National Character Area profile:

46. The Fens

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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.

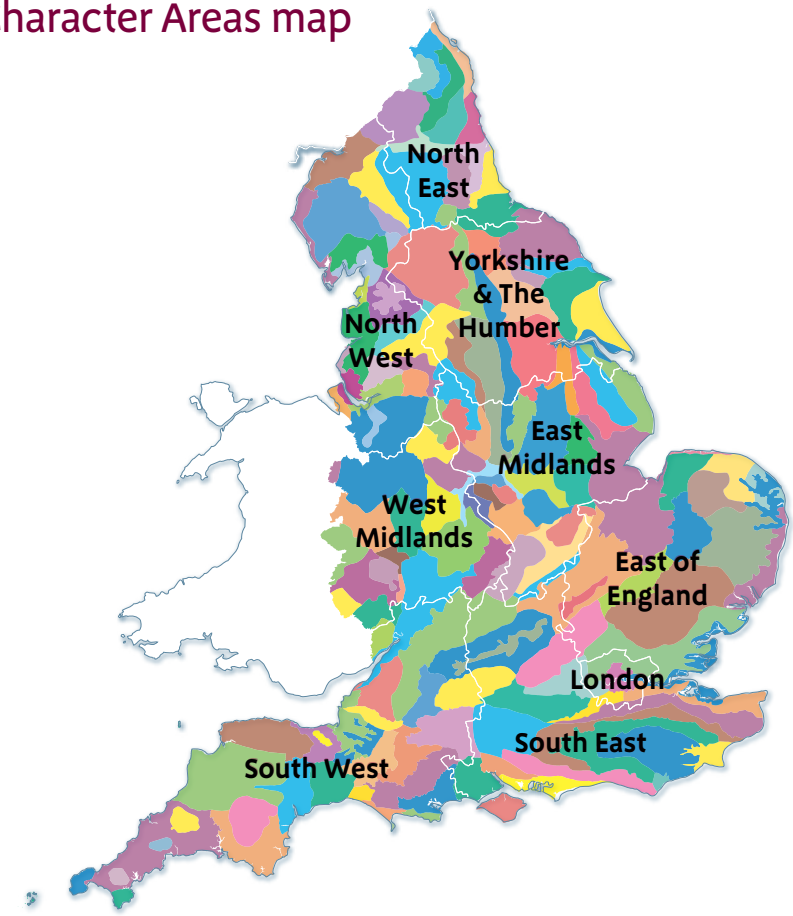
NCA profiles are guidance documents which can help communities to inform their decision-making about the places that they live in and care for. The information they contain will support the planning of conservation initiatives at a landscape scale, inform the delivery of Nature Improvement Areas and 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 Fens National Character Area (NCA) is a distinctive, historic and human-influenced wetland landscape lying to the west of the Wash estuary, which formerly constituted the largest wetland area in England. The area is notable for its large-scale, flat, open landscape with extensive vistas to level horizons. The level, open topography shapes the impression of huge skies which convey a strong sense of place, tranquillity and inspiration. One per cent of the NCA falls within the Norfolk Coast Area of Outstanding Natural Beauty.

It is a large, low-lying, flat landscape with many drainage ditches, dykes and rivers that slowly drain towards the Wash, England's largest tidal estuary. The single obvious factor uniting the Fens is the low-lying, level terrain reflecting its geological past. With the exception of the Isle of Ely, which reaches above 20 m, elevations rarely pass the 10 m contour, and typically vary by little more than one or two metres over long distances. Much of the land is below sea level, relying on pumped drainage and the control of sluices at high and low tides to maintain its agricultural viability. The level horizons and the huge scale of the landscape create a strong sense of isolation and tranquillity, and a distinctive sense of place. There are, typically, large open panoramas and enormous skies, whose changing weather patterns have a strong influence on the observer. Four major rivers drain into the Wash: the Witham, Welland, Nene and Great Ouse. All rivers now have artificial canalised courses that run straight for long distances and are bounded by high banks to contain the watercourse from the lower adjacent fields.

The Fens are the bread basket of Britain. The drainage of this area from the 17th century onwards presented valuable soils which provide excellent conditions for large-scale cultivation of arable and horticultural crops; holdings of more than 100 ha make up 77 per cent of farmed land. As cultivation techniques have become more intensive, however, the soil resource is increasingly diminished through desiccation and erosion. Clays and silts laid down by marine incursions dominate the area abutting the Wash and extend inland along the rivers, forming the fertile horticultural soils of the silt fens. This area is now marginally higher in altitude than the inland peatlands which have 'wasted'. The fertile peat soils have been historically drained and managed to support national food production at the expense of other ecosystem services. Drained peat is more vulnerable to loss, particularly where the deposits are deep and the water table is kept artificially low. Peat wastage through shrinkage, oxidation and wind erosion is a long-term issue affecting the ecosystem services of the Fens.

The Wash includes salt marsh and mudflats that support large, internationally important populations of seals, waders and wildfowl, including pink-footed and Brent geese, shelduck, knots, oystercatchers, common terns and various plover species. It is accordingly designated a Ramsar site, a Special Area of Conservation (SAC), a Special Protection Area (SPA), a European Marine Site (EMS), a Site of Special Scientific Interest (SSSI), a National Nature Reserve (NNR) and a Local Nature Reserve (LNR). Other important wetland habitats include areas of relic old fen, washland, rivers, drains and a network of lesser drainage channels known locally as ditches, dykes or sewers.

Several SSSI in the Fens are designated for their buried interest – a geological record contained in the sediments of the Wash basin and fenland – making

an important contribution towards our understanding of the effects of climate and environmental change over millions of years. Also, the Oxford Clay and Kings Dyke brick pit have been very important for palaeontology, with major Jurassic reptiles including the pliosaur *Pachycostasaurus dawnii* unearthed here. *Leedsichthys*, the world's largest fish, was discovered in these sediments and is still being unearthed from them.

There is a long history of human occupation here, accounts of which can be found in the Historic Environment Records for Norfolk, Suffolk, Cambridgeshire, Peterborough and Lincolnshire. Early prehistoric sites are mostly deeply buried beneath the fen sediments or occur on the low slopes of the higher fen 'islands'. Scheduled Ancient Monuments of prehistoric to post-medieval date are located across the fens and many undesignated sites and monuments are known, again mainly from the fen edges and islands. However, Flag Fen is a site of international importance – a preserved, wooden, bronze-age platform and causeway crossing the marsh to the east of the Peterborough fen edge, off which votive deposits (symbolising a wish, desire or prayer) of bronze and iron tools, weapons and decorative items were thrown into the marsh.

Ancient remains of settlements or task sites are increasingly being discovered as the peat dries out across the fenland area, or through development – for example eight log boats were found in an ancient river channel along with associated riverside settlements at Whittlesey, and numerous artefact scatters of prehistoric to Roman sites are annually ploughed up where the peat is thinnest on the gravel island edges and emerging crests. The impressive Ely Cathedral is a major landmark dominating the Cambridgeshire peat fen from its location atop the Isle of Ely, as is 'Boston Stump' (St Botolph's Church, Boston) in the Lincolnshire silt fen, while similar island-top locations were also used for monastic and secular establishments across the fenland region (such as Ramsey, Thorney, Crowland and Chatteris). Lodes, slades and canals historically formed the early transport opportunities across the fens, commencing after the Roman conquest of Britain but increasingly in the late Saxon and medieval periods.

Authors Sir Harry Godwin and H.C. Darby have written major works on the Fens, and Rex Sly has chronicled the history of the Fens from Roman times until the present and written about fenland families and life in a series of three books published in the 2000s. Chris Gerrard has authored a book of work by fenland artists showcasing the landscapes and biodiversity of the Fens.

Although many of the Fens waterways are heavily embanked, limiting views across the landscape, water-based recreation is a popular pastime with a focus at Ely marina. Angling is popular here.

Click map to enlarge; click again to reduce

Statements of Environmental Opportunities:

- **SEO 1:** Manage the agricultural landscape and soils which allow the Fens to be a major provider of food and horticultural produce, while seeking to enhance opportunities for biodiversity.

- **SEO 2:** Manage the core wetland complexes and increase their connectivity by enhancing the main rivers, waterways and their associated riparian habitats and improve recreational access opportunities to the Fens.

- **SEO 3:** Plan for the creation of new coastal landscapes in the Wash area that are adapted and resilient to the impact of climate change, for the benefit of people and wildlife.

- **SEO 4:** Conserve, manage and enhance the Fens landscape and increase educational opportunities to access its geodiversity, archaeology and cultural heritage to enhance enjoyment and understanding for those who live and work in and visit the Fens.

The Fens today.

Description

Physical and functional links to other National Character Areas

The area abuts a number of other National Character Areas (NCAs). To the east lie North West Norfolk and The Brecks NCAs. To the south-east rises the gently rolling East Anglian Chalk NCA and to the south-west is the undulating Bedfordshire and Cambridgeshire Claylands NCA. To the west rise the gently shelving slopes of the Kesteven Uplands and the South Lincolnshire Edge NCAs. To the north-west the woods and gravel workings of the Central Lincolnshire Vale NCA gradually slope down to the Lincolnshire fens, while due north the Lincolnshire Wolds NCA rises to create a dominant 'upland' horizon. The Steeping River marks the quieter north-east boundary to the Lincolnshire Coast and Marshes NCA. The land boundary of the Fens is typically drawn along a series of catchwater drains, dykes, canalised rivers and lodes. To the north-east the Fens are bounded by the North Sea.

Four main rivers, the Witham, Welland, Nene and Great Ouse, drain much of the surface water from the East Midlands across the Fens. The rivers often flow in canalised channels before discharging into the large Wash estuary. The rivers and their associated networks of ditches and dykes provide ecological networks and functional links to other NCAs.

Marine processes strongly influence the physical and biological character of the Wash. Marine sediments originating from the eroding nearshore seabed off central Lincolnshire and the Holderness coast of East Yorkshire predominate, although some accreted sediments originate from further north. While much of this sediment settles within the Wash, some moves seaward again to help supply the coastal structures along the North Norfolk coast.

Due to its low-lying landform, views to and from the neighbouring NCAs strongly reflect their geology, particularly the higher ground of the gently rolling East Anglian Chalk NCA to the south-east, the undulating Bedfordshire Claylands to the south-west, and to the west the gradually shelving slopes of the Kesteven Uplands and the South Lincolnshire Edge NCAs, while due north the Lincolnshire Wolds NCA rises to create a dominant elevated horizon. There are vast, open views of the sky throughout and wide, flat panoramic views, particularly over the mudflats of the Wash in the east.

Fenland farming is nationally important with, for example, a quarter of England's potatoes grown here and over one-third of English vegetables. Agriculture is the major source of employment, with approximately 27,000 people employed either permanently or seasonally/temporarily throughout the year. Nearly 90 per cent of the Fens were classified as either Grade 1 or Grade 2 agricultural land under the Provisional Agricultural Land Classification (ALC) survey of the late 1960s and early 1970s. Peat wastage will have reduced this since then.

The Fens play host to several major transport links. The East Coast railway mainline cuts across the south-western corner and there are east–west rail passenger and freight lines running through the area. Major roads include the A47, the A16 and A17, among numerous other A roads which form transport corridors across the landscape. Other major infrastructure, such as power stations, major gas and electrical distribution networks, either supply surrounding NCAs or the Fens are supplied by them.

Distinct areas

- Open coastal marshes
- Drained coastal marshes
- Settled inland fens
- Open inland fens

Key characteristics

- Expansive, flat, open, low-lying wetland landscape influenced by the Wash estuary, and offering extensive vistas to level horizons and huge skies throughout, provides a sense of rural remoteness and tranquillity.
- Jurassic clays are overlain by rich, fertile calcareous and silty soils over the coastal and central fens and by dark, friable fen peat further inland. The soils are important for agriculture, which is hugely significant for the rural economy in the Fens. There are over 4,000 farms in the Fens; enough wheat is grown here annually to produce a quarter of a million loaves of bread and one million tons of potatoes are grown here. In addition to traditional vegetables, exotics such as pak choi are now cultivated. Some 40 per cent of England's bulbs and flowers are also produced in the Fens.
- The Wash is the largest estuarine system in Britain, supporting internationally important intertidal and coastal habitats influenced by constant processes of accretion and deposition, forming salt marsh and mudflats and providing habitats for wildfowl, wading birds and other wildlife, including grey seals and approximately 90 per cent of the UK's common seals. It also provides important natural sea defences and plays a key role in climate change regulation. Flood storage areas on the Nene, Cam, Lark and Ouse washes also provide significant biodiversity interest. True fen mainly occurs at remnant conservation sites, such as Baston or Wicken Fen.
- Overall, woodland cover is sparse, notably a few small woodland blocks, occasional avenues alongside roads, isolated field trees and shelterbelts of poplar, willow and occasionally leylandii hedges around farmsteads, and numerous orchards around Wisbech. Various alders, notably grey alder, are also used in shelterbelts and roadside avenues.
- The predominant land use is arable – wheat, root crops, bulbs, vegetables and market gardening made possible by actively draining reclaimed land areas. Associated horticultural glasshouses are a significant feature. Beef cattle graze narrow enclosures along the banks of rivers and dykes and on parts of the salt marsh and sea banks.
- Open fields, bounded by a network of drains and the distinctive hierarchy of rivers (some embanked), have a strong influence on the geometric/rectilinear landscape pattern. The structures create local enclosure and a slightly raised landform, which is mirrored in the road

Key characteristics (continued)

network that largely follows the edges of the system of large fields. The drains and ditches are also an important ecological network important for invertebrates, fish including spined loach, and macrophytes.

- The area is very rich in geodiversity and archaeology, with sediments containing evidence for past environmental and climate changes and with high potential for well-preserved waterlogged site remains at the fen edge, within some of the infilled palaeo-rivers and beneath the peat.

- Large, built structures exhibit a strong vertical visual influence, such as the 83 m-high octagonal tower of 'Boston Stump' (St Botolph's Church), Ely Cathedral on the highest part of the Isle of Ely dominating its surrounding fen, wind farms and other modern large-scale industrial and agricultural buildings, while drainage and flood storage structures and embanked rail and road routes interrupt the horizontal fen plain.

- Settlements and isolated farmsteads are mostly located on the modestly elevated 'geological islands' and the low, sinuous roddon banks (infilled ancient watercourses within fens). Elsewhere, villages tend to be dispersed ribbon settlements along the main arterial routes through the settled fens, and scattered farms remain as relics of earlier agricultural settlements. Domestic architecture mostly dates from after 1750 and comprises a mix of late Georgian-style brick houses and 20th-century bungalows.

Wisbech North Brink - the tidal River Nene and inland port.

The Fens today

The Fens are an expansive, flat, open, clay and peat landscape that slowly drains towards the Wash, England's largest tidal estuary. The obvious factor characterising the Fens is the low-lying, level terrain, with much of the land below sea level. The level horizons, large open panoramas and enormous skies create a strong sense of remoteness and isolation. The geological history and human intervention are strongly evident in this landscape, especially in the strong rectilinear drainage pattern that has long been used to make the land viable for agricultural production. The Fens are the bread basket of Britain and the silt and peat soils are a major and essential resource of national importance for agriculture, with wheat, vegetables and sugar beet of major value here.

The geology of the Fens can generally be described as glacial deposits on Jurassic and Cretaceous bedrock. During the Holocene (Flandrian) period, these were overlain by diverse deposits, including sands, silts, clays and peat. Elevated islands of Jurassic clay occur at the inner margins of the area where they may be overlain by Pleistocene tills or glacial sands and gravels. The soils over the wide central and coastal fens comprise rich, fertile, stoneless, calcareous, silty soils of marine origin; while inland there are swathes of dark, friable, organic-rich mineral soils and deeper fen peat, which contains partly fossilised trees known as 'bog oaks'. Due to wastage, the peats are becoming increasingly thin and in extensive areas only remnants of the former peat coverage still remain.

Agriculture is tremendously important to and in the Fens. Fenland farming is nationally important, with a quarter of England's potatoes grown on 25,000 ha here and more than a third of English vegetables on 29,000 ha. Sugar beet, at 21,500 ha, is another major fenland crop. Farmers have recently diversified into more exotic crops such as pak choi. Agriculture is a major employment sector, attracting workers from across Europe.

Water from much of the East Midlands drains eastwards across the Fens into the Wash through four major rivers: the Witham, Welland, Nene and Great Ouse. All rivers now have artificial canalised courses that run straight for long distances and are bounded by high banks to contain the watercourse from the lower adjacent fields. In some locations 'roddons', sinuous silt banks that are fossilised remnants of tidal creek systems, are elevated, in some places up to 2–3 m above the dark peat soils which have subsequently wasted as a result of continuous cultivation, drainage and wind erosion of the peat. This irreversible wastage creates an ever-greater demand for artificial drainage of the land. Remnants of the original fen, as at Wicken Fen, are rare exceptions.

There are marked variations and graduations in the Fens landscape, shaped by the differing lengths of settlement history. The 'settled inland fens', which run in a broad arc inland from the Wash between King's Lynn and Boston, form an ancient, small-scale landscape of sinuous lanes and relative intimacy with a higher density of settlements, some fine churches and remnant grasslands. The extensive 'peaty fens' or 'black fens', which were finally comprehensively drained in the 17th to 19th centuries, comprise broad rectilinear fields and straight roads. The only consistent relief to the level landform are the notches of the drainage ditches and the raised berms and banks of the artificial drainage channels. The fens of south-east Lincolnshire between the settled inland fens, where there are some hedgerows along the sinuous lanes, and the Wolds were the last area to be drained. The drainage here was so thorough that scarcely a vestige remains of what had been one of Britain's richest wildlife habitats. This is an open, productive landscape with a strongly rectilinear form. The band of marshes reclaimed from the Wash by the construction of a series

of sea wall defences begun in the 17th century has fields of vegetable crops that stand alone against the sky. Beyond the defensive walls, salt marshes and tidal mudflats, often abundant with wildfowl, stretch out into the Wash.

The Wash, an internationally important Special Protection Area (SPA)/ Ramsar site, is the largest estuarine system in Britain and this vast seascape supports an extensive habitat mosaic of salt marshes, intertidal banks of sand and mud, shallow waters and deep channels. It is the most important staging post and overwintering site for migrant wildfowl and wading birds in eastern England. It supports a valuable commercial fishery for shellfish, is an important nursery area for flatfish and holds one of the North Sea's largest breeding populations of common seals and some grey seals.

The Fens are also very important for biodiversity. The Ouse Washes and Nene Washes SPA/Ramsar sites are areas of seasonally flooded grassland important for national and international populations of breeding and overwintering waders and wildfowl. Both sites are of note for their diversity of plant and animal life. Their associated watercourses are designated for important spined loach populations. In the Welland catchment, the Counter Drain in Baston Fen Special Area of Conservation (SAC) contains high densities of spined loach. Fenland SAC holds large areas of calcareous fen and is also important for populations of spined loach and great crested newt. The Wash and North Norfolk Coast SAC is considered to be one of the best areas in the UK for sand banks and Atlantic salt meadows. In terms of biodiversity, Wicken Fen is the richest site in the UK; Holme and Woodwalton Fens are also important relic habitats.

There is negligible woodland throughout the Fens landscape, with a few trees lining roads or clustering around villages and the fen estates, as at Thorney. Exceptions include Woodwalton to the west and small ex-decoy woodlands such as in the Eastern Fens, where for instance Friskney Decoy Wood is a Lincolnshire Wildlife Trust (LWT) reserve. Extensive orchards and associated windbreaks are located in the Wisbech area to create a distinctive though dwindling landscape cover.

On the island crests and at the fen margins, archaeological features occur in large numbers, while fewer are known from the undulating deeper parts of the fen basin as here they are covered by blanketing deposits of marine clays, peat and silts. Flag Fen Archaeology Park and Scheduled Ancient Monument is home to a bronze-age wooden causeway, some 3,500 years old, and is a site of national and international importance.

Stonea Camp iron-age hill fort near March in the Cambridgeshire Fens is the lowest-lying hill fort in Britain. It has been suggested as the site of Boudicca's last stand against the Romans. Having defeated the local tribes, the Romans erected a substantial administrative/military building near Stonea Camp to impose their authority in the Fens, by then a probable imperial estate. The Fens were very important in Roman times and the Fen Causeway, or Fen Road, stretched for over 40 km between Denver, Norfolk, and Peterborough through Flag Fen, where it joined the major Roman north–south route, Ermine Street.

Around the low, clay hills, most notably the Isle of Ely, occasional remnant ridge-and-furrow pasture is evident.

The settlement pattern follows the historical development of the area. The settled inland fens or 'townlands' comprise medium to large settlement clusters around Boston, Spalding, Holbeach and Wisbech, with many villages having fine medieval churches, such as West Walton. The medieval pattern of north–south drove lines, between parent and daughter settlements on the coast and fen edge

respectively, was crossed in the 19th century by the A17 and A47. Since then the settlements in these townlands have spread along these principal routes to create ribbon developments of smallholdings, modern bungalows, farmsteads with large agricultural barns, and food processing buildings, such as Sutton Bridge.

The 'peaty fens' inland are, by contrast, very sparsely settled with isolated farmsteads and houses on local areas of raised land being the only built elements for long distances. Many fenland buildings are now derelict; either standing at alarming angles or shored up, while the linear roads have likewise suffered showing significant undulations.

Ely, Boston, Wisbech, Spalding and King's Lynn provide the major historic settlements within the Fens. Ely Cathedral dominates the skyline over a large area 'like a great ship tugging at its moorings' (Betjeman). At Boston, once England's largest port, the 83 m-high octagonal tower known as the 'Boston Stump' is a marker across the open fen. Stone for large buildings, including Ely Cathedral and the Boston Stump, was imported from the quarries of Lincolnshire (Ancaster), Northamptonshire (Barnack, now Cambridgeshire), Rutland and Yorkshire. The brick industries around Whittlesey have provided key vernacular characteristics for the landscape in that area, the products of which have been used for the traditional building style of brick and slate-roofed farmhouses and brick-pantile workers' cottages. The subtle variation in settlement patterns from fen to fen reflects settlement history and the length of time since drainage took place. A few historic pumping stations such as Stretham bear witness to the latter. Local building materials include reed for thatching and clay for bricks, with its variations in colour and texture, but the use of thatch is now exceptional as a result of the loss of reedbeds.

Roads and rail links are often situated on elevated banks, and long straight roads crossing the large fenland fields are typical. Road schemes, power lines, industrial and residential development have had an impact on local character, and light pollution associated with transport networks has become increasingly prevalent.

Communities in this NCA include many migrant workers, have high indices of multiple deprivation (IMD), and various health issues, including obesity, lower-than-average life expectancy and high levels of physical inactivity, and many experience issues with isolation. The ageing population is also an issue.

The fenland waterways are an important recreational resource and there is a major marina at Ely. Long-distance walking routes include the Ouse Valley Way, Hereward Way and Nene Valley Way while the old drove roads are an important cycling resource. Access to wildlife is of major importance for recreation and tourism, especially at the many designated sites with good visitor access. For example, the Wildfowl and Wetlands Trust (WWT) Welney Wetland Centre, part of the Ouse Washes SPA/Ramsar site, is a spectacular swan spectacle and major attraction, and Wicken Fen is one of the top tourist sites in the Fens.

Agriculture in the Fens.

The landscape through time

The solid geology of the Fens is dominated by Upper Jurassic marine clays, including the Oxford, Ampthill and Kimmeridge Clays (formed around 157–152 million years ago). Tectonic activity and sea-level changes have raised these deposits above sea level; the clays have yielded tremendously important fossil reptiles and fish new to science, including the pliosaur *Pachycostasaurus dawnii* and *Leedsichthys*, the largest fish ever discovered, as well as many invertebrate species. Additionally, an isolated mass of richly fossiliferous Upper Jurassic Corallian Limestone, including coral reef deposits, out-crops around Upware. Lower Greensand rocks at Ely and Stuntney, and Lowestoft Till at March, also form 'islands' for historic centres of human settlement.

Much of this geology is overlain by Quaternary deposits: the area was covered by a large ice sheet during the Anglian glaciation around 50,000 years BP and glacial erosion beneath the ice sheet is thought to be responsible for the scouring-out of the Fen Basin and the area now occupied by the Wash. The ice sheet deposited sands, gravels and clays across the area and left a shallow basin in which later deposits accumulated. During the Holocene, a cyclic succession of peats, estuarine and marine silts, clays and sands was deposited in both terrestrial and marine environments, reflecting sea-level changes and river flood plain activity. These demonstrate a detailed record of climatic and environmental changes over the last 11,500 years although part of this record is threatened by the shrinking peat, increased exposure and erosion. Several Sites of Special Scientific Interest (SSSI) within the NCA have been designated for this geological climate- and landscape-change record.

Much of the human history of the Fens has been a battle of man against the

A modern addition to the landscape.

forces of nature to bring out the full agricultural potential of the land. Much of the early archaeological evidence is now becoming apparent as peat wastage exposes evermore well-preserved remains. In the deepest areas of the fen basin, Mesolithic and Neolithic occupation remains lie buried beneath 4–5 m of later water-related deposits. However, these early prehistoric sites occurred on former, dry, land surfaces, indicating a period when these lowest-lying parts of the fen basin were host to dry grassland with areas of pine and deciduous woodlands – a time before the fens were wet. Nationally important designated sites of the Bronze Age are known from Flag Fen, Peterborough and Must Farm, Whittlesey, where wooden platforms, raised causeways, piled settlements and a group of eight boats have been found. In Lincolnshire, evidence of Neolithic and bronze-age occupation is often closer to the surface and tends to be known only towards the western edge.

Roman settlements occurred mainly on the high, drier islands and above the fen edge, while contemporary transport canals indicate huge efforts to traverse and control the fens. Car Dyke links the River Witham to the River Cam, while the Fen Causeway canal and road system linked a major Roman settlement at Peterborough with the Norfolk fen edge at Denver. Although salt-making sites were known throughout the fens from the 1st millennium BC, such as at Northborough, the industrialisation of this economy took off in the Roman period (for example at Deeping and Morton Fens and in the tidal creeks at March) with further expansion during the Saxon and medieval period.

In the Middle Saxon period, from around 650 AD, high-status centres and hermitages on the fen islands became centres of communities which later became monasteries with massive estates such as that at Crowland, Ramsey and Thorney. The earliest sea defences, the sea banks and sea dykes date from this period although they were subsequently expanded and modified.

At the time of the Domesday Book in 1086, monastic houses owned the vast majority of the fen and fen-edge land. The swamps of the 'black fen', veined with watercourses, famously provided refuge for the Saxon folk hero Hereward the Wake in his resistance to the Norman authorities. A monastery preceded the establishment of the abbey and the cathedral church at Ely and lands on the clay island were granted to the monks to tend. The monasteries were at the heart of large-scale attempts to drain the fens, including the creation of stretches of canalised waterways. The River Great Ouse was diverted to run close to the Isle of Ely in the 13th century.

During the Middle Ages, the wetland resource of the Fens was widely used and was a centre of productivity for fishing, wildfowling, grazing, peat extraction and salt production. Medieval fisheries owned by the numerous fen monasteries occur at the margins of the former fen meres, for example those at Whittlesey, Willingham and Soham, and eels were a dominant element of the fenland food repertoire and manorial/local economies. Requiring greater connectivity across the marshes, the medieval monasteries and abbeys promoted the realignment and canalisation of some of the fenland rivers, as at March and Ely, and created canals and slades for transport between various islands – such as those between Ely, Chatteris and Ramsey.

In the 15th century, further attempts to create comprehensive drainage systems included the 22-km Mortons Leam, which still functions today, cut between Peterborough and Guyhirn under the aegis of Bishop Morton to carry waters of the River Nene to the Wash. This was the prototype for post-medieval fenland drainage schemes. Piecemeal drainage through 'assarting',

the process by which common land was enclosed under licence from landlords, allowed areas off the fen edge to be drained. This can be seen in the field systems surrounding some of the fen islands.

Seasonal grazing was prevalent in the medieval period when a pattern of radiating drove lines known as 'The Smeeth' developed between the coast and the inland grazing on the fens. Salt-making was also characteristic at that time. Residual mounds or 'salterns' remain in many places, especially at Spalding and around Boston. There is a line of salterns extending several kilometres southwards from Wainfleet.

The earthworks of 17th-century English Civil War defences are preserved in many parts of the fens, especially at the river estuaries and around the Wash. In the same century, the most important phase of land claim began when the 4th Earl of Bedford gained a Royal Charter to drain the 'wastelands' to create good summer grazing. The first engineering works commenced in the 1630s, but progress was halted by the Civil War. In the 1650s, Cornelius Vermuyden, a Dutch engineer, was appointed to continue the works. Rivers were straightened to increase water flow and sluices created against tidal inflow. The Hundred Foot or Ouse Washes were created to enable temporary controlled flooding at high tides and high river levels. Through this process the North, Middle and South 'Bedford' Levels were created. At this time, the economy in the area depended heavily on fishing, especially of eels, wildfowling and mixed farming. The fiercely independent locals, known as the 'Fen Tigers', fought against the drainage works which they thought would take away their livelihoods.

As peat soil was drained, it wasted and land levels lowered, which necessitated artificial pumping. In the 18th century, wind-powered pumps covered the landscape, to be replaced by steam pumps in the 19th century which allowed the shallower open water of the meres to be drained. Whittlesey Mere was the last mere to be drained in the 19th century. Reclamation of the coastal salt marshes has also been significant, with new sea walls built to extend the rich agricultural land into the Wash resulting in loss of estuary habitats. Today, diesel and electric pumps are used to manage water levels.

The drainage was so advantageous to the productivity of the land that the former pastoral areas were converted to Grade 1 soils suitable for intensive arable, vegetable and horticultural production, with rebuilt farmsteads accommodating the yard-fed cattle whose manure further boosted fertility. The wealth created by the drainage of the area also came from new sources such as seed and bulb cultivation. The last areas to be drained were the East, West and Wildmore Fens of south-east Lincolnshire. Besides the draining of the inland fens, the reclamation of the coastal salt marshes has been significant. Council smallholdings developed as a distinctive feature of the Fens in the late-19th to mid-20th centuries.

The most noticeable change in the landscape at the end of the 20th and beginning of the 21st centuries has been caused by improved farming techniques such as trickle irrigation and the use of more precise technology. The Fens have remained mainly rural, although infrastructure – including wind turbines and rail gantries, visible from long distances – has been constructed. The bombing range at RAF Wainfleet has now closed but RAF Holbeach is still in regular use with aircraft noise carrying across wide areas. There have been recent efforts to re-create fenland to provide important habitat for rarer species and there has been focused activity on re-creating areas of wet grassland and fen, in particular at the Great Fen through the Great Fen Project, with the intention of creating an important link between Woodwalton and Holme Fens in the Cambridgeshire Fens. Partnership working elsewhere is also focusing efforts to re-create fenland to provide important habitat for rare species.

Ecosystem services

The Fens 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 Fens NCA is contained in the 'Analysis' section of this document.

Provisioning services (food, fibre and water supply)

- **Food provision**: Of the soils in the Fens, 87 per cent are classified as Grade 1 and Grade 2 agricultural land. The Fens NCA is one of the most important areas of food production in the UK, producing 37 per cent of our outdoor vegetables, 24 per cent of our potatoes, and 17 per cent of our sugar beet. An estimated 4,000 farms employ 27,000 people, pointing to some very intensively managed systems of food provision. Cropping includes a mix of arable crops, field-scale vegetables and fruit (for example around Wisbech). Glasshouses, polytunnels and plastic sheeting are a feature on the productive soils and multiple cropping is often undertaken with irrigation to satisfy market forces. This can place significant stress on soil and water resources.

- **Water availability:** There are a number of major rivers in the NCA, including the Great Ouse, rising on the Yardley–Whittlewood Ridge on the Northamptonshire–Buckinghamshire border, and the Nene and Welland, which rise in the Northamptonshire Uplands NCA. Small parts of a number of major aquifers fall just within the Fens NCA boundary. Where catchment abstraction management strategy (CAMS) assessments have been undertaken, their status is assessed as 'no water available' in the summer months and 'water available' during the winter months. Rivers in the south and far south-east of the NCA generally have an 'over-abstracted' status. This has implications for active river processes, and the ecosystem services provided, throughout the system. Groundwater is also over-abstracted and again the underlying geology has implications for storage and yield.

- **Genetic diversity:** There are opportunities to preserve old varieties of fruit from traditional orchards for their taste, their genetic information and possible future crop breeding for resistance to diseases, for instance. A few rare breed livestock are maintained in the Fens – these are an important genetic resource.

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

- **Climate regulation:** Peat deposits represent a key part of the carbon storage resource of the UK. Salt marshes and mudflats also have potential for long-term storage of carbon. Based on a review of the available literature, it appears likely that fenland peat soils are wasting at up to around 2.1 cm/year. For the surviving areas of deep peat it is estimated that the average wastage rate is around 1.5 cm/year. This is equivalent to around 9 per cent of the annual loss of organic carbon from 0–15 cm depth of all soils across England and Wales reported by Bellamy and others (2005) and about 0.3 per cent of the UK's annual industrial emissions of carbon dioxide.

- **Regulating soil erosion:** Loamy and clayey soils with impeded drainage, particularly those with a high silt content, are easily compacted by machinery or livestock if accessed when wet, increasing risks of localised water run-off. Lighter-textured, silt-rich soils are at risk of water erosion

and sediment loss where cultivated or if bare soil is exposed, but this is likely to be localised due to lack of gradients. The coarser-textured (fine sandy and silty) mineral soils are also prone to wind erosion, particularly where low in organic matter content.

The peat-rich soils in this NCA are at risk of erosion. Loss of peat soil through peat wastage as a result of shrinkage by drainage and oxidation and wind erosion of exposed soils is particularly problematic with spring-sown root cropping such as sugar beet, carrots and parsnips where land is exposed throughout the winter. Wind erosion can be a major problem – 'fen blows' during prolonged dry spells can quickly erode large quantities of soil and, if they occur shortly after seeding, can result in large economic losses.

The loamy and sandy soils with naturally high groundwater and a peaty surface and the fen peat soils typical of inland areas are permeable soils with good infiltration and therefore at low risk of water erosion (except where cultivated land is susceptible to flooding) but are at high risk of wind erosion (blowing), especially where spring-sown crops are grown. Drainage and cultivation are leading to ongoing loss (wastage) of surface peat through shrinkage and oxidation.

Water erosion of soils is an issue in the Little Ouse priority catchment with light sandy soils, under maize and root cropping. In the Lincolnshire Coast Rivers catchment, water erosion may be associated with outdoor pig rearing or intensive cereal and oilseed rape production.

Increased rates of erosion and weathering are also likely as a consequence of future climate change.

- **Regulating soil quality:** The fine, light silty fens and the dark, humus-rich peaty fens are the key natural resource of the Fens. Wastage and lowering of the inland peat areas and the gradual transformation of their soils over time from peaty to mineral dominated, together with sea-level rise in an area dominated by pumped artificial drainage, will have a major impact on the ecosystem services provided in the longer term. In some wasted peat soils, locally the subsoils become highly acidic giving rise to hard, iron-rich 'drummy' layers affecting crop rooting and growth, and for damaging iron-ochre formation which blocks drains.

- **Regulating water quality:** Excess nitrates, phosphates and pesticides have led to pollution and eutrophication in watercourses. In addition, soil erosion is identified as an issue. The Anglian River Basin Management Plan indicates that the ecological status of rivers and waterways in the NCA is either good or moderate. Owing to a range of factors (cross-compliance, Environment Agency (EA) schemes, catchment sensitive farming (CSF), technological improvements and better understanding among farmers), water quality is improving. Chemical water quality is generally good apart from sections of the Nene and Great Ouse which fail to reach good status within the majority of their lengths within the NCA. Where the groundwater chemical status has been assessed, it is rated as good.

- **Regulating water flow:** The Fens are low lying with much land below sea level. The Environment Agency flood risk map indicates that the majority of the NCA is at high risk of river and/or coastal flooding. Flood control is a key issue for most of the NCA, particularly since the major flooding events in 1953. Possible increases in precipitation associated with climate change may lead to an increase in flooding. However, most settlements are offered some protection from flooding by manmade defences on

the coast and main rivers. In addition, washlands (areas of permanent grassland deliberately flooded to prevent rivers overtopping) have been created on the major river systems.

- **Regulating coastal flooding and erosion:** The coastline within this NCA is formed of mudflats and salt marshes, which provide internationally important habitats for wildlife as well as important natural sea defences, backed by manmade coastal defences. The salt marshes are currently increasing in area, affording increased natural protection for the coastline. Over the medium and long term, it is probable that the balance of salt marsh and mudflats will change or be lost altogether through erosion, as a result of climate change, and associated isostatic adjustment will increase coastal squeeze where the salt marsh is constrained by coastal defences on its landward side. In the short term, the policy approach is to hold the existing sea bank alignments and in the medium and long term (with the risk of erosion of mudflats and salt marshes) landward realignment will need to be considered as an alternative to holding the line. Climate change presents a challenge to how we regulate/change the balance.

Cultural services (inspiration, education and wellbeing)

- **Sense of place/inspiration**: The sense of place in the Fens is provided by the geodiversity underpinning the large-scale, flat and open landscape with long views, expansive skies and spectacular sunsets. The feeling of scale is further emphasised by the rich and varied, intensive agricultural land use that also produces strong seasonal changes from the black of bare, peaty soils to the rich colours of agriculture to the whites of winter. The feel and light in the landscape can quickly change with weather conditions. The landscape and its associated wildlife have inspired artists including Sir Peter Scott (who founded the Wildfowl and Wetland Trust) and more recently Carry Akroyd.

Traditional activities such as ice skating on frozen marshes, eeling and punting through reedbeds have become even more marginalised during the 20th and early 21st centuries. Graham Swift's 1980s novel Waterland keenly identifies the changing lifestyles of fenland people.

- **Sense of history**: The Fens' distinct history and character is inextricably associated with the rich soils which are only accessible as a result of persistent efforts to drain the area. The drainage infrastructure (including the network of drainage ditches, embankments and pumping stations) provides an evident reminder of the area's reclaimed past. The sediments themselves contain a record of ancient landscape and climates, with the currently wasting peat revealing well-preserved remains of prehistoric landscapes with especially rich archaeology, including prehistoric and Roman artefacts and features found on fen margins. Diverse field patterns are being exposed, ranging from the ancient semi-regular enclosure of the settled fens to the engineered 18th-century fields of the open inland fens.

  The underlying clay has enabled a brick-making industry which has been a major part of local economies and provided much employment at the 'brick pits.'

- **Tranquillity:** Many parts of the Fens are tranquil, particularly around the edge of the Wash. The open and empty landscape means different things to different people; some can find it featureless and intimidating whereas others value the tranquillity that still persists away from the settlements and major transport corridors. Sense of tranquillity is likely to be particularly associated with the area's remaining wetland habitats, notably the large marsh areas adjacent to the Wash.

- **Recreation:** Major habitat restoration projects at Great Fen, Willow Tree Fen and Wicken Fen offer opportunities for improving and creating new access. There is a visionary long-term plan for a Fens Waterway Link joining Lincoln, Boston and Ely, which will progressively open up the Fens for boating. New national coastal access routes are planned and there are opportunities for promoting long-distance walking (such as the Ouse Valley Way, Hereward Way and Nene Valley Way). In addition to the Fens Waterway Link project, the Fens for the Future project is providing a long-term vision. Both aim to give local people a sense of ownership of their local waterways and a sense of belonging, with opportunities for recreation, enjoyment and healthy activities.

- **Biodiversity:** The Fens are particularly important in terms of their biodiversity. Areas of the Fens have been designated as Special Areas of Conservation (SAC) and Special Protection Areas (SPA) because they are internationally important for species including the spined loach. Important habitats include seasonally flooded, wet grassland such as the Ouse Washes, calcareous fen and ditches. The large embayment of the Wash, with its associated salt marsh and mudflats, provides important habitats for a number of bird species including pink-footed and Brent geese, shelduck, lapwings, oystercatchers, common terns and various plover species. The Fens are important as a feeding ground for marsh harriers; the Wash also has 90 per cent of the UK's common seals.

- **Geodiversity:** Geodiversity is also very important in determining the wider landscape and character of the Fens, from the topography to the soils. More locally, the Jurassic clays are significant for palaeontology, with major Jurassic reptiles present and many smaller fossils – ammonites, belemnites and other genera – common. Leedsichthys, the world's largest fish, was discovered in, and is still being unearthed from, these same sediments. The Quaternary deposits contain important records of climate and environmental change. These provide an important context and insight into our understanding of the potential impacts of future climate change and global warming. Several Sites of Special Scientific Interest (SSSI) have been notified for their buried Holocene (Flandrian) sediments, which record fluctuations of relative land and sea levels during the Holocene. The Ouse Washes are geomorphologically significant as a notable example of a naturally functioning flood plain system.

The famous Holme Post demonstrates the historic wastage of peat.

Statements of Environmental Opportunity

SEO 1: Manage the agricultural landscape and soils which allow the Fens to be a major provider of food and horticultural produce, while seeking to enhance opportunities for biodiversity.

For example, by:

- Maintaining the valuable, productive, open agricultural landscape of the Fens National Character Area (NCA) with its high-quality soils, many of which are classed as Grade 1 agricultural land, through sustainable farming and agricultural agreements to the benefit of food production, biodiversity, sense of place and climate change regulation.
- Increasing opportunities to manage and protect the remaining peat resource, for example by raising water levels, to maintain (or enhance where possible) the build-up of organic matter; and encouraging landowners and managers to pursue such activities.
- Encouraging landowners and managers to use sustainable farming methods that protect the soil, such as maintaining vegetative cover and using grass buffer strips to reduce soil erosion from susceptible arable fields in the autumn and winter.
- Encouraging the adoption of good practice to avoid soil compaction and maintain good soil structure.
- Encouraging landowners and managers to manage land to prevent peat from drying out, and to maintain wetted peat soils to reduce loss through compaction, oxidation and wastage.
- For mineral soils in the NCA, promoting management techniques to build up soil organic matter to help maintain and enhance soil quality.
- Encouraging farmers to use techniques such as establishing break crops to manage land and protect soil.
- Encouraging minimum tillage and greater use of organic manures, biosolids and digestates plus soil conditioners, which will help to ameliorate soil losses if pursued on sufficient scale.
- Encouraging the establishment of areas of semi-natural habitat such as reedbed and washland which slow the passage of water through the hydrological system.
- Restoring and managing traditional orchards where there is already a traditional pattern, for example around Wisbech, promoting the planting of new orchards of mixed fruit trees to encourage bees where they are absent, and promoting the expansion of traditional shelterbelts around orchards.

SEO 2: Manage the core wetland complexes and increase their connectivity by enhancing the main rivers, waterways and their associated riparian habitats and improve recreational access opportunities to the Fens.

For example, by:

- Promoting the creation and restoration of wetland landscapes through co-ordinated and sensitive management of water resources in conjunction with Fens for the Future partners, including Internal Drainage Boards (IDBs) and the farming community.
- Managing key wetland sites, including Wicken, Woodwalton and Holme Fens, remnants of the original fen, together with the great washlands which will form the core wetland complexes.
- In addition to the existing core areas, developing extensions at Baston Fen, Great Fen and Wicken Fen as envisioned in the Wicken Vision, as well as new areas such as Lakenheath Fen, Needingworth and the Wissey Wetland, to create more and larger areas of wetland habitats.
- Improving the water quality and quantity in water bodies in the Fens and improving their habitat value by creating buffer zones and undertaking habitat enhancement works, and identifying means by which issues including diffuse pollution can be co-operatively tackled, thus making a valuable contribution to outcomes required by the Water Framework Directive.
- Critically assessing the engineered network of ditches, installing new water management mechanisms where necessary, to enable localised management of groundwater.
- Encouraging winter flood storage on appropriate areas of land, ensuring appropriate management and control of any water resource created, in accordance with Water Level Management Plans, promoting the reversion of existing flood-storage washlands to permanent grassland with extensive grazing regimes, and promoting the creation of new multi-functional washlands.
- Ensuring that sustainable flood risk management for the Fens is delivered through close partnerships.
- Promoting and establishing strategic, appropriately sized areas for biodiversity across the Fens to mitigate the impacts of local, summer storm-related catchment flooding, and to develop robust populations.
- Integrating and developing water resource management within flood management works and land management regimes, particularly at break point areas along the edge of the fen.
- Ensuring that the soils remain adequately hydrated to prevent erosion and maintain soil chemistry, especially where these soils could form ochre and become extremely acidic if dried and re-wetted.
- Promoting the creation of permissive and definitive access to increase opportunities for people to visit the Fens using sustainable transport methods; identifying the strategic gaps in the network and providing public transport in association with employment, heritage, education and recreation initiatives for local people and neighbouring towns and cities; and ensuring that existing projects with capacity such as Fens for the Future and the Fens Waterway Link address recreational and access issues.
- Identifying the strategic access gaps in the network and providing public transport in association with employment, heritage, education and recreation initiatives for local people and neighbouring towns and cities.

SEO 3: Plan for the creation of new coastal landscapes in the Wash area that are adapted and resilient to the impact of climate change, for the benefit of people and wildlife.

For example, by:

- Seeking opportunities to reinstate intertidal salt marshes through realignment from arable to extensively grazed salt marsh, in line with the Wash Shoreline Management Plan.
- Seeking opportunities to create grazing marsh, reedbed and salt marsh throughout the Fens to compensate for losses of these habitats at the coast as a result of climate change and associated isostatic adjustment-induced sea-level rise, or where work carried out has damaged habitat.
- Seeking opportunities to identify and monitor key coastal active process sites.
- Replacing habitat lost from the coast through the East of England Regional Habitat Creation Programme.
- Planning for provision of permissive and definitive access (including the coastal access path) to increase opportunities for people to visit the Fens using sustainable transport methods.

Realignment at Freiston Shore.

SEO 4: Conserve, manage and enhance the Fens landscape and increase educational opportunities to access its geodiversity, archaeology and cultural heritage to enhance enjoyment and understanding for those who live and work in and visit the Fens.

For example, by:

- Protecting and appropriately managing the historic environment, for its contribution to local character and sense of identity and as a framework for habitat restoration and sustainable development.
- Improving the condition of heritage assets through appropriate measures and seeking to reduce conflicting or unsympathetic management regimes, while recognising the high potential in this landscape for undiscovered remains.
- Providing a wider understanding of the geological record of environmental change held within the peat and associated Quaternary sediments, and supporting demonstration projects and sites that illustrate the cultural history, successional fenland habitats and geodiversity of the Fens.
- Managing and conserving the geological exposures throughout the Fens by the removal of undergrowth and the prevention of fly-tipping on these sites, in addition to identifying and protecting new (key) sites as they are discovered.
- Making links between geodiversity, archaeology and cultural heritage, building towards an integrated approach with the surrounding natural environment/landscapes.
- Conserving and monitoring buried geological and archaeological remains that are under threat through erosion of peat, increased or inappropriate cultivation, drying out from dewatering for irrigation, and pressures from development.
- Conserving historic landmark buildings and earthwork sites together with their setting, especially on the settled fens and clay islands.
- Using understanding of the area's traditional and historic architecture, and its distinct patterns of settlement, to inform appropriate conservation and use of historic buildings and farmsteads, and to plan for and inspire any environmentally beneficial new development that makes a positive contribution to local character.
- Promoting understanding of the benefits and potential adverse impacts of wind farms and associated electricity transmission pylons, which are an increasing feature of the fenland landscape.

Additional opportunity

1: Seek partners to aid in the development and future provision of new, distinctive, Fenland economies.

For example, by:

- By promoting fenland cuisine and food preparation using local ingredients.
- Promoting natural art and craft production (such as baskets, woven reed mats, screens and fences for garden or poultry/animal management purposes) in order to diversify the economic opportunities and output from Fenland resources.

Supporting document 1: Key facts and data

Total area: 382,606 ha

1. Landscape and nature conservation designations

2,701 ha of the NCA are within the Norfolk Coast Area of Outstanding Natural Beauty (AONB), less than 1 per cent of the total NCA area.

Management plans for the protected landscape can be found at:

- www.norfolkcoastaonb.org.uk/

Source: Natural England (2011)

Wicken Fen National Nature Reserve and windmill. The Fens have a long history of capturing wind energy.

1.1 Designated nature conservation sites

The NCA includes the following statutory nature conservation designations:

Tier	Designation	Name	Area (ha)	Percentage of NCA
International	Ramsar	The Wash; Ouse Washes; Nene Washes; Wicken Fen; Woodwalton Fen; Gilbraltor Point.	7,630	2
European	Special Protection Area (SPA)	The Wash SPA; Ouse Washes SPA; Nene Washes SPA; Breckland SPA; Gibraltar Point SPA	7,441	2
	Special Area of Conservation (SAC)	The Wash & North Norfolk Coast SAC; Fenland SAC; Ouse Washes SAC; Nene Washes SAC; Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC	4,172	1
National	National Nature Reserve (NNR)	The Wash NNR; Holme Fen NNR; Wicken Fen NNR; Woodwalton Fen NNR; Gibraltar Point NNR	1,390	<1
National	Site of Special Scientific Interest (SSSI)	A total of 41 sites wholly or partly within the NCA	8,938	2

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 253 local sites in The Fens covering 4,468 ha, which is 2 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 at: 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/ – select 'Designations/Land-Based Designations/Statutory'

1.1.1 Condition of designated sites

Condition category	Area (ha)	Percentage of SSSI land in category condition
Unfavourable declining	361	4
Favourable	5,251	59
Unfavourable no change	2,397	27
Unfavourable recovering	930	10

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

Ground levels across the NCA range from 20 cm below sea level to 44 m above sea level, with a mean elevation of 2 m.

Source: Natural England (2010)

2.2 Landform and process

With the exception of the Isle of Ely, ground levels rarely rise above the 10 m contour, and typically vary by little more than one or two metres over many miles.

The exceptional flatness is due to the extensive cover of silts and peats that accumulated on the flat, Late Jurassic bedrock surface during the last few thousand years of Flandrian sea level rise, which lead to repeated flooding of this low lying area by high rivers or storm waters.

The Late Jurassic bedrock consists primarily of mudstone which was easily eroded by rivers and ice during the Late Tertiary and Quaternary, explaining why this landscape is generally no more than a few metres above or below sea level. In the south, marginally more resistant bedrock forms the higher ground islands such as Ely. The Silt Fens closest to the sea have largely had their sediments deposited by wave or tidal action.

Over the last few centuries land has built outwards into the Wash over 1km. This has been assisted by manmade walls, constructed to hold in tidal waters, increasing the deposition of coastal mud. The Wash has a large tidal range that generates strong tidal currents that are sufficient to move and transport sediment. Combined with wave action this leads to local erosion and sediment

transportation, helping to constantly shape the Wash's interface with the North Sea. In the middle of the Wash there are a series of deep water channels, for example the Boston Deeps, that are scoured by the tide as it rushes out of the Wash embayment. The strength of this flow is further increased by the volume of water discharged from the four main rivers. The outfall of these rivers into the embayment is characterised by classic delta formations.

Human intervention has directly shaped the geography and the contemporary development of the Wash and enhanced the ongoing large-scale natural process of accretion. The settlement of King's Lynn and the River Great Ouse mark the change from extremely wide low-lying Fenland to a relatively narrow coastal strip backed by higher ground. Here land rises sharply towards the A149 and King's Lynn. From Hunstanton to the south there are also sandy beaches backed by a natural, although maintained, shingle ridge.

Source: The Fens Countryside Character Area description; The Fens Natural Area Profile

2.3 Bedrock geology

The solid geology of the area is dominated by Upper Jurassic clays including the Oxford, Ampthill and Kimmeridge clays, formed around 150 million years ago. These deposits were laid down in relatively deep tropical seas and are often rich in fossils including important giant marine reptile remains and ammonites of international significance. Of particular note is an isolated and well known mass of richly fossiliferous Upper Jurassic limestone, including coral reef deposits, which outcrops around Upware.

Source: The Fens Natural Area Profile

2.4 Superficial deposits

Underlying geology is a combination of post-glacial alluvium and freshwater clays and post-Roman marine clays. The exception is the elevated islands of Jurassic clay at the inner margins of the area, for example at Ely. Deposits within the Wash embayment include a cyclic succession of peats, estuarine and marine clays deposited in both terrestrial and marine environments. The sequence of deposits in Fenland demonstrate a detailed record of climatic changes over the last 10,000 years and are important for their contribution to discussions of future climate change and global warming.

Source: The Wash Shoreline Management Plan

2.5 Designated geological sites

Tier	Designation	Number
National	Geological Site of Special Scientific Interest (SSSI)	10
National	Mixed interest SSSI	3
Local	Local Geological Site	1

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

There are 8 main soilscape types in this NCA; loamy and clayey soils of coastal flats with naturally high groundwater, covering 51 per cent of the NCA; loamy and sandy soils with naturally high groundwater and a peaty surface (28 per cent); fen peat soils (7 per cent); lime-rich loamy and clayey soils with impeded drainage (2 per cent); slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils (2 per cent); loamy and clayey flood plain soils with naturally high groundwater (2 per cent); freely

draining lime-rich loamy soils (2 per cent); and shallow lime-rich soils over chalk (1 per cent). Those covering 10 per cent or more are described below.

The loamy and clayey soils of coastal flats with naturally high groundwater (51 per cent) have a high agricultural potential, especially along the east coast, but this is dependent on the continued ability to pump drain and protect the soils from sea flooding and saline intrusion. Locally some soils are saline and at risk of structural damage where drained.

The Oxford Clay at Whittlesey.

These soils are increasingly under threat of loss from sea level rise although they will help protect other inland soils from these threats. Where there is a high silt/fine sand content compaction and, or capping may be an issue which may be reduced by increasing soil organic matter content. The loamy and sandy soils with naturally high groundwater and a peaty surface (28 per cent) are at risk of continuing organic matter loss where drained and cultivated, and topsoil loss and re-deposition as a result of wind erosion. Some of these soils may also be locally prone to extreme acidity. Main soil types; clay and silt (61 per cent); peat (18 per cent); and sand and gravel (6 per cent).

Source: National Soil Research Institute (Soilscapes maps), RSPB / Cranfield University 'An estimate of peat reserves and loss in the East Anglian Fens' I.P. Holman 2009, 'A revised estimate of peat reserves and loss in the East Anglian Fens' IP Holman and C Kechavarzi January 2011.

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)	Percentage of NCA
Grade 1	167,489	44
Grade 2	164,006	43
Grade 3	32,945	9
Grade 4	7,788	2
Grade 5	0	0
Non-agricultural	3,686	1
Urban	5,689	1

Source: Natural England (2010)

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

3. Key waterbodies and catchments

3.1 Major rivers/canals

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

Name	Length in NCA (km)
Great Ouse	56
Witham	39
Nene	35
New Bedford River or Hundred Foot Drain	33
Old Bedford	32
South Forty Foot Drain	32
South Holland Main Drain	29
Glen	24
Twenty Foot River	24

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.

Four major rivers drain the Fens into the Wash; the Witham, Welland, Nene and Great Ouse. The original courses of the rivers meandered slowly across the level Fens causing widespread seasonal water-logging by river water and high tides. In some locations 'roddons', inland silt banks, mark the old river beds and now lay up to 2 to 3 m above the surrounding land. The engineering of the rivers over centuries has changed the river pattern completely. All Fenland rivers now have artificial canalized courses which run straight for miles and are bounded by high banks to contain the watercourse from the lower adjacent fields. Outfalls into the Wash are trained and the channels are dredged to make sure navigability is maintained. Sluices and locks are a major feature. The Great Ouse which enters the Wash at King's Lynn has its source in the Northamptonshire Vales NCA. It is the fourth longest river in the UK and an important river for navigation as well as helping to drain much of the Fens. The construction of the Cut-Off Channel and the Great Ouse Relief Channel in the 20th century has helped to reduce Fenland flooding.

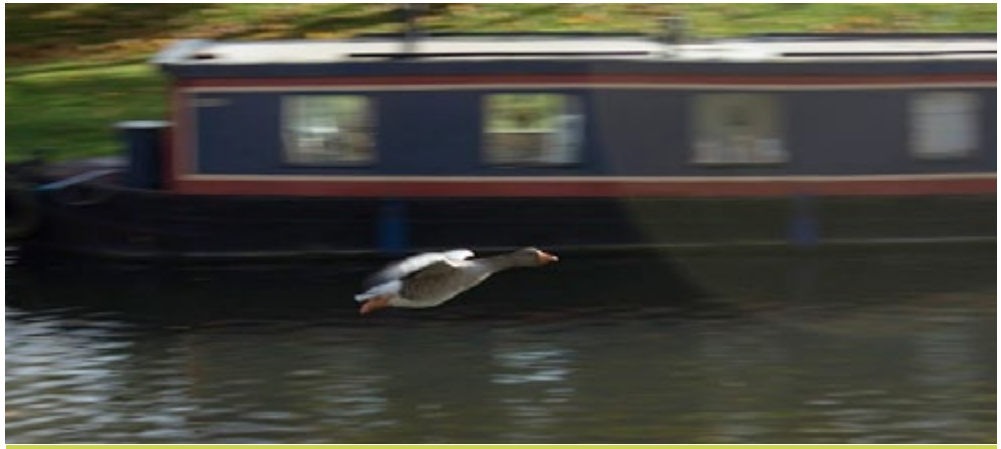
3.2 Water quality

The total area of Nitrate Vulnerable Zone is 94 per cent of NCA.

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 at: **http://maps.environment-agency.gov.uk/wiyby/wiybyController?ep=maptopics&lang=_e**



Wildlife and recreation in the Fens in the middle of Ely.

4. Trees and woodlands

4.1 Total woodland cover

The NCA contains 4,022 ha of woodland, 1 per cent of the total area, of which 160 ha is ancient woodland. Only woodlands of more than 2 ha in size are included in these figures.

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

Wicken Fen National Nature Reserve with mature fen woodland.

4.2 Distribution and size of woodland and trees in the landscape

Woodland cover across this NCA is sparse. There are no large areas of tree planting. New planting which is being undertaken mainly takes the form of small isolated blocks throughout the inland open fen area and the extension of existing woodlands. New tree planting to create shelter is largely of poplar and Leyland cypress. Avenues to roads are occasional and elsewhere isolated trees are significant. Shelterbelts including poplar and willow occur around farmsteads, along with occasional Leyland cypress hedges. There are many orchards around the Wisbech area, but loss of orchards is significant.

Source: The Fens Countryside Character Area description; Countryside Quality Counts (2003)

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)	Percentage of NCA
Broadleaved	3,381	1
Coniferous	298	<1
Mixed	61	<1
Other	282	<1

Source: Forestry Commission (2011)

Area and proportion of ancient woodland and planted ancient woodland within the NCA:

Woodland type	Area (ha)	Percentage of NCA
Ancient semi-natural woodland	160	<1
Ancient re-planted woodland (PAWS)	59	<1

Source: Natural England (2004)

5. Boundary features and patterns

5.1 Boundary features

Traditional boundaries in this NCA are drainage ditches and dykes which form key landscape elements. Hedgerows tend to be located on clay islands and areas of infrequently 'enclosed' pockets of inland Fenland, but these historic patterns have been weakened due to housing development and limited management. There is a pattern of linear poplar, or more recently Leyland cypress, shelter belts around small settlements and farmhouses. Agri-environment scheme agreements for ditches in 2003 accounted for more than 15 per cent of the national total (364 km in 2003). In 2011 ditch management under Environmental Stewardship had risen to 3,670 km. There are a limited number of agreements in the Fens NCA for the management of hedgerows.

Coastal boundary features are present as a series of visible defences within the Wash. These are mostly grassed earth embankments, more commonly known as sea banks. At a number of places, behind these main frontline defences, the remnants of secondary and tertiary lines of defences exist in the form of old sea banks. Although sea banks are characteristic of most of the Wash embayment, most of the south-eastern face is defended by frontline defences consisting of a natural, but maintained, shingle ridge, backed by a secondary line in the form of a sea bank. The Hunstanton frontage is protected against erosion by a combination of sea walls, promenades, wave return walls and beach control structures, including timber and concrete groynes. Within the Wash embayment deepwater channels form the boundary between offshore banks and the intertidal sand and mud flats and salt marshes.

Source: The Wash Shoreline Management Plan; The Fens Countryside Character Area description; Countryside Quality Counts (2003)

5.2 Field patterns

Inland, the younger, rich soils of the Peat Fens support a pattern of large fields created by varied and multiple cropping, with a strong rectilinear pattern of drainage, fields and roads. The area of the Fens, known as the Settled Fens or Silt Fens, has been farmed since medieval times. Set back in an arc from the Wash, they provide an isolated example of ancient Fenland countryside with ancient intricate and irregular field patterns

Source: The Fens Countryside Character Area description; Countryside Quality Counts (2003)

Fenland fields.

6. Agriculture

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

6.1 Farm type

Rich and varied agricultural land use including a wide range of arable and root crops, vegetables, oil seeds and livestock. In 2009 the total farmed area was 308,589 ha, comprised of 3,096 holdings. The Fens NCA is a major producer of cereals, potatoes, sugar beet, vegetables, oil seeds, fruit, bulbs and flowers.

Source: Agricultural Census, Defra (2010)

6.2 Farm size

Farm size in the Fens is large with 802 holdings of more than 100 ha; this is 26 per cent of the total land holdings. Medium sized farms of 20 to 50 ha account for 721 holdings or 23 per cent. Overall, holdings over 100 ha make up 77 per cent of the total farmed area. This compares to those of 50 to 100 ha which make up 13 per cent of the farmed area. The trend of farm size has shown a general decrease in each size band between 2000 and 2009, with a decrease in the total number of holdings of 751 or 20 per cent. The largest percentage decrease was in the 5 to 20 ha band with a decrease of 206 holdings or 23 per cent. The smallest decrease was in the band over 100 ha with a decrease of 107 holdings or 12 per cent.

Source: Agricultural Census, Defra (2010)

6.3 Farm ownership

2009: Total farm area = 308,589 ha; owned land = 193,623 ha
2000: Total farm area = 327,355 ha; owned land = 194,787 ha

Source: Agricultural Census, Defra (2010)

6.4 Land use

The dominant land use is cereals production. In 2009 137,033 ha or 44 per cent of the farmed land in the Fens was used for growing cereals, 46,845 ha or 15 per cent of farmed land was used for growing cash roots (potatoes and sugar beet), and grassland (sole-rights rough grazing and uncropped arable land) and vegetables each account for 11 per cent of the total farmed area. Between 2000 and 2009 the area of farmed land used to grow cereals decreased by 18,600 ha or 12 per cent of the farmed land area. The area on which cash roots are grown decreased by 12,601 ha or 21 per cent and grassland decreased by 7,814 ha or 18 per cent. Horticulture accounts for the smallest area of farmed land use, this area decreased by 945 ha or 32 per cent. Over the same period the area of farmed land used to grow oil seeds increased by 13,959 ha or 128 per cent, and the area of land used to grow stock feed increased by 1,315 ha or 442 per cent. The area used for vegetables also increased by 5,510 ha or 18 per cent.

Source: Agricultural Census, Defra (2010)

Potato ridges.

6.5 Livestock numbers

The total number of pigs, 59,700 in 2009, decreased from 2000 by 35,800 or 48 per cent; sheep, 26,900 in 2009, decreased from 2000 by 12,700 or 32 per cent; and cattle, 28,100 in 2009, increased from 2000 by 1,200 or 4 per cent.

Source: Agricultural Census, Defra (2010)

6.6 Farm labour

In 2009 there were 4,300 landholdings managed by principal farmers and 698 managed by salaried managers. There were 2,285 full time workers, 1,047 part time workers and 4,549 casual workers or gang workers. Trends from 2000 to 2009 show a decrease of 1,165 in the number of principal farmers and an increase of 136 in the number of salaried managers. The numbers of full time employees reduced considerably by 1,304 with a decrease of 149 in part time workers. During this period the number of casual workers increased by 373.

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

Very little semi-natural land remains in this heavily cultivated landscape. Farmed land is an important habitat in the Fens, and includes important features such as ditches, drains and small watercourses which also provide connectivity. Washlands, with extensive winter flooding and traditional forms of agricultural management including grazing and mowing of permanent grassland and rotational ditch clearance, are important for wintering and breeding ducks and waders. They occur on the major river systems of the Nene, Ouse and Cam. Relics of wetland areas are rare exceptions, but can be found at Wicken, Woodwalton and Holme fen where mosaics of wetland habitat, fen, reedbed and wet woodland remain. There is little true fen remaining. Open water occurs in the form of large rivers and drains, many smaller watercourses, occasional ponds and borrow pits, and flooded gravel workings. Some ditches, particularly in Lincolnshire, are extremely rich in aquatic plants.

Woodland cover in the Fens is sparse. Pollard willows along drainage ditches are characteristic. There are a few traditional orchards around Wisbech, Bluntisham and Somersham. Hedgerow habitats are scarce within the Fens.

There are very few unploughed lowlands meadows. Associated with the Wash are river outfall structures, tidal mudflats, sandbanks and saltmarshes.

The NCA also contains important arable habitats. These support nationally important assemblages of arable birds.

Source: The Fens Natural Area Profile

7.2 Biodiversity Action Plan (BAP) 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

Planned peat fenland - Semi-natural fen habitat at Fowlmere Fen, Cambridgeshire.

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)	Percentage of NCA
Fens	5,789	2
Coastal and flood plain grazing marsh	5,042	1
Lowland meadows	4,086	1
Broadleaved mixed and yew woodland (broad habitat)	1,064	<1
Purple moor grass and rush pasture	1,740	<1
Reedbeds (new inventory)	1,249	<1
Mudflats	196	<1
Lowland calcareous grassland	49	<1
Saline lagoons	47	<1
Lowland heathland	36	<1
Coastal sand dunes	32	<1
Coastal vegetated shingle	26	<1
Lowland dry acid grassland	9	<1

Source: Natural England (2011)

Maps showing locations of priority habitats are available at

- http://magic.defra.gov.uk select 'Habitats and Species/Habitats'

7.3 Key species and assemblages of species

- Maps showing locations of some key species are available at: http://magic.defra.gov.uk select 'Habitats and Species/Habitats'
- Maps showing locations of S41 species are available at: http://data.nbn.org.uk/

8. Settlement and development patterns

8.1 Settlement pattern

The settlement pattern follows the historical development of the area. The 'Settled Fen' or 'Townlands' comprise medium to large clusters around Boston, Spalding, Holbeach and Wisbech. The medieval pattern of north-south drove lines, between parent and daughter settlements on coast and fen edge respectively, was crossed in the 19th century by the A17 and A47.

Since then the settlements in these Townlands have spread along these principal routes to create ribbon developments of smallholdings, modern bungalows, large agricultural barns and food processing buildings such as those at Sutton Bridge. The 'Peat Fens' inland are, by contrast, very sparsely settled with isolated farmsteads and houses on local areas of raised land being the only built elements for miles. Ely, Boston, Wisbech, Spalding and King's Lynn provide the major historic settlements within the Fens.

Port development has historically been important within the area with Boston once England's largest port. Wisbech was also once a coastal port and King's Lynn also developed as a port and trading centre. There has been extensive expansion of towns such as Peterborough and Ely and considerable future growth is likely around Cambridge. Settlements throughout the low-lying coastal strip around the Wash are generally concentrated in a 'belt' between three and five miles from the shoreline, on slightly higher ground, which also contains the main roads. The areas between the settlements and the shoreline, and also the area landward of the settlements, the hinterland, are sparsely populated.

Source: The Fens Countryside Character Area description; Countryside Quality Counts (2003)

8.2 Main settlements

Main towns within the NCA are; Boston, King's Lynn, Spalding, Wisbech and Ely. The total estimated population for this NCA (derived from ONS 2001 census data) is: 451,449.

Source: The Fens Countryside Character Area description; Countryside Quality Counts (2003), Natural England (2012)

8.3 Local vernacular and building materials

In the 'Peat Fens' damage resulting from the shrinkage of the peat soils means that many buildings are now derelict, either standing at alarming angles or shored up, while the linear roads have likewise suffered showing significant undulations. Due to the lack of natural building materials most materials were imported except for reed and clay bricks. For the fine ecclesiastical and collegiate buildings stone came from the quarries of Lincolnshire, Northamptonshire, Rutland and Yorkshire including Ancaster and Barnack stone. Brick is the ubiquitous material with variations in texture and colour. It is found in the use of red bricks in the Wisbech merchants' houses and yellow brick, gault clay brickwork, in the Bedford Estate cottages at Thorney. In the rural areas thatch is now the exception due to the reduction in the availability of suitable reed and loss of reed beds.

Source: The Fens Countryside Character Area description; Countryside Quality Counts (2003)

9. Key historic sites and features

9.1 Origin of historic features

Early archaeological evidence is now becoming apparent as shrinking peat levels are exposing well-preserved remains for the first time since the Bronze Age. The Romans were the first to attempt to control water levels by building a sea wall along the inner Fen margin and cutting channels. These waterways fell into disuse after the Roman civil structure declined.

In the Dark Ages, monastic houses began to play an important role in the evolution of the area, and from the Fen edge monasteries developed in Lincolnshire, such as on the gravel island at Crowland, and in Cambridgeshire, where a monastery preceded the cathedral at Ely.

From the 13th century attempts were made to set up drainage systems. One of these – the 14 mile cut known as Mortons Leam – still functions today. In the Medieval period grazing was prevalent together with salt making. Residual mounds or 'salterns' remain in many places.

The most influential stage in changing the character of the area was in the 17th century when the Earl of Bedford gained a Royal Charter to turn the 'wastelands' into good summer grazing. The Dutch engineer, Vermuyden, undertook the vast engineering project to create the North, Middle and South Bedford levels. Washes between parallel watercourses were created, such as The Hundred Foot or Ouse Washes. The peat soils shrank and oxidised as they dried, and it became necessary to artificially pump the land. The productive land created as a result of this drainage meant the former pastoral areas became Grade 1 soils suitable for intensive arable, vegetable and horticultural production.

The last areas to be drained were the East, West and Wildmore Fens of south-east Lincolnshire. The reclamation of the coastal salt marshes has also been significant. New sea walls were built to further extend the rich agricultural land into the Wash, which resulted in the loss of estuary habitats.

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

9.2 Designated historic assets

This NCA has the following historic designations:

- 5 Registered Parks and Gardens covering 86 ha.
- 0 Registered Battlefields.
- 201 Scheduled Monuments.
- 3,373 Listed Buildings.

Source: Natural England (2010)

- More information is available at the following address: **www.english-heritage.org.uk/caring/heritage-at-risk/**
- **www.english-heritage.org.uk/professional/protection/process/national-heritage-list-for-england/**

10. Recreation and access

10.1 Public access

- Less than 1 per cent of the NCA 2,654 ha is classified as being publically accessible.
- There are 2,314 km of Public Rights of Way at a density of 0.6km per km^2.
- There are no National Trails but the Hereward Way is recognised locally.

Sources: Natural England (2010)

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

Access designation	Area (ha)	Percentage of NCA
National Trust (Accessible all year)	167	<1
Common Land	479	<1
Country Parks	35	<1
CROW Access Land (Section 4 and 16)	627	<1
CROW Section 15	233	<1
Village Greens	33	<1
Doorstep Greens	10	<1
Forestry Commission Walkers Welcome Grants	12	<1
Local Nature Reserves (LNR)	100	<1
Millennium Greens	2	<1
Accessible National Nature Reserves (NNR)	1,533	<1
Agri-environment Scheme Access	111	<1
Woods for People	623	<1

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.

Wisbech North Brink with Georgian buildings fronting the tidal River Nene.

11. Experiential qualities

11.1 Tranquillity

Based on the CPRE map of tranquillity (2006) the lowest score is to the north-west of Boston. The higher scores are along the edge of the Wash, the highest score being recorded between Terrington St Clement and Breast Sands.

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

Tranquillity	Score
Highest	131
Lowest	-62
Mean	17

Sources: CPRE (2006)

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

11.2 Intrusion

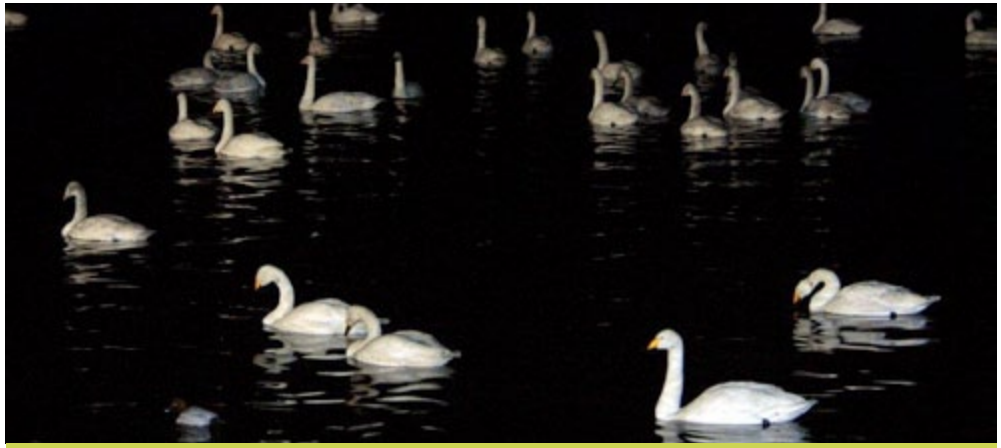
The 2007 Intrusion Map (CPRE) shows the extent to which rural landscapes are 'intruded on' from urban development, noise (primarily traffic noise), and other sources of visual and auditory intrusion. This shows that areas of disturbed land are associated with the major settlements of King's Lynn, Ely, March, Wisbech, Spalding and Boston together with the urban edges of both Peterborough and Cambridge. Disturbance is also associated with the main link roads between these centres of population including the A10, A16, A17, A141, A142 and the A1101. A breakdown of intrusion values for this NCA is detailed in the table below.

Intrusion category	1960s (%)	1990s (%)	2007 (%)	Percentage change (1960s-2007)
Disturbed	9	23	34	25
Undisturbed	89	75	64	-25
Urban	1	1	2	1

Sources: CPRE (2007)

Notable trends from the 1960s to 2007 are, in the 1960s the majority of the Fens was largely undisturbed except around major towns. By 2007 the majority of the Fens had some level of intrusion, all the major towns, including some that do not appear in the 1967 results, and the main transport routes showed a level of intrusion which reflects the large recorded change between 1960 and 2007.

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



Swans at Welney at night.

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 Forest Inventory, Forestry Commission (2011)
- Countryside Quality Counts Draft Historic Profiles, English Heritage (2004)*
- Ancient Woodland Inventory, Natural England (2003)
- BAP 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)
- NFU (undated) Why farming matters in the Fens. 16pp.
- 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)

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

Trees and woodlands

- Orchards remain characteristic in the area around Wisbech despite more recent losses.
- Woodland cover is very sparse, in an open agricultural landscape. There is evidence of more recent tree planting close to settlements or along field boundaries. Coniferous shelterbelts are particularly common around isolated farm buildings.
- Woodland cover in the Fens is extremely low at only 1 per cent of the NCA. Between 1999 and 2003 the proportion of established eligible National Inventory of Woodlands and Trees stock increased from about 9 per cent to about 27 per cent.
- There were no large areas of planting, although the extension of woodlands through new planting mainly takes the form of small isolated blocks throughout the inland open fen area. New planting can introduce inappropriate and visually intrusive elements in this flat and open landscape. Most of the increase is in association with existing wet woodland sites including Holme Fen and Wicken Fen.

Boundary features

- There has been some loss of historic hedgerow patterns on clay islands found in the inland fen area due to housing development and limited management.
- Boundary features continue to be maintained through stewardship schemes but there are limited agreements in place under options for management. There are few agreements in place for ditches despite their extensive number and their importance.

Agriculture

- Fenland agricultural land use is constantly changing. Between 2000 and 2009 the area of farmland used to grow cereals, the largest crop by area, decreased from 156,000 to 137,000 ha. The area used to grow oil seeds increased by 128 per cent (to 24,858 ha), for stockfeed by 1,300 ha to 1,600 ha and for vegetables by 18 per cent. The arable area in 2007 was 322,302 ha i.e. 83.7 per cent of the NCA area. Numbers of pigs and sheep farmed in the Fens decreased to just under 60,000 and nearly 27,000 respectively between 2000 and 2009 but cattle numbers rose from approximately 27,000 to 28,000.
- The Fens NCA is dominated by agricultural land use, including a wide range of arable, root crops, bulbs, vegetable and livestock. Polytunnels and plastic sheeting are being used, especially early in the growing season, over increasing areas. Between 1999 and 2003, the area of grassland increased, and there was a reduction in the number of general cropping farm types.

- The loss of pasture is particularly evident around settlements. Pasture and older grassland survives principally on the fen islands (where settlements are long established) and in churchyards both on islands and elsewhere in the Fens.

- The general increase in farm size is reflected in the proliferation of new large-scale agricultural buildings. An increase in the number of poly-tunnels and glass houses reflects the popularity in bulb growing. These structures can reduce the sense of remoteness in rural areas and cause visual intrusion, enclosing previously open views. There has been a loss of medium-size farm enterprises which have largely been edged out.

- In 2003, significant areas of the NCA were covered by management agreements for pastures on neutral/acid soils (2,846 ha), regeneration of grassland/semi-natural vegetation (1,628 ha) and saltmarsh and intertidal habitats. In 2011, the total extent of grassland under agreements was 10,921 ha.

Settlement and development

- Modern built development is eroding the architectural and historic character of some Fenland villages. Development on settlement margins can be particularly damaging, creating visual intrusion and resulting in the loss of surrounding landscape features and increasing the risk of coalescence. The proliferation of smaller, unplanned residential development along arterial roads is also changing the landscape, reducing the sense of remoteness and enclosing views.

- Road improvements are commonplace, including straightening of existing routes and new 'by-pass' schemes designed to alleviate congestion within towns and villages.

- There has been a significant increase in the number of larger industrial scale units, mainly related to the agricultural/horticultural industry with minimal screening to assimilate the structures into the open landscape.

- Light pollution is an increasing issue but this may decrease with new, energy-efficient more directional lighting technology.

Semi-natural habitat

- In 2011, there was a total extent of 13,764 ha (3.6 per cent of the NCA) of semi-natural habitat with meadows, coastal and flood plain grazing marsh, purple moor-grass and rush pastures and woodland being the most extensive.

- The Great Fen project has seen an increase in the area of wet grassland and washland. Recent concerted efforts to re-wet areas have been successful with areas of wet grassland and washland increasing and new reedbed and fen areas being created. The other major wetland restoration schemes, some of which are as extensive as the Great Fen, are: Wicken Vision, Lakenheath Fen, Wissey Wetlands, South Lincolnshire Fens (Baston & Thurlby) and Kingfishers Bridge. The RSPB Nene and Ouse Washes are major areas of grazing flood plain.

- Up to 2003 there had been an increase in the uptake of stewardship schemes for saltmarsh restoration to grassland and intertidal habitats.

- By 2011, the main environmental stewardship effort was devoted to grasslands, freshwater and estuarine alluvium.

Historic features

- The wet or anaerobic conditions present in the fen deposit sequence enable the preservation of waterlogged wooden structures, objects and other organic archaeological remains. These together with evidence of past environmental conditions provided by preserved plant and microfaunal remains, significantly enhances our understanding of how people lived and worked in and around the fenland basin in the past. While some of these remains are encountered through development-led excavations, elsewhere, as the drying peat shrinks, other archaeological remains and palaeoenvironmental evidence are being revealed and/or destroyed. These important archaeological remains present an opportunity for education and learning and the landscapes that contain them require appropriate protection and management.

- English Heritage's annual 'Heritage at Risk' register indicates heritage assets that stand to be lost through neglect, inappropriate cultivation methods or through dewatering. Ancient earthworks, more recent agricultural buildings (such as historic farmhouses and barns), pumping structures or relict military structures are a typical focus in this NCA.

Coast and rivers

- Abstraction levels from the majority of rivers and water courses in this NCA are above those needed to achieve good status in line with the Water Framework Directive, so potentially there are issues with deterioration due to over-abstraction.

- On the Lincolnshire coast, newly engineered flood defences are being created and parts of the existing sea bank are deliberately being breached. This is in an effort to combat the growing threat associated with sea level rise linked to the effects of climate change.

- In 2003, Countryside Stewardship agreements for saltmarsh restoration and intertidal habitats covered almost 1,000 ha. The reclamation of salt marsh for agriculture and consequential squeezing of intertidal mudflats has had a significant impact on character but has now largely halted.

Drivers of change

Climate change

- Climate change and associated isostatic adjustment are causing sea levels to rise and are likely to result in increased storminess, sea level rise and increased threat of drought or floods. The challenges within the Fens include how the current system of drainage will be maintained, and dealing with the consequences of rising sea levels. Defra predictions indicate that by 2105 sea level will increase by 1.1m.

- Fen soils and peats are already under threat through the desiccation and erosion of exposed soils. The increased incidence of droughts may mean soils become more vulnerable to damage through prolonged periods of exposure and loss and increased erosion through wind-blow and run-off; increased storminess may well lead to a reduction in soil fertility and thickness. It appears likely that fenland peat soils are wasting at up to around 2.1 cm/yr. For the surviving areas of deep peat it is estimated that the average wastage rate is around 1.5 cm/yr. This is equivalent to around 9 per cent of the annual loss of organic carbon from 0-15 cm depth of all soils across England and Wales reported by Bellamy et al. (2005) and about 0.3 per cent of the UK's annual industrial emissions of carbon dioxide.

- Increased storminess could have an impact on the protection levels that sea defences provide and on the behaviour of sediments in the Wash. Dealing with the consequences of rising sea levels in an area where the majority of the land is already below sea level is problematic. Climate change could present a major threat to coastal landscapes where the intertidal zones become 'squeezed' between rising sea levels and sea defences. If the defences stay where they currently are, their size and nature will change significantly, probably to the detriment of landscape quality and biodiversity.

- The Ouse and Nene Washes are recognised as a nationally and internationally important freshwater wetland, and are designated as Sites of Special Scientific Interest (SSSI) Special Protection Areas (SPA), Special Areas of Conservation (SAC) and Ramsar sites. The condition of the Ouse Washes has deteriorated since the 1970s largely due to an increase in the frequency of flooding events in spring and summer and an increase in the depth and duration of winter floods. Major enhancement projects such as the Ouse Washes Habitat Creation Project and the Block Fen/Langwood Fen Masterplan both of which seek to deliver substantial biodiversity enhancements to the Ouse Washes.

Other key drivers

- New wind energy schemes will create visual landmarks on this predominantly flat landscape and reduce the sense of remoteness and isolation; they should be sited away from visually prominent locations. The Government's commitment to increasing energy from renewable sources means there is likely to be continued pressure to accommodate such schemes.

- Cabling for electricity to get energy from off-shore windfarms onto the land and connected to the grid, needs to be buried. The proliferation of wind turbines on the horizon can bring an industrial landscape into an area that has a wild and remote feeling. Visual impact assessments should be carried out for wind farms.

- Given the proliferation of windfarms in this area and the potential for impacts on the interest features of statutory sites and protected species, it is crucial (given the predominantly arable nature of the landscape) that semi-natural habitats and green corridors (rivers, ditches, hedgerows) linking them are maintained and enhanced as far as possible. This includes protection from the potential adverse effects of wind turbines.

- Projects and partners working to re-wet the Fens offer an important opportunity to halt the loss of carbon from long-term soil stores and also make significant contribution to biodiversity and green infrastructure targets and objectives.

- The prevention or reduction in the number of spring and summer flood events on washlands impacts upon ground-nesting birds.

- Agri-environment schemes offer an opportunity to work with farmers and landowners to increase the area of valuable habitat, and develop networks of linked habitats.

- The exposure of important archaeological remains such as those at Whittlesey offer valuable opportunities for science and education

- Existing rural landscape features should be protected and positive management of those features lost or under threat should be encouraged. Restoration of hedgerows on the clay islands should be a priority.

- There has been pressure to increase housing stock in villages with poor control over materials and design and considerable future growth likely around Cambridge. These expansions present opportunities for re-creation of fenland landscapes of recreational and amenity value.

- The Fens have a relatively poor provision of accessible and connected green infrastructure, but there are significant opportunities to improve this situation in new development proposals through proactive planning and design from the outset. It is especially important that this is fully considered through the planning process.

- Work in partnership to create new lowland grassland habitats and compensate for habitat loss as a result of sea level rise. Develop descriptions of connected green infrastructure to draw attention to initiatives linked to the Wicken Vision (for example the Lodes Way) and the Great Fen 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.

Sunset over North Brink, Wisbech.

Statement of Environmental Opportunity	Ecosystem Service: Food provision	Timber	Biomass	Water availability	Genetic diversity	Climate regulation	Water quality	Water flow	Soil quality	Soil erosion	Pollination	Pest regulation	Coastal erosion	Sense of place	Sense of history	Tranquillity	Recreation	Biodiversity	Geodiversity
SEO 1: Manage the agricultural landscape and soils which allow the Fens to be a major provider of food and horticultural produce, while seeking to enhance opportunities for biodiversity.	↑ ***	↔ **	↗ ***	↗ **	↔ **	↗ **	↗ ***	↗ ***	↑ ***	↑ ***	↑ ***	↗ **	↘ ***	↗ ***	↔ **	↔ **	↔ **	↑ **	↗ **
SEO 2: Manage the core wetland complexes and increase their connectivity by enhancing the main rivers, waterways and their associated riparian habitats and improve recreational access opportunities to the Fens.	↘ ***	↔ *	↔ *	↑ ***	↔ **	↑ **	↑ ***	↑ ***	↑ **	↑ **	↗ ***	↗ ***	↔ ***	↗ **	↗ **	↗ **	↑ ***	↑ ***	↑ ***
SEO 3: Plan for the creation of new coastal landscapes in the Wash area that are adapted and resilient to the impact of climate change, for the benefit of people and wildlife.	↔ **	↔ **	↔ **	↗ **	↔ **	↗ **	↘ **	↑ ***	↔ **	↑ ***	↗ **	↔ **	↑ ***	↑ ***	↔ **	↔ **	↗ ***	↑ ***	↗ ***
SEO 4: Conserve, manage and enhance the Fens landscape and increase educational opportunities to access its geodiversity, archaeology and cultural heritage to enhance enjoyment and understanding for those who live and work in and visit the Fens.	↔ **	↔ **	↔ **	↑ **	↔ **	↑ ***	↗ ***	↗ ***	↑ ***	↑ ***	↔ **	↔ **	↔ ***	↑ ***	↑ ***	↑ ***	↗ ***	↔ **	↑ ***

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.

National Importance; Regional Importance; Local Importance

Landscape attributes

Landscape attribute	Justification for selection
Open, flat expansive estuarine landscape and seascape with extensive skies and panoramic views offer a sense of remoteness and tranquillity.	■ The flat landscape of the Fens, which results from the underlying geology, is large and open, with big skies, wide views and large open geometric fields. Seasonal colour changes and sunsets are dramatic. ■ When the bombing range at RAF Holbeach is not in use, the coastal zone offers a feeling of tremendous remoteness and tranquillity. ■ This predominantly flat landscape and the sense of remoteness and isolation could be lost through insensitive placing of new wind energy schemes and other types of visually dominant infrastructure. ■ SSSI notified for their geological interest make a significant contribution to our understanding of past environments, particularly in regard to climate change. ■ One per cent of the NCA falls within the Norfolk Coast Area of Outstanding Natural Beauty.
Highly productive peat soils support large-scale commercial agricultural activity which is nationally important for food production.	■ 87 per cent of land in the Fens is Grade 1 or Grade 2 agricultural land. In 2009, 44 per cent of the farmed land was used for growing cereals. ■ Between 2000 and 2009 the area of farmed land used to grow oil seeds increased by 128 per cent, for stockfeed by 442 per cent and for vegetables by 18 per cent. ■ The loamy and clayey soils of coastal flats with naturally high groundwater (51 per cent) have a high agricultural potential, especially along the east coast. Continual pumping of water is necessary to maintain water at levels which will allow cultivation. ■ Soils over the coastal and central fens are rich, fertile calcareous and silty. Further inland soils are defined by dark, friable fen peat. ■ Loss of peat results in loss of carbon and reduces the ability of an area to store carbon.
A historic wetland landscape with a distinct hierarchy of rivers, drains and ditches and large rectilinear geometric fields which create a strong pattern in the landscape.	■ A distinct hierarchy of rivers, drains and ditches strongly influences the strong dominant rectilinear/geometric landscape pattern and is a consistent feature of the area. ■ Fossil drainage systems for example roddons. ■ Drainage ditches are the dominant boundary features, some being of considerable antiquity. They are key landscape features and important areas for biodiversity. The Ouse Washes, Nene Washes, Fenland and Baston Fen are all designated as Special Areas for Conservation because the ditches on these sites support the internationally protected species of spined loach. ■ Ditch and embankment upgrading to aid flood protection. Some over-management of ditches has reduced aquatic and marginal vegetation. ■ Agri-environment schemes for ditches in the Fens in 2003 covered more than 15 per cent of the national total. ■ Losses of grazing banks, tree belts and grasslands around settlements to ploughing, and a move to cropping and subsequent loss of livestock, have impacted on the character of the farmed landscape.

Landscape attribute	Justification for selection
A mosaic of semi-natural wetland habitats such as wet woodlands and grassland, salt marshes, mudflats, reedbeds and fen.	■ The Fens are predominantly cultivated and remnants of semi-natural land are rare, found only at places like Needingworth and Baston, Lakenheath, Wicken, Woodwalton and Holme Fens. Drainage of the fens has caused the loss of 97 per cent of the original fenland habitat. Despite this, the surviving patches of protected fens are among the richest places for wildlife in the country. ■ The Nene and Ouse Washes are designated as Special Protection Areas under the Birds Directive because the washland habitat found on them supports major populations of overwintering and breeding wildfowl. ■ The Nene Washes are part of the Peterborough higher level Environmental Stewardship target area. ■ The Environment Agency's Anglian Habitat Restoration Programme will create habitat to compensate for its loss through flood and coastal risk. ■ The intertidal mudflats and saltmarshes of the Wash Ramsar/SAC and SPA site represent one of Britain's most important winter feeding areas for waders and wildfowl. The reclamation of saltmarsh for agriculture and consequential squeezing of intertidal mudflats has had a significant impact on character.
The Wash estuarine landscape and seascape which is internationally important for nature conservation.	■ The Wash Shoreline Management Plan states that the Wash is accreting at present. The saltmarsh and mudflats provide important habitats for wildlife and act as an important natural sea defence. It will be important to retain these flood defence capabilities. ■ The shoreline of the Wash between Gibraltar Point and a point to the north-west of King's Lynn is characterised by a sea bank that divides saltmarsh and mudflat from extensive low-lying agricultural land. ■ Marshes directly adjacent to the Wash exhibit an exceptionally open aspect (broken only by sea walls). The coastal area of the Fens is valued by visitors seeking peace and quiet recreation and those enjoying the abundant wildlife present at certain times of the year. ■ Saltmarsh maintenance is important for carbon sequestration as well as for its value as a natural flood defence and feeding ground for protected birds and for its extensive livestock grazing systems.
A traditionally unwooded character.	■ Only 1 per cent of the NCA is woodland - 0.04 per cent is ancient semi-natural woodland covering small areas that are particularly valued, and have historic value. ■ There are no large areas of tree planting although extension of woodlands through new planting is marked. ■ The pollarding of existing willows along ditches and watercourses should be encouraged, particularly where they are local features such as at Whittlesey. ■ Traditional orchards, for example the former extensive orchards in the northern fen to the south of The Wash, are being replaced by arable cultivation or new development.

Landscape attribute	Justification for selection
A varied settlement pattern.	■ This reflects settlement history and past responses to the location of dry land. The more extensive and older settlements are on clay islands in the peat and alluvium. ■ Linear settlements along the main roads (for example the A17) in more dispersed patterns in drained coastal marshes and on the higher ground of the inland fens. Long straight roads are typical. Dispersed historic farms occupy the elevations offered by roddons. ■ Visually intrusive development at settlement margins includes road schemes, power lines, industrial and residential construction and has impacted upon local character. There has been much building outside urban and fringe areas. ■ Linking fen villages and settlements to their surrounding landscapes using grassland, wetland, shelterbelts and hedgerow planting could be considered, with the mix dependent on local patterns.
Historic character and archaeological features provide cultural and experiential qualities which contribute strongly to the sense of place.	■ The fen 'islands' of land rising to between 5 m to 20 m AOD, roddons and the fen margins have been influential in determining the historic settlement pattern. Settlement character contrasts between the northern silt fen and the southern peat fen. ■ In the north, numerous 16th and 17th century houses are evident in small historic village cores around medieval churches or manors. Substantial post-medieval mansions occur in large gardens or parklands. ■ Urbanisation of the towns that developed around the ports of Wisbech and King's Lynn is reflected in building types, where industrial zones retain some historic elements. The southern peat fen is host to numerous islands, many of which had medieval manors, monastic establishments, market places and river/canal systems that secured continuous occupation in these seasonally isolated settlements. More erosion of the historic fabric of these villages has occurred but timber framed, thatched or pan-tiled houses are still present in their core areas. ■ Industrial buildings (such as lumber yards, foundries, engine houses and brick kilns) and the historic wharves, quays and docks along the tidal rivers, indicate a rich and varied history of traded and local goods, manufacture and distribution, while the major sluices at Denver and Dog-in-a-Doublet are strong reminders of the strict management of the regional water environment enabling the present day habitation and cultivation of the fens ■ The fen deposits conceal considerable evidence of prior settlement dating back to prehistoric times. An intricate pattern of roddons, former tidal creeks, is evident from aerial and LiDAR images. ■ As the peat shrinks, well preserved remains of prehistoric landscapes are revealed. Particularly rich archaeology is found on fen margins where diverse settlements and field patterns are being exposed. ■ Key historic buildings such as St. Botolph's Church ("Boston Stump"), Ramsey Abbey and Ely Cathedral are iconic local buildings.

Landscape opportunities

- Maintain and conserve the area's valuable soils through sustainable farming and agricultural agreements to the benefit of food production, biodiversity, sense of place and climate change regulation.
- Expand the total area of semi-natural habitat and increase connectivity to allow adaptation to climate change. In particular, increase connectivity between new and existing wetlands by the creation of linear habitats and river enhancement. Of particular value is the washland habitat which supports internationally-important numbers of water fowl and wildfowl; its management could increase habitat connectivity and contribute to managing flood risk. It is important as the last refuge of BAP lowland meadows in the Fens.
- Ditches and watercourses are seen as features in the landscape and need to be better managed. Management of the field boundary ditch system will reinforce the wetland character of the area.
- Preserve and manage the historic orchards which characterise the area around Wisbech both for their landscape value and their genetic diversity.
- Protect and manage the sandflats, mudflats and saltmarsh areas around the Wash which support international numbers of overwintering and breeding wildfowl, while recognising the mobility of these species.
- Put in place better protection and management practices for the subsurface archaeological sites which provide an important educational resource and which are assessed as being at risk from damaging agricultural and drainage practices.
- Protect the long views and open expansive unwooded character of the landscape and work to visually mitigate the impact of large structures including unsympathetic buildings and energy infrastructure that are highly visible in this flat landscape.
- Work to minimise the effects of light pollution, especially from transport routes in rural areas.
- Protect the distinctive character of settlements throughout the landscape and consider the visual impact of new development such as Alconbury Weald and Northstowe, which lie just outside the NCA and have an effect locally as centres of commercial and residential development.
- Make use of village and town design statements and conservation area appraisals for informing future development proposals. Encourage design that minimises visual impact on local landscapes.

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 Climate Shellfish	Soils over the coastal and central fens are rich, fertile and calcareous. Further inland soils are defined by dark, friable peat. 44 per cent of the soil in the NCA is classified as Grade I agricultural land, 43 per cent as Grade II. In1987 it was estimated that there were 24, 000 ha of lowland peat soils in the Fens. (Holman 2009) The Wash is an important shellfish fishery. Some wildfowling still takes place here.	National	The Fens produces 37 per cent of all outdoor-grown vegetables in the UK (including 24 per cent of potatoes and 17 per cent of sugar beet). Nearly 4,000 farms employ more than 12,800 people in intensive food production here. Arable crops, vegetables, fruit (for example around Wisbech) and horticulture (around Lincolnshire Fens) produce high value outputs. Fenland agriculture involves all year round cropping systems, heavy machinery which can cause compaction, use of herbicides and pesticides and fertiliser (NPK) inputs. Soil management is primarily aimed at supporting food production, which may be at the expense of other ecosystem services. The use of peatlands for arable or horticultural production requires drainage, which leads to subsidence of the ground surface and destruction of peat. Food production is important but current loss of soil means it may become less viable and/or productive in the future. There are issues around land use and the unsustainable use of water. Diffuse pollution of waterways is a problem but sewage is a far larger problem than from agriculture.	Work with farmers to ensure the long-term viability of soil and hence support the production of food and the agriculture industry and to ensure there are mechanisms to restore and maintain peat. Encourage farmers to use techniques such as establishing break crops to manage land and protect soil. Support research into new cultivation practices to protect the soil. Increase the area of land under pasture/ permanent grassland to reduce the loss of soils from wind-blow. Seek opportunities to harvest sustainable quantities of shellfish from the Wash. Restore and promote a distinctive "Fenland cuisine" using the locally produced larder of vegetables, salads, grain, fruit, and sustainable fish and fowl.	**Regulating soil quality** **Food provision** **Regulating water quality** **Regulating water flow** **Regulating soil erosion** **Biodiversity**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Timber provision	Small areas of woodland	Very limited resource at present within this NCA covering just 1 per cent.	Local	While there are small areas of woodland in duck decoys (hide areas to where ducks are lured) and shelterbelts, the timber resource is scarce in this NCA. The fertility of the land affords a much greater economic return for growing food crops than for growing timber.	Minor opportunities for local timber for fuel and other uses.	**Timber provision** **Biodiversity** **Sense of place / inspiration**
Biomass energy	Biomass crops	Small amounts of miscanthus are grown in the Cambridgeshire Fens.	Local	Potential miscanthus yield is high throughout the NCA. The large-scale, flat open landscape would mean that biomass crops were highly visible, changing the extensive vistas which make this area distinctive. Biomass energy is a new use for willow/osiers, which has traditionally been grown for gardening and thatching. Plantings which link to existing features such as copses, shelterbelts, farmsteads or villages, would be less intrusive. The presence of biomass crops would be likely to displace the food growing capability in this area. There is potential to establish short rotation coppice (SRC) especially where extensive peat loss has already occurred but this would also be likely to displace the food growing capability in this area and could affect water availability. Erosion/destruction of archaeological remains by invasive root system, planting and harvest methods where soil cover is thin.	Work with the farming community to consider the role of biomass crops both as a potential fuel and for its biodiversity value and to protect soil texture.	**Biomass energy** **Regulating soil quality** **Regulating water quality** **Pollination**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Water availability	Rivers Drains Washlands Groundwater	The rivers that have been subject to assessment have a Catchment Abstraction Management Strategy (CAMS) status of 'no water available' in the summer months, and a 'water available' status during winter months (typically the period of high flow). Rivers in the south and far south-east of the NCA generally have a CAMS 'over abstracted' status[4], including the River Great Ouse and The River Lark. The groundwater in this area also has an 'over abstracted' status. Rivers in the north of the NCA had not been subject to water availability assessment in 2011. Ground water is also over-abstracted.	National	The Fens has the lowest precipitation rates in the UK. Small parts of a number of major aquifers fall just within the NCA boundary (in the south-east and north-west). There is also a large number of major rivers in the NCA including the Ouse, Nene and Welland which rise well beyond the Fens. Potable water for the north of the NCA, including the urban areas such as Peterborough, comes from outside the NCA. Abstractions in the south-central NCA area are mainly for irrigation and industry, there being no public water supply licences in this area. Instead water is imported from outside the catchment for public water supply[5]. The Ely Ouse to Essex Transfer Scheme takes place in this NCA, transferring surface water to Essex and using groundwater to augment flows in the Little Ouse (which flows through this NCA and the Brecks NCA) and the Thet (located in the Brecks NCA). At times of low flow there is insufficient water in the Ely Ouse to meet abstraction demand for the Transfer Scheme. A supplementary scheme has been developed using a series of groundwater boreholes to pump water into the Little Ouse and Thet rivers with an additional transfer from the Little Ouse at Hockwold.	Potential to increase storage of water in this NCA by increasing the number of washlands and the storage capacity of existing washlands. This will increase water available for agriculture irrigation as well as provide opportunities to benefit nature conservation. Opportunities also include potential storage of water within the large ecological restoration schemes – Great Fen, Wicken Vision, Lakenheath, Wissey Wetlands, South Lincolnshire. Explore the potential to work with the farming community to consider the role of drought-resistant strains of crop or to develop alternative farming strategies.	**Water availability** **Regulating water quality** **Regulating water flow** **Biodiversity** **Sense of place / inspiration** **Sense of history**
Genetic diversity	Orchards Wild and naturalised relatives of cropped brassicas	Orchards hosting heritage species of fruit trees, such as very old Bramley apple trees and rare species. Traditional orchards such as those around Wisbech are being lost through neglect and poor management or due to land sales for development. Wild and naturalised relatives of cropped brassicas are locally common in the NCA.	National	The presence of old/original fruit varieties could be important for future crop breeding. Traditional orchards are inherent to historic landscape character. Black mustard (Brassica nigra) is locally common on ditch banks, waste ground near the sea, on river banks and on road verges. Bargeman's cabbage (Brassica rapa ssp campestris), also known as wild turnip, is compromised somewhat by hybridisation with cultivated subspecies of B. rapa, but may be native on the banks of streams and rivers here and there in Fenland. There are records of it by the Great Ouse and other main rivers.	Opportunities to preserve old varieties of fruit for their taste, to retain genetic information for its current value and for possible future crop breeding for example for resistance to diseases. Opportunities to protect orchards and bring them into positive management should be explored, promoted and secured through use of agri-environment schemes Opportunities to protect wild relatives of agricultural brassicas	**Genetic diversity** **Biodiversity** **Food provision** **Sense of history** **Sense of place / inspiration** **Pollination**

[4] The Cams and Ely Ouse Catchment Abstraction Management Strategy, March 2007. The Environment Agency.
[5] The Old Bedford including Middle Level Catchment Abstraction Management Strategy, March 2006. Environment Agency.

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Climate regulation	Peat soils Saltmarsh and mudflats	Estimates indicate that there are 24,000 ha of peat soils in this NCA. This makes a valuable contribution to carbon sequestration and storage. Loss of peat and the carbon it stores has been very significant as a result of peat wastage in agriculturally drained and cultivated soils. In accreting systems salt marshes have the potential for long-term storage of carbon.	Regional	The peat soils are highly valuable for agriculture (86 per cent of the NCA is Grade I and II) but continuing loss of peat and its stored carbon through wastage (shrinkage and oxidation) has been very significant where land is drained and intensively managed. In some areas ground levels have fallen by 1-2 m as a result of peat wastage. At Holme Fen the Victorian post, driven into the ground in 1851, records loss of a depth of over4 m since then. In the future wind erosion of remaining dried peat soils will become increasingly significant. Fenland peat soils are wasting at up to around 2.1 cm/yr. For the surviving areas of deep peat it is estimated that the average wastage rate is around 1.5 cm/yr. In some areas peat depth is now very shallow (less than 200 mm) for example parts of Wimblington Fen which creates cultivation pressure as well as impacts on underlying archaeological remains. Loss of palaeoenvironmental evidence and organic remains in such areas is total. Where peat soils and their hydrological status are well managed, they will retain an important role in the storage of carbon. The drying out and oxidation of peat, which can occur through a number of mechanisms, contributes to CO2 omissions. Peatlands retaining a high water table continue to store new carbon through the build up of plant material that has captured atmospheric carbon through photosynthesis. Grazing is important on the saltmarsh, major drainage embankments and flood meadows. Saltmarsh and mudflats have an important role in climate regulation due to carbon lock-in and they have important roles in coastal defence due to for example, their absorption of wave energy.	Re-creation of wet fen, wet grassland and washland together with changes to arable management (specifically minimum tillage, greater use of organic manures, biosolids and digestates plus soil conditioners) will help to ameliorate these significant losses if pursued on sufficient scale. Increase opportunities to manage and protect the remaining peat resource soils appropriately for example by re-wetting and the build up of organic matter. Encourage land owners and managers to pursue such activities. Encourage the establishment of permanent grassland and other uncultivated land such as semi-natural habitats.	**Climate regulation** **Food provision** **Regulating soil quality** **Regulating soil erosion** **Regulating water quality** **Regulating coastal erosion** **Biodiversity** **Sense of place / inspiration** **Sense of history** **Recreation**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water quality	Permanent grassland Semi-natural habitats Washlands Reedbeds and other wetland habitats	Excess nitrates, phosphates and pesticides from sewage and, to a lesser extent, from agriculture, have led to pollution and eutrophication in watercourses while sedimentation in rivers is a feature of the priority catchments in the NCA (the Little Ouse and Lincolnshire Coast Rivers). In both catchments excess chemicals from arable and horticultural food production are identified as issues.	Regional	Excess nitrates, phosphates and pesticides have led to pollution and eutrophication in water courses. In addition, soil erosion is identified as an issue. The Anglian River Basin Management Plan indicates that the ecological status of rivers and waterways in the NCA are either good (for example the River Haven, parts of the River Nene and the River Welland north of Spalding) or moderate (for example the River Witham north west of Boston). Chemical water quality is generally good apart from sections of the Nene and Great Ouse which fail to reach good status for much of the NCA. Where the groundwater chemical status has been assessed the groundwater chemical status is good. Washlands on the rivers Nene, Ouse and Cam all contribute to the regulation of water quality. Habitat restorations schemes indicate there will be larger areas of washlands in future. Within agricultural areas, measures can be taken to reduce nutrient and sediment run-off by establishing permanent grassland as a buffer along watercourses. Some of the most productive areas in the NCA are on peat which brings its own issues in terms of soil management and moisture. Semi-natural habitat such as reedbed and washland slow the passage of water through the hydrological system and help purify the water. New areas of permanent grassland could be established to improve the management of existing ones and other semi-natural habitats including reedbeds, fens and wet grassland to establish natural enhancement of water quality.	Manage farmland under the principles established under the England Catchment Sensitive Farming Delivery Initiative. Encourage landowners and managers to manage land to prevent the drying out of peat. Encourage the establishment of areas of semi-natural habitat such as reedbed and washland which slow the passage of water through the hydrological system. Establish new areas of permanent grassland and improve the management of existing ones and other semi-natural habitats including reedbeds, fens and wet grassland. Survey and monitor the ditch flora and fauna to understand the impact that changing nutrient levels are having on the biodiversity of this habitat. Work with the farming community to realise programmes of in-field nutrient analysis to inform fertiliser application rates which are performed at key times of the year.	**Regulating water quality** **Food provision** **Biodiversity** **Geodiversity** **Sense of history** **Sense of place/ inspiration** **Climate regulation** **Regulating soil erosion** **Regulating soil quality**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water flow	Semi-natural habitats Extensively grazed permanent grasslands and washlands Rivers and their washlands, ditches and dykes Remaining fens and large ecological restoration schemes Artificial flood defence structures	The four main catchments within the NCA are the Witham, Welland, Nene and Great Ouse. The Environment Agency (EA) flood risk map indicates the majority of the NCA is at high risk of river and/or coastal flooding; flood control is a key issue for most of the NCA. The remaining fens allow a longer period of water storage. UKNEA provides a rigorous estimate of the possible increase in flood hazard. This is a crucial task for planning future climate change adaptation strategies but our understanding of this change in risk is currently limited. There are solidly-built flood defence structures as the ground is so flat – rivers, especially where diverted, are embanked. The rivers and wetland of the Fens also assist upstream, neighbouring NCAs with their water regulation. The salt marshes along the coast absorb wave energy and provide a barrier hence mitigating tidal flooding.	Regional	The Fens are low-lying with much land below sea level. The EA flood risk map indicates that the majority of the NCA is at high risk of river and/or coastal flooding. Flood control is a key issue for most of the NCA particularly since the major flooding events in 1953. Increases in precipitation events associated with climate change may lead to an increase in flooding. The current flood storage capacity in the NCA needs to be maintained and increased particularly where there is the likelihood of high tide and high run-off/river flow combinations. A flood risk management strategy is being produced for the Fens to investigate how flood risk varies across the area and the best approach to managing this risk in the future. However, most settlements are offered some protection from flooding by man-made defences on the coast and main rivers. In addition, washlands (areas of permanent grassland deliberately flooded to prevent rivers overtopping) occur on the major river systems and include three large SSSI: the Ouse, Nene and Cam washes. In the past the washland habitat was considerably more extensive; estimates suggest that only 3 per cent now remains. This means that the ability of the land to retain and slow water passage has been lost. Historically the Fens have been heavily managed to reduce the probability of river and tidal flooding. Flood risk is expected to increase in future. Short-term, existing flood defences can be maintained at existing levels – this is current policy. In future flooding is expected to become more intense, so protection given by these defences might decline. There is a risk of growing salinity within groundwater, especially close to the coast, due to over-abstraction.	Increase the current flood storage capacity by creating sizeable areas of lowland fen, reedbeds, flood plain grazing marsh on coasts and rivers concentrating on areas at risk near settlements. Implement the recommendations from the EA Anglian Habitat Restoration Programme. Produce a strategy to develop a sustainable, integrated and long-term flood risk management approach. Adopt Great Fen strategy elsewhere, combining objectives for rewetting flood plains for biodiversity and for flood risk management; this aims to store winter floodwater while also providing water to restore and maintain fenland habitat on previously arable land. Other objectives include improving water quality, increasing recreation and tourism opportunities, and improving quality of life for local people.	**Regulating water flow** **Food provision** **Water availability** **Climate regulation** **Regulating soil erosion** **Regulating soil quality** **Regulating water quality** **Regulating coastal erosion** **Biodiversity** **Sense of place / inspiration** **Sense of history** **Recreation**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating soil quality	Agricultural land, permanent grassland and other semi-natural habitats Soils	86 per cent of the soils in the Fens are Grade 1 and Grade 2 agricultural land.	National	The dark humus-rich peaty fens and the finer lighter silty fens are the key natural resource. Wastage of peat areas together with sea level rise in an area dominated by artificial drainage will impact on the ecosystem services provided in the longer term. This could be devastating for agriculture as it becomes more difficult to pump waterlogged soils dry. Compacted and poorly structured soils lead to reduced infiltration and storage of water and, potentially, increased soil erosion, especially in areas where mineral soils are dominant. Maintenance of the integrity of the hydrological system in this NCA will contribute to maintaining and improving soil quality. Dry soils here are lost through "fen blows" which are a major cause of erosion. Some of the soils are re-deposited elsewhere in the Fens but much soil is lost to sea or to neighbouring NCAs. High volumes of material can be deposited into watercourses.	Encourage the adoption of the Defra Code for Good Agricultural Practice (2009) and Environment Agency's 'Think Soils' manual (2008) to avoid soil compaction and maintain good soil structure. Maintain wetted peat soils to reduce loss through compaction, oxidation and wastage. For mineral soils in the NCA, management to build up soil organic will help to maintain and enhance soil quality.	**Regulating soil quality** **Biomass provision** **Regulating water quality** **Climate regulation** **Pollination** **Food provision** **Biodiversity** **Geodiversity** **Sense of history** **Sense of place / inspiration** **Regulating soil erosion**
Regulating soil erosion	Semi-natural habitats Extensively grazed permanent grassland Soils with high organic matter Trees and woodland	The Holman report indicates a reduction in peat soil depth of up to 1.27 cm/yr in the early 21st century. Average wastage rate estimated in 2011 is 1.2 cm/yr.	National	Loss of peat through wastage is largely due to shrinkage by drainage, and, oxidation where the peat has dried. Water erosion is an issue in the Little Ouse Priority Catchment with light sandy soils, under maize and root cropping In the Lincolnshire Coastal Rivers Catchment, water erosion may be associated with outdoor pig rearing or intensive cereal and oil seed rape production. Use of heavy high-powered equipment increases the risk of soil compaction and consequently incidence of enhanced run-off and erosion by water. For mineral soils, management to build up soil organic reduces the chance of soil compaction and therefore erosion Wind erosion is a problem, particularly where spring-sown crops offer a bare loose soil surface to strong winds. This is an issue particularly on peaty and sandy soils, as is the removal of soil with harvested root crops. Soil erosion (by water or wind) from cultivated and unvegetated land has an important link with pollution to surface waters, particularly from pesticides and phosphates although phosphates originate significantly more from sewage than from agriculture.	Increase opportunities to manage and protect the remaining peat resource, for example by raising water levels to maintain (or enhance where possible) the build up of organic matter. Encourage land owners and managers to pursue such activities. Encourage landowners and managers to use farming methods that protect the soil such as maintaining vegetative cover. Use of grass buffer strips can reduce soil erosion from susceptible arable fields in the autumn and winter. Encourage the adoption by farmers and landowners of the Environment Agency's 'Think Soils' manual (2008)	**Food provision** **Climate regulation** **Regulating soil erosion** **Regulating water quality** **Regulating coastal erosion** **Sense of history** **Sense of place / inspiration** **Biodiversity**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Pollination	Orchards Semi-natural habitats Older, broader grass verges and sea/ flood-banks positioned close to arable fields	Some biofuels, such as oilseed crops, require insect pollination. These crops may become more widespread in the future if demand increases. Some crops such as strawberries, tomatoes and peppers are mainly pollinated by managed bumblebees which are imported commercially. Lowland meadow habitats found in the NCA provide important nectar sources for pollinating insects in an area otherwise devoid of significant remaining semi-natural habitats. Traditional orchards such as those around Wisbech are being lost through neglect and poor management.	Regional	The area is very poorly served by pollinators as large swathes of landscape are increasingly devoid of the semi-natural habitats on which the pollinators depend for food and shelter. These habitats are now found in isolated pockets save for a few larger areas/strips, especially the flood meadows and grazing marshes of the Ouse and Nene washes. There has been a severe and corresponding decline in wild and managed pollinator numbers over the last 30 years. This trend is likely to continue. The problem is caused by loss of semi-natural habitat, the introduction of pathogens, the inappropriate use of agro-chemicals and by climate change. Traditional orchards are inherent to historic landscape character. A greater variety of pollinators would allow a greater variety of crops to be grown. Creating further semi-natural habitats would be very cost-effective as it would be much cheaper than importing bees in the long term.	Use the Countryside Stewardship scheme (for example pollen and nectar mixes for field margins) to enhance landscape character and increase landscape connectivity. This would increase the ability of the pollinators to service nominated food crops. Opportunities to protect orchards and bring them into positive management should be explored, promoted and secured through use of agri-environment schemes. Use of buffer strips and modified crop-management to reduce the input of NPK fertiliser to verges/banks and other forb-rich habitats.	**Food provision** **Biodiversity** **Sense of place / inspiration** **Sense of history**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating coastal flooding and erosion	Salt marshes and sandbanks	The salt marshes along the coast of the Wash are accreting between the River Steeping at Gibraltar Point and Wolferton Creek. The current Shoreline Management Plan does not identify a policy for the prevention of the erosion of mudflats and salt marshes. The policy approach is to hold the existing sea bank alignments. From Wolferton Creek to Heacham the coastline is characterised by a natural shingle ridge backed by a grassed sea bank. The general movement of sediment is from the north to the south along the coastline. The Wash SMP identifies the need for a more detailed study is required to identify future actions. During the 20th century 3, 000 ha of marsh were reclaimed on the Wash.	National	Climate change is causing sea levels to rise. It is also likely to bring about increased storminess, which will have an impact on the rate of erosion/accretion and could impact the protection levels that sea defences provide and on the supply and behaviour of sediment in the Wash. It could also affect the quantity and frequency of sediment exchanges between habitats, and alter processes such as sea-defence functions in saltmarsh (UK NEA). Saltmarsh and mudflats in the Wash are accreting along this low energy coastline. They provide internationally important habitats for wildlife as well as important natural sea defences and are leading to increased natural protection for the coastline. In the short term (today to 2025), the policy approach is to hold the existing sea bank alignments. Climate-related sea level rise will increase coastal squeeze where the saltmarsh is constrained by coastal defences on its landward side. Its ability to regulate erosion and mitigate flood and storm damage is threatened by changes in the frequency and severity of storms and low sediment availability. Future sea-level rise may squeeze saltmarsh habitats against sea walls. This could be mitigated by managed realignment; the RSPB have created a 72 ha area of managed realignment at Freiston, near Boston as part of their work in this area.	Having areas of optimally-grazed marsh increases diversity and allows some less competitive halophytes to survive. There is opportunity to reduce overgrazing of saltmarsh, which affects the vegetation structure and therefore the ability of the saltmarsh to trap sediment and to store nutrients and pollutants. Opportunities to maintain the physical processes which sustain the Wash's tidal, sub tidal and fringing coastal habitats.	**Regulating coastal flooding and erosion** **Climate regulation** **Regulating soil erosion** **Regulating of soil quality** **Sense of place / inspiration** **Sense of history** **Tranquillity** **Recreation** **Biodiversity**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of place / inspiration	Expansive open, flat wetland landscape and seascape	A sense of place is created by the wide landscapes of flat, low-lying farmed landscapes where the fields are separated by an extensive system of dykes which in turn form key parts of the landscape. The Wash seascape and the agricultural use of the land produce strong seasonal changes. Big skies as well as the 'value of nothingness' are appealing, regarded as tranquil and thought-provoking rather than exciting. The wind is a key characteristic of the landscape experience in the area.	National	A hierarchy of embanked rivers, drains and ditches forms a distinct geometric pattern and provides a strong influence throughout the area. Marshes, swamps and fens add a further distinct character, notably adjacent to the Wash where the exceptionally open aspect is broken only by sea walls. Despite apparent uniformity, marked variations occur throughout the area. Built forms exhibit a strong influence ranging from historic cathedrals and churches, like Ely and Boston, to large agricultural and industrial structures. The Fens have inspired writers, poets and artists over the centuries, including John Clare, Charles Kingsley and Graham Swift, Peter Scott and Carry Akroyd. Offshore windfarms are changing the character of this landscape. The size of the individual units, the area covered by windfarms and the cumulative effect of their locations is having a significant impact on the long views out of this NCA to the east. The swans at Welney are a major visitor draw and contribute strongly to sense of place.	Ensure that the system of open field and dykes is maintained so that it both contributes to the landscape and provides linking habitats. Adopt cultivation practices that will ensure the long-term sustainability of agriculture. Protect and enhance the wildlife interest of the Fens including the spined loach in the ditches and the large populations of birds overwintering at the Washes. Seek opportunities to bring attention to the rivers and their role of water in shaping the landscape, especially where rivers are concealed behind flood defences. Retain long open views and the experience of big skies and Fenland sunsets.	**Sense of place / inspiration** **Recreation** **Tranquillity** **Sense of history** **Biodiversity**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of history	Sediments containing a rich record of past environmental and climate change over millions of years Well-preserved remains of prehistoric landscapes exposed due to shrinking peat levels Historic dykes, drainage pattern and system Traditional orchards and , historic hedgerow pattern Grazing marshes with traditional breeds of cattle Ely Cathedral and Boston Stump Flag Fen and major finds such as the log boats found recently near Whittlesey	A sense of history results from the environmental records preserved within the Fenland sediments and well-preserved remains of prehistoric landscapes that are being exposed due to shrinking peat levels with especially rich archaeology including bronze-age and Roman features found on fen margins. The dykes, flood banks, sluices, flood plains and drainage patterns reveal other aspects of the history of the Fens. The diversity of field patterns is enhanced by ancient semi-regular enclosures.	Regional	The area's distinct history and character are inextricably associated with the fine balance between man's ability to extract agricultural wealth from a productive landscape and the forces of the natural landscape which are constantly poised to return to a 'waterland' state. The subtle changes in soils and drainage have determined the historic settlement pattern, with the monastic establishments at Ely, Crowland and Thorney reflecting the clay islands' ability to support large settlements. Likewise the 'silty fen', arcing around the Wash, gave rise to the towns with their fine medieval churches (such as Boston) and Georgian merchant houses in Wisbech and Spalding. Distinctive 'half houses' are tiny vernacular houses typical of the Lincolnshire Fens, and were owned by smallholders with very small holdings. They were usually dispersed in areas where smallholdings were the norm. The settlements on the 'Peaty Fen' followed the systematic drainage of the Levels and is less rich in visible historic features, however they conceal considerable evidence of prior settlement dating back to prehistoric times (for example at the nationally important waterlogged wood structures at Flag Fen). Flag Fen is a site of international importance – a bronze-age platform and causeway just outside what is now Peterborough. The peaty fens also conceal a detailed fossil record of past landscapes and climates as well as an intricate pattern of former watercourses and creeks that are evident in aerial, infra red and LiDAR images. Archaeology in the Fens is well protected where the fen deposit sequence is intact or peat levels relatively deep. Remains are increasingly being discovered as the peat dries out - for example the dugout log boats revealed at Whittlesey at the end of 2011.	Raise awareness of the value of the rich archaeology and historic time depth associated with this area. Protect and interpret the historic landscapes of large fields and ditches with flood banks along rivers that show evidence of changing human use; the protection of heritage assets should be ensured at every opportunity. Seek opportunities to enhance the setting, interpretation and legibility of heritage assets should be identified and realised. The restoration and conversion of vernacular buildings should be sympathetic and in keeping with local landscape character While archaeology in the Fens may be protected from ordinary building development because of its deep nature in parts, there are other areas, for example near Spalding, where the shallow deposits are severely threatened by development. Opportunities to ensure that gravel extraction below the archaeological horizon does not threaten the bronze-age landscape in e.g. South Lincolnshire	**Sense of history** **Sense of place / inspiration** **Recreation** **Tranquillity**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Tranquillity	Areas away from settlements and major transport corridors Wetland landscape , seascape and coastal zone	Tranquillity is an important feature of the NCA, with 64 per cent classified as undisturbed according to the CPRE Intrusion Map 2007 (representing a decrease from 90 per cent since the 1960s).	Local	The open and empty landscape means different things to different people; some can find it featureless and intimidating whereas others value its tranquillity, which still persists away from the settlements and major transport corridors. Tranquillity is likely to be particularly associated with the area's remaining wetland habitats, notably the large marsh areas adjacent to the Wash. There is, however, major aircraft noise within several miles of the bombing range at RAF Holbeach.	The tranquil character of the area should be protected and intrusion into the most rural areas avoided. In particular light pollution and light spillage from any new development should be prevented or minimised. Opportunities to conserve the sense of remoteness and 'wildness' should be taken. Tranquillity should be enhanced where opportunities arise through the removal of obtrusive features, such as signage, lighting, overhead lines and poles.	**Tranquillity** **Sense of place / inspiration** **Recreation** **Sense of history**
Recreation	Rights of way Long-distance walking routes Open access land Coastal access Biodiversity sites Rivers	2, 314 km of rights of way within this NCA. Much of the landscape is not accessible as it is intensively agricultural with no public footpaths and no means of crossing ditches without many detours. The sea wall is fronted by large areas of saltmarsh and the sea is often not visible. Angling is a popular recreation.	Regional	Agriculture dominates the landscape and recreational opportunities are restricted, even though recreation is supported by 2,314 km of rights of way (at a density of 0.6km per km^2) and 627 ha of open access land. The coast is not widely used due to its inaccessibility and the noise from the bombing range at RAF Holbeach. Communities in this NCA include many migrant workers andhave high Indices of multiple deprivation (IMD), with various health issues including obesity, lower than average life expectancy, high levels of physical inactivity and many experience issues with isolation. The ageing population is also an issue.	Major habitat restoration projects at Great Fen and Wicken Fen offer opportunities for improving and creating new access. New national coastal access routes are planned. The Fens Waterways Link is an ambitious project to connect, by navigable water, the cathedral cities of Lincoln, Peterborough and Ely. There are opportunities for promoting long distance walking (such as the Ouse Valley Way, Hereward Way and Nene Valley Way) and good routes for cycling along old drove roads. Seek opportunities to promote biodiversity sites such as the swans at Welney and bird-watching at the Washes. Enhance historic and natural environment interpretation facilities in key fenland visitor spaces. Promote opportunities to maintain water quality for the benefit of anglers. Opportunities to address health problems and other effects of high deprivation indices issues can be provided within the NCA: improved access to local green spaces could provide a potential solution to many of these issues, offering people opportunities to improve their lifestyles, whilst benefitting from closer interaction with the natural environment.	**Recreation** **Tranquillity** **Sense of place / inspiration**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Biodiversity	Internationally, nationally and locally protected sites	A number of sites in the Fens are notified for their international importance because the habitats they contain support internationally important numbers of breeding and/or overwintering species. The Wash's salt marshes and sandbanks are particularly important, and inland the rivers Ouse, Nene and Cam Washes are vital resources for wildlife. Of major importance are the areas such as Wicken, Holme and Woodwalton fens. Wicken especially is the single most species-rich site in the UK; other sites including Baston Fen in Lincolnshire are important for spined loach. The NCA is important for common seals, overwintering birds - pink-footed and Brent geese, shelduck, lapwings, oystercatchers, common terns and various plover species, for spined loach, and great crested newts. The Fens include several important Ramsar sites, SPAs and SAC including the Wash, the Ouse Washes and the Nene Washes. There are 41 SSSI in this NCA covering 8,939 ha. In March 2011, 59 per cent (by number) were favourable, 27 per cent were unfavourable, 10 per cent were unfavourable recovering and 4 per cent were unfavourable declining.	International	The Fens are of international importance for their biodiversity. Inland, habitats are provided by seasonally flooded wet grassland, calcareous fen, and a vast network of ditches which are home to the spined loach. The Ouse, Nene and Cam washes are of major importance for waterfowl; the Welney Washes near Ely are world-famous for their swans. Key to the success of these habitats is the presence of water at the right time of year in the appropriate quantities. The large embayment of the Wash with its associated salt marsh and mud flats provide important habitats for a number of species including pink-footed and Brent geese, shelduck, lapwings, oystercatchers, common terns and various plover species. The Wash is a feeding ground for marsh harriers. Connectivity of species is aided by the creation of fresh habitats as is happening with the Great Fen Project. Inputs of nitrates, phosphates and other pollutants have a major impact on biodiversity though eutrophication of waterways and changes to soil chemistry. These impacts in turn affect the entire food web. Drought clearly affects wetlands such as fens. Drought-intolerant species can be assisted by regulation of water flow and water levels within the Fens.	Better management of water courses including the reconnection of watercourse channels with their associated washlands. Opportunities to assist the conservation and growth of biodiversity by connecting diverse areas and enabling the spread of wildlife through the generation of. corridors and stepping stones. The Great Fen project and Wicken, Holme and Woodwalton fens provide major opportunities to conserve and support biodiversity and there is scope for similar initiatives elsewhere in the Fens. Opportunities to review Local Wildlife Sites (LWS) as appropriate and to monitor/improve the condition of these. Also to designate new LWS to preserve them for their educational, scientific/ research, aesthetic and/or historic value.	**Biodiversity** **Sense of place / inspiration** **Sense of history** **Tranquillity** **Regulating water flow** **Climate regulation** **Regulating coastal flooding and erosion**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Geodiversity	Nationally and locally designated sites Jurassic clays Quaternary sediments including peat	Jurassic sediments including the Oxford, Kellaway and Kimmeridgian clays with greensand and chalk at the south-east of the NCA. Quaternary deposits include a cyclic succession of peats, estuarine and marine clays and these demonstrate a detailed record of climatic and environmental changes over at least the last 500,000 years. The wealth and variety of geology and geomorphology provides opportunities for study, reinforces local distinctiveness and character and, along the coast, helps to regulate flooding and erosion.	National	Brickmaking is a major industry at Whittlesey and around Peterborough with local bricks forming a distinct vernacular building material. The Oxford Clay and Kings Dyke Brick Pit have been very important for palaeontology, with major Jurassic reptiles unearthed here. Leedsichthys, the world's largest fish, was discovered here, and is still being unearthed from these same sediments. At Kings Dyke, fossiliferous sediments are made available for collection and research. This is very popular with local schoolchildren. The local geology, especially the Quaternary deposits, is important for its record of climate and environmental change. Several SSSI have been notified for their buried Holocene (Flandrian) sediments.	Work with brick pit owners to ensure future availability of fossils for collection and research. Work with landowners and tenants to conserve buried sediments which record climate change. Ensure that such sites are maintained at optimum levels to prevent drying out and the formation of acidic ochre. Opportunities to review Local Geological Sites (LGS) as appropriate and to monitor/improve the condition of these. Also to designate new LGS to preserve them for their educational, scientific/research, aesthetic and/or historic value,	**Geodiversity** **Sense of place/ inspirational places** **Sense of history**

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