National Character Area profile:

75: Kesteven Uplands

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Introduction

As part of Natural England's responsibilities as set out in the Natural Environment White Paper[1], Biodiversity 2020[2] and the European Landscape Convention[3], we are revising profiles for England's 159 National Character Areas (NCAs). These are areas that share similar landscape characteristics, and which follow natural lines in the landscape rather than administrative boundaries, making them a good decision-making framework for the natural environment.

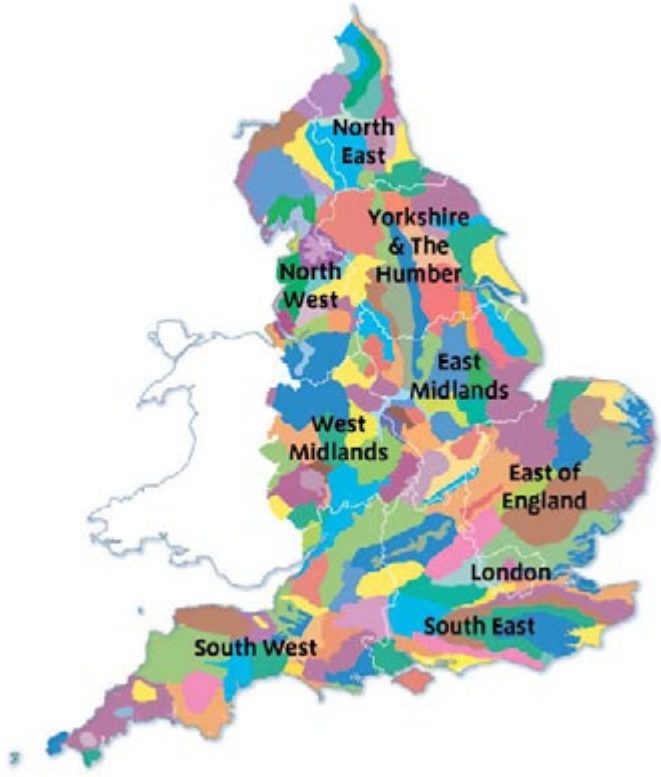
NCA profiles are guidance documents which can help communities to inform their decision-making about the places that they live in and care for. The information they contain will support the planning of conservation initiatives at a landscape scale, inform the delivery of Nature Improvement Areas and encourage broader partnership working through Local Nature Partnerships. The profiles will also help to inform choices about how land is managed and can change.

Each profile includes a description of the natural and cultural features that shape our landscapes, how the landscape has changed over time, the current key drivers for ongoing change, and a broad analysis of each area's characteristics and ecosystem services. Statements of Environmental Opportunity (SEOs) are suggested, which draw on this integrated information. The SEOs offer guidance on the critical issues, which could help to achieve sustainable growth and a more secure environmental future.

NCA profiles are working documents which draw on current evidence and knowledge. We will aim to refresh and update them periodically as new information becomes available to us.

We would like to hear how useful the NCA profiles are to you. You can contact the NCA team by emailing ncaprofiles@naturalengland.org.uk

National Character Areas map



[1] The Natural Choice: Securing the Value of Nature, Defra (2011; URL: www.official-documents.gov.uk/document/cm80/8082/8082.pdf)
[2] Biodiversity 2020: A Strategy for England's Wildlife and Ecosystem Services, Defra (2011; URL: www.defra.gov.uk/publications/files/pb13583-biodiversity-strategy-2020-111111.pdf)
[3] European Landscape Convention, Council of Europe (2000; URL: http://conventions.coe.int/Treaty/en/Treaties/Html/176.htm)

Summary

The Kesteven Uplands National Character Area (NCA) is a gently rolling, mixed farming landscape dissected by the rivers Witham and the East and West Glen. The area lies at the junction of Lincolnshire, Cambridgeshire, Northamptonshire, Leicestershire and Rutland. However, the majority falls within the historic Kesteven district of Lincolnshire which extends south to the impressive stone town of Stamford. This is a deeply rural landscape which has only a very small urban area.

This area is geologically varied with a wide range of soil types, from limestone through to heavy clays. The area's well-drained calcareous loam soils support the cultivation of cereals, oilseeds and root crops. Wide road verges with herbs and wild flowers characterise the area, and individual hedgerow trees provide important woodland character. The origin of the word 'Kesteven' comes partly from the Celtic word 'coed' meaning woods, and much scattered woodland survives throughout the area with some important semi-natural and ancient woodlands.

The Special Area of Conservation area at Grimsthorpe is designated for the semi-natural dry grasslands and scrublands in a former limestone quarry. There are several designated Sites of Special Scientific Interest, along with a number of disused limestone, ironstone and sand extraction sites which comprise geological exposures alongside calcareous grassland.

The area has an abundant mix of heritage features, from prehistoric settlement sites, the Roman route known as Ermine Street – which continues on to Lincoln – to medieval deserted settlements, monastic sites (for example, Vaudey Abbey and the Templar Preceptory at South Witham) and very fine stone-built houses and associated estates, for example at Grimsthorpe, Irnham Hall and Stoke Rochford Hall.

There is a principal aquifer within the underlying limestone, which also extends north to the Humber and continues beyond the area. The protection of water quality and improvement of water availability are therefore very important issues for this area as the Kesteven Uplands form a watershed between a number of catchments including the River Glen. The River Witham rises in the NCA and both of the rivers drain into The Wash.

There are challenges around how to maintain the valuable food contribution which the land provides while enhancing biodiversity and water management. Managing and expanding the woodland resource will also be key for biodiversity, increasing biomass potential, regulating climate change, water quality and providing additional recreational assets.

Click map to enlarge; click again to reduce.

Statements of Environmental Opportunity

SEO 1: Manage and enhance the agricultural landscape and soils of the Kesteven Uplands, continuing the long tradition of mixed farming which has shaped the area, securing viable and sustainable food production, while seeking to enhance biodiversity and improve water quality and availability.

SEO 2: Protect and significantly increase the extent, quality and connectivity of the unimproved and limestone grasslands throughout the NCA, to enhance biodiversity, ecological networks, water availability and quality, climate regulation and sense of place.

SEO 3: Manage and expand the native woodlands throughout the Kesteven Uplands to reinforce the area's wooded character, benefit biodiversity, increase the potential for biomass, access and recreation, and help to regulate climate change and water quality.

SEO 4: Protect, manage and promote the area's rich historic environment including the significant limestone geology, the historic parklands, the manor houses and medieval monastic buildings, and deserted medieval villages, while also improving access and interpretation to enhance people's understanding and enjoyment of the landscape.

Woodlands are an important aspect of the NCA although can be fragmented.

Description

Physical and functional links to other National Character Areas

The Kesteven Uplands National Character Area (NCA) is a rolling, mixed farmland landscape dissected by the rivers Witham and East and West Glen.

This NCA overlooks the lower-lying level Fens NCA to the east and borders the Rockingham Forest NCA to the south. The Leicestershire and Nottinghamshire Wolds NCA lies adjacent and to the west while north of the area lie the Trent and Belvoir Vales NCA and the Southern Lincolnshire Edge NCA.

The more elevated arable areas, for example around Swinstead, have exposed distant views of the West Glen river valley. This landscape also bears similarities with the Northern Lincolnshire Edge and Coversands NCA to the north.

Within the NCA lies the Lincolnshire Limestone ridge. This ridge sweeps across England, extending from the Cotswolds to the Humber and then gradually west to Yorkshire. The limestone geology forms an important aquifer in this region and extends into a number of NCAs including both the Southern Lincolnshire Edge and Northern Lincolnshire Edge and Coversands NCAs. The Southern Lincolnshire Limestone Aquifer is important as 80 per cent of the abstraction is for public water supply.[4]

Rivers are an important feature of the NCA. Both the East and West Glen rivers run parallel in a southerly direction, having carved their way through the boulder clay towards Stamford and Market Deeping, and eventually drain into The Wash. The

Wildflowers such as greater knapweed are often restricted to areas such as nature reserves where soils are limestone-rich.

[1] *Baseline Report Series 23: The Lincolnshire Limestone*, British Geological Survey and Environment Agency (2006)

River Witham also rises in the Kesteven Plateau close to South Witham, and flows into the Vale of Belvoir before passing through the Lincoln Gap. The East Glen and the West Glen both have their sources in the north of the NCA near Ropsley, flowing south and joining to form the River Glen near Greatford, which continues east through The Fens NCA. The River Welland flows eastwards into The Fens NCA where both the Welland and Witham eventually drain into the Wash Estuary.

The Witham is linked to the River Trent's catchment via the Fossdyke. The Fossdyke also provides a waterway link from the Witham to the wider navigable waterway network and the Witham corridor provides a recreational link to the city of Lincoln.

Other recreational links include the Viking Way, a long-distance footpath which starts on the banks of the Humber in the north and winds its way through Lincolnshire to finish on the shores of Rutland Water in the Leicestershire and Nottinghamshire Wolds NCA.

Main roads such as the A1, which runs from London to York and beyond, link the area to adjacent NCAs both to the north and the south. Other main roads include the A15 and A16. The London–Edinburgh East Coast Main Line also crosses this NCA.

Kesteven Uplands.

Water resources and water quality are important as shown at Cringle Brook at Stoke Rochford.

Key characteristics

- Medium-scale, undulating mixed farmland landscape gently rising from the Fens in the east to the limestone ridge in the west. Large arable fields predominate on the higher ground of the Kesteven Plateau, with clipped and gappy hedgerows, while heavier land in the river valleys provides good grazing for cattle and sheep. Enclosure is generally by hedgerows and more locally by stone walls.

- Rivers Witham, East Glen and West Glen dissect the area, their valleys containing species-rich meadows, grazing marsh and woodlands.

- Underlying limestone supports shallow, well-drained calcareous loams, with areas of less permeable clayey soils developed on glacial till. Limestone quarries are scattered across the area, many of which are disused, and these and roadside verges support important wildlife including rare moths, butterflies such as marbled white and dingy skipper, common lizard and adder.

- Significant areas of woodland including semi-natural and ancient woodland, commercial woodlands and parkland landscapes which, in combination with the topography, frame and contain views.

- Nucleated settlement pattern comprising small traditional villages with few isolated farmsteads or houses. Villages are evenly distributed throughout the area with the exception of the line of settlements along the edge of the Fens to the east and larger villages towards Stamford.

- Picturesque villages and towns with buildings constructed in the local honey-coloured limestone, with roofs of the local yellowish Collyweston slate in the south and red pantiles in the north. Also present is a concentration of historic country houses with their associated parklands.

In the hamlet of Lenton, St Peter's Church provides a sense of history.

- An archaeologically rich area containing ancient trackways, Roman settlements, deserted medieval villages and Scheduled Ancient Monuments such as Car Dyke, which runs along the western edge of the Fens. Recreation includes restored sand and gravel quarries and long-distance routes and trackways.

- Major roads and the East Coast Main Line run north–south dissecting the landscape (such as the major viaducts at Great Ponton).

Kesteven Uplands today

The Kesteven Uplands lie at the junction of the counties of Lincolnshire, Cambridgeshire, Northamptonshire, Leicestershire and Rutland. The majority of the area lies within the historic Kesteven district of Lincolnshire which extends south to the impressive stone town of Stamford. To the east lie the level Fens from which the Lincolnshire Limestone ridge of the Kesteven Uplands gently rises to reach a height of over 130 m around Colsterworth on the A1 main road. To the south, the area runs towards the River Nene and Rockingham Forest while, to the west, a band of ironstone meets the heavier clay soil of the neighbouring Leicestershire Wolds. The northern extent reaches to the lighter soils of the Lincolnshire Edge.

To the eastern boundary the uplands ease down to the fen edge, the boundary being marked by the Car Dyke. In this transition zone the landscape has fewer woodlands and more subtle topography. In the east the lowest elevation is 3 m above sea level. However, the land gently rises in the west, reaching a maximum of 57 m here. Much of the NCA is agricultural land; arable predominates on this higher ground or plateau where crops such as cereals, vegetables and oilseed are grown in larger fields bounded by clipped and intermittent hedgerows. There is also pasture, particularly where heavier land in the river valleys provides good grazing for cattle and sheep. In the valleys the fields are generally smaller and less regular, enclosed by hedgerows and more locally by stone walls. Species-rich verges and meadows are notable adjacent to these boundaries.

There are significant areas of woodland including semi-natural and ancient woodland. Trees include oak and ash with a variable amount of hazel coppice which, in combination with the topography, frame and contain views. There

Small areas of grazing land and associated boundaries such as hedgerows are found across the agricultural landscape.

are many small hills and sheltered valleys, providing an intimate landscape of enclosure and shade. This is enhanced by the extensive woodland found throughout much of the area, arranged in plantations.

The NCA is important for biodiversity such as limestone grassland. The Grimsthorpe Special Area of Conservation has developed on the site of a former small limestone quarry. Cribbs Meadow National Nature Reserve

The honey-coloured local limestone has been widely used and combined with pantiles, has created attractive historic village centres.

supports key grassland species such as nationally scarce pasque and early gentian, green-winged orchid and farmland bird species including barn owl, skylark and lapwing.

Flood plain grassland is found in the lower elevations, while the upper stretches of the River Witham have freshwater habitats which support important populations of crayfish. Calcareous flushes are present and also include wetland species.

Significant areas of the limestone plateau are overlain with calcareous boulder clay which has resulted in the survival of a high proportion of ancient semi-natural woodland. A few, mainly improved, clay grasslands also survive.

Highly calcareous loam soils derived directly from the underlying oolitic limestone are found mainly on the steeper slopes. Some good remnants of biologically rich limestone grassland survive on unploughable areas such as the steepest slopes, roadside verges and quarries. An area along the southern Lincolnshire boundary, centred on Holywell, has a particularly high concentration of biologically rich sites.

The NCA is generally characterised by villages with low densities of dispersed settlement, with a local concentration of settlement along the fen edge in the east. Most villages are distinguished by local limestone houses and farm buildings, with Collyweston slate roofs distinctive to the south and red pantiles more prevalent in the north. Many settlements retain a rich historic character, including the stone town of Stamford and its surrounding villages.

The NCA is an archaeologically rich area with ancient trackways, abundant evidence of Roman settlement and deserted medieval villages. Large country

houses and estates with parklands and large blocks of woodland characterise the Kesteven Uplands and a number of these fine houses draw visitors to the area. Tourist destinations include the birthplace of Sir Isaac Newton at Woolsthorpe-by-Colsterworth, a National Trust property. The long-distance Viking Way route also crosses this NCA.

Leafy country lanes with wide road verges bounded by enclosure hedgerows are typical of the area and give variety and texture to the landscape, contrasting with the more common open roads in the rolling countryside. Individual hedgerow trees provide important character but are becoming less common.

Limestone and ironstone quarries are found throughout the area. Many are now disused, although Ketton Quarry is still active and a visible landmark. A pocket of sand- and gravel-bearing land west of Market Deeping has been extensively worked. Some of these areas have now been restored to benefit biodiversity and for informal recreation, such as Deeping Lakes Wetland Nature Reserve.

Apart from the main roads of the A1 and A15 and the East Coast Main Line there are some 20th-century intrusions such as wind turbines, and airfield sites, some now redundant, are present in exposed elevated areas. Recent development is mainly residential around the towns and close to the A1.

A 'beetle bank' as shown here, improves biodiversity in the Kesteven Uplands arable landscape.

The landscape through time

The underlying geology comprises predominantly the Middle Jurassic Lincolnshire Limestone, which comprises mudstone and oolitic limestones, deposited in a very shallow sea during estuarine conditions.

The NCA's shallow, well-drained calcareous loam soils are similar to those of the Southern Lincolnshire Edge NCA. However, in contrast there are also areas of slowly permeable and seasonally waterlogged clayey soils, developed on glacial tills such as to the north of Corby Glen. Smaller areas of Jurassic sand and clay support a deep, stoneless, coarse loam where groundwater is controlled by ditches, as at Ingoldsby and around Bourne. To the west, beds of Jurassic ironstone support some well-drained, loamy, ferruginous soils.

There is archaeological evidence of occupation of the fen edge from the Iron Age onwards. The glacial till which caps the Jurassic beds of clay around Bourne made the land too difficult for the early farmers to cultivate and too wet to be ideal for pasture, so it is probable that more of this area remained as woodland than other limestone plateau landscapes.

The invading Roman army made its way northwards along the route of Ermine Street (now the A1), pausing in Great Casterton to build a camp to protect a strategic bridge over the River Gwash, which became a walled town with a large nearby villa complex including houses, barns, corn driers and a bath house.

The Car Dyke is a Roman feature (sections of which are designated as Scheduled Ancient Monuments) thought to have been created to drain the adjacent fenland and, as such, represents one of the first recognisable attempts in Lincolnshire to control the water system for agricultural purposes.

The geology is varied and ironstone, limestone and sand have all been exploited in this area. This exposure is from Ketton Quarry SSSI.

The majority of settlements along the fen edge were in existence, in some form, by the time of the Domesday survey of 1086. The actual shape of the villages as seen today is the result of much later growth. There was a significant monastic influence in the area with, for example, Vaudey Abbey and the Templar Preceptory at South Witham.

Surviving ridge and furrow earthworks suggest that from the medieval period villages were set within a pattern of open arable fields, farmed in strips by the tenants and rotated annually on a three-field system. The arable land was complemented by areas of grazing land at the edge of each parish, used as common land. These earthworks, and the remains of deserted medieval villages, have been conserved by long use as pasture for sheep which developed from the 14th century in the wake of the collapse in land values following the Black Death and subsequent epidemics. The importance of the wool trade encouraged early enclosure of common land and open field in pursuit of this profitable farming type. From around the 16th century the wool trade supported many middle-class yeoman farmers, whose houses and barns survive. Private landowners further prospered after the Dissolution of the Monasteries, their mark being felt in the importance of their houses, set in designed landscapes and the area's estate villages. Individual landowners such as the Turnors of Stoke Rochford played a prominent role in the enclosure of land and the establishment of planned farmsteads in the decades around 1800.

There are several parklands that are important for biodiversity and give the Kesteven Uplands both landscape character and recreational opportunities.

On the fen edge it is thought that cattle and sheep were grazed on the fens in summer, when the land was drier, and then over-wintered either on the higher heath, or in small closes adjacent to the villages. East–west routes also indicate that these settlements developed to serve this movement of livestock. The wealth of this area grew in medieval times largely as a consequence of the wool trade and several large estates were established with grand houses set in large parklands. Epidemics such as the Black Death led to a reduction in population, leaving a number of villages deserted; these are still evident in the landscape.

Small-scale irregular fieldscapes exist in many areas, around the fringes of the smaller village settlements and within the valleys of the lowland vales and rolling farmland, often with mature and well-wooded hedgerows. The open-field farming system remained in place until the 18th and 19th centuries when many of the open fields surrounding the villages and large areas of open heath were subject to planned enclosure. The other large-scale change was the drainage of the fens by means of new watercourses and channels, many of which still survive, along with the associated isolated farmsteads.

Villages were often altered to accommodate the needs of the estates. Some villages, such as Edenham near Grimsthorpe, were completely remodelled with buildings demolished in favour of new uniform cottages for estate workers,

many of which remain today. Thus the influence of the larger estates is felt throughout the NCA, and not merely within the formal parks and gardens.

From the early part of the 20th century there was a reduction in the number of country houses with the conversion of many of their associated parkland landscapes to agricultural use. In some cases, the grassland has been ploughed up for arable cultivation, often leaving veteran parkland trees isolated within fields of crops. The modern field pattern, produced through the consolidation of smaller fields, seems to retain much of the rectilinear character of the underlying planned enclosures, and there is still significant survival of planned enclosure landscapes.

Proximity to the A1 and East Coast Main Line has ensured that Stamford remains the largest settlement. The late arrival of the railway reduced the impact of industrialisation and, despite the construction of several large housing estates on its edges, it has retained its historic core. Towns and villages such as Bourne, Heckington, Colsterworth and Corby Glen which are located close to main roads have experienced considerable expansion. In some places new housing has followed existing main roads, resulting in ribbon development and the loss of the discrete, nucleated character of the fen-edge villages.

Part of the extensive catchment of the Witham falls within the Kesteven Uplands NCA, such as the Upper Witham at Claypole.

Ecosystem services

The Kesteven Uplands NCA provides a wide range of benefits to society. Each is derived from the attributes and processes (both natural and cultural features) within the area. These benefits are known collectively as 'ecosystem services'. The predominant services are summarised below. Further information on ecosystem services provided in the Kesteven Uplands NCA is contained in the 'Analysis' section of this document.

Provisioning services (food, fibre and water supply)

- **Food provision:** Agricultural food production is an important service in the NCA. Some 78 per cent of the area is classified as Grade 3 agricultural land. Medium-scale mixed farming is the main land use with arable crops dominating; 46 per cent of the NCA area is cereals with 27 per cent cash crops/root crops and 21 per cent uncropped grassland. It supports around 10,000 cattle, 32,000 sheep and 4,000 pigs.

- **Timber provision:** There are significant areas of woodland covering approximately 8 per cent of the NCA and many of these woodlands are currently managed for timber production. There is some scope for increasing the production of timber through expansion and creation of broadleaf woodland which would also benefit climate regulation, reducing soil erosion, water flow and biodiversity, as well as strengthening the distinctive wooded character of the area. The good-quality farmland and important grasslands may limit expansion.

- **Water availability:** There is a major aquifer – the Southern Lincolnshire Limestone – located in the east of the NCA for which the outcrop areas are mainly in the western tributary catchment of the West Glen. The aquifer is an important source for public water supply. However, the aquifer currently has a Catchment Abstraction Management Strategy (CAMS) 'over-abstracted' status.[5]

Arable fields are typical of the Kesteven Uplands.

Tributaries of the West Glen provide recharge to the Southern Lincolnshire Limestone Aquifer. However, this reduces flows further downstream. The Gwash Glen transfer scheme is in place and operates to augment flows in the River Glen.

[5] *Welland Catchment Abstraction Management Strategy*, Environment Agency (2013)

Several sections of the rivers have 'over-licensed' CAMS status or an 'over-abstracted' status. Abstraction combined with low rainfall and sink holes in the river beds has resulted in the upper reaches of rivers such as the East and West Glen drying up for very long periods, and so they are unable to support much aquatic wildlife.

As demand for water for public supply and irrigation is likely to increase and summers are predicted to become warmer and drier, it is imperative that issues of over-licensing and over-abstraction are addressed and that water is used more sustainably.

Regulating services (water purification, air quality maintenance and climate regulation)

- **Regulating soil erosion:** Half of the NCA has soils that are generally not susceptible to soil erosion. However, the shallow lime-rich soils over limestone and the lighter-textured freely draining lime-rich loamy soils are at risk of erosion, particularly on sloping cultivated ground or where bare soil is exposed. The relatively small area of freely draining slightly acid but base-rich soils can be susceptible to capping and slaking, increasing the risk of soil erosion. These soils need to be managed carefully to reduce risks with careful timing of cultivation and maintenance of vegetation cover. Sedimentation of watercourses is currently one of the factors negatively affecting water quality in this area.

- **Regulating soil quality:** Most soils are of good agricultural quality. The shallow, lime-rich soils over limestone and the freely draining lime-rich loamy soils, while typically shallow and susceptible to drought, have a degree of natural resilience due to their calcareous nature. They are valuable for aquifer recharge, requiring the maintenance of good structural conditions. Measures are required to increase the organic content of soils to aid water infiltration and also assist with climate regulation and soil erosion.

  The slowly permeable, seasonally wet loamy and clayey soils suffer compaction and/or capping as they are easily damaged when wet. In turn this may lead to increasingly poor water infiltration and diffuse pollution as a result of surface water run-off. Management measures that increase organic matter levels can help to reduce these problems as will time of cultivation to avoid compaction.

- **Regulating water quality:** With the important principal aquifer there is a need to ensure good water quality. The whole area is a nitrate vulnerable zone. A small section of the River Eye priority catchment is located within the NCA.[6] Farmers and landowners are required to comply with regulations to protect the water. Measures can be taken to improve the rate of infiltration of rainwater and reduce sediment and nutrient run-off into watercourses.

  The water quality within this NCA is generally in need of improvement. The potential ecological status of the River Witham and East Glen River is 'moderate'. The West Glen has a 'good' ecological status in its upper reaches which reduces to 'moderate' just south of Creeton. The potential ecological status of the Gwash is 'poor', but where it meets the River Welland near Stamford this increases to 'medium', while the Welland has 'poor' potential ecological status until it is joined by the River Gwash.

  Pollutants and sediments potentially entering watercourses as a result of soil and nutrient run-off and livestock directly accessing watercourses have been identified as issues within the priority catchment. Over-abstraction is also an issue within this catchment.

[6] River Eye ECFSDI Priority Catchment – Catchment Sensitive Farming Initiative

Cultural services (inspiration, education and wellbeing)

- **Sense of place/inspiration:** A sense of place is provided by the rolling nature of this landscape which is dissected north to south by the rivers Witham, East Glen and West Glen. Significant areas of medium-sized woodland, both semi-natural and ancient, are dispersed throughout the area, framing and containing views, and alongside wide species-rich verges, meadows and mixed farmland generally enclosed by hedgerows reflect a deeply rural landscape.

  The settlement pattern is generally dispersed but nucleated, with small, picturesque honey-coloured stone villages evenly distributed throughout the area, with the exception of the line of settlements along the edge of the Fens to the east and a cluster of larger villages around Stamford.

  Aside from the built form, local geology is reflected in the drystone walls in the south of the area, and in the exposed geological features including characteristic limestone and ironstone quarries. The area has a high concentration of historic country houses and distinctive parklands.

  A sense of inspiration and escapism is associated with the intimate landscape of small woodlands, stone villages, parklands and halls which contrasts with the more open, elevated arable areas with exposed, distant views.

- **Sense of history:** The historic evidence includes the route of the Roman Ermine Street, with visible archaeological evidence of settlements and villas concentrated along the route, such as Roman settlements. Later, medieval monastic influences include Vaudey Abbey and the Templar Preceptory at South Witham.

  Part of the NCA was once the ancient Forest of Kesteven[7]; this was part of the Royal Forest, which became deforested after 1231. Hunting has long been associated with the area. The NCA includes a large concentration of deserted medieval villages, areas of ridge and furrow, ancient trackways, boundary features such as dry limestone walls and ancient hedgerows.

  The history of farming can be traced through small-scale, irregular medieval fields which remain in many areas, alongside the large-scale and regular enclosures of the 18th and 19th centuries and numerous ancient woodlands with evidence of later enclosures visible in more regular fields on higher ground to the south and west. Historic parklands and wood pasture and large houses founded on the wealth of the wool trade are distinctive features of the area.

  The long history of using local limestone for the construction of buildings is evident from the abandoned quarries scattered around the area and the vernacular which dominates. Notable examples of the worked stone are evident in Stamford. There is scope for protecting features further and raising awareness for the attention of a wider audience.

- **Biodiversity:** There are over 3,200 ha of priority habitats (5 per cent of the NCA), which include broadleaved woodland, calcareous grassland, fen, grazing marsh, reedbeds and meadows. The NCA contains one Special Area of Conservation, at Grimsthorpe, and approximately 1 per cent of the NCA is nationally designated as Sites of Special Scientific Interest (SSSI).

  The key habitats associated with the area's rivers include native crayfish supported, for example, by parts of the River Witham.

  Expanding, buffering and connecting the fragmented semi-natural habitats in the area, including those within the parklands, would improve their condition and make them more resilient. Networks of hedgerow and permanent grassland

[7] The Bourne Archive

margins could be established within the farmed environment and would provide support for pollinating insects, and farmland birds could also benefit.

- **Geodiversity:** The local geology is reflected in the use of locally quarried limestone in buildings and drystone walls. The exploitation of stone and mineral extraction has given rise to some important exposures in disused quarries.

  There are four quarries, all designated as SSSI for the exposures of the Lincolnshire Limestone Formation and rare ammonite fossils found there. These provide opportunities for education and interpretation of the geodiversity and natural features of the area.

Faulting in Jurassic limestone and mudstone rocks exposed at the now disused Ketton Quarry SSSI.

Statements of Environmental Opportunity

SEO 1: Manage and enhance the agricultural landscape and soils of the Kesteven Uplands, continuing the long tradition of mixed farming which has shaped the area, securing viable and sustainable food production, while seeking to enhance biodiversity and improve water quality and availability.

For example by:

- Working with the farming community to maintain present levels of production in this agricultural landscape while protecting soils from erosion, and maintaining water quality and water availability.
- Promoting suitable management of arable land to deliver habitat for farmland birds and protecting and enhancing the bird population of the area.
- Encouraging farmers through agri-environment schemes to establish margins to create a network of habitats across the farmed environment and to link semi-natural habitats, thus allowing species movement as well as capturing sediment and nutrient run-off, and supporting pollinating insects, farmland birds and other beneficial species. Encouraging mixed farming to preserve the unique character of the area along with its associated wildlife.
- Encouraging cultivation practices that increase organic content of soil, avoiding cultivation on steep slopes, introducing grass strips and beetle banks and increasing permanent grasslands.
- Creating buffer zones and undertaking habitat enhancement works in riparian areas to improve the water quality and biodiversity value of the waterbodies in the Kesteven Uplands.
- Managing livestock numbers and movements through best practice methods, for example encouraging the use of management plans that address the issues of bank erosion and direct deposition into watercourses from livestock directly accessing watercourses, reducing soil erosion and sedimentation of watercourses.
- Promoting good nutrient and pesticide management, including improving farm infrastructure and waste management, and informed infield nutrient application to reduce diffuse pollution of watercourses and meet the requirements of the Water Framework Directive.
- Managing mineral soils in the National Character Area to build up soil organic matter in order to maintain and enhance soil quality.
- Encouraging the adoption of good soil management to avoid soil compaction and maintain good soil structure by timing farming operations carefully.
- Encouraging landowners and managers to use sustainable farming methods that protect the soil such as maintaining vegetative cover. Use of grass buffer strips in arable areas can reduce soil erosion from susceptible fields in the autumn and winter.
- Conserving blocks of woodland and expanding the areas of semi-natural grassland. Manage margins and the pattern of hedgerows and fragmented habitats. These are important for wildlife as corridors and habitat networks within the farmed environment as well as for landscape character.
- Continuing the sensitive management of historic environments.
- Retaining mature hedgerow trees and augmenting them to ensure continuity, and restoring neglected riverside pollards.
- Raising awareness of the relevant management options available under environmental stewardship, woodland grant schemes and catchment sensitive farming schemes.
- Managing key wetland sites to provide sufficient areas of wetland habitats.

SEO 2: Protect and significantly increase the extent, quality and connectivity of the unimproved and limestone grasslands throughout the NCA, to enhance biodiversity, ecological networks, water availability and quality, climate regulation and sense of place.

For example by:

- Managing pockets of unimproved grassland that are rich in wildlife. Some have survived mainly on steep ground unsuitable for ploughing or fertilising, on roadside verges and in long-abandoned limestone quarries.
- Managing the fragmented limestone grasslands, such as on the limestone plateau roadside verges, working in partnership with the highways authorities and Wildlife Trust Living Landscapes and Life on the Verge projects.
- Protecting grasslands through grazing management, re-introducing grazing regimes where necessary and controlling scrub encroachment.
- Seeking opportunities to restore areas of unimproved grassland, especially where these sites will expand and connect existing sites, to buffer them and make them more resilient to climate change.
- Increasing opportunities to manage and protect the remaining unimproved neutral grasslands.
- Improving the management of the limestone grasslands in the Kesteven Uplands. Improve the value of the habitat by reducing habitat fragmentation and developing a network of habitats.
- Conserving and managing the suite of Sites of Special Scientific Interest (SSSI) and Local Sites to protect and improve their condition.
- Raising awareness of the value and importance of the species-rich roadside verges.
- Expanding the areas of semi-natural grassland to increase biodiversity and conserve and buffer areas displaying ridge and furrow patterns, a legacy of historical land use.
- Encouraging the adoption of good practice to maintain good soil structure.
- Protecting and increasing other areas of unimproved grassland along with their associated insect life.
- Raising awareness of accessible sites and developing these for their educational benefits.
- Managing the disused limestone quarries and exploring opportunities to extend calcareous grassland management.

Some roadside verges are home to important limestone grasslands with plants such as pyramidal orchid.

SEO 3: Manage and expand the native woodlands throughout the Kesteven Uplands to reinforce the area's wooded character, benefit biodiversity, increase the potential for biomass, access and recreation, and help to regulate climate change and water quality.

For example by:

- Promoting the extension of existing woods and planting of new woodlands of mixed broadleaved trees where this is appropriate.
- Encouraging succession planting and promoting sustainable management for priority woodland habitat.
- Managing and restoring boundary features including hedgerows, replacing over-mature hedgerow trees and restoring neglected riverside pollards.
- Conserving the canopy through woodland creation, where appropriate, in the many small copses, coverts and spinneys, a legacy of historic land use.
- Conserving and managing the suite of woodland SSSI and Local Sites to protect and improve their condition.
- Encouraging the adoption of good practice in woodland management.

Opportunities to increase the woodland character exist by linking existing woodland areas.

SEO 4: Protect, manage and promote the area's rich historic environment including the significant limestone geology, the historic parklands, the manor houses and medieval monastic buildings, and deserted medieval villages, while also improving access and interpretation to enhance people's understanding and enjoyment of the landscape.

For example by:

- Managing geological exposures throughout the Kesteven Uplands in former quarries and small-scale excavations by the removal of undergrowth and the prevention of fly-tipping on these sites.
- Providing access to and interpretation of sites of geological interest to raise awareness and improve understanding. Negotiating long-term conservation of exposures with mineral companies and site owners at key geological sites.
- Managing former extraction sites for their range of mutually beneficial heritage interests including geodiversity, biodiversity and industrial archaeology.
- Identifying, conserving and monitoring above-ground and buried archaeological remains that are under threat from increased cultivation and pressures from development.
- Working collaboratively with partners and stakeholders to undertake restorative management of designated sites.
- Maintaining the character of historic villages, towns and the area's architecture including farmsteads and country houses by using locally quarried stone in restoration where possible, to reinforce links with the underlying geology and strengthen sense of place. Also to use understanding of this architecture and the settlement pattern to plan for and influence any environmentally beneficial new development which makes a positive contribution to local character.
- Conserving the settings of historic landmark buildings including the medieval churches, abbeys and country houses.
- Conserving and managing the suite of geological SSSI and Local Sites to protect and improve their condition.
- Continuing the sensitive management of geological and historic sites and features, supporting volunteer initiatives and continued close working with community groups.
- Promoting public access and the creation of permissive and definitive access to increase opportunities to visit the area in a sustainable way. Providing access to encourage educational and recreation initiatives including through improved public transport.

Additional opportunity

1. Conserve the strong settlement character of the Kesteven Uplands villages and ensure that new development is sympathetic to this, protecting its tranquil characteristics away from major urban influences.

For example by:

- Conserving the sense of tranquillity associated with the open hills, undeveloped valleys and remoter ridgetops by protecting the relatively sparse settlement pattern of small, isolated villages and ensuring that any new development is integrated into the landscape sensitively.
- Planning new developments to ensure that they do not negatively impact on the character of the settlements or surrounding landscape and that they provide accessible open green spaces as an integral component.
- Encouraging the use of local building stone and adherence to any guidelines provided by English Heritage.
- Planning for new community greenspaces and green infrastructure to provide wildlife corridors in order to improve the resilience of species to climate change, and to increase opportunities for local communities to enjoy their local greenspace and benefit from the recreation and health benefits it affords them.

A typical view of the Kesteven Uplands with its rolling landscape with good views and some fragmented habitats.

Supporting document 1: Key facts and data

Total area: 69,004 ha

1. Landscape and nature conservation designations

The Kesteven Uplands NCA contains no protected landscapes.

Source: Natural England (2011)

1.1 Designated nature conservation sites

The NCA includes the following statutory nature conservation de1signations:

Tier	Designation	Name	Area (ha)	% of NCA
International	n/a	n/a	0	0
European	Special Protection Area (SPA)	n/a	0	0
	Special Area of Conservation (SAC)	Grimsthorpe SAC	<1	<1
National	National Nature Reserve (NNR)	Cribbs Meadow NNR	4	<1
National	Site of Special Scientific Interest (SSSI)	A total of 29 sites wholly or partly within the NCA	674	1

Source: Natural England (2011)

Please note: (i) Designated areas may overlap (ii) all figures are cut to Mean High Water Line, designations that span coastal areas/views below this line will not be included.

There are 289 local sites in the Kesteven Uplands covering 5,695 ha, which is 8 per cent of the NCA.

Source: Natural England (2011)

- Details of individual Sites of Special Scientific Interest can be searched at: http://www.sssi.naturalengland.org.uk/Special/sssi/search.cfm
- Details of Local Nature Reserves (LNR) can be searched: http://www.lnr.naturalengland.org.uk/Special/lnr/lnr_search.asp
- Maps showing locations of Statutory sites can be found at: http://magic.defra.gov.uk/website/magic/ – select 'Rural Designations Statutory'.

1.1.1 Condition of designated sites

SSSI condition category	Area (ha)	% of SSSI land in category condition
Unfavourable declining	13	2
Favourable	336	50
Unfavourable no change	7	1
Unfavourable recovering	316	47

Source: Natural England (March 2011)

Details of SSSI condition can be searched at: http://www.sssi.naturalengland.org.uk/Special/sssi/reportIndex.cfm

2. Landform, geology and soils

2.1 Elevation

The lowest elevation in this NCA is 3 m; the highest point is 157 m. The mean elevation across the NCA is 68 m.

Source: Natural England (2010)

2.2 Landform and process

The Kesteven Uplands lie at the junction of the counties of Lincolnshire, Cambridgeshire, Northamptonshire and Leicestershire. To the east lie level fens from which the Kesteven Uplands gently rise to reach a height of over 130 m. To the south, the area runs towards the River Nene and Rockingham Forest, while to the west, a bandstone of ironstone meets the heavier clay soil of the neighbouring Leicestershire Wolds. The northern extent reaches to the lighter soils of the Lincolnshire Edge, along a line running due east of Grantham. The rolling landform is most noticeably divided by the East and West Glen rivers.

Source: Kesteven Uplands Countryside Character Area Description

2.3 Bedrock geology

The Kesteven Uplands comprises mainly of the Middle Jurassic Lincolnshire Limestone, which supports shallow well-drained calcareous loams similar to those of the Lincolnshire Edge. A breakdown of solid geology, as a proportion of the total land area is as follows: 43 per cent limestone, 30 per cent mudstone, 12 per cent sandstone and siltstone, interbedded, 10 per cent argillaceous rocks with subordinate sandstone and limestone, 4 per cent ooidal ironstone, 1 per cent sandstone, siltstone and mudstone and 1 per cent limestone, ooidal.

Source:Natural England (2010); Kesteven Uplands Countryside Character Area Description

2.4 Superficial deposits

In contrast to the Lincolnshire Edge, there are areas of slowly permeable and seasonally waterlogged clayey soils, developed on glacial tills, examples are found north of Corby Glen on glacial till and boulder clay.

Source: Kesteven Uplands Countryside Character Area Description

2.5 Designated geological sites

Designation	Number of sites
Geological Site of Special Scientific Interest (SSSI)	2
Mixed interest SSSI	2

There are 20 Local Geological Sites within the NCA.

Source: Natural England (2011)

- Details of individual Sites of Special Scientific Interest can be searched at: http://www.sssi.naturalengland.org.uk/Special/sssi/search.cfm

2.6 Soils and Agricultural Land Classification

Smaller areas of Jurassic sand and clay support a deep, stoneless, coarse loam where groundwater is controlled by ditches, as at Ingoldsby and around Bourne. To the west of the uplands, beds of Jurassic ironstone support some well-drained, loamy, ferruginous soils.

Source: Kesteven Uplands Countryside Character Area Description

The main grades of agricultural land in the NCA are broken down as follows (as a proportion of total land area):

Agricultural Land Classification	Area (ha)	% of NCA
Grade 1	0	0
Grade 2	10,128	15
Grade 3	54,076	78
Grade 4	1,241	2
Grade 5	0	0
Non-agricultural	2,720	4
Urban	839	1

Source: Natural England (2010)

Maps showing locations of Statutory sites can be found at: http://magic.defra.gov.uk/website/magic/ – select 'Landscape' (shows ALC and 27 types of soils).

3. Key water bodies and catchments

3.1 Major rivers/canals

The following major rivers/canals (by length) have been identified in this NCA.

Name	Length (km)
East Glen River	33
West Glen River	23
River Witham	22
River Gwash	19
River Glen	14
River Welland	13

Source: Natural England (2010)

Please note: other significant rivers (by volume) may also occur. These are not listed where the length within the NCA is short.

The rolling landform is divided by the East and West Glen rivers which meander southwards across the area to a confluence below Bourne. The River Welland cuts through from the west to Stamford in the east, to drain into the Wash. The River Witham also rises in the uplands flowing into the Vale of Belvoir before passing through the Lincoln Gap. The drainage contrasts with that of earlier periods when rivers flowed from west to east.

3.2 Water quality

The total area of Nitrate Vulnerable Zone is 69,004 ha, which is 100 per cent of the NCA.

Source: Source: Natural England (2010)

3.3 Water Framework Directive

Maps are available from the Environment Agency showing current and projected future status of water bodies http://maps.environment-agency.gov.uk/wiyby/wiybyController?ep=maptopics&lang=_e

4. Trees and woodlands

4.1 Total woodland cover

The NCA contains 5,472 ha of woodland (8 per cent of the total area), of which 2,643 ha is ancient woodland.

Source: Natural England (2010), Forestry Commission (2011)

4.2 Distribution and size of woodland and trees in the landscape

Numerous medium sized woodlands provide a well-wooded appearance in many areas, particularly across the mixed farmlands, clustered along the watercourses and on the higher ground between the East Glen and West Glen rivers. Woodland cover includes both recent, commercial, coniferous plantations and ancient woodland. The latter comprises oak/ash woodland with a variable amount of hazel coppice and occasional wild service trees.

Source: Kesteven Uplands Countryside Character Area Description; Lincolnshire and Rutland Limestone Natural Area Profile

4.3 Woodland types

A statistical breakdown of the area and type of woodland found across the NCA is detailed below.

Area and proportion of different woodland types in the NCA (over 2 ha)

Woodland type	Area (ha)	% of NCA
Broadleaved	3,974	6
Coniferous	850	1
Mixed	244	<1
Other	404	1

Source: Forestry Commission (2011)

Area and proportion of Ancient Woodland and Planted Ancient Woodland within the NCA.

Woodland type	Area (ha)	% of NCA
Ancient semi-natural woodland	1,448	2
Ancient re-planted woodland (PAWS)	1,194	2

Source: Natural England (2004)

5. Boundary features and patterns

5.1 Boundary features

To the south, the local limestone is intermittently found in field boundaries as walling, although many walls are in need of restoration. The small scale fields are bounded with mature and well wooded hedgerows. The higher ground fields to be found in the south and west and within the wider vales are broadly defined by thorn hedges and limestone walls.

Source: Kesteven Uplands Countryside Character Area Description; Countryside Quality Counts (2003)

5.2 Field patterns

Large arable fields predominate on the higher ground with intermittent clipped hedges. Small scale irregular late medieval fieldscapes exist in many areas, around the fringes of the smaller village settlements and within the valleys of the lowland vales and rolling farmland. The higher ground to the south and west and within the wider vales were more regularly encloses, either by the parliamentary act or through the private arrangements by majority landowners in the later 18th or early 19th centuries.

Source: Kesteven Uplands Countryside Character Area Description; Countryside Quality Counts (2003)

6. Agriculture

The following data has been taken from the Agricultural Census linked to this NCA.

6.1 Farm type

The majority of farms in this area were predominately arable, with cereals dominating (228 holdings, 61 per cent). There were some grazing livestock farms (46, 12 per cent).

Source: Agricultural Census, Defra (2010)

6.2 Farm size

The majority of the area's 374 holdings were large, with 43 per cent over 100 ha and accounting for 87 per cent of the agricultural area, and 32 per cent of holdings between 20 and 100 ha, accounting for 11 per cent of the land area.

Source: Agricultural Census, Defra (2010)

6.3 Farm ownership

2009: Total farm area = 55,244 ha; owned land = 29,239 ha
2000: Total farm area = 57,654 ha; owned land = 27,057 ha

Source: Agricultural Census, Defra (2010)

6.4 Land use

Out of a total farm area of 55,244 ha, the majority was arable; 46 per cent cereals, 18 per cent oilseeds, 2 per cent cash roots, a small amount of stock feed and 7 per cent other arable. Grass and uncropped land mades up 21 per cent of the area.

Source: Agricultural Census, Defra (2010)

6.5 Livestock numbers

In 2009 there were 10,400 cattle (11,000 in 2000), 31,900 sheep (45,700 in 2000) and 4,400 pigs (26,100 in 2000).

Source: Agricultural Census, Defra (2010)

6.6 Farm labour

The total agricultural workforce was 923 in 2009 of which 57 per cent were principal farmers, 19 per cent full-time workers, 13 per cent part-time workers, 7 per cent casual/gang workers and 5 per cent salaried managers.

Source: Agricultural Census, Defra (2010)

Please note: (i) Some of the Census data is estimated by Defra so will not be accurate for every holding (ii) Data refers to Commercial Holdings only (iii) Data includes land outside of the NCA belonging to holdings whose centre point is within the NCA listed.

7. Key habitats and species

7.1 Habitat distribution/coverage

The underlying rock, which is largely limestone or glacial boulder clay, gives rise to calcareous soils. Grasslands on these soils have an extraordinarily high number of plants and animals compared with the many other types of grassland.

Road verges have some of the best surviving grassland habitats, particularly along ancient trackways and drove roads.

Freshwater habitats are a small, but important, feature in the NCA and include a number of rivers and calcareous and limestone flushes along the springline with the clay.

The Upper Witham contains a large population of the internationally important native crayfish.

Farmland habitats include areas of unimproved grasslands, hedges, streams, ponds and woodland copses.

Source: Lincolnshire and Rutland Limestone Natural Area Profile

7.2 Priority habitats

The Government's new strategy for biodiversity in England, Biodiversity 2020, replaces the previous Biodiversity Action Plan (BAP) led approach. Priority habitats and species are identified in Biodiversity 2020, but references to BAP priority habitats and species, and previous national targets have been removed. Biodiversity Action Plans remain a useful source of guidance and information. More information about Biodiversity 2020 can be found at; www.naturalengland.org.uk/ourwork/conservation/biodiversity/protectandmanage/englandsbiodiversitystrategy2011.aspx.

The NCA contains the following areas of mapped priority habitats (as mapped by National Inventories). Footnotes denote local/expert interpretation. This will be used to inform future national inventory updates.

Priority habitat	Area (ha)	% of NCA
Broadleaved mixed and yew woodland (broad habitat)	2,481	4
Lowland calcareous grassland	222	<1
Fens	163	<1
Coastal and flood plain grazing marsh	138	<1
Reedbeds	104	<1
Lowland meadows	50	<1
Purple moor grass and rush pasture	4	<1

Source: Natural England (2011)

Maps showing locations of priority habitats are available at

- http://magic.defra.gov.uk/website/magic/ select 'Habitat Inventories'

7.3 Key species and assemblages of species

- Maps showing locations of Priority Habitats are available at: http://magic.defra.gov.uk/website/magic/
- Maps showing locations of S41 species are available at http://data.nbn.org.uk/

8. Settlement and development patterns

8.1 Settlement pattern

The Kesteven Uplands have a dispersed settlement pattern, comprising small traditional villages generally evenly distributed through the area. There are two exceptions to this; firstly the line of settlements to the east, on the boundary to the fens between Billingborough and Bourne – the latter having grown to a town, and secondly the larger clusters of villages around Stamford. There are a number of fine houses associated with parks and estates.

Source: Kesteven Uplands Countryside Character Area Description; Countryside Quality Counts (2003)

8.2 Main settlements

The main settlements are Stamford, Bourne, Colsterworth, Northorpe and Billingborough. The total estimated population for this NCA (derived from ONS 2001 census data) is 71,648.

Source: Kesteven Uplands Countryside Character Area Description; Countryside Quality Counts (2003)

8.3 Local vernacular and building materials

The warm, honey-coloured stone villages, with picturesque groupings of buildings, appear throughout the area. The good quality local stone, quarried for example at Barnack and Ancaster, has been used extensively in both civic, domestic architecture and some agricultural buildings. To the south of the uplands, local Collyweston slate, which is a yellow, slightly sandy, flaggy Jurassic limestone, is a common roofing material. Further to the north, the stone roofing is replaced by red pantiles and building styles are more in common with those of the Lincolnshire Edge, with brick being seen more frequently alongside the stone.

Source: Kesteven Uplands Countryside Character Area Description; Countryside Quality Counts (2003)

9. Key historic sites and features

9.1 Origin of historic features

Ermine Street, later the Great North Road, is central to the western uplands, providing the focus of Roman settlement and later medieval monastic institutions. Deserted medieval villages, the second largest concentration in Lincolnshire, lie along the north part of the NCA and can be attributed to the rise in sheep economy from the later medieval periods onwards. Large country house estates (such as Burghley Park), smaller manor houses and gentry' houses are another distinctive feature in this NCA. Stamford, the main settlement, retains the character of the late medieval market town and Georgian coaching stop, largely unaffected by the industrial revolution.

Source: Countryside Quality Counts Draft Historic Profile, Countryside Character Area Description

9.2 Designated historic assets

This NCA has the following historic designations:

- 6 Registered Parks and Gardens covering 1,888 ha.
- 0 Registered Battlefields.
- 88 Scheduled Monuments.
- 1,795 Listed Buildings.

Source: Natural England (2010)

More information is available at the following address:

- http://www.english-heritage.org.uk/caring/heritage-at-risk/
- http://www.english-heritage.org.uk/professional/protection/process/national-heritage-list-for-england/

10. Recreation and access

10.1 Public access

- 2 per cent of the NCA 1,677 ha is classified as being publically accessible.
- There are 684 km of public rights of way at a density of 1 km per km2.
- There are no National Trails within this NCA.

Sources: Natural England (2010)

The table below shows the breakdown of land which is publically accessible in perpetuity:

Access designation	Area (ha)	% of NCA
National Trust (accessible all year)	0	0
Common Land	0	0
Country Parks	0	0
CROW Access Land (Section 4 and 16)	969	1
CROW Section 15	0	0
Village Greens	21	<1
Doorstep Greens	0	0
Forestry Commission Walkers Welcome Grants	109	<1
Local Nature Reserves (LNR)	8	<1
Millennium Greens	<1	<1
Accessible National Nature Reserves (NNR)	4	<1
Agri-environment Scheme Access	51	<1
Woods for People	1,569	2

Sources: Natural England (2011)

Please note: Common Land refers to land included in the 1965 commons register; CROW = Countryside and Rights of Way Act 2000; OC and RCL = Open Country and Registered Common Land.

11. Experiential qualities

11.1 Tranquillity

Based on the CPRE map of tranquillity (2006) the least tranquil areas are to be found around the settlements, for example, Stamford and Bourne. The most tranquil areas are in the less populated and developed, more rural areas to the far west of the NCA.

A breakdown of tranquillity values for this NCA is detailed in the table below:

Tranquillity	Tranquillity Score
Highest value within NCA	44
Lowest value within NCA	-61
Mean value within NCA	8

Sources: CPRE (2006)

More information is available at the following address:
http://www.cpre.org.uk/what-we-do/countryside/tranquil-places/in-depth/item/1688-how-we-mapped-tranquillity

The 2007 Intrusion Map (CPRE) shows the extent to which rural landscapes are 'intruded on' from urban development, noise (primarily traffic noise), and other sources of visual and auditory intrusion. This shows similar results to the tranquillity map with most of the disturbed areas around the settlements and the road network particularly the A1.

A breakdown of intrusion values for this NCA is detailed in the following table.

Intrusion category	1960s (%)	1990s (%)	2007 (%)	Percentage change (1960s-2007)
Disturbed	16	30	38	22
Undisturbed	83	70	61	-22
Urban	1	1	1	0

Sources: CPRE (2007)

Notable trends from the 1960s to 2007 were an increase in the area of disturbed/intruded land by 22 per cent, matched by a decrease in the areas of undisturbed/un-intruded land by 22 per cent.

More information is available at the following address:
http://www.cpre.org.uk/resources/countryside/tranquil-places

12 Data sources

- British Geological Survey (2006)
- Natural Area Profiles, Natural England (published by English Nature 1993-1998)
- Countryside Character Descriptions, Natural England (regional volumes published by Countryside Commission/Countryside Agency 1998/1999)
- Joint Character Area GIS boundaries, Natural England (data created 2001)
- National Parks and AONBs GIS boundaries, Natural England (2006)
- Heritage Coast Boundaries, Natural England (2006)
- Agricultural Census June Survey, Defra (2000,2009)
- National Inventory of Woodland & Trees, Forestry Commission (2003)
- Countryside Quality Counts Draft Historic Profiles, English Heritage (2004)*
- Ancient Woodland Inventory, Natural England (2003)
- Priority Habitats GIS data, Natural England (March 2011)
- Special Areas of Conservation data, Natural England (data accessed in March 2011)
- Special Protection Areas data, Natural England (data accessed in March 2011)
- Ramsar sites data, Natural England (data accessed in March 2011)
- Sites of Special Scientific Interest, Natural England (data accessed in March 2011)
- Detailed River Network, Environment Agency (2008)
- Source protection zones, Environment Agency (2005)
- Registered Common Land GIS data, Natural England (2004)
- Open Country GIS data, Natural England (2004)
- Public Rights of Way Density, Defra (2011)
- National Trails, Natural England (2006)
- National Tranquillity Mapping data, CPRE (2007)
- Intrusion map data, CPRE (2007)
- Registered Battlefields, English Heritage (2005)
- Record of Scheduled Monuments, English Heritage (2006)
- Registered Parks and Gardens, English Heritage (2006)
- World Heritage Sites, English Heritage (2006)
- Incorporates Historic Landscape Characterisation and work for preliminary Historic Farmstead Character Statements (English Heritage/Countryside Agency 2006)Detailed River Network, Environment Agency (2008)

Please note all figures contained within the report have been rounded to the nearest unit. For this reason proportion figures will not (in all) cases add up to 100%. The convention <1 has been used to denote values less than a whole unit.

Supporting document 2: Landscape change

Recent changes and trends

Trees and woodlands

- At the end of 1998 young trees approved for planting under a Woodland Grant Scheme agreement accounted for about 2 per cent of the mature woodland stock. Between 1999 and 2003 an area equivalent to 2 per cent of the 1999 total stock was approved for new planting under a Woodl and Grant Scheme agreement (72 ha).

- In 1999 about 14 per cent of the established eligible National Inventory of Woodlands and Trees stock was covered by a Woodland Grant Scheme and this fell to 11 per cent in 2003.

- About 60 per cent of the woodland cover is on ancient woodland sites. The proportion of these sites covered by a Woodland Grant Scheme agreement has remained around 13 per cent since 1999.

- A significant area of woodland is managed by the Forestry Commission and so the agreement statistics may not reflect the full picture but overall the area has retained its wooded character.

Boundary features

- In the past 10 years many kilometres of new hedges have been planted and old hedges restored resulting in a linking of habitats.

- Between 1999 and 2003 Countryside Stewardship agreements for linear features included fencing (53 km), hedgerow management (26 km), hedgerow planting and restoration (97 km), restored boundary protection (26 km), stone wall repair (0 km) and stone wall restoration (1 km) representing about 5 per cent of the total estimated boundary length for the NCA (4,362 km).

- Since 2004 re-planting of hedgerows by farmers has helped restore habitat corridors and areas impacted by previous mineral working.

- Registered and unregistered parks are in Higher Level Stewardship agreements (HLS), such as Grimsthorpe Park with its associated SSSI and a variety of projects.

- There are various areas of calcareous grassland including SSSI and roadside verges. Many of these are managed under HLS. In some cases, for example at Hungerton, areas of species-rich grassland have been extended by grass re-creation and hay spreading adjacent to the species-rich area. A population of the rare Duke of Burgundy butterfly, a species associated with calcareous grassland, occurs around Grimsthorpe. There are also four spotted moths in Wood Nook Valley. Calcareous plants such as fluellens, have also been encouraged by using the cultivated margin and stubble options.

Agriculture

- Cereal production and oilseed crops have increased in the past ten years. Livestock numbers have altered between 2000 and 2009 with the numbers of sheep reducing by 30 per cent, cattle reducing by 6 per cent and pigs reduced by 83 per cent.

- Reversion to grassland and buffering of the River Gwash just north of Stamford through agri-environment schemes has ensured the river corridor is now substantially pastoral with improved biodiversity.

- In the past few years Environmental Stewardship has helped to retain and enhance important farmland bird populations and rare arable plants in the area. For example annually cultivated margins have been left untreated with chemicals to benefit both birds and plants in arable areas.

- The uptake of Countryside Stewardship for annual area features was above the national average since 1999 with emphasis on maintenance of lowland pastures on neutral/acid soils (771 ha), regeneration of grassland/semi-natural vegetation (365 ha), and lowland hay meadows (163 ha in 2003).

- A few small areas of vine production on south facing slopes have been trialled in recent years on the western fringe of the NCA.

Settlement and development

- There is a moderately high rate of development outside of urban and fringe areas but development is scattered throughout the NCA and has had little overall impact, except in the north-east around Billingborough and near the A1 main road with a major impact locally.

- The NCA has seen a high level of interest in renewable energy with single, small-medium wind turbine applications at farm level and this will contribute to landscape change. There has been an increase in planning applications for solar farms over 50 ha in size.

Semi-natural habitat

- Conservation management has been beneficial in SSSI woodlands such as Pickworth Great Wood and in SSSI quarries such as Clipsham. In the latter grazing and scrub management have been re-introduced to benefit the limestone flora and butterfly interest.

Historic features

- There has been limited uptake of Environmental Stewardship agreements for the management of historic features in agricultural areas However the protection of archaeological features such as Scheduled Ancient Monuments has improved, for example at the moated site in Essendine, where invasive scrub was removed and grazing is being re-introduced, the Woodhead former castle site where grazing has also been re-introduced and on part of the Great Casterton Roman occupation site which was reverted to grassland.

- In 1918, about 4 per cent of the NCA was historic parkland but by 1995, 51 per cent of this was estimated to have been lost. About 63 per cent of the remaining parkland is covered by a Historic Parkland Grant and 26 per cent is included in an agri-environment scheme.

- It should also be noted that many historic farm buildings remained unconverted. Most are intact structurally but dereliction of isolated farm buildings and agricultural units is likely.

Rivers

- Several of the water bodies are failing to meet Water Framework Directive 'good' ecological status/potential, although this can reflect habitat as well as water quality.

- A section of the River Eye is within the River Eye I priority catchment and has a 'moderate' ecological potential. Pollutants and sediments entering water courses as a result of soil and nutrient run-off and livestock directly accessing watercourses are identified as issues within this priority catchment.

- The potential ecological status of the Gwash is 'moderate'. The Welland has 'poor' ecological potential until it is joined by the River Gwash where the Welland becomes 'moderate'. Higher Level Stewardship schemes are in place alongside the River Witham. These are helping to protect the water quality which is particularly important for the native crayfish that are present.

- The section of the River Witham which falls into the NCA area is classified as 'moderate' ecological status upstream of Great Ponton, and 'moderate' ecological potential downstream of Great Ponton. However, two of its tributaries within the NCA area, the Wyville Brook and upper part of the Cringle Brook, are classified as 'good' ecological status.

- The north-east part of the NCA covers some of the tributaries of the South Forty Foot system. The majority of this system is at 'moderate' ecological potential.

Minerals

- Limestone quarries are present in the NCA but several of these are now disused.

- Working quarries are found on the border of the NCA including Ketton Cement Works, which visually impacts on the NCA and the Nottinghamshire and Leicestershire Wolds NCA.

- Extensive quarrying for ironstone was carried out near Colsterworth until the 1970s.

Drivers of change

Climate change

A summary of climate change risks for the East Midlands[8] indicates that:

- There is a possibility of an increase in the number of flood events, affecting the farmland.

- Higher summer soil moisture deficits would increase the water demand for irrigation to maintain crop yields and quality.

- Increasing demand for water resources in an area of low rainfall may limit agriculture, and/or impact on water quality and freshwater habitats. There may also be an increase in the need for water storage reservoirs on farms for watering crops and stock.

- An increasing demand for water supply is likely and an increase in peak flows. If air temperatures rises, so will water temperatures particularly in shallow stretches of rivers and the surface waters of lakes, reducing levels of dissolved oxygen. The rivers, streams and reservoirs may become unsuitable for certain species and increased summer temperatures may see an increase in the incidence of algal blooms on some of the larger water bodies.

- If stream flows peak earlier in the spring, owing to warmer temperatures, then low flows will begin earlier in the summer and last longer into the autumn. These changes will stress aquatic plants and animals adapted to specific flow conditions.

- Summer droughts may lead to deterioration of habitats such as fens and grazing marsh.

[8] http://www.climate-em.org.uk/images/uploads/East midalnds-NewText-2Apdf.pdf, Climate East Midlands (2012)

- There may be a move towards new crops or increased yields from traditional crops due to warmer conditions.
- New conditions may favour generalist species, pests, diseases and invasive non-native species, leading to a reduction in biodiversity and/or disrupting habitats.
- Phenological mismatch may lead to a disruption of food species thus putting species and ecosystem services at risk; for instance, a decline in invertebrates could affect breeding birds.
- In addition, more frequent and more intense storm events may increase the amount of surface water run-off from agricultural land, thus increasing diffuse pollution from sediment and nutrient run-off.
- Pests and diseases new to the area may occur as a result of increased temperatures. Changes in species composition, and damage or loss to trees through increased prevalence of pests and diseases, wind-blow and fire. There is a risk of loss of traditional woodland species.
- Climate change may bring increased risk of soil erosion and unstable ground as a result of long periods of drought followed by intense rain. It may lead to increased risk of flooding and potentially alter the courses of rivers and streams.

Other key drivers

- Housing expansion could impact on the local landscape, placing more demands on the water available in the aquifer, but also creating opportunities to improve green infrastructure and provide links to the adjacent countryside for both access and biodiversity.
- As population size increases there will be increased demand for housing. The main area of growth will be to the south of Grantham where a large-scale sustainable urban extension is already planned. Bourne and Stamford, as the largest settlements in this NCA, are also likely to experience growth.
- Continuing pressure for water for domestic, industrial and agricultural use may lead to the lowering of water tables and impacts on watercourses downstream.
- Agricultural developments such as new crops, along with an increased demand for water for crop irrigation, may lead to the construction of further reservoirs.
- The demand for renewable energy is likely to increase and the area has already seen a recent rise in wind and solar energy schemes.
- Economic conditions may alter to make the extraction of minerals such as ironstone, an attractive prospect again. Demand for limestone, sand and gravel is likely to continue or even increase and it is therefore likely that existing quarries will need to be extended and new quarry sites found. While these may impact negatively on the landscape and environment in the short term, they will also create opportunities for landscape enhancement, habitat creation and recreation, and provide opportunities for interpretation, understanding and research into the geodiversity and landscape processes of the area.

Supporting document 3: Analysis supporting Statements of Environmental Opportunity

The following analysis section focuses on a selection of the key provisioning, regulating and cultural ecosystem goods and services for this NCA. These are underpinned by supporting services such as photosynthesis, nutrient cycling, soil formation and evapo-transpiration. Supporting services perform an essential role in ensuring the availability of all ecosystem services.

Biodiversity and geodiversity are crucial in supporting the full range of ecosystem services provided by this landscape. Wildlife and geologically-rich landscapes are also of cultural value and are included in this section of the analysis. This analysis shows the projected impact of Statements of Environmental Opportunity on the value of nominated ecosystem services within this landscape.

The Upper Witham supports native crayfish, an internationally important species.

Statement of Environmental Opportunity	Ecosystem service: Food provision	Timber provision	Water availability	Genetic diversity	Biomass provision	Climate regulation	Regulating water quality	Regulating water flow	Regulating soil quality	Regulating soil erosion	Pollination	Pest regulation	Regulating coastal erosion	Sense of place / Inspiration	Sense of history	Tranquillity	Recreation	Biodiversity	Geodiversity
SEO 1: Manage and enhance the agricultural landscape and soils of the Kesteven Uplands, continuing the long tradition of mixed farming which has shaped the area, securing viable and sustainable food production, while seeking to enhance biodiversity and improve water quality and availability.	↑	↑ **	↗ *	n/a	↗ ***	↔ *	↗ ***	↗ **	↗ ***	↗ **	↑ ***	↗ **	n/a	↑ ***	↗ ***	↗ **	↗ **	↗ ***	↗ ***
SEO 2: Protect and significantly increase the extent, quality and connectivity of the unimproved and limestone grasslands throughout the NCA, to enhance biodiversity, ecological networks, water availability and quality, climate regulation and sense of place.	↗ *	↗ ***	↗ ***	n/a	↔ **	↗ *	↗ ***	↗ *	↗ *	↗ *	↑ **	↗ *	n/a	↑ ***	↗ ***	↗ ***	↗ ***	↗ ***	. ***
SEO 3: Manage and expand the native woodlands throughout the Kesteven Uplands to reinforce the area's wooded character, benefit biodiversity, increase the potential for biomass, access and recreation, and help to regulate climate change and water quality.	↔ ***	↑ ***	↗ ***	n/a	↔ **	↗ *	↗ **	↗ **	↗ **	↗ **	↗ **	↗ **	n/a	↗ **	↗ **	↗ **	↗ **	↗ **	↔ ***
SEO 4: Protect, manage and promote the area's rich historic environment including the significant limestone geology, the historic parklands, the manor houses and medieval monastic buildings, and deserted medieval villages, improving access and interpretation to enhance people's understanding and enjoyment of the landscape.	↔ ***	↔ ***	↔ ***	n/a	↔ ***	↗ *	↔ ***	↔ ***	↔ **	↔ ***	↔ ***	↔ ***	n/a	↑ **	↑ **	↑ **	↑ **	↑ **	↑ **

Note: Arrows shown in the table above indicate anticipated impact on service delivery ↑=Increase ↗ =Slight Increase ↔=No change ↘ =Slight Decrease ↓=Decrease.
Asterisks denote confidence in projection (*low **medium***high) . =symbol denotes where insufficient information on the likely impact is available .

Dark plum =National Importance; Mid plum =Regional Importance; Light plum =Local Importance

Landscape attributes

Landscape attribute	Justification for selection
Free draining loamy soils on limestone plateau giving rise to productive cropping managed from large farmsteads.	■ Productive farmland, most of it managed in large units over 100 ha. ■ Predominantly arable (cereals, oilseeds, potatoes and other arable crops) with specialist pig and poultry farms. ■ Rectilinear fields arising from mostly 18th and 19th enclosures of the limestone plateau. Smaller fields adjacent to settlements and in the valleys. ■ The geology and soils have an influence on the landscape character, field patterns and land use. ■ Limestone walls most frequent in the south.
The field pattern is large to medium sized rectilinear fields. The boundaries are well-managed hedgerows or occasional drystone walls.	■ Rectilinear patterns of Parliamentary enclosure fields bounded by a mixture of drystone walls and hedgerows closure patterns and previous ridge-and-furrow farming practices. ■ Older, smaller field patterns are found around the villages, and some contain fossilised ridge-and-furrow earthworks, which are an important historic feature. ■ Importance of hedgerows for landscape character and as wildlife corridors. ■ John Clare wrote poetry about the impact of the Parliamentary enclosures.
The area is well wooded character, with areas of mixed, deciduous and some coniferous woodland.	■ Over 7 per cent of the area is covered by broadleaved and mixed woodland, with priority broadleaved woodland habitat and ancient semi-natural woodland. ■ Broadleaved woodland forms the majority of the wooded landscape with the remainder being coniferous and mixed woodland types. ■ Predominant tree species include ash, oak and sycamore. ■ The area has a strong hunting tradition and was once part of the former Royal Forest of Kesteven. ■ Woodland includes SSSI. ■ Numerous medium-sized woodlands, particularly across the mixed farmlands, clustered along water courses and on higher ground between East Glen and West Glen rivers.

Landscape attribute	Justification for selection
Fragmented limestone grassland often associated with wide verges of straight roads, often former drovers routes.	■ Species-rich calcareous grasslands often as fragmented habitat. ■ Roadside verges and local sites-Roadside Nature Reserves support a range of flowering species, creating important corridors for wildlife as well as attractive areas for travellers. ■ Roadside verges are sometimes 20 m wide supporting assemblages associated with species-rich limestone grasslands including plant species and insects such as grizzled skipper, dingy skipper and green hairstreak. ■ Historic land use evidence in the form of ancient ridge and furrow markings contributes to the cultural history.
Open, rolling agricultural landscape with views.	■ Few trees on the higher ground -this quality is key to the sense of place of the NCA. ■ Views enjoyed from higher ground.
Dispersed settlement patterns and buildings constructed from local building stone.	■ Attractive villages with buildings of characteristic local limestone or stone/ brick buildings. ■ Collyweston Slate roofing with its blue colour, is strongly characteristic .where found in the area. Elsewhere the stone and pantiles characterise the distinctive villages. ■ Most of the older dwellings are built of local honey-coloured Jurassic limestone.
Clear, fast-flowing watercourses.	■ The watercourses and water bodies give character to the area. ■ They provide public water supply and for agriculture but there are issues with availability. ■ Biodiversity of rivers such as the River Witham, which includes populations of native crayfish.
The parklands, with their important habitats and historic landscape features.	■ Parkland is characterised by large oak trees, which offer insights into the landscape history of the area and contribute to its biodiversity. ■ Grimsthorpe Castle with Deer Park and landscaped gardens. ■ The variety of semi-natural habitats in Kesteven Uplands derived from its basic soils and geology, resulting in limestone grassland.
Evidence of historic environment including Roman influence through roads, tracks, and medieval settlement, also evidence of abandoned villages.	■ Early settlement is visible including ancient monuments, linear boundary features and tracks. ■ Ermine Street runs north–south through the area. ■ Deserted and shrunken medieval villages probably deserted as a result of agricultural changes.

Landscape opportunities

- Protect, manage and restore the areas species-rich grasslands, particularly limestone grassland.
- Encourage mixed farming where appropriate to introduce more managed grassland into rotations and provide conditions suitable for more farmland birds and arable plants.
- Maintain and restore hedgerows and drystone walls, including replanting where necessary, to maximise their contribution to landscape character and biodiversity networks. Restore and introduce hedgerow trees into key locations to reinforce field patterns.
- Conserve and manage the open character of the Kesteven Uplands protecting long distance views.
- Manage and expand broadleaf woodlands where possible, conserving the predominant tree species that include ash and oak and considering successional tree planting to conserve the tree canopy in existing woodland. Manage existing wet woodland, and extend and buffer where possible.
- Manage and enhance existing parklands as appropriate, encouraging diversity of habitats and protecting veteran trees.
- Manage plantation woodlands to ensure their long term survival as landscape features, increasing the content of native broadleaved trees.
- Manage grassy verges to encourage greater species richness and to maintain them as a feature as former drovers' routes.
- Manage disused limestone, ironstone and sand quarries to retain their geological interest, and expand their habitats of interest, including limestone grassland.
- Restore disused ironstone quarries and sites, ensuring the creation of habitats such as species-rich grassland, heathland and broadleaved woodland and managing them to enhance biodiversity interest as well as strengthen local landscape character; provide access and recreation where appropriate.
- Protect stone-built vernacular architecture including farmhouses and use appropriate local materials and techniques when restoring vernacular architecture.
- In restoration schemes, ensure that new open water and wetland habitats are managed to contribute to the local landscape and enhance biodiversity interest.
- Conserve the vernacular of existing settlements by ensuring any new developments respect the established settlement pattern and use traditional building materials.
- Manage the urbanising influences on areas which have a high tranquillity rating and where light pollution is presently limited.

Ecosystem service analysis

The following section shows the analysis used to determine key Ecosystem Service opportunities within the area. These opportunities have been combined with the analysis of landscape opportunities to create Statements of Environmental Opportunity.

Please note that the following analysis is based upon available data and current understanding of ecosystem services. It does not represent a comprehensive local assessment. Quality and quantity of data for each service is variable locally and many of the services listed are not yet fully researched or understood. Therefore analysis and opportunities may change upon publication of further evidence and better understanding of the inter-relationship between services at a local level.

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Food provision	Fertile soils Arable fields Pasture Watercourses	Agricultural food production is an important service to the area. 15 per cent of the area is classified as Grade 2 agricultural soil and 78 per cent as Grade 3, with only 2 per cent Grade 4. Of a total farmed area of 55,244 ha, the majority is arable: 46 per cent cereals, 18 per cent oilseeds, 2 per cent cash roots, a small amount of stock feed and 7 per cent other arable. Grass and uncropped land makes up 21 per cent of the area. Arable fields predominate on the higher ground with heavier soils in the river valleys providing good grazing for cattle and sheep. The NCA supports around 10,000 cattle, 32,000 sheep and 4,000 pigs.	Regional	The landscape is mixed farmland; arable predominates but there are significant amounts of pasture. Mixed farming provides multiple benefits in terms of maintaining the level of food production, preserving the historic landscape character and benefiting biodiversity. Livestock numbers and movements in the pastoral areas need to be managed sustainably to avoid putting pressure on watercourses and soil quality. Climate change may lead to changes to agricultural areas with a possible further shift towards arable, increasing the risk of soil erosion. There could be impacts on the landscape of even more reduced water availability.	Opportunities exist to work with land managers and farmers to support food production and increase yields by optimising production while maintaining biodiversity, and historic and landscape character. Seek opportunities to enhance and expand semi-natural habitats, reinstate hedgerows and establish flower-rich margins in arable areas, creating a mosaic of habitat types that will benefit biodiversity, soil quality, carbon storage, water quality, and water availability. Enhance historic landscapes by working with land managers to alter cultivation practices to avoid damaging historic landscape patterns and buried archaeology, while maintaining levels of food production. Promote the management of traditional field boundaries including drystone walls. **Continued over...**	**Food provision** **Regulating soil erosion** **Regulating soil quality** **Water availability** **Regulating water quality** **Sense of place/ inspiration** **Biodiversity**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Food provision continued					**...continued from previous** Work with livestock farmers to promote Catchment Sensitive Farming to minimise impacts of farming practices on watercourses. Encourage sustainable use of water and seek opportunities to increase water availability through the creation of winter storage reservoirs.	
Timber provision	Woodlands and plantations	Existing woodland covers approximately 8 per cent of the NCA. Area of conifer plantation: 850 ha (1 per cent). Area of broadleaf woodland: 3,974 ha (6 per cent). Many types of woodland are managed for timber production[9] including Bourne Woods (owned by the Forestry Commission) some of which may be a part of the old 'Kesteven Forest'. The predominant tree species include ash, oak and sycamore. There are three sawmills in the area and wood fuel boilers and wood fuel suppliers.	Local	With limited woodland cover the timber industry is limited. The existing woodland cover is important in strengthening the landscape and there is scope for increasing the provision of low-grade timber. Expansion of woodland cover could increase climate regulation through sequestration of carbon and will be beneficial for biodiversity, soil quality and would reduce soil erosion and improve water quality. It would potentially benefit recreation and increase local provision of wood fuel.	Seek opportunities to increase woodland cover, particularly broadleaved woodland. Encourage landowners to regenerate and restore ancient woodland sites, in areas where it will not undermine other biodiversity resources. Encourage the management of existing woodlands, promoting sustainable management practices, (such as traditional coppicing and rotational wood fuel production), thus increasing carbon storage/sequestration; and improving the woodlands' resilience to climate change. Where appropriate, provide opportunities to increase access provision, such as new footpaths and bridleways.	**Timber provision** **Recreation** **Climate regulation** **Regulating soil erosion** **Regulating soil quality** **Regulating water quality** **Regulating water flow** **Biomass energy** **Sense of place/ inspiration** **Biodiversity**

[9] Bourne Woods Archive

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Water availability	Southern Lincolnshire Limestone aquifer Rivers Witham, East and West Glen, Gwash and River Welland	A major aquifer, the Southern Lincolnshire Limestone aquifer is located in the NCA. The aquifer is regionally important and large demands are placed upon it to meet domestic, industrial and agricultural needs.[10] The outcrop areas are mainly in the western tributary catchment of the West Glen. The tributaries of the West Glen provide recharge to the Southern Lincolnshire Limestone aquifer, but this leads to reduced flows in the West Glen and further downstream. The Gwash-Glen transfer scheme operates to augment flows in the River Glen. There are uncontrolled artesian boreholes discharging to waste located within the confined area of the aquifer: A capping programme has been implemented to seal or control many of the derelict bores in order to conserve the aquifer's resource. Part of the River Witham is 'over-licensed',[11] while the Glen, the East and West Glen and the Gwash are fully committed to existing users. Abstraction combined with low rainfall and sink holes in the river beds has resulted in the upper reaches of rivers; such as the East and West Glen, drying up for long periods and so are less able to support aquatic wildlife. The section of the River Welland in the NCA is fully committed to existing users.	Regional	Abstracted water is used for agriculture and public water supply. The aquifer and majority of the rivers have 'over licensed' or 'over abstracted' status. High levels of unsustainable abstraction create low flow levels that negatively impact on biodiversity and water quality. Drier summers as the climate changes are likely to exacerbate this problem. Increasing water availability through greater capture of rainfall on farms could increase agricultural outputs at times when irrigation is limited during periods of drought. There is a need to encourage practices that slow run-off and aid water infiltration so increasing ground water recharge. Promote expanding semi-natural habitats to increase groundwater recharge.	Opportunities exist for careful management of extraction, efficient use of water and seeking more sustainable sources of water supply. There are opportunities to develop sustainable water use, rainwater harvesting and winter storage reservoirs, water conservation measures in new developments and promote good soil management. Changes to crop selection will create opportunities and multiple benefits could be gained from increasing area of semi-natural habitats.	**Water availability** **Regulating water flow** **Food provision** **Biodiversity**
Genetic diversity	n/a	n/a	n/a	n/a	n/a	**n/a**

[10] *Welland Catchment Abstraction Management Strategy*, Environment Agency (2013)

[11] *Witham Catchment Abstraction Management Strategy*, Environment Agency (2004)

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Biomass energy	Existing woodlands	Existing woodland covers approximately 8 per cent of the NCA. This resource offers some potential for the provision of biomass.	Local	There is potential for the provision of biomass, both through bringing unmanaged woodland under management and as a by-product of commercial timber production. The NCA has a generally medium to high potential yield for short rotation coppice (SRC), with areas of medium potential yield around Bourne and Market Deeping in the east of the NCA and high potential yield in the area to the north of Stamford and around Burton-le-Coggles in the west of the NCA. The potential miscanthus yield in the NCA is generally medium, with some areas of high potential yield immediately to the east of Stamford and around Folkingham in the north-east. The area to the north of Stamford has low potential yield. An increase in the provision of SRC for fuel has potential to increase climate regulation, but could decrease the provision of food if located on farmland. For information on the potential landscape impacts of biomass plantings within the NCA, refer to the Natural England website: http://www.naturalengland.org.uk/ourwork/farming/funding/ecs/sitings/areas/003.aspx	Encourage the management of existing woodlands to provide wood fuel for local use. There is an opportunity to increase biomass provision. Small scale energy crop planting is possible but landscape impacts must be considered; growing renewable energy crops adjacent to existing woodland would reduce the visual impacts and concentrate sources of supply.	**Biomass energy** **Climate regulation** **Regulating soil erosion** **Regulating soil quality** **Biodiversity** **Timber provision**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Climate regulation	Soils Woodlands New woodland planting Permanent pasture Flood plain grazing marsh and fen	Carbon content of the soils within this NCA is generally low although soils under unimproved grasslands, woodlands and other semi-natural habitats have a carbon content of 5–20 per cent. Approximately 8 per cent of the area is woodland of which the majority is broadleaved. There is flood plain grazing marsh and fen habitat within the NCA	Local	The NCA offers limited climate regulation through carbon storage. Organic carbon levels in the intensively farmed soils of the NCA will be relatively low. Soil carbon storage will be higher under areas of woodland and permanent pasture/grasslands. Increasing the areas where carbon storage is higher would enhance climate regulation, with additional benefits including greater biodiversity, increased water capture and improvements to water quality. Carbon sequestration and storage in mineral soils can be raised by improving soil structure, steadily increasing organic matter inputs, and by reducing the frequency and area of cultivation. At present, much of the area's woodland is managed.	Seek opportunities to work with farmers and land managers to reduce fertiliser inputs, increase organic soil content. Seek opportunities to restore and expand semi-natural habitats. Increasing woodland condition will benefit carbon storage in soils. Encourage sympathetic planting of new woodland and hedgerows and ensure that new woodland creation is appropriately located.	**Climate regulation** **Biodiversity** **Sense of place/ inspiration**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water quality	Rivers: Witham West Glen East Glen Welland Gwash Aquifer Soils Woodlands, hedgerows, buffer strips	The NCA falls within a nitrate vulnerable zone (NVZ). A small section of the River Eye England Catchment Sensitive Farming (CSF) Priority Catchment is located within the NCA at Sproxton. The section of the River Eye within the NCA is currently classified as having an ecological status of 'moderate'. The north-east part of the NCA covers some of the tributaries of the South Forty Foot system. The majority of this system is at 'moderate' ecological potential. The section of the River Witham which falls into this NCA is classified as 'moderate' ecological status upstream of Great Ponton, with a 'moderate' ecological potential downstream. Two tributaries – the Wyville Brook and upper part of the Cringle Brook – are classified as 'good' ecological status. The potential ecological status of the River Witham and East Glen River is 'moderate'. The West Glen has a 'good' ecological status in its upper reaches which reduces to 'moderate' just south of Creeton. The potential ecological status of the Gwash is 'poor', but where it meets the River Welland near Stamford, this improves to 'medium' while the Welland has 'poor' potential ecological status until it is joined by the River Gwash.	Regional	The water quality within this NCA is generally in need of improvement. Many of the water bodies are failing to meet Water Framework Directive 'good' ecological status/ potential, although this can reflect other elements such as habitat condition as well as water chemistry and biota. Pollutants and sediments entering water courses as a result of soil and nutrient run-off and livestock directly accessing watercourses are identified as issues within this Priority Catchment. The River Eye catchment is characterised by heavy clay soils that are prone to compaction. High connectivity from fields to water courses has led to significant sedimentation and high phosphorous levels in the river. Advice focuses on improving soil condition to prevent run-off into the river. Most of the damage on heavy soils is caused when the soil is wet or waterlogged and therefore operations should be avoided in these conditions or mitigation measures taken. Over-abstraction of water can affect water quality and this is likely to become an increasing problem in the future. More extreme rainfall events as a result of climate change are likely to increase the risk of sediment and nutrient run-off, which could cause increased hydraulic scour and eutrophication effects. Warmer summers may raise water temperatures causing greater incidences of algal blooms and concentration of pollutants.	Work with the farming community to adopt best practice in soils, nutrient and pesticide management. Seek to minimise operations that might damage soils such as considering the need for a fine seedbed, timing mechanised operations to avoid compacting wet soils and dealing with any compaction appropriately. Managing agricultural land through extensive grazing, particularly adjacent to watercourses. Increasing the amount of riparian vegetation and strengthening hedgerow networks to protect watercourses by aiding the capture of chemicals/nutrients and filtering or slowing sediments and organic matter, preventing them from travelling into the watercourses. Reducing fertiliser inputs to improve the quality of the water flowing into the streams. Providing buffer strips of semi-natural vegetation around the water bodies and increase the quantity of reedbeds to naturally filter the water. Targeting the use of agri-environment schemes to deliver Water Framework Directive priorities.	**Regulating water quality** **Regulating water flow** **Regulating soil quality** **Regulating soil erosion** **Biodiversity**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water flow	Rivers Southern Lincolnshire Limestone Aquifer Semi-natural habitats	There are several main catchments within the NCA: the rivers Witham, West Glen, East Glen, Welland and Gwash. The main catchments in the NCA for the purposes of flood management are the River Witham Catchment[12] and the River Welland Catchment. The Environment Agency flood risk map[13] indicates that for much of the NCA flooding is not a major issue, although there are some areas of flood risk in the far east of the NCA in the lower lying areas and valleys. The River Welland Catchment Flood Management Plan[14] indicates that there is currently a risk of river flooding associated with the River Welland in Stamford. Upstream of Stamford the flood storage at Medbourne Brook and Great Easton flood storage reservoirs reduce flood waters entering the River Welland which provides some protection from flooding for areas downstream. **Continued over...**	Local	Localised flooding does occur and actions to mitigate these events could include investigation of land use changes, which could reduce run-off rates and lessen soil erosion from farmland. More intense rainfall events brought about by climate change may undermine the stability of river valleys and intensify erosion. Improvements to river corridors for example the establishment of semi-natural wetland habitats, grassland buffers and re-establishment of flood plains can reduce flow rates and provide additional water storage.	Seek opportunities to reduce bank and channel maintenance to help naturalise rivers and improve flows between the rivers and their flood plains. Encourage changes in land use, development of sustainable farming practices and environmental enhancement to mitigate an increase in flooding in the future, such as expanding semi-natural habitats, avoiding soil compaction, restoring hedgerows to slow over-land flows. Identify opportunities where existing water level control structures, such as mills and sluices, can be removed to improve fish passage and improve aquatic habitats.	**Regulating water flow** **Water availability** **Regulating water quality** **Regulating soil quality** **Regulating soil erosion** **Biodiversity**

[12] *The River Witham Catchment Flood Management Plan (CFMP) Summary Report*, Environment Agency

[13] Environment Agency flood risk maps

[14] *The River Welland Catchment Flood Management Plan (CFMP) Summary Report*, Environment Agency

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water flow continued		**...continued from previous** Flood walls are also in place in Stamford which offers some protection. The continued maintenance and inspection of flood protection measures including Medbourne Brook and Great Easton Brook flood storage reservoirs is proposed in the CFMP. It is also proposed that an environmental enhancement project to improve the state of the river Welland and its habitats will be undertaken, with reduced maintenance along Stamford Meadows providing the opportunity to improve the flow between the river and its flood plain and to improve wetland and aquatic habitats. Groundwater flooding has also been identified as a risk for parts of the River Glen catchment and for areas around Stamford when there are high groundwater levels within the underlying rock. There is a relatively low risk of flooding to people and property associated with the upper reaches of the River Witham, with river flooding infrequent and the consequences of flooding low. Proposals to reduce bank and channel maintenance will help naturalise the river and improve continuity with its flood plain.				

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating soil quality	Geology Soils Agricultural practices Woodlands Hedgerows	This NCA has six main soil types: ■ Shallow lime-rich soils over limestone, covering 42 per cent of the NCA. ■ Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils (35 per cent). ■ Freely draining lime-rich loamy soils (11 per cent). ■ Loamy soils with naturally high groundwater (4 per cent). ■ Loamy and clayey flood plain soils with naturally high groundwater (3 per cent). ■ Freely draining slightly acid but base-rich soils (2 per cent).	Regional	The slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils may suffer compaction or capping as they are easily damaged when wet. In turn this may lead to increasingly poor water infiltration and diffuse pollution as a result of surface water run-off. The relatively small area of freely draining slightly acid but base-rich soils can be susceptible to capping and slaking, increasing the risk of soil erosion. These soils need to be managed carefully including timing of cultivations and maintenance of vegetation. The shallow lime-rich soils over limestone and the freely draining lime-rich loamy soils are typically shallow and droughty but due to their calcareous nature have a degree of natural resilience. They are valuable for aquifer recharge, requiring the maintenance of good structural conditions to aid water infiltration and the matching of nutrients to needs to prevent pollution of the underlying groundwater. Management measures that increase organic matter levels can help reduce these problems.	Encourage sustainable farming practices such as reducing stocking rates and machinery operations on more vulnerable soils during protracted wet periods, encouraging permanent leys to improve soil structure, minimising cultivation, steadily increasing organic matter content, and ensuring appropriate grazing levels to prevent erosion and compaction.	**Regulating soil quality** **Regulating soil erosion** **Regulating water quality** **Regulating water flow** **Climate regulation**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating soil erosion	Woodlands Hedgerows Reedbeds Pasture	Half of the NCA has soils that are generally not susceptible to soil erosion; the slowly permeable, seasonally wet, slightly acid but base-rich loamy and clayey soils and the loamy and clayey flood plain soils with naturally high groundwater have a low erosion risk, as do the loamy soils with naturally high groundwater except where coarser textured variants occur on sloping or uneven ground. By contrast, shallow lime-rich soils over limestone and the lighter textured freely draining lime-rich loamy soils are at risk from erosion particularly on sloping cultivated ground or where bare soil is exposed. The relatively small area of freely draining slightly acid but base-rich soils can be susceptible to capping and slaking, increasing the risk of soil erosion.	Regional	The shallow lime-rich soils over limestone, the lighter textured freely draining lime-rich loamy soils (particularly on sloping cultivated ground or where bare soil is exposed), and the freely draining slightly acid but base-rich soils need to be managed carefully to reduce risks of erosion with careful timing of cultivations and maintenance of vegetation cover. A small section of the River Eye Priority Catchment is located in the far west of the NCA. Soil erosion is identified as an issue within this catchment, particularly from bank erosion and direct deposition into water courses from livestock (directly accessing watercourses), and erosion from mixed and livestock farming practices. The potential for soil erosion is exacerbated where organic matter levels are low after repeated and frequent arable cultivation or where soils are compacted. There is the potential for wind erosion on some coarse-textured cultivated variants.	Review farming practices, promoting good soil management through initiatives such as Catchment Sensitive Farming, managing livestock movements to minimise poaching and erosion (particularly in riparian zones), buffering water courses, and encouraging the use of in-field margins, green manure crops and winter stubbles. Seek opportunities to decrease the frequency and intensity of cultivation on vulnerable slopes. Increase woodland cover and shelterbelts, and restore 'gappy' hedgerows and drystone walls that are in poor condition, to act as wind breaks.	**Regulating soil erosion** **Regulating water flow** **Regulating soil quality** **Biodiversity**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Pollination	Species-rich grasslands Arable margins Road verges Hedgerows	The semi-natural grasslands and arable margins in the NCA provide some nectar sources for pollinating insects. A network of species-rich verges and hedgerows is found throughout the area. However, they are limited in extent and distribution. Many of the roads have wide verges with some flowering plants.	Local	Pollinators play a vital role in food provision, pollinating crops such as oilseed rape, but research shows that their numbers have declined sharply. Providing suitable nectar sources at a landscape scale and the habitat structures required for other stages of their life cycles should help to address this. The hedgerows and grasslands provide good corridors and habitats for pollinators. Species-rich hedgerows, managed to maintain a diversity of structure and maturity, provide the best sources and networks for pollinating invertebrates to move through and between food crops.	Enhance the quality, extent and interconnectivity of the networks of woodland, semi-natural grassland, hedgerows, road verges and arable margins, to bring a structural diversity and a variety of flowering plants that can provide breeding sites and a food source for pollinators throughout the season.	**Pollination** **Pest regulation** **Biodiversity** **Food provision** **Sense of place/ inspiration** **Regulating soil erosion** **Regulating soil quality** **Climate regulation**
Pest regulation	Semi-natural habitats Hedgerows Arable margins Road verges	The semi-natural habitats, hedgerows, margins and verges support a variety of predatory species which can contribute to the regulation of pests. The parklands and ancient and semi-natural woodlands contain important and veteran trees which support predator species.	Local	Regulation of pest species can be encouraged through the provision of appropriate habitats and resources, and by reduction in pesticide-induced mortality of natural predators. Resources required by natural predators include pollen and nectar, shelter habitats, alternative prey and an appropriately structured environment. These resources can be provided by hedgerows and banks, buffer strips on cultivated land, wild bird and nectar mixtures, undersown spring cereals and enhanced stubbles, beetle banks, low input and species-rich grasslands and upland meadows. There are benefits to encouraging biological control and surveys indicate the importance of establishing grass or wildflower margins around arable fields.	Enhance the interconnectivity of the networks of habitats including grassland, hedgerows, road verges and arable margins, to bring a structural diversity and a variety of flowering plants that can provide breeding sites for predator species while also benefiting, for example, farmland birds.	**Pest regulation** **Pollination** **Food provision** **Biodiversity**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of place/ inspiration	Rural views Rivers Woodlands Parkland Pastoral areas Stone walls and buildings Country houses	A sense of place is provided by the rolling nature of this landscape, dissected by rivers including the Witham, East Glen and West Glen. The mixed farmland combines arable with pasture; hedgerows, meadows and wide road verges. Significant areas of medium-sized woodland, both semi-natural and ancient, give the area a wooded character. The wealth of distinctive parklands with veteran trees surrounding large country houses such as the Grimsthorpe estate add to this wooded character. Picturesque villages and towns with buildings constructed from the local limestone, with roofs of red pantiles or the local Collyweston slate, occur in a dispersed settlement pattern, evenly distributed throughout the area with the exception of the line of settlements along the edge of the Fens to the east and a cluster of larger villages around Stamford. Aside from the built form, local geology is reflected in the drystone walls in the south of the area, and in the exposed geological features including characteristic limestone and ironstone quarries. A number of redundant Second World War airfields are still evident in exposed, elevated locations. Woolsthorpe Manor, (National Trust) the birthplace of Sir Isaac Newton, is a visitor attraction. The area also has strong literary links to the poet John Clare who was born in Helpston. Senses of inspiration and escapism are associated with the intimate landscape of small woodlands, stone villages, parklands and halls which contrasts with the more open, elevated arable areas with exposed, distant views.	Local	A sense of place can be impacted by changes. There is pressure for housing and renewable energy; potential neglect of boundaries and demand for greater provision of food. There are also opportunities to enhance the sense of place. Management to maintain locally distinctive features and elements is also likely to increase the sense of history and benefit biodiversity. Threats to the sense of place and character include the pressure for housing and renewable energy, neglect of boundaries, as well as increasing demand for greater food provision.	Working in partnership with local organisations and landowners and managers to provide services that will contribute to sense of place such as increasing woodland cover, restoring hedgerows, naturalising river channels. Management to maintain locally distinctive features that define the Kesteven Uplands including the agricultural landscape, ancient woodland, the limestone grassland the nucleated villages, the local building materials and the open views.	**Sense of place/ inspiration** **Sense of history** **Recreation** **Biodiversity**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of history	Ancient earthworks Roman routes and settlements Deserted medieval villages Areas of ridge and furrow Historic field patterns Significant historic buildings Parklands and manor houses Quarries Airfields	A sense of history is reflected in the main transport routes such as the A1 which follows the route of the Roman Ermine Street. There is visible archaeological evidence concentrated along the route, such as Roman settlements and later the medieval monastic influences such as Vaudey Abbey and the Templar Preceptory (at South Witham). The area includes a large concentration of deserted medieval villages. The history of farming can be traced through small-scale, irregular medieval fields, areas of ridge and furrow, ancient track ways and boundary features such as dry limestone walls and ancient hedgerows. Historic character is further reinforced by the picturesque villages constructed in local materials. Notable examples of the worked stone are evident in Stamford which is important for its medieval and Georgian buildings. Other key historic features include the historic parklands with their large houses linked to growth of the wool trade. Landscape features exist such as curving woodlands and cuttings alongside former light railways and truck roads related to the ironstone mining industry. Places with historic interest with access for the public include the designed parklands and large country houses such as Burghley House, Grimsthorpe Castle and Woolsthorpe Manor. There are six Registered Parks and Gardens covering 1,888 ha, 88 Scheduled Monuments and 1,795 Listed Buildings.	Regional	By managing and interpreting the historic attributes there is the potential to provide opportunities for education, recreation and tourism.	Working in partnership with landowners and managers, relevant local organisations, and English Heritage to encourage the management and conservation of historic parklands. Encourage the restoration and maintenance of Scheduled Monuments, traditional buildings and drystone walls. Ensure new developments respect the historic settlement patterns and reflect the local vernacular. Work with land managers to ensure land management practices do not damage historic features and recognising the potential for undiscovered below-ground archaeology. Protect and manage historic sites and features, providing interpretation and access to enhance public understanding and enjoyment. For example, the important Roman remains at Great Casterton, working with local estates to continue sensitive management of sites and features. Supporting volunteer initiatives and continued close working with community groups such as natural history societies.	**Sense of history** **Sense of place/ inspiration** **Geodiversity** **Recreation**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Tranquillity	Woodlands Open views Parklands Meadows Picturesque villages	The 'Intrusion Map 2007' provided by the Campaign for the Protection of Rural England (CPRE), shows over 61 per cent of the NCA is classified as 'undisturbed' (down from 83 per cent in the 1960s). This is a rural landscape with many remote areas away from the main settlements. A sense of tranquillity is associated with the picturesque villages, extensive woodlands and parklands as well as the meadows of the rural landscape. Disturbance is associated with the transport corridors (including the A1, A15, A16, A52 and A6121) and the urban centres of Grantham to the north and Stamford.	Local	According to data collated by CPRE, the area of undisturbed territory is declining. Many parts of the area have a feeling of remoteness, especially in the well wooded areas. Increasing tranquillity through expanding areas of woodland could increase biodiversity and natural beauty, and enhance the sense of place and the settings of the numerous heritage assets. Promote the restoration of parkland which is important in the NCA. Explore improvements to access where there are publicly accessible parkland and gardens.	Protect core areas of the NCA where intrusion is low. Seek opportunities to expand areas of woodland and create new woodlands in the NCA, enabling public access and recreation where appropriate Increase tree planting around new developments to reduce their impact on the surrounding countryside. Protect and restore the open parklands which provide a connection with nature and a tranquil recreational resource. Raise awareness of the numerous heritage assets for their cultural value while maintaining a balance between undisturbed areas and public access.	**Tranquillity** **Sense of place/ inspiration** **Biodiversity** **Recreation** **Regulating soil erosion** **Regulating soil quality** **Regulating water quality** **Regulating water flow**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Recreation	Rights of way network Open access land Long-distance trails Forestry Commission woodlands Country houses and parklands Nature reserves	Only 2 per cent of the NCA is publically accessible. The NCA offers a network of rights of way totalling 684 km at a density of nearly 1 km per km^2, as well as open access land covering 22.6 ha (just under 0.05 per cent of the NCA). There are a number of long distance trails such as the Viking Way, and these, along with country lanes and ancient trackways provide some good opportunities for walking and cycling in the countryside. There are many accessible woodlands in the NCA (1,569 ha of Woods for People) including Bourne Woods and its Easy Access Trail. There are six Registered Parks and Gardens covering 1,888 ha. Country houses and parklands such as Burghley House, Grimsthorpe Castle and Woolsthorpe Manor, (National Trust) provide recreational opportunities. The Cribbs Meadow NNR and Local sites and roadside nature reserves are important.	Local	There is limited existing visitor pressure. New recreational opportunities should be sought with careful consideration given to the impacts on tranquillity and biodiversity. Current recreational opportunities include woodland trails, bird watching, walking, cycling, horse-riding and tourist attractions such as country houses and parklands. New opportunities should be explored such as at Stamford which is already well connected with the River Welland, and the improving water quality of the nearby Gwash could bring fishing. Restoration of mineral workings could provide recreational opportunities.	Promote the recreational and educational opportunities afforded by the assets of the NCA in the natural and built environment, improving access and interpretation. Maintain and enhance the network of footpaths and bridleways, encouraging the responsible use of the area by visitors. Maintain and extend access and recreational opportunities in woodlands and other natural environments for walkers, cyclists, horse riders, and other users, providing suitable provision for all abilities. Examples include the Forestry Commission's Easy access trails at Bourne Woods (FC). Explore opportunities to increase access through working in partnership with landowners and managers, local authorities, the Forestry Commission and through Local Access Forum. Increasing green infrastructure links to connect to surrounding towns such as Grantham and Peterborough in adjacent NCAs.	**Recreation** **Sense of place/ inspiration** **Biodiversity** **Regulating water quality** **Regulating soil erosion** **Sense of history**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Biodiversity	Sites designated for nature conservation Priority habitats Streams and rivers Hedgerows, road verges and arable margins	There are over 3,198 ha of priority habitat covering 5 per cent of the NCA area. These include broadleaved woodland, calcareous grassland, fen, grazing marsh, reedbeds and meadows. One per cent of the NCA is nationally designated as Sites of Special Scientific interest. Grimsthorpe SSSI and SAC is probably the best remaining example of ancient parkland in Lincolnshire, thought to date from the 12th century. Ancient and mature trees support more than 250 species of beetle and provide bat roosts. The site lies partly on boulder clays and partly on the Lincolnshire limestone, and therefore supports varied ground flora. There is a population of rare Duke of Burgundy butterfly on calcareous grassland around Grimsthorpe. There are also rare Four spotted moths in Wood Nook Valley. Several disused stone quarries support a rich limestone flora such as Clipsham Old Quarry and Pickworth Great Wood SSSI, which also contains one of the largest blocks of deciduous woodland in the county with stands representative of ancient semi-natural woodland on clay soils. Slow worms breed in the disused quarry. **Continued over...**	National	The mosaic of calcareous grassland, meadows, purple moor grass and rush pasture, and wetter habitats including woodlands, streams and rivers, fen and reedbeds are important for wildlife. By managing and extending the area of these habitats, there can be benefits for soil and water quality, climate regulation and recreation as well as creating more resilient habitat networks. Many of the woodlands are important because they are ancient semi-natural woodlands (ASNW) supporting many species including rare invertebrates and plants. In some areas, a reduction in woodland management is leading to a decline in biodiversity. Loss of ancient trees in the historic parklands/woodlands due to old age is adding to the erosion of character. Limestone grassland (calcareous) is now confined to small fragmented sites such as nature reserves, quarry sites and roadside verges. A strategy is in place to secure the future of these calcareous grasslands. The Calcareous plants, for example, fluellens, have been encouraged by using the 'cultivated margin and stubble options' in Environmental Stewardship. The Living Landscapes[15] projects are helping wildlife adapt to climate change, improving access for people, and providing volunteering opportunities and skills training. **Continued over...**	Encourage partnership working with landowners and managers to ensure woodlands are carefully managed and extended where possible for priority habitats and multiple benefits. Encourage landowners and managers, local authorities and quarry operators to work together to protect and enhance the limestone grassland, geology and landscape of this area. Work in partnership with the farming community and landowners to maintain and enhance the quality of grasslands, grazing marsh and fen, and extend these habitats wherever possible. Working with landowners to conserve the historic parklands and associated grasslands, encouraging best practice in pastoral management including encouraging longevity of veteran trees and the planting of new specimens. Supporting appropriate connection and expansion of areas of woodland and permanent pasture. **Continued over...**	**Biodiversity** **Sense of place/ inspiration** **Regulating water quality** **Regulating soil erosion** **Recreation** **Climate regulation**

[15] Life on the Verge, Lincolnshire Wildlife Trust

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Biodiversity continued		**...continued from previoous.** Abundant hedgerows, road verges, grass margins and meadows provide natural corridors through the farmed landscape and the area is recognised as nationally important for the assemblage of farmland birds it supports.		**...continued from previoous.** The Southern Lincolnshire Limestone includes priority species such as; dingy skipper, grizzled skipper, Duke of Burgundy butterfly, large garden bumblebee, four-spotted moth, skylark, grey partridge, purple milk-vetch, basil thyme, pasque flower, chalk eyebright, field gentian and man orchid. River and streams support plentiful wildlife. Some species such as the native crayfish are internationally important and watercourses and riparian zones need to be carefully managed to protect these. Maintaining and enhancing the network of unimproved pastures, meadows, hedgerows, grass margins and road verges is critical to maintaining the connectivity of the farmed environment, supporting the farmland bird assemblage and protecting certain rarer species.	**...continued from previoous.** Manage habitats for the species and assemblages for which this NCA is recognised as nationally important. Enhance water quality of the watercourses and naturalise river channels wherever possible. Work with landowners and managers to maintain and enhance the network of unimproved pastures, meadows, hedgerows, grass margins and road verges to maintain the connectivity of the farmed environment.	

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Geodiversity	Topography Quarries Local building materials Designated sites Local Geological Sites Industrial heritage	The landform exemplifies the link between geology and topography. Jurassic geology overlain by glacial till and boulder clay has produced moderately fertile soils. There are two geological SSSI (Castle Bytham Quarry SSSI and Sproxton Quarry SSSI) and two mixed interest SSSI (Ketton Quarry SSSI and Clipsham Old Quarry and Pickward Greatwood SSSI). There are 20 Local Geological Sites within the NCA. The exposed geological features include the characteristic limestone and ironstone quarries. The SSSI quarries provide some of the finest and most complete sections of the Lincolnshire Limestone Formation and rare ammonite fossils. Most of the older dwellings are built of local limestone which reinforces the links between the geology and human habitation. Aside from the built form, local geology is reflected in the drystone walls in the south of the area.	Regional	The legacy of quarrying for stone contributes to the industrial heritage and to the character of the NCA and beyond. The NCA supplied stone for the construction of the Cambridge colleges and Ely Cathedral. Local building stone is still available, and is used in construction, enhancing local distinctiveness. Protecting the geology and encouraging continued research, interpretation and understanding of the geodiversity of the NCA is important. Abandoned quarries are of both geological and nature conservation interest.	Improve the condition of designated sites through restorative management plans, thus ensuring continued access to important sections and mineral veins for education and research. Work in partnership to further the objectives and aspirations of the Local Geodiversity Action Plan. Restorative management of Local Geological Sites offers opportunities for volunteering and reinforces links between local residents and the area in which they live. Improve access to and interpretation of geological sites and features, exploring and explaining the links between the geology, landscape, biodiversity and cultural heritage of the area to enhance the public's understanding and enjoyment of these assets. Manage geological exposures throughout the Kesteven Uplands in former quarries and small-scale excavations by the removal of undergrowth and the prevention of fly-tipping on these sites. Maintain and restore vernacular buildings and drystone walls using local stone wherever possible to reinforce links with the underlying geology and strengthen sense of place.	**Geodiversity** **Biodiversity** **Sense of place/ inspiration** **Sense of history** **Recreation** **Water availability**

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