposited by rivers, along with overlying silts and clays, during the process of creating the present-day floodplains over the last several hundred years. Slightly older than these are the sands and gravels of **river terraces**, dating from the last several thousand years, following the climatic improvement at the end of the last ice age. These are the valley-side remnants of older floodplains at higher levels, into which the present-day rivers have incised. Pre-dating the river terraces are the various deposits of the Quaternary ice ages, most of which (in North Yorkshire) relate to the last ('Devensian') glaciation, which peaked around 18,000 years ago. Those which are important in terms of mineral resources include sands and gravels laid down by glaciers (**glacial** deposits) and meltwater rivers (**glacio-fluvial** deposits), together with the finer-grained sediments which settled out in large glacial lakes at the margins of former glaciers and ice sheets (**glacio-lacustrine** deposits).
- 2.17 Sand and gravel deposits are capable of yielding a wide range of construction aggregate materials, from concreting gravels and 'sharp' concreting sands to finer-grained mortar and plastering sands. However, the suitability of each resource for these various end uses, and the ease (and therefore cost) of separating out the various size fractions depends to a large extent on the nature of the deposit and the proportion of unusable fines (silt and clay) within it. Sediments laid down by rivers are generally much better in this respect, than those laid down by former glaciers or their meltwater rivers, which tend to be less-well sorted in terms of grain size. After excavation, the deposits may need to be washed to remove excess fines and then screened into different size fractions. Typically, if the deposits have a fines content of more than about 10 to 15%, the cost of processing will be too high for them to be regarded as commercially viable resources. For this and other reasons (e.g. the thickness and extent of the deposit, the rock types of the gravels within it, the location of the deposit relative to potential markets and a wide range of environmental factors), only some parts of the sand & gravel deposits shown on the BGS maps will be suitable for commercial exploitation.
- 2.18 The glacio-lacustrine deposits, naturally winnowed-out from the coarser-grained glacial sediments by powerful meltwater rivers and discharged into large glacial lakes, provide concentrations of finer-grained silts and clays, but also sands and gravels in the form of beach deposits at some of the lake margins. Of these, the clays are sometimes used for the manufacture of bricks and tiles but, once again, this depends on a wide range of factors and not all of the glacio-lacustrine sediments shown on the BGS maps will be suitable for this purpose. Glacio-lacustrine beach deposits may sometimes provide viable resources of fine aggregate (sands) and are exploited for this purpose in parts of the Vale of Pickering (where they are mapped as '**undifferentiated sand & gravel**').

- 2.19 The terms Cretaceous, Jurassic, Permian and Carboniferous all relate to successively older time periods, extending from 65 to 359 million years before present. The deposits laid down at these times, within oceans, shallow seas and river systems, have been consolidated over time into rocks – the older of which have generally become harder and stronger compared with those which are more recent.
- 2.20 The relatively young **Cretaceous Chalk** is generally too weak and too soluble to be used as either a construction aggregate or building stone, though it can be used, with care, as general fill material, as well as for agricultural lime and in the manufacture of cement.
- 2.21 **Jurassic** and **Permian Limestones**, being older, stronger and less soluble, are capable of being used as relatively low grade construction aggregate (that is, for relatively low specification uses, largely excluding concrete and asphalt products), but have also been used extensively as building stone, due to the ease with which they can be cut, compared with older rocks. Although the outcrops of these strata in many areas include old, disused quarries where building stone was formerly extracted for local use, modern building stone production tends to be focused primarily on those parts of the resource which exhibit the thickest ‘beds’ of rock, from which the largest blocks can be cut.
- 2.22 **Carboniferous Sandstones**, particularly those of the ‘Millstone Grit Series’, are similarly used for building stone and low grade aggregate. Unlike the younger limestones, which are made up almost entirely of calcium carbonate, the sandstones comprise grains of sand made up of harder and less soluble minerals, particularly quartz, feldspars and iron. This makes the sandstones more suitable for the production of paving stones and kerbs, as well as other types of building stone where strength and durability are more important than ease of production. Thinly-bedded sandstones have also been extensively used, in the past, as roofing stones, though they are rarely quarried for this purpose now.
- 2.23 **Silica sands** within both the Carboniferous and Jurassic sequences are sandstones in which the proportion of quartz is very high, making them suitable for a variety of specialist industrial uses where high purity is important. These range from glass production to a wide range of manufacturing, horticultural and leisure applications.
- 2.24 **Carboniferous Limestones**, the oldest rocks in the geological sequence exposed within North Yorkshire (excluding the National Parks), are also the hardest. In contrast to the younger limestones, the individual grains of calcium carbonate within these rocks have been consolidated to a much greater degree over a much longer period of time and in many cases have re-crystallised to produce a denser and much harder rock. As a consequence, they are important sources of relatively high grade construction aggregate - capable of being used in more demanding situations, including the manufacture of concrete and certain asphalt products (but not those used within wearing courses on the road surface itself, where a much higher degree of resistance to polishing and skidding is required).

Resource Information for Individual ASMRPs

ASMRP 1: Sub-Alluvial Gravels

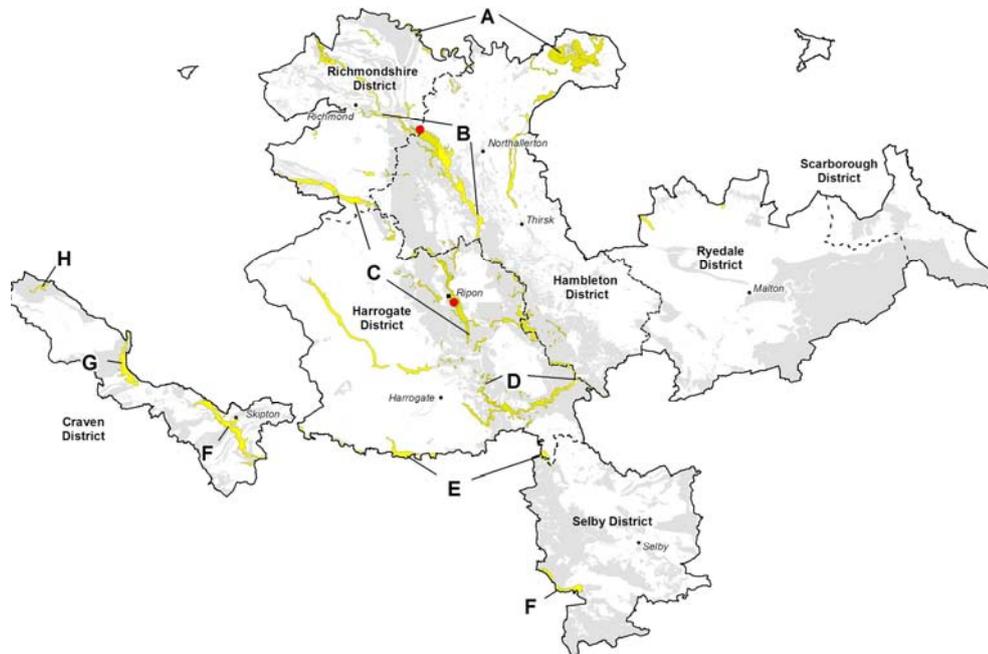


Figure 2 ASMRP 1: Sand and Gravel - Sub-alluvial Deposits.

Please also refer to Appendix 1, Drawing CS049966_01_002_Rev2 – ASMRP 1: Sand and Gravel - Sub-alluvial Deposits.

2.25 As noted above, sub-alluvial gravels occur beneath the floodplains of present day rivers, and are naturally developed to the greatest extent within the main valleys and their principal tributaries. From the north of the county to the south and west, the main areas of sub-alluvial gravels, as mapped by the BGS, are along the valleys of:

- A.** the **River Tees**, which forms the northern border of the county, and its tributary the River Leven, to the west of Great Ayton;
- B.** the **River Swale**, from Richmond in the north west to its confluence with the River Ure to the east of Boroughbridge, together with the tributaries Gilling Beck, to the north of Richmond, and Cod Beck, to the east of Northallerton;
- C.** the **River Ure**, from Leyburn to Masham and from West Tanfield through Ripon and Boroughbridge to its confluence with the Swale (continuing thereafter as the River Ouse to the county boundary);

- D.** the **River Nidd**, from Lofthouse to the north west of Pateley Bridge, to Killinghall to the north west of Harrogate, and again from Knaresborough to its confluence with the River Ouse, together with the tributary valley of Crimple Beck to the south of Knaresborough;
- E.** the **River Wharfe**, along much of the southern boundary of Harrogate District, and to the north west of Tadcaster in Selby District;
- F.** the **River Aire**, from the area north west of Skipton to Glusburn in Craven District, and again from Fairburn to Beal, along part of the West Yorkshire border with Selby District;
- G.** the **River Ribble**, to the south of Settle; and
- H.** the **River Greta**, to the south west of Ingleton.

2.26 In many of these areas, especially within the upstream sections of the valleys, the deposits are likely to be of limited commercial value because they are too thin; too limited in surface extent, or because the ratio of mineral to overburden and 'waste' (e.g. very silty or clayey layers) is too low. The upper sections of the valleys also tend to be more distant from potential markets, accessible only by relatively minor roads through numerous towns and villages and, in many cases, more sensitive in terms of landscape and environmental impacts (though this is to be the subject of further analysis later in the project). This combination of factors has influenced the current distribution of commercial extraction within these deposits, which occurs only within area B, to the East of Catterick, and within area C, around Ripon. In both cases, these locations are within a few miles of the A1, which allows good access to the markets of both Teeside, to the north, and West Yorkshire, to the south. For the same reasons, the most likely prospects for working sub alluvial deposits in future years are likely to be in similar areas, in terms of both distance from the A1 and distance upstream within the major valleys.

ASMRP 2: River Terrace Sands and Gravels

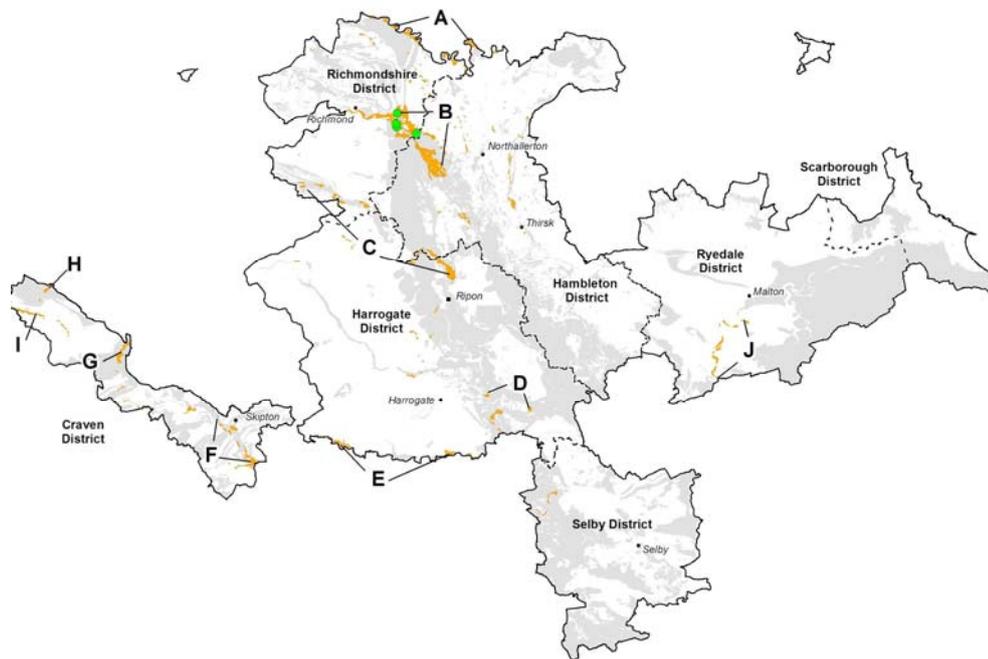


Figure 3 ASMRP 2: Sand and Gravel – River Terrace Deposits.

Please also refer to Appendix 1, CS049966_01_003_Rev2 – ASMRP 2: Sand and Gravel – River Terrace Deposits.

- 2.27 As explained above, river terraces are the remnants of older floodplains into which the present-day rivers have incised. They are therefore found, sporadically, along parts of the same major valleys, between the modern alluvium and the valley sides. In some cases they are also mapped along valleys where there are no significant alluvial deposits. The most extensive areas of mapped terrace deposits are found within:
- A.** the **Tees Valley**, to the south of Darlington;
 - B.** the **Swale Valley**, primarily between Richmond and Leeming, and the southern part of the **Cod Beck Valley**, to the north of Thirsk;
 - C.** the **Ure Valley**, sporadically to the south of Leyburn and from West Tanfield to Nunwick, to the north of Ripon;
 - D.** parts of the **Nidd Valley**, between Knaresborough and Tockwith, and the eastern part of the **Crimple Beck Valley** to the south of Knaresborough;
 - E.** parts of the **Wharfe Valley**, to the south and south west of Harrogate;
 - F.** parts of the **Aire Valley**, between Skipton and Glusburn in Craven District;
 - G.** the **Ribble Valley**, to the south west of Settle;
 - H.** the **Greta Valley**, immediately to the west of Ingleton;

- I. the **Wenham Valley**, around High Bentham; and
- J. the **Derwent Valley**, south of Malton.

2.28 Existing gravel pits within these deposits occur only in area B, between Brompton on Swale and Catterick. Subject to further investigation, and taking account of location (including proximity to the A1), additional prospects for commercial exploitation are perhaps most likely to be found elsewhere within this part of the Swale Valley and within parts of the Tees and Ure Valleys (areas A and C).

ASMRP 3: Glacio-Fluvial Sands and Gravels

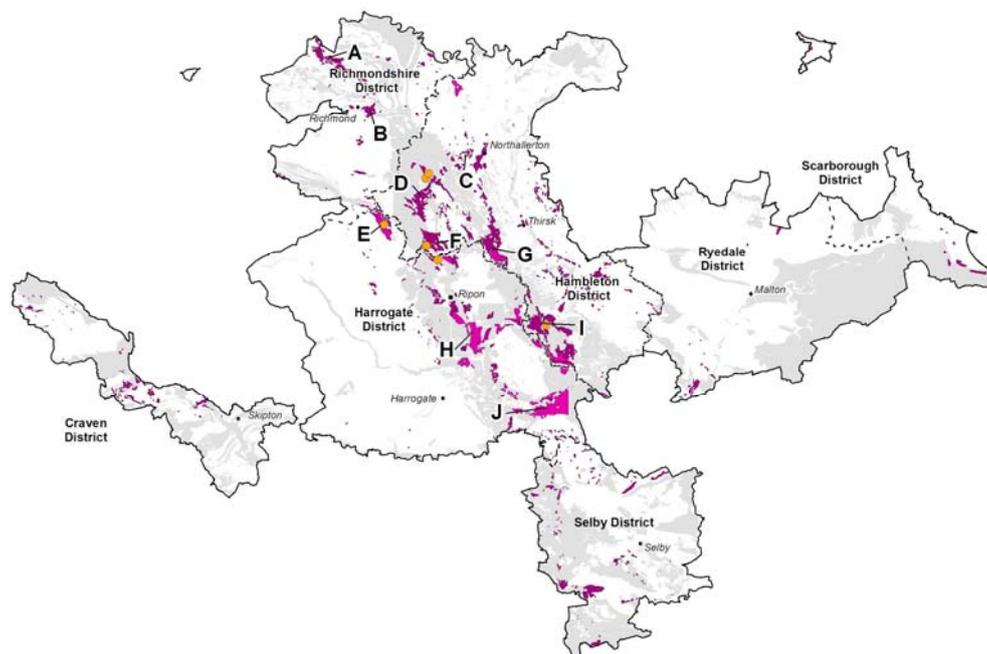


Figure 4 ASMRP 3: Sand and Gravel – Glacio-fluvial Deposits.

Please also refer to Appendix 1, CS049966_01_004_Rev2 – ASMRP 3: Sand and Gravel – Glacio-fluvial Deposits.

2.29 Glacio-fluvial sands and gravels are the deposits of meltwater streams and rivers which issued from former glaciers and ice sheets. In the last (Devensian) glaciation, valley glaciers occupied most of the major river valleys draining from the high ground of the Pennines and coalesced into a much broader ice sheet which extended across the Vale of York and down into South Yorkshire. A combined Scottish and Scandinavian ice sheet which flowed across the North Sea also impinged onto the coast of the North York Moors and East Yorkshire, extending inland from Filey across part of the Vale of Pickering. Meltwater from these various ice fronts generally followed the topography of the present-day valleys, often at a higher level, at the margins of the glaciers, and also extended across some of the 'interfluvial' areas of higher ground between the valleys. The resulting deposits have been reworked in

many places by subsequent (post-glacial) river activity, leaving behind a more sporadic pattern of glacio-fluvial sediments. From north to south the more extensive of these deposits are preserved within the following areas:

- A. the valley of **Gilling Beck**, to the north of Richmond;
- B. the Swale Valley, immediately south of **Richmond**;
- C. areas within and immediately to the south of **Northallerton**;
- D. areas to the east and south of **Bedale**;
- E. areas on the western side of the Ure Valley to the north of **Masham**;
- F. areas on the north-eastern side of the Ure Valley between **Nosterfield** and **Wath**;
- G. areas within the Swale Valley between **Leeming** and **Topcliffe**;
- H. areas on both sides of the Ure Valley downstream of **Ripon**;
- I. areas in the lower part of the Ure Valley to the east and south east of **Boroughbridge**;
- J. the lower part of the Nidd Valley, to the north of **Tockwith**; and
- K. part of the Aire Valley, between **Brotherton** and **Kellington**.

2.30 Many other smaller deposits occur sporadically throughout this general area.

2.31 The deposits are only worked, at present, at three quarries (Marfield, Nosterfield and Ripon quarry), all of which are located in the Ure Valley, within resource areas E, F and H. Subject to detailed investigation, however, opportunities for future resource development could potentially be found in any of the above-mentioned areas, especially those within reasonably close proximity to the A1.

ASMRP 4: Glacial Sands and Gravels

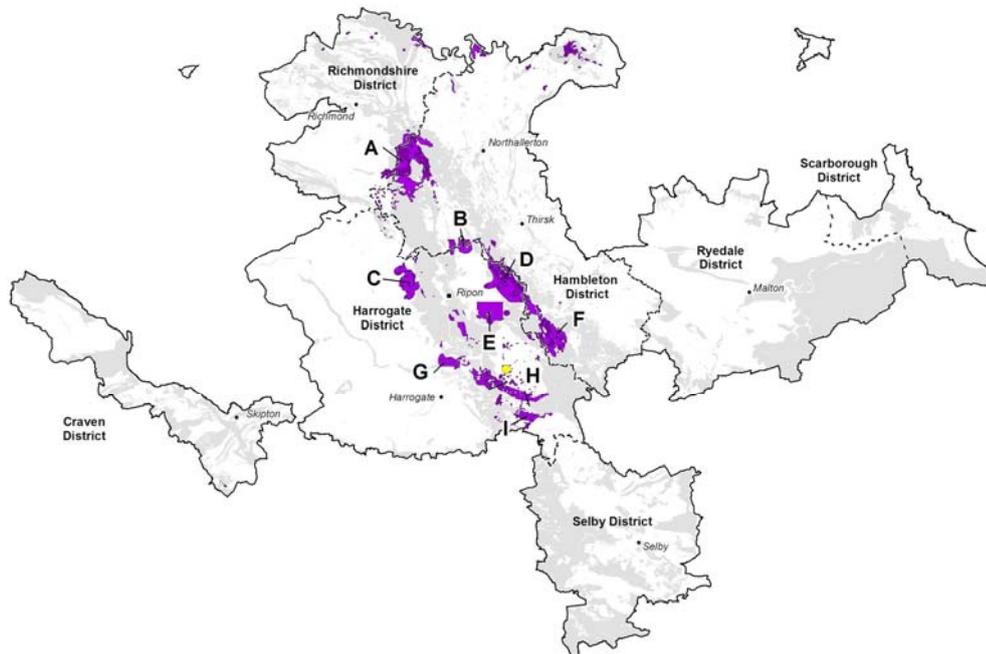


Figure 5 ASMRP 4: Sand and Gravel – Glacial Deposits.

Please refer to Appendix 1, CS049966_01_005_Rev2 – ASMRP 4: Sand and Gravel – Glacial Deposits.

- 2.32 Glacial sands and gravels are those which were deposited directly at the margins of the former glaciers, following transportation by ice. Unlike glacial till deposits ('boulder clay'), which comprise a mixture of all grain sizes, including very large quantities of silt and clay, the glacial sands and gravels have been at least partially sorted by the action of meltwater within, beneath or on the surface of the glaciers. As a consequence, the deposits offer much greater potential for commercial exploitation, although they will often have greater proportions of both fines and 'oversize' cobbles and boulders, by comparison with the better-sorted glacio-fluvial and post-glacial river sediments. In reality, there is a complete gradation from glacial sand & gravel to various types of glacial till, and the distinction between the two is often somewhat arbitrary. The glacial sand & gravel resources, as mapped by the BGS, are located primarily within and at the margins of the Vale of York, indicating successive positions of the former Vale of York glacier, as it retreated back towards the higher ground of the Yorkshire Dales at the end of the last glaciation. Within this area the deposits are preserved as residual patches (following post-glacial erosion) both within the major valleys and across many of the intervening areas. From north to south the more extensive remaining deposits are located within the following areas:

- A.** between **Catterick, Bedale** and **Leeming**;
- B.** around **Baldersby** to the north east of **Ripon**;
- C.** around **Galphay**, to the west of **Ripon**;

- D. between **Dishforth** and **Helperby** in the Swale Valley;
- E. around **Kirby Hill** to the north of Boroughbridge;
- F. between **Helperby** and **Linton on Ouse** in the lower part of the Swale Valley;
- G. between **Brearton** and **Scotton**, to the north of Harrogate;
- H. between **Knaresborough** and **Kirk Hammerton**; and
- I. between **Tockwith** and **Cowthorpe**.

2.33 Many other smaller patches of mapped glacial sand & gravel resources occur sporadically throughout this general area.

2.34 The deposits have previously been worked at two currently dormant quarries within area A (at Fairfield Farm and Leases Quarry West, to the north west of Leeming); in area F (at Myton Lane quarry, which is now closed) and in area H (at Allerton Park quarry). Once again, subject to detailed investigation, opportunities for future resource development could potentially be found in these and any of the other resource areas identified above, especially those within reasonably close proximity to the A1.

ASMRP 5: Undifferentiated Sands and Gravels

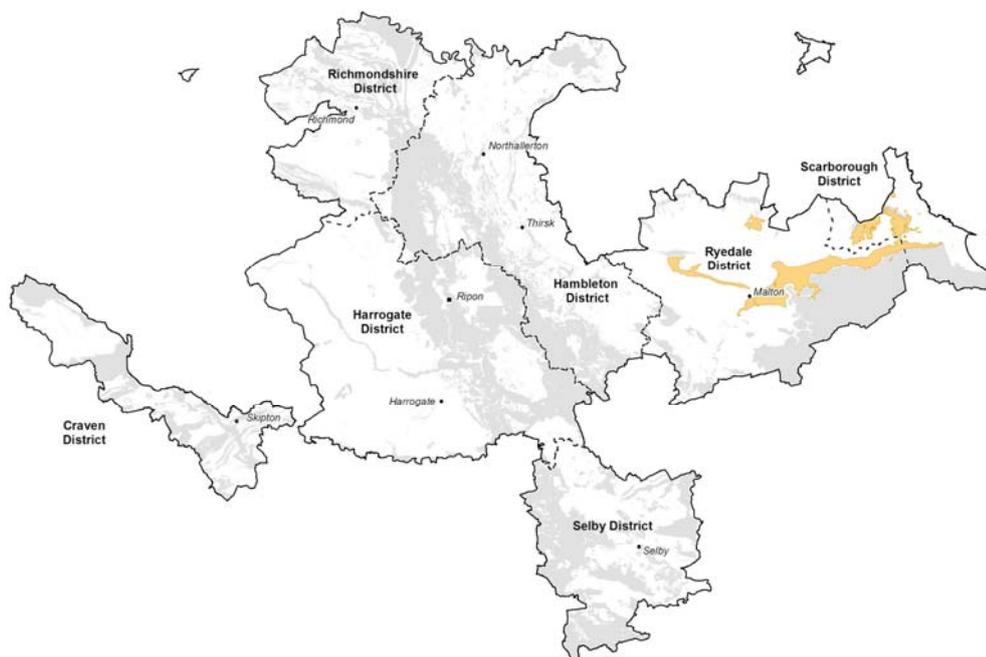


Figure 6 ASMRP 5: Sand and Gravel – Undifferentiated.

Please also refer to Appendix 1, CS049966_01_006_Rev2 – ASMRP 5: Sand and Gravel – Undifferentiated.

2.35 Undifferentiated sand & gravel resources are mapped within the Vale of Pickering and appear to correspond to (or at least to include) beach deposits formed at the margins of the

former ice-dammed glacial lake which occupied the whole of this area during the Devensian glaciation. The deposits extend continuously along the foot of the Chalk escarpment of the Yorkshire Wolds, from Norton-on-Derwent in the west to Muston, near Filey in the east. They also occur along the northern margin of the former lake to the south and west of Seamer, Wykeham and Brompton, and to the south of Pickering. A further outcrop extends along the western margin of the former lake to the north west of Malton. The deposits are currently worked at the West Heslerton sand pit in the first of these areas, and at Wykeham Quarry in the second area. A third active pit at Ings Farm Quarry near Yedingham also appears to work similar deposits, though the outcrop here is not shown on the BGS resources map and is probably concealed by younger lake sediments and/or post-glacial peat and alluvium. Future prospects for working these deposits are likely to be limited by their distance from major markets, although local supplies to towns such as Scarborough, Eastfield, Filey, Malton, Norton and Pickering will continue to be needed.

ASMRP 6: Quaternary Brick Clay Resources

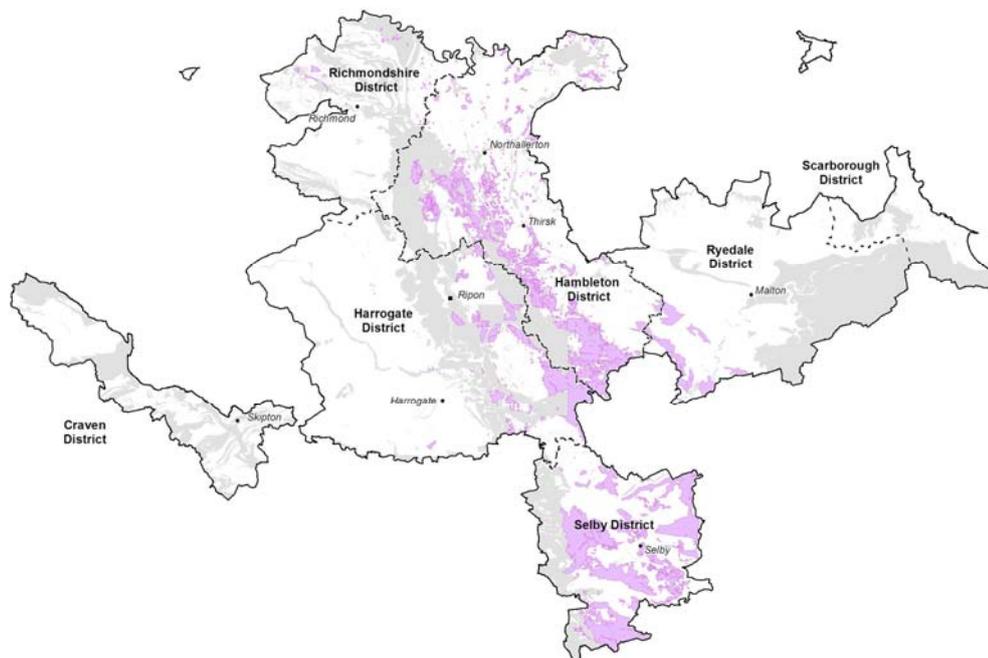


Figure 7 ASMRP 6: Brick Clay – Quaternary.

Please also refer to Appendix 1, CS049966_01_007_Rev2 – ASMRP 6: Brick Clay - Quaternary.

- 2.36 Fine-grained glacio-lacustrine sediments (clays and silts) accumulated on the beds of both large and small glacial lakes at the margins of the Vale of York glacier. Remnants of these deposits are widely preserved throughout this area, notably within the central and southern parts of Hambleton District, the eastern parts of Harrogate District, the south western part of Ryedale District and throughout much of Selby District. A succession of different lakes would have developed at different stages during the advance and subsequent retreat of the glacier, being trapped between the ice and adjoining higher ground. The suitability of individual deposits for brick-making depends once again on a wide range of factors including

grain size distribution (uniform clays being preferred), organic content, colour, and proximity to markets.

- 2.37 The deposits are currently worked for brick-making at just one site within North Yorkshire: at Alne, to the south of Easingwold. Similar deposits are worked for pottery clay at Park Hill Quarry at Littlethorpe, near Ripon and as a component of concrete block products at Hemingbrough, to the east of Selby (the manufacturing taking place at Great Heck).

ASMRP 7: Cretaceous Chalk Resources



Figure 8 ASMRP 7: Chalk – excluding concealed.

Please also refer to Appendix 1, CS049966_01_008_Rev2 – ASMRP 7: Chalk – excluding concealed.

- 2.38 The Chalk deposits of the Yorkshire Wolds represent an extensive resource that has been used in the past as a source of both agricultural lime and (in neighbouring East Yorkshire and Humberside) for cement manufacture. Within North Yorkshire the Chalk has most recently been worked at Knapton Quarry, to the east of Norton and at Flixton Quarry to the north west of Hunmanby, but neither of these appears to be active at the present time. Future workings are likely to be inhibited by the distance of these resources from principal construction markets, by comparison with the resources available at South Ferriby on the Humber Estuary, which are still used extensively for the production of cement.

ASMRP 8: Jurassic Limestone Resources

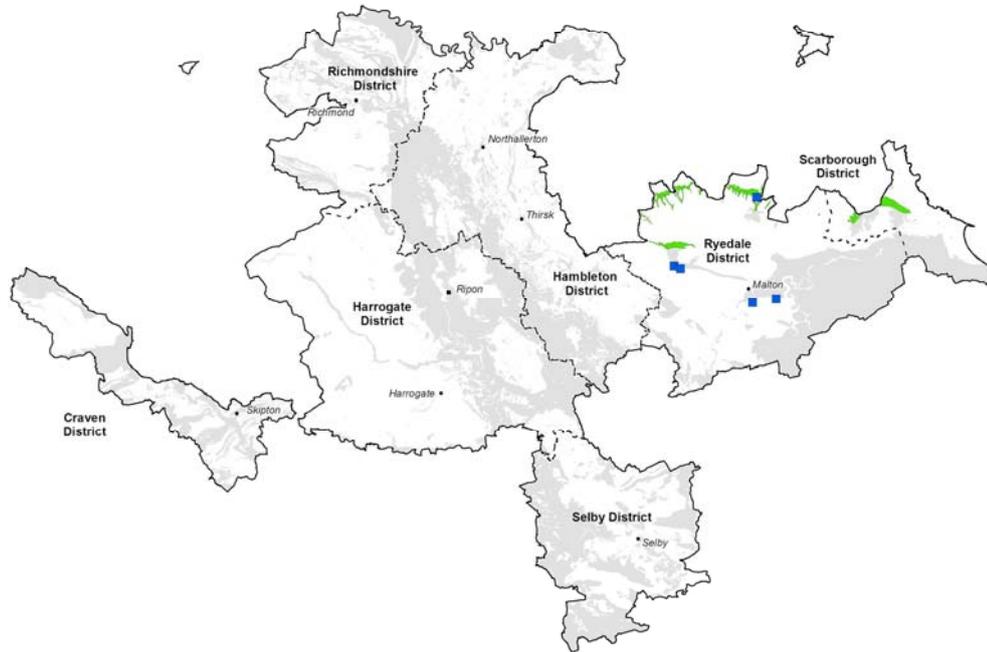


Figure 9 ASMRP 8: Limestone – Jurassic

Please also refer to Appendix 1, CS049966_01_009_Rev2 – ASMRP 8: Limestone – Jurassic.

- 2.39 Jurassic Limestones occur within the southern part of the North York Moors, partly within the National Park and partly within North Yorkshire. The latter outcrops are found between Helmsley and Pickering in the west, and to the north of Seamer in the east. The quarry at Newbridge, to the north of Pickering, produces crushed rock aggregates from the Upper Calcareous Grit formation which directly overlies the limestone, but the limestone itself, formerly used as a local building stone, is no longer worked in this area, except on a very local scale from intermittently active quarries. Further south within Ryedale District, in areas which are not identified on the BGS resource maps, the Jurassic Limestone ('Malton Oolite') is, or recently has been, worked at four locations around Malton (Hovingham, Wath, Whitewall and Settrington quarries). The Hovingham site is not currently being worked, having been mothballed for several years. Again, these workings are primarily geared towards relatively low-grade crushed rock aggregate production, rather than building stone.

ASMRP 9: Permian 'Magnesian' Limestone Resources

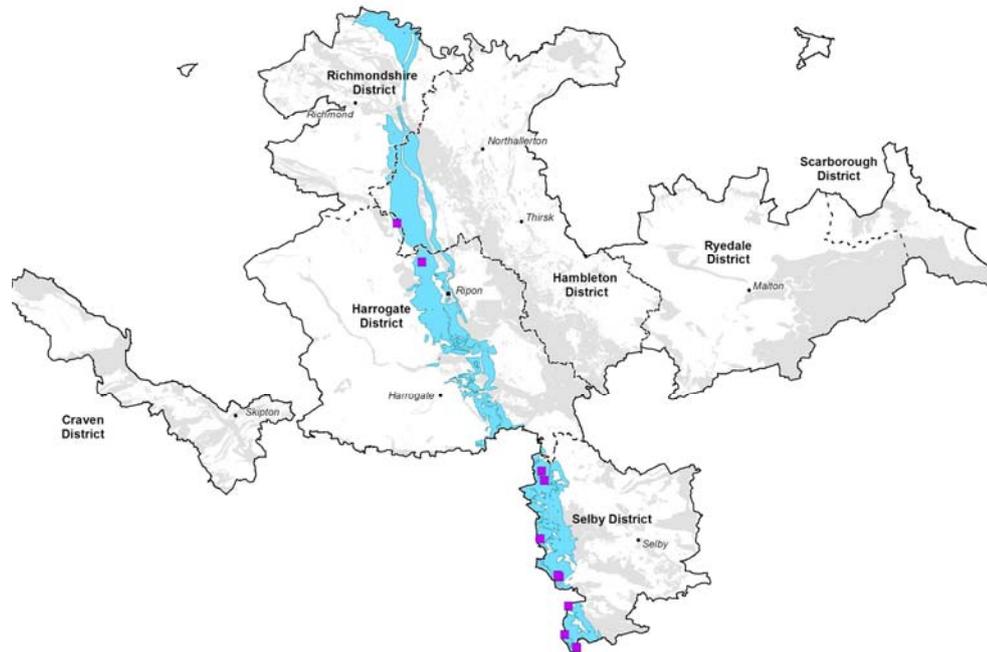


Figure 10 ASMRP 9: Limestone – Permian.

Please also refer to Appendix 1, CS049966_01_010_Rev2 – ASMRP 9: Limestone – Permian.

- 2.40 The Magnesian Limestone is primarily a dolomite rather than a true limestone, as it is made up of magnesium carbonate as well as calcium carbonate. The difference allows it to be used for a variety of industrial applications, notably in steel and glass-making, and as a source of agricultural lime. The rock has also been used extensively in the past as a source of building stone for many prestigious architectural projects, within Yorkshire and elsewhere, and is still used for this purpose to some degree, but the primary use today is as a construction aggregate. The resource comprises two geological formations: the Cadeby Formation, which tends to be massively bedded, and the most suitable for building stone production (as well as aggregates) and the thinner and more thinly-bedded Brotherton Formation, which occurs higher in the Permian sequence, outcropping further east. The two outcrops run more or less parallel to each other in a narrow and almost unbroken belt which extends throughout North Yorkshire, from the area around Manfield in the north of Richmondshire to the area around Kirk Smeaton in the south of Selby District. The resource continues northwards into County Durham and southwards into South Yorkshire and Nottinghamshire.
- 2.41 Throughout its length, the Magnesian Limestone outcrop lies close to the A1 road, giving good access to major construction markets. For this reason, it has been extensively quarried. Although some parts of the resource (notably in South Yorkshire) are capable of yielding high quality aggregate that is suitable for use within concrete products, most of the Permian Limestone quarries within North Yorkshire produce relatively low grade aggregate that is used primarily as sub-base material in road construction and as general fill. Eleven

separate quarries are currently operating. From north to south these are: Gebdykes near Masham; Potgate near Ripon; Jackdaw Crag near Tadcaster; Newthorpe near Sherburn in Elmet; Brotherton and Foxcliffe to the east of Castleford; Darrington, to the east of Pontefract; Went Edge near Wentbridge; and Barnsdale Bar / Long Lane near Kirk Smeaton.

ASMRP 10: Carboniferous Shallow Coal Resources



Figure 11 ASMRP 10: Coal – excluding tertiary.

Please also refer to Appendix 1, CS049966_01_011_Rev2 – ASMRP 10: Coal – excluding tertiary

- 2.42 Shallow coal resources, potentially suitable for opencast extraction or shallow mining, occur within the Carboniferous coal measure sandstone outcrops between Ingleton and High Bentham in Craven District. They are classified by the BGS as being of secondary importance, comprising thin, widely-spaced coal seams. Around and to the north west of Ingleton itself, the coal is concealed by up to 50m of overburden, making it suitable only for underground mining. Whilst these resources have been worked in the past they are no longer viable, and their relatively small scale (compared to the extensive resources of both opencast and deep coal in other coalfield areas) is such that they are unlikely to be exploited in the foreseeable future.
- 2.43 Shallow coal, concealed by up to 50m of overburden (including the overlying Magnesian Limestone resources) is also shown on the BGS resource maps along the western boundary of Selby District, to the south of Tadcaster. These resources represent an easterly continuation of the exposed outcrops (including primary opencast resources) which occur immediately to the west, within West Yorkshire and South Yorkshire. The same resources

also continue further east at greater depth, within the Selby Coalfield, where coal was extensively worked by deep mining until 2004. Given their proximity to these other resources, it is again considered unlikely that the shallow coal within Selby District will be exploited in the foreseeable future.

ASMRP 11: Carboniferous Brick Clay Resources



Figure 12 ASMRP 11: Brick Clay – Carboniferous.

Please also refer to Appendix 1, CS049966_01_012_Rev2 – ASMRP 11: Brick Clay - Carboniferous.

- 2.44 Seams of mudstone and ‘fireclay’ which occur within the Carboniferous coal measures have been extensively worked, as raw materials for brick and tile making, in most coalfield areas of the UK. Such resources occur, in close association with the shallow coal resources, along the western edge of Selby District. However, as noted above, the coal measures are concealed beneath a significant thickness of overburden, including Permian Limestone resources.
- 2.45 Fireclays, which occur in thin beds directly beneath individual coal seams, have always been extracted as a bi-product of coal production, and their future extraction is therefore intimately dependent on that of the coal. As explained above, the likelihood of future shallow coal extraction in North Yorkshire would seem to be very limited.
- 2.46 Other mudstones within the coal measure rocks, which occur in much thicker seams or beds, are capable of being worked separately, where they occur at or near the surface. Although clay pits of this type are to be found in neighbouring parts of West and South Yorkshire, the

fact that the coal measure mudstones are not exposed in North Yorkshire means that there are no such pits in this area.

ASMRP 12: Carboniferous Sandstone Resources



Figure 13ASMRP 12: Sandstone.

Please also refer to Appendix 1, CS049966_01_013_Rev2 – ASMRP 12: Sandstone.

- 2.47 Sandstones occur throughout the Carboniferous coal measure series and have been utilised in the past for walling stone but are no longer commercially exploited. Better quality building stone is obtained from some of the sandstones towards the top of the underlying Carboniferous Millstone Grit series, and it is these which are picked out on the BGS resources map and represented by ASMRP 12. It should be noted that these outcrops form only part of the Millstone Grit which, overall, has a much wider distribution across much of western moors of North Yorkshire. The identified resources crop out within parts of Craven District, primarily to the south-east of Settle and to the south of Skipton. A separate outcrop occurs directly to the north of Harrogate and Knaresborough. None of these outcrops are currently worked however, either for aggregates or building stone, although there may be intermittently worked quarries in some areas that are used as sources of stone for the repair of local historic buildings.
- 2.48 There are however, a number of sandstone quarries listed by the BGS in North Yorkshire, which fall outside the selected outcrops that are shown on their resource maps. These comprise Green Bank Farm, Carkin Moor and Gatherley Moor quarries, to the north of Richmond, which all work sandstones of the Alston Formation; Grey Yaud quarry, between Leyburn and Masham and Home Farm quarry, to the south of Harrogate, which both work

the Follifoot Grit, and Killinghall quarry, to the north-west of Harrogate, which is now closed but formerly worked the Lower Plompton Grit. Both the Follifoot Grit and the Plompton Grit form part of the Millstone Grit Series, whilst the sandstones of the Alston Formation form part of the underlying Yoredale Series – an alternating sequence of sandstones, shales, limestones and occasional thin coal seams. In all cases these sandstones are worked primarily for use as local building stone.

ASMRP 13: Carboniferous and Jurassic Silica Sand Resources



Figure 14 ASMRP 13: Silica.

Please also refer to Appendix 1, CS049966_01_014_Rev2 – ASMRP 13: Silica.

- 2.49 Two, separate, small areas of silica sand resources are identified on the BGS maps. The first of these, around the village of Blubberhouses, to the west of Harrogate, forms part of the Carboniferous sandstone sequence. The deposit has been worked in the past (c. 20 years ago) and the deposits there are capable of producing sand of sufficient quality for glass manufacture, subject to chemical processing, but the quarry lies within the Nidderdale Area of Outstanding Natural Beauty and is not currently active. The second area is located at Burythorpe, to the south of Malton in Ryedale District, and forms part of the Jurassic Scalby Formation. Silica sand is produced here for ceramic, construction, sports and leisure markets and for the production of resin-coated sand for foundry applications. In both cases, the prospects for future resource development are extremely limited by the extent of the outcrops involved.

ASMRP 14: Carboniferous Limestone Resources

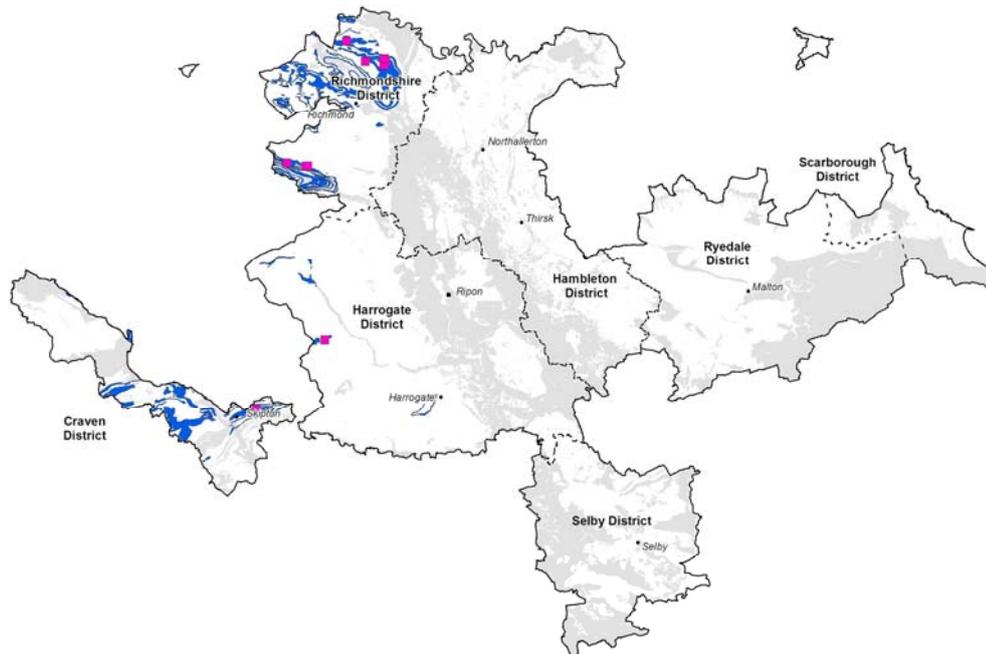


Figure 15 ASMRP 14: Limestone – Carboniferous.

Please also refer to Appendix 1, CS049966_01_015_Rev2 – ASMRP 14: Limestone – Carboniferous.

- 2.50 Carboniferous Limestone occurs within the central part of Craven District, between and to the south of Settle and Skipton and more extensively within Richmondshire District, primarily to the south and west of Leyburn and to the north and west of Brompton on Swale and Richmond. Smaller outcrops occur to the south west and north-west of Pateley Bridge in Harrogate District.
- 2.51 Given the importance of hard Carboniferous Limestone as a major source of construction aggregate, the deposits are quarried in all of these areas. In Craven, the only currently active quarry is that of Skipton Rock, located to the north-east of Skipton. In Harrogate District, limestone is worked at Pateley Bridge Quarry. In the Leyburn area there are two quarries (Wensley and Leyburn) and in the north of Richmondshire there are a further five quarries (Forcett, Low Grange, Melsonby, Barton and Duckett Hill). As an indication of their importance, six of these ten quarries are operated by major aggregate companies (Tarmac, Hanson and Cemex UK) and a further two are operated by a regionally important independent firm (Sherburn Stone).
- 2.52 All of the resources described above provide both existing and potential future sources of high quality construction aggregate, with the possible exception of some of the thinner limestones within the Yoredale Series, which may not be economically viable.

- 2.53 In addition to the 'normal' varieties of Carboniferous Limestone, the area around Ingleton in Craven District includes small outcrops of high purity limestone (containing more than 97% calcium carbonate). Such deposits are valued for use in a range of industrial applications, and are extensively developed within both the Yorkshire Dales and Peak District National Parks, but are not currently worked in the Ingleton area. The prospects for such workings in future will be limited by the small outcrop size and their location immediately next to the National Park boundary, but might need to be considered.

3. Historic Environment Data Concordance

Introduction

- 3.54 With the aim of providing a comprehensive and succinct overview of the heritage resource in North Yorkshire, a wide range of evidence relating to the historic environment was brought together in a process of Historic Environment Data Concordance. Spatial datasets were organised and queried in a Geographical Information System (GIS) to create a single, distilled data layer depicting Areas of Historic Environment Interest and Potential (AHEIP).

Geographic Information System Terminology

- 3.55 Within this chapter and elsewhere throughout the report, there are references to features and processes relating to the analysis of spatial data within the Geographic Information System (GIS) that has been developed as part of this work. The following details provide an explanation of some of the terms which are frequently used.

Attribute Table A tabular file containing information about a set of geographic features. In a Geographic Information System (GIS) attribute tables are joined or related to the spatial data layer.

Centroid The geometric centre of a feature.

Geographic Information System An integrated collection of computer software and data used to view and manage information about geographic places and analyse spatial relationships.

Metadata Data about data. Metadata describes how and when and by whom a particular set of data was collected and how the data is formatted.

Normalisation The process of organising, analysing and cleaning data to increase efficiency for data use.

Polygon A polygon in GIS is a map feature that bounds/represents an area at a given scale.

Spatial Proximity Analysis A type of analysis / spatial query in which geographic features are selected based on their distance from other features.

Spatial Query A statement or logical expression that selects geographic features based on location or a spatial relationship.

Methodology

- 3.56 The process was intended to incorporate all pertinent heritage-related digital sources with a view to providing an analytical assessment of the archaeological density and heritage potential across the study area. The data were represented graphically within a GIS which provided a basis for both characterising the historic environment within each ASMRP (see Chapter 5), highlighting the significance and density of the heritage resource and for the objective selection of representative sample areas for more detailed investigation in Stage 2 of the project (see Chapter 7).
- 3.57 Heritage-related digital data were captured for the wider study area (extending across much of North Yorkshire). Each data source was assessed for its potential to contribute to the production of an AHEIP layer, which represented the character of the heritage resource within discrete areas, defined by polygons, that coincided with areas of surface mineral resource. Historic Landscape Character (HLC) polygons were used as they provided groupings of present day land use that in general are of broadly comparable size. In practice, there were some extremely small HLC polygons (less than 10ha) and these were excluded from the process as they were unlikely to provide much relevance at the broader level. Within each HLC polygon the number of monuments; their date and their status was scored (as described in detail below) to provide a combined assessment of the number and significance of the heritage resources within each HLC polygon. The method is a variation of one originally applied by the Lynher Valley project (Cornwall Archaeology Unit 2002 and subsequently during the Ribble ALSF project (OA North and University of Liverpool 2007; Cook *et al* 2008). The principles of the Archaeological Data Services Guide to Good Practice for creating GIS data (Gillings and Wise 1998) were adopted and the metadata were created using Version 2 of the UK Gemini Specification for Geographical Metadata (Walker 2010). This is a relatively broad brush approach to assessing the heritage resource but has the benefit of being straightforward and quick to apply. It provides a clear indication of the historic character of the resource across the county. HLC is a key English Heritage programme for managing change to the 'historical and archaeological dimensions of the living landscape' (Aldred and Fairclough 2003) and, as such, is a suitable starting point for landscape-wide studies. However, experience in the North West Regional Landscape Characterisation Framework (OA North 2010) indicates that HLC data can be too detailed for county-wide assessment. To eliminate unnecessary granularity, the HLC was stripped of all unnecessary attribute data and was generalised within the GIS so that adjacent polygons with identical attributes were merged into single features.
- 3.58 The steps involved in processing the historic environment data were as follows:

Stage 1: Data Capture

- 3.59 The following datasets were captured and incorporated into the GIS:
- Historic Landscape Character (HLC)

- Historic Environment Record (HER)
- National Monument Record (NMR)
- Register of Listed Parks and Gardens
- Register of Listed Battlefields
- Scheduled Ancient Monuments (SAM)
- List of Buildings of Special Architectural and Historic Interest
- World Heritage Sites (Fountains Abbey/Studley Royal)
- Portable Antiques Scheme database

- 3.60 An assessment of the datasets was undertaken to examine the potential for each to contribute to the resource analysis. The HER data was found to overlap considerably with the NMR data, necessitating a rationalisation process (see Stage 2, overleaf) to eliminate duplication, which would otherwise have distorted the results.
- 3.61 It had been the intention to also use information from the National Mapping Project but that data was not made available to us in time to be included in the analysis. It will, however, be utilised in later stages of the project.
- 3.62 In consultation with the administrators of the Portable Antiquities Scheme, geolocated finds data was made available on a site selective basis but not at a county-wide level. This meant that it could be used to inform the character of the sample areas but not at a wider level sufficient to inform the selection of the sample areas.
- 3.63 The potential for listed buildings to inform the overall assessment of historic environment resources was examined and discussed at length with the project team and with the client during the Stage 1 Workshop. It was considered that the use of this dataset would provide an excessive bias of the results towards urban areas and to the post-medieval period. The intention was to be more inclusive and to represent the heritage across both rural and urban areas and across all time periods. For these reasons, the listed buildings data was excluded from the normalisation and scoring process but was retained as a layer within the GIS project to be referred to independently of the scoring.
- 3.64 Scheduled sites are all of national importance and need to be given due recognition within the scoring process to reflect this. Similarly, the Register of Parks and Gardens identifies some of the more important designed landscapes within the study area and is a product of a systematic nationwide survey. As such, the Register is an objective selection of the more significant of these landscapes. Similarly, the Register of Listed Battlefields reflects important historic events at a national level, even though the extant archaeological remains may be limited. It was recognised that due weight should be given to the landscapes within both registers within the scoring process.

Stage 2: Rationalisation of the HLC Polygons

- 3.65 A process of rationalisation of the Historic Landscape Characterisation dataset was undertaken to provide a more uniform coverage of the study area that would allow the pertinent attribution of heritage data within the GIS. Points and lines were excluded, as part of this process, leaving only the polygon data. The HLC data were clipped in the GIS to exclude the areas covered by York and the two National Parks. HLC polygons smaller than 10ha were excluded from the dataset. In addition, where there were adjacent small polygons with identical attributes, these were merged to reduce the granularity. HER and NMR data were compared and duplicates were identified based on spatial coincidence and internal cross referencing. Where duplication occurred, the relevant NMR sites were omitted from the data set.

Stage 3: Selecting Relevant HLC Polygons

- 3.66 A spatial query was run to establish the degree of overlap between the HLC regions and the combined footprint of all 14 ASMRPs. HLC polygons that were contained within, or which overlapped with any part of this combined footprint (including a 1km buffer zone around it) were retained for use in the analysis. All other polygons were excluded.

Stage 4: Merging Polygons with Heritage Resource.

- 3.67 The HER / NMR data was uploaded and monuments that were either wholly or partly within the boundary of each HLC polygon were incorporated as attributes to the HLC polygon. A centroid was produced for each HER item in each HLC polygon. A similar strategy was undertaken for the scheduled monuments, World Heritage Sites and the Registers of Battlefields and Parks and Gardens. A limited number of attributes from each site or monument was incorporated into the HLC polygons, including monument number coordinates, period, period qualifier, monument type and designated status.

Stage 5: Rationalising the Dates

- 3.68 The North Yorkshire HER has 417 date categories which include every possible combination of date and date range. Before any analysis could be undertaken it was therefore necessary to rationalise these down to a limited range of only nine date periods. Where the HER date range was too generalised (for example Roman to Modern) then it was categorised as unknown. In order to simplify the scoring procedure, some prehistoric periods (e.g. Iron Age and Bronze Age) were combined. The final, simplified date categories are as follows:

- Modern
- Unknown
- Post-medieval
- Medieval / Post-medieval
- Medieval

- Early Medieval
- Roman
- Iron Age / Bronze Age
- Mesolithic/Neolithic

Stage 6: Scoring

3.69 An analytical stage was undertaken which defined the numbers of HER / NMR monuments within each HLC polygon. The initial search made no distinction between any monuments, in respect of period or significance. A scoring system was therefore developed to 'normalise' the dataset and to make allowance for the fact that post-medieval monuments, for example, are typically more common and, as such, can be considered of lesser archaeological importance. Ranking was provided for rarer and by implication, more significant monuments. A Neolithic site thus has a significantly higher score than a post-medieval site, as indicated by the scoring system below.

Period Scores:

Period	Score
Modern	0
Unknown	1
Post-medieval	1
Medieval / Post-medieval	2
Medieval	3
Roman	3
Iron Age / Bronze Age	3
Early Medieval	4
Mesolithic / Neolithic	4

3.70 As a separate process, additional scores were given to designated features, using the system shown below.

Designation Scores:

Designation	Score
Parks and Gardens	4
Battlefields	4
Scheduled Ancient Monuments	5
World Heritage Sites	5

Historical Mineral Extraction Sites

2

- 3.71 For each scheduled monument there will also be an HER / NMR entry, which is separately scored and the total score for each HLC polygon is the addition of both the period and the designation scores. For example, a prehistoric scheduled monument would gain a total score of 9 (4+5).
- 3.72 The scoring procedure was thus implemented separately on the basis of both period and designation and the resultant scores were defined as an attribute column within the HLC polygons; a further column reflected the combined score. The total of the combined score, for each HLC polygon, represents the numerical definition of scoring and reflects not only the numbers of monuments within the HLC polygon but also their period and status. The adoption of the scoring system was discussed amongst the project team and was approved at the Stage 1 workshop.

Stage 7: Density

- 3.73 The HLC polygons are not of a uniform size and it was therefore necessary to express the total scores in terms of 'densities', i.e. scores per unit area, for each polygon. This was simply obtained by dividing the combined total score (defined in Stage 6 above) by the area of the HLC polygon to produce a density of combined score per km². This was defined as a separate attribute column within the HLC polygons. This combined layer of HLC polygons, with density scored according to period and designation defines the **Areas of Historic Environment Interest and Potential (AHEIPs)**. A high scoring AHEIP polygon typically reflects an area with many pre post-medieval sites.

Stage 8: Correlating the HLCs with ASMRPs

- 3.74 In order to provide a quick, broad indication of the relative importance of heritage resources within each of the mineral resources, a simple correlation exercise was undertaken within the GIS which highlighted the coincidence between the ASMRP and HLC polygons. A mean density AHEIP score for all the HLCs linked to each ASMRP polygon was thus compiled and included as an attribute for the ASMRP polygon concerned within the GIS.
- 3.75 In practice it was found that many of the mineral polygons were extremely large, so this process of correlation provided only a much generalised indication of the heritage resource within each ASMRP. A more detailed perspective was obtained by examining the AHEIP density scores within the individual HLC polygons within each ASMRP, which had much greater granularity and this approach was therefore used in selecting the sample areas (see Chapter 7).

Results

- 3.76 Full results of the analyses can be viewed in the attribute table of the output AHEIP data layer. *Table 1*, below, summarises the overall differences between each ASMRP in terms of the percentages of associated HLC polygons falling within each of eight classes of AHEIP Density Scores. The high scores associated with ASMRP 5 (within the Vale of Pickering) and

ASMRP 7 (the Yorkshire Wolds) is particularly notable. The high scores for ASMRP 13 (silica sand) are distorted by the very small area involved.

Table 1: Summary percentage of HLC polygons falling within each AHEIP Density score classes, for each ASMRP

AHEIP Density Score:	0	0-5	5-10	10-20	20-50	50-100	100-1000	1000-2000
ASMRP								
1	27.55	20.09	14.16	16.25	12.95	5.71	3.29	0.00
2	26.30	21.09	13.26	16.74	12.39	5.22	5.00	0.00
3	29.09	23.38	16.92	12.17	11.98	4.18	2.28	0.00
4	28.61	20.25	14.54	15.30	13.02	5.04	3.14	0.10
5	12.45	8.58	18.03	16.31	25.32	11.16	7.73	0.43
6	34.46	23.37	16.55	12.69	8.43	2.81	1.61	0.08
7	12.61	8.11	10.36	13.06	30.63	14.41	10.81	0.00
8	22.79	7.35	14.71	16.91	24.26	8.82	5.15	0.00
9	24.01	16.05	15.17	16.94	17.08	6.48	4.27	0.00
10	41.18	19.61	9.80	10.78	16.67	1.96	0.00	0.00
11	25.00	12.50	7.50	15.00	32.50	7.50	0.00	0.00
12	36.29	35.48	11.29	10.48	4.84	1.61	0.00	0.00
13	0.00	0.00	20.00	10.00	45.00	15.00	10.00	0.00
14	28.71	22.28	12.62	14.85	12.13	5.45	3.96	0.00

4. Strategic Environmental Mapping

Introduction

- 4.77 To facilitate a broad and strategic understanding of the key characteristics of each ASMRP, a number of spatial datasets pertaining to the natural and historical environment, along with the landscape character, were collated and organised within a GIS. By bringing together the data from a number of disparate sources, a robust multi-disciplinary evidence base was established, upon which the characteristics, interactions and relationships could be explored through a series of spatial analyses.

Methodology

Stage One: Collation of Spatial Datasets

- 4.78 *Table 2*, below, provides a summary of spatial datasets collated in the GIS and a short description of the areas they represent:

Table 2 Summary of Spatial Datasets

Data/Resource	Description	Source
Areas of Surface Mineral Resource Potential (ASMRPs)	14 ASMRP layers as defined in Chapter 2 of this report, derived from 1:50,000 scale digital resource map data	British Geological Survey (BGS)
International Designations – Statutory		
World Heritage Sites (WHS)	Sites inscribed on the World Heritage List by UNESCO, for their globally important cultural or natural interest.	English Heritage
Special Protection Areas (SPAs)	Areas designated under the EU Wild Birds Directive and managed for the protection of rare or endangered bird species.	Natural England
Special Areas of Conservation (SACs)	Areas designated under the EU Habitats Directive and managed for the protection of important and/or rare habitats for a wide range of wildlife species.	Natural England
Ramsar Sites	Important wetland areas designated under the international Ramsar Convention and managed for nature conservation purposes.	Natural England
National Designations – Statutory		
Areas of Outstanding Natural Beauty (AONBs)	Areas recognised for their natural beauty incorporating their wildlife, cultural heritage, landscape and scenery.	Natural England
National Nature	Nationally designated areas containing	Natural England

Reserves (NNRs)	important natural and semi-natural terrestrial and coastal ecosystems, managed for nature conservation purposes	
Sites of Special Scientific Interest (SSSIs)	Nationally designated areas containing some of the UK's best examples of flora, fauna and/or geological or geomorphological features, and managed for their conservation.	Natural England
Scheduled Ancient Monuments (SAMs)	Nationally important sites and monuments, protected against unauthorised change.	English Heritage
Parks and Gardens	Significant designed landscapes designated for their historic/cultural importance.	English Heritage
Listed Buildings (points and areas)	Buildings listed for their special architectural and historical interest.	English Heritage
National Designations – Non-Statutory		
Heritage Coasts	Sections of coast recognised for their exceptional scenic quality, containing features of special significance and interest.	Natural England
Ancient Woodlands	Areas of woodland which have existed continuously for the last 400+ years and of special interest due to the diversity of species which they contain.	Natural England
Battlefields	Sites of important English battles, recognised for the topographical and archaeological evidence they contain and the turning points they mark in English history.	English Heritage
Local Designations – Non Statutory		
Sites of Importance for Nature Conservation (SINC)	A local designation which recognises important nature conservation sites in North Yorkshire; designated for both ecological and geological interest.	NYCC
Local Nature Reserves (LNR)	Areas declared and managed at a local level for nature conservation purposes, providing research and education opportunities as well as local amenity	Natural England
Other Classifications		
Natural Areas	Areas defined as having similar wildlife and natural features	Natural England
National Character Areas (NCA s)	Areas, directly linked to Natural Areas, but defined as having broadly similar landscape character.	Natural England
North Yorkshire Landscape Character Types (LCT s)	A more detailed, County-scale classification of areas defined as having similar landscape character.	NYCC / Chris Blandford Associates

Biodiversity Landscape Areas	Broad areas, comparable in scale to NCAs, for which habitat creation and restoration targets are currently being developed, guided by the UK Biodiversity Action Plan (BAP) and the Regional Biodiversity Strategy.	NYCC
Biodiversity Opportunity Areas	Areas, of greatly varying scale, identified by the Yorkshire and Humber Biodiversity Forum (and partner organisations) as locations where effort should be focused in order to maximise the delivery of UK BAP targets.	NYCC
Green Infrastructure Corridors	Identified by Natural England in conjunction with local authorities creating three levels of corridor, Regional, sub-Regional and District. These corridors are used by local authorities and other bodies for protection, monitoring and informing.	NYCC
Green Infrastructure Areas	Areas identified by Natural England, corresponding, in Yorkshire, with the Areas of Outstanding Natural Beauty. These areas are used by local authorities and other bodies for protection, monitoring and informing.	NYCC
Areas of Historic Environment Importance and Potential (AHEIP)	Historic Landscape Character (HLC) Polygons/Data created during the historic data concordance exercise, detailed in section 3 of this report.	Task 1ii – CSL/OAN

Stage 2: Spatial Proximity Analyses

- 4.79 The individual ASMRP layers were then assessed against each of the natural and heritage designations in turn by applying spatial proximity analysis to the resource layers. This enabled an understanding to be gained of the designations ('indicators') which make up each ASMRP and their extent.
- 4.80 To prevent spatial distortions being created in the analysis, due to the irregular size of some resource polygons, a 200mx200m grid was firstly overlaid and used to 'cut' the ASMRP layers into more regular shaped polygons.
- 4.81 'Polygon in polygon' analysis was then applied to calculate:
- the total area (m²);
 - the count/number;

- and the percentage coverage of each designation within each of the polygons making up the individual ASMRPs.
- 4.82 The resultant calculations were stored in fields in the attribute table accompanying each of the ASMRP layers.

Results

- 4.83 Summary statistics for the individual ASMRPs were created by summing the total areas and calculating percentages for the whole of each resource. The resulting figures are used throughout the analysis in Chapter 5 and summary tables are provided at the end of that chapter.

5. Key Environmental Characteristics of the ASMRPs

Introduction

5.1 North Yorkshire is rich and diverse in geology, landscape, history and architecture. As such there are large numbers of both designated and undesignated sites and features that contribute to its complex character. This chapter attempts to assess the key environmental characteristics at a broad, strategic level, focusing on three separate but closely inter-related aspects within each individual ASMRP:

- **Landscape characteristics**-including *World Heritage Sites (WHS), Areas of Outstanding Natural Beauty (AONBs), Heritage Coasts, Ancient Woodlands, Natural England's National Character Areas (NCAs) and North Yorkshire County Council's more detailed Landscape Character Types (LCTs)*;
- **Historic environment characteristics** - *focusing on the density of, and features within AHEIPs identified from HER and HLC datasets within the data concordance exercise (see Chapter 3), rather than relying on designations alone*;
- **Natural environment characteristics**- *including Special Areas of Conservation (SACs), Special Protection Areas (SPAs), Ramsar Sites, National Nature Reserves (NNRs), Sites of Special Scientific Interest (SSSIs), Local Nature Reserves (LNRs) and Sites of Importance for Nature Conservation (SINCs), together with Biodiversity Landscape Areas (BLAs), Biodiversity Opportunity Areas (BOAs) and Green Infrastructure Areas and Corridors.*

5.2 With respect to landscape, the statutory designations relate to different aspects of landscape quality but cover only limited parts of the study area. Country Parks were also considered in the analysis but none of these exist within the study area. Other, non-statutory, local designations, such as Areas of Great Landscape Value were not available as a standardised dataset, so were not able to be used. Moreover, any exclusive emphasis on landscape quality designations would be at odds with the general ethos of the European Landscape Convention (ELC), which involves the notion of 'valuing all landscapes', whether designated or not. The landscape character areas and character types, by contrast, cover the entire landscape, though they deal only with landscape character, not quality. For the purposes of this assessment, the character areas and character types, in addition to the information on designations, have informed the descriptions of key characteristics for each ASMRP. But in the selection of representative sample areas, only the landscape quality designations were used.

5.3 With respect to the historic environment, the characteristics of the modern landscape are the result of human interaction with the natural environment over many thousands of years. The development of this inherited landscape is only partially reflected in the distribution of designated or scheduled features, and is best understood from a more general account of the evolution of the whole landscape of the study area over historic time (see below), including reference to the social and economic forces which led to successive changes in the

landscape. For the purpose of assessing the character and significance of the historic environment within individual ASMRPs, we have focused on the density of monuments and other historical evidence within HLC polygons, adjusting/ weighting the data as described in Chapter 3 in order to obtain a reasonable overall assessment which reflects the entire historical period. The scoring system used has helped to distinguish the most representative areas within each of the 14 ASMRPs from those which are characterised by unusually high or low densities of historic environment features.

- 5.4 With respect to the natural environment, the various statutory and non-statutory designations provide a reasonable basis for characterising the resource areas and their distributions have therefore been used in the selection of representative sample areas. It should be noted, however, that the concepts set out in the European Landscape Convention regarding the value of all landscapes, whether designated or not, is being promoted by Natural England with respect to wider aspects of nature conservation, including biodiversity and geodiversity. Whilst this is important to recognise, it cannot properly be reflected in a strategic study of this type.
- 5.5 Additional information is available in the form of Biodiversity Landscape Areas and Biodiversity Opportunity Areas, both of which are datasets supplied by NYCC. Neither of these currently provides information which specifically helps to characterise the natural environment, although they provide useful indications of the potential for mineral restoration schemes (as well as other projects) in different areas to enhance biodiversity in a way that contributes to national and regional targets.
- 5.6 Broadly similar observations apply to the Green Infrastructure Areas (as identified by Natural England, coinciding with the three AONBs) and Green Infrastructure Corridors (as identified by Natural England in conjunction with local authorities at Regional, Sub-Regional and District levels). The Regional level corridors within North Yorkshire relate to each of the main river valleys in that area (Tees, Swale, Ure, Nidd, Wharfe, Aire, Ouse and Derwent) and to the coast. Sub-Regional and District corridors relate to a variety of smaller valleys and other coherent landscapes, such as the western part of the Wolds and certain parts of the (Magnesian) Limestone Ridge. These various areas and accompanying descriptions are intended for use by local authorities and others in the interests of such things as: protecting existing green infrastructure; monitoring change; informing development proposals, planning decisions, policies and strategies and focusing green infrastructure enhancement in areas where gains can be maximised.

Historical Landscape Evolution in North Yorkshire

- 5.7 An understanding of historical landscape evolution necessarily begins with the physical characteristics (topography, landforms, minerals, soils and drainage characteristics) that were created by the underlying geology and by the action of geomorphological processes. These characteristics represent the 'starting point' for human interaction with the landscape which has continued for millennia, as a two-way process. The geomorphological processes

themselves are continuing (e.g. through periodic flooding of rivers, erosion of the coast and mass movement of unstable ground), often necessitating continued adaptation of land use and development to the changing conditions. For the most part, however, these changes are very gradual and, except where it has been modified significantly by human intervention (e.g. through agriculture, drainage, mineral extraction and construction), the overall physical characteristics of the modern landscape are broadly similar to the way they were at the end of the last 'Devensian' glaciation, approximately 11,500 years ago¹.

- 5.8 The Devensian glaciation was responsible for many of the landscape features seen today, modifying the effects of earlier ice ages and the larger scale topographic patterns associated with the underlying bedrock. With some important exceptions, most of North Yorkshire was either over-ridden by vast ice-sheets and valley glaciers, or was submerged beneath large ice-dammed lakes. The glaciated areas were subject, in varying degrees, to the scouring effects of glacial erosion but also to the deposition of glacial and/or glacio-fluvial sediments. Both erosion and deposition were concentrated in the valleys, with large moraine systems being constructed at the maximum extent of the glaciers (notably the Escrick moraines which mark the maximum extent of the **Vale of York Glacier**). Smaller moraines and associated outwash sediments mark various points of standstill and readvance during the subsequent overall retreat of the ice from the peak of the Devensian glaciation approximately 18,000 years ago. These occur both within the Vale of York and within most of the tributary valleys of the Yorkshire Dales.
- 5.9 At their peak, the Devensian ice sheets were also responsible for the creation of two major ice-dammed lakes: **Lake Pickering**, which occupied the whole of the present day Vale of Pickering and Vale of Rye and **Lake Humber**, which extended south from the Vale of York glacier across most of Selby District and beyond – bounded on the west by the Magnesian Limestone ridge.
- 5.10 Areas which remained ice-free at this time and which avoided inundation by the ice-dammed lakes included the North York Moors, the Yorkshire Wolds, most of the Howardian Hills and the southern part of the Magnesian Limestone ridge. All of these would have experienced a severe 'periglacial' climate at the time of the glacial maximum but relatively favourable conditions may have prevailed in more sheltered lowland areas at the margins of the glacial lakes (and this may help to explain why these areas preserve the longest known records of human settlement within the study area – see below).
- 5.11 As the Vale of York glacier retreated, Lake Humber extended northwards, particularly within and to the east of the Swale valley but also extending into the lower reaches of the Nidd and Ure Valleys as these became free of ice. Eventually, as the ice retreated further, the lakes within the Vale of York gradually silted up to create a mosaic of wetland areas fringed by sandier, well-drained soils and separated by areas of higher ground on the moraines and

¹ The transition from the Devensian glaciation to the subsequent (post-glacial) Holocene period has traditionally been dated at about 10,000 years Before Present (BP), but recent evidence from the Mesolithic site at Star Carr in the Vale of Pickering has suggested a more accurate dating of 11,530+/-30 Calendar years BP (Dark, 2000).

valley sides. In the Vale of Pickering and in the Humberhead Levels, where the lowland areas are not broken up by moraine deposits, the former lakes are likely to have been replaced by more extensive wetland areas which eventually, during the post-glacial Holocene period, saw the development of raised lowland peat bogs.

- 5.12 With the reduction in sediment supply after the ice sheets had gone, the Holocene rivers began to cut down into the glacial, glacio-fluvial and glacio-lacustrine sediments to create river terraces and, below these, the modern floodplains, many of which date from just the last few hundred years. These Holocene changes, which occurred partly in response to major changes in both climate and natural vegetation, also reveal increasing evidence of Man's influence on the landscape. This influence has not just been 'cosmetic'. It has included interference with the natural processes of surface runoff and sediment production within upland areas (through woodland clearances and other changes in land cover); extensive drainage of both upland fells and lowland plains to facilitate agriculture; Substantial River and coastal engineering works and the effects of urbanisation.
- 5.13 The following account of the historical development of North Yorkshire's landscape through human interaction draws on a variety of sources, including the accounts given in the North Yorkshire and York Landscape Characterisation Project (North Yorkshire County Council/Chris Blandford Associates, October 2010); the Historical Atlas of North Yorkshire (Butlin (Editor), 2003) and a number of more specific research papers, as cited in the text.
- 5.14 Some of the earliest evidence of human activity in North Yorkshire dates from the early Mesolithic period, soon after the rapid global warming which marked the late glacial / Holocene transition, approximately 11,500 years ago (see footnote 1, above). Such evidence, relating to hunter gatherer activities from approximately 10,920 years ago, has been found at **Star Carr** – a world-renowned archaeological site immediately adjacent to ASMRP 5 at the eastern edge of the Vale of Pickering (Clark, 1954; Mellars & Dark, 1998; Dark, 2000) (see the section below on ASMRP 5 for further details).
- 5.15 During the succeeding Neolithic period, from approximately 5,500 to 3,700 years BP, human civilisation progressed from hunter gathering to farming and began to make a more permanent impact on the landscape. Evidence from this period, in the form of long barrows, occupation sites, pottery, and prolific stone axes is primarily associated with the Yorkshire Wolds (ASMRP 7) but is also found in the southern part of the North York Moors (including ASMRP 8) and in the intervening Vale of Pickering (including ASMRP 5). Large ceremonial and burial sites were being constructed across the study area throughout this period, including the round barrow at Duggleby Howe on the Yorkshire Wolds and the spectacular henge alignment further west at **Thornborough**, on the glacio-fluvial sand & gravel plateau of ASMRP 3 between the Swale and Ure valleys. This forms part of a larger grouping of six henges on the western side of the Vale of York. Such monuments became foci of ceremonial landscapes created over thousands of years from the mid Neolithic period through to the Bronze Age. During this time there appears to have been a chronological shift in monument focus – from the Wolds long barrow concentration, followed by the cursus complex centred

on Duggleby and succeeded by the Thornborough henge grouping and then a return to the Wolds with the round barrow concentration.

- 5.16 As part of the move towards settled farming, the Neolithic period also saw the beginnings of extensive woodland clearances, which expanded during the succeeding Bronze Age, creating areas that have since become managed grassland and moorland landscapes. The initial clearances, in turn, would have had a significant impact on river systems, increasing both surface runoff and the delivery of sediment from exposed upland areas and contributing to the complex chronology of fluvial activity that is evidenced by ASMRP 2 river terrace sequences in most of the major valleys.
- 5.17 Climate change had an impact on the use of land. The extent of cultivation retreated in colder and wetter periods, when farming and associated field enclosure developed on the drier land of the higher Wolds and limestone areas. During the Bronze Age there was a retreat to lowland areas with uplands largely being used for pasture. In the Yorkshire Wolds, extensive linear earth works constructed during the Bronze Age are thought to have been associated with stock management. The development of wood, stone and metal tools influenced the level of intervention and land use and people are likely to have clustered in small settlements on the edges of the arable land. Archaeological evidence shows that these settlements continued in use into the Roman period.
- 5.18 Successive changes in land management and organisation of agriculture and settlement occurred under the influence of Roman, Anglo Saxon and Norman land owners and lords. The Roman invaders developed military sites and established a formal surfaced road system which in North Yorkshire roughly aligns with the historic Great North Road (the present A1) and links to other Roman established forts and towns. York developed as the major Roman administrative centre and town, with smaller Roman towns established across the study area, for example Aldborough near Boroughbridge, Catterick in the north of the study area and Malton on the edge of the Vale of Pickering and the Yorkshire Wolds. Evidence also exists of country villas and estates on sites close to fertile farm land or roads and ports. The Anglo Saxon and Scandinavian settlers cleared woodlands and developed new villages. They occupied and developed the existing administrative and land use systems to create structured villages, large estates and the beginnings of 3-field rotational agriculture systems. Anglo Saxon place names and surviving churches provide evidence of the changes being wrought in the study area during this period leading up to the Norman Conquest.
- 5.19 The Norman Conquest can be seen as more of a transposition of aristocracy than a new wave of settlers and the Domesday Book of 1086 provides an overview of the results of the previous millennia of migration and settlement. The centuries following the Conquest saw a continued clearing of woodlands and growing urbanisation in the larger settlements and towns. Land was divided into large estates with Norman lords living off land farmed by feudal tenants. Large defensive castles were built in Richmond and Scarborough (as well as in York, outside the study area). Depopulation as a result of the harrying of the north under William 1, in which Yorkshire was the worst-affected county and later through epidemics such as the Black Death in 1349, affected both land tenure and the aspirations of agricultural

labourers. Surviving communities were able to move on to more productive land and ultimately enjoy a more prosperous livelihood.

- 5.20 The pattern of agriculture by the early 14th century broadly reflected soil, climate and topography. The northern/upland areas and valley bottoms were predominantly used for pasture, whilst grain was cultivated on the drier and lower lands in the Vale of York and Vale of Mowbray. The limestone and Chalk hills of ASMRPs 7, 8, 9 and 14 were primarily sheep farming country, as the demand for wool grew. The farmed landscape was composed of large open fields broken by managed woodland and deer parks. Remnants of the farmed strips and ridge and furrow patterns have been found across the study area in places where later farming activity has not obliterated all traces. Settlement in the Vales of York and Mowbray and on the Wolds mainly developed in scattered villages. A number of the more isolated farmsteads commonly found in the upland areas of the Wolds were the site of former hamlets. Evidence of former dwellings is still visible as earthworks in the surrounding fields, where it has not been lost to later development and deep ploughing.
- 5.21 The expansion of the Cistercian monasteries and the creation of large systems of farms and farming called Granges were important in the development of settlements, road patterns and field boundaries in large areas of rural North Yorkshire, as routes to and from the farms and abbeys became established. The abbeys and priories controlled large estates in the North Yorkshire study area and, as their activities expanded and their influence over land management grew, smaller farms were abandoned and settlement was increasingly concentrated in villages set amidst arable fields, with life centred on the parish church. The Cistercians specialised in wool production on the large Fountains Abbey estate, whilst cattle grazing was important in Nidderdale. The monasteries recognising the conditions that best suited stock raising and wool production across the lands they owned and to meet available markets and the farms were managed and developed accordingly.
- 5.22 In the post-Medieval period there was a gradual development of what were to become more distinctive local economies in many parts of England, including North Yorkshire. This area saw the early development of cottage based industry and exploitation of minerals – both the Romans and the Monastic communities had previously mined lead, and from medieval times it is known that agriculture was often combined with small scale mineral extraction plus spinning and weaving of wool. The Abbeys sold their fleeces, bred livestock, and owned fisheries and potteries in addition to mining, smelting and forging. As the population began to recover from the Black Death, the village communities became more prosperous, and the process of enclosure began in earnest – moving away from medieval strip fields and beginning the creation of larger fields bounded by hedgerows or dry stone walls. With fewer people and more land available, sheep rearing spread and some villages on the Wolds and in the Vales ceased to exist. Woodland cover decreased as the practice of assarting (clearing forested land to allow the expansion of agriculture) created more isolated farms and hamlets – particularly in the Vale of York.
- 5.23 Increased sheep grazing in the 16th century resulted in enclosure of open land and the erection of hedges and walls becoming the norm. However, parts of the Vale of York and

the Wolds remained unenclosed until Parliamentary Acts in the 18th century. Agricultural improvements included the drainage of low-lying land, particularly within the Humberhead Levels and the Vale of Pickering, to bring it more land into cultivation, and the spreading of burnt lime on fields. Disused small-scale limestone and chalk quarries used for this purpose are scattered throughout their respective outcrops and the remains of coal- or charcoal-fired lime kilns are also found in many places, usually within or close to the limestone or chalk outcrops.

- 5.24 The landscape was also shaped by the aesthetic aspirations and desires of wealthy landowners. As large houses no longer needed to be constructed for defence, they began to be built as homes for comfort and display, for example Newby Hall (1693). Parkland trees were planted and gardens and grounds were designed and developed in many parts of the study area. Examples include those at Studley Royal, Castle Howard, Newby Hall and Beningbrough Hall.
- 5.25 The 18th century saw improved communication with major road improvements undertaken. The large scale industrialisation of the surrounding areas in the 19th century had a more limited impact in North Yorkshire – but new road and rail networks opened up markets for agricultural products, brought in new materials for building construction, and introduced new farm machinery and farming practices. There was a resulting increase in efficiency and productivity. There were mills in many of the valleys, coal mines in the area around Ingleton and many smaller iron works. Lead mining was important in the Yorkshire Dales, including some parts of the ASMRP 14 Carboniferous Limestone outcrop outside of the National Park Lime was extracted on a commercial scale for the chemicals industry in Langcliffe and Mealbank in the present Craven District. More generally, however, the study area did not support the scale of heavy industry and urbanisation found in the adjoining areas of Teesside, West Yorkshire and Lancashire. The railways linked the conurbations in these areas, and further afield, to North Yorkshire’s popular coastal resorts of Whitby, Scarborough and Filey.
- 5.26 The present landscape of the study area is a predominantly rural in character, with urban development concentrated in market towns such as Ripon, Harrogate, Knaresborough, Richmond, Malton/Norton, Northallerton and Selby, or around Scarborough and Whitby on the coast. Much of the landscape is dotted with a pattern of smaller settlements. Nucleated villages are common where arable farming predominates, whilst hamlets and scattered farmsteads prevail in the uplands. Long houses combining house and byre were the predominant building type for centuries. Thinly-bedded sandstones and siltstones were commonly used as roofing stones, especially within the Pennines. Elsewhere, bricks and pantiles made from local clay deposits were widely available in the Vale of York and the Vale of Pickering, and used extensively in these and adjoining areas, e.g. the Yorkshire Wolds. Within these areas, ‘polite’ brick farmhouses with an enclosed farmyard became common from the 18th century onwards.
- 5.27 Broad patterns of agricultural land use reflect geology, topography and climate: the western lowlands are dominated by improved grassland and the eastern lowlands by arable fields.

The field patterns and boundaries are a mixture of ancient and modern features established by successive periods of enclosure. Pockets and belts of woodland are associated with upland valleys and stream corridors where land has not been cleared for other agricultural activities.

- 5.28 Field boundaries and buildings reflect the nature of the land and available materials. Drystone walls are characteristic of the upland areas, where rock outcrops occur at or very near the surface, while hedges and hedge row trees prevail in the Vale farmlands. In the past, buildings in the upland areas were generally constructed of local stone – Carboniferous sandstones and limestones, Magnesian Limestone, Jurassic limestone, or Chalk, depending on the local geological resource.
- 5.29 In the text which follows, more detailed information on the historic environment is provided for each of the 14 ASMRPs, alongside similar information on general landscape character and the natural environment.

ASMRP 1: Sub-Alluvial Gravels

General Landscape Characteristics

- 5.30 At the international level of designation, North Yorkshire contains a single World Heritage Site – Fountains Abbey/ Studley Royal, to the west of Ripon. This site extends across the valley and floodplain of the River Skell, immediately adjacent to but not quite overlapping with any of the ASMRP 1 mineral resources which occur within the lower parts of this valley.
- 5.31 At the national level of landscape designation, ASMRP 1 resources fall partly within both the Nidderdale and Howardian Hills AONB designations. Together, these affect 6.49% of the mapped resource, primarily within the Nidderdale AONB, which extends into parts of the Ure Valley to the north and the Wharfe valley to the south, as well as Nidderdale itself. In view of the large extent of the designations, they include a large number of individual resource polygons where 100% of the mineral outcrop is within the AONB.
- 5.32 0.4% of the resource area is coincident with Ancient Woodland designations. Although these are scattered over much of the resource area, they tend to be concentrated within the narrower central and upper parts of the valleys and less common within the broader, lower sections which have been more heavily modified by arable farming. This is particularly noticeable within the lower part of the Swale Valley, below Brompton-on-Swale; in the Ure Valley downstream of Ripon; below Knaresborough on the River Nidd; the whole of the lower Aire Valley and within much of the lower Tees Valley.
- 5.33 In terms of landscape character, ASMRP 1 extends, discordantly, across seven of Natural England's National Character Areas, from the high ground of the Yorkshire Dales (NCA 21) and Pennine Dale Fringes (NCA 22) to the Tees Lowlands (NCA 23), the Vale of Mowbray (NCA 24), the Vale of York (NCA 28) and the Lancashire Valleys (NCA 35), cutting directly across the Southern Magnesian Limestone (NCA 30) in several places. The ASMRP aligns far

more closely, however, with a number of NYCC's Landscape Character Types, since these reflect the more detailed subdivision of the landscape, distinguishing various types of valleys and dales from the intervening upland areas.

- 5.34 A very large proportion of ASMRP 1 lies, not surprisingly, within **LCT 24** (River Floodplain landscapes). This applies throughout almost all of the River Swale, below Richmond, almost all of the River Ure, below Leyburn and the lower parts of the River Nidd, below Knaresborough, the River Wharf, around Tadcaster, and the River Aire around Byram. The key landscape characteristics of these areas are:
- Flat, low lying narrow river corridors which flow through various different types of adjoining farmed landscapes;
 - A landscape pattern that is a mixture of flood meadows, neutral grasslands and floodplain mires, often with prominent flood levees;
 - The watercourse is often lined with trees and lush vegetation.
- 5.35 Within the Wharfe valley upstream of Wetherby and in the Aire Valley between Skipton and Glusburn, ASMRP 1 occurs within **LCT 31** (Settled, Industrial Valleys). Here, the semi-natural characteristics of the floodplains are far more heavily modified by human activity, with many roads, buildings and industrial heritage features and with improved pasture, historic parklands and wooded estates in place of flood meadows and wetlands.
- 5.36 Within the upper part of the Nidd Valley (upstream of Knaresborough and largely within the Nidderdale AONB), ASMRP 1 is in the centre of **LCT 36** (Gritstone Valley). This landscape is more enclosed by the gritstone moors and fells through which it passes and is characterised by a predominantly rural landscape with an associated strong sense of tranquillity. The valley floors contain a patchwork of species-rich grasslands and a diverse range of ecological habitats but also reservoirs and conifer plantations. The floodplain of the River Tees, around Darlington is also shown in the NYCC landscape assessment as falling within LCT 36, but this area has a completely different, more open character.
- 5.37 The remaining ASMRP 1 areas fall within a range of other Landscape Character types, including Broad Valleys (**LCT 11**) in the case of the Ribble; Vale Farmland with Dispersed Settlements (**LCT 27**) in the case of the extensive deposits in the River Leven valley around Stokesley; Settled Vale Farmland (**LCT 25**) in the case of Cod Beck to the east of Northallerton and Moors Fringe (**LCT 13**) in the case of Gilling Beck, above Richmond. Except for the Ribble Valley, the individual valleys are not distinguished (in the County assessment) from the more general characteristics of these LCTs. Further details of LCT's are described in later sections, in relation to other ASMRPs which are more extensively associated with the landscapes involved.

Historic Environment Characteristics

- 5.38 The archaeological resource within ASMRP 1 is associated with earlier land use within active river floodplains as they developed, largely during the last millennium, and in some cases as

recently as within the last 300 to 500 years (OA North and University of Liverpool 2006). The archaeological resource visible on the surface is therefore inevitably of relatively recent date.

- 5.39 Valley floors have always been important, as they provided access to water (for drinking, for power and for transportation) as well as flat land for cultivation. River floodplains are also characterised, however, by a risk of flooding which, in most areas, has discouraged intensive settlement and other activities that are susceptible to frequent inundation. Instead the land was most commonly used, in the past, as water meadow and this does not leave much surface expression. The heritage resource that is identified, most typically has a direct relationship to the adjacent river, and includes the communication lines that cross it, and would include fords, and bridges. There are also industries that take advantage of the river for power or as a water source; the former includes water mills, which would typically be accompanied by leats and weirs. The sites that used the water source include retting ponds that would have been fed by a leat off the river.
- 5.40 AHEIPs within ASMRP 1 that are characterised by high density scores (see Chapter 3, Stage 1 report) are found mainly in some of the smaller resource polygons (since the larger ones typically include a wider range of landscapes and are therefore more likely to have 'average' density values overall). The Valley of Upper Nidderdale, within the AONB, is the highest scoring area of heritage resource. It is steep-sided and settlement is close to the river. This includes the town of Pateley Bridge and the villages of Summerbridge, Ramsgill and Lofthouse. There was extensive lead working in the Nidd Valley and while much of the extraction was on higher ground there were also shafts and adits at lower levels and this ASMRP includes the remains of lead processing and transportation facilities. Areas of medium density are found along the floodplains of the Swale and Ure and within smaller tributary floodplain areas throughout the Vales of Mowbray and York.
- 5.41 Some 395 listed buildings are located within this large dispersed ASMRP. There is also a small degree of overlap (1.2%) with Registered Battlefields (at Boroughbridge on the Lower Ure and at nearby Myton on the lower Swale) and with Listed Parks and Gardens (1.1%). These small percentages are, at least in part, a function of the relatively recent origin of most river floodplain surfaces (see below). Halls and manor houses are key features on land immediately adjacent to the ASMRP, however, with notable historic parks and gardens extending onto the floodplain itself at Norton Conyers, Newby Hall and Beningbrough Hall. These, along with the World Heritage Site at Fountains Abbey / Studley Royal, provide a context for the historic management of both ASMRP 1 and adjoining landscapes.
- 5.42 Largely for similar reasons (i.e. the relatively recent origin of modern floodplain surfaces), only 0.23% of the ASMRP falls within areas that are designated as Scheduled Ancient Monuments (SAM).
- 5.43 Much of the archaeological evidence relating to former settlement and land use within floodplain areas has either been lost (or redistributed) as the rivers have gradually reworked the floodplain sediments, or has been buried by the accumulation of more recent overbank

flood deposits. There is evidence from recent ASLF funded studies (OA North and University of Liverpool 2006) of a high incidence of buried remains of former human occupation preserved at depth beneath sub alluvial deposits. In the Ribble Valley, such deposits have been dated to as recently as cal AD 1460-1610 (*ibid*). In the most active gravel-bed rivers, floodplains have been extensively reworked over the last 200 years by the shifting course of the meandering streams and rivers (e.g. Thompson, 1984). Where the rivers are less active, there has at least been incremental deposition of over-bank silts and clays during periodic flood events, gradually burying older archaeological evidence. In the Ripon area, such deposition has been responsible for infilling subsidence cavities within the Ure floodplain, formed through the collapse of underground gypsum deposits (Thompson *et al*, 1996). Deeply buried archaeological features would not have been evident from the data used to undertake the data concordance exercise, since the monuments which are now evident on the surface are limited to those which post-date the deposition of the alluvium. This aspect is crucial to understanding the heritage resource within all river floodplains and is something that should be taken into consideration in future decision-making within this ASMRP.

- 5.44 Paradoxically, however, floodplain sites are generally characterised by high groundwater levels, and the resulting permanent saturation of the floodplain sediments can provide optimal conditions for the preservation of buried artefacts.
- 5.45 The density of known archaeological evidence within ASMRP 1 (and also ASMRPs 2, 3, 4, 6 and 9) shows a particularly strong association with the principal historic north/south transport route through the study area: the most recent manifestation of which is the A1 / A1(M) trunk road/motorway – the Great North Road. This partly reflects the economic importance of this primary communication route, which in turn owes its origin in part to the geomorphology of the area: it follows well-drained lowland terrain through the Vale of York and Vale of Mowbray. However, the density of archaeological evidence here is also distorted by the much greater intensity of recent archaeological investigations along this route corridor. These have been principally associated with the widening and upgrading of the A1 to motorway standards, but also in connection with previous mineral planning applications in this general area.

Natural Environment Characteristics

- 5.46 Overall, 5.24% of the ASMRP 1 resource area overlaps with one or more natural environment designations.
- 5.47 None of the resource falls within any international designations (i.e. Special Areas of Conservation (**SACs**), Special Protection Areas (**SPAs**) or wetland sites designated under the **Ramsar** convention).
- 5.48 At the national level, there are no National Nature Reserve (**NNR**) designations but there are 25 instances where the mineral resource polygons either fall within or overlap with Sites of Special Scientific Interest (**SSSIs**). In total, these affect just under 3% of the mapped resource and, in most cases, they represent either the fragmented remains of semi-natural

habitats which would once have been far more widespread within river floodplains, or features which have been created artificially through the construction of reservoirs or through mining subsidence. They occur primarily within the following areas:

- The Ure Valley, including a narrow strip of riparian vegetation along the right bank of the Ure, and its tributary the River Cover, near East Witton, designated as '**River Ure Grasslands**'; an area of wetland vegetation between the River Ure and Marfield quarry, designated as **Mar Field Fen**; the extensive designation of **Ripon Parks**, which encompasses a range of floodplain habitats including grasslands and bogs but also some adjoining areas of woodland on the valley side; and **Bishop Monkton Ings**, an area of diverse wetland habitats within an abandoned former course of the Ure valley;
- The Nidd Valley, upstream of Pateley Bridge, including the artificial water body of **Gouthwaite Reservoir** and adjoining bank side vegetation; and three small areas around the village of Lofthouse, collectively designated as the **Upper Nidderdale** geological SSSI. This comprises the underground course of the River Nidd which flows in large passages at the exceptional depth of 30 metres beneath the valley floor;
- The Ribble Valley, between Settle and Hellifield, comprising the single SSSI of **Long Preston Deeps**, which encompasses both the meandering river channel and adjoining areas of wet grassland; and
- the lower part of the Aire Valley, around Byram, comprising the **Fairburn and Newton Ings** SSSI – open water bodies and adjoining marshland / wet pasture within the floodplain, created inadvertently through mining subsidence.

5.49 At a local level, just two of the resource polygons fall within Local Nature Reserve (LNR) designations, these being the **Hell Wath** grassland and scrub LNR in Ripon which overlaps part of the resource within the tributary valley of the River Skell, immediately to the west of Ripon, and the **Newton Ings** LNR, directly adjacent to the Fairburn and Newton Ings SSSI in the lower part of the Aire Valley. The latter falls primarily within neighbouring West Yorkshire, and there is only a very minor overlap with the ASMRP 1 resource (less than 0.05% of the resource outcrop). In addition, a total of 55 polygons fall within one or more Sites of Importance for Nature Conservation (SINCs), though this amounts to just 2.23% of the overall area of the ASMRP 1 resource outcrop.

5.50 ASMRP 1 resources within the upper reaches of the Ure Valley (around and upstream of Leyburn) and the Nidd Valley (around and upstream of Pateley Bridge), fall within the Biodiversity Landscape Area (BLA) 7 (Moorland Fringe). In addition, ASMRP 1 resources in parts of the lower courses of these rivers and associated tributaries, along with the lower course of the River Aire, cut through BLA 8 (Southern Magnesian Limestone). Upstream of the limestone, the resources within the Aire Valley fall within BLA 18 (the Waterway Corridor Landscape Scale Project) whilst those downstream of the limestone extend into BLA 9 (Lower Aire and Went Valleys). In the east of the county, some small areas of ASMRP 1 lie within BLA 12 (the Vale of Pickering). Overall, these areas of overlap account for more than

32% of the total ASMRP 1 resource outcrop, highlighting the importance of river floodplains for biodiversity.

- 5.51 A further indication of this is that the ASMRP 1 resources within almost all of the valleys overlap to a substantial degree (just over 40% in total) with individual Biodiversity Opportunity Areas. They also overlap to an even greater extent (66%) with Regional-level Green Infrastructure Corridors that are associated with each of the main river valleys, and to a lesser extent with Sub-Regional (12.8%) and District (6.7%) Green Infrastructure Corridors.

ASMRP 2: River Terrace Sand & Gravel

General Landscape Characteristics

- 5.52 At the national level, parts of the resource fall within the Nidderdale, Forest of Bowland and Howardian Hills AONB designations. In total, these cover some 5.95% of the overall mapped resource. In all cases there are isolated areas of the resource which lie 100% within the respective AONBs. These include areas within the Ure Valley, parts of Wharfe Valley, in the Ribble Valley to the south west of Settle, near High Bentham in the Wenham Valley and in the Derwent Valley south of Malton.
- 5.53 0.29% of the resource area overlaps with Ancient Woodland designations and although scattered throughout the resource area there are many areas of resource that are unaffected for example around the Swale Valley.
- 5.54 The ASMRP 2 resource extends, discordantly, across twelve different National Character Areas, following a similar pattern to that described earlier for the floodplains of ASMRP 1.
- 5.55 Once again, there is a much higher degree of concordance with the more detailed Landscape Character Types, with a large proportion of the resources falling within **LCT 24** (River Floodplains) or **LCT 31** (Settled Industrial Valleys). The characteristics of these have already been described (for ASMRP 1) but, in the case of ASMRP 2, the main difference is that the land is elevated more above the rivers and is therefore better drained and less prone to flooding. These differences are reflected in the detailed land use and settlement patterns, with more improved pasture and arable land and generally with more roads and buildings than on the floodplain itself.
- 5.56 Reflecting this in the Swale Valley in particular, the ASMRP 2 deposits extend beyond the floodplain margins into adjoining areas of other Character Types including **LCT 25** (Settled Vale Farmland in the Vale of Mowbray – as described in relation to ASMRP 3, below) and **LCT 27** (Vale Farmland with Dispersed Settlements, within the Tees Lowlands – as described in relation to ASMRP 4). In the lower Derwent Valley, downstream of Malton and Norton, the valley itself is not separately identified within the County-landscape assessment and instead, the ASMRP 2 deposits fall within the more general landscapes of **LCT 12** (Wooded Hills and

Valleys of the Howardian Hills) and **LCT 28** (Vale Farmland with Plantation Woodland and Heathland, within the Vale of York – as described for ASMRP 3, below).

Historic Environment Characteristics

- 5.57 The archaeological resource within ASMRP 2 is associated with earlier settlement of and land use within river terraces as they developed during the post-glacial Holocene period. In some cases the archaeological evidence may relate to periods, over the last several thousand years, when these were active floodplain surfaces, before the rivers cut down to their present levels. In other cases they relate to more recent settlement and land use, when the terraces had become areas of good quality, well-drained land above the levels of most flood events, as they are today.
- 5.58 In the centre of the county, the surviving archaeological features include the Neolithic henge monuments at Thornborough and Nunwick, and, in the north, the Neolithic cursus monument at Scorton, and the important Roman and medieval and medieval centres of Catterick and Richmond. The modern day A1 (M) motorway traces the route of the Dere Street Roman road, and this corridor has probably formed a primary communications artery since humans first re-inhabited the landscape, post-glaciation.
- 5.59 The density of known historic and archaeological sites within this ASMRP reflects the importance of this area at various times in the past, and is not entirely due to the amount of development associated with road widening schemes, although these undoubtedly account for some bias in the results. In addition to the known sites and those which are visible above ground, there are likely to be a vast number that, as yet, remain undetected. The absence of more recent alluvium, and the nature of the underlying geology, means that aerial photography and other remote sensing techniques, such as geophysical survey, will probably be fairly successful in identifying buried remains, although they cannot be expected to yield comprehensive results, with factors like background magnetism possibly inhibiting magnetometry and natural formations obscuring cropmark features.
- 5.60 Mesolithic lithic finds indicate the earliest human presence in these areas, and by the Neolithic period monumental complexes demonstrate that they were favoured as a place of congregation and ceremony. This is best exemplified by the siting of the henge monuments along the north/south communication corridor, at the points where the major south-east/north-west rivers valleys intersect. Excavation has proven that the visible monuments are only the most prominent elements of, what can be extensive and complex, archaeological landscapes of considerable longevity. The results from the archaeological work in advance of Nosterfield quarry (Dickson and Hopkinson 2011) provide a particularly good example of the range of prehistoric archaeological features that might be expected, and, indeed, have been found to occur elsewhere within this ASMRP. Although burials have been found, Neolithic activity is often merely represented by pits, occurring either in isolation, clustering in complexes or arranged into formal alignments. These features frequently contain structured deposits, including various artefacts and palaeoenvironmental remains. By the Bronze Age, funerary monuments such as barrows and cists have been

found, associated with cremations and inhumation burials. There is also some evidence for permanent settlement and enclosure, which certainly exists by the pre-Roman Iron Age. The monumental burial tradition finds new expression at this latter time, with square barrows occurring at Nosterfield.

- 5.61 By the Roman period, this ASMRP may have been more intensively farmed and settled, although the evidence does not suggest this was uniformly the case. The arrival of Roman rule did, however, result in new forms of settlement, communications and land management. The Roman town of Cataractonium (Catterick; Wilson 1990), was a planned town and important economic centre, developing around a Flavian fort, and accounts for most of the Roman evidence. Activity might also be expected to focus along the line of Dere Street, but away from it the agricultural landscape may have undergone little change from earlier times.
- 5.62 Early medieval remains have been also been widely found in the vicinity of Catterick, including settlement features, such as grubenhäuser, and inhumation burials. Evidence from this period can be very difficult to detect archaeologically, except serendipitously during excavation. So, although the present distribution largely focusses on the Roman centres, the easily tilled soils will have continued to be attractive, and other sites may yet exist undiscovered within the ASMRP. Mottes appear after the Norman Conquest, with Richmond becoming established as a town, developing in conjunction with the Norman Castle and a number of monastic foundations. Monastic structures, associated with Kirkham Priory, occupy the river terraces of the Derwent through the Kirkham Gorge, and several prominent dwelling houses, amongst them Howsham Hall, are also located there. Elsewhere, evidence from this period largely consists of field boundaries and ridge and furrow cultivation, although many of the present day settlements may also trace their origins to the Middle Ages. In addition to the industrial and agricultural archaeology that characterises the post-medieval period, there is a proliferation of aircraft crash sites and military installations recorded, principally in the Catterick area, many dating to the Second World War.
- 5.63 Areas of high density historic environment features occur in polygons along the River Swale below Richmond, through Brompton and Bolton on Swale and Catterick towards Kiplin Hall. More representative areas of medium density are found to the north east of Leeming and within a small area close to Ilkley in Wharfedale. Overall 1.14% of the ASMRP overlaps with **SAMs** and a further 2.13% with listed park and gardens. There are 153 listed buildings.
- 5.64 The more consistent occupation of these older river terraces yields a rich archaeological/cultural resource, however the Historic Landscape characterisation (HLC) (The North Yorkshire and Lower Tees Valley Historic Landscape Characterisation Project. NYCC and English Heritage 2010) shows that in terms of landscape the ASMRP is now largely characterised as Modern Improved Fields’.
- 5.65 The Thornborough Henges complex is a group of three Neolithic henges, part of a wider grouping of 7 henges located between the Swale and the Ure. The Northern henge is covered by woodland, the Southern most is only visible as a crop marking. They are thought

to be the largest such ritual site grouping outside Wessex (Thornborough Henges NMP English Heritage Air Mapping Project). They are in an area of increased pressure for large scale gravel extraction and there have been an extensive catalogue of watching briefs and investigations in association with extraction since 1991. Holes in the Landscape: 17 years of excavating at Nosterfield by Antony Dickson and Guy Hopkinson summarises the reports and findings of the field work and the extensive finds record.

(<http://www.archaeologicalplanningconsultancy.co.uk/thornborough/index.php>)

- 5.66 Chronology -The earliest monument is the cursus between the River Ure and Thornborough village, dating from the Middle Neolithic and overlain by one of the Later Neolithic/Early Bronze Age henges. Environmental evidence from pollen indicates the earliest peoples moving around this landscape in the Mesolithic were in woodland of birch and poplar with a sedge and fern undergrowth. There may have been open water bodies – evidenced by finer clay deposits. There is little evidence of any permanent settlement – just flint scatters. An increase in occupation appears to date from the Late Neolithic/Early Bronze Age evidenced by an increase in finds including Grooved Ware pottery. The Early-Middle Bronze Age shows extensive funerary activity – both cremation and inhumation, evidence of an established local community. (Dickson and Hopkinson 2011). Iron Age activity as seen from excavations and watching briefs on quarry activity is limited but interesting – particularly a ritual and likely sacrificial quadruple animal burial (4 horses). Roman activity finds have been limited to agricultural/industrial activity with the remains of what is believed to be a corn dryer. In the post Medieval period the biggest impact comes from 18th and 19th century enclosures creating regular field boundaries and linear drainage ditches.
- 5.67 The Northern and Central Henges survive as substantial earthworks. The NMP revealed additional information about the construction of the Southern Henge with crop marks showing the re cut of an inner ditch or an earlier feature. The NMP looked at the wider ritual landscape, and the results of Iron Age and Roman land division and settlement right through to 20th century military activity associated with the WWII airfields in the area. The Thornborough Henges complex had influence over a wider geographic area and appears to have been a crossing and meeting place over a long period of time. Crop markings have proved useful in widening understanding of the ritual landscape but in this area are interrupted by quarries, areas of pasture and areas of less permeable soils and geology.
- 5.68 Continued gravel extraction whilst resulting in the loss of archaeological features has also contributed to a wider understanding of the monuments and the context of the ritual landscape in which they are located.

Natural Environment Characteristics

- 5.69 Overall, just over 2.3% of the ASMRP 2 resource area lies within one or more natural environment designations.

- 5.70 At an international level, six small resource polygons are overlapped by a total of four **SACs**, one of which is also designated a **SPA**. Three of the polygons are terrace fragments within the Derwent Valley downstream of Malton, all of which are clipped by the **River Derwent SAC** – a designation relating primarily to the presence of river lamprey *Lampetra fluviatilis* within the river. Only the lower reaches of the Derwent are designated, reflecting the spawning distribution of the species in the Derwent system. The three other SACs are at **Kirk Deighton** to the south east of Knaresborough (designated for its breeding population of Great crested newts - *Triturus cristatus*); a residual fragment of mountain hay meadow habitat forming a small part of the **North Pennine Dales Meadows SAC**, at the edge of the Swale valley within Richmond; and in a minor headwater valley to the north west of Leyburn, where a small terrace fragment falls within part of the extensive **North Pennine Moors SAC**, designated for its dry heathland and a wide range of other upland habitats. There are no **Ramsar** sites. The total area falling within one or more of these international designations represents just 0.16% of the available surface area of potential resource within ASMRP 2.
- 5.71 At the national level, again there are no **NNR** designations but there are 19 instances where resource polygons either fall within or are overlapped by **SSSIs**. In total, these areas of overlap amount to just 0.46% of the mapped resource. The SSSIs involved include all of the SACs mentioned above, together with a number of other features including **Ripon Parks**, mentioned above in relation to ASMRP 1; the **Swale Lakes SSSI** near Catterick, designated for its diverse population of breeding birds and of wintering wildfowl and waders, within former gravel workings; the **Sutton Ings SSSI** within the valley of Cock Beck, to the south of Tadcaster; and **East Keswick Fitts SSSI**, downstream of Harewood in Wharfedale. In almost all of these cases (the Swale Lakes being the main exception) the designation relates to features which are primarily contained within the floodplain and which are only bordered upon by the ASMRP 2 outcrops.
- 5.72 At a local level, there are no **LNR** designations but a total of 42 polygons are overlapped by one or more **SINCs**, though this amounts to just 1.86% of the overall area of the resource outcrop. Of these, most occur within the Swale Valley, between Richmond and Catterick and include at least three large areas of former gravel extraction. Many other smaller sites occur within the Ure Valley, between Leyburn and Masham.
- 5.73 Most of the ASMRP 2 resources fall outside the current Biodiversity Landscape Areas. There is some overlap with **BLA 8** where the valleys of the Rivers Ure and Nidd cut through the Magnesian Limestone Ridge and to a much smaller extent with **BLA 7** (Moorland Fringe) in the upper reaches of these valleys, and in the Wharfe Valley, downstream of Ilkley. The Wharfe Valley resources also overlap with **BLA 18**, the Waterway Corridor project and the terraces of the Derwent fall within **BLA 14** (the Lower Derwent Valley). Overall, these and other minor areas of overlap account for just over 24% of the total ASMRP 2 resource outcrop.
- 5.74 In addition, the ASMRP 2 resources within many of the valleys overlap to a slightly greater degree (almost 28% in total) with individual Biodiversity Opportunity Areas. They also

overlap to a much greater extent (64.2% in total) with the Regional-level Green Infrastructure Corridors associated with each of the main river valleys and to a lesser extent with various Sub-Regional (8.5%) and District (7.9%) corridors.

ASMRP 3: Glacio-Fluvial Sand & Gravel

General Landscape Characteristics

- 5.75 At the international level of designation, the Fountains Abbey/Studley Royal World Heritage Site, to the west of Ripon, overlaps to a very minor extent with the far western edge of the ASMRP 3 resource in that area. This represents just over 0.005% of the total ASMRP outcrop.
- 5.76 At the national level, parts of the resource fall within the Nidderdale, Forest of Bowland and Howardian Hills AONB designations. In total these cover just over 2.3% of the overall mapped resource. This occurs both in the western section of this resource, in the Bowland Fells in Craven District, within Harrogate District and within the Ure Valley near Masham and downstream of Ripon and the very eastern section of the resource within Hambleton District. In all cases these isolated areas are 100% within the respective AONBs.
- 5.77 Only 0.7% of the resource area overlaps with Ancient Woodland designations, however the areas of Ancient Woodland are scattered throughout the resource area and it is not possible at this stage to comment on individual sites.
- 5.78 0.3% of this ASMRP, overall, falls within the Heritage Coast designation. This occurs only within the most easterly polygon, to the south east of Hunmanby, where 62% of the mineral outcrop falls within the designation.
- 5.79 In terms of landscape character, the ASMRP 3 resource occurs within 13 of the 15 National Character Areas that are present to any significant degree within the County. The only exceptions are the areas of high ground between the former British and Scandinavian ice sheets which were not covered by ice during the last glaciation and which therefore did not receive deposition from glacial meltwater streams. These broadly correspond to the National Character Areas of the North York Moors / Cleveland Hills (NCA25) and the Yorkshire Wolds (NCA 27).
- 5.80 Of the remaining NCAs, those which are most closely associated with ASMRP 3 resources are The Pennine Dales Fringe (NCA 22), the Vale of Mowbray (NCA 24), the Southern Magnesian Limestone (NCA 30), the Vale of York (NCA 28) and the Humberhead Levels (NCA 39). The relevant landscape characteristics in each of these areas are described below, with reference to the component Landscape Character Types from the County assessment.
- 5.81 For the deposits which fall within NCA 22 (the Pennine Dales Fringe), a clear distinction can be made between those within the main river valleys (the River Ure around Masham and the River Swale, around Richmond), which fall within **LCT 24** (River Floodplains) and those which occur in minor tributary valleys (not separately identified at either National or County scale

landscape assessments. The characteristics of LCT 24 are outlined under ASMRP 1, above. The remaining areas, predominantly within the valley of Gilling Beck, to the north of Richmond, reflect at least part of the general character of NCA 22 and of **LCT 13** (Moors Fringe), - the two being virtually coincident, except for the major valleys. The Moors Fringe is essentially a tranquil, rural landscape and the key characteristics are those of a transitional zone between higher ground, open moors and areas of pastoral farming, to the west, and areas of lower ground and predominantly arable farming to the east. Buildings and walls are constructed predominantly from local stone giving a strong sense of unity and harmony within the landscape.

5.82 The ASMRP 3 resources around Northallerton and those within the Swale Valley between Leeming and Topcliffe, fall within NCA 24, the Vale of Mowbray. Here again, an important distinction can be made between those which fall within **LCT 24** (River Floodplains, described earlier) and **LCA 25** (Settled Vale Farmland). The key landscape characteristics of the resource areas within LCA 25 include:

- Flat or gently undulating farmland that has a relatively sparse cover of trees and woodlands and a strong sense of openness;
- Predominantly arable fields, often delineated by mature hedgerows;
- Distant visual containment provided by the higher ground of the Pennines to the west and the Cleveland Hills / North York Moors to the east.

5.83 The ASMRP 3 resources which overlie the Magnesian Limestone of ASMRP 9, in a broad swathe of land from Bedale in the north, through Ripon and Knaresborough and along the eastern edge of Selby District in the south, fall within NCA 30, the Southern Magnesian Limestone. This coincides predominantly, with the Magnesian Limestone Ridge of **LCT 6** though, again some resources within the Ure, Nidd and lower Aire valleys fall within **LCT 24** (River Floodplain). Away from these valleys, the key landscape characteristics of LCT 6 include:

- A low ridge of smoothly rolling landform covered by fertile farmland with large scale arable fields, dissected by dry valleys, wooded limestone gorges, caves and crags;
- Long views over adjoining lowlands to the east, within the Vale of Mowbray, Vale of York and the Humberhead levels;
- Limestone quarries (both active and infilled or abandoned) are a feature of the landscape, and local limestone is extensively used in walls and older buildings, creating a distinctive, unified character.

5.84 Those parts of ASMRP 3 which occur within the lowest part of the Ure Valley to the east and south east of Boroughbridge, and in the lowest part of the Nidd Valley, to the north-east of Tockwith, fall predominantly within NCA 28, the Vale of York. Once again, some of these resources occur within **LCT 24** (River Floodplains), as described earlier but many others lie within adjoining areas of **LCT 28** (Vale farmland with Plantation Woodland and Heathland). The key landscape characteristics of the resources in those areas include:

- A patchwork of low lying, predominantly arable land with little undulation, interspersed with regular-shaped patches of mixed and coniferous woodland;
- A strong sense of openness but with distant visual containment provided by the higher landscapes of the Magnesian Limestone ridge to the west and the Howardian Hills to the east;
- Medium to large sized open fields with arable and dairy, generally delineated by a network of mature hedgerows;

(Note that the main areas of Heathland which characterise parts of LCT 28 occur to the north, south, and south-east of York, outside the study area).

5.85 In the lower parts of the Aire Valley between Brotherton and Kellington and on the low interfluvium between the Aire and the Ouse, to the south west of Selby, ASMRP 3 deposits occur within NCA 39, the Humberhead Levels. In these areas, this coincides largely with **LCT 23** (Levels Farmland) but some of the deposits around the villages of Kellington, Beal and Kellingly extend onto the floodplain of the River Aire (**LCT 24**). The key landscape characteristics of the resource areas within LCT 23 include:

- Predominantly flat, low lying landscape with an open character;
- Large scale, open and rectilinear pattern of arable fields often divided by dykes and ditches, with a general absence of hedgerows;
- Areas of remnant heath and large isolated conifers;
- Modern installations including power stations, mine workings and spoil heaps are prominent within the low lying landscape.

Historic Environment Characteristics

5.86 Within ASMRP 3 there are important heritage resources centred at Snape Castle, where there was previously a Roman villa, and at Thornborough. As noted in the historical overview section at the beginning of this chapter, Thornborough contains an alignment of three Neolithic henges and is a key component of a larger group of henges extending over a much wider area on the western side of the Vale of York. This is an exceptionally important prehistoric landscape. Other henge sites are found close to this ASMRP, including Nunwick, near Ripon.

5.87 Other known archaeological sites also occur in dense concentrations to the south of Northallerton (Romanby), to the south of Bedale west of the A1, and to the south of Ripon. Also important, but less dense, are those concentrations of sites near Tockwith and, Linton on Ouse and, within much smaller areas, close to Galphay and Leeming.

5.88 The density of known historic and archaeological sites within this ASMRP reflects the importance of this area at various times in the past. In addition to the known sites and those which are visible above ground, there is likely to be a numerous sites, from all periods that, as yet, remain undetected. The absence of more recent alluvium, and the nature of the underlying geology, means that aerial photography and other remote sensing techniques,

such as geophysical survey, will probably be fairly successful in identifying buried remains, although they cannot be expected to yield comprehensive results, with factors like background magnetism possibly inhibiting magnetometry and natural formations obscuring cropmark features.

- 5.89 Mesolithic lithic finds indicate the earliest human presence in these areas, and by the Neolithic period monumental complexes demonstrate that they were favoured as a place of congregation and ceremony. This is best exemplified by the henge monuments at Thornborough and Nunwick and the Devil's Arrows standing stone alignment, at Aldborough. Excavation has proven that the visible monuments are only the most prominent elements of, what can be, extensive and complex archaeological landscapes of considerable longevity. The results from the archaeological work in advance of Nosterfield quarry (Dickson and Hopkinson 2011) provide a particularly good example of the range of prehistoric archaeological features that might be expected, and, indeed, have been found to occur elsewhere within this ASMRP. Neolithic activity is often merely represented by pits, occurring either in isolation, clustering in complexes or arranged into formal alignments. These features frequently contain structured deposits, including various artefacts and palaeoenvironmental remains. By the Bronze Age, funerary monuments such as barrows and ring ditches occur and a number of findspots show more generalised activity. Evidence for settlement and enclosure is widespread throughout the areas by the pre-Roman Iron Age. The monumental burial tradition finds new expression at this latter time, with square barrows being excavated at Nosterfield.
- 5.90 By the Roman period, this ASMRP may have been more intensively farmed and settled and the arrival of Roman rule resulted in new forms of settlement, communications and land management. An important Roman town Isurium Brigantum, a centre for the Brigantes, developed at Aldborough. Elsewhere, there is evidence of wider Romanisation, with villas known at Snape and Wilstrop Hall, near Kirk Hammerton. The enclosures that probably originated during the pre-Roman Iron Age continued to develop throughout the Roman period and, aside from the villas, rural areas were inhabited in a manner similar to the way they had been previously.
- 5.91 In the early medieval period, inhumation burials in the vicinity of Aldborough provide evidence that this continued to be a focus for activity at this time. Elsewhere early medieval sites are relatively frequent, with a wide distribution existing across the ASMRP. In the north of the county, south of the A66, several Anglo-Saxon finds and an early medieval corn mill are known. Early medieval villages are recorded at Morton-on Swale; at Sandhutton, near to Pickhill; and near to Snape. There are also early medieval elements surviving at Northallerton. As sites of this period can be very difficult to identify archaeologically, further, as yet, undiscovered sites should be anticipated. Medieval sites are widely known and are predominantly of a rural character comprising moats, manors, villages and deserted villages, field boundaries, and ridge and furrow cultivation. A deserted village and watermill is recorded near to Littlethorpe; a shrunken village, park pale and motte at Ravensworth; and a motte at Northallerton was also the palace of the Bishops of Durham. Ecclesiastical remains include the Premonstratensian Easby Abbey, associated with the important medieval centre

of Richmond, and the Carmelite and Augustinian friaries at Northallerton. The site of the battle of Myton, where the Scots triumphed over the English, also lies within this ASMRP.

- 5.92 Sites of the post-medieval period are widely dispersed and varied, largely being rural in character, although industrial remains also occur, including a linoleum factory at Northallerton and railway infrastructure near to Ripon. The Battle of Marston Moor was of pivotal importance during the English Civil War and, given the good preservation of the battlefield and the large number of combatants, it can be expected to have left an archaeological trace. There are also several aeroplane crash sites associated with the airfields at Leeming and Linton.
- 5.93 Overall, some 4.46% of the ASMRP 3 resource overlaps with designated historical sites –the highest figure seen in any of the ASMRPs. Most of this (2.56%) comprises overlaps with two Registered Battlefields (Marston Moor, to the east of Tockwith, and Myton, to the east of Boroughbridge). It also includes a number of Registered Parks and Gardens (1.27%) and Scheduled Ancient Monuments (0.62%). In addition there are 275 listed buildings.

Natural Environment Characteristics

- 5.94 Overall, 1.8% of the ASMRP 3 resource area falls within one or more natural environment designations.
- 5.95 At an international level only one small ASMRP 3 polygon is affected, within the headwaters of the River Laver, 11km to the west of Ripon. The site in question forms part of the extensive **North Pennine Moors** designation (see under ASMRP 2, above) and is designated both as a SAC and a SPA. The total area affected represents less than 0.004% of the available surface area of potential resource within ASMRP 3. There are no **Ramsar** sites.
- 5.96 At the national level again there are no **NNR** designations but there are 12 instances where the resource either falls within or overlaps with **SSSIs**. In total, these affect just over 0.12% of the mapped resource in addition to the SAC/SPA site mentioned above. They include the **Mar Field Fen** SSSI north of Masham, the **Bishop Monkton Ings** to the south of Ripon (both of which have already been described under ASMRP 1), the **Farnham Mires** designation to the north of Knaresborough and the **Pan Beck Fen** SSSI to the south west of Hellifield. All of these are fragmentary remains of wetland habitats which would once have been more extensive within the river valleys concerned.
- 5.97 At a local level, there are two **LNR** designations, one covering 5.7% of the large spread of resource around Nosterfield, between Ripon and Bedale and the other within a smaller resource outcrop in the lower part of the River Skell valley, on the western edge of Ripon, where just 2.5% of the resource is affected. In addition, a total of 68 mineral resource polygons overlap with one or more **SINCs**, though this amounts to just 1.48% of the overall area of ASMRP 3 resources. The sites are distributed throughout the resource outcrop and affect some of the larger resource polygons as well as smaller ones. Most notable, perhaps, is the large area of resource around Nosterfield, where almost 14% of the outcrop is covered by a total of 6 separate SINC designations – the three largest of which are restored areas of former gravel extraction.

- 5.98 Approximately one third (29.8%) of the ASMRP 3 resources fall within one or another of the currently identified Biodiversity Landscape Areas. Once again, the main area of overlap is with **BLA 8**, where outwash deposits from the Vale of York Glacier cut across the Magnesian Limestone Ridge. Other notable areas of overlap occur along the western edge of **BLA 11** (the Howardian Hills AONB and Western North York Moors Belt), within **BLA 20** – (the Lower Ouse), and within **BLA 9** (the Lower Aire and Went Valleys).
- 5.99 In addition, the ASMRP 3 resources in many areas overlap to a limited degree (just over 13% in total) with individual Biodiversity Opportunity Areas. They also overlap to greater extent (31.4%) with the Regional-level Green Infrastructure Corridors associated with the main river valleys (particularly the Swale and the Ure) and with various Sub-Regional (15.3%) and District (10.7%) corridors.

ASMRP 4: Glacial Sand & Gravel

General Landscape Characteristics

- 5.100 At the national level, the Nidderdale AONB designation covers almost 7.8% of the overall mapped resource. This solely affects the western section of this resource, around and to the north of Galphay, to the west of Ripon. Within that area, almost all of the individual resource polygons are 100% within the designation.
- 5.101 In addition, 0.34% of the overall resource area is covered by Ancient Woodland designations. The areas affected are, again, predominantly around Ripon within Harrogate District but also within the northern parts of the Richmondshire and Hambleton Districts.
- 5.102 The ASMRP 4 resource distribution is very similar to the main parts of ASMRP 3, described above, being restricted to just five of Natural England's National Character Areas: NCA 22 (Pennine Dales Fringe); NCA 24 (Vale of Mowbray); NCA 28 (Vale of York, NCA 30 (Southern Magnesian Limestone) and NCA 23 (Tees Lowlands).
- 5.103 Within the first four of these, the landscape characteristics are very similar to those described above for the corresponding areas of ASMRP 3, with important subdivisions between the floodplain areas (falling within **LCT 24** – River Floodplains) and the adjoining landscapes (forming parts of **LCT 13**, **LCT 25**, **LCT28** and **LCT 6**, respectively). Descriptions for all of these have been provided earlier so are not repeated here. A more general difference in character is that the glacial deposits of ASMRP 4 tend to be more irregular in form and to exhibit greater local relief than the glacio-fluvial sediments of ASMRP 3, though this is not always the case.
- 5.104 In the fifth area (Tees Lowlands), the ASMRP 4 deposits occur within **LCT 27** (Vale Farmland with Dispersed Settlements) and **LCT 36** (Gritstone Valley). The LCT 27 areas associated with these resources are characterised by:
- Low-lying, gently undulating, medium to large scale agricultural landscapes;

- Distant sense of enclosure provided by the backdrop of the North York Moors and the Yorkshire Dales;
- Mature hedgerows, often containing hedgerow trees;
- Dispersed settlement pattern of farmsteads, small hamlets and villages;
- Extensive traditional use of local clays for making bricks and pantiles.

Historic Environment Characteristics

- 5.105 A high density of archaeological monuments is also found within the valley of the River Ouse, below the confluence of the Swale and the Ure. These include more settlement features than are found on the adjoining floodplain, reflecting the fact that the higher ground of ASMRP 4 is less prone to flooding. Representative medium density polygons are found to the south east of Kirby Malzeard, to the west of A1 south east of Thornborough and to the east of A1 by Helperby.
- 5.106 The highest density of known archaeology for this ASMRP is close to the line of the A1, which largely follows the alignment of the Dere Street Roman road. It reflects proximity to the historic towns of Boroughbridge and Aldborough and the extensive settlement that developed along this major communications artery. The resource area includes the remains of an important motte and bailey castle at Maiden Bower near Topcliffe. The castle was formerly a strategic seat of the Percys, the Earls of Northumberland, who were a major political force during the medieval period.
- 5.107 In addition to the known sites and those which are visible above ground, there is likely to be others that, as yet, remain undetected. The absence of more recent alluvium, and the nature of the underlying geology, means that aerial photography and other remote sensing techniques, such as geophysical survey, will probably be fairly successful in identifying buried remains. However, they cannot be expected to yield comprehensive results, with factors like background magnetism possibly inhibiting magnetometry and natural formations obscuring cropmark features.
- 5.108 There are some findspots indicative of an early prehistoric human presence in this area and a possible Neolithic henge at Skelton on Ure, but generally fewer monuments are known than on the river terraces of ASMRP 2. Several barrows have been identified, which are probably of Bronze Age date, indicating activity at this time. A tree trunk coffin, found north of Wath, may also date to this period. The Bronze Age monumental funerary tradition is echoed by the square barrows of the pre-Roman Iron Age, with one probable example being identified on Howe Moor. There are a large number of enclosures that are not presently closely dated, but, as dated enclosures are also known, in all likelihood, some of these will have a pre-Roman Iron Age genesis, whereas others will have developed during the Roman period. Hut circles are characteristic of the rural domestic settlements during both periods, and the town at Aldborough (Isurium Brigantum) is thought to have been an important tribal centre for the Brigantes.

- 5.109 Most of the evidence for the early medieval period comprises a distribution of stone crosses, although a watermill and village are recorded near to Crakehill. Settlements of this period are notoriously difficult to detect archaeologically, except serendipitously during excavation, and the easily tilled soils will have continued to be attractive, so other sites may yet exist undiscovered within the ASMRP. There are a great many known medieval archaeological sites with a wide distribution over this ASMRP. Against a background of evidence relating to agriculture, including field boundaries and ridge and furrow cultivation, other site types include moats, manors, parkland, granges and deserted villages, such as that at Brafferton and another in the vicinity of Maiden Bower castle. The archaeology of the post-medieval period is predominantly rural in character, (although early railways are also of interest), and includes high-status halls, such as Helperby Hall, and planned parks, such as Nidd Park, close to Harrogate.
- 5.110 Overall, the ASMRP 4 resources overlap to only a small extent (1.03%) with historic environment designations. These are mostly Historic Parks and Gardens (0.75%) but also SAMs (0.11%) and the Registered Battlefields at Boroughbridge and Marston Moor which, together, overlap with 0.17% of the overall resource outcrop. In addition, there are 400 listed buildings.

Natural Environment Characteristics

- 5.111 Overall, just below 1.2% of the ASMRP 4 resource area falls within one or more natural environment designations.
- 5.112 International environmental designations affect two small resource polygons to the south of Cowling in the extreme south of Craven District. In each case the designation involved forms part of the **South Pennine Moors** SAC and SPA which is identified primarily for its upland dry heaths and areas of blanket bog, together with the populations of wild birds which they support. These include Merlin (*Falco columbarius*) and Golden Plover (*Pluvialis apricaria*). There are no **Ramsar** sites. The total area covered by these international designations represents just under 0.06% of the available surface area of potential resource within ASMRP 4.
- 5.113 At the national level, again there are no **NNR** designations but there are four **SSSIs** which, in total, affect just under 0.15% of the ASMRP 4 resource. One of the SSSIs is coincident with the **South Pennine Moors** SAC/SPA designations mentioned above. The three others comprise the fen wetland habitats of **Cow Myers** SSSI, which affects the very eastern margin of the extensive deposits around Galphay, to the west of Ripon; the **Hay-a-Park** SSSI – an open water body of importance to breeding birds and wintering wildfowl, which occupies former gravel workings and overlaps with a small part (2.5%) of a large outcrop of unworked resources immediately to the north east of Knaresborough; and the **Farnham Mires** SSSI, which contains rare grassland and marsh associated with the underlying Magnesian Limestone, but which overlaps with some 25% of a small ASMRP 4 resource polygon to the north west of Knaresborough.

- 5.114 At a local level, there are no **LNR** designations but a total of 38 polygons are overlapped by one or more **SINCs**, accounting for just less than 1.05% of the total area of mapped ASMRP 4 resources. The sites affect some of the larger resource polygons, including the area between Galphay and Grewelthorpe, to the west of Ripon and an area around Langthorne, to the north west of Bedale, as well as numerous smaller polygons scattered throughout the area. The percentage affected typically amounts to around 4 to 5% in the case of the larger polygons but up to 100% in the case of small outcrops.
- 5.115 Most of the ASMRP 4 resources fall outside the current Biodiversity Landscape Areas. The main overlap is with **BLA 8**, where the course of the former Vale of York Glacier cuts across the Magnesian Limestone Ridge. These areas, together with a very minor overlap with **BLA 20** (Lower Ouse) account for just over 7% of the total ASMRP 4 resource outcrop.
- 5.116 In addition, many of the resources overlap to a somewhat greater degree (just over 18% in total) with individual Biodiversity Opportunity Areas. They also overlap to a notable extent (19.7%) with Regional-level Green Infrastructure Corridors (mostly within the Lower Swale and Ouse valleys); with Sub-Regional corridors (6.8%, mostly within the Bedale area) and within various District-level corridors (4.6%).

ASMRP 5: Undifferentiated Sand & Gravel

General Landscape Characteristics

- 5.117 At the national level, the Howardian Hills AONB designation covers almost 2.8% of the overall mapped resource. This is located only within the western-most section of the resource, to the north west of Malton.
- 5.118 A small number of Ancient Woodland designations also occur within the very northern tip of the resource area in Scarborough District. The total area of the resource involved is just 0.02%.
- 5.119 In terms of landscape character, ASMRP 5 is confined almost entirely to the fringes of NCA 26, the Vale of Pickering (which at this level of detail includes the Vale of Rye). Along its southern margin, the resource overlaps onto the northern edges of the Yorkshire Wolds (NCA 27) and the Howardian Hills (NCA 29). On its northern margin it also clips the southern edge of the North York Moors (NCA 25) in the area around East Ayton and West Ayton. For the most part, however, these areas of overlap can be attributed to the relatively coarse scale of the NCA mapping.
- 5.120 When examined in more detail at the scale of the County landscape assessment, the ASMRP 5 resource lies entirely to the north of the Chalk Wolds (**LCT 18**) and entirely to the south of the Limestone Foothills and Valleys (**LCT 4**) which form the southern edge of the North York Moors. There is some minor overlap with the Chalk Foothills (**LCT 19**) to the south east of Rillington and with the Jurassic Limestone Ridge (**LCT 5**) to the south west of Norton and to the north west of Malton. Elsewhere however, the ASMRP 5 resource either coincides very closely with the Sand and Gravel Vale Fringe (**LCT 30**), or extends out into the flatter areas

which comprise **LCT 22** (Open Carr Vale Farmland), within in the Vale of Pickering in the east, and **LCT 26** (Enclosed Vale Farmland) within the Vale of Rye in the west. The most relevant features of these three character types, to the ASMRP 5 resource areas, are outlined below.

- 5.121 LCT 30 is virtually defined by the presence of the mineral resources which form areas of gently sloping land at the margins of the Vale of Pickering and the Vale of Rye. They form transition zones between the very flat land of the Vales themselves and the higher ground which exists both to the north (in the North York Moors) and to the south (in the Yorkshire Wolds and the Howardian Hills). The key landscape characteristics of these areas include:
- gently sloping or gently undulating land, slightly elevated above the adjoining flat land of the Vale of Pickering;
 - striking settlement pattern with villages located along the spring line at the foot of the Wolds escarpment (along the historic courses of the A64 and A1039 roads), and at the foot of the North York Moors dip slope (along the A170);
 - many buildings constructed from locally derived Chalk (in the south) or Jurassic Limestone (in the north), reflecting the respective proximity of these areas to local quarries within adjoining landscape types;
 - extensive archaeological evidence testifying to a continuum of human settlement, farming and rural industry throughout the last 10,000 years, following the climatic improvement at the end of the last glaciation.
- 5.122 LCT 22 (Open Carr Vale Farmland) occupies the Vale of Pickering and includes areas where the ASMRP 5 resources extend out into the Vale in sufficient thicknesses to be commercially exploited. Further out still, the sands and gravels grade into uncommercial silts and clays, which accumulated in the former glacial lake. The key landscape characteristics of the areas where sand & gravel resources exist include:
- broad, flat, vale landscape, contained to the north by the limestone foothills of the North York Moors and to the south by the Chalk scarp of the Yorkshire Wolds;
 - predominantly arable farmland, underlain by peaty soils, and comprising medium-to large scale rectangular fields, delineated by drainage ditches and dykes;
 - settlement pattern over most of the area comprises scattered, isolated farmsteads;
 - relatively sparse tree cover except for localised plantations, including screening areas associated with the sand & gravel workings around Wykeham Lakes (which extend beyond the mapped limits of the ASMRP resources);
 - several prehistoric sites (such as Star Carr), heritage features (such as Wykeham Abbey) and historic drainage works (such as the Hertford River) are scattered throughout the landscape.
- 5.123 LCT 26 (Enclosed Vale Farmland) occupies the Vale of Rye, which effectively forms a westerly extension of the Vale of Pickering, with only subtle changes in landscape character. The differences relate primarily to the slightly greater topographic relief seen in this area, with

fewer areas of flat, open carr and more differentiation between individual river valleys and intervening areas of broadly undulating terrain. ASMRP 5 resources occur only at the southern edge of the area. The key landscape characteristics include:

- broad vale landscape, contained to the north and west by the limestone foothills of the North York Moors and to the south by the Howardian Hills;
- predominantly arable farmland, comprising medium-to large scale rectangular fields, with some areas of improved pasture;
- lightly settled landscape, predominantly rural in character, with an overall sense of tranquillity.

Historic Environment Characteristics

- 5.124 The high density of known archaeological sites within this ASMRP is partly a reflection of the intensity of ongoing research and excavation projects that have taken place in this area over several decades, but it is also indicative of the area's exceptional importance in terms of yielding evidence for a continuum of historical land use and settlement from the Early Mesolithic to the present day. There is a distinctive sense of place with the former glacial lake and wide U shaped valley easily envisaged within the present landscape, and man has been settling and using this landscape from at least 9000BC (Vale of Pickering Statement of Significance . unpublished draft, Dr Louise Cook, Landscape Research Centre August 2011). The landscape today is largely the result of 19th century agricultural improvements and there is little in its present day appearance that provides visual evidence of the density of past human occupation.
- 5.125 Chronology- The margins of the Vale of Pickering have long been known as areas that attracted early settlers from the Mesolithic period onwards. This is likely to reflect the fact that they were both ice free and relatively sheltered during the last glaciation, by comparison with the adjoining higher landscapes of the Yorkshire Wolds and the North York Moors, and were marginally higher than the areas submerged beneath the intervening Lake Pickering. There is a concentration of Mesolithic finds at the former lakeshore on the 25 metre contour (Cook LRC, 2011), as the climate grew warmer the lake gradually filled in. There is thought to have been a relatively sedentary hunter/gatherer community living on the lake edge. Intensive farming in the Vale of Pickering limits such finds compared to the lithic scatters found on the less densely used North York Moors.
- 5.126 From the Neolithic period, c. 3500 BC there is evidence of major human activity with the construction of long barrows on the Wolds, Moors and 'edges' of the Vale of Pickering. Henge forms are closely spaced along the same contour line from Malton to Seamer in the east and Malton to Hovingham in the west (Cook LRC, 2011). C. 3000 BC round barrows appear, cursus monuments and mortuary enclosures, mainly on the south side of the Vale. There is evidence of island settlements and burials within the peat fens, linked by trackways. The landscape is already being divided into large blocks by pit alignments, cemeteries and trackways along boundaries.

- 5.127 The Bronze Age resulted in extensive cemeteries on the 30-40 metre contour on the south and probably also the north side of the River Derwent (LRC, aerial photography and continuous appraisal). The high density and continuous human occupation of these sites lasted for over 1000 years. The Beaker settlement excavated by the LRC at Cooks Quarry contains the only known Beaker kiln found in the world. By the Mid Bronze Age there were cemeteries and settlements at West Heselton, located on sand and grave islands in the surrounding wetland. Arable production was carried out on drier land, but by 1200BC climate change ended arable cultivation on the north York Moors.
- 5.128 Evidence of the Iron Age comes from 1000's of square barrow burials in the Vale of Pickering and its North and South slopes. A large population was living in round houses and increasingly in ladder settlement – a nucleated core of with enclosures either side of a trackway. From 500BC to 500AD there is evidence that settlements 'oscillated', with small shifts, abandonment and relocation and restocking over many years.
- 5.129 It is important to note that many of these Neolithic and Bronze Age interventions do not appear on geophysical returns or aerial photographs as they are covered by later layers of windblown deposits and sands – loess.
- 5.130 The Roman period brought the influence of the new Roman fort and town of Malton. Ladder settlements continued to thrive with some Roman villas and structures such as the bath house excavated at Hovingham in the mid 18th century providing evidence of a very different life style that did not greatly influence the local population. At West Heselton a Roman shrine has been excavated, associated with a well or spring that probably had an earlier ritual significance as well. The 'backward' flowing River Derwent (the glacier diverted its course west to the Ouse Basin) is associated with several such sites (Cook LRC, 2011).
- 5.131 There is a high concentration of Anglo Saxon sites in the Vale of Pickering and aerial photography is revealing a similar density in the Wolds with settlements every 800 metres and small villages at 2,500 metres. In the 8th century there is a shift in settlement to the north and South sides of the Vale (possibly associated with Viking settlers) and a reorganisation of the landscape into rig and furrow. The religious communities at Lastingham, Coxwold, Gilling and Stonegrave are located close to this relatively densely populated area.
- 5.132 The Domesday Book shows that this was a wealthy and complex economy in the early Medieval period (Cook LRC 2011), the Norman Conquest introduced castles but the parish churches were probably the biggest addition to the landscape of the Vale, and the influence of Monastic granges is found in the remains of extant buildings reused within later farms.
- 5.133 From the 18th century enclosure and intensive agriculture wrought major changes in the Vale of Pickering. Major drainage works were carried out to increase arable production and improve grazing land. Plans were made to straighten the River Derwent and separate the high ground run off from the lowland drainage. Major works were undertaken in the 1970's and Drainage Boards still manage silt clearance and bank maintenance. The railway arrived

in 1845 opening up new markets and employment and the large estates at Wykeham and Scampston created new aesthetically designed landscapes and estate house and villages.

- 5.134 The sand and gravel surfaces have therefore have been highly attractive to humans, and any intervention within these areas is likely to encounter surviving archaeology. Indeed, extensive survey by the Landscape Research Centre (LRC; <http://www.landscaperesearchcentre.org/>) has found few areas where archaeology appears to be absent, and it seems wise to treat these apparent areas of absence with suspicion.
- 5.135 Internationally important archaeological remains at the Mesolithic site at Star Carr near Scarborough represent the best preserved evidence of early human activity in the north-east of England. These date from up to 10,900 cal BP – just 600 years after the abrupt climatic improvement which signalled the end of the last glaciation and the start of the present Holocene interglacial. Earthen long barrows distributed across the Vale are a sign of occupation by later Neolithic farmers. Of major importance is the well-investigated settlement site at West Heslerton has activity dating from the Mesolithic period through to the later Bronze Age. There is also evidence here of later Roman activity, a shrine complex, and it became an important early and late Anglo-Saxon settlement. The Heslerton Parish Project has provided a framework for over 20 years of research into historic activity in the landscape and discoveries of major Iron Age cemeteries at West Heslerton and Rillington and the extensively excavated Anglo-Saxon cemetery at West Heslerton mean the Vale of Pickering is now recognised as having one of the highest concentrations of archaeological activity in Britain. Indeed, so much so, that the remains at West Heslerton, now hardly seem exceptional by local standards, although they certainly are nationally important.
- 5.136 The work of the LRC has demonstrated that, when used in combination, high-resolution geophysical survey and aerial photographic survey can be highly informative concerning the nature of the sub-surface archaeological resource. Neither method can be exclusively relied on, however, and ground truthing by excavation has proved that survey results are seldom comprehensive. The results of aerial survey can be influenced by different regimes of land management, ploughing, the nature of the overburden and the climatic specifics of a particular season – a site that is visible one year may not be the next and vice versa. Geophysical survey can be affected by the nature of the geology and overburden. In most instances, survey of a site following topsoil removal will yield better, more detailed results.
- 5.137 Aeolian sands started to be deposited within the Vale of Pickering, probably, at the end of the Devensian glaciation. These tend to shift over time, and accumulate differentially depending upon the nature of the land use and vegetation. This means that archaeological horizons can become sealed beneath deposits of cover sand, which both protect and obscure them. Deep ploughing, associated with the very recent intensification of farming, is having a widespread impact across the area. This is disturbing both the cover sand and the archaeological deposits it seals, which, in certain serendipitous circumstances, can reveal previously unknown archaeological sites, shortly prior to their eventual destruction. In parts of the area, prevailing wetland conditions promote the survival of organic archaeological

remains, the ongoing desiccation of these wetlands threatens the integrity of any such resources.

- 5.138 This ASMRP includes Malton/ Norton which was the site of important Roman fort and vicus and the hub for Roman roads in East Yorkshire. The present settlement developed from a Norman castle at Malton. Remains from the medieval period include fortified manors and churches. Wealthy landowners of large estates in the 18th and 19th century such as Wykeham Abbey also changed the appearance of the landscape of the Vale of Pickering through agricultural improvements and other aesthetically motivated improvements and this. It is not always easy to see these layers of landscape evolution in what is a low-lying predominantly farmed landscape.
- 5.139 There are a number of polygons with a medium range of density found close to Malton, to the south of Yedingham, close to Seamer and to the smaller settlements at Staxton, Ganton and Sherburn.
- 5.140 Overall, there are 349 listed buildings and 1.56% of the total ASMRP area falls within listed Parks and Gardens. A further 0.46% of the ASMRP 5 resource falls within areas that are designated as Scheduled Ancient Monuments. This clearly does not reflect the true archaeological importance of the Vale of Pickering, which is more accurately characterised by the AHEIP density scores, as noted above. This discrepancy will need to be taken into account in the assessment of environmental sensitivities which is to follow in Stage 3 of this project.
- 5.141 There is concern that intensive agriculture, further land drainage and (potentially) any dewatering that might be associated with future mineral extraction in this area, may adversely affect the survival of archaeological remains, particularly within waterlogged organic soils which have successfully preserved these features and artefacts for many thousands of years.

Natural Environment Characteristics

- 5.142 Overall 0.53% of the ASMRP 5 resource area falls within one or more natural environment designations.
- 5.143 The largest of the 29 resource polygons, which extends along the southern and eastern margins of the Vale of Pickering, overlaps to a very minor extent, with one international environmental designation, this being the **River Derwent SAC** which, as previously noted in relation to ASMRP 2, is designated for its spawning population of river lamprey. The SAC clips the edge of the resource polygon in two locations. Together, these amount to less than 0.004% of that polygon and just under 0.003% of the overall ASMRP 5 resource. There are no **SPAs** and no **Ramsar** sites.
- 5.144 At the national level, again there are no **NNR** designations and only three **SSSIs** which, in total, affect just over 0.065% of the ASMRP 5 resource. In addition to the River Derwent

referred to above, these include the small **Wintringham Marsh** SSSI to the south east of Rillington and the **Betton Farm Quarries** geological SSSI, which clips a very small resource outcrop to the east of Ayton, near Scarborough.

- 5.145 At a local level, there are no **LNR** designations and just 6 polygons which are overlapped by one or more **SINCs**, accounting for 0.46% of the total area of mapped ASMRP 5 resources. Thirteen individual SINCs are recorded within the largest resource polygon referred to above, where they affect 0.56% of the mapped resource area.
- 5.146 Almost all (86%) of the ASMRP 5 resources fall within one or another of the current Biodiversity Landscape Areas. The predominant area of overlap (almost 77% of the resource) is with **BLA 12**, the Vale of Pickering. Much smaller areas of overlap occur with the adjoining **BLA 11** (Howardian Hills AONB and Western NYM Belt); **BLA 10** (North York Moors Grassland Fringe), and **BLA 14** (Lower Derwent Valley).
- 5.147 In marked contrast to these figures, only 15% of the ASMRP 5 resources overlap or coincide with individual Biodiversity Opportunity Areas. Although there are many such areas within and around the Vale of Pickering, most of them are either outside or only slightly overlapping with the mineral resource. The resources also overlap (by 27.1%) with the Derwent Valley Regional-level Green Infrastructure Corridor; the Rye and Wolds Sub-Regional corridors (24.3%); and with the Hertford River and Pickering Beck District corridors (9.4%).

ASMRP 6: Quaternary Brick Clay Resources

General Landscape Characteristics

- 5.148 At the national level, just 0.77% of the total ASMRP 6 resource, at the extreme eastern edge of its outcrop, overlaps with the Howardian Hills AONB designation.
- 5.149 A number of Ancient Woodland designations also occur within the resource outcrop, predominantly on the western and eastern edges. The total area of the ASMRP 6 resource thus affected is 1.58%.
- 5.150 The ASMRP 6 resource distribution is broadly similar to that of ASMRP 3, described above, but more extensive. It falls predominantly within National Character Areas 24 (Vale of Mowbray); 28 (Vale of York); 39 (Humberhead Levels) and, to a lesser extent, NCA 30 (Southern Magnesian Limestone) and NCA 23 (Tees Lowlands). The principal difference is the much greater extent of the deposit within the first three of these areas, and especially within the Humberhead Levels where it occupies a very large proportion of the landscape.
- 5.151 In each of these areas there are, once again, important subdivisions between the floodplain areas (falling within **LCT 24** – River Floodplains) and the adjoining landscapes (forming parts of **LCT 25**, **LCT28**, **LCT23**, **LCT 6** and **LCT 27**, respectively). Descriptions for all of these have been provided earlier so are not repeated here.

- 5.152 A more general difference in character is that the glacio-lacustrine deposits within ASMRP 6 tend to form areas of much flatter and relatively poorly-drained land, underlain by clay soils, in contrast to the more undulating topography and well drained sandy soils associated with ASMRPs 3 and 4. Although many of these areas are small, some of them are very extensive, particularly within the Vale of York and the Humberhead levels. In those areas the characteristics of the ASMRP 6 resource outcrops exert a dominating influence on the wider landscape.

Historic Environment Characteristics

- 5.153 This ASMRP contrasts markedly in terms of known archaeological sites with the more densely populated Magnesian limestone ridge to the west. The highest density of sites occur around Boroughbridge, both to the east of the A1 (including the important Roman town of Isurium Brigantum at Aldborough) and to the west (including the Roman fort at Roelcliffe which had a very short occupation in the first century AD) and also in Selby to the south of the county. A lower density of sites occur in a large band that extends immediately to the east of and parallel to, the line of the A1, centred on Pickhill and Swainby Abbey, and also close to Selby, to the south east of Boroughbridge and between Leeming and Baldersby to the east of the A1. Elsewhere within the area, sites occur only in low frequencies.
- 5.154 This distribution clearly reflects the past importance of the communications corridor followed by the A1 (M), which follows the same line as Roman Dere street. Otherwise, the comparatively low density of known archaeological sites may genuinely be due to the lower-lying, heavier soils (and, prior to drainage, the presence of residual lakes and extensive swamps) supporting a smaller population in the past. Alternatively, this may instead be an artefact of recovery, due to the lower levels of recent development in this rural area, and problems with site visibility. Cropmarks do not form well on these water-retaining soils, and geophysical survey can yield unreliable results. Consequently, it is probably safe to assume that archaeological sites of all periods could occur in areas where no indication is provided by non-intrusive survey.
- 5.155 The evidence from the earlier prehistory is largely restricted to isolated findspots, and monuments are presented only by rare round barrows of probable Bronze Age date. This most likely reflects a genuine difference in land use and patterns of inhabitation to the Magnesian limestones. There is some evidence for settlement and enclosure during the pre-Roman Iron Age, demonstrating that the area was permanently settled at around the same time as other areas of the county. Apart from the Roman sites already listed, there is also a wide distribution of settlements and enclosures, known throughout the area. An example is the known Roman villa close to Drax.
- 5.156 There is a paucity of evidence for the early medieval period, and it largely comprises stone findspots such as crosses, grave slabs and a hogbacked stone, although there is a deserted village near Maunby. However, for the reasons described above, it is possible to speculate that archaeological sites of this period remain, as yet, undiscovered. Relatively speaking, there are a great many known medieval archaeological sites with a wide distribution over this ASMRP. Against a background of evidence relating to agriculture, including field

boundaries and ridge and furrow cultivation, other site types include moats, manors, parkland, granges, deserted villages and ecclesiastical centres such as Nun Monkton Priory. The site of the Battle of Myton, fought between the Scots and the English, during the fourteenth century, lies immediately adjacent to ASMRP 6 deposits within this area. Many of the present day villages also probably originated at this time.

- 5.157 The post-medieval archaeology comprises agricultural remains, rural settlements, parks and halls, such as Woolas Hall, Beningbrough Hall, Scarthingwell and Rest Parks, canals, railways and small-scale industrial sites, including brick kilns. The flat character of the land has made it particularly suitable for airfields, and numerous Second World War recorded crash sites are associated with Linton, Tholthorpe, Topcliffe, Leeming, Burn, Church Fenton, Riccall and Sherburn in Elmet airfields.
- 5.158 There are 170 listed buildings and some polygons include both listed Parks and Gardens and SAMs (covering 0.47% and 0.17% of the overall ASMRP 6 resource area, respectively). A further 0.18% of the resource overlaps with Registered Battlefields.
- 5.159 AHEIPs with high density of historic environment scores within ASMRP 6 occur around Boroughbridge, both to the east of the A1 (including the important Roman town of Isurium Brigantum at Aldborough) and to the west (including the Roman fort at Roecliffe which had a very short occupation in the first century AD) and also in Selby to the south of the county. Medium density heritage scores are found in a large band that extends immediately to the east of and parallel to, the line of the A1, centred on Pickhill and Swainby Abbey. There are also medium density polygons close to Selby, to the south east of Boroughbridge and between Leeming and Baldersby to the east of the A1.
- 5.160 Aside from these areas, the heritage scoring for the vast majority of the ASMRP 6 mineral resource is low.
- 5.161 There are 170 listed buildings and some polygons include both listed Parks and Gardens and SAMs (covering 0.47% and 0.17% of the overall ASMRP 6 resource area, respectively). A further 0.18% of the resource overlaps with Registered Battlefields.

Natural Environment Characteristics

- 5.162 In total, just over 2.2% of the ASMRP 6 resource area falls within or is overlapped by one or more natural environment designations.
- 5.163 Four of the resource polygons overlap with international designations. These include the **Lower Derwent Valley** at the eastern edge of Selby District, which is one of the largest and most important examples of traditionally managed species-rich alluvial flood meadow habitat remaining in the UK. It is designated as a **SAC**, specifically because of its high quality lowland hay meadow habitats, but also as a **SPA**, in recognition of its outstanding importance in supporting populations of numerous water birds throughout the year and as a **Ramsar** site. The latter citation notes, additionally, that the river and flood meadows play a substantial role in the hydrological and ecological functioning of the Humber Basin. The resource also overlaps with the **River Derwent** SAC, designated primarily for river lamprey.

This overlaps with part of the Lower Derwent Valley designations but also affects areas further upstream in Ryedale District. It also overlaps with the **Stensall Common** SAC, designated for both North Atlantic wet heath and European dry heath habitats. This designation occurs predominantly within York but extends marginally into the south western edge of Ryedale District. Together, these designations affect only the very fringes of the ASMRP 6 resource outcrop, amounting to less than 0.013% of its total surface area.

- 5.164 At the national level, parts of the Lower Derwent Valley SAC are also designated as a **NNR**, and all of the SACs mentioned above are designated as **SSSIs**. These and a handful of other small **SSSIs** in the same general area affect less than 0.037% of the overall mapped resource within ASMRP 6.
- 5.165 At a local level, there are two **LNR** designations and a total of 110 individual locations fall within **SINCs**. The latter are distributed more widely throughout the mapped extent of the resource but are still predominantly within Selby District, mostly within the extensive clay deposits between Selby, Sherburn, Church Fenton and Eggborough, where about 6.5% of the resource is affected. Overall, however, **SINC** designations cover just fewer than 2.16% of the mapped ASMRP 6 resource.
- 5.166 Just below 23% of the ASMRP 6 resources coincide with one or another of the current Biodiversity Landscape Areas. They overlap substantially (11.6%) with **BLA 9** (the Lower Aire and Went Valleys) and to a lesser extent with **BLA 8** (Lower Magnesian Limestone), **BLA 14** (Lower Derwent), **BLA 20** (Lower Ouse) and **BLA 11** (Howardian Hills etc.).
- 5.167 In addition, there is a slightly lower overall degree of overlap (just under 18%) with individual Biodiversity Opportunity Areas, scattered throughout the resource. The mineral also overlaps, to varying degrees, (22.2% in total) with all of the Regional-level Green Infrastructure Corridors and with several of the Sub-Regional (11.3%) and District (3.7%) corridors.

ASMRP 7: Cretaceous Chalk Resources

General Landscape Characteristics

- 5.168 At the national level, this resource area does not fall within any AONBs. However, along the western boundary of the resource area are 5 Ancient Woodland designations, covering just 0.08% of the overall mineral resource. This can be subdivided into 0.37% of the lower purity Chalk, which crops out primarily on the steeper slopes at the margins of the resource, and 0.01% of the higher purity resource, which occupies the more gently rolling higher areas of the Wolds. At the eastern edge of its outcrop within North Yorkshire, ASMRP 7 overlaps with part of the Flamborough Headland Heritage Coast designation. This covers fewer than 2% of the overall ASMRP 7 area, including both high and low purity subdivisions.
- 5.169 In terms of more general landscape character, the ASMRP 7 resource falls almost entirely within NCA 27, the Yorkshire Wolds, with very small areas extending northwards into the Vale of Pickering (NCA 26). In the more detailed County landscape assessment, the Wolds are

subdivided into the Chalk Headland (**LCT 17**), the Chalk Wolds (**LCT 18**), the Chalk Foothills (**LCT 19**), the Broad Chalk Valley (**LCT 20**), and the Narrow Chalk Valley (**LCT 21**), each of which are briefly summarised below. In some places along the foot of the northern scarp, the ASMRP 6 resource appears to extend slightly into **LCT 30** (the Sand & gravel Vale Fringe), described earlier under ASMRP 5.

- 5.170 Those parts of the resource which extend into LCT 17 (Chalk Headland) comprise the steep cliffs and adjoining Chalk farmland to the north east of Speeton, on the northern-most part of Flamborough Head. The key characteristics of this area are the steep Chalk cliffs, the rolling farmland behind, with fields delineated by low hedgerows, and various aspects of the historic environment from evidence of Neolithic cultures to World War II defence structures.
- 5.171 The main part of the ASMRP 7 resource falls within the Chalk Wolds landscape type (LCT 18), particularly on the higher, rolling plateau surfaces above the Broad Chalk Valley of the Gypsy Race (LCT 20) and above the Narrow Chalk Valley system (LCT 21) around Thixendale in the west. The key landscape characteristics of the resource within LCT 18 include:
- prominent Chalk hills which rise from the surrounding lower landscapes and have a predominantly open character;
 - dispersed, nucleated farmsteads surrounded by large, open, predominantly arable fields crossed by drove ways and enclosure roads with wide verges;
 - high concentration of historic sites, reflecting prehistoric habitation of the plateaux;
 - visible evidence of medieval villages, cultivation terraces and earthworks;
 - overall strong sense of tranquillity, remoteness and associated dark night skies.
- 5.172 Two parts of the ASMRP 7 resource, to the south and south east of Rillington and around Hunmanby in the east, extend into LCT 19 (the Chalk Foothills). The first of these areas is the more typical of this character type, with steep, clearly-defined scarp slopes characterised by a general absence of development, swathes of species-rich Chalk grassland, numerous blocks of deciduous woodland and long, open views across the adjoining lowland landscapes. The second area, whilst including a scarp slope looking out over Filey Bay, is predominantly characterised by a more general Wolds landscape, as described for LCT 18, above.
- 5.173 To the south of the main crest of the Chalk escarpment, the ASMRP 7 resources fall within the broad valley of the Gypsy Race (LCT 20) which, unusually for Chalk landscapes, includes a surface stream which flows eastwards over a thin cover of alluvial soils towards Bridlington on the East Riding coast. Within the North Yorkshire section, this valley has a lightly settled landscape with a pattern of linear villages and minor roads, largely contained within the valley floor and undeveloped valley sides. The latter are given over predominantly to arable cultivation. The fields are large scale and delineated by hedgerows. Some are of parliamentary enclosure origin.
- 5.174 A small part of the ASMRP 7 resource, around the village of Thixendale in the west of the Wolds, falls within a series of converging narrow dry valleys that have been separately identified as LCT 21 (Narrow Chalk Valley). These areas are largely undeveloped and

characterised by a patchwork of species-rich Chalk grassland, pastoral sheep farming and swathes of semi-natural woodland. Both the woodlands and the steep valley sides create a sense of enclosure and a strong sense of tranquillity.

Historic Environment Characteristics

- 5.175 The rolling Yorkshire Wolds is not a densely populated area, but has a long history of occupation. In 'Ancient Landscapes of the Wolds', completed as part of the National Mapping Programme (NMP), Catherine Stoertz analysed aerial photographs dating from the 1950's to 1990's to describe the archaeological resource and visible remains and describe how the landscape has changed over the course of this continuous human activity (Stoertz, C. RCHME 1997). There are a great many recorded archaeological sites, which is partially, but not entirely, due to factors governing their visibility. Low population levels and non-intensive land use have until recently helped promote the survival of the archaeology, with many sites still standing as readily identifiable earthworks. In most cases, buried archaeological deposits occur near to the present day land surface and are not sealed beneath alluvium or aeolian sand like ASMRPS 1 and 5, contributing to archaeological visibility, but also making them vulnerable to erosion or ploughing. The exception to this is the dry valleys that run down from the Wolds, where sediments have accumulated over time, sealing and preserving buried archaeological horizons. The dry valleys were created by streams running off the frozen Wolds.
- 5.176 The largest and broadest of the valleys, the Great Wolds Valley, carries the Gypsey Race from close to Duggleby Howe east and then south to the sea at Bridlington. It is the only permanently flowing watercourse through the Wolds, but due to water abstraction is not often seen on the surface until it reaches Rudston in East Yorkshire. Other small streams and springs are found at the edges of the Wolds where the chalk meets the dense clay deposited by the glacial lake. The change in the soil on this ASMRP from early times to the present is evidence of the impacts of continued human occupation. Barrow excavations reveal that there was a thick brown soil at the time of construction in the Bronze Age, whereas today the soil cover is thin brown clay with many chalk fragments. (Stoertz, 1997 *ibid*). Soil samples also reveal that the Wolds were once wooded, but have been cleared, cultivated, abandoned and re wooded and then cleared again over many millennia. The linear earthworks and trackways of the Bronze Age were probably laid out in an open landscape. The Roman fort and town at Malton probably contributed to an increase in arable cultivation on the lower slopes and valleys, with pasture on the tops. Cultivation resulted in the levelling of all but the largest barrows (like Duggleby Howe).
- 5.177 Parliamentary enclosure in the 18th and 19th centuries saw regular hedged fields replace pasture, sheep walks and open fields, both revealing and destroying barrows and earthworks, but bringing new artefacts to light. New shelter belts and coverts were planted by large landowners and helped to preserve some of the remaining man made features of earlier times. The introduction of wide spread mechanised farming in the 20th century resulted in bigger fields and further wearing away of the chalk surface and soil movement.

- 5.178 The landscape today is dominated by large fields and cereal growing, the valley sides are still used for sheep pasture, with trees on the steepest slopes.
- 5.179 Techniques such as aerial photographic survey and geophysical survey yield highly informative results on this geology, although, topographic survey and walkover survey can also be productive. As a consequence of their visibility, many of the sites have been known since antiquarians first became active in the area, and this long tradition of archaeological survey and research may introduce a bias if the Wolds are compared with other areas. This is particularly true of the adjacent ASMRP 5 where, recent survey work has revealed an archaeological landscape which is, if anything, denser than that on the Wolds. Notwithstanding this potential bias, the Wolds contain a wealth of important archaeological evidence and many of the known sites may only presently be partially characterised and are most probably complemented by a great number of sites that remain as yet undiscovered.
- 5.180 An abundance of important prehistoric monuments, dating particularly from the Neolithic period, include a substantial number of Neolithic long barrows, such as Willerby Wold, Kemp Howe and Kilham. The large Neolithic Duggleby Howe round barrow is at the centre of a large causewayed circular enclosure and there are considerable remains of multi-period activity within its vicinity. Duggleby Howe sits at the head of the Gypsy Race at the west end of the Great Wold Valley and its survival in the midst of what were the village open fields may be attributed to its size and past prosaic use as a windmill stance.
- 5.181 There are also a higher number of Group VI (Langdale) axes recovered from the Wolds than from any other part of Britain, including the Lake District source. This is symptomatic of an extremely large volume of surface-gathered lithic material from the Wolds, which are indicative of extensive early occupation. The numerous surviving earthworks on the higher slopes are thought to represent territorial boundaries and droveway systems that were used and developed over a long period. There are numerous Deserted Medieval Villages (DMVs) particularly along the northern margins of the Wolds where villages have shrunk in size or lost their population altogether at different periods in history. The surviving present-day villages are few, small and compact, usually linear in form and laid-out along each side of the street or a long narrow green and designed to take advantage of the available land for a mixed farming economy. In the higher Wolds such as at Kirby Grindalythe, the villages are often located in the valley bottom with regular cropped land on the surrounding slopes and with pasture beyond. In other settlements towards the foot of the chalk scarp, the scarp was used for pasture with arable land on the more easily cultivated lower gradient fields beyond.
- 5.182 Dispersed farmhouses and farm building groups were built throughout the Wolds by prosperous farmers in the 18th and 19th centuries and are characteristic of the area. The large Sledmere estate was responsible for major agricultural improvements and for the creation of managed parkland during this period. Some of the harder bands of chalk found in this area, as well as the flint nodules and cobbles contained within it were extensively used in the past for construction and there is therefore a visual link between these aspects of the historic environment and the local geology.

- 5.183 AHEIPS with high density historic environment scores occur within most parts of the resource, particularly within the western and eastern-most parts of the area. In marked contrast to this, designated SAMs affect only 0.67% of the overall geological resource and there are no Registered Battlefields or Parks and Gardens. There are just 77 listed buildings which, as much as anything, is a reflection of the very limited extent of surviving built development within the area. As noted earlier for ASMRP 5, these statistics do not do justice to the archaeological importance and potential of the Yorkshire Wolds, and this discrepancy will need to be taken into account in the assessments of environmental sensitivities which are to follow in Stage 3 of this project.

Natural Environment Characteristics

- 5.184 Overall, just below 2.4% of the ASMRP 7 resource area falls within one or more natural environment designations.
- 5.185 Two international designations, comprising the **Flamborough Head and Bempton Cliffs SPA** and the fractionally smaller **Flamborough Head SAC**, affect the Speeton Cliffs in the easternmost part of the resource, to the south east of Hunmanby. Each of the designations covers around 0.08% of the overall Chalk resource area within ASMRP 8. The SPA designation specifically relates to the large numbers of nesting seabirds including: Puffin (*Fratercula arctica*), Razorbill (*Alca torda*), Guillemot (*Uria aalge*), Herring Gull (*Larus argentatus*), Gannet (*Morus bassanus*), and, especially, Kittiwake (*Rissa tridactyla*). The corresponding SAC designation relates to the habitats associated with these species including the Chalk reefs, the vegetated cliffs and the submerged or partially submerged sea caves within the Chalk cliffs. There are no **Ramsar** sites.
- 5.186 At the national level, there are no **NNR** designations but there are 31 instances within the resource which fall within **SSSIs**. These include the Speeton Cliffs section of the **Flamborough Head** site referred to above which, as a SSSI, is designated for geological and geomorphological as well as ecological reasons, along with 12 other, mainly smaller SSSI designations. These are scattered throughout the resource area but occur predominantly within the outcrop of higher purity Chalk. They mostly occur within individual dales at the western end of the Wolds but also include a disused Chalk pit (**Wharram Quarry**, designated for its managed succession of flora and fauna within a former Chalk quarry), the **Fordon Chalk Grasslands** SSSI, designated for its variety of rare, species-rich grassland systems, and two sites on the brow of the northern scarp, overlooking the Vale of Pickering. The latter include the **Spell Howe plantation**, which provides a refuge for species such as baneberry (*Actaea spicata*), within the ash (*Fraxinus excelsior*) and elm (*Ulmus glabra*) woodland; and also **East Heselton Brow**, where the unusual pattern of Chalk spurs and small valleys, arising from former landslips, supports a community of Chalk grassland with typical herbs and orchids. In total, SSSIs affect just under 1% of the ASMRP 7 resource area.
- 5.187 At a local level, there are no **LNR** designations but a total of 57 locations scattered throughout the resource either contain or overlap with **SINCs**. These account for just below 1.39% of the overall ASMRP 7 resource area.

- 5.188 A large proportion (41%) of the ASMRP 7 resources fall within **Biodiversity Landscape Area 15**, (the West Wolds). In addition, much smaller areas overlap with **BLA 17** (the North Yorkshire Coast and Flamborough Headland), or with **BLA 12** (the Vale of Pickering). Altogether, these three areas account for just over 42% of the total Chalk outcrop.
- 5.189 In addition, many parts of the resource, including areas not covered by the BLAs mentioned above, fall within separately identified Biodiversity Opportunity Areas. Overall, these areas cover 15.6% of the resource outcrop. The resources also overlap to a small extent (2.2%) with the Regional-level Green Infrastructure Corridor for the coastal area, and to a much greater extent with the Wolds Sub-Regional Corridor (46.8%, primarily in the western part of the resource) and with the Gypsey Race and Hertford River District Corridors (9% in total).

ASMRP 8: Jurassic Limestone Resources

General Landscape Characteristics

- 5.190 At the national level, the Howardian Hills AONB designation covers 17.16% of the overall mapped resource. This solely affects the most southern section of this resource, near Nunnington and covers 96% of that particular resource polygon.
- 5.191 25 separate Ancient Woodland designations occur within those parts of the resource between Helmsley and Pickering, amounting to 2.96% of the overall ASMRP 8 resource area. No such designations occur within the outcrops around Nunnington or those within Scarborough District.
- 5.192 The ASMRP 8 resources are primarily associated with the southern part of Natural England's National Character Area 25 – the North Yorkshire Moors and Cleveland Hills. Within the more detailed County assessment, those areas fall within **LCT 4** (Limestone Foothills and Valleys). That character type also includes the outlier of ASMRP 8 at Caulkleys Bank, to the south of Nunnington which at the national scale, is located within NCA 29, the Howardian Hills. The remaining part of the resource extends southwards from the dip slope of the North York Moors into the Vale of Pickering (NCA 26) in the areas to the north of Wykeham Abbey and between East Ayton and Crossgates. Those areas fall primarily within **LCT 30**, as described earlier in relation to ASMRP 5.
- 5.193 With respect to LCT 4, the key landscape characteristics associated with ASMRP 8 outcrops include:
- arable landscapes on the relatively open, dissected dip slope surfaces;
 - adjoining valley landscapes characterised by predominantly pastoral farming with clear demarcation between the enclosed fields, farms, settlements and the wooded valley sides;
 - traditional farm buildings constructed of local pale limestone walls and red pantile roofs
 - local stone walls and hedgerows enclosing fields, now sometimes replaced by post and wire;

- many remnant areas of predominantly ancient, semi-natural woodland occurring mainly on valley side slopes, on escarpments and fringing hills, but also areas of extensive coniferous plantations.

Historic Environment Characteristics

- 5.194 ASMRP 8 occupies an important location, in terms of historical settlement, being an area of well drained, slightly undulating ground between the uplands of the North York Moors and the wetlands associated with the former Lake Pickering. As such, it has acted as a focus for settlement and agricultural activity since early times. The main east/west communications for the region extended through this topographic zone and along it is a line of long established settlements, which include Helmsley, Beadlam, Kirkbymoorside, Sinnington, Middleton exploiting the band of better land and most were mentioned in the Domesday Book; both Pickering Pickering and Helmsley have early castles.
- 5.195 The area of the ASMRP extends just above and to the north of this line of settlements, and includes the areas of former open field relating to the settlements. The strips of the former open fields of Pickering, Middleton and Wrelton have been fossilised as very long, narrow, aratrally curved strip fields, and extend into the areas of the ASMRP. This demonstrates that parts of the areas have been subject to ploughing for an extended period. The area above and to the north of these open fields would have been pastureland / waste and has had reduced plough damage. In these former pasturelands there is the survival of a significant prehistoric funerary resource, which includes Neolithic long cairns, as well as the considerably more numerous Bronze Age round cairns; given the density of funerary remains there is also the potential for associated field systems and settlement.
- 5.196 The roads that now extend through the ASMRP areas were historic drove routes or outgangs to bring the stock in off the upland pastures, and one of these, Cawthorne Lane, had its origins as a Roman road leading to Cawthorne Roman camps just to the north of the ASMRP area. Other Roman sites in the area, and spatially associated with the ASMRP is the Beadlam Roman villa.
- 5.197 The Jurassic Limestone has served as a valuable resource in the past as a source of good quality building stone, and more recently for producing lime. The area is characterised by numerous post-medieval quarries and some with associated limekilns; many of these are small quarries and kilns serving local and agricultural needs, but there are a number of larger quarries, such as Newbridge Quarry, near Pickering operating on an industrial scale. Limestone is still occasionally used for the repair of vernacular architecture but is now worked mainly for crushed rock aggregates.
- 5.198 The ASMRP has a moderate density of historic environment scores, and reflects the number of prehistoric burial mounds. A 0.09% of the total ASMRP falls within areas that are designated as Scheduled Ancient Monuments and 0.06% is within Registered Parks and Gardens. There are 109 listed buildings and no Registered Battlefields.

Natural Environment Characteristics

- 5.199 Overall, some 3.76% of the ASMRP 8 resource area falls within one or more natural environment designations.
- 5.200 None of it is covered by international environmental designations (**SPAs**, **SACs** or **Ramsar** sites).
- 5.201 Similarly, at a national level there are no **NNRs** but there are 9 **SSSIs** which cover just over 0.51% of the ASMRP 8 resource area. The outcrops to the north of Pickering overlap to a very minor extent with various parts of the **Haugh and Gundale Slacks** SSSI and with the **Newbridge Quarry** geological SSSI. The outcrop around the village of Nunnington, between Malton and Helmsley contains the **Nunnington Cutting and Quarries** geological SSSI and a smaller area to the east of Ayton, near Scarborough includes the Betton Farm Quarries geological SSSI.
- 5.202 At a local level, there are no **LNR** designations but the resource is affected at 17 locations by **SINCs**, mostly areas of woodland on the sides of small valleys, scattered throughout the resource outcrop. Together, these account for just below 3.25% of the overall ASMRP 8 resource area.
- 5.203 A high proportion (almost 69%) of the ASMRP 8 resources fall within one or more of the current Biodiversity Landscape Areas. The main overlap (almost 39%) is with **BLA 10** (North York Moors Grassland Fringe) but other areas fall within **BLA 12** (Vale of Pickering) and **BLA 11** (Howardian Hills).
- 5.204 In addition, 15% of the resources overlap with individual Biodiversity Opportunity Areas. The resources also overlap to a limited extent (13.6%) with the Derwent Regional-level Green Infrastructure Corridor; the Rye Sub-Regional corridor (17.9%) and three separate District corridors within valleys around and to the west of Pickering (34.3% in total).

ASMRP 9: Permian 'Magnesian' Limestone Resources

General Landscape Characteristics

- 5.205 At the international level of landscape designation the Fountains Abbey/Studley Royal World Heritage Site, to the west of Ripon, covers just below 0.8% of the overall surface area of the ASMRP 9 resource outcrop, although in terms of its setting, a much wider area needs to be taken into account. The Cistercian monks managed substantial estates and those from Fountains Abbey were responsible for large farms and areas of grazing which supported thousands of sheep. This, in turn, supported the increasing enclosure of fields; the creation of permanent roads and paths to reach the fields and farms and the increased concentration of the population within nucleated villages.

- 5.206 At the national level, the Nidderdale AONB overlaps with 2.47% of the overall mapped resource within ASMRP 9. This again, is within parts of the outcrop immediately to the west of Ripon.
- 5.207 A number of Ancient Woodland designations are scattered throughout the Magnesian Limestone outcrop, covering some 1.48% of the ASMRP 9 resource area overall. The areas involved include:
- 5 small areas within Richmondshire District;
 - 8 areas within Hambleton District;
 - 30 areas within Harrogate District, many of which fall within the AONB area;
 - 30 areas within Selby District, primarily to the south-west of Tadcaster and to the west of Sherburn-in-Elmet.
- 5.208 In terms of more general landscape character, the ASMRP 9 resource is primarily and very strongly, associated with NCA 30 – the Southern Magnesian Limestone. This coincides largely with the Magnesian Limestone Ridge (**LCT 6**) in the more detailed County landscape assessment. The key landscape characteristics of LCT 6 have already been described in relation to ASMRP 3 above, so are not repeated here.
- 5.209 The high correlation between NCA 30, LCT 6 and the underlying limestone resource testifies to the strong influence which the rock exerts upon both the physical and cultural landscape. The main exceptions to this are where the ridge is cut through by the major river valleys of the Swale, Ure, Nidd and Aire. In those areas, the limestone is still present at depth but its surface expression is replaced by that of the river floodplains (**LCT 24**), also described earlier, within ASMRP 1. Other exceptions within these general areas are where the limestone resource extends locally, and for short distances, into the adjoining landscape character types of the Moors Fringe (**LCT 13**), to the west of the main ridge; or the Levels Farmland (**LCT 23**), the Vale Farmland in the Vale of York (**LCT 28**), or the Settled Vale Farmland of the Vale of Mowbray (**LCT 25**), all of which lie to the east. These landscape types have all been described earlier, in relation to ASMRP 3.
- 5.210 To the north of Bedale, within Richmondshire District, the Magnesian Limestone is not recognised as a distinctive landscape unit in its own right, either within the National or County-scale landscape character assessments. Instead, the ASMRP 9 resources in this area fall within NCA 23, the Tees Lowlands, and the broadly corresponding **LCT 27** (Vale Farmland with Dispersed Settlements). The latter has already been described in relation to ASMRP 4.

Historic Environment Characteristics

- 5.211 As noted above, the Magnesian limestone ASMRP forms a prominent north-south feature throughout much of North Yorkshire. The slightly elevated limestone ridge was utilised as the alignment for major Roman roads which over time, have been replaced by the Great North Road and most recently, the A1 (M) motorway. Archaeological resources are extremely populous, and include Mesolithic struck lithic finds, monuments and sites from

the Neolithic/Early Bronze Age through all the periods of occupation since, and reflect both this lengthy settlement and the important communications artery that the ridge formed. The landscape has been influenced in many areas by wealthy landowners – from the monks at Fountains Abbey to large houses and gardens such as Studley Royal, Bedale Hall, Braham Park, Ledston and Lotherton. Designed landscapes including parks and woodlands, are an important feature of the historic environment in this ASMRP.

- 5.212 The density of known historic and archaeological sites within this ASMRP reflects the continuous importance of this area of the Vale of York. The Magnesian limestone is thought to have been favoured by the first farmers, as the woodland that grew there was easy to clear and the land was suitable for early agriculture. Due to the nature of the underlying geology, aerial photography and other remote sensing techniques, such as geophysical survey, produce very good results. Cropmark plots from aerial photographs exist for extensive areas of this ASMRP, and large-scale geophysical surveys have been undertaken, often in association with linear developments, such as road schemes. Although immensely informative, the surveys cannot be expected to be truly comprehensive. They are usually very successful in identifying, enclosed sites, such as moated manors, linear features, such as trackways, or complexes of linear features, such as field systems, but can be less successful in identifying unenclosed settlements or discrete features, such as burials or prehistoric pits. So, despite the wealth of evidence, in addition to the known sites, there is likely to be a vast number that, as yet, remain undetected or have not been properly characterised. Where the Magnesian limestone is overlaid by deposits of clay or alluvial soils crop mark visibility diminishes. West Yorkshire Archaeology Service has recently published the results of a survey of the Magnesian Limestone area through North Yorkshire to Nottinghamshire which has included a study of crop marks (*ASLF Magnesian Limestone Project- Archaeological Cropmark Landscapes of the Magnesian Limestone* Ian Roberts, David Berg, Alison Deegan, WYAS 2011). This has characterised early occupation of the Southern Vale of York, Magnesian Limestone area as ovoid or rectangular enclosures of Iron Age date, which have evolved into a bigger complex or a multiple enclosed system (WYAS 2011 *ibid*). There hasn't been evidence for larger field systems or nucleated settlements from the Romano British period found elsewhere. Little large scale excavation has taken place outside of the A1 road studies.
- 5.213 Mesolithic lithic finds indicate the earliest human presence in this ASMRP, and during the Neolithic period, in the south of the area (adjacent to ASMRP 2), a monumental henge complex was constructed at Thornborough. This place was probably favoured partly as it lay on the north/south communication corridor that followed the limestone ridge. More generally, though, the archaeology of this date comprises isolated pits, pit alignments or artefact scatters. There are a large number of round barrows known from the limestone belt that date to the Bronze Age and are associated with both inhumation and cremation burials. However, settlement remains of the same date have, so far, proved elusive, although it is possible that they lie outside the areas that have been subject to development.
- 5.214 It seems that the first major phase of landscape enclosure took place during the pre-Roman Iron Age, and many of the enclosure systems and trackways, visible as cropmarks, originated during this time. Certainly, the results of archaeological fieldwork demonstrate that

substantial swathes of the landscape had been enclosed by the latter part of this period, and numerous enclosed and unenclosed settlements were dotted amongst the enclosures. Recent work by Roberts et al (2010) summarises the evidence from the limestones for the prehistoric and Roman periods, and settlements have recently been excavated at Ledston, Wattle Syke and, on the county boundary, Micklefield. These excavations have shown the rock-cut enclosure ditches to be substantial in nature, and that the roundhouses within the settlements are often associated with pit complexes, some of the pits containing animal and human inhumations.

- 5.215 These systems of enclosure continue to expand and develop throughout the Roman period, although the archaeological evidence suggests that, in material terms, life went on very much as it had before throughout much of the area. Roman rule did bring about some changes, however, with a network of new roads being established, including Dere Street that closely follows the ridge, and some of the previously existing boundaries and trackways being reconfigured accordingly. In the north of the area, a Roman town (Cataractonium; Wilson 2002) formed around the fort at Catterick. Elsewhere in this ASMRP other Romanised buildings include the baths at Well and possible villas near Sutton Grange and Snape. By the end of the Roman period some of the settlements away from the urban centres began to take on some Romanised characteristics, with buildings being constructed in stone, for example.
- 5.216 Early medieval remains have been widely found in the vicinity of Catterick, including settlement features, such as grubenhäuser, and inhumation burials, and other sites of this date also have a wide distribution across this ASMRP. Noteworthy amongst these, is the reputed site of King Athelstan's palace at Sherburn in Elmet. Evidence from this period can be very difficult to detect archaeologically, except serendipitously during excavation, and the easily tilled soils will have continued to be attractive, so it is likely that further remains exist undiscovered.
- 5.217 The Normans began to exert their influence after the conquest, and a wealth of medieval sites, with a wide distribution, include mottes, moated manors, ecclesiastical centres, deserted villages, parks and a forest at Knaresborough. Field boundaries and ridge and furrow cultivation, continue to attest to the agricultural importance of the land, and many of the present day settlements can trace their origins to this period. The site of the battle of Towton, fought between Yorkist and Lancastrian forces during the War of the Roses, also lies within this ASMRP.
- 5.218 The post-medieval archaeology of the area is largely agricultural, mixed with evidence for small-scale industry, including railways, quarries and limekilns. The Magnesian limestone was used as a prestige building stone, for the construction of York Minster, York City Walls, Ripon Minster and many other prestigious buildings, as well as more general building throughout the area and beyond, often in combination with red clay pantiles. To some extent this tradition still continues, at least for the repair of major buildings, and limestone quarries continue to be a relatively common feature of the landscape. There is a proliferation of aircraft crash sites and military installations, principally in the Catterick area, many dating to the Second World War.

- 5.219 High density AHEIP polygons occur regularly along its length, reflecting the long settled and exploited nature of this area. Medium density polygons are also distributed throughout the resource, especially within the southern part of the County, within Selby District. As noted above, this ASMRP falls partly within the Fountains Abbey/Studley Royal World Heritage Site, which has historic environment significance as well as being a landscape designation. 1.79% of the ASMRP area lies within other Registered Parks and Gardens, 1.12% of the resource falls within the Registered Battlefield at Towton, to the south of Tadcaster and a further 0.72% overlaps with Scheduled Ancient Monuments. There are 769 listed buildings.
- 5.220 The modern landscape is characterised by Modern Improved Fields overlying previous planned enclosure. (NYCC and English Heritage, 2010).

Natural Environment Characteristics

- 5.221 Overall, some 3.45% of the ASMRP 9 resource area falls within one or more natural environment designations.
- 5.222 In terms of international designations, there is just one small **SAC**, at **Kirk Deighton**, to the south-east of Knaresborough. As previously noted, in relation to ASMRP 2, this site has been designated for its breeding population of Great crested newts (*Triturus cristatus*) but it covers just under 0.008% of the overall ASMRP 9 resource. There are no **SPAs** and no **Ramsar** sites.
- 5.223 At the national level, there are no **NNR** designations but there are 13 **SSSIs** which, in total, affect just under 0.53% of the ASMRP 9 resource area. These occur primarily within the southern part of the outcrop, and include features relating directly to the limestone but also several sites which occur within overlying Quaternary deposits. The first group includes the calcareous grassland and woodland communities within **Quarry Moor** and within the **Burton Leonard Lime Quarry** both near Ripon; semi-natural woodland and ancient meadows within the **Brockadale** SSSI, on the flanks of the Went valley near Kirk Smeaton; and the extensive semi-natural ancient broadleaved woodland of **Birkham Wood** on the banks of the River Nidd in Knaresborough. The second group, relating features developed on overlying Quaternary deposits, comprises a number of SSSIs which have already been described in relation to other ASMRPs: **Ripon Parks, Swale Lakes, Sutton Ings, Fairburn & Newton Ings** and **Kirk Deighton**.
- 5.224 At a local level, there are four **LNR** designations, affecting just under 0.18% of the ASMRP 9 outcrop and a total of 140 instances, distributed throughout the resource, where the limestone overlaps with **SINCs**. Together, these affect a much larger area, amounting to 2.74% of the overall outcrop.
- 5.225 Not surprisingly, a very high proportion (more than 47%) of the ASMRP 9 resources coincide or overlap with **Biodiversity Landscape Area 8** (the Southern Magnesian Limestone). A smaller area overlaps with **BLA 9** (Lower Aire and Went Valleys), bringing the total overlap with BLAs to just under 54%.

- 5.226 In addition, almost 18% of the resources fall within numerous individual Biodiversity Opportunity Areas scattered throughout the outcrop. The resources also cut across many individual Green Infrastructure Corridors, overlapping by 17.5% with those at the Regional-level (from the Tees in the north to the Aire in the south) but also by 31.4% with those at the Sub-Regional level and by 5.9% with those identified at a District level.

ASMRP 10: Carboniferous Shallow Coal Resources

General Landscape Characteristics

- 5.227 At the national level, the Forest of Bowland AONB covers almost 6.2% of the overall ASMRP 10 resource. This is within the western section of the resource, around Bentham in Craven District and affects some 13.25% of the resource polygon within that area. The remaining area of this resource, in Selby District, does not fall within any AONBs.
- 5.228 A number of Ancient Woodland designations overlap or occur within the resources within both Craven and Selby Districts. The total area of the resource involved amounts to 6.69% and includes:
- 4 areas within Craven District; and
 - 19 areas within Selby District, where a total of 19% of the resource is within these designations (although the southernmost part of this resource area is not affected at all).
- 5.229 In terms of overall landscape characteristics, the ASMRP 10 resources within the Craven District fall primarily within NCA 33 (Bowland Fringe and Pendle Hill) but also extend into the adjoining Yorkshire Dales character area (NCA 21), to the north of the Craven Fault. At a County level, all of these resources fall within **LCT 32** (Drumlin Valleys).
- 5.230 The key landscape characteristics of the LCT 32 areas are dominated by the superficial glacial drift deposits which form the impressive drumlin topography and have almost no relationship with the much deeper coal-bearing strata. The characteristics include:
- distinctive 'basket of eggs' drumlin topography comprising smooth rounded hills, the long axes of which are aligned with the direction of former ice flow;
 - small river corridors which meander among the drumlin fields, including the River Greta, which runs directly through the coalfield, and the River Wenning, to the south;
 - landscape pattern comprises a series of medium-sized, predominantly pastoral fields, delineated by drystone walls and occasional hedgerows;
 - predominantly rural character with an associated strong sense of tranquillity;
 - clumps of trees are particular landscape features.
- 5.231 The ASMRP 10 resources which lie within the western edge of Selby District fall within Natural England's National Character Area 30, the Southern Magnesian Limestone and **LCT 6**, the corresponding Magnesian Limestone Ridge. The coal measures lie beneath the

limestone and it is the latter which provides the dominant geological influence on the landscape character – essential details of which have already been described under ASMRP 3, above.

Historic Environment Characteristics

- 5.232 The defining characteristic of ASMRP 10 is that it comprises shallow coals, but these are often concealed beneath more recent Quaternary drift deposits and in the east, within Selby District, they are also concealed by Permian Magnesian limestone resources. In each case it is the overlying deposits which have had a more intrinsic influence upon the topography and the heritage resource. Although the shallow coal resources have been worked in the past, leaving some historical evidence, they are no longer commercially viable. In the eastern part of the resource there are many more monuments within the HER that relate to historic limestone quarries and limekilns than there are historic coal workings.
- 5.233 There are 71 listed buildings are sited within the ASMRP and 0.44% of the total ASMRP lies within areas designated as Scheduled Ancient Monuments. There are polygons with a medium density of historic environment designations in both of the resource areas, centred on Burton in Lonsdale in the Craven District and on the western boundary of Selby District close to Garforth and the A1.
- 5.234 The western area of the ASMRP falls within the gently undulating, but essentially lowland area of the Craven gap, between the Yorkshire Dales to the north and the Forest of Bowland to the south. It is predominantly pasture land, though it has been subject to arable farming in the past as reflected in areas of ridge and furrow. Either on the northern margins of the ASMRP block, or immediately to the north, within the area of the Yorkshire Dales National Park there is a line of complex enclosed settlements set just above the valley floor. One of these is on the northernmost boundary of the ASMRP at Broadwood, Ingleton, which was excavated and found to have an Iron Age foundation date, continued in occupation for much of the Roman period (Johnson, 2004).
- 5.235 In the centre of this western area is the historic village of Burton in Lonsdale, which has a motte and bailey fortification on its margin. At the western limit of the ASMRP is a very high density heritage resource, just to the south of Clapham, which reflects intensive archaeological research undertaken in advance of a United Utilities sewerage scheme. This work identified remains of what was potentially a shrunken medieval village and which could have been an early element of the adjacent Clapham village.
- 5.236 The three eastern parts of the ASMRP follow a line adjacent to the A1 road, within the southern end of the Vale of York. The topography of each is broadly similar comprising flat, well drained land that is in mixed arable and pastoral land with some wood plantations; however, the main land use is arable and much of the area has been subject to intensive ploughing. Again there are numerous limestone quarries and lime kilns reflecting the presence of ASMRP 9 resources at or near the surface. The New Fryston ASMRP block is just to the west of the study area for the Vale of York survey, but has been examined as part of the National Mapping Programme, which revealed a very substantial and significant

east/west orientated Iron Age / Romano-British ladder settlement to the east of Aberford and demonstrates that the area has good site visibility for crop marks and that was intensively occupied in the later prehistoric period.

- 5.237 Recent work in advance of the A1 improvements (Brown *et al*, 2007) discovered a very significant prehistoric resource on the West Yorkshire side of the New Fryston ASMRP block, but within the same, shallow coal geology, which included a Bronze Age barrow cemetery, pit alignments, and a chariot burial. In the same immediate locale is the Ferrybridge Henge and collectively demonstrates considerable activity during the later prehistoric period.
- 5.238 In the centre of the southernmost ASMRP block is a comparable resource of prehistoric crop mark features, and there is also a shrunken medieval village of Stapleton, which contracted as a result of the expansion of Stapleton Park, following the construction of the elegant Stapleton Hall by Baron Harewood in the late 18th century.

Natural Environment Characteristics

- 5.239 Overall, just over 6.7% of the ASMRP 10 resource area falls within one or more natural environment designations – a higher figure than for most of the other ASMRPs.
- 5.240 Two international environmental designations, comprising a **SPA** and a coincident **SAC**, forming part of the **South Pennine Moors** designation, affect one very minor part of the resource, to the south west of Cowling in the extreme south of Craven District. Each of these designations, described earlier in relation to ASMRP 4, affects less than 0.001% of the resource area. There are no **Ramsar** sites.
- 5.241 At the national level, there are no **NNR** designations but there are four **SSSIs** which in total, affect just over 3.38% of the ASMRP 10 resource area. The **South Pennine Moors** SSSI which is coincident with the SPA/SAC of the same name affects the very small resource near Cowling. The resource near Ingleton within Craven District falls partly within the **Newby Moor** SSSI, an area of lowland mire which supports an outstanding complex of wetland plant communities, reflecting a wide variation in landform, soil and water conditions. Resources on the western edge of Selby District overlap with the **Fairburn and Newton Ings** SSSI near Castleford and with the **Brockadale** SSSI further south. In both of these cases, the designations relate to features associated with overlying younger strata, rather than the Carboniferous rocks themselves.
- 5.242 At a local level, there is one **LNR** designation, the **Fairburn Ings Nature Reserve**, which overlaps very slightly with the Fairburn and Newton Ings SSSI at the extreme south western edge of that resource polygon and a total of 20 locations, scattered throughout the resource, which fall within **SINCs**. Together, these cover just over 3.32% of its total area.
- 5.243 High proportions of the ASMRP 10 resources fall within **Biodiversity Landscape Area 8** (Southern Magnesian Limestone) and **BLA 9** (Lower Aire and Went Valleys). Each of these overlaps with more than 21% of the resource outcrop, covering almost 43% in total. In each case, the biodiversity opportunities relate primarily to the surface geology and conditions, rather than to those associated with the buried coal.

- 5.244 Individual Biodiversity Opportunity Areas overlap with almost 19% of the resource, including areas that are both within and outside the two BLAs. The mineral resources also overlap to a limited extent (4.3%) with Regional-level Green Infrastructure Corridors in the Ure, Nidd and Aire valleys; with Sub-Regional corridors in the Burn, Washburn and Wenning valleys (25.5% in total) and with the District corridors in the Laver valley and the Ingleton-Bowland link (24.5% in total).

ASMRP 11: Carboniferous Brick Clay Resources

General Landscape Characteristics

- 5.245 There are no national or international designations affecting the resource.
- 5.246 13 Ancient Woodland designations occur within ASMRP 11 in all but the southern section of the resource. The total area of overlap is 1464.34 km², representing 6.69% of the overall ASMRP 11 resource area.
- 5.247 In terms of landscape character, the ASMRP 11 resource is situated within Natural England's National Character Area 30, Southern Magnesian Limestone and the corresponding LCT 6 (Magnesian Limestone Ridge), the characteristics of which have already been described under ASMRP 3, above. The Carboniferous strata which make up this resource lie beneath the limestone and, as noted previously for ASMRP 10, it is the limestone which provides the dominant geological influence on the landscape character.

Historic Environment Characteristics

- 5.248 As noted above, the historic landscape of this area is largely characteristic of the long-settled nature of the limestone ridge which overlies the coal measures and forms the dominant geological feature in this part of Selby District. There is also a substantial spatial overlap between the brick clays of this ASMRP with that of ASMRP 10, the shallow coals. While cropmarks typically show up well on the soils overlying shallow coals, they are not particularly prevalent in areas of clay soils. Given the overlap between the ASMRPS, there is inevitably some erratic visibility of crop marks. In the area of the Micklefield ASMRP block there are very extensive crop marks revealed, but the northernmost ASMRP block, near Tadcaster, the crop mark record is more patchy and in places poor.
- 5.249 The eastern areas of the ASMRP follow a line adjacent to the A1 road, in the southern end of the Vale of York. The topography of each is broadly similar comprising flat, well drained land that is in mixed arable and pastoral land with some wood plantations; however, the main land use is arable and much of the area has been subject to intensive ploughing.
- 5.250 The area has an incidence of both high and medium density AHEIP polygons. 1.46% of the total area falls within the boundaries of Scheduled Ancient Monuments, and 1.32% of the resource outcrop falls within the Registered Battlefield of Towton.

- 5.251 The area has been examined as a result of the recent A1(M) improvements (Brown et al 2007), and this has revealed a rich resource within the extent of the ASMRP. The New Fryston ASMRP block is just to the west of the study area for the Vale of York survey, but has been examined as part of the National Mapping Programme, which revealed the very substantial and significant east/west orientated Iron Age / Romano-British Highfield ladder settlement to the east of Aberford, and the Castle Hills settlement and field system (SM 31531); this demonstrates that the area has good site visibility for crop marks. Excavations of Site R (ibid) to the west of Castle Hills have revealed elements of a field system, which had Iron Age pottery in the lower fills and AD 2nd / 3rd century Roman pottery in the upper fills. To the north-west of the Castle Hills complex was a small, and separate, Romano-British settlement (Site C4SA; ibid). Collectively these demonstrate considerable settlement activity throughout the area of this ASMRP block during the Iron Age / Romano-British period.
- 5.252 The A1 improvements (Brown et al 2007) also revealed a very significant prehistoric resource on the West Yorkshire side of the New Fryston ASMRP block which included a Bronze Age barrow cemetery, pit alignments, and a chariot burial. In the same immediate locale is the Ferrybridge Henge and collectively demonstrates considerable activity during the later prehistoric period for this geologically similar area, albeit just outside the North Yorkshire county boundary.
- 5.253 Archaeological investigations through the Aberford ASMRP block were undertaken in advance of the Asselby to Aberford gas pipeline (OA North 2010, Site 20-4) and this revealed an Iron Age / Romano-British field system and D Shaped Enclosures, which had initially been identified as cropmarks.
- 5.254 The northernmost of the ASMRP blocks is characterised by the Hazelwood Castle and park. The castle dates back to a license to crenellate from 1290, and the expansion of its parkland engulfed adjacent to nucleated settlement, and there are the remains deserted medieval settlements within the parkland.
- 5.255 The ASMRP has a significant heritage resource, which is evident from the archaeological explorations associated with the A1 (M) improvements and the Asselby to Aberford Pipeline. Some of these monuments and landscapes were identified from crop marks but a significant proportion were not, this highlights that there is a high potential from archaeological remains which are not necessarily evident from aerial photography.

Natural Environment Characteristics

- 5.256 Overall, almost 13.3% of the ASMRP 11 resource area falls within one or more natural environment designations.
- 5.257 None of these are international designations (**SPAs**, **SACs** or **Ramsar** sites).
- 5.258 At the national level there are again no **NNRs** but there are 2 **SSSIs** which, in total, cover almost 3.44% of the ASMRP 11 resource area. Once again, the largest of these is the **Fairburn and Newton Ings** SSSI where, as noted above, the Carboniferous strata are buried beneath both Permian Limestone and alluvial deposits. The other SSSI, much smaller in size,

is at **Sutton Ings**, located within the narrow floodplain of Cock Beck – a tributary to the River Wharfe to the south of Tadcaster. Here again, the Carboniferous mudstones are partly concealed by the Permian Limestone.

- 5.259 At a local level, there is just one small area which falls within an **LNR** designation (Fairburn Ings Nature Reserve) and 13 locations which overlap with **SINCs**. Most of these are fairly large areas of woodland, to the south west of Tadcaster and to the West of Sherburn-in-Elmet. Together, they cover some 9.8% of the ASMRP 11 resource area.
- 5.260 Almost 90% of the ASMRP 11 resources fall within **Biodiversity Landscape Area 8** (the Southern Magnesian Limestone). As with ASMRP 10, the biodiversity opportunities here relate to the geology and topography of the limestone which overlies the Carboniferous coal and brick clay resources, and this would be important to recognise in any future restoration scheme, should the clay ever be exploited.
- 5.261 32% of the resource overlaps with individual Biodiversity Opportunity Areas, almost all of which fall within the Magnesian Limestone ridge of **BLA 8**. In addition, virtually all of the resource falls within Green Infrastructure Corridors: 7.6% lies within the Aire Valley Regional-level Corridor but the majority (92.3%) falls within the Limestone Ridge Sub-Regional Corridor.

ASMRP 12: Carboniferous Sandstone Resources

General Landscape Characteristics

- 5.262 At the national level, the Forest of Bowland AONB covers 19.8% of the ASMRP 12 resource outcrop. This is in parts of the western-most section of the resource, to the southeast of Settle.
- 5.263 A number of Ancient Woodland designations occur within many parts of the resource, amounting to 0.4% of its surface area, in total. The areas concerned include those around Settle, around Skipton and to the north of Harrogate and Knaresborough, where the resource area is strongly connected with a single large Ancient Woodland designation, Springwood.
- 5.264 The ASMRP 12 resources occur primarily within Craven District, where they extend across five of Natural England's National Character Areas: the Yorkshire Dales (NCA 21), the Bowland Fells and Pendle Hill (NCA 33), the Bowland Fells (NCA 34), the Lancashire Valleys (NCA 35) and the Southern Pennines (NCA 36). In addition, the smaller resource outcrop to the north of Harrogate straddles the boundary between the Pennine Dales Fringe (NCA 22) and the Southern Magnesian Limestone (NCA 30). This considerable diversity of landscape across the resources is emphasised further at the more detailed scale of the County landscape assessment and it is therefore necessary to consider the resource in three separate areas: the outcrops near Settle, those near Skipton, and those to the north of Harrogate.

- 5.265 The resources near Settle fall predominantly within NCA 33 but also extend into NCAs 21 and 34. In terms of the more detailed Landscape Character Types, the resources occur within **LCT 32** (Drumlin Valleys), **LCT 11** (Broad Valleys), **LCT 14** (Rolling Upland Farmland), **LCT 37** (Siltstone and Sandstone High Moors and Fells) and extend slightly into **LCT 13** (the Moors Fringe). In the first of these, the sandstone resources have little or no direct influence on the landscape, which is controlled instead by the cover of Quaternary glacial deposits which make up the drumlin fields (as described earlier under ASMRP 10). Similarly, within LCT 11 the sandstone lies deeply buried beneath the fluvial sediments which form the floodplain and terraces of the River Ribble. The landscape there is broadly similar to that of river floodplains elsewhere: flat, prone to frequent flooding and dominated by pastoral farming with areas of woodland. The floodplain is crossed by a major road (the A65) and a mainline railway, and settlement is restricted to small hamlets on the sides of the valley (except for the town of Settle which straddles the valley floor immediately upstream). Within the remaining three character types, which form the hills and flanks of the Bowland Fells, the sandstone lies closer to the surface and exerts a greater influence on the landscape. LCT 14 is a predominantly pastoral landscape of gently undulating farmland with a network of drystone walls and farm buildings made from the local sandstone and with pockets of broadleaved woodland and moorland. LCT 37, which forms part of the more extensive Bowland Fells, is characterised by rounded, gently-sloping hills underlain by sandstone and siltstone, with large expanses of blanket bog and characteristic moorland vegetation, interspersed with pockets of neutral and acid grassland. The area has a predominantly undeveloped rural character with an associated sense of tranquillity, and affords extensive, panoramic views across the lower landscapes to the north and east.
- 5.266 The second area of ASMRP 12 resources, around Skipton, falls primarily within NCAs 35, 36 and just touches NCA 21. In terms of Landscape Character Types, the resources occur within two areas of relatively high ground – **LCT 35** (Gritstone Low Moors and Fells) and **LCT 38** (Siltstone and Sandstone Low Moors and Fells). They also extend beneath the lower ground which surrounds those areas, classified as **LCT 31** (Settled Industrial Valleys). The general character of LCT 31 has already been described under ASMRP 1 although, in this area, the classification has been applied to a number of upland valleys and adjoining hillsides, as well as to the main valley of the River Aire. As in the Settle area, however, the presence of the underlying bedrock is most noticeable within the upland areas. The first of these (LCT 35) comprises the areas to the south east of Skipton known as Skipton Moor, High Bradley Moor and Low Bradley Moor. These are characterised by open moorland vegetation on the highest areas with enclosed areas of improved grassland, used for sheep grazing and a sparse settlement pattern of isolated farms on the lower slopes. Minor roads and tracks lead up to the farms but do not cross the higher parts of the moors. The higher areas afford extensive panoramic views across the surrounding lower landscapes. The second upland area (LCT 38) is that of Elslack Moor to the south west of Skipton. The landscape here is almost identical in general character to that of LCT 35, the principal differences being that minor roads do cross the moorland areas and that a large area of coniferous plantation woodland is present on the northern side of the hill, along with a small water supply reservoir.

- 5.267 The third area of the resource, to the north of Harrogate and Knaresborough, straddles the boundary between NCAs 22 and 30. The resource is equally divided across the two NCAs. This is almost exactly replicated in the more detailed County landscape assessment, with the resource spanning the boundary between **LCT 6**(Gritstone Valley) and **LCT 6** (Magnesian Limestone Ridge) character types, both of which have been described in earlier sections. The boundary between these two areas is, not surprisingly, more accurately drawn in the County assessment, distinguishing the Nidd Gorge of LCT 36 from the adjoining higher ground of LCT 6. However, although the latter is dominated, further east, by the Magnesian Limestone outcrop, it also extends some distance over the adjoining sandstone to the west which is concealed, in that area by a cover of glacial drift deposits.

Historic Environment Characteristics

- 5.268 The ASMRP resources are characterised by a generally undulating and relatively well drained landscape that is currently for the most part in pastoral use. In the eastern part of the district it coincides with a somewhat higher semi-upland area, which includes Skipton Moor that rises up to 373m AOD.
- 5.269 Particularly in the eastern part of the district there is a very significant prehistoric funerary resource, and is a typical feature of the upland terrain, and reflects that the area was marginal land, used for communication routes and presenting a visible landmark for settlement areas in the valleys. The resource includes a Neolithic type of long cairn, and Bronze Age cairn circle on Black Hill, and a recumbent stone circle near Wrathmell in the eastern part of the district, but there were also significant numbers of Bronze Age round cairns which were sited on summits or prominent locations with a wide vista. What is perhaps not so typical of the upland terrain is a significant concentration of cup and ring marked stones, and similar rock art. These utilised the outcropping and easily worked sandstone, and the absence of subsequent exploitation of the land allowed their survival.
- 5.270 In the same area is a defended enclosed settlement, which took advantage of the exposed upland terrain to enhance its defences. A further defensive site is the Roman fort of Burwen Castle at Elslack, which is just outside the ASMRP area, but the easterly road to Glusburn and Keighley extended across the ASMRP area.
- 5.271 In the western part of the district, the terrain is lower, less exposed and has been subject to predominantly dispersed pastoral farms; however, there are a number of nucleated settlements which in the medieval period had a predominantly arable economy. Most notable of these was the village of Wrathmel, which has the survival of expansive remains of ridge and furrow in the area of the former open fields below the village. It was identified by LiDAR and reflect an exceptional survival of a medieval arable landscape.
- 5.272 The sandstone has been historically used as quality building stone in the past and may still be exploited for repairs. There are numerous quarries across the areas which were in part for local needs, but there are a number of larger, industrial scale, quarries that have provided building stone and even roof tiles. The Wharfe and Aire river valleys to the south of Skipton have long been characterised by small-scale industrial activity, associated with

mixed farming and have been relatively densely settled, reflecting a stable economy and good communication routes.

- 5.273 Overall there is a relatively rich resource, and 0.01% of the total area of this ASMRP falls within areas that are designated as Scheduled Ancient Monuments, many of which are the rock art on Skipton Moor. Medium density polygons occur to the south west of Giggleswick and Skipton, with high density historic environment sites and features occurring close to Kildwick and Skipton. The rich resource reflects that because of the upland terrain, there has been little subsequent intensive exploitation, and that there is lower soil build up over the sites, so the sites are exposed on the surface, and there is a generally good site visibility.

Natural Environment Characteristics

- 5.274 Overall, almost 6.5% of the ASMRP 12 resource area falls within one or more natural environment designations.
- 5.275 Three adjoining resource polygons, located to the south of Cowling in Craven District are overlapped by international designations, comprising the **South Pennine Moors SPA** and **SAC** (described earlier under ASMRP 4). Each of these coincident designations covers just over 3.23% of the total ASMRP 12 resource area. There are no **Ramsar** sites.
- 5.276 At the national level, there are no **NNR** designations and just eight polygons overlap with a total of six **SSSIs** which, in total, cover some 4.32% of the ASMRP 12 resource area. To the largest of these is the **South Pennine Moors SSSI** which is coincident with the SAC/SPA. Other SSSIs affect the outcrops around and to the south west of Settle. These include **Hesley Moss**, a small but important example of a relatively intact basin raised mire, developed in a hollow between Millstone Grit outcrops; **Cocket Moss**, which combines an area of lowland fen, marsh and swamp with a separate area of neutral grassland; and the wetland area of the **Long Preston Deeps SSSI** within the River Ribble floodplain, where the sandstone resource lies deeply buried beneath Holocene alluvium. To the north west of Settle, narrow outcrops of the sandstone resource are overlapped by **Austwick & Lawkland Moss SSSI**, a narrow area of peatland within the valley of the River Wenning, which exhibits a range of associated habitats and plant communities; and **Newby Moor SSSI**, a complex lowland mire which has already been described under ASMRP 10.
- 5.277 At a local level, there are no **LNR** designations but there are 28 **SINCs** scattered throughout most of the resource, affecting just over 2.14% of its total area.
- 5.278 Less than 9% of the ASMRP 12 resources fall within existing Biodiversity Landscape Areas. A small amount of overlap (7.3%) occurs with **BLA 22** (Yorkshire Peatlands) and a further 1.3% overlaps with **BLA 8** (the Southern Magnesian Limestone).
- 5.279 Largely outside of those areas but overlapping with them to some extent, a much higher proportion of the sandstone outcrop (almost 28%) coincides with a variety of individual Biodiversity Opportunity Areas. The sandstone resources also overlap by 20.6% (in total) with Regional-level Green Infrastructure Corridors within the Nidd, Wharfe, Aire and Ribble valleys and to a similar extent (21.3%) with the River Wenning sub-regional corridor. There

is also a very small overlap (0.15%) with the District-level corridor of the Ingleton-Bowland link.

ASMRP 13: Carboniferous and Jurassic Silica Sand Resources

General Landscape Characteristics

- 5.280 At the national level, the Nidderdale AONB covers more than 76% of the overall ASMRP 13 resource. However, the western area of outcrop, situated around Blubberhouses, is 100% within the AONB, whilst the eastern area, around Burythorpe, is entirely outside this designation.
- 5.281 The area of resource around Blubberhouses also contains a single Ancient Woodland designation. This affects 0.44% of the resource in that area and 0.34% of the ASMRP 13 resources overall.
- 5.282 The Blubberhouses resource area falls predominantly within NCA 22 (the Pennine Dales Fringe), though the higher, south western part of the outcrop also extends slightly into NCA 21 (the Yorkshire Dales). A similar split is seen in the more detailed County assessment, where the northern and eastern parts of the resource, within the Washburn Valley fall within **LCT 36** (Gritstone Valley), while the higher areas to the south and west fall within **LCT 34** (Gritstone High Moors and Fells). The general landscape characteristics of LCT 36 have already been described, in relation to ASMRP 1. In this area, however, the valley is more specifically of upland character, with water supply reservoirs immediately upstream and downstream of the resource outcrop and with extensive woodland plantations on the valley sides adjacent to the river. The landscape of LCT 34 is characterised steep-sided, rounded gritstone hills supporting extensive areas of open moorland vegetation, interspersed with neutral and acid grassland and areas of both blanket bog and valley mires. These various habitats, in turn, support a diverse range of bird species. The undeveloped character of the moors gives a strong sense of tranquillity and facilitates extensive panoramic views across the surrounding lower landscapes. Although there are generally few signs of human influence, the existing (currently inactive) silica sand workings adjacent to the A59 on the southern edge of Kex Gill Moor, provide a local exception.
- 5.283 The eastern resource area, around Burythorpe, falls within the foothills of the Yorkshire Wolds -NCA 27 and **LCT 19** (Chalk Foothills). Whilst these classifications are justified in terms of overall landform and proximity to the main Chalk escarpment of the Wolds, they are at odds with the underlying geology which forms part of the older, Jurassic sandstone sequence rather than the Chalk. The general landscape characteristics of LCT 19 have already been described in relation to ASMRP 7 but, in this area, the foothills extend further out from the main scarp and grade into a gently undulating agricultural landscape. The resource itself occupies a broad area of level ground, bounded by slightly elevated land to the north and south, and with a coniferous plantation on its western margin.

Historic Environment Characteristics

- 5.284 The western outcrop of this resource, around Blubberhouses, forms part of an undulating upland area of predominantly unenclosed moorland, which has gained significance being on the line of the main historic trans Pennine, 'Craven Gap', communications route which has been adopted by the present A59 road, a former turnpike, and a Roman road (just to the south of the ASMRP).
- 5.285 Within this area are a series of Bronze Age cairns, a possible cist and an Iron Age pit alignment which may potentially relate to a former territorial boundary, as such this range of prehistoric monuments reflects a not unsurprising heritage resource for such an upland landscape.
- 5.286 More significantly, just to the south of the resource, towards Ilkley, there is a more significant prehistoric resource, that includes cup and ring marked stones and a higher density of sepulchral monuments. The rock art has the potential to reflect the usage of routeway across Blubberhouses Moor.
- 5.287 At Kex Gill, near the summit of Blubberhouses Moor, is an area of disused former lead workings and more recently in the 1980s a silica sandstone quarry was established (now disused).
- 5.288 Within the Jurassic silica sand resource near Burythorpe there is a single Scheduled Ancient Monument (a Roman site) which occupies 2.90% of the outcrop in that area (representing 0.68% of the overall ASMRP outcrop). This part of the ASMRP also lies close to the location of Mount Ferrant – the remains of a motte and Bailey Castle.
- 5.289 There are no listed buildings, registered battlefields or listed Parks and Gardens in any part of the ASMRP.

Natural Environment Characteristics

- 5.290 Overall, just below 4.6% of the ASMRP 12 resource area falls within one or more natural environment designations, all of which are associated with the resources around Blubberhouses.
- 5.291 Two small areas within the south-western corner of the resource are overlapped by the **North Pennine Moors SPA** and **SAC**. These are extensive designations, protecting large areas of blanket bog and European dry heath habitats as well as more specialised habitats in local areas. These, in turn, support a number of protected bird species including Golden Plover (*Pluvialis apricaria*), Hen Harrier (*Circus cyaneus*), Merlin (*Falco columbarius*), Peregrine Falcon (*Falco peregrinus*), Curlew (*Numenius arquata*) and Dunlin (*Calidris alpina schinzii*). These international designations affect 2.65% of the Blubberhouses resource outcrop, and just over 2% of the total ASMRP 13 resource. There are no **Ramsar** sites.
- 5.292 At the national level, there are no **NNR** designations and just one **SSSI - West Nidderdale, Barden and Blubberhouses Moors** - which is coincident with this part of the North Pennine

Moors SAC/SPA and designated for the same reasons (dry heathland, blanket bog and a variety of breeding birds).

- 5.293 At a local level, there are no **LNR** designations and just two **SINCs**, affecting 3.32% of the Blubberhouses outcrop, and 2.54% of the overall ASMRP 13 resource. One of these relates to the **Thruscross reservoir** and the small valley leading into it. The other comprises the small area of **West End Marsh**, located on the hillside above.
- 5.294 The ASMRP 13 resources around Blubberhouses fall entirely within **Biodiversity Landscape Area 7** (Moorland Fringe), whereas those around Burythorpe are not within any of the current BLAs. Overall, this means that almost 77% of the silica sand resources fall within **BLA7**.
- 5.295 A similar pattern is seen in relation to individual Biodiversity Opportunity Areas, where there is a total overlap of more than 69%, almost all of which occurs within the Blubberhouses area. The resources in that area also overlap by 29% with the Washburn Valley Sub-Regional Green Infrastructure Corridor.

ASMRP 14: Carboniferous Limestone Resources

General Landscape Characteristics

- 5.296 At the national level, the Nidderdale AONB covers 3.16% of the total ASMRP 14 resource area. This occurs to the south west and north west of Pateley Bridge in Harrogate District, where 100% of the individual resource polygons fall within the designation.
- 5.297 Ancient Woodland designations occur within 1.26% of the overall ASMRP 14 resource, primarily within the following areas:
- Craven District, where only five of the resource polygons are involved;
 - to the west and south of Leyburn where there are nine areas of Ancient Woodland within the mapped resource; and
 - to the north and west of Brompton on Swale and Richmond, where 18 areas of Ancient Woodland occur within the mapped resource.
- 5.298 The ASMRP 14 resource has a widespread distribution within the western parts of North Yorkshire, where it occurs within seven of Natural England's National Character Areas (NCAs 21, 22, 23, 24, 33, 35 and 36) and within twelve of the more detailed Landscape Character Areas (LCTs 9, 11, 13, 14, 27, 29, 31, 32, 33, 34, 36, and 38). In view of this wide diversity of landscape types, the characteristics need to be considered separately in relation to the four main areas of outcrop: the Craven District; the area around Leyburn in southern Richmondshire; the area north of Richmond; and the upper parts of the Nidderdale AONB.

- 5.299 Within the first of these areas, Craven District, the Carboniferous Limestone occurs primarily within the lowland areas of **LCT 32** (Drumlin Valleys), **LCT 31** (Settled Industrial Valleys) and **LCT 11** (Broad Valleys) but also extends into some of the adjoining higher landscapes of **LCT 14** (Rolling Upland Farmland) and **LCT 38** (Siltstone and Sandstone Low Moors and Fells). Each of these has been described in relation to other ASMRPs. It is useful to note, however, that in each of these areas, the limestone is not a dominant factor in the landscape. It is overlain by superficial drift deposits in the lowland areas and is subservient to other rock types (gritstones, sandstones and siltstones) in the higher areas.
- 5.300 Around Leyburn, the limestone falls largely within **LCT 9** (Farmed Dale) but also extends into **LCT 33** (the Gritstone High Plateau), which overlooks the dale. LCT 9 is generally characterised by strong relationships between landscape and underlying geology. In this part of Wensleydale, the Carboniferous Limestone forms distinctive scars on the higher parts of the valley sides (see below) but the lower slopes and the valley floor are largely masked by superficial drift deposits, including those of ASMRPs 1, 2 and 3. The valley has a predominantly pastoral character, with extensive woodlands along the valley floor upstream of Wensley village, and large areas of parkland. Traditional stone field barns are a feature of the landscape. The floodplain directly south of Leyburn is characterised by an actively meandering section of the River Ure, and much of the land here is likely to have been reworked by the shifting course of the channel within the last few hundred years. The higher parts of the valley sides and the overlooking moors fall into LCT 33 which, in this area, comprises the gently undulating, upland plateau surface of Redmire Moor, Preston Moor and Broomber Rigg, to the northwest of Leyburn. These areas are generally distinguished by their undeveloped character, extensive blanket bog, open moorland vegetation, open skylines, extensive views and a strong sense of tranquillity and remoteness, with dark night skies. The plateau contains many areas of former mine workings for lead and other minerals, including disused tips, shafts and rakes (opencast workings). The ASMRP 14 resource, however, is mapped only at the southern edge of these areas, both above and below the Carboniferous Limestone crags of Redmire Scar. Existing limestone quarries, mostly disused, are numerous within and above these crags.
- 5.301 In the outcrops of ASMRP 14 to the north of Richmond, the resources fall primarily within **LCT 13** (Moors Fringe) and **LCT 33** (Gritstone High Plateau) but also extend slightly into **LCT 27** (Vale Farmland with Dispersed Settlements). The general characteristics of each of these character types has already been summarised in earlier sections but it is worthy of note that many of the gritstone plateau areas within LCT 33 to the north west of Richmond fall within the MOD's Feldom Ranges danger areas, which tend to emphasise the sense of remoteness and tranquillity (except, of course, during operational military exercises).
- 5.302 Within the Nidderdale AONB, the ASMRP 14 resources to the west and northwest of Pateley Bridge fall within National Character Area 21 (North Pennines). At the more detailed County level of assessment there is a distinction between the outcrops located within LCT 36 (Gritstone Valleys) and those within the adjoining LCT 34 (Gritstone High Moors and Fells), The general landscape of both of these character types have already been described.

Historic Environment Characteristics

- 5.303 The ASMRP comprises bands of outcropping Carboniferous Limestone in three main areas, to the north and east of Richmond, to the south of Leyburn, and in the Craven valley. For the most part the topography is undulating upland, and in some instances is fairly exposed moorland. However, the geology extends into the lowland areas around Scotch Corner, where the terrain is relatively flat. The land is generally now pasture land, and some comprises extensive areas of upland waste, but there is also the notable exception around the Scotch Corner area where the land is now under cultivation. In addition, even within areas that are now long established pasture there are remains of ridge and furrow and lynchets that would indicate historic cultivation, probably from the medieval period.
- 5.304 The predominantly upland and pastoral character of the landscape means that there is a relatively good survival of the heritage remains and that there is relatively good site visibility of the heritage resource that are evident on the surface.
- 5.305 There are often significant prehistoric remains surviving on the uplands, particularly to the south of Leyburn and to the north of Richmond, and includes round cairns, and similar Bronze Age burial monuments. In the area to the north of Richmond there are also cup and ring marked stones. Other notable sites include a Romano-British / Iron Age type of enclosed settlement with associated field system at Cote Pasture, to the south-west of Leyburn, and an Iron Age type of D Shaped enclosure near Melsonby. In the lowland part of the ASMRP, recent excavations along the line of the A66, have revealed a number of settlement sites (SCA 15 and 14) that were dated to the Late Iron Age / Early Roman period, and included field systems and round houses (Zant and Howard Davis In Press). The SCA15 site was very close to Scotch Corner and activity at the site may have been enhanced as a result of its proximity to the adjacent Roman Dere Street.
- 5.306 These prehistoric funerary and settlement landscape features reflect the typical upland landscape and are not a particular characteristic of the ASMRP; however, there are a number of quarry and extraction sites which have worked either the limestone or mineral seams within the limestone and are very specific to this ASMRP. The most common site from the HER within the ASMRP are limekilns and reflects the importance of the base geology for lime production. Most of these are small kilns that processed limestone from small adjacent quarries, but there are also a number of large scale industrial operations, including the very large Hoffmann Lime kilns from Mealbank (near Ingleton) and Langcliffe (near Settle), both in the Craven District; these are very important monuments and is reflected in their scheduled status.
- 5.307 In addition there is a propensity for lead rich minerals in seams within the base carboniferous limestone, and these have been worked extensively in the past. Most notably within the limestone outcropping at Middlesmoor and Greenhow, in Nidderdale, where there was extensive extraction and processing of lead ore; at Greenhow, in particular, there is a very high density of remains associated with former, mainly nineteenth century, lead extraction. Other lead working sites within the ASMRP includes the large lead mines at Keld Heads in Wensleydale.

- 5.308 Overall, 0.52% of the total area of this ASMRP overlaps with Scheduled Monuments, and a further 1.46 % coincides with Listed Parks and Gardens and reflects that this inherently marginal land was appropriate for the establishment of designed landscapes. The high scoring resource areas are very localised and correspond to the area north of Settle, specifically the Langcliffe lime works and Hoffman limekiln, where there were a number of nineteenth century mills, and also the Nidderdale lead working landscapes. Areas of moderate heritage resource are centred upon Leyburn and the A66/Scotch Corner area to the north-east of Richmond; the latter being enhanced by the identification of a number of crop mark sites and recent explorations in advance of road improvements.

Natural Environment Characteristics

- 5.309 Overall, just over 4.9% of the ASMRP 14 resource area falls within one or more natural environment designations.
- 5.310 Four areas of resource, all within Richmondshire District, fall within a total of four internationally designated sites, three of which form fragmented parts of a single **SAC**. The fourth site, which is also designated as a **SPA**, is the **North Pennine Moors**, which has already been described in relation to ASMRP 13. This clips two adjoining outcrops to the north west of Leyburn. On the southern edge of Richmond, a very small resource outcrop is slightly overlapped by an equally small fragment of the **North Pennine Dales Meadows SAC**. To the north of Richmond, two other fragments of the same SAC overlap with small parts of a more extensive limestone outcrop. Together, these international designations cover just under 0.1% of the overall ASMRP 14 resource. There are no **Ramsar** sites.
- 5.311 At the national level, again there are no **NNR** designations but there are 24 parts of the outcrop, distributed throughout the area, which fall within a total of nine **SSSI** designations. The two European sites mentioned above coincide, respectively, with the **Lovely Seat – Stainton Moor SSSI** (blanket bog, dry heathland), **Richmond Meadows** (unimproved neutral grassland) and **Gingerfields** (botanically rich traditional meadows). Other SSSIs which have a notable degree of overlap with the limestone resource include the **Lower Swaledale Woods and Grasslands SSSI**, just upstream of Richmond, and parts of the **Upper Nidderdale geological SSSI**, to the north west of Pateley Bridge (as described earlier in relation to ASMRP 1). Other SSSIs include the **Long Preston Deeps** river and wet grassland near Settle (described earlier under ASMRP 1), and three geological sites: **Haw Crag Quarry**, near Gargrave, **Hambleton Quarry** near Skipton and **Greenhow Quarry** to the west of Pateley Bridge. In total, SSSIs affect just over 0.91% of the ASMRP 14 resource area.
- 5.312 At a local level, there are no **LNR** designations but 71 individual resource polygons overlap with one or more **SINCs** (148 instances in total), accounting for just over 4% of the total area of mapped ASMRP 14 resources.
- 5.313 Most of the ASMRP 14 resources fall outside the current Biodiversity Landscape Areas. The main overlap is with **BLA 7** (Moorland Fringe), which covers almost 23% of the resource within a central strip encompassing the western parts of Richmondshire and Harrogate

districts. The resources in Craven, to the south west and in northern Richmondshire, to the east, are not affected.

- 5.314 Individual Biodiversity Opportunity Areas cover a wider range of areas within the resource, but amounting to a smaller percentage overall (just over 15%). The limestone resources also overlap, by 28.6% in total, with Regional-level Green Infrastructure Corridors in the Swale, Ure, Nidd, Wharfe, Aire and Ribble valleys, and to a more limited extent with Sub-Regional (14.4%) and District (9.9%) corridors.

Summary of ASMRP Environmental Characteristics

- 5.315 The foregoing review has attempted to identify the characteristic features of each ASMRP, in terms of landscape character and quality, the historic environment, and the natural environment. As explained in the introduction, slightly different approaches have been necessary for each of these topics, with an emphasis on seeking to identify the most representative environmental and landscape characteristics of each resource area. This is a particular requirement for identifying the selection of sample areas for more detailed analysis in Stage 2 of the project (see Chapter 7 for further details of that process) but it also helps to distil the immense complexity of the modern landscape into a manageable number of key parameters. These, in turn, provide the initial evidence base for analysing some of the key relationships between different parameters, as discussed in Chapter 6.
- 5.316 In terms of **landscape quality** designations, Table 3, below summarises the percentage coverage within each ASMRP.

Designation	AONB	Ancient Woodland	Country Parks	Heritage Coasts	All Designations
ASMRP					
ASMRP 1	6.49%	0.40%	0%	0%	6.89%
ASMRP 2	5.95%	0.29%	0%	0%	6.24%
ASMRP 3	2.31%	0.70%	0%	0.30%	3.31%
ASMRP 4	7.78%	0.34%	0%	0%	8.12%
ASMRP 5	2.77%	0.02%	0%	0%	2.79%
ASMRP 6	0.77%	1.58%	0%	0%	2.35%
ASMRP 7	0%	0.08%	0%	1.96%	2.04%
ASMRP 8	17.16%	2.96%	0%	0%	20.12%
ASMRP 9	2.47%	1.48%	0%	0%	3.95%
ASMRP 10	6.20%	2.01%	0%	0%	8.21%
ASMRP 11	0%	6.69%	0%	0%	6.69%
ASMRP 12	19.82%	0.40%	0%	0%	20.22%
ASMRP 13	76.58%	0.34%	0%	0%	76.92%
ASMRP 14	3.16%	1.26%	0%	0%	4.42%

Table 3 Percentages of each ASMRP which are directly covered by landscape designations

5.317 As discussed earlier in this chapter there are areas within all the ASMRPs that contain one or more landscape designations. Whilst in some cases these affect the whole of a particular resource polygon, overall, the percentage of the total area of the ASMRP is usually small, as illustrated in the table above. The most evident contrast is between ASMRP 13 where over 75% of the area is covered by designations and ASMRP 7, where only 2.04% is. This, however, is largely a reflection of the very limited size of the ASMRP 13 outcrops.

5.318 In terms of more general **landscape character**, Table 4, below summarises the percentage overlap of the main National Character Areas within each ASMRP.

National Character Areas	21	22	23	24	25	26	27	28	29	30	33	34	35	36	39
ASMRP 1	6.6%	15.4%	16.6%	18.2%	0.1%	1%	-	11.3%	-	19.2%	3.3%	-	2.8%	5%	0.4%
ASMRP 2	3.9%	10.9%	10.8%	43.7%	-	-	0.4%	1.1%	2.7%	13.6%	4.8%	0.3%	2.4%	5.3%	-
ASMRP 3	-	11.2%	5.6%	26.5%	-	-	-	27.6%	-	29.1%	-	-	-	0.1%	-
ASMRP 4	1.1%	12.8%	0.6%	18.9%	0.5%	0.7%	0.9%	26.3%	1.7%	30%	2.7%	-	0.3%	-	3.3%
ASMRP 5	-	-	-	-	1.3%	78.4%	16.8%	-	3.5%	-	-	-	-	-	-
ASMRP 6	0.5%	0.2%	2%	15.5%	0.1%	-	0.4%	35.5%	2.8%	6%	-	-	-	-	37.2%
ASMRP 7	-	-	-	-	-	1.5%	98.5%	-	-	-	-	-	-	-	-
ASMRP 8	-	-	-	-	56.4%	27.6%	-	-	16%	-	-	-	-	-	-
ASMRP 9	-	6%	10.2%	10.5%	-	-	-	0.4%	-	69.2%	-	-	-	-	3.7%
ASMRP 10	10.3%	-	-	-	-	-	-	-	-	42.5%	46.9%	-	-	0.3%	-
ASMRP 11	-	-	-	-	-	-	-	-	-	100%	-	-	-	-	-
ASMRP 12	9.3%	1.7%	-	-	-	-	-	-	-	1.6%	28.6%	9.8%	18.6%	30.4%	-
ASMRP 13	14.2%	62.4%	-	-	-	-	23.4%	-	-	-	-	-	-	-	-
ASMRP 14	36.9%	15.8%	16.5%	7.3%	-	-	-	-	-	-	12.7%	-	10.1%	0.8%	-

Table 4 Percentages of each ASMRP which fall within each of the National Character Areas

5.319 It is evident from this table that many of the ASMRPs cover a wide range of NCAs. This is primarily because the NCAs provide only a very broad-brush indication of landscape character. As the foregoing analysis has shown, the more detailed Landscape Character Types, assessed at the County level, generally show a much closer degree of correlation with the underlying geology and geomorphology and thus with the various ASMRPs.

5.320 With regard to the **historic environment**, the long settled nature of much of North Yorkshire is demonstrated in the rich and diverse nature of the overall heritage resource. Table 5 below summarises the percentage coverage of individual heritage designations within each ASMRP. Overall, the percentages are very low. Whilst the percentages of overlap give only limited information, by comparison with the more detailed review of the data from the Historic Environment Record/Historic Landscape Characterisation presented for each ASMRP earlier in this chapter, they do provide an overall impression of the extent to which the resources are potentially constrained, in terms of future extraction, by designated features of the historic environment.

Designation ASMRP	SAM	Parks and Gardens	Battlefields	World Heritage Sites	All designations
ASMRP 1	0.23%	1.10%	1.19%	0.00%	2.52%
ASMRP 2	1.14%	2.13%	0.00%	0.00%	3.27%
ASMRP 3	0.62%	1.27%	2.56%	0.01%	4.46%
ASMRP 4	0.11%	0.75%	0.17%	0.00%	1.03%
ASMRP 5	0.46%	1.56%	0.00%	0.00%	2.02%
ASMRP 6	0.17%	0.47%	0.18%	0.00%	0.82%
ASMRP 7	0.67%	0.00%	0.00%	0.00%	0.67%
ASMRP 8	0.09%	0.06%	0.00%	0.00%	0.15%
ASMRP 9	0.72%	1.79%	1.12%	0.77%	4.40%
ASMRP 10	0.44%	0.00%	0.00%	0.00%	0.44%
ASMRP 11	1.46%	0.00%	1.32%	0.00%	2.78%
ASMRP 12	0.01%	0.00%	0.00%	0.00%	0.01%
ASMRP 13	0.68%	0.00%	0.00%	0.00%	0.68%
ASMRP 14	0.52%	1.46%	0.00%	0.00%	1.98%

Table 5 Percentages of each ASMRP which are directly covered by historic designations

5.321 With respect to the **natural environment**, Table 6, below, summarises the percentage overlap of each designation type within each ASMRP. The table shows that, with the exception of ASMRP 11, which is more constrained but largely by minor designations, the

remaining ASMRPs generally overlap to only a limited extent (in most cases less than 5% overall) with natural environment designations. Once again, whilst the percentages of overlap give only limited information, by comparison with the more detailed review of the designation types presented for each ASMRP earlier in this chapter, they do provide an overall impression of the extent to which the resources are potentially constrained, in terms of future extraction, by protected features of the natural environment.

5.322 International designations cover up to 3.24% of the total surface area of individual ASMRPs, though in most cases this figure is less than 0.1%. At the national level, SSSIs cover up to 4.32% (though this includes all of the areas which are also within international designations). At a local level, up to 9.8% of the area of individual ASMRPs fall within or are overlapped by SINCs. When all of these designations are combined, allowing for areas of overlap, they cover between 0.53% and 13.3% of the resource areas.

Designation ASMRP	SAC*	NNR**	SSSI	LNR	SINC	All Designations (allowing for overlap between some designations *, **)
ASMRP 1	0%	0%	2.97%	0.05%	2.23%	5.24%
ASMRP 2	0.16%	0%	0.46%	0%	1.86%	2.30%
ASMRP 3	0.004%	0%	0.12%	0.10%	1.48%	1.80%
ASMRP 4	0.06%	0%	0.15%	0%	1.05%	1.20%
ASMRP 5	0.003%	0%	0.07%	0%	0.46%	0.53%
ASMRP 6	0.01%	0.005%	0.04%	0.05%	2.16%	2.2%
ASMRP 7	0.08%	0%	0.98%	0%	1.39%	2.40%
ASMRP 8	0%	0%	0.52%	0%	3.25%	3.76%
ASMRP 9	0.01%	0%	0.53%	0.18%	2.74%	3.45%
ASMRP 10	0.001%	0%	3.38%	0.004%	3.32%	6.70%
ASMRP 11	0%	0%	3.44%	0.01%	9.84%	13.3%
ASMRP 12	3.24%	0%	4.32%	0%	2.14%	6.50%
ASMRP 13	2.03%	0%	2.03%	0%	2.54%	4.60%
ASMRP 14	0.10%	0%	0.91%	0%	4.01%	4.90%

Table 6 Percentages of each ASMRP which are directly covered by environmental designations

* Areas of SAC designations are sometimes also designated as SPAs and/or Ramsar sites, and all of these designations occur within SSSIs

** Areas covered by NNR designations also occur within SSSIs

5.323 As the analysis presented earlier in this chapter has shown, there are certain areas within each ASMRP which are more heavily constrained, including some resources close to existing

or recent areas of active mineral extraction. However, in quite a number of cases, the designated sites themselves are restored or disused areas of former mineral extraction and, where this is the case, are unlikely to have a major influence on the viability or environmental acceptability of future extraction on other land nearby. Of greater concern are the designations, whether local, national or international, which relate to areas of either semi-natural vegetation or ancient woodlands and meadows, together with the habitats and the fauna which they support. In all cases these are surviving fragments of habitats which were once far more extensive, and they provide vital refugia for rare and endangered species.

- 5.324 Consideration has also been given to the degree of overlap with the Biodiversity Landscape Areas (BLAs) and Biodiversity Opportunity Areas (BOAs) identified by North Yorkshire County Council and/or partner organisations. Neither of these classifications confers any kind of protection on the landscapes involved: they simply aim to identify where there are important opportunities for biodiversity enhancement and/or monitoring, in accordance with the priorities established in national and/or regional biodiversity action plans or strategies. Such areas provide an important context for the consideration of habitat creation and biodiversity enhancement schemes associated with the restoration of surface mineral workings (such as those demonstrated by the 'Nature After Minerals' programme currently being operated by Natural England and the RSPB). That said, the distribution of BOAs, in particular, reveals little in the way of an overall pattern, being strongly influenced by the interests of particular interest groups in different areas. Sites which fall outside of these areas may have just as much potential for biodiversity enhancement, particularly when they facilitate the extension of existing habitats or other enhancement schemes in adjoining areas.
- 5.325 Similarly, consideration has been given to the degree of overlap with Green Infrastructure Corridors at Regional, Sub-Regional and District levels. Overall, there is a high level of correspondence, ranging from a minimum of 29% in ASMRP 13 to almost 100% in ASMRP 11, between the mineral resources and Green Infrastructure Corridors at one or more of these levels. Once again, these classifications do not confer any specific level of protection on the areas involved but they identify areas which might subsequently become protected within individual Local Development Frameworks and/or which have potential for the most effective biodiversity improvement.
- 5.326 Most importantly, the BLAs, BOAs and Green Infrastructure corridor initiatives represent opportunities for future improvements that should, amongst other things, help to re-establish links between the fragmented habitats protected by existing designations.

6. Strategic Relationships and Interactions between Key Environmental Characteristics

Introduction

- 6.1 Stage 1v of the project was required to examine the relationships and interactions between some of the key environmental characteristics (as identified in the previous chapter) within each of the ASMRPs. Of the many individual 'indicators' within each of the three broad environmental topics (landscape, historic environment and natural environment) there is an almost infinite number of permutations between pairs and larger groups of factors which might exhibit some degree of correlation with each other and with the characteristics of the underlying geological resources. In order to provide a more useful analysis, this chapter focuses on just the key relationships which are likely to be of relevance to the project at a strategic level, and for which causal factors can be readily identified.
- 6.2 The most fundamental relationship here (Theme 1) is that between geology and mineral resources. This has already been described in Chapter 2.
- 6.3 Based on the details set out in Chapter 5, and on the combined experience of the project team, the following additional key relationship themes have been identified:
2. Geology, Geomorphology and Landscape;
 3. Geomorphology, Mineral Resources and Past Human Activity;
 4. Mineral Resources and the Built Environment;
 5. Geology, Land Use and Nature Conservation.
- 6.4 In the text which follows, each of these themes is examined in turn, dealing first with generic issues and then examining in greater detail the nature of the relationships within each of the ASMRPs in which they are most relevant.

Theme 2: Geology, Geomorphology and Landscape

- 6.5 The geology (i.e. the rocks and sediments which underlie the surface) and the geomorphology (i.e. the landforms created through the processes of erosion, sediment transportation and deposition) are both intimately associated with the physical topography of the present-day landscape. The on-going geomorphological processes themselves (rivers, waterfalls, coastal processes etc.) also form important, dynamic characteristics of the landscape.
- 6.6 It is important to recognise, however, that the underlying geology has also influenced, to varying degrees, the *natural environment* (e.g. through the creation of soils, habitats and the dynamics of water supply); the *historic environment* (e.g. through the effects of topography and drainage on both the siting of ancient settlements and on the preservation

potential of archaeological remains) and the ‘modern’ **built environment** (e.g. through the use of local building materials in vernacular architecture and more generally through the provision of land that is suitable and safe for development).

- 6.7 This section deals specifically with the influence of geology and geomorphology on **landscape character**, which incorporates all of these various influences. The other individual relationships mentioned above, however, are explored in greater detail in the sections which follow.
- 6.8 At the simplest level, the oldest and hardest rocks tend to form the areas of highest and most rugged topography, as seen in the upland fells and moorlands which dominate the outcrops of ASMRP 14 – the Carboniferous Limestone; whilst the youngest Quaternary deposits of the river floodplains (ASMRP 1) generally form the areas of lowest topography and lowest relief (other than the exceptionally flat Vale of Pickering, which owes its origin to deposition within a former ice-dammed lake). In between the areas of highest and lowest terrain, the Permian Limestone and the Cretaceous Chalk form distinctive areas of intermediate elevation and relief – the Magnesian Limestone escarpment (ASMRP 9) and the Yorkshire Wolds (ASMRP 7), respectively. The Quaternary glacial sediments (ASMRP 4) are preserved on many of the hillsides along the route of the Vale of York ice sheet and its tributary glaciers but also in areas of morainic topography within the bottoms of the valleys and across the Vale of York. The glacio-fluvial outwash sediments (ASMRP 3) extend downstream from these deposits, merging into the more recently formed river terraces of ASMRP 2. The glacio-lacustrine clays of ASMRP 6 form areas of flat, low-lying ground beyond and in between the various moraines, whilst the beach deposits of ASMRP 5 correlate very strongly with the margins of the former glacial Lake Pickering, in what is now the Vale of Pickering and the Vale of Rye.
- 6.9 The text which follows examines these relationships in greater detail, retaining a strategic focus but bringing in the linkages with National Character Areas and Landscape Character Types in each of the identified ASMRPs.

ASMRP 1: Sub-alluvial gravels and ASMRP 2: River Terrace Sands & Gravels

- 6.10 Sub-alluvial gravels occur beneath the floodplains of present-day rivers, whilst the terrace deposits, representing former floodplain surfaces, occur along the valley sides. At the detailed level of the North Yorkshire Landscape Assessment, both of these ASMRPs thus have a very strong correlation and a strong causal relationship with the Landscape Character Types identified for individual valleys, as detailed within Chapter 5. However, as noted in that chapter, the rivers and their floodplains and terraces tend to cut across the more generalised National Character Areas (NCAs), which reflect the overall character of much larger swathes of the countryside, often combining both valleys and intervening hills.

ASMRPs 3 and 4: Glacio-Fluvial and Glacial Sands & Gravels

- 6.11 ASMRPs 3 and 4 are again frequently associated with the present-day river valleys and vales and thus show a similar discordance with those NCAs which primarily reflect the underlying rocks (e.g. the Pennine Dales, the Pennine Fringes and the Southern Magnesian Limestone).

However, because the deposits also extend across many interfluvial areas between the valleys, there is less correlation with the more detailed character areas of the County Assessment. Much greater concordance is seen within the Vale of York (NCA 28), which became one of the main outlet glaciers from the ice sheets of northern England during the last ice age. Within the Vale, the glacial deposits in particular can be distinguished by their gently undulating topography and greater relief, rising above the flatter surfaces of the glacio-fluvial sediments and those of the modern floodplains.

ASMRP 5: Undifferentiated Sands & Gravels

- 6.12 ASMRP 5, being composed of sediments deposited on the beaches of the former glacial Lake Pickering, is very strongly associated with the outer margins of the low-lying Vale of Pickering and Vale of Rye. There is a very strong correlation with NCA 26 and also with the component Landscape Character Types (22 and 26). The marginal areas exhibit a broad, flat or very gently undulating rural landscape, surrounding and merging almost imperceptibly into the flatter, central part of the Vales. Much of the land has been drained for arable cultivation and drainage features such as linear ditches, dykes and embankments are features of the landscape, along with pockets of wetland and marsh. Locally, in the area to the south of West Ayton (Wykeham Lakes), the landscape has been transformed by former and on-going mineral extraction into a series of lakes, used for leisure purposes, surrounded in part by woodlands.

ASMRP 6: Quaternary Brick Clay Resources

- 6.13 ASMRP 6 has a strong association with those NCAs which relate to lower level rural farmed landscapes within the Vale of York (NCA 28), the northern part of the Humberhead Levels (NCA 39) and the Vale of Mowbray (NCA 24). Because of the disjointed rather than continuous nature of the deposits, the correlation is only partial, with the ASMRP 6 deposits in these areas being interspersed with those of other Quaternary drift deposits. Nevertheless, the features associated with ASMRP6 provide an important part of the assemblage of landforms which make up the physical character of these areas. Within the Vale of York, the landscape character is predominantly flat and low lying but with sporadic low hills formed by glacial moraines and by the glacial sands & gravels of ASMRP 4. The area is characterised by large to medium sized low hedged fields of arable and dairy, with floodplains used for hay meadow. Further south, within the Humberhead Levels, the landscape becomes very flat with extensive areas underlain either by the glacio-lacustrine clays of ASMRP 6 and/or fine-grained river alluvium (without sub-alluvial gravels). These areas have been intensively drained for agriculture and individual fields are more likely to be surrounded by ditches than hedgerows. In places there are remnants of heath vegetation on lowland raised bogs which developed during the Holocene period on top of the poorly-drained clay soils. In the Vale of Mowbray, the areas of glacio-lacustrine sediments become more dispersed and make up a smaller proportion of the overall landscape which, as a consequence, is more varied.
- 6.14 In Harrogate District, some patches of ASMRP 6 deposits occur in isolated hollows within parts of the Southern Magnesian Limestone character area (NCA 30). More generally, the

landscape here is smooth and rolling with dry valleys and large arable fields which, in places, are combined with woodland. The northernmost part of this ASMRP comprises numerous dispersed small fragments which lie within the Tees Lowlands (NCA 23). Once again they contribute (along with the equally dispersed fragments of other ASMRPs and areas of non-mineral) to the varied landscape character of this area.

ASMRP 7: Cretaceous Chalk

- 6.15 ASMRP 7 correlates almost precisely with that part of the Yorkshire Wolds character area (NCA 27) which falls within North Yorkshire. This is because the underlying Chalk provides both the mineral resource and the characteristic principal landforms of the area. It forms a prominent escarpment above the Vales of York and Pickering, with a relatively steep scarp face and a high plateau surface of rolling hills, diversified by numerous dry valleys on the dip slope. It is the rounded, concavo-convex profiles of these valleys, resulting from a combination of fluvial erosion, dissolution and solifluction² of the soluble Chalk during the cold climatic conditions of earlier glaciations, which creates the characteristic rolling landscape of the plateau. Steeper and more deeply-incised valleys dissect the northern and western scarp slopes in places. Although most of the valleys are now dry, except when the water table is exceptionally high, one major exception to this is the extensive open valley of the Gypsy Race which flows eastwards towards Bridlington in neighbouring East Riding from the central part of ASMRP 7. In the far east of the area, where the outcrop reaches the coast at Flamborough Head, both the rolling plateau and the steep northern face of the escarpment are abruptly truncated by sheer coastal cliffs. Inland, numerous old, disused quarries are often a feature of the landscape, exposing the Chalk strata and providing important geodiversity sites. In terms of land use, the gently rolling, well-drained plateau areas are characterised by large, regular, arable fields and, in places by pig farming, whilst the steeper slopes are more suited to unimproved grassland for sheep grazing and limited areas of woodland. As described more fully in Chapter 5, the North Yorkshire Landscape Character Types elaborate on the contrast between the lower slopes, the dry valleys and the plateaux of the Chalk Wolds.

ASMRP 8: Jurassic Limestone

- 6.16 ASMRP 8 occurs predominantly within the southern slopes of the North York Moors and Cleveland Hills (NCA 25), where these grade down into the northern margin of the Vale of Pickering (NCA 26) but also within part of the Howardian Hills (NCA 29) around Nunnington. Although these three National Character Areas exhibit very different landscape types, overall, the specific areas involved here (i.e. the outcrop of the Jurassic Limestone) mostly correspond to a single Landscape Character Type: the Limestone Foothills and Valleys. These areas are very similar to each other, each comprising gentle dip slopes rising above the Vale of Pickering, diversified by small, incised, wooded valleys.

² Downhill slumping of saturated soils above permanently frozen ground.

ASMRP 9: Permian Magnesian Limestone Resources

- 6.17 As noted in the previous chapter, within Harrogate, Hambleton and Selby Districts this ASMRP has a clear and direct relationship with NCA 30, the Southern Magnesian Limestone. This largely coincides with the Landscape Character Type of the Magnesian Limestone Ridge, in the more detailed North Yorkshire Landscape Assessment. Within this area, the two limestone units within the Permian sequence (the Brotherton Formation – or Upper Magnesian Limestone – and the Cadeby Formation – or Lower Magnesian Limestone) form relatively resistant rocks, compared to the weak mudstones and highly soluble gypsum / anhydrite strata which occur in between and above them. They therefore give rise to distinctive north-south oriented ridges and hills within much of this area, interrupted by the discordant broad valleys of the Rivers Ure, Nidd, Wharfe and Aire. In between these valleys, the outcrops are partially concealed by Quaternary glacial drift deposits but the limestone still exerts a strong influence on the landscape, characterised by gently rolling low hills diversified by dry valleys and steep wooded limestone gorges with caves and crags.
- 6.18 Further north, from the edge of Hambleton District and into Richmondshire, the Magnesian Limestone exerts a more limited influence on both topography and landscape character, and this is reflected in the fact that NCA 30 does not extend into these areas. Instead, the ASMRP 9 resources fall partly within NCA 23 (Tees Lowland) and partly within NCA 24 (the Vale of Mowbray). In both cases the limestone outcrop appears to have been more extensively worn down by Quaternary (and earlier) erosion and subsequently overlain by greater thicknesses of glacial and other superficial deposits, than is the case further south. It is these factors which thus exert a greater influence on the present-day topography and landscape character of those areas.

ASMRP 10: Shallow Coal Resources and ASMRP 11: Carboniferous Brick Clay

- 6.19 As noted in Chapter 5, these two resource areas are partly coincident with each other and both are concealed by younger strata, including the Magnesian Limestones (within Selby District) as well as various Quaternary drift deposits. As a direct consequence of this, they have no direct bearing on landscape character.

ASMRP 12: Carboniferous Sandstone and ASMRP 14: Carboniferous Limestone

- 6.20 These rocks form part of the same overall succession of Carboniferous strata, with the sandstones, forming part of the Millstone Grit sequence, being the younger of the two. The Limestones, which extend beneath the Millstone Grit, crop out further to the west. Together, these are the oldest and hardest rocks seen within the study area and thus generally form the areas of highest and most rugged terrain. The Millstone Grit tends to form broad upland plateaux characterised by open moorland vegetation, with distinctive gritstone crags and ‘edges’ above the deep valleys of the River Nidd and its tributary, the River Washburn. The Carboniferous Limestone also forms areas of high moorland, especially where it has been overlain by a cover of glacial drift deposits. However, as the limestone occurs within the ‘Yoredale Series’ of alternating of rock types (sandstones, mudstones and thin coal seams as well as limestones) the differences in resistance to erosion of these

various rock types are clearly reflected in the detailed character of the hills and valley sides, with the hard limestones, in particular, standing out as prominent steps and crags.

- 6.21 Despite these strong correlations between geology and scenery, there is much less correlation between the distributions of either of these resource outcrops and either National Character Areas or Landscape Character Types. At the strategic level, the limestones and to a lesser extent the sandstones are primarily associated with the Yorkshire Dales (NCA 21) the Pennine Dales Fringes (NCA 22) and the Southern Pennines (NCA 36) but in Craven District they also occur within the Bowland Fells (NCA 34), the Bowland Fringes (NCA 33) and the Lancashire Valleys (NCA 35). In Richmondshire, the limestone also extends, beneath Quaternary drift deposits, into NCA 23 (Tees Lowland) and NCA 24 (Vale of Mowbray).

ASMRP 13: Silica Sand Resources

- 6.22 The two small outcrops of silica sand resources reflect the character of their respective areas and are thus quite different to each other. The western deposit, of Carboniferous age, is located around Blubberhouses in the Pennines and straddles the boundary between the Yorkshire Dales (NCA 21) and the Pennine Dale Fringes (NCA 22). In terms of geology, topography and landscape character it has more in common with the sandstone resources of ASMRP 12 than with the other (eastern) outcrop of ASMRP 13. The latter is of Jurassic Age and is located close to Burythorpe, to the south of Malton. It falls within the national character area of the Yorkshire Wolds (NCA 27), but lies beyond the foothills of the Chalk escarpment and, geologically, has more in common with the Jurassic rocks of the Howardian Hills.

Theme 3: Geomorphology, Mineral Resources and Past Human Activity

- 6.23 The long history of human occupation, farming and industry within North Yorkshire has created a complex legacy of archaeological features, land use patterns and architectural styles. All of these contribute to the modern landscape of the area, its rich historical environment and its very considerable archaeological potential.
- 6.24 Spatial variations in the density of archaeological features have been found to have specific relationships with some of the geomorphological factors which have also influenced the distribution of Quaternary mineral resources, especially within lowland areas (i.e. ASMRPs 1 to 6). In other cases, the level of historical interest has been found to be at least partially influenced by the spatial distribution of former mineral workings, including lead mining in the Yorkshire Dales, ironstone workings in the North York Moors, coal mining in both the Craven and Selby Districts, Chalk and limestone workings with ancillary kilns within or close to those outcrops and the more widespread distribution of building and roofing stone quarries, aggregate quarries and clay pits. Although the first two of these activities took place primarily outside the study area (within the Yorkshire Dales and North York Moors National Parks, respectively), their legacy of industrial archaeology (and of secondary deposition of mobilised heavy metals, in some cases), extends down into the adjoining lowland areas. For example, although lead was extracted from mainly higher level land, the

processing and transport of lead has had an impact on the historic environment designations and archaeological resource of ASMRP polygons in the upper river valleys of the Nidd and Ure within the study area.

- 6.25 This section explores the particular relationships evident within each of the ASMRPs.

ASMRPs 1& 2: Sub-alluvial Gravels& River Terraces

- 6.26 The archaeological resource within ASMRPs 1 and 2 is associated with earlier settlement of and land use within river floodplains as they developed during the post-glacial Holocene period. Valley floors are likely to have been important sites for settlement, as they provided access to water (for drinking and for transportation) and flat land for cultivation. River floodplains are also characterised however, by a risk of frequent flooding which, in some areas at least, will have restricted development in close proximity to the rivers themselves. As noted in the previous chapter, much of the archaeological evidence relating former settlement and land use within floodplain areas has either been lost (or redistributed) as the rivers have gradually reworked the floodplain sediments, or has been buried by the accumulation of more recent overbank flood deposits. Paradoxically, however, floodplain sites are generally characterised by high groundwater levels and the resulting permanent saturation of the floodplain sediments can provide optimal conditions for the preservation of buried artefacts. More extensive evidence of land use and settlement is often preserved on the river terraces which adjoin the modern floodplains. In some cases this evidence may relate to periods, over the last several thousand years, when these were active floodplain surfaces, before the rivers cut down to their present levels. In other cases they relate to more recent settlement and land use, when the terraces had become areas of good quality, well-drained land above the levels of most flood events, as they are today. Examples include monastic sites along the Swale near Richmond and Catterick and Kirkham Abbey on the River Derwent. In Upper Nidderdale there is a very strong correlation with lead mining but this is to do with processing and transportation – the mineral was extracted from higher ground.
- 6.27 The density of known archaeological evidence within ASMRPs 1 and 2 (and also ASMRPs 3, 4, 6 and 9) shows a particularly strong association with the principal historic north/south transport route through the study area: the most recent manifestation of which is the A1/ (M) trunk road/motorway – the Great North Road. This partly reflects the economic importance of this primary communication route, which in turn owes its origin in part to the geomorphology of the area: it follows well-drained lowland terrain through the Vale of York and Vale of Mowbray. However, the density of archaeological evidence here is also distorted by the much greater intensity of recent archaeological investigations along this route corridor. These have been principally associated with the widening and upgrading of the A1 to motorway standards but also in connection with mineral planning applications in this general area.

ASMRPs 3 & 4: Glacio-fluvial and Glacial Sands & Gravels

- 6.28 As noted in Chapter 5, these resources cover a wider area, extending onto higher ground above the river terraces, as well as being present within the valleys and the Vales of York

and Mowbray. There is evidence of rich archaeological remains and archaeological potential, reflecting the long continuous settlement of these areas that were less prone to flooding than ASMRPs 1 and 2. The location of the Great North Road running north-south through the centre of these ASMRPs and providing access for communication and economic opportunity has again been an important influence on past settlement and land use, and has also influenced the abundance of archaeological evidence. There are important designated scheduled sites and listed buildings within or near to ASMRPs 3 and 4, including earlier castles, manor houses and listed Parks and Gardens.

ASMRP 5: Undifferentiated Sands & Gravels

- 6.29 As noted in Chapter 5 (see BOX 1), the margins of the Vale of Pickering, which is the location of these resources, have long been known as areas that attracted early settlers from the Mesolithic period onwards. This is not least because they were both ice free and relatively sheltered during the last glaciation, by comparison with the adjoining higher landscapes of the Yorkshire Wolds and the North York Moors and were marginally higher than the areas submerged beneath the intervening Lake Pickering. Internationally important archaeological remains from this period have been found at Star Carr, dating from up to 10,900 cal BP. Earthen long barrows distributed across the Vale are a sign of occupation by later Neolithic farmers and there is evidence at West Heslerton and elsewhere of all subsequent periods of occupation. Together, these provide this ASMRP with a very strong association with an extremely important existing archaeological resource, which has considerable potential for further discoveries of well-preserved archaeological remains.
- 6.30 There is concern that intensive agriculture, further land drainage and (potentially) any dewatering that might be associated with future mineral extraction in this area, may adversely affect the survival of archaeological remains, particularly within waterlogged organic soils which have successfully preserved these features and artefacts for many thousands of years.
- 6.31 Extensive landscape research within the Heslerton Parish Project has demonstrated that the best archaeological sites are likely to be below later deposits. Crop marks are therefore not good predictors of archaeological potential. More than 25 years of research and investigation in this area suggest that many other sites are likely to possess unpredictable and unknown archaeological potential, as exemplified by the Iron Age burials at West Heslerton which reflect a more densely occupied landscape from the post Roman period to the Conquest than previously thought.

ASMRP 6: Quaternary Brick Clay Resources

- 6.32 These resources are extensive throughout the Vale of York and, especially, the Humberhead Levels. Areas with a high density of archaeological designations are, however, found predominantly in the central part of the Vale of York. Generally, this is an area that has long been settled, with Roman cultivation of the heavier clay soils evident from villa/farm remains in the Vale. Although, as noted in Chapter 5, there are some notable historical sites, such as Aldbrorough and although the ASMRP overall has an association with archaeological

remains from many different periods, the majority of the resource outcrop is characterised by only medium to low density heritage scores.

ASMRP 7: Cretaceous Chalk Resources

- 6.33 The well-drained uplands of the Yorkshire Wolds have long been settled and archaeologically, there is widespread evidence of deserted and shrunken medieval villages within this ASMRP. The area is now sparsely populated and the number of designated scheduled monuments affects only a small percentage of the overall resource. These include barrows and earthworks from the Neolithic period, and extensive earthworks and burial sites. The ceremonial landscape centred on Duggleby Howe and the number of DMVs all reflect historical changes in the past occupation and use of this landscape. The retreat from widespread cultivation during periods of poorer climate, with farming activity abandoning poorer and drier soils, reflects similar activity in other parts of eastern England such as North Norfolk and is responsible for the survival of monuments which have been lost elsewhere through deep ploughing and more intensive cultivation. The high volume of surface-gathered material and the evidence of multi-period activity give much of the ASMRP a high to medium scoring in terms of its existing and potential archaeological resources.

ASMRP 8: Jurassic Limestone Resources

- 6.34 The Jurassic Limestone outcrop between the North York Moors and the Vale of Pickering lies close to a line of historic settlements which follow the northern edge of the Vale but the density assessment using the available designation and HLC data indicates only low to moderate archaeological remains and potential within the ASMRP itself.

ASMRP 9: Permian 'Magnesian' Limestone Resources

- 6.35 The linear outcrop of Magnesian Limestone, which extends up the centre of the Vale of York, runs approximately parallel to and generally just a few km to the west of the historic A1 route (The Great North Road). As noted in Chapter 5, there is considerable archaeological/heritage resource within the limestone outcrop, including the high density resource areas of Catterick, Leeming / Bedale, Ripon, Knaresborough, Wetherby and Tadcaster. The landscape retains archaeological evidence from the Iron Age of ditches and banks to bound settlements, stock pens and tracks, as woodland was cleared and farmsteads and field systems became established. The limestone ridge was the location of the major Roman roads that became the modern A1 and it has continued to exert a major influence on settlement and land use throughout history. As previously noted, the outcrop also includes the World Heritage Site of Fountains Abbey / Studley Royal which is a cultural designation with important archaeological remains and sites associated with the Cistercian abbey, together with a later (18th century) designed landscape. Elsewhere, this ASMRP encompasses wider fieldscapes and woodlands commissioned as part of the landscape enhancements by private owners and now recognised as an important part of the historic landscape character area has always been an attractive one for settlement and crop marks show earlier sites and enclosure systems. It was an area of intensive medieval settlement, supported by extensive cultivation and quarrying of the local stone. Woodland areas,

including the parkland landscapes of the 18th and 19th centuries, are responsible for the survival of barrows and earthworks in this ASMRP.

ASMRP 10: Shallow Coal Resources

- 6.36 This mineral is no longer worked in North Yorkshire and few remains of earlier extraction survive. The scoring identified only moderate and some low heritage resources within the ASMRP and, for the reasons previously noted in Chapter 5, there appears to be no particular correlation between the archaeological resource and the geomorphology of this ASMRP.

ASMRP 11: Carboniferous Brick Clay Resources

- 6.37 There are a number of areas of high heritage resource within this ASMRP but they are typically fairly localised and, by virtue of the fact that the mineral is concealed beneath younger strata and thus has no influence on surface topography, there is no evident correlation between the heritage features, the mineral resource and the geomorphology of the areas involved. The close proximity of the route corridor now occupied by the A1 is likely, once again, to have had a more direct influence on the archaeological features that are present, including the recorded earthworks and the Registered Battlefield of Towton.

ASMRP 12: Carboniferous Sandstone Resources

- 6.38 Polygons of medium density heritage scores occur within this resource to the south west of Giggleswick whilst higher density scores and features are found close to Kildwick and Skipton. There is a link with earlier sandstone extraction for building stone and prehistoric rock art and stone cairns are associated with the resource at Low Bradley south of Skipton in Craven District, for example.

ASMRP 13: Carboniferous and Jurassic Silica Sand Resources

- 6.39 The Carboniferous Silica Sand resources around Blubberhouses coincide with a high density heritage resource, in part reflecting cup and ring marks on Blubberhouses and Denton Moors. At Burythorpe there is evidence of Roman settlement within the ASMRP area and crop marks and recorded finds further indicate that this ASMRP, although covering a relatively small total area, is of archaeological interest. However with the limited information available it is not possible to say if there is any direct relationship between the archaeology and the geomorphology of these two disparate locations, although the siting on higher ground (in the case of Blubberthorpe) is likely to have been important.

ASMRP 14: Carboniferous Limestone Resources

- 6.40 For the most part, the Carboniferous Limestone outcrops are associated with a moderate density of heritage resources. High heritage scores are found near Settle and in the Nidd valley. Carboniferous Limestone was quarried directly from the face of the outcrops where it was exposed below more recent deposits in Wensleydale. It was increasingly processed from the 18th through to the 20th century for agricultural and industrial processes (ruins of small limekilns are prevalent throughout the study area where outcrops occur). The Scheduled

Ancient Monuments at Langcliffe and Mealbank are directly associated with this ASMRP as the most recent manifestation of a strong association with the extraction and processing industries.

Theme 4: Mineral Resources and the Built Environment

- 6.41 The historic built environment encompasses all sites and features that have designated status as listed buildings and designed landscapes but also those parts of mans interaction with his local environment which create or retain local or regional distinctiveness. With respect to mineral resources, such things include the use of local building and roofing stone; the use of locally made bricks and pantiles; the use of walling stone for field enclosures and other boundary constructions; the use of distinctive mortars based on locally available sands and cements and the use of cobbles or (more recently) specific types of aggregate, in the construction of roads, pavements and concrete products.
- 6.42 Mineral extraction of raw materials has a long history within the study area, as evidenced by both current and remnant mineral working in some of the ASMRPs. Lead and coal were exploited from early times – Roman lead ingots have been found near Pateley Bridge. Many of the remnant lead mining sites are now recognised as being of historic interest and sites such as Keld Heads near Castle Bolton are designated as Scheduled Ancient Monuments. The sand and gravel ASMRPs in Nidderdale also bear evidence of lead processing. Limestone is currently the main mineral extracted in North Yorkshire, followed by sand and gravel aggregates and then sandstone. There are many disused quarries – some large and many very small, which were exploited in the past because of their location near a building site, extracted near a kiln to burn lime for agriculture or construction or increasingly in the 19th century, developed because of ease of extraction, processing and carriage. Disused limestone quarries in particular have become nature conservation sites and disused limekilns are found in relatively large numbers across the study area. Together, these contribute to our understanding past agricultural and building practices and how our ancestors used local resources.
- 6.43 Disused or inactive quarries can also provide links with the construction of specific historical buildings, monuments or other features. As such, they represent important aspects of the wider built environment (and the resources remaining within them and in adjoining areas). The use of appropriate matching stone is important for the faithful repair of historic and vernacular buildings, as well as for the construction of sympathetic new development and is established in local and national planning policy and guidance. Unsuitable and unauthentic repairs and construction can have a negative visual impact on historic settlements and landscapes. The reopening of small quarries to meet local demand for the repair of old buildings and/or the construction of new sympathetic developments can help to maintain local character and is now increasingly recognised as both a conservation and construction policy issue. Local quarries could supply stone to reduce reliance on foreign imports from less sustainable sources. However large scale extraction from quarries now recognised as a natural environment resource and opening up new sites brings other potential problems that will be examined later in this study.

- 6.44 Within the ASMRPs there is some evidence of past extraction and processing of mineral resources within the designations and this, with our general understanding of the landscape character and past and present extraction activities, has allowed us to make some general strategic observations about mineral extraction and its impact on the historic built environment.

ASMRPs 1 to 5: Sand & Gravel Resources

- 6.45 These resources have been exploited over many centuries, although in recent decades this has been primarily for use in concrete products. Exceptions to this have included the use of building sands in distinctive mortars and screeds and the use of larger boulders and cobbles within the facings of buildings and in the construction or repair of drystone walls.

ASMRP 6: Quaternary Brick Clay Resources

- 6.46 Locally sourced clay bricks and pantiles became increasingly common from the 16th century (flat clay tiles were used as infill for many Medieval buildings in York) and have been sourced from many individual outcrops within this ASMRP, particularly within the Vale of York and the Humberhead Levels. In Chalk and limestone areas clay pantiles have traditionally been used to roof stone buildings giving a particular character to the historic built environment that has been maintained through repairs and constraints on new building. There are a number of brick works within this ASMRP perpetuating the historic industry and providing tiles and bricks for restoration as well as new build projects.

ASMRP 7: Cretaceous Chalk Resources

- 6.47 Chalk has been extracted in this area for many centuries and, in contrast to the relatively weak and soluble Chalk outcrops seen further south, the material has frequently been utilised for the construction of houses and farm buildings (often in combination with red clay pantile roofs) which contribute to the landscape character of this ASMRP type. There are numerous disused chalk quarries – some of which are now recognised for their natural/ecological or geological value.

ASMRP 8: Jurassic Limestone Resources

- 6.48 Jurassic Limestone has been exploited in the past as a characteristic building stone in many of the settlements that lie at the interface between the North York Moors and the arable lands of the Vale of Pickering to the south. Today, one or two very small quarries are worked periodically to supply similar stone for restoration projects.

ASMRP 9: Magnesian Limestone Resources

- 6.49 The Magnesian Limestone has been used as a prestige building stone for many centuries and is notable for its contribution to the character of the built environment in the lower lying areas on either side of the limestone ridge, as well as within the outcrop itself. It was used widely for large houses like Bramham Park, for churches and other formal buildings throughout this area and for many of the local historic buildings within towns and villages

such as Bedale, Ripon, Knaresborough, Harrogate, Wetherby, Boston Spa, Tadcaster and Sherburn-in-Elmet. As noted earlier, the stone is also directly associated with the construction of major prestigious buildings further afield, such as York Minster. There are still pressures to quarry this stone for aggregate use as well as for building stone but also policies to promote its use to preserve the special character of listed buildings and historic settlements.

ASMRP 10: Carboniferous shallow Coal Resources

- 6.50 As previously noted, the shallow coal resources around Ingleton in Craven District have been worked in the past but this has little visual impact on the character and appearance of the present-day built environment. The resources within Selby District have not been worked, except by means of deep underground mining within the Selby coalfield.

ASMRP 11: Carboniferous Brick Clay Resources

- 6.51 These resources have not been worked, historically, within North Yorkshire, and are concealed beneath Permian limestone resources. As such, they have had no influence upon the built environment.

ASMRP 12: Carboniferous Sandstone Resources

- 6.52 Carboniferous Sandstone has been extensively used as a local building stone and walling stone throughout much of the Pennines and Yorkshire Dales, being easier to work, for these purposes, than the much harder Carboniferous Limestones. More thinly-bedded adjoining formations within the Carboniferous sequence have also been utilised, in the past, as distinctive roofing stones, in contrast to the clay pantiles seen further east and the Cumbrian and Welsh slates seen in many other built-up areas.

ASMRP 13: Carboniferous and Jurassic Silica Sand Resources

- 6.53 Neither of these resource outcrops has been seen to have any direct relationship with the immediate built environment.

ASMRP 14: Carboniferous Limestone Resources

- 6.54 Carboniferous Limestone has been extracted for commercial use for many centuries. Lime was of great importance for agriculture from the 18th century onwards and to the chemical industry in the 19th and early 20th centuries. Its primary use, however, and the one most directly associated with the built environment, have been (and still are) as a reliable, all-purpose construction aggregate. In this form it has contributed to the construction of most roads (as a constituent of all but the uppermost layers of asphalt). Disused quarries are found in many parts of the limestone outcrop and there are the remains of small and large scale lime kilns throughout this ASMRP. Limestone is still quarried in a number of locations, as detailed in Chapter 2.

Theme 5: Geology, Land Use and Nature Conservation

- 6.55 Nature conservation, encompassing both biodiversity and geodiversity, has a number of links with the underlying geology and geomorphology but also with both historic and on-going land use, including mineral extraction and the restoration of former workings.
- 6.56 It is important to recognise that the concept of nature conservation applies to all parts of the natural environment, not just designated sites. However, for the purposes of objective analysis within this project, the only consistent data available on this topic is that relating to the distribution of designated sites as described in Chapter 5 of this report.
- 6.57 As noted in that chapter, data is also available regarding the distribution of Biodiversity Landscape Areas, Biodiversity Opportunity Areas and Green Infrastructure Corridors. These, however, are not consistent datasets: they are strongly influenced by areas of local and regional interest and the first two, in particular, do not purport to identify all areas of biodiversity quality or opportunity on a consistent basis throughout the County. The Green Infrastructure Corridors are more consistent in terms of being linked to a standardised methodology but even these cannot easily be correlated with existing biodiversity quality or importance. The emphasis in all three cases is on targeting future biodiversity enhancements on areas where this is likely to be most effective, for example in meeting BAP targets).
- 6.58 As already demonstrated in Table 6, only small proportions of the various ASMRP outcrops (in most cases less than 5%) are affected by natural environment designations and many of these are sites that have been identified within areas of former mineral extraction. They include sites designated for their biodiversity interest, including both wildlife and habitats (whether deliberately created through quarry restoration schemes or resulting from the natural colonisation of abandoned sites). They also include sites that are designated for their geodiversity interest, either on its own or in combination with biodiversity features. Together, these sites demonstrate the beneficial effect which quarrying activity can ultimately have on nature conservation (a benefit which can help to offset or compensate for any adverse effects which might result from quarrying itself).
- 6.59 The geological sites, in particular, provide invaluable inland exposures, often in areas which otherwise are devoid of opportunities to examine the geology. Similarly, the biodiversity sites often provide refuge for rare and endangered species in areas where their natural habitats have been greatly diminished through centuries of human occupation and cultivation. Increasingly, through initiatives such as 'Nature After Minerals' operated by Natural England and the RSPB, but also through the independent actions of responsible mineral operators, quarry restoration is providing opportunities for the creation or replacement of priority habitats, and for the creation of linked habitats and wildlife corridors, rather than just isolated features of interest.
- 6.60 Most of the sites within former quarries are local designations (Local Nature Reserves and Sites of Importance for Nature Conservation, which include 'Local Geological Sites') but some are Sites of Special Scientific Interest.

- 6.61 Sites which are not related directly to mineral extraction, including small numbers of international designations as well as national and local ones, generally relate to those parts of the landscape which have been affected least by other human impacts, such as built development, agriculture, land drainage, commercial forestry and other forms of land management. Very little of the present-day landscape can be described as truly natural. Almost all of it has been modified in one way or another, the only exceptions being steep rocky outcrops and coastal cliffs such as those at Flamborough Head and natural lakes. Such areas are frequently (though not always) designated for their biological and/or geological importance. Elsewhere, despite the extensive modifications introduced by human occupation and management, certain types of land use have either created or maintained semi-natural conditions which are important areas of biodiversity. They include areas of open moorland, ancient woodland, unimproved permanent pasture and unconstrained river channels.
- 6.62 Broadly speaking, the highest concentrations of nationally and internationally designated nature conservation sites which are not related to former mineral extraction are found within ASMRP 12 – the Carboniferous Sandstone outcrops – particularly those within moorland areas. This is reflected in the percentages seen in Table 6. Slightly lower percentages of national (SSSI) designations are also seen within ASMRPs 10 and 11 (Carboniferous shallow coal and associated brick clay resources) and within ASMRP 1 (Sub-Alluvial Gravels). The latter relate to important areas of woodland and/or wetland habitat within, or at the edges of river floodplains, whilst the others relate primarily to woodlands on higher ground. In terms of local designations that are unrelated to mineral extraction, relatively high concentrations are again seen in ASMRP 11 (relating primarily to woodlands developed on the Permian Limestone which overlays the Carboniferous strata) and in ASMRP 14 (relating to a variety of woodland, grassland and geological exposure sites within the Carboniferous Limestone).

Summary

- 6.63 The foregoing analysis has identified just some of the many inter-relationships between environmental and landscape factors which are of particular relevance to this project. In order to obtain a fuller impression of these relationships, however, it is useful to examine how they have interacted with each other and with a myriad other factors, to create the landscape that we see today.
- 6.64 Literally underlying all of the relationships is the varied geology of the area and the way in which this has influenced the geomorphological process of erosion, sediment transportation and deposition to create both the physical topography of the landscape and the distribution of mineral resources within it. The bedrock geology, which in the simplest of terms comprises an easterly- tilted layer-cake of different rock types, is revealed as a series of roughly north-south oriented outcrops with the oldest and hardest in the west and the youngest in the east. Although modified in detail by the overlay of Quaternary superficial deposits (see below), this basic pattern has directly influenced the predominant characteristics of landscape, land use and settlement.

- 6.65 The older rocks in the west generally form the areas of highest and most rugged terrain which is sparsely settled and largely given over to open moorland and grassland, used primarily for rough grazing. The moorland areas, in particular, include extensive biodiversity and habitat designations, including both national and internally protected sites. Buildings and walls throughout these areas incorporate local building materials from the Carboniferous sandstone and limestone outcrops, adding to the character of the landscape.
- 6.66 On the eastern fringes of the Pennine moorlands and extending up into the Dales which cut deeply into the higher ground, the land has been more intensively settled and extensively 'improved' by generations of farmers, transforming the landscape and leaving substantial archaeological remains. Here again there is substantial evidence of the use of local building materials within the walls, farmsteads and houses.
- 6.67 Further east, the landscape is progressively dominated by arable, rather than pastoral farming, with a higher density of settlement, especially within the lowland areas and along route corridors, such as that of the A1 and major valleys. A number of important towns (Richmond, Ripon, Knaresborough and Wetherby) are located within the valleys of the major rivers (Swale, Ure, Nidd and Wharfe respectively) at points which lie at the boundaries between predominantly pastoral farming in the west and arable farming to the east. Their locations are directly related to their historical function as market towns, where produce from the contrasting areas on either side could be bought and sold. This in turn is related largely to the underlying geology, in combination with climate (particularly rainfall, which is much higher in the west). The settlement patterns, both now and throughout the historical development of the area, have strongly influenced the distribution of archaeological remains (although knowledge of this is highly distorted by the locations of recent archaeological surveys, particularly those associated with the A1 improvements and recent mineral planning applications). The City of Ripon provides a major focus of historical interest, with archaeological and built environment features spanning all historical periods.
- 6.68 In the easternmost parts of the area, the 'grain' of the underlying geology swings round to produce an east- west alignment, with clear distinctions between the foothills of the North York Moors, which include steep wooded slopes on the outcrops of Jurassic Limestone; the clay lowlands of the Vale of Rye and the Vale of Pickering, which have been extensively drained to facilitate arable farming; and the Yorkshire Wolds, which provide some of the largest areas of intensive arable and pig farming in the area, interspersed with narrow dry valleys, many of which contain important nature conservation sites. Settlement in these areas has been focused along the northern edge of the Vale of Pickering (where there has been extensive use of the Jurassic Limestone as a local building material); in the twin market towns of Malton and Norton, located astride the River Derwent and the important A64 route and in the coastal resort towns of Scarborough and Filey. Other areas are more sparsely populated but often contain a rich heritage of archaeological remains, notably at the Star Carr site in the Vale of Pickering and the many Deserted Medieval Villages on the Wolds. The sheer chalk cliffs which form the east coast of the Wolds are a direct product of the interaction between the geology and coastal processes and are protected as one of the most important sites for nesting seabirds in Europe.

- 6.69 Superimposed upon the broad characteristics associated with the bedrock geology are the consequences of Quaternary landscape evolution, including both natural processes and human interaction with the landscape from the early Mesolithic period onwards. The natural processes have included the carving out of deep valleys during periods of fluvial and glacial erosion; the deposition of glacial, fluvial and glacio-lacustrine sediments within and beyond these areas and the effects of underground dissolution of soluble rocks including the limestones, the Chalk and, most dramatically, the layers of gypsum within the Permian sequence (which have given rise to periodic subsidence in Ripon and other parts of the outcrop further north). These various processes have modified the broader relationships, summarised above, by introducing local variations in ground conditions and flood risk which, in turn have influenced patterns of settlement and land use, as well as the preservation potential of archaeological remains and the creation of diverse habitats.
- 6.70 Together, the underlying geology and the action of geomorphological processes have laid the foundations for the most recent development of the landscape over historical time. They dictated the areas which were most attractive for early settlement and those which have subsequently been most suited to different types of land use and development. They have also largely dictated the most effective transport corridors and thus the locations of associated urban (and rural) development.
- 6.71 Importantly, geological and geomorphological conditions have also strongly influenced the preservation potential of archaeological remains (being particularly high in the waterlogged organic soils of lowland areas such as the Vale of Pickering and the Humberhead Levels, and in areas of sparse population density such as the dry, arable soils of the Yorkshire Wolds). Similarly, areas of the most dramatic topography, particularly along the coast but also along river corridors and in wild moorland areas have often been the foundation for a growing tourist industry. Conversely, the need for agricultural ‘improvements’ in wetland and moorland areas, together with increasing urbanisation in some areas and growing tourist pressures in others, all represent potential or actual threats to both natural and heritage resources.
- 6.72 Mineral extraction falls within this kaleidoscope of influences. The resources directly reflect the geological legacy; the pattern of previous workings is closely tied-in with most other aspects of past human activity; the workings and their ancillary structures are often important historical features in their own right and they may also represent both threats to the remaining historical and natural resources but also opportunities for learning, outreach and habitat creation.
- 6.73 Through an understanding of these complex and interacting processes, it may be possible to plan for future mineral extraction in a way which maximises benefits and minimises further damage. That, essentially, is the goal which this work is seeking to support.

7. Identification of Sample Areas for Detailed Study

Introduction

- 7.1 Task 1(vi) of the project involved identifying, mapping the spatial extent of and briefly describing key sample areas for further detailed study in Stage 2 of the project. The requirement, as identified in Section 2.1.5 of the Invitation to Tender, was for the sample areas to be selected *“in order to gain a representative sample of each surface mineral resource type and its different key characteristics, covering elements of geology, landscape, biodiversity and historic environment. This may include more than one sample area for each ASMRP, particularly where the mineral resource type is present in disparate locations, and/or is particularly widespread, for example the areas of sands and gravels.”*
- 7.2 The tender document further noted that *“It is envisaged that a maximum of twelve sample areas will be selected, covering a maximum combined area of 360 hectares”*.
- 7.3 Following discussions with the Client team during the course of Stage 1, it was confirmed that the twelve selected areas should include representative samples of most, but not all, of the 14 ASMRPs. Those which were proposed to be excluded from the selection process were:
- **ASMRP 10** (Shallow Coal Resources) – on the basis that none of these resources is regarded as being likely to be exploited within the foreseeable future (see Chapter 2 for discussion);
 - **ASMRP 11** (Carboniferous Brick Clay Resources) – on the basis that these are also very unlikely to be worked within North Yorkshire (see Chapter 2); and
 - **ASMRP 13** (Silica Sand Resources) – on the basis that there are only two outcrops involved, each of which has extremely different geological and environmental characteristics, meaning that neither could be representative of the silica sand resource as a whole.
- 7.4 The exclusion of these three groups of resources allowed for one sample area to be allocated to each of the remaining eleven ASMRPs, with the twelfth sample area being available to be allocated as a second site in one of those areas, subject to discussion at the first Review Point meeting at the end of Stage 1.

Criteria for Selection

- 7.5 The twin primary aims in selecting the twelve sample areas were to be as objective as possible (in order to avoid introducing bias) and to identify sites that were as representative as possible of the ASMRPs concerned.
- 7.6 The need for objectivity dictated a requirement for using sound and consistent criteria, drawn from the GIS evidence on key environmental characteristics that was utilised in

producing Chapter 5 of this report and for using automated GIS processes, as far as possible, to avoid any subjective influences.

7.7 The need for identifying the most representative sites required the exclusion of areas within each ASMRP that were ‘uncharacteristic’ in terms of having very high or very low percentages of overlap with the key landscape, historic environment and natural environment constraints described in Chapter 5 and then applying additional criteria to the resulting shortlist of ‘characteristic’ areas. The GIS methodology for creating the initial shortlists and then applying the additional criteria is described separately below.

7.8 After identifying the initial shortlists, the following additional selection criteria were applied, sequentially:

- i. identify candidate sample areas of approximately 30 hectares (e.g. 500m x 600m), wherever these will fit;
- ii. exclude from the candidate sites those which have limited or no public access, and which would therefore be impractical for field investigation in Stage 2 of the project;
- iii. use random numbers to identify four of the remaining sites for consideration by the Project Team and the Steering Group;
- iv. discuss and agree the final selection of one preferred site from each group of four (plus one additional site), at the Project Review meeting at the end of Stage 1.

7.9 With the exception of the final step, the entire selection process was carried out objectively, using automated procedures within the GIS. The final step, whilst introducing an element of subjectivity, was included to allow for some degree of local knowledge to be taken into account in the final selection and to reach a consensus on which ASMRP the twelfth sample area should be allocated to.

Methodology of Selection

7.10 In order to identify the initial shortlists, consideration was given to the various datasets compiled within the earlier Task 1(iv), i.e.

- Natural Environment designations
- Landscape designations
- Areas of Historic Environment Interest and Potential (AHEIP)

Designation Group	Designation
Natural Environment	SSSIs, SPAs, SACs, Ramsars, NNRs, LNRs and SINCs
Landscape	AONBs, Ancient Woodlands and Heritage Coasts
AHEIP	Concordant dataset incorporating designations outlined in Section 3 of this report

- 7.11 The latter dataset, being the output from the data concordance exercise, was used in preference to the Historic Environment designations data, as it was considered to be a more comprehensive dataset which was better able to characterise all parts of the resources.
- 7.12 For the first two datasets, GIS calculations were made of the total percentage overlap of each ASMRP with all of the included designations (i.e. summing the percentages for each designation to obtain a total 'score' for each dataset). In calculating the percentages, each ASMRP was further divided using a 200m x 200m 'grid overlay', in order to overcome the difficulty of individual resource polygons being vastly different in size. Percentage scores were thus obtained for each individual polygon created.
- 7.13 The AHEIP dataset was trimmed to the resource boundary extents and the scores from the original Historic Data Concordance exercise were utilised.
- 7.14 Once the scores for each of the three datasets had been obtained, the mean and standard deviation of the scores was calculated for each of the ASMRP layers. In each case, the polygons which were closest to the mean value (and thus most likely to be representative of the ASMRP, for that dataset) were automatically selected. In order to select a suitable number of polygons for comparison between the three datasets the banding for selection was altered on a 'trial and error' basis working from the lowest fraction of a Standard Deviation. This involved selecting all cells falling within; 0.25, 0.33, 0.5 or 0.66 of one Standard Deviation (dependent upon the number of the cells selected within the dataset in order to identify sample sites of a suitable size).
- 7.15 The selected polygons from each of the datasets were then exported and combined to identify areas of commonality. Polygons demonstrating commonality (i.e. average Natural Environment, Landscape and AHEIP scores) were then exported and dissolve functions applied to remove divisions created by the earlier grid overlay process. The resultant dataset provided a shortlist of potential sample sites for the ASMRP.
- 7.16 To refine the shortlist further a series of analyses were then performed:
- Areas falling within urban boundaries were erased (using the OS Meridian Developed Land Use Areas dataset);
 - Areas falling across roads were erased (using a 7.5m buffered OS Meridian road network datasets);
 - Polygons less than 30ha in size were removed;
 - Spatial proximity queries were performed on the remaining polygons to see if they were intersected by Public Rights of Ways /Access land and to see if they fell within 200m of a road (A, B and Minor roads). Those polygons not intersected by a PRoW and not within 200m were removed.
- 7.17 A random selection algorithm was then applied to identify 4 polygons out of those that remained to identify a refined shortlist of potential sample sites.

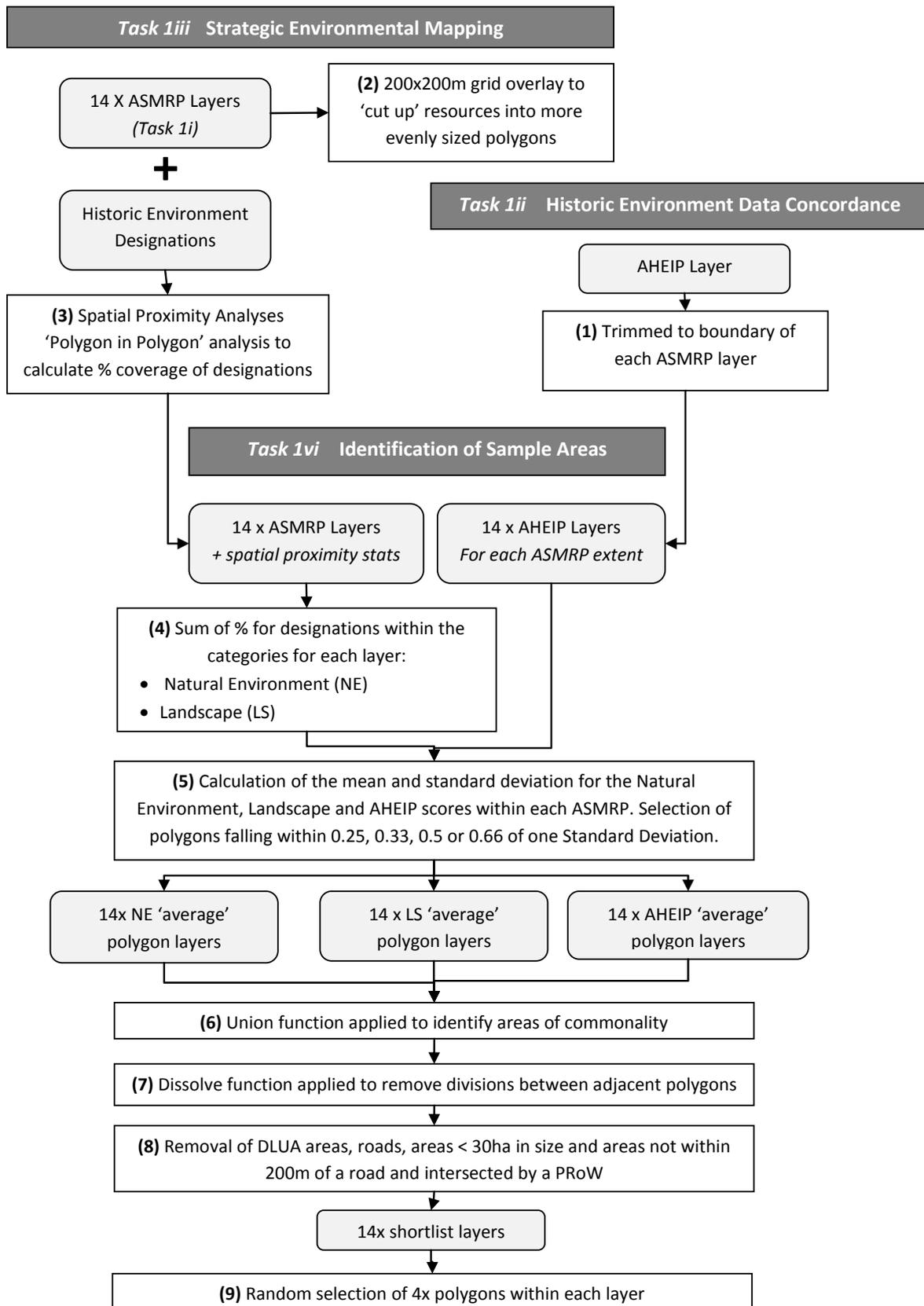


Figure 16 Flow diagram of methodology

Details of the Selected Sample Areas

7.18 Maps showing the locations of the four 'candidate' sample areas in each of the ASMRPs to be sampled were tabled for discussion with the Project Steering Group at the Review Point meeting on 8th July. At the meeting, preferred choices were agreed regarding the sample areas to be investigated, and a decision was made to allocate two sample areas to ASMRP 1, in order to capture the details of two different sites. The final selection of twelve sampling sites is shown below and illustrated in Figure CS049966_01_018_Rev 1, Preferred Options.

- **ASMRP 1.1:** Floodplain of the River Tees at Croft on Tees, in Richmondshire District;
- **ASMRP 1.2:** Floodplain of the River Nidd at Hunsingore, in Harrogate District;
- **ASMRP 2:** Terraces of the River Ure north of Nunwick, near Ripon in Harrogate District;
- **ASMRP 3:** Glacio-fluvial sand & gravel near Coneythorpe, in Harrogate District;
- **ASMRP 4:** Glacial sand & gravel south of Great Crakehall, in Hambleton District;
- **ASMRP 5:** Undifferentiated sand & gravel at Rillington, in Ryedale District;
- **ASMRP 6:** Quaternary brick clay resources east of Monk Fryston, in Selby District;
- **ASMRP 7:** Chalk resources south of Duggleby, in Ryedale District;
- **ASMRP 8:** Jurassic limestone resources north of Wrelton, in Ryedale District;
- **ASMRP 9:** Magnesian Limestone resources north of Ripon, in Harrogate District;
- **ASMRP 12:** Sandstone resources south-east of Skipton, in Craven District; and
- **ASMRP 14:** Carboniferous Limestone resources at Holgate Moor, in the north-west of Richmondshire District.

7.19 It must be emphasised that the selection of sample locations does not reflect the likelihood or otherwise of future mineral extraction in those areas: they locations are intended simply to be representative of the respective ASMRPs. During the course of the Stage 2 investigations in these areas, consideration will be given to the issues which might arise if, hypothetically, mineral extraction was to take place. Again, however, this will purely be for the purpose of exploring the generic issues that would be associated with quarrying anywhere within the ASMRP concerned.

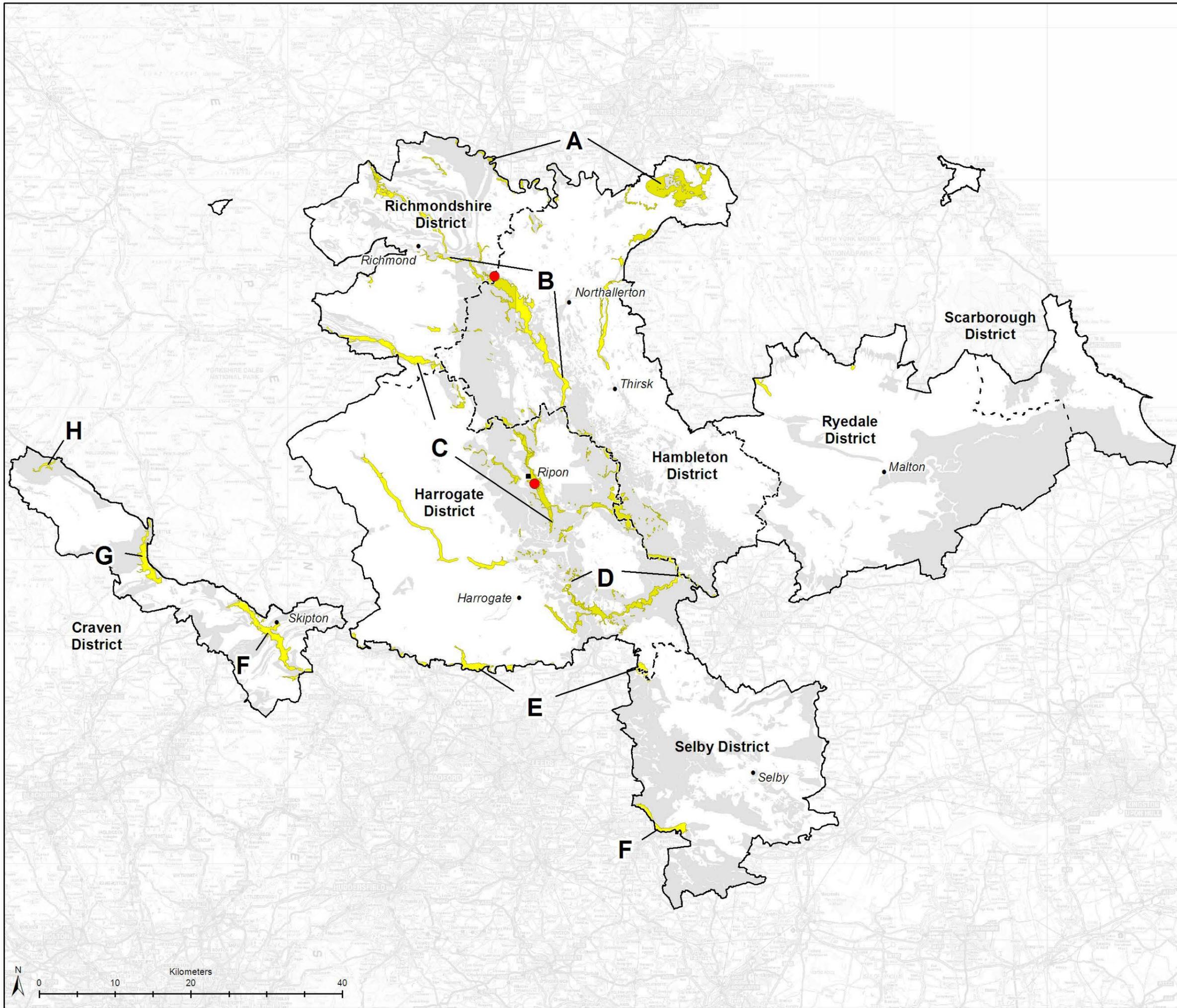
Stage 2

- 7.20 Agreement of the sample sites within selected ASMRPs for detailed assessment, marks completion of Stage 1. Stage 2 of the project involves detailed environmental evidence gathering and assessment of the selected sample areas. The products of Stage 2 will be Spatial GIS layers and text describing and characterising each sample area.

Appendix One

CS049966_01_002_Rev2
CS049966_01_003_Rev2
CS049966_01_004_Rev2
CS049966_01_005_Rev2
CS049966_01_006_Rev2
CS049966_01_007_Rev2
CS049966_01_008_Rev2
CS049966_01_009_Rev2
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CS049966_01_012_Rev2
CS049966_01_013_Rev2
CS049966_01_014_Rev2
CS049966_01_015_Rev2
CS049966_01_018_Rev1

ASMRP 1: Sand and Gravel - Sub-alluvial Deposits
ASMRP 2 Sand and Gravel - River Terrace Deposits
ASMRP 3 Sand and Gravel – Glacio-fluvial Deposits
ASMRP 4 Sand and Gravel - Glacial Deposits
ASMRP 5 Sand and Gravel - Undifferentiated
ASMRP 6 Brick Clay - Quaternary
ASMRP 7 Chalk- Excluding Concealed
ASMRP 8 Limestone – Jurassic
ASMRP 9 Limestone - Permian
ASMRP 10 Coal - Excluding Tertiary
ASMRP 11 Brick Clay – Carboniferous
ASMRP 12 Sandstone
ASMRP 13 Silica
ASMRP 14 Limestone – Carboniferous
Preferred Options



Key

- ASMRP 1 - Active Pits
- ASMRP 1: Sand and Gravel - Sub-alluvial deposits**
- Sub-alluvial: indicated resources (only in areas assessed by BGS)
- Sub-alluvial: inferred resources
- Study Area

Client **North Yorkshire County Council**

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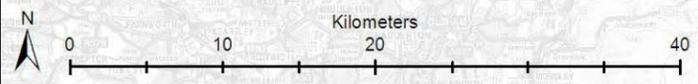
**NYCC/BES/18376
Managing Landscape Change**

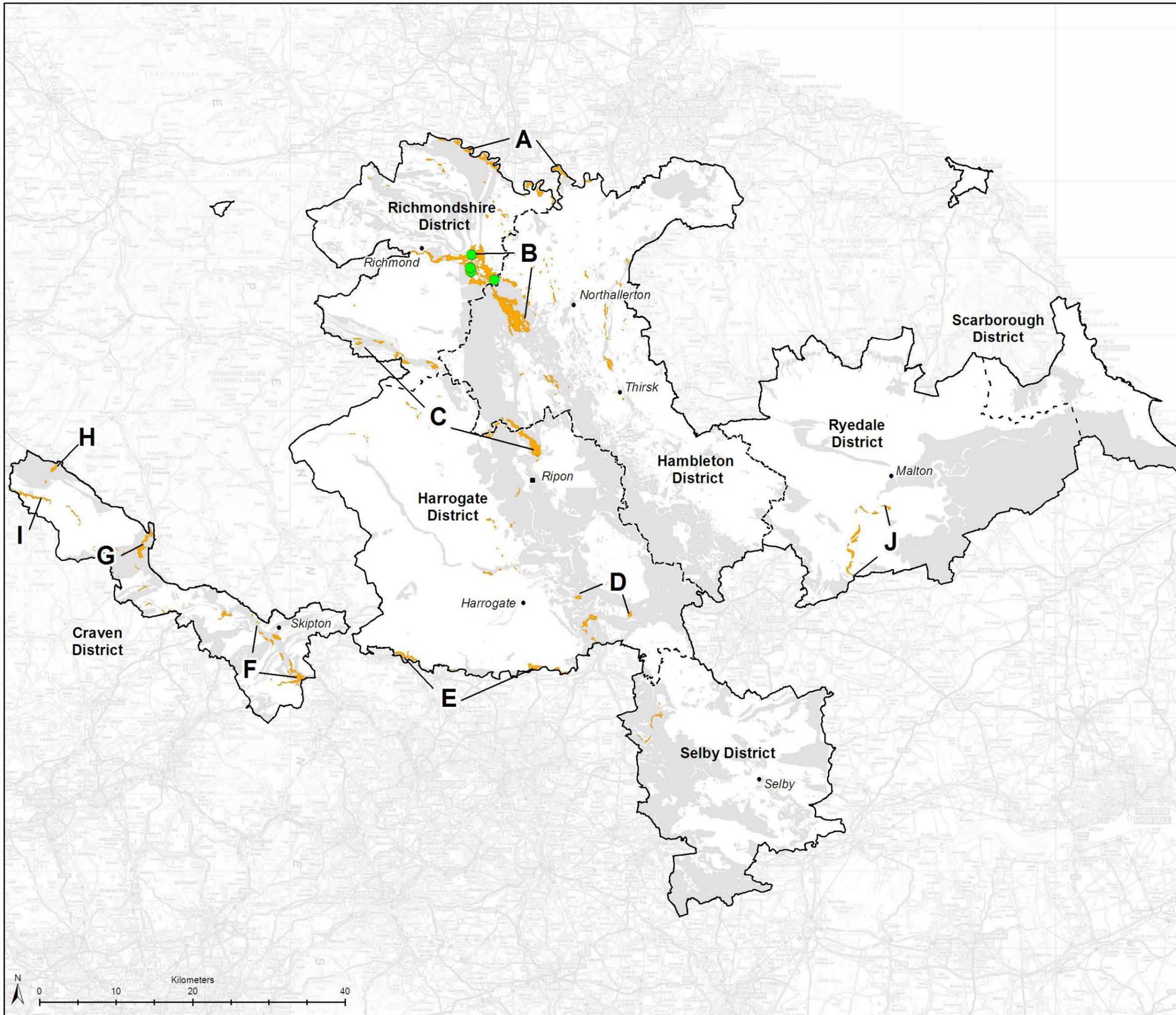
**ASMRP 1: SAND AND GRAVEL
- SUB-ALLUVIAL DEPOSITS**

Drawn By	KJ
Checked By	AT
Approved By	JG
Drawing No	CS_049966_01_002_Rev2
Date	29 June 2011

CAPITA SYMONDS

The Capita Building
Kingmoor Business Park
Carlisle
CA6 4SJ





Key

- ASMRP 2 - Active Pits
- ASMRP 2: Sand and Gravel - River Terrace Deposits
- River terrace deposits
- Study Area

Client



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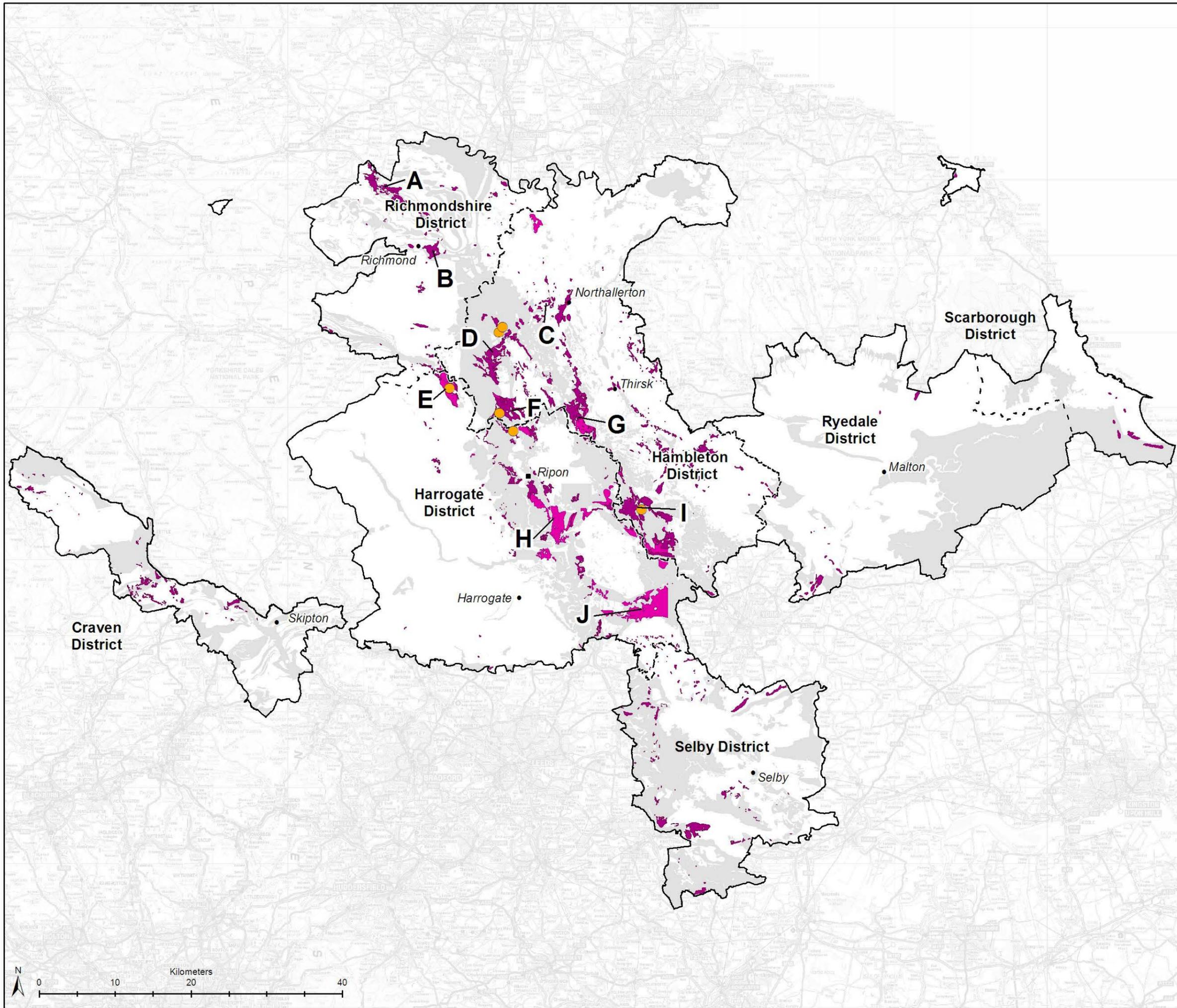
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Managing Landscape Change**

**ASMRP 2: SAND AND GRAVEL
- RIVER TERRACE DEPOSITS**

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Checked By	AT
Approved By	JG
Drawing No	CS_049966_01_003_Rev2
Date	29 June 2011

CAPITA SYMONDS

The Capita Building
Kingmoor Business Park
Carlisle
CA6 4SJ



Key

- ASMRP 3 - Active Pits
- ASMRP 3: Sand and Gravel - Glaciofluvial**
- Glaciofluvial deposits
- Glaciofluvial deposits: concealed (only in areas assessed by BGS)
- Study Area

Client



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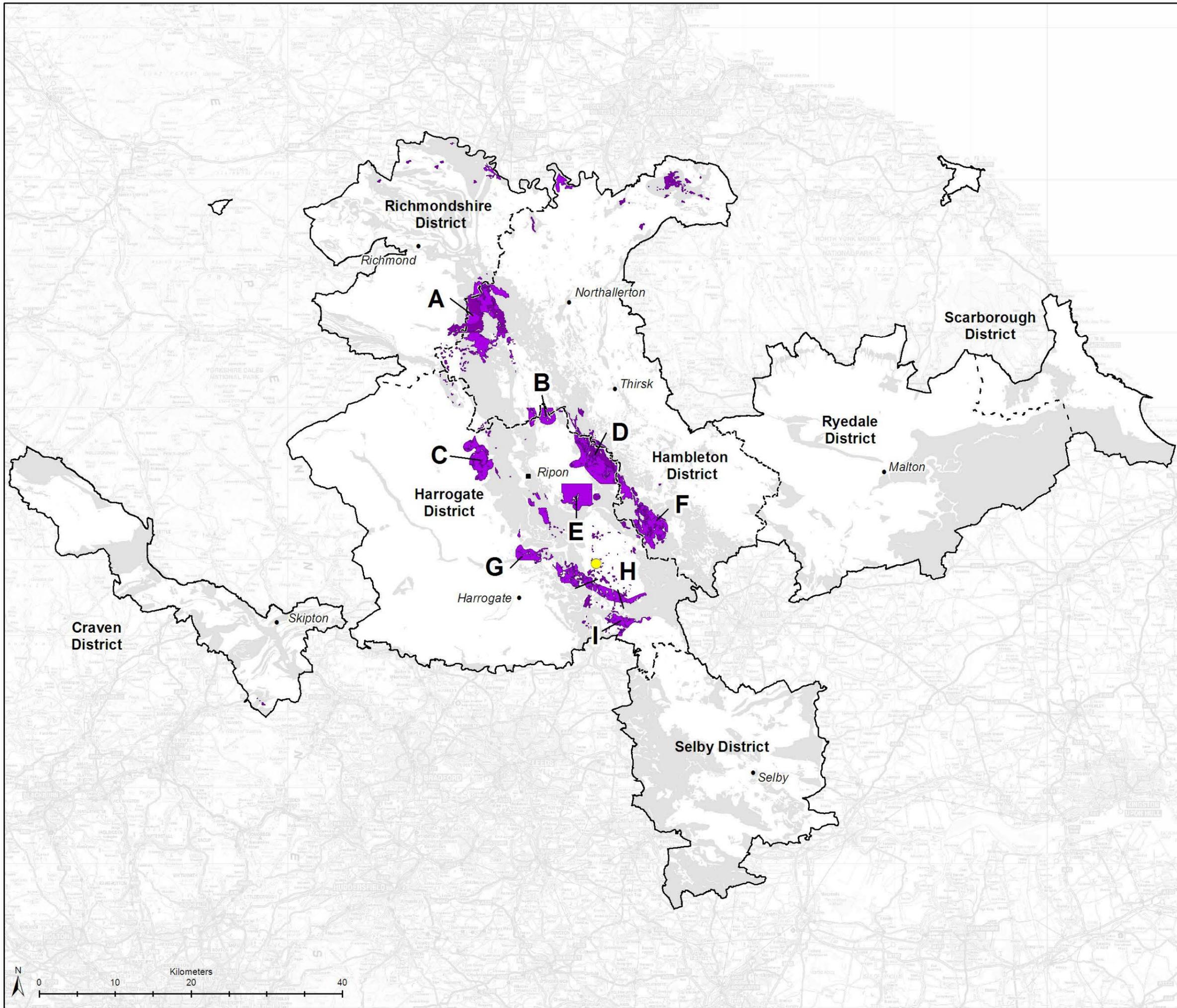
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Managing Landscape Change

**ASMRP 3: SAND AND GRAVEL
 - GLACIOFLUVIAL DEPOSITS**

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Checked By	AT
Approved By	JG
Drawing No	CS_049966_01_004_Rev2
Date	29 June 2011

CAPITA SYMONDS

The Capita Building
 Kingmoor Business Park
 Carlisle
 CA6 4SJ



Key

- ASMRP 4 - Active Pits
- ASMRP 4: Sand and Gravel - Glacial deposits**
- Glacial deposits
- Glacial deposits: concealed (only in areas assessed by BGS)
- Study Area

Client



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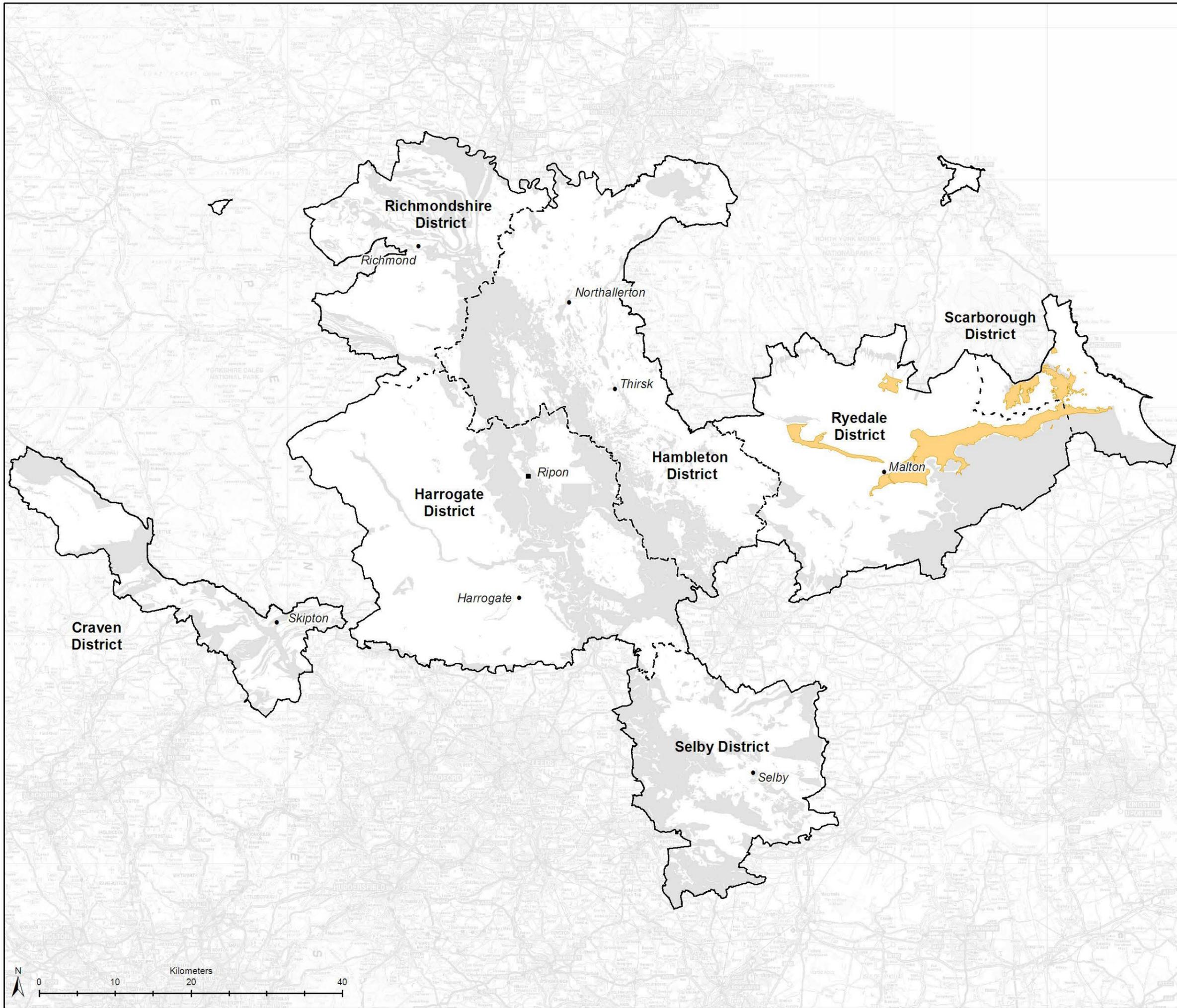
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Managing Landscape Change

ASMRP 4: SAND AND GRAVEL
- GLACIAL DEPOSITS

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Checked By	AT
Approved By	JG
Drawing No	CS_049966_01_005_Rev2
Date	29 June 2011

CAPITA SYMONDS

The Capita Building
 Kingmoor Business Park
 Carlisle
 CA6 4SJ



Key

ASMRP 5: Sand and Gravel - Undifferentiated

 Undifferentiated sand and gravel

 Study Area

Client



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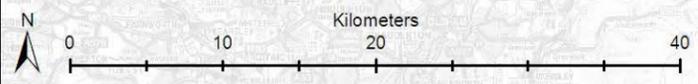
NYCC/BES/18376
Managing Landscape Change

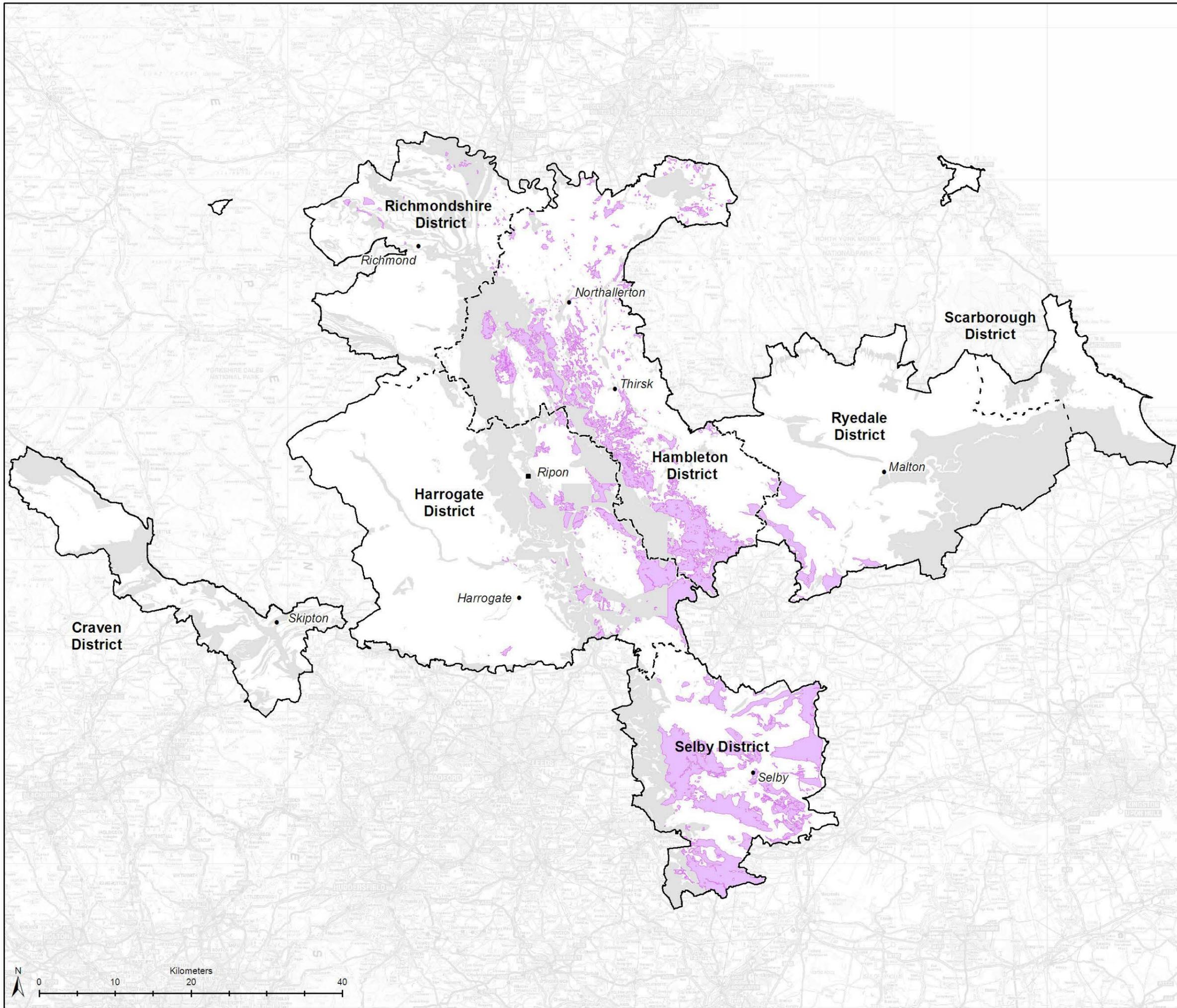
ASMRP 5: SAND AND GRAVEL
- UNDIFFERENTIATED

Drawn By	KJ
Checked By	AT
Approved By	JG
Drawing No	CS_049966_01_006_Rev2
Date	29 June 2011

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Key

ASMRP 6: Brick Clay - Quaternary

Brick clay: Quaternary, glaciolacustrine deposits (clay and silt)

Study Area

Client



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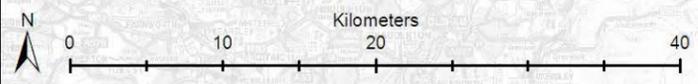
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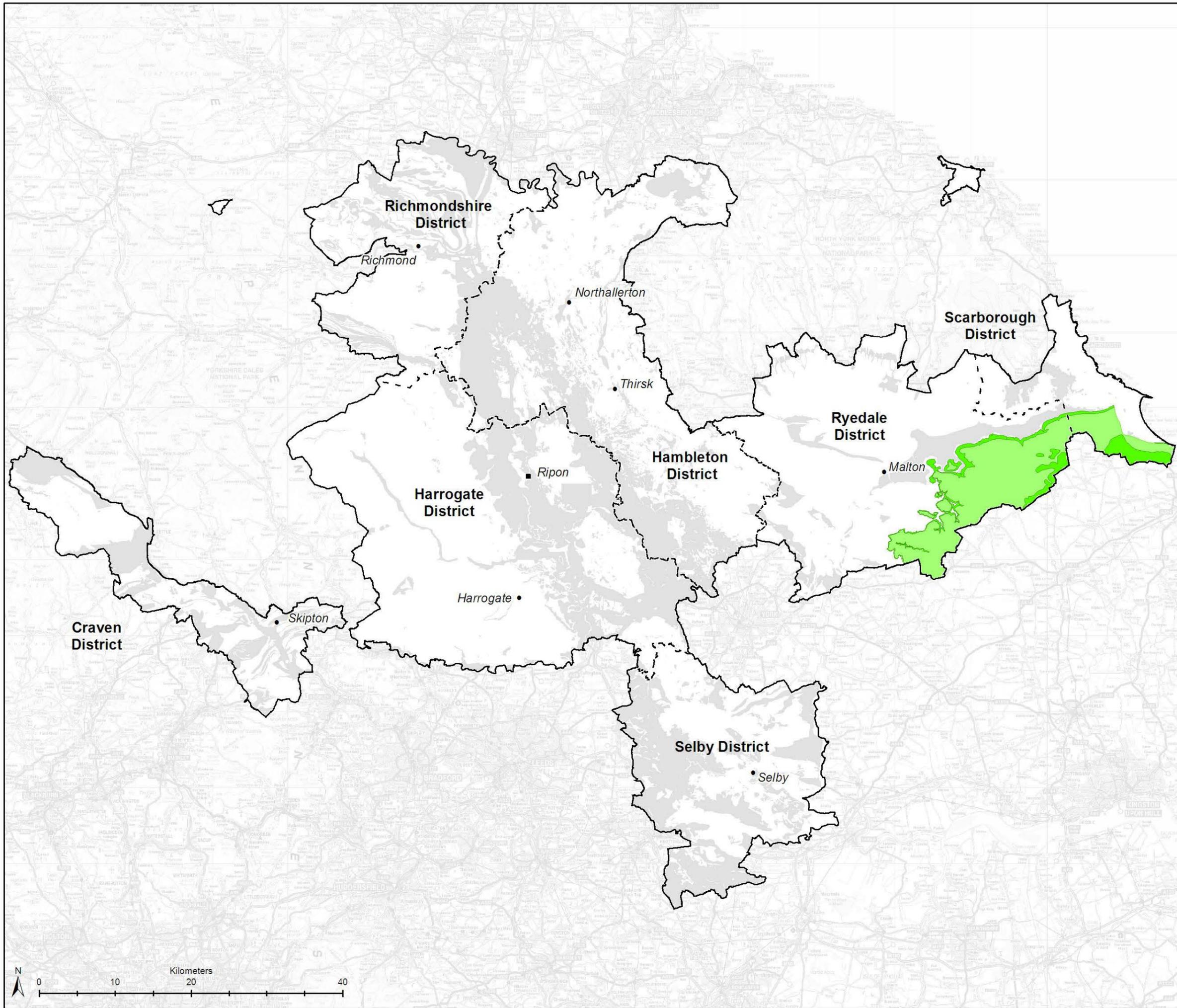
ASMRP 6: BRICK CLAY
- QUATERNARY

Drawn By	KJ
Checked By	AT
Approved By	JG
Drawing No	CS_049966_01_007_Rev2
Date	30 June 2011

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Key

ASMRP 7: Chalk - excluding concealed

■ Higher purity chalk (>97% CaCO₃)

■ Lower purity chalk (93-97% CaCO₃)

Study Area

Client



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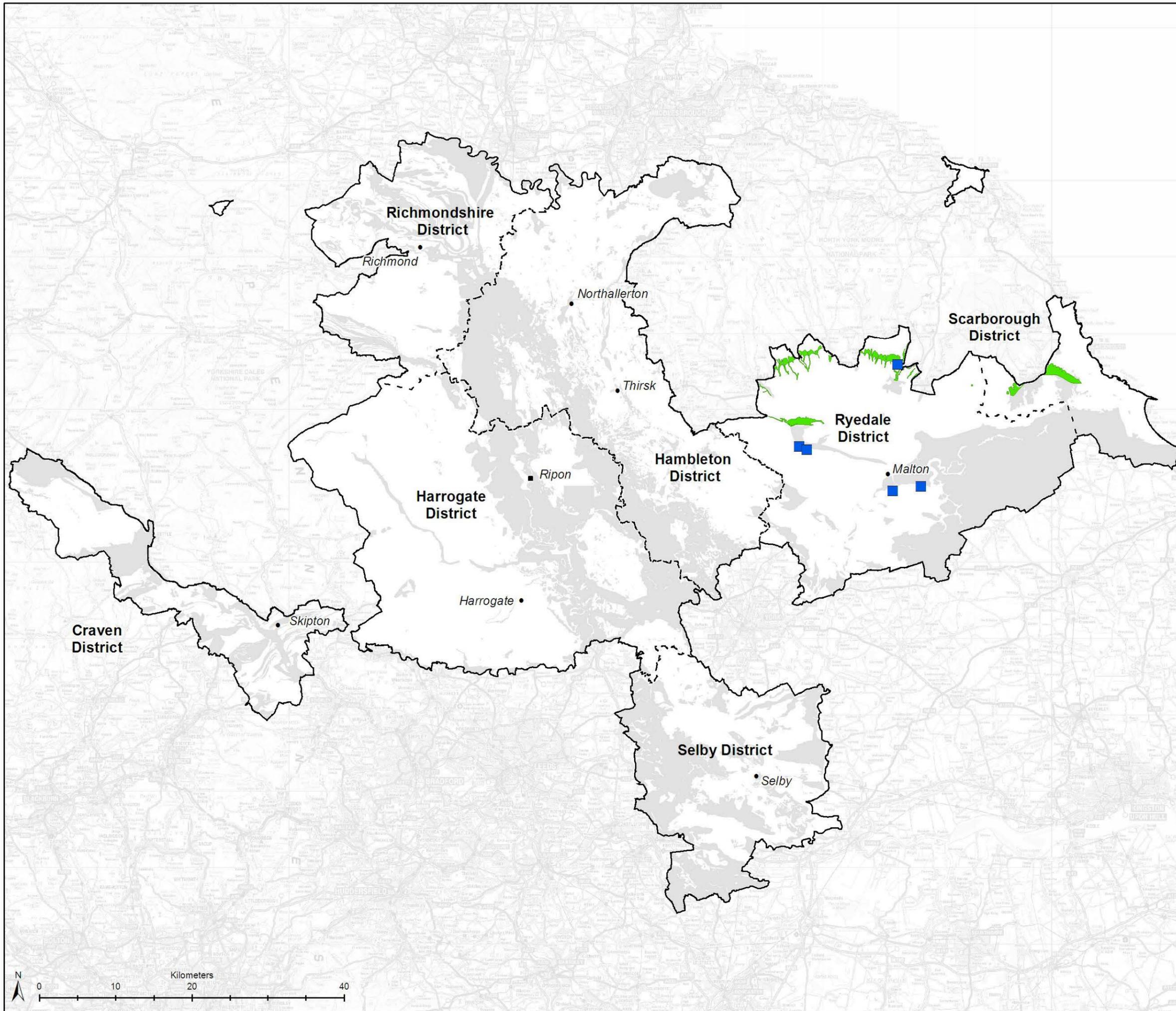
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**ASMRP 7: CHALK
- EXCLUDING CONCEALED**

Drawn By	KJ
Checked By	AT
Approved By	JG
Drawing No	CS_049966_01_008_Rev2
Date	30 June 2011

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Key

- ASMRP 8 - Active Pits
- ASMRP 8: Limestone -Jurassic**
- Limestone: Jurassic, Lincolnshire Limestone / Malton Oolite
- Study Area

Client



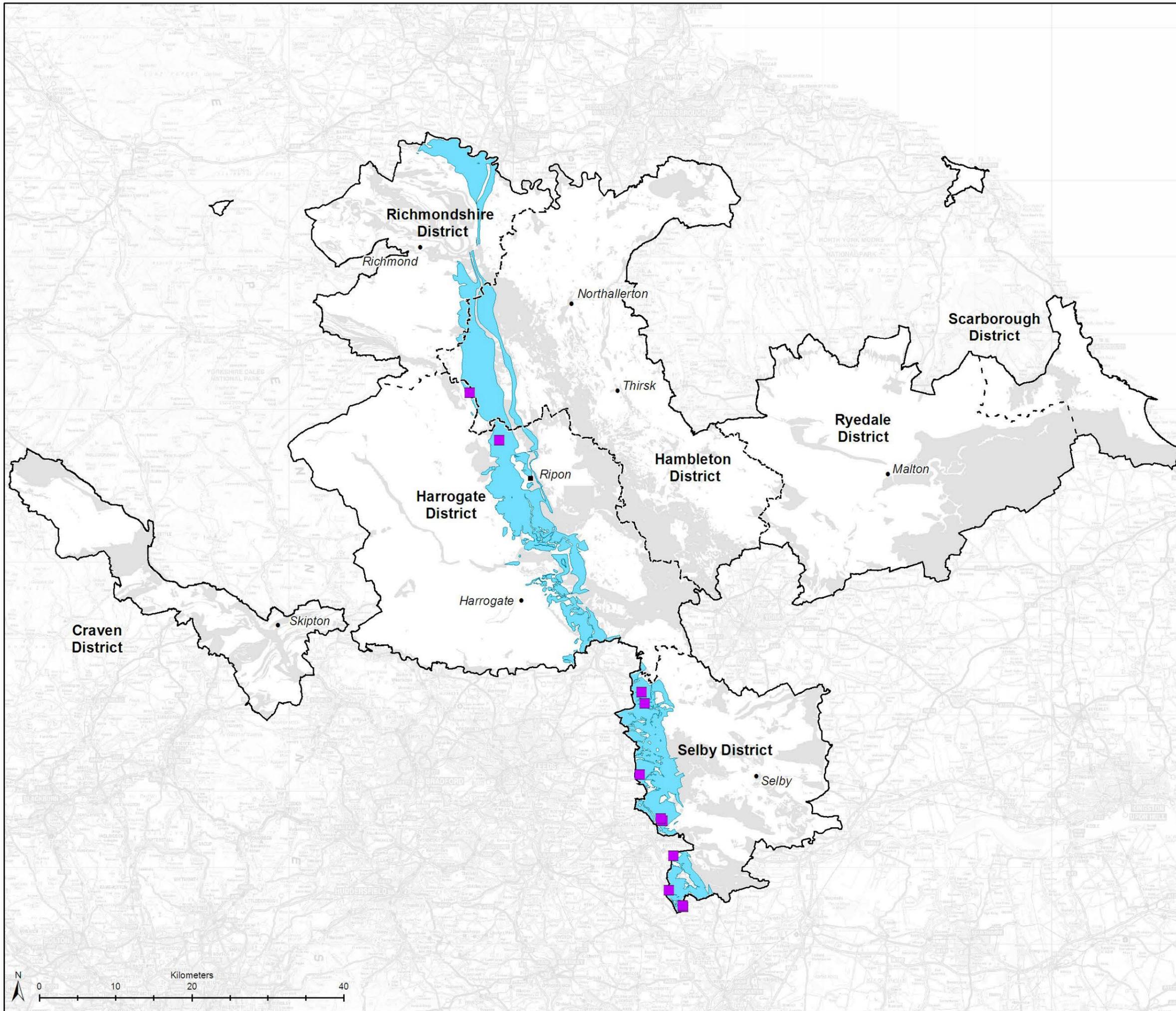
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**ASMRP 8: LIMESTONE
- JURASSIC**

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Drawing No	CS_049966_01_009_Rev2
Date	30 June 2011

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Key

- ASMRP 9 - Active Pits
- ASMRP 9: Limestone - Permian**
- Dolomite and dolomitic limestone: Permian, Cadeby and Brotherton formations (Magnesian Limestone)
- Study Area

Client



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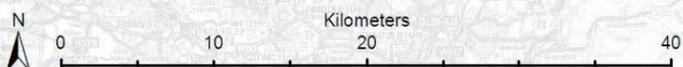
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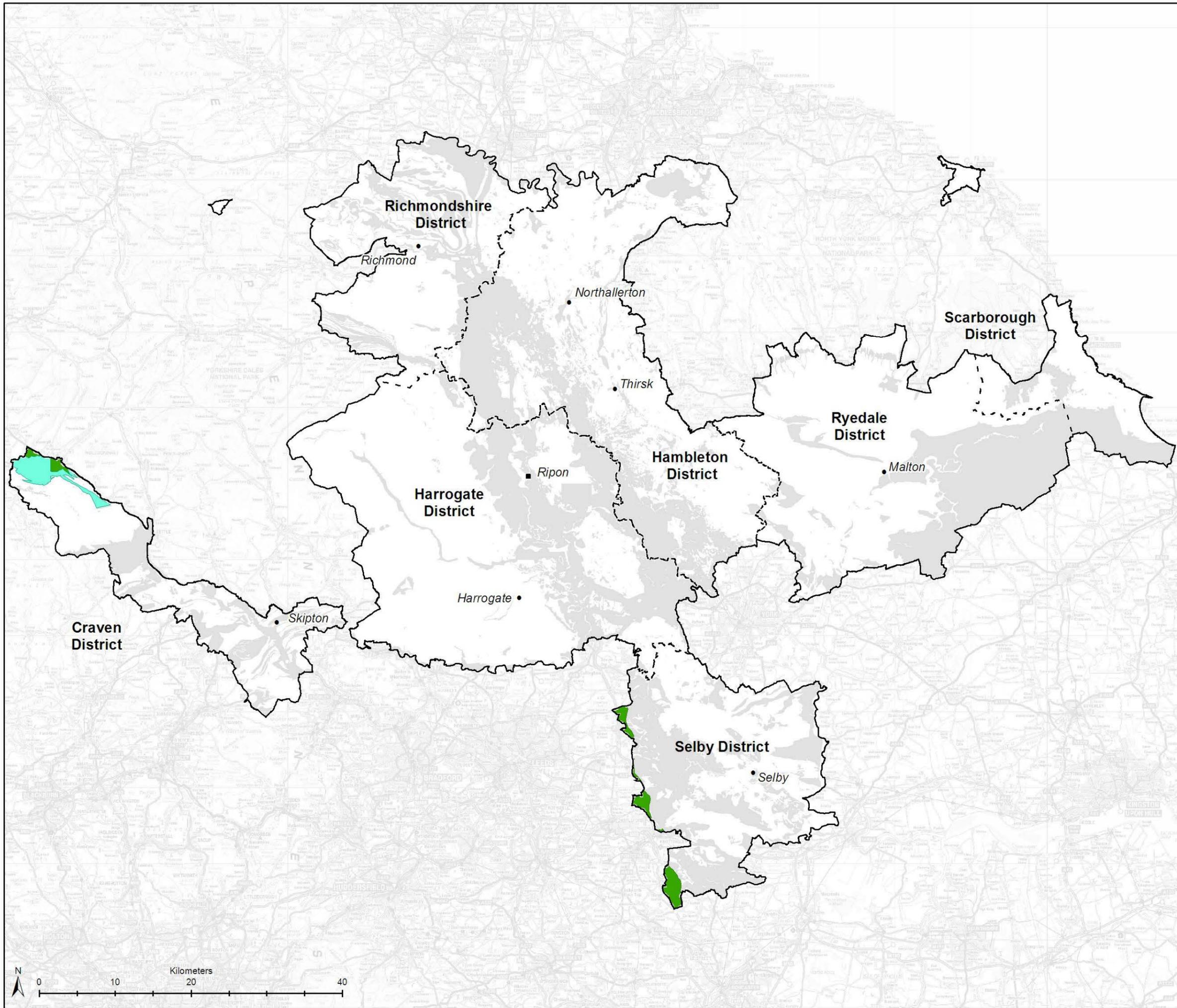
**ASMRP 9: LIMESTONE
- PERMIAN**

Drawn By	KJ
Checked By	AT
Approved By	JG
Drawing No	CS_049966_01_010_Rev2
Date	30 June 2011

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Key

- Study Area
- ASMRP 10: Coal (shallow) - excluding tertiary
- Buried coal resource overlain by up to 50m overburden
- Secondary opencast coal resource area

Client



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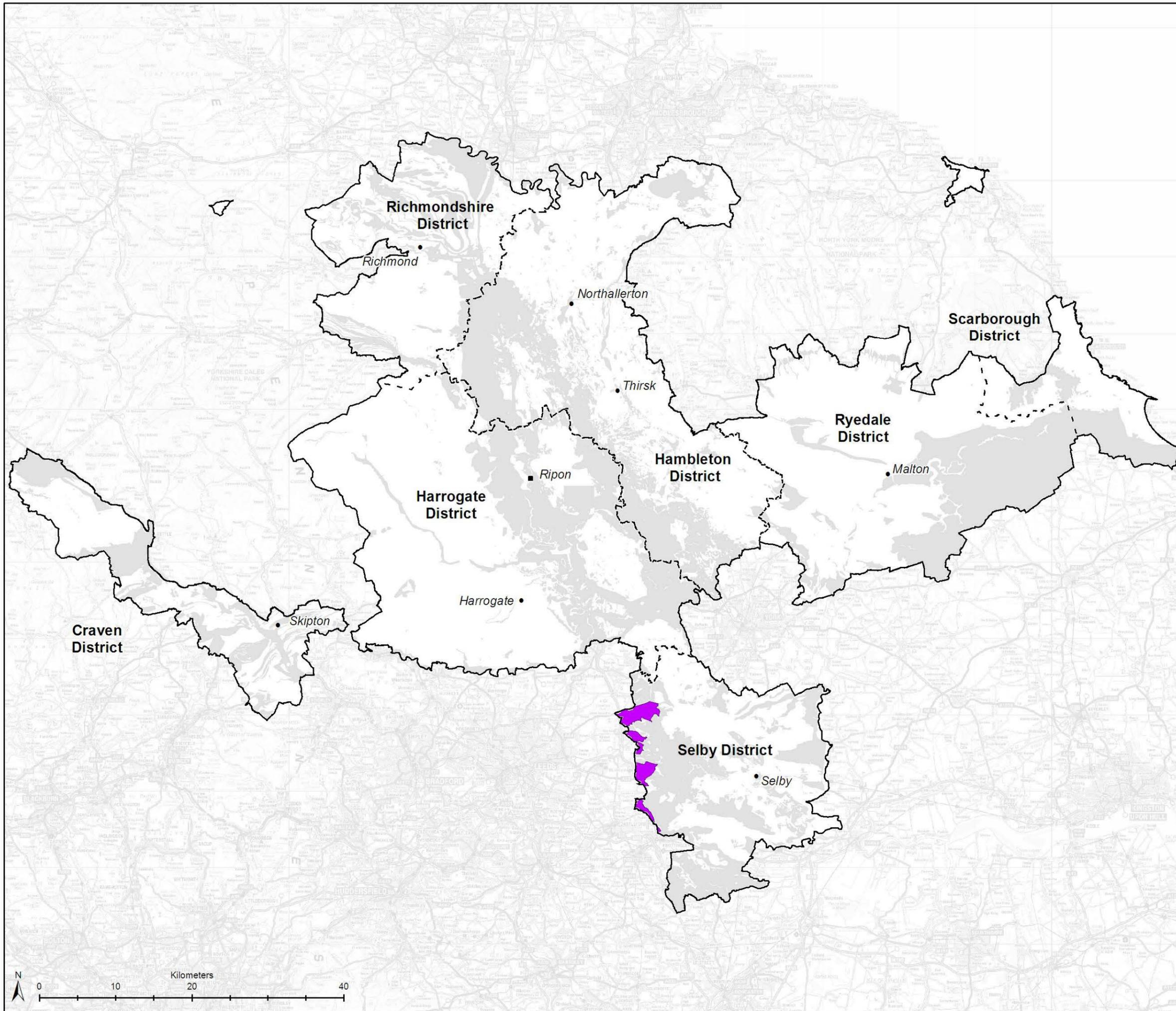
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ASMRP 10: COAL (SHALLOW)
- EXCLUDING TERTIARY

Drawn By	KJ
Checked By	AT
Approved By	JG
Drawing No	CS_049966_01_011_Rev2
Date	30 June 2011

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Key

- Study Area
- ASMRP 11: Brick Clay - Carboniferous**
- Brick clay, Carboniferous, Coal Measures mudstones (coincident with shallow coal)

Client



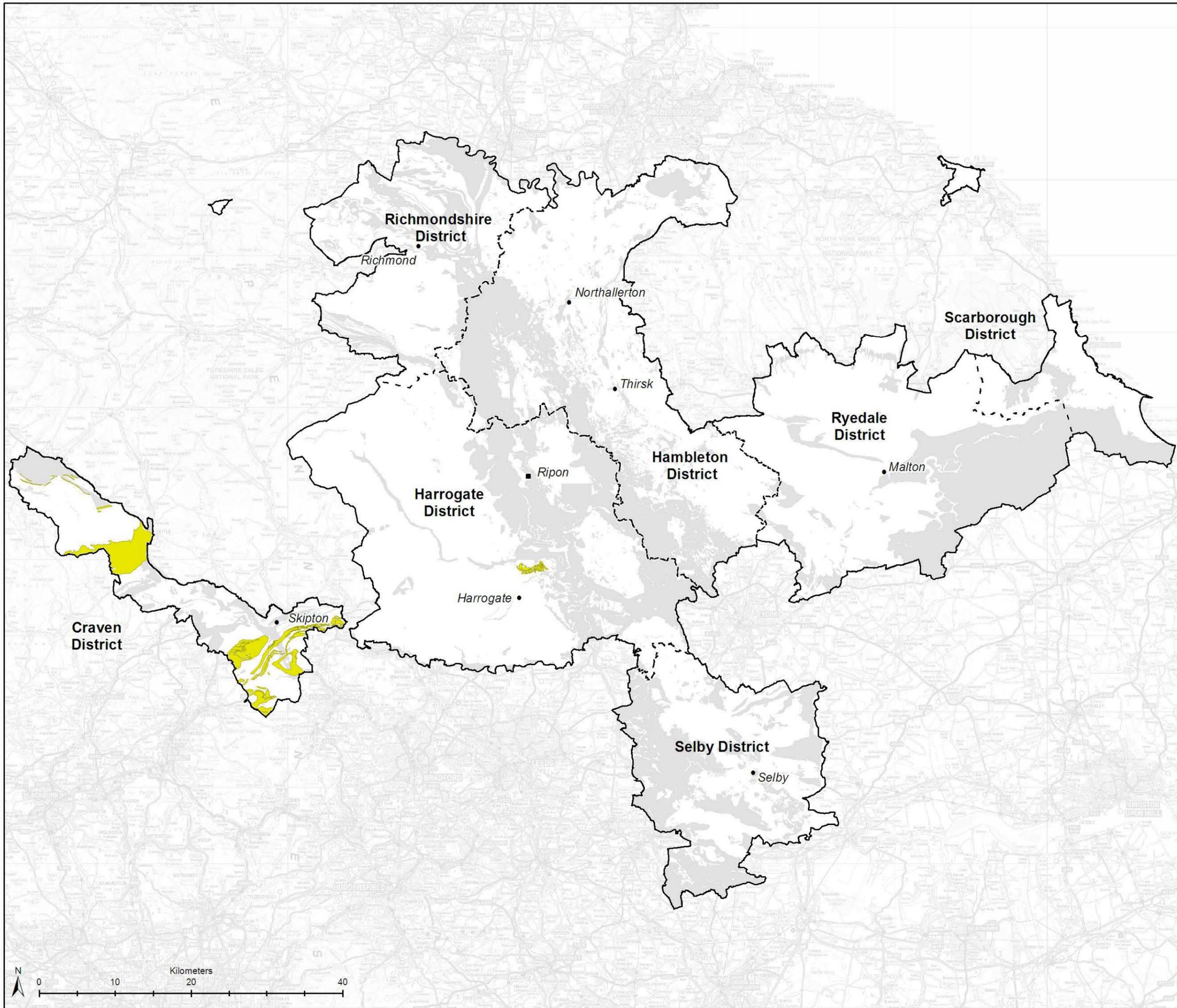
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**ASMRP 11: BRICK CLAY
- CARBONIFEROUS**

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Approved By	JG
Drawing No	CS_049966_01_012_Rev2
Date	30 June 2011

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Key

ASMRP 12: Sandstone

Sandstone: Carboniferous, Millstone Grit and Coal Measures

Study Area

Client



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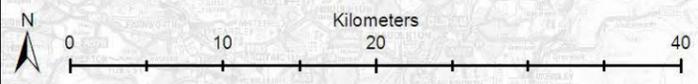
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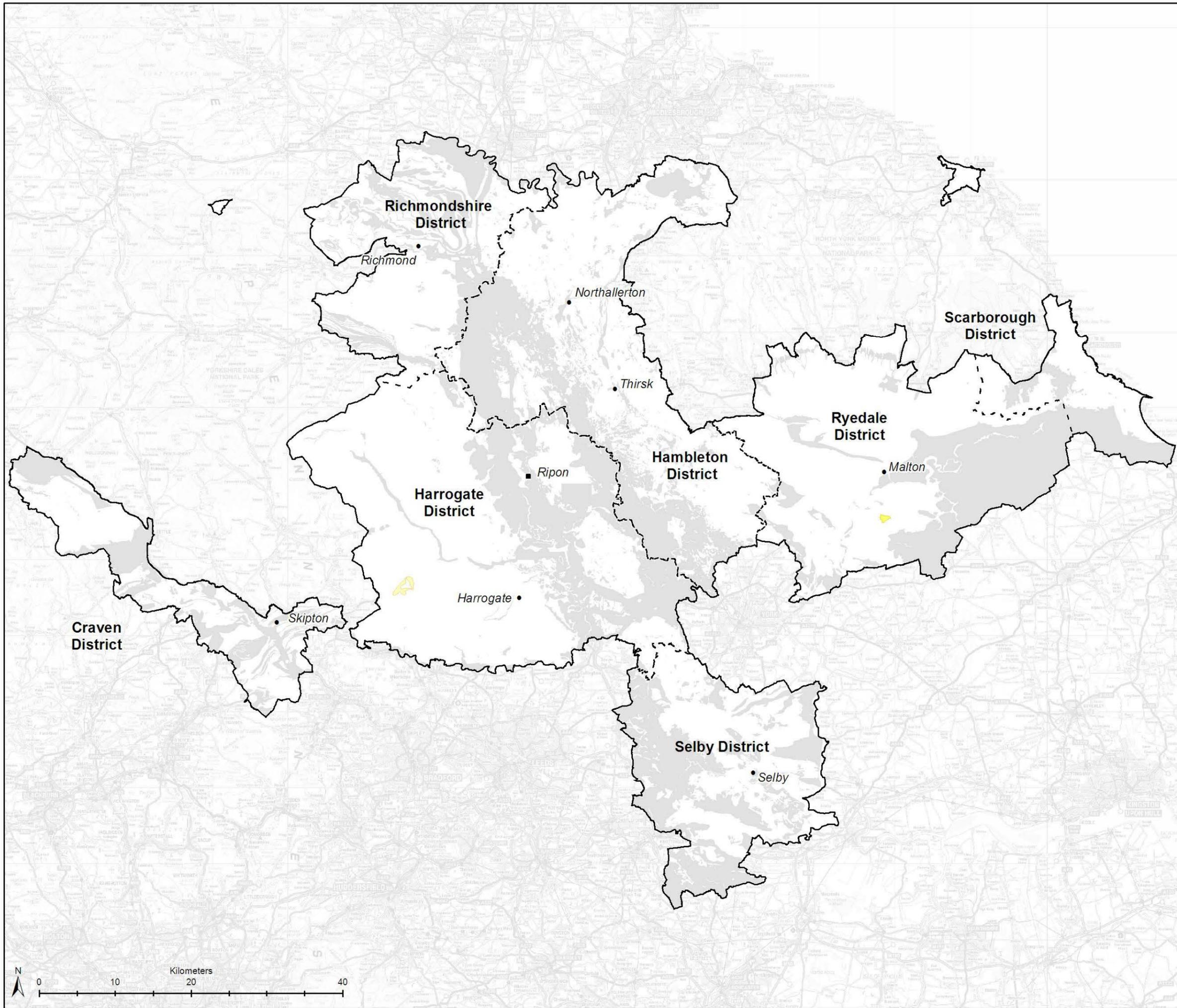
ASMRP 12: SANDSTONE

Drawn By	KJ
Checked By	AT
Approved By	JG
Drawing No	CS_049966_01_013_Rev2
Date	30 June 2011

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Key

ASMRP 13: Silica

- Silica sand: Carboniferous, Millstone Grit (Blubberhouses only)
- Silica sand: Jurassic, Osgodby Formation (Burythorpe area only)
- Study Area

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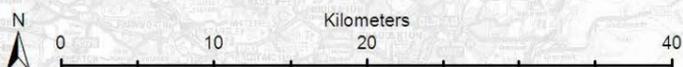
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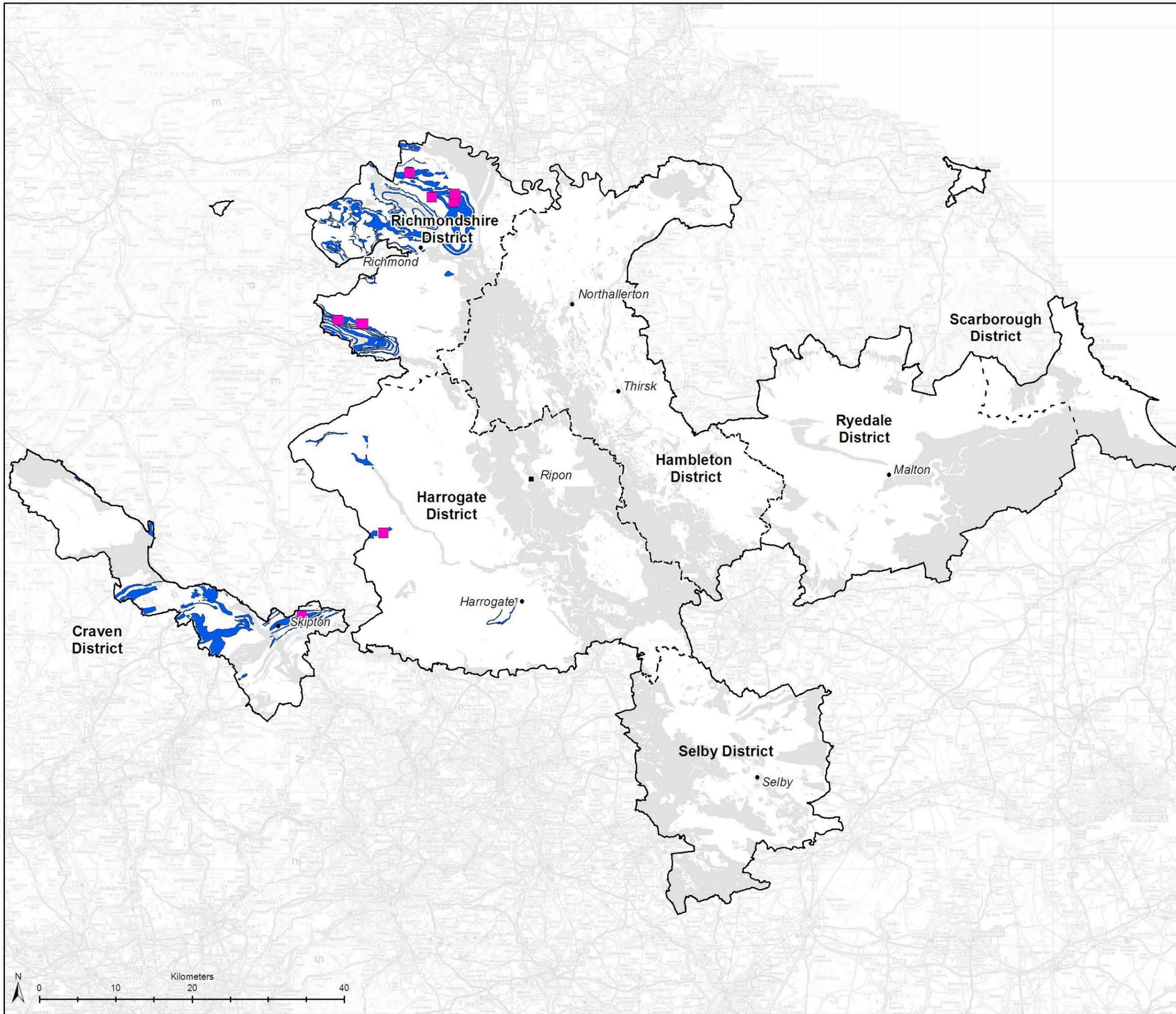
ASMRP 13: SILICA

Drawn By	KJ
Checked By	AT
Approved By	JG
Drawing No	CS_049966_01_014_Rev2
Date	30 June 2011

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Key

- ASMRP14 - Active Pits
- ASMRP 14: Limestone - Carboniferous**
- Limestone: Carboniferous
- Limestone: Carboniferous, high purity (>97% CaCO₃)
- Study Area

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**ASMRP 14: LIMESTONE
- CARBONIFEROUS**

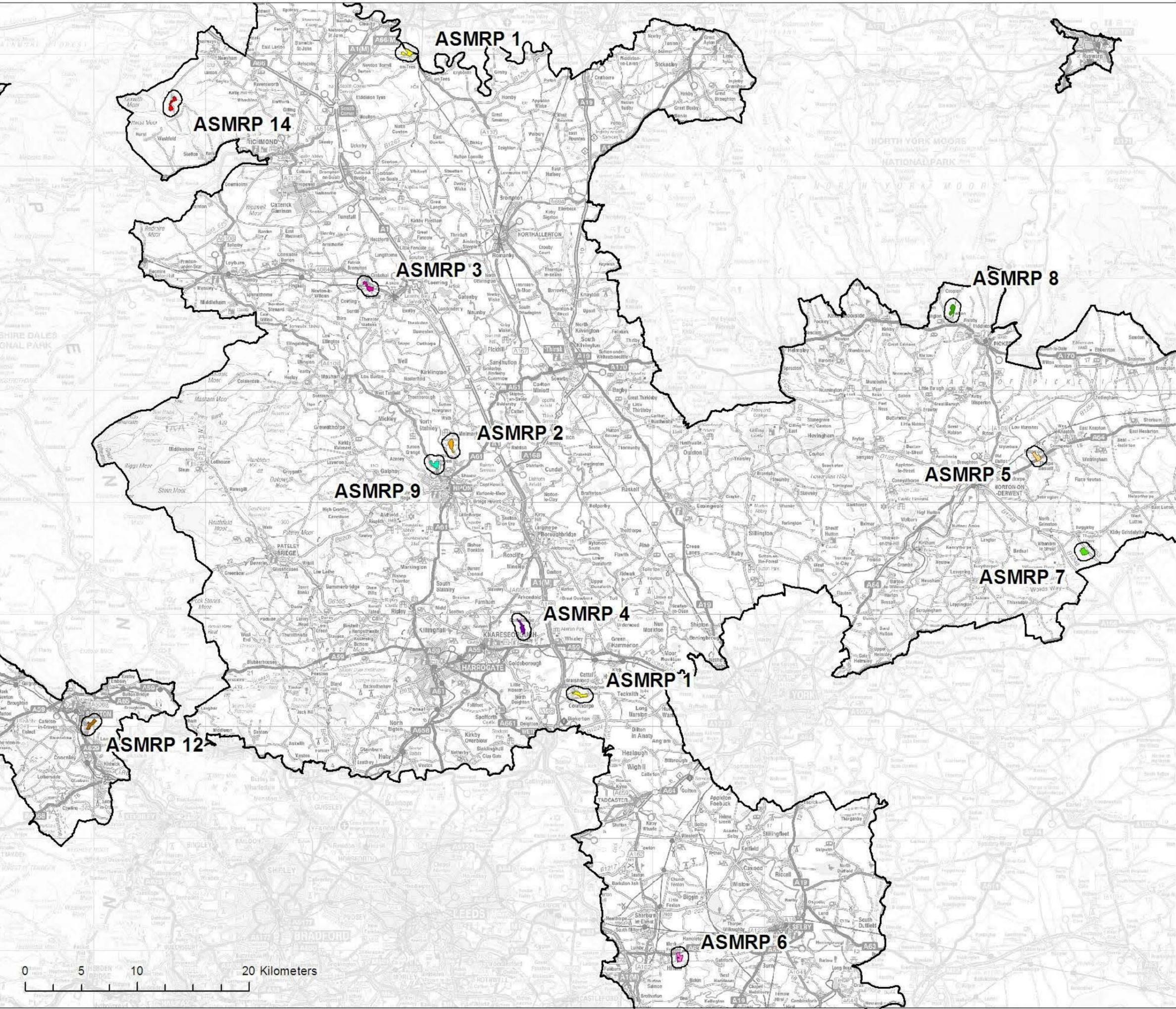
Drawn By	KJ
Checked By	AT
Approved By	JG
Drawing No	CS_049966_01_015_Rev2
Date	30 June 2011

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Key

- ASMRP 1
- ASMRP 2
- ASMRP 3
- ASMRP 4
- ASMRP 5
- ASMRP 6
- ASMRP 7
- ASMRP 8
- ASMRP 9
- ASMRP 12
- ASMRP 14
- 500m Buffer of Sample Sites
- Study Area



Client



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Preferred Options

Drawn By	KJ
Checked By	AT
Approved By	JG
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Date	12 July 2011

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