



The Broads

Landscape Character Assessment 2025

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Introduction

This Landscape Character Assessment (LCA) Supplementary Planning Document (SPD) is an updated version of the current Broads Authority Landscape Character Assessment (2016). The original landscape character assessment was completed in 2006, was subsequently added to in 2012 and updated and edited in 2016 as part of a second stage Heritage Lottery bid. Amendments have now been made to ensure that it is in accordance with current guidance and reflects any changes that have occurred to the landscape in the intervening period. The format of the document has also changed to ensure it meets current accessibility standards. It will form part of the evidence base for the Broads Authority's new Local Plan and informs landscape policies within that forthcoming document. It will be used to inform planning applications as well as used in decision-making. It will also be a Supplementary Planning Document.

The purpose of this LCA SPD is to provide an assessment of the different landscape characters within the Broads Authority Executive area to enable informed planning and management of the landscape, for example to meet the requirements of the National Planning Policy Framework (NPPF). The NPPF 2024 sets out at paragraph 189 that 'great weight should be given to conserving and enhancing landscape and scenic beauty' in the Broads, which has the highest level of protection in relation to these issues. It goes on to state that, 'development within their setting should

be sensitively located and designed to avoid or minimise adverse impact on the designated areas'. Paragraph 190 requires that applications for major development in the Broads should include an assessment of any detrimental impact on the landscape and the extent to which that impact could be moderated. By providing accessible baseline information on the character and condition of the landscape, the LCA will support these requirements.

Landscape character can be defined as the distinct and recognisable pattern of elements, or characteristics in the landscape that make one landscape different from another. Landscape character assessment is the process of identifying and describing such variations in character across a landscape. It also seeks to identify and explain the unique combination of features and attributes (characteristics) that make different landscapes distinctive. This LCA SPD identifies the 13 landscape types found in the Broads and assesses the 31 different landscape character areas.

The Norfolk and Suffolk Broads is a protected landscape with a unique, nationally significant mosaic of gentle landform, habitats, lakes and rivers. The document sets out how this interplay between the land, water and people has shaped the landscape of the Broads over many centuries. Much of the area forms the flood plains of the main rivers of the Bure, Yare and Waveney and their tributaries.

Key to ensuring that the special qualities of the Broads are protected is an understanding of what makes the Broads special. It is intended

that the Broads Authority's Landscape Character Assessment should achieve this. The special qualities of the Broads are:

- The winding rivers and open water bodies – the 'broads'
- The variety of habitats
- The abundance and rich diversity of wildlife
- Navigable, lock-free waterways to explore and enjoy
- The variety of patterns and textures in the landscape
- Countryside access to both land and water
- 'Big sky' views, dark skies and a sense of remoteness, tranquility and wildness
- The people, the visitors, the activities
- The history and historic environment: Earth heritage, heritage assets, archaeology
- Boating, boat building and unique heritage fleets
- Cultural assets, skills and traditions such as thatching and millwrighting
- People's interactions with the landscape
- Waterside settlements and quiet villages
- The Broads as a flood risk management asset.

The Broads Authority is the Local Planning Authority within the Broads area and this SPD applies only to areas within the Authority's

executive boundary. However, given that the landscape itself crosses boundaries and has impacts beyond the Broads Authority Executive Area, the LCA SPD should be used by neighbouring LPAs to assess proposals that may affect the setting or views from the Broads.

This is particularly important as Section 245 of the Levelling Up and Regeneration Act (2023) now requires relevant authorities to 'seek to further' the statutory purposes of the Broads Authority.

It should also be noted that Natural England have assessed National Character Areas. The Broads is covered by National Character Area: 80 - The Broads. A profile of the area can be found on Natural England's website:

nationalcharacterareas.co.uk/The-Broads/

About Supplementary Planning Documents

The NPPF 2024 defines supplementary planning documents as 'documents which add further detail to the policies in the development plan. They can be used to provide further guidance for development on specific sites, or on particular issues, such as design. Supplementary planning documents are capable of being a material consideration in planning decisions but are not part of the development plan.'

The Authority considers that this SPD will help planning applicants consider the issue of impact on the landscape. The SPD should be read alongside policies SP7, DM16 and DM43 of the Local Plan for the Broads (adopted 2019)

and successor policies, although many Local Plan policies refer to landscape impact including DM17, DM18, DM19 and DM20. The SPD is a material consideration in determining planning applications. The advice and guidance herein will not add unnecessary financial burden to development.

The Authority is aware that the Government are seeking to phase out the use of SPDs. However, the transition arrangements to phasing out SPDs and the progress of the emerging Local Plan for the Broads are such that the Authority considers it appropriate and relevant to produce this SPD.

A consultation on this document was carried out on the SPD in January - February and in March-April 2026 to address some issues with the mapping used in the first consultation. Comments received have been considered and amendments to the final document made as appropriate. Please see the Consultation Statement for more details.

The Broads Authority Landscape Character Assessment SPD was adopted at the 8 May 2026 Planning Committee and 15 May 2026 Broads Authority meeting.

Consultation and SEA Screening

The SEA Screening is available on the Broads Authority website here. We do not consider there is a need for a full SEA as the document does not require development but provides background information to guide development. Natural England, the Environment Agency and

Historic England were consulted but raised no objection to this stance as part of this consultation.

Local Plan policies SP7 and DM16.

The Landscape Character Assessment SPD is in conformity with the Local Plan for the Broads (adopted 2019) and the National Planning Policy Framework (NPPF) (2024). It expands on Local Plan policy SP7, DM16 and DM43:

Policy SP7: Landscape Character

Development proposals will ensure that the location or intensity of the use or activity is appropriate to the character and appearance of the Broads and pay particular attention to the defining and distinctive qualities of the varied positive landscape character areas and the character, appearance and integrity of the historic and cultural environment.

Policy DM16: Development and Landscape

Development proposals which conserve and enhance the key landscape characteristics of the Broads and comply with other relevant policies, in particular Policy DM43 (design), will be permitted.

[Plan-making regulations explainer - GOV.UK](#)

Planning applications shall clearly demonstrate that development proposals are informed by:

i) The Broads Landscape Character Assessment (2017); and

ii) Appropriate site-based investigations

The design, layout and scale of proposals shall conserve and enhance landscape features that are worthy of retention and that contribute positively to landscape features which typify the traditional characteristics of the area and safeguard the positive experiential and visual amenity qualities of the landscape.

The restoration of landscapes will be sought where either natural or cultural heritage features of importance have been lost or degraded.

Development proposals that would have an adverse impact on either the character of the immediate or the wider landscape or the special qualities of the Broads will not be permitted.

In exceptional circumstances, where the landscape, biodiversity, navigation, social or economic benefits of a proposal are considered to outweigh the loss of a feature or the impact on landscape character or existing habitat, the development may be permitted subject to adequate compensatory measures being implemented. However, wherever possible the design and layout of the development should be configured to make provision for the retention, enhancement or restoration of these features.

DM43: Design

All development will be expected to be of a high design quality. Development should integrate effectively with its surroundings,

reinforce local distinctiveness and landscape character and preserve or enhance cultural heritage. Innovative designs will be encouraged where appropriate.

Proposals will be assessed to ensure they effectively address the following matters:

a) Siting and layout: The siting and layout of a development must reflect the characteristics of the site in terms of its appearance and function, and be an easy to navigate environment.

b) Relationship to surroundings and to other development: Development proposals must complement the character of the local area and reinforce the distinctiveness of the wider Broads setting. In particular, development shall respond to surrounding buildings and the distinctive features or qualities that contribute to the landscape, streetscape and waterscape quality of the local area. Design shall also promote permeability and accessibility by ensuring ease of movement between homes, jobs and services and by creating links to public transport services.

c) Mix of uses: To create vitality and interest, proposals should incorporate a mix of uses where possible and appropriate.

d) Density, scale, form and massing: The density, scale, form, massing and height of a development must be appropriate to the local context of the site and to the surrounding landscape/streetscape /waterscape character.

e) Appropriate facilities: Development shall

incorporate appropriate waste management and storage facilities, provision for the storage of bicycles, and connection to communication networks.

f) Detailed design and materials: The detailing and materials of a building must be of high quality and appropriate to its context. New development should employ sustainable materials, building techniques and technology where appropriate. Proposals shall minimise construction waste.

g) Crime prevention: The design and layout of development should be safe and secure, with natural surveillance. Measures to reduce the risk of crime and antisocial behaviour should be considered at an early stage so as not to be at the expense of overall design quality.

h) Accessibility and adaptability: Developments shall be capable of adapting to changing circumstances, in terms of occupiers, use and climate change (including changes in water level). In particular, dwelling houses should be able to adapt to changing family circumstances or ageing of the occupier(s) and commercial premises should be able to respond to changes in industry or the economic base. Applicants are required to consider if it is appropriate for their proposed dwelling/ some of the dwellings to be built so they are accessible and adaptable and meet Building Regulation standard M4(2) and M4(3). If applicants do not consider it appropriate, they need to justify this. For developments of five dwellings or more, 20% will be built to meet Building Regulation

Standard M4(2).

i) Flood risk and resilience: Development shall be designed to reduce flood risk but still be of a scale and design appropriate to its Broads setting. Traditional or innovative approaches may be employed to reduce the risks and effects of flooding.

j) Biodiversity: The design and layout of development shall aim to protect, provide for, restore and enhance biodiversity.

k) High quality landscaping. All proposals shall be designed to respond to and integrate effectively with the landscape character of the area, making a positive contribution through a high quality landscaping scheme as appropriate.

How to use this SPD

This document is primarily intended to inform the planning process and will be of use to all those involved in it, including site owners, applicants, architects, agents, the Local Planning Authority and the Planning Inspectorate. It also provides interesting information that may be of interest to a wider audience, including those managing landscape-based projects (for example ecologists, statutory bodies or arboriculturists) and the wider public.

It is intended that those planning or assessing development within the Broads would take the time to read Section 1: Evolution and History which summarises the physical processes that have shaped and moulded the Broads landscape that we see today.

Section 2 sets out the special qualities of each of the 13 different landscape types found in the Broads and this should be referred to in order to find out more about the landscape type/s where development is planned. Landscape types are distinct types of landscape that are relatively homogenous in character. They are generic in nature, in that they may occur in different areas, but wherever they occur they share broadly similar combinations of geology, topography, drainage patterns, vegetation, historical land use and settlement pattern.

Section 3 of the document should then be explored. This analyses the current Broads landscape, setting out the key landscape features and elements throughout the area which give it its unique sense of place. The well-established process of Landscape Character Assessment (LCA) has been used to identify 31 different landscape character areas. When using this part of the document, the section relating to the area where development is proposed should be referred to. It will set out the different landscape types found within that area, explain why the area is special, and cover a series of topics such as topography and skyline, geology and soils, the main features of land cover and use, enclosure, scale and pattern and what can be done to help keep the area special. If a proposal has the potential to affect the landscape of a neighboring district, their LCA should also be referred to.

The LCA SPD should be referred to in supporting information submitted with applications. This information should enable the

landscape context of the development to be fully understood and a successful development achieved which respects and enhances the landscape within which it sits.

Section 1

Evolution and history

1.1 Introduction to the evolution of the Broads landscape

The landscape of the Broads is a product of dramatic landscape change over millennia. Who would have thought that millions of years ago the area was part of a warm tropical sea which led to the formation of the Chalk strata underlying the area. This is so important to us today as it provides an aquifer and has provided building materials, such as lime and flint, a common feature of buildings in the area.



Changes in the relative sea levels saw coastlines advance and retreat and different river systems evolve. During certain periods the Broads was connected to the continent allowing people to travel between the two areas.

When the climate cooled there were periods of glaciation when ice sheets swept over the area depositing sands and gravels which are still exploited today as a source of aggregate.

Ice sheets retreated when the climate warmed and the swampy freshwater environment encouraged the formation of peat, the excavation of which eventually shaped the Broads. More recently the importance of peat as a carbon dioxide store has been recognised.

The shaping of the Broads by humans to resemble the landscape we see today has only occurred during relatively recent history. It initially started with the clearance of land for grazing but in the Roman period impressive structures such as Burgh Castle fort were built.

The Anglo Saxon period saw settlements established that still thrive today, their origins hinted at in their Scandinavian place names. Many of those settlements found skirting the Broads area on the higher land have unusual round-tower churches.

The broads, which give the area its name, were excavated in the mediaeval period to provide peat for fuel. The excavations subsequently flooded providing valuable areas of conservation and recreational activity today.

Humans have shaped and exploited the

marshland as a valuable grazing resource for many centuries adapting to increases in water levels, through the construction of flood defences, mill structures and elaborate dyke networks which supplemented the natural creeks in helping to drain the area.

From the 19th century onwards, tourism and recreation activities have had a significant influence on the Broads landscape. The same can be said of the changing management regimes for the wetland landscape as traditional uses decline, economic drivers dictate land use for agricultural enterprises and conservation bodies increase their land ownership.



1.2 How the Broads landscape has been shaped over many thousands of years.

The physical landscape of the Broads that we see today is the result of many thousands of years of gradual change. Natural land-forming processes, such as glaciation and variation of sea level, work together with climatic processes to bring about a slow but steady transition. The Broads is a low-lying landscape, and so slight shifts in water level and quality may easily have widespread effects.

The following text is a simplified version of the sequence of events that have taken place over deep time to shape the physical fabric of the Broads landscape. Some of the land-forming processes are particularly significant today for providing the 'raw materials' for the establishment of special wildlife habitat, and for humans to exploit for fuel or building purposes.

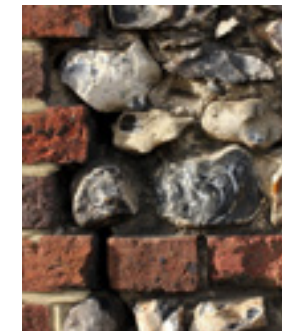
70 million years ago

This area was part of a warm, tropical sea in the Cretaceous period. Mud rich in fossils and microfossils was deposited on the sea bed, leading to the formation of thick layers of Chalk, which underlies all the Broads area.

The chalk is a vital aquifer for the Broads because it supplies groundwater to the rivers Waveney, Yare and Bure and their tributaries through seeps and springs in the valleys. It supplies most of the drinking water, directly through boreholes and indirectly from surface sources such as the River Bure at Belaugh



◀ Lime workers at Whitlingham Chalk Pit. Image courtesy of Whitlingham Charitable Trust.



▲ Map of Europe in the Cretaceous period. © Prof Ron Blakey, Colorado Plateau Geosystems, Arizona.

◀ Flint is a hard grey rock consisting of nearly pure silica (chert), occurring chiefly as nodules in chalk, have been used extensively in local buildings.

and the River Waveney at Shipmeadow. Its calcareous nature produces lime-rich water, which influences the distinctive biodiversity of the Broads.

Flint is a mineral which formed as nodules in the chalk. It is widely used in the Broads area as a building stone, whether as cobbles or knapped (broken) pieces.

The chalk can be seen in the Broads area where valleys have cut down through younger geological layers to expose it. Chalk was quarried and mined along the valley sides of the rivers Bure and Yare.

70 to 2.5 million years ago

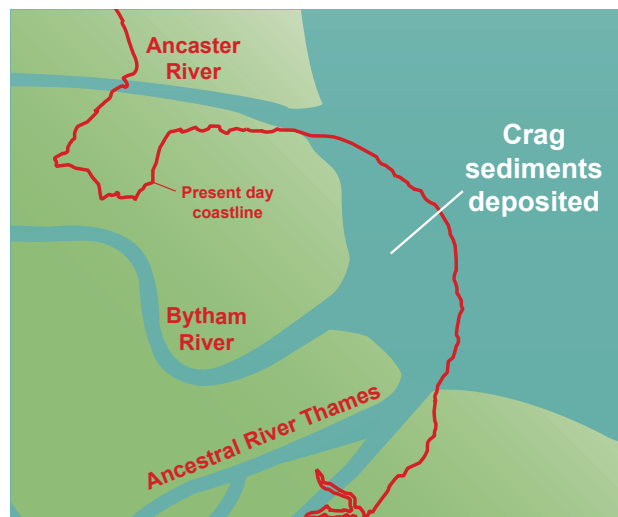
The Broads area underwent many dramatic changes, as seas advanced and retreated and climates changed over millions of years. It eventually became a lowland area on the edge of the North Sea basin, to be strongly influenced by any changes of sea level.

2.5 to 1.8 million years ago

The area of what is now the Broads lay under the western edge of the North Sea, in a cool, temperate climate. Relative sea levels were high, and the coastline at that time lay somewhere near Norwich.

Marine sands, gravels and clays of the Red Crag and Norwich Crag were laid down on the sea floor. Sediments of the Norwich Crag are exposed in the Broads area today, and form areas of sandy soils along the sides of valleys, such as the Ant, Bure and Yare.

▼ *The marine sediments of the Norwich Crag Foundation are evidence that the Broads area lay under the western North Sea about 2 million years ago. Three major rivers flowed into the Crag sea, bringing different land-sourced sediments to the area. Image with acknowledgements to Lee et al: Journal of Quaternary Science No.21, 2006*



▲ *A geological profile through Norwich Crag sediments at Bramerton. The site is conserved as a Site of Special Scientific Interest. Image courtesy Dr Peter Riches.*

The position of the shoreline shifted as the climate fluctuated between a succession of warmer and cooler periods, leading to deposition of a variety of estuarine and shallow marine sediments. By analysing the fossil pollen and foraminifera contained in these sediments, geologists have been able to divide the Crag into a series of time zones; some of these are named after place names and river names in the Broads, such as Pre-Ludhamian (about 2.5 million years ago), Ludhamian (about 2.3 million years ago), and Antian and Bramertonian (about 2.0 million years ago).

The Crag deposits are typically sandy, but sometimes contain layers of fossil shells, which may give a chalky quality to the groundwater in places. Many mammal fossils have been found in the Norwich Crag, providing evidence of life on land and sea at the time, including walrus, whale, mastodon and sabre-tooth cat.

As time went on, local sea-levels fell, due to uplift of the land. The shoreline generally retreated north-eastwards, and a major river (the early Thames) flowed into the Broads area from the south-west, leaving traces in the form of distinctive gravel deposits overlying the Crag.

1.8 to 0.5 million years ago

The Broads area gradually became land once again, as local sea-levels fell and the shoreline of the North Sea retreated north-eastwards. The area was influenced by two major rivers.

Marine sands, gravels and clays of the Wroxham Crag were laid down on the sea floor. They can

be distinguished from the older Norwich Crag by their higher proportion of exotic, quartz-rich material they contain. These sediments are exposed in areas of sandy soil along the valley sides of the Yare and Bure. Later, local uplift of the land caused the coastline to shift north-eastwards, until about 0.8 million years ago, it lay somewhere near Mundesley.

About 0.5 million years ago



▲ The Bytham and early Thames rivers are thought to have converged in the Broads area about a million years ago, with an estuary near Happisburgh. Image courtesy The British Museum.

As the land was uplifted, rivers flowed into the Broads area. Their deposits are known as the Cromer Forest-bed Formation. We have evidence of a major estuary near Happisburgh around 0.9 million years ago. The earliest humans in north-west Europe lived along its banks. British Museum excavations have revealed flaked flint tools, and rich evidence of the local environment, including fossils of mammoth, beaver and elk as well as plants



and beetles. Later, continuing land uplift in Norfolk caused these rivers to take a more southerly course, eventually entering the North Sea basin in Suffolk. The influence of another major river became evident in the Broads area about 0.8 million years ago. It originated in the English Midlands, and is known as the 'Bytham River'. Its distinctive suite of sands and gravels suggest that it flowed from the Waveney valley towards Great Yarmouth. A rich assemblage of fossil remains has been excavated from the mud of this river at Norton Subcourse. There is evidence that early humans known as *Homo heidelbergensis*, thought to be the ancestors of ourselves and the Neanderthals, lived along its

▲ Recent excavations at Happisburgh have revealed evidence of a site of earliest known human occupation in North-West Europe around 0.8 million years ago. Habitats in the vicinity would have included the tidal river, salt marshes, freshwater marshes and a grass-dominated flood plain grazed by herbivores. The West Runton Elephant, probably the largest elephant skeleton ever found and the best example of its species known, was preserved in the Cromer Forest Bed deposit. Image courtesy John Sibbick/AHOB.

banks, as flint tools have been found at Pakefield just south of the Broads area. The sediments here have been dated to around 0.7 million years ago.

The climate cooled and sea levels fell as the Broads area entered a cold period known as the Happisburgh glaciation. An ice sheet swept over the area from the north, as far south as Beccles and the Waveney valley. Almost all the higher ground in Broadland north of the Yare valley is founded on glacial deposits from this period, as are the Isle of Flegg and the coastal high ground of Lothingland as far south as Lowestoft.

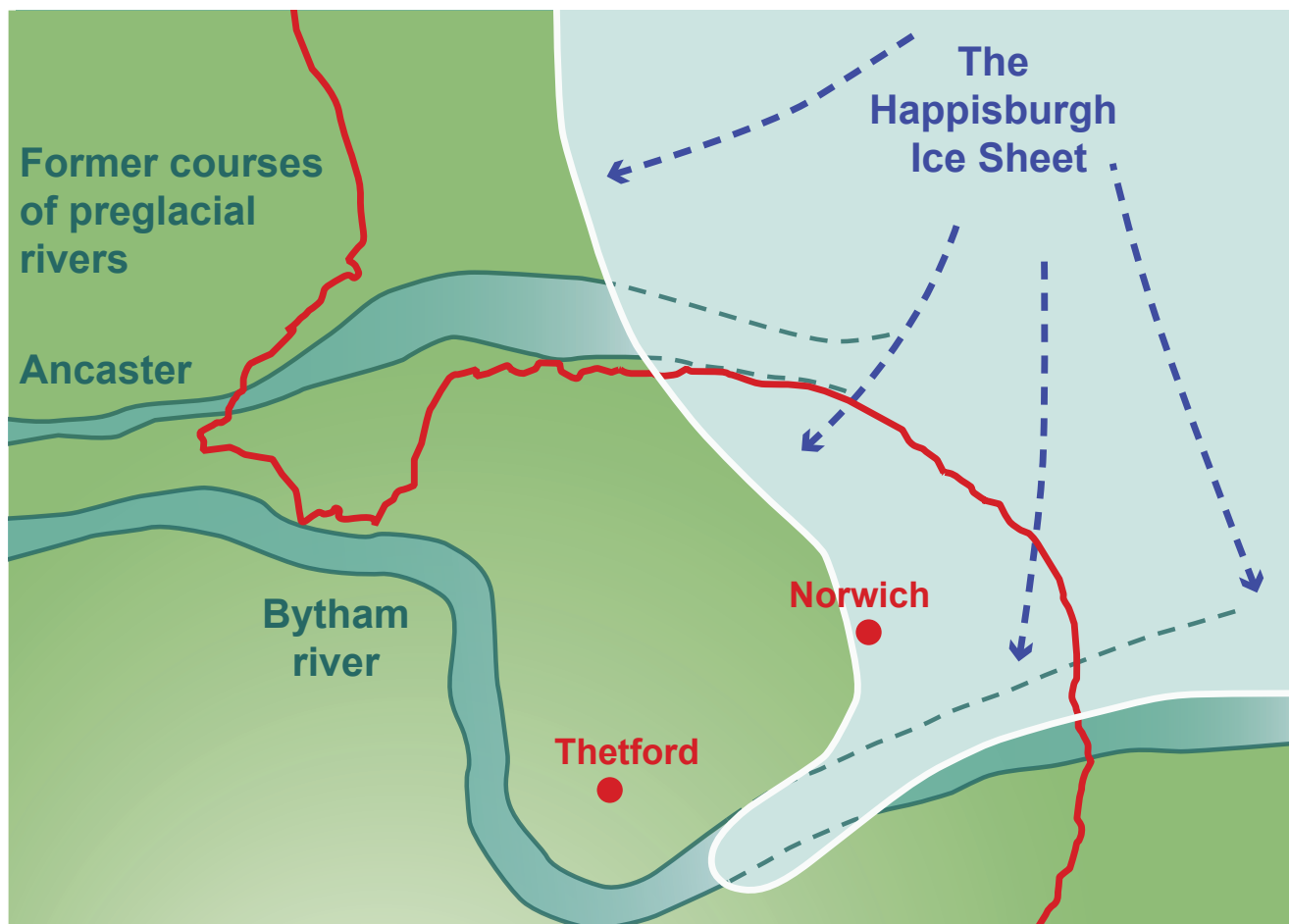
The Happisburgh ice sheet deposited layers

of stony debris beneath it known as the Happisburgh Till, while meltwaters streaming from the ice-front gave rise to rivers which deposited layers of sand and gravel, and also lakes in which finer-grained material settled out to form silts and clays. The meltwaters in the area of the Waveney valley initially flowed along the route of the Bytham River towards Great Yarmouth. Later, a thick sheet of outwash sand known as the Corton Sands was deposited as the ice sheet retreated; this may have been

deposited under water on the margin of a big meltwater lake occupying the southern North Sea basin. The sands and gravels are exploited as a source of aggregate, as at Kirby Cane, and fine-grained, silty sediments have been exploited for brickearth, as at Somerleyton.

Clay from the Happisburgh glaciation used to be dug at Somerleyton brickworks. Red and white bricks were used to build local cottages and the railway stations at York and London Liverpool Street, and even a Belgian palace.

The exact dating of the Happisburgh glaciation is debated by geologists. Some place it at 0.63 million years ago; others closer to 0.47 million years ago. Geological research in the Broads and Norwich areas is likely to play an important role in resolving this question.



◀ The ice sheet from the Happisburgh glaciation period extended to the Waveney valley. Almost all the higher ground north of the River Yare and the Isle of Flegg are formed from deposits of this period. Image courtesy Lee et al: 'British Regional Geology. East Anglia'. British Geological Survey, 2015.

About 0.45 million years ago

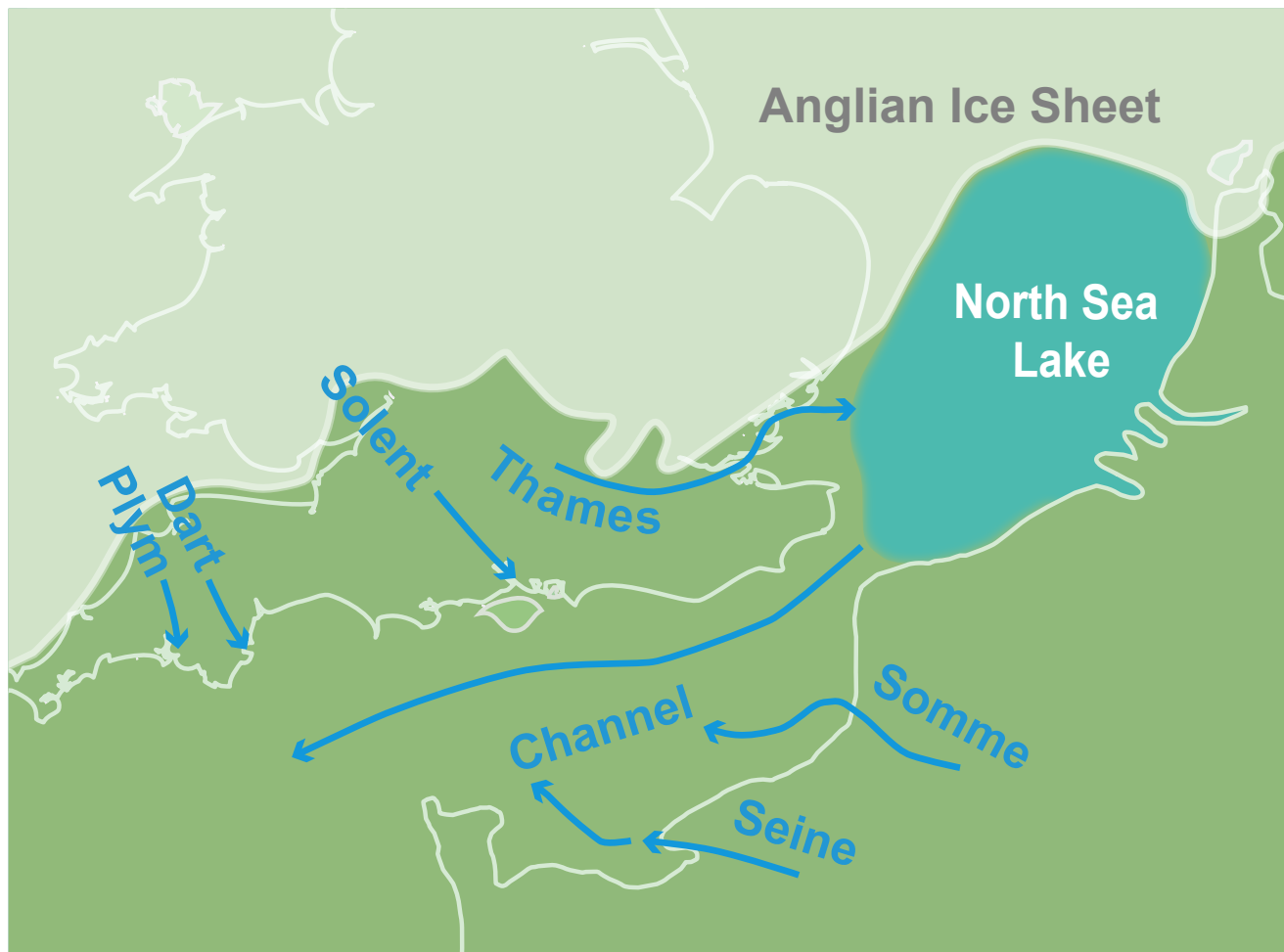
A second ice sheet entered the Broads area, this time from the west. This episode is known as the Anglian glaciation. The ice sheet is thought to have overrun the whole area, and may have been over a half a mile thick. It deposited thick layers of clay and sand which now form tracts of higher ground, especially

in the southern part of the Broads.

Characteristic deposits of the Anglian ice sheet include chalk-rich stony debris known as till (this particular deposit is called the Lowestoft Till), and meltwater sands and gravels. The uplands of the Cromer Ridge were deposited in North Norfolk, probably as a moraine of glacial debris shunted forward by an advancing phase of the

ice sheet. Strangely, evidence for the Lowestoft Till is patchy in the areas north-east of the Yare valley; deposits are not found further north-east than Acle and the Isle of Flegg. This has not yet been satisfactorily explained by geologists. Some have suggested that a separate lobe of ice originating from the north-east may have occupied these areas and blocked the Lowestoftian ice sheet from advancing over them. Alternatively, later erosion may have removed evidence for its presence here.

When the Anglian ice sheet retreated, the Waveney and Yare valleys were major routes for escaping meltwaters, leaving evidence in the form of a relict river terrace (abandoned floodplain remnant) at Earsham. The Lowestoft Till has a high chalk content, which contributes to the lime-rich nature of ground-waters originating in the till.



◀ A map of the southern North Sea at the height of the Anglia glaciation. Meltwater from the North Sea Lake escaped through the Straits of Dover. Image courtesy White et al. *Journal of Quaternary Science*, Jan 2016.

420,000 years ago

The climate warmed up into what is known as the Hoxnian period. The rivers of the Broads area we know today began to develop on the bare landscape left behind after the Anglian ice sheet retreated. We have evidence that early humans visited the area.

Lakes began to fill hollows in the land, and life returned, including early human settlement. Some of the gravels in the Yare valley contain Palaeolithic Acheulean hand axes which are thought to date from this time, as at Whitlingham. These are likely to have been made by *Homo heidelbergensis*.

400,000 to 30,000 years ago

There was as a succession of alternating warm and cold climatic periods over the next 370,000 years. The familiar shape of the Broads landscape began to form in this period: the pattern of uplands and lowlands we know today, and the wide river valleys of the Ant, Bure, Thurne, Waveney and Yare flowing into the North Sea.

Several notable features of the landscape were formed during this time:

During warmer periods, sea level rose to approximately the same levels as today, though the coastline itself is likely to have lain somewhat further eastwards. Marine erosion has removed a slice of this extended land area; the shape of the Thurne and Lothing catchments suggests their rivers must have had headwaters in this coastal land area now lost to the sea.



During colder periods, high-energy meltwaters deposited layers of sediment on wide gravelly floodplains in the Yare and Waveney valleys. There have been subsequently dissected by erosion to form terrace remnants; two post-Anglian terraces have been recognised in the Waveney valley, probably because it was an important route for meltwaters escaping from a proglacial lake (Lake Paterson) associated with an ice sheet occupying the Fenland basin, about 160,000 years ago. Terrace 2 in the valley may date from this time. When permeable sandy ground was frozen it could be eroded by meltwaters, so giving rise to some of the undulating slopes and dry valley features of the Broads area.

Neanderthal humans (*Homo neanderthalensis*) were able to colonise the area in warm periods, as evidenced by a distinctive flint hand axe found at North Cove in the Waveney valley.

▲ *The fossils preserved during the Ice Ages in Norfolk are internationally important and show us how climate and geology interact. During cool periods reindeer, bison, woolly mammoth and rhinoceros grazed the steppe grasslands. In warm interglacial periods hippopotamus and pond turtle basked in the rivers and straight-tusked elephant browsed the forests. Image courtesy Nick Arber Norfolk Museums service.*

30,000 to 12,000 years ago

This was a cold climatic period, which saw the advance of an ice sheet southwards as far as north Norfolk. This took place about 20,000 years ago, during what is called the Hunstanton glaciation. The Broads area was a chill, arctic landscape, and most of the North Sea was a low-lying plain at this time. Meltwater rivers were active in spring and summer, filling the valleys floors with transported sand and gravel.

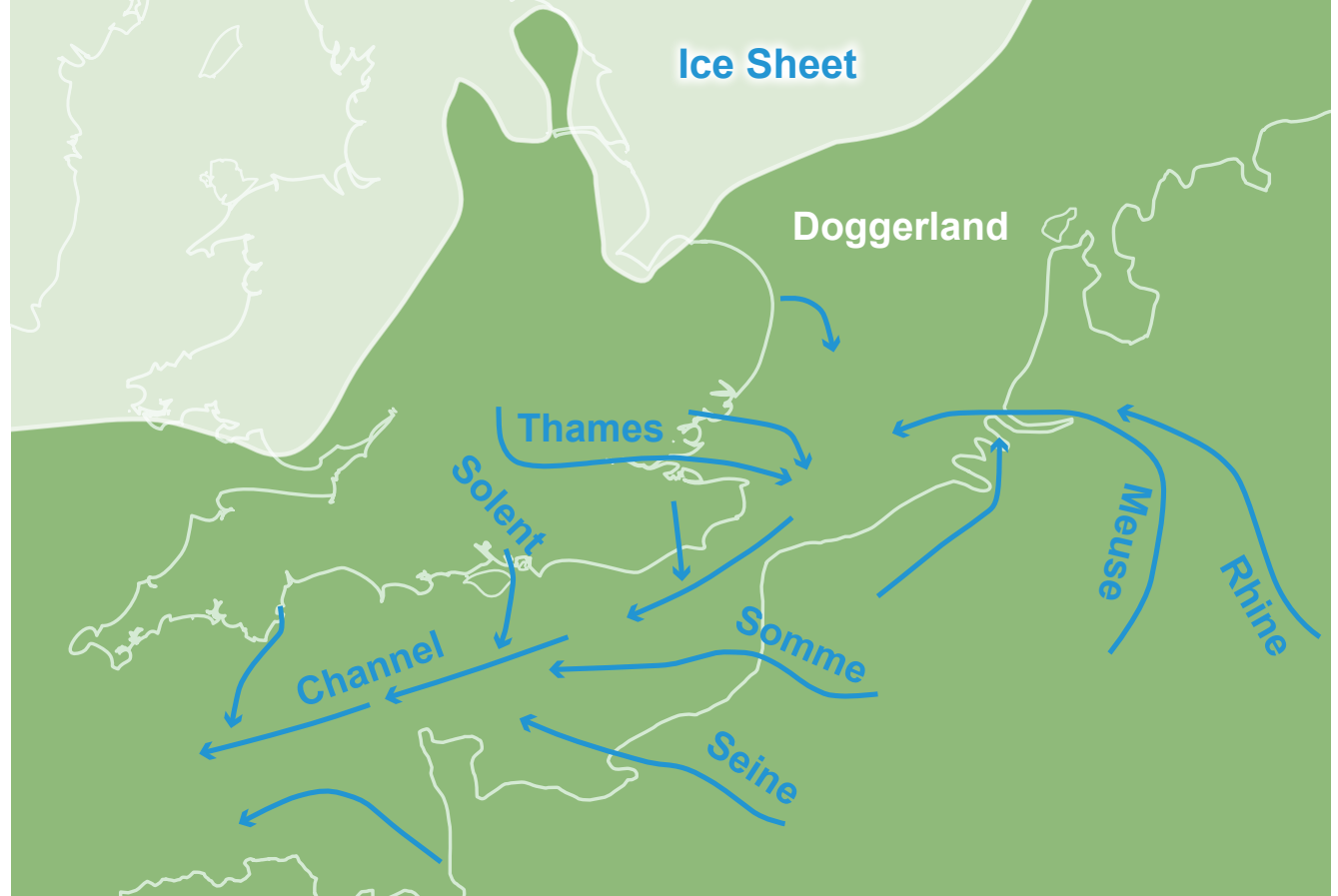
With so much water locked up in ice globally, sea levels were over 100 m lower than today.

Broadland had a periglacial climate, with ground deeply frozen and arctic tundra-type vegetation. No human settlement was possible.

An ice sheet covered the area of The Wash and north-west Norfolk. A big meltwater lake was ponded up in Fenland at this time, and had its main outlet along the Little Ouse / Waveney valley corridor, flushing large quantities of sand and gravel through it.

The periglacial conditions affected the Broads landscape in several ways:

- Soil layers melted in summer, and tended to sludge slowly downhill, draping sides of valleys with layers of mixed sediment known as head. This is found at the head of fringing, minor valleys in the Broads area;
- Freeze-thaw process sapped the ground around springs and wetlands, creating pits and hollows;
- When permeable, sandy soils were frozen they could be eroded by meltwaters, so producing undulating slopes and dry valley features along upland edges;
- Desiccating winds blew storms of dust into the air, depositing layers of fine silt known as coverloam across the surface of the area. This is a major component of the fine, freely-draining soils of the upland areas of the Broads, particularly in Lothingland and areas north of the Yare Valley;
- Snow-melt and overspill from Lake Fenland swelled the rivers of the Broads area,



and transported large volumes of sand and gravel through multiple (braided) channels and deposited them on the valley floors. In the upstream parts of rivers, these valley gravels underlie the floodplain in many places, as at Trowse and Ellingham, where they are labelled as Terrace 1 on geological maps. However, towards the sea, the rivers flowed through valleys deeper than those of today, because they were draining to a much lower base level out in the North Sea basin. These valley floors are now buried by later sediments; the sands and gravels which compose them are known as the Yare Valley Formation.

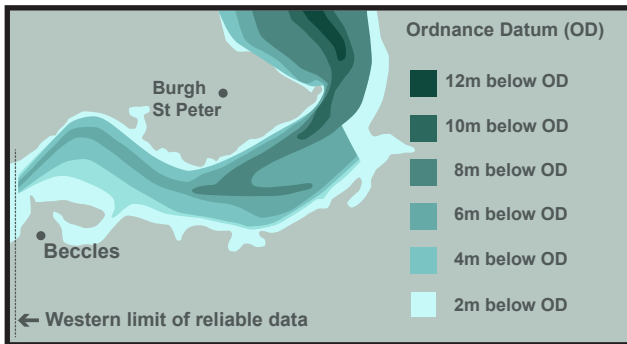
▲ *The Broads was a chill arctic landscape during the Hunstanton Glaciation. Image courtesy White et al 2016, Lost Landscapes of Palaeolithic Britain, Oxbow Books.*

**12,000 to 10,000 years ago
(10,000 - 8,000 BC)**

Life returned to the Broads area, as the ice sheet retreated from north Norfolk and the climate became milder. The Broads area was upland on the south-western side of a huge, undulating, sandy plain where the North Sea now lies. This land area has been called Doggerland. The rivers of Broadland drained to a deeper base level than today, somewhere out in the North Sea basin, so their valleys were deeper and had steeper sides. Humans of our own species began to visit the area.

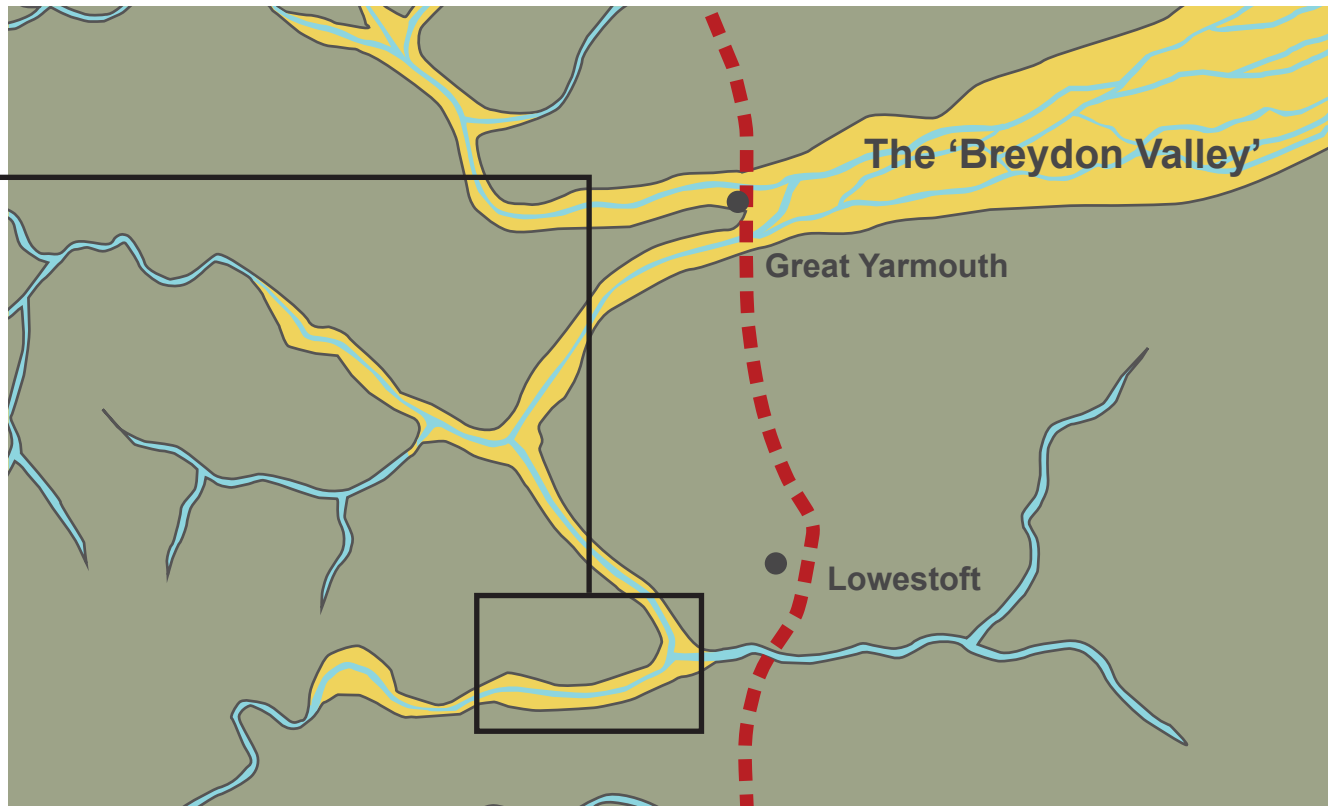
Seasonal snow-melt produced large volumes of runoff which fed the rivers of the Broads. Their floodplains were covered with sands and gravels and threaded with shifting channels. The Waveney was a tributary of the Yare, and the Yare and Waveney converged in the area of Great Yarmouth and flowed eastwards through the 'Breydon Valley'; the valley floor here was some 22 metres deeper than today. Their waters eventually joined the vast ancestral Rhine which flowed south-westwards through the Straits of Dover (the Channel River catchment). The Thurne and Lothing rivers drained south-

west to the Bure and westwards to the Waveney respectively. This is called the Late Glacial period. Patchy forests of birch and willow developed in the valleys, and there were herds of horse, mammoth and reindeer. Late Upper Palaeolithic hunter-gatherers of our own species visited the area; they left evidence of their flint-knapping in the form of long blade tools, as at Earsham, Geldeston and Postwick. There may be other evidence of their settlement to the east, but if so it must lie buried beneath later deposits and/or the sea.



▲ According to borehole evidence, an ancient valley lies buried in sediment deep beneath the present day Waveney valley. This is where the river flowed at the end of the last ice age. Information derived from NERC data @ British Geological Survey.

► The rivers of the Broads flowed eastward into Doggerland via the 'Breydon Valley'. Image with acknowledgments to Dr M Godwin.



**10,000 to 8,500 years ago
(8,000 - 6,500 BC)**

10,000 years ago the climate warmed up. The rivers of the Broads flowed through deep-set valleys towards the sea. The Broads area was upland on the south-western side of Doggerland, and its rivers drained eastwards into the southern North Sea basin via the 'Breydon Valley'.

Mean sea levels were at about - 60m OD at the beginning of this period, rising to about -10m by the end. Around 8000 years ago the rate of rise

was fast, something between 23 and 48mm per year. Around 8,300 years ago the northern and southern North Sea basins were connected by a through-channel, so the Dogger Bank became an island between northern England and Denmark.

The rivers of the Broads flowed through valleys with steeper sides, and were faster flowing compared with today as they had steeper gradients. The River Yare between Postwick and Surlingham fell by about 1 metre/km, at this time, compared with 6 centimetres/km today.

The landscape of the Broads area was a

patchwork of marshland, grassland and forests of birch, with willow, alder, hazel, juniper and pine; hazel began spreading after 9,000 BC. Lakes and marshes occupied low-lying land. This was the early Mesolithic period, during which humans lived by hunting and gathering, and tended to live close to water sources. Evidence for human occupation of the Broads at this time is scanty, and settlement sites may well lie buried beneath later deposits and the sea. Evidence of which has been recovered by fishermen from the southern North Sea.



◀ The progressive inundation of Doggerland, pictured between 9,000 and 8,000 years ago. Image with acknowledgements to Gaffney et al: 'Europe's Lost World'; CBA, 2009.

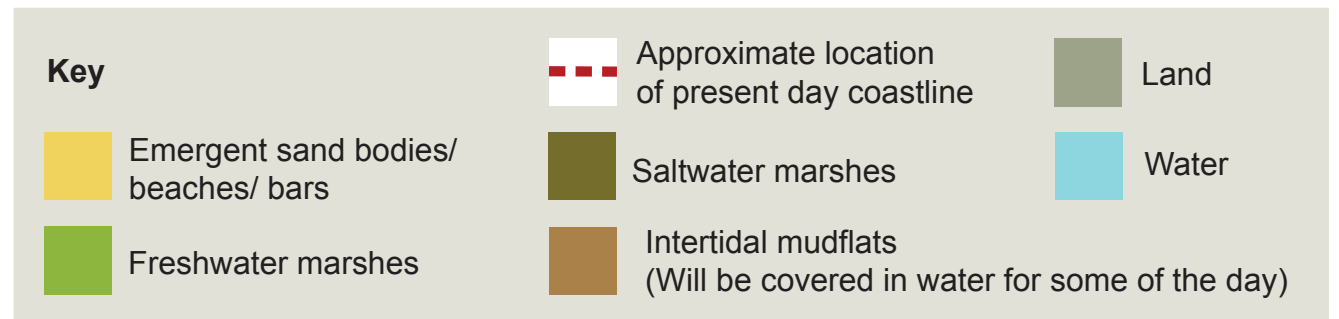
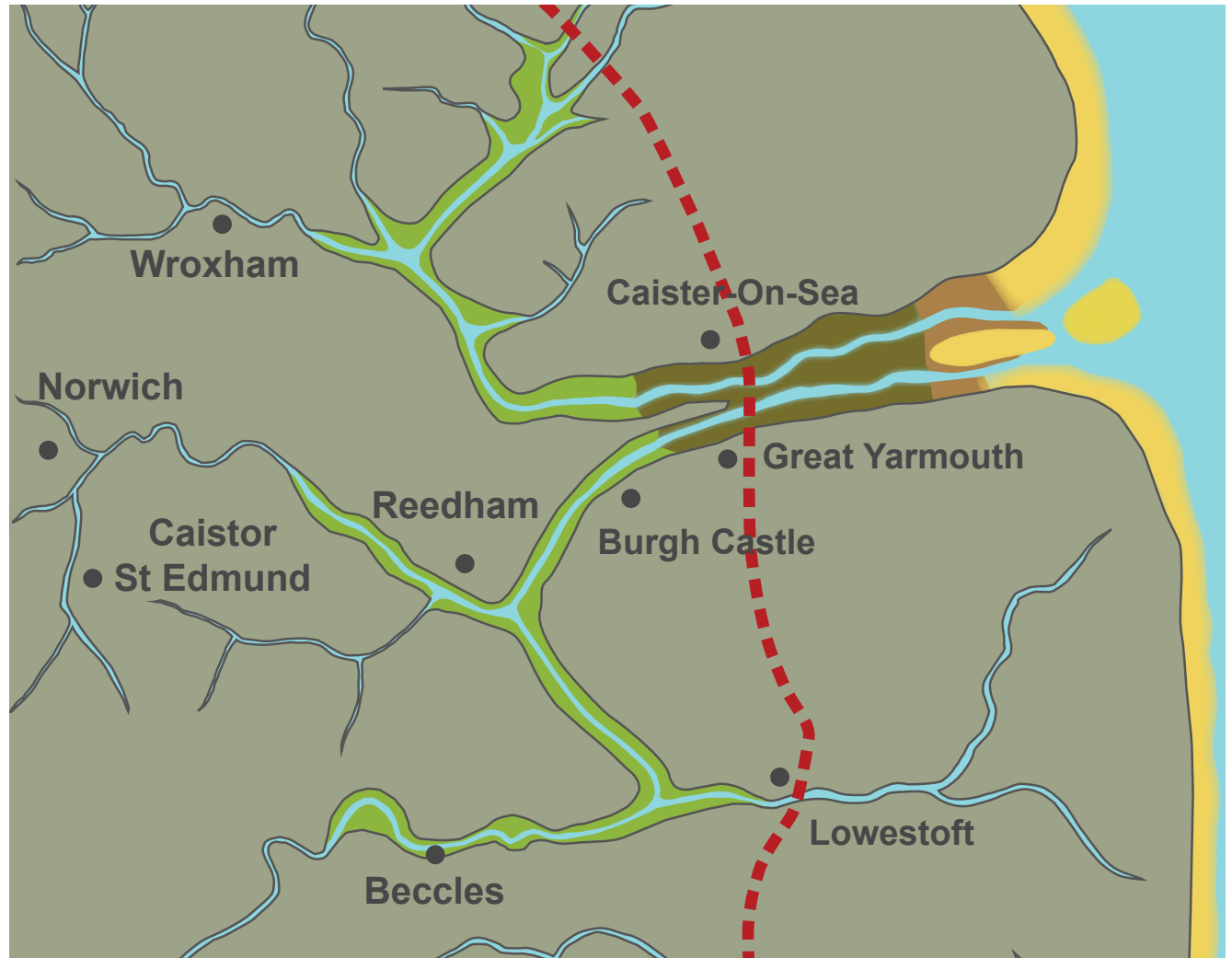
**About 8,500 to 7,500 years ago
(6,500 - 5,500 BC)**

Gradually, as sea levels rose, the rivers developed wider floodplains with reed-swamps and fens, thus forming a layer known as the Lower Peat which is extensive in the Broads but rarely exposed.

Around 7,800 years ago the sea levels rose to about -8 metres OD, and the coastline of Norfolk and Suffolk lay somewhere about 7 km to eastward.

The Lower Peat is the earliest post-glacial sediment in the valleys of the Broads area (the lowest member of what geologists call the Breydon Formation). Fossil pollen shows that the land was forested, with oak, elm, lime and alder. This was the later Mesolithic period, during which humans continued to live by hunting and gathering. Evidence for their settlement is scattered through the Broads area, particularly along valley sides, as at Woodbastwick.

► Lower Peat was formed in the widening floodplains as sea levels rose. Image with acknowledgments to Dr M Godwin.



**About 7,500 to 5,000 years ago
(5,500 - 3,000 BC)**

Sea levels rose to slightly above present day levels, and the coast retreated westwards, perhaps reaching some 5 km east of its present line. 7,500 years ago onwards, mudflats with tidal channels and creeks spread inland along the lower valleys of the Broads area, depositing the Lower Clay. The upstream limit of the Lower Clay in the Yare valley was at Brundall, and in the Bure valley at Horning; beyond this, the Lower Peat continued to be deposited.

The estuary was of drowned river valley (ria) type with strongly sloping valley sides, and had an unobstructed open mouth, probably containing some shoals; later, a sand spit began to form across its mouth.

This was the time of the 'climatic optimum', when Britain had a warmer climate than today. This period spanned the late Mesolithic and early Neolithic periods, with the transition from hunter-gatherer to farming lifestyles. People lived close to water, and farmed the easily worked soils of the valley floors and sides. A Neolithic long barrow and settlement have been recorded at Broome Heath, Ditchingham, and a henge monument in the Yare valley at Arminghall (3250 BC). A hoard of Neolithic axes was found in a valley bottom at Belton, showing that Lothingland was inhabited at this period.

► Lower Clay was formed as tidal channels and creeks spread inland along the lower valleys of the Broads area. Image with acknowledgments to Dr M Godwin.



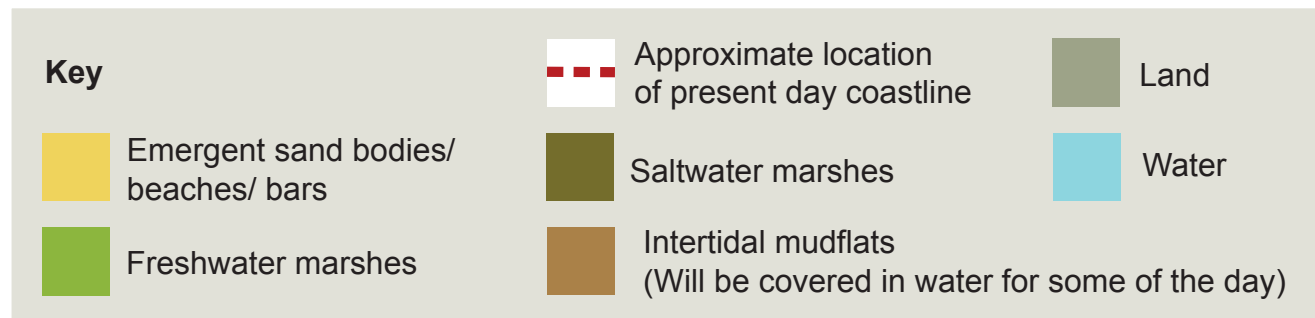
**About 5,000 to 2,250 years ago
(3,000 - 250 BC)**

The coastline lay perhaps 1 km to the east of its present position. About 4,500 years ago a spit is thought to have grown southward across the mouth of the Yare estuary. This strongly influenced the environment in the Broads area by preventing marine influence from extending up the valleys. A swampy freshwater environment thus developed behind this barrier, and the Middle Peat was deposited.

The composition of the Middle Peat changed over time, as reed swamp gave way to alder carr, though brushwood peat alone was deposited in headwaters areas. Remains of oak and birch trees buried in the peat at Somerton Level have been dated by radiocarbon to about 3540 and 2770 years ago respectively (1540 BC and 770 BC). About 2,250 years ago Middle Peat deposition ceased.

There is evidence that the land began gently subsiding by about 2mm per year around 4,000 years ago (2,000 BC) onwards. Henceforth, marine influence would become increasingly apparent in the Broads area.

This period spanned the late Neolithic, Bronze Age, and early and middle Iron Age. Settlement was scattered thinly across the area. Lothingland and the Isle of Flegg were notably settled, as shown by metalwork finds (e.g. the Somerleyton Hoard) and early Bronze Age round barrows (e.g. Woodbastwick).



▲ The Broads area in Middle Peat times, perhaps 4,000 years ago. Image with acknowledgments to Dr M Godwin.

**2,250 to 1,600 years ago
(250 BC to 400 AD)**

Sea levels began to rise, and the spit at the mouth of the Yare estuary was breached by the sea; its remains became a shingle bank in the mouth of the estuary. Marine conditions progressively returned to the Broads area, and a 'Great Estuary' was formed. Layers of Upper Clay were deposited, as estuarine and saltmarsh environments extended inland up the river valleys.

Relative sea levels began to rise again, probably because the spit at the mouth of the Yare estuary had been breached by the sea or by heavy river flows. Marine conditions extended up to 23 km inland in the Broads area, for example as far up-river as Whitlingham in the Yare valley, though freshwater peat deposits continued to form in the upper valleys. Relict shorelines with distinct breaks of slope may be found in the Broads area, as at Reedham, and the Isle of Flegg was truly an island at this time.

This was the later Iron Age and Roman period. Lines of late Iron Age posts in the marshes near Beccles may have marked prehistoric land boundaries; there is evidence here of a transition from a freshwater wetland to estuarine conditions as sea levels rose. The 'Great Estuary' was an important North Sea port and naval dock centre in Roman times. Access to the Great Estuary was controlled by two Roman forts at Caister on Sea and Burgh Castle. Aerial photography has identified a variety of likely Roman sites, including possible farmsteads and field systems and even villas, most notably at Beighton.



Key	 Intertidal mudflats (Will be covered in water for some of the day)
 Emergent sand bodies/ beaches/ bars	 Roman roads
 Freshwater marshes	 Land
	 Water

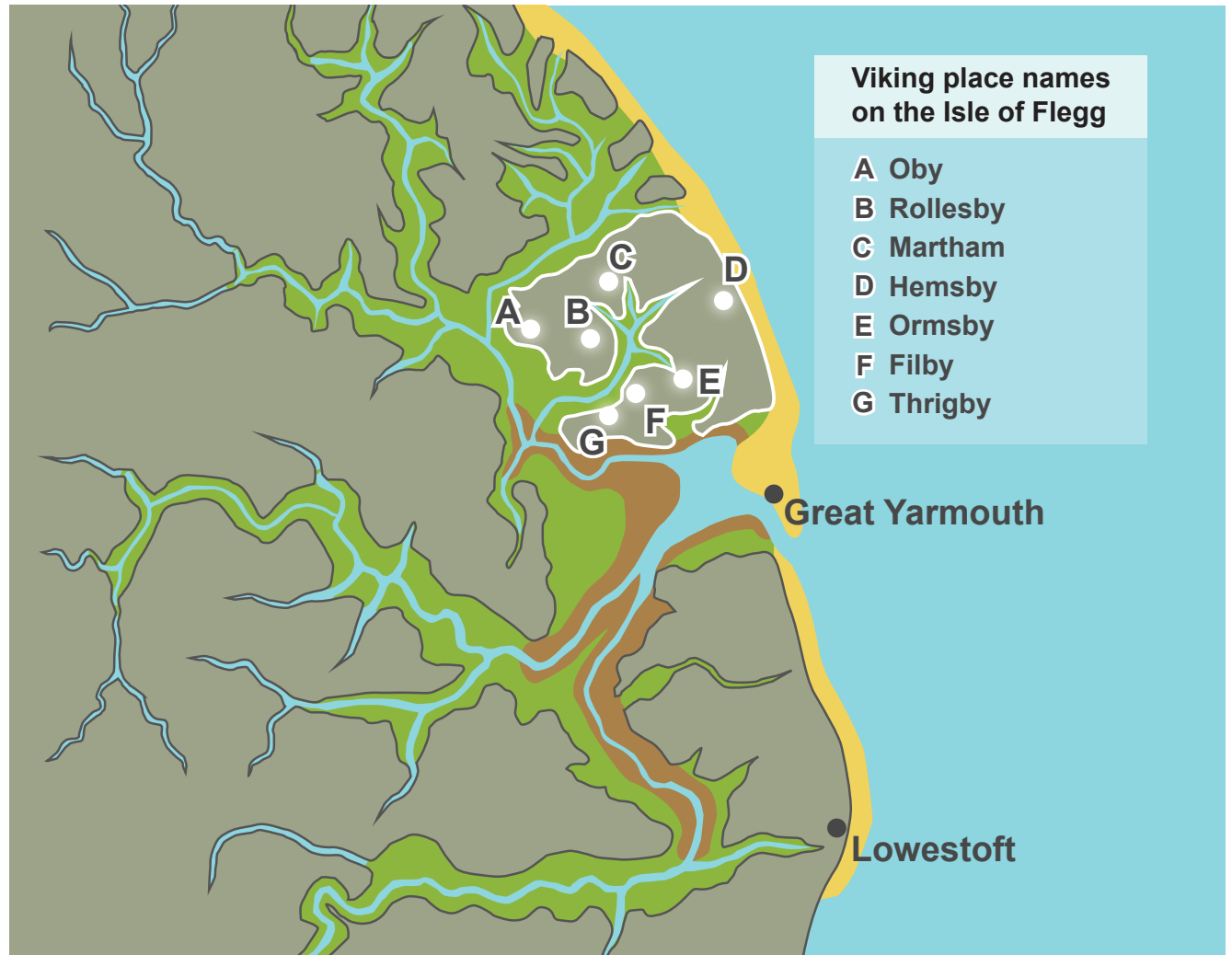
▲ The Broads area in Roman times. Image with acknowledgments to Norfolk Archaeological Trust.

1,600 to 1,000 years ago (400 to 1,000 AD)

A new shingle spit developed at the mouth of the 'Great Estuary', leading to a loss of estuarine influence inland. Freshwater fen and alder carr re-advanced in the valleys, leading to deposition of the Upper Peat in Saxon times, although Upper Clay deposition continued in the tidal areas of the Broads.

This was the Anglo-Saxon period, and the time of the Viking invasions. Villages were founded; the earliest have -ham names, e.g. Stalham, Wroxham and Worlingham. Scandinavian place names (e.g. Herringby) suggest Viking settlement, notably concentrated on the Isle of Flegg. People exploited the extensive wetland areas for fish and wildfowl. 'Ey' sites such as Horsey and St Benet's developed as 'islands', 'holms' or 'eys' in the marshes. Great Yarmouth was founded at this time on the coastal spit, as a small town with fishing as the basis of its economy.

► *The Broads area in Anglo-Saxon times. Image with acknowledgement to Dr M Godwin.*



Key

Emergent sand bodies/
beaches/ bars

Intertidal mudflats
(Will be covered in water for some of the day)

Freshwater marshes

Land

Water

**1,000 years ago to the present day
(1,000 AD onwards)**

This period is essentially a continuation of the environmental story which began 1,600 years ago, but it has seen the increasing impact of human activity on the Broads environment through peat extraction, land reclamation and drainage, built development, flood control, pollution and water abstraction. The coast has continued to retreat, with numerous sea breaches of the coastal barrier through history.

Upstream development of the Upper Peat has continued, and the Upper Clay has continued to be deposited in tidal areas of the Broads area, though marine influence is mostly confined to Breydon Water now. Peat lying at the seaward ends of the valleys has been lost by wastage and oxidation of the exposed peat, and also from peat extraction in the Medieval period. The old peat diggings became flooded to form the Broads we know today.

Coastal retreat has been ongoing during this period, and the sea has continued occasionally to break into low-lying coastal areas, but these events have been slowed in recent centuries by coastal defence work. Records show that extensive coastal floods have happened since the Middle Ages. The village of Waxham Parva has been lost to the sea, and in 1608 floodwaters reached as far inland as Trowse. Groynes, sea walls and offshore reefs have been installed to reduce the likelihood of sea breaches which were more frequent in the past. Faden's map of 1797 shows nine separate breaches

between Horsey and Waxham. The possibility of future breaches cannot be ruled out, as climate change may raise sea levels by as much as 1m by the end of the 21st century.

Waves and tides have continued to shape depositional features along the coast, including sand dunes and Winterton Ness.

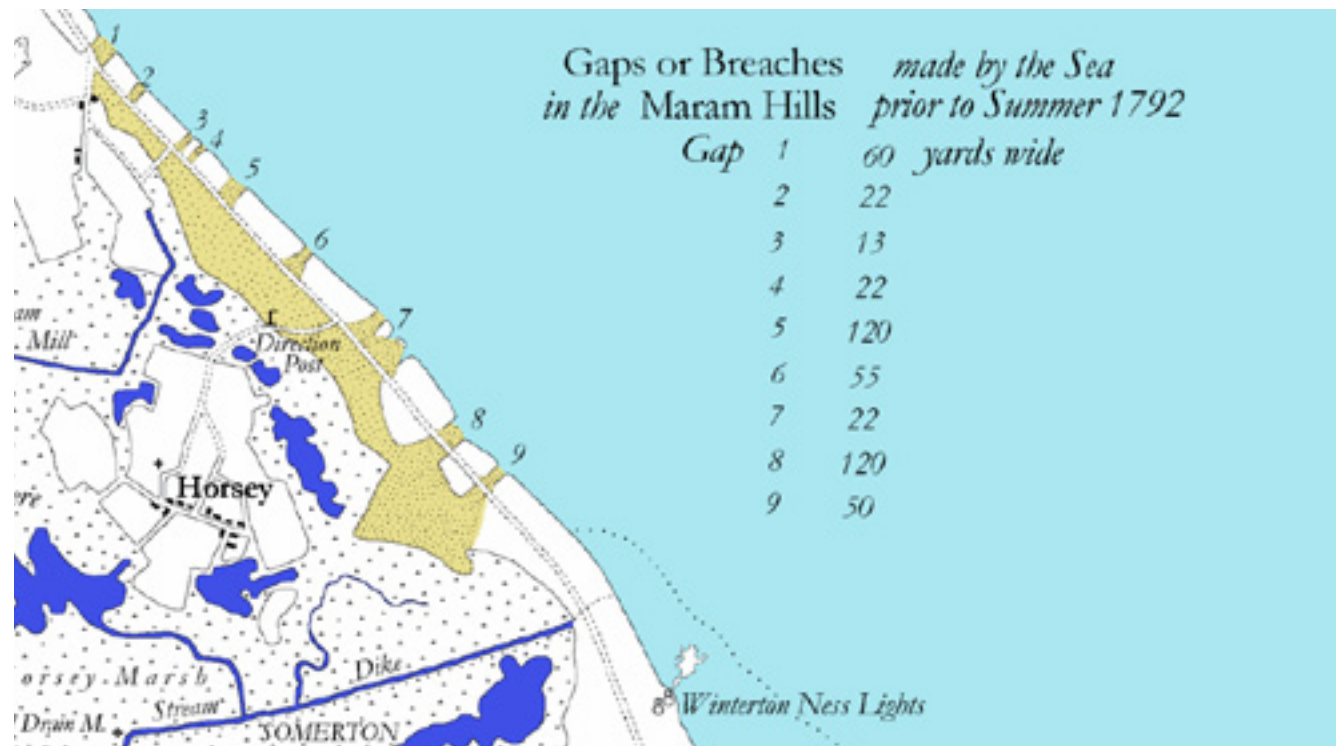
By the 12th century the coastal spit at Great Yarmouth extended almost as far south as Lowestoft; the present harbour entrance was created through it in about 1560.

Drinking water, a precious resource in dry parts

of eastern England, is abstracted from rivers and broads, as at Ormesby, Fritton and Shipmeadow, and from groundwater boreholes, as at Cantley, Ludham and Beccles. It is stored in reservoirs at Ormesby and Lound.

Water quality is an ongoing issue in the Broads.

The natural penetration of salty water is a problem along the coastal margin, as at Hickling and Horsey, where drainage has lowered freshwater levels. Pollution by phosphates from sewage and by nitrates from agricultural run-off is also a problem, leading to eutrophication of surface waters in some places.



1.2 The Human Dimension

The Broads landscape of today although perceived to be natural, is the result of both exploitation and modification by humans. This shaping and moulding has, relative to the physical processes, only taken place over relative recent history.

Much is still to be learnt about past human exploitation and use of the Broads as opportunities for archaeological investigations to date have been quite limited.

Occasionally though, fascinating glimpses of the past, such as the remarkable find of the Chet boat, come to light. Analysis of aerial photographs by historians as part of the National Mapping Project also highlighted the tantalising archaeological potential of the area.

The following text sets out a summary of what we do know and understand about human intervention and use of the Broads and some of the mysteries still to unravel.

Circa 4000 BC to 400 AD

Significant human influence on the landscape did not occur until the arrival of the Romans who constructed the massive Burgh Castle fort.

It is believed that sometime around 4000 BC people switched to procuring food by a combination of hunting and gathering, to growing cereals and raising domestic livestock. Around 1500 BC in the middle Bronze Age, the

English landscape began to change as alongside the establishment of settlements relatively large areas of countryside began to be divided up into blocks of fields. Aerial photography has detected rectilinear cropmarks around the margins of the Great Estuary which may date from this period. They indicate field system complexes, probably associated with seasonal movement of livestock between summer and winter pastures. Traces of square, ditched enclosures have also been detected; these may be Iron Age burial sites (or perhaps later features of Roman age); one of them at Haddiscoe is associated with a Bronze Age cemetery. Further archaeological investigations could provide an insight about the relationship in both human and physical terms, between the land and the watery landscape of the 'Great Estuary'.

However there is little visible evidence left of human activity from this period on the land within the Broads. Occasionally some treasures come to light, often when development requires excavations. This was the scenario at Beccles Marshes when excavations for the recent Flood Alleviation works exposed what is thought to be a Bronze Age causeway from around 1000 BC. Historians believed that this was in use through the Iron Age, to Roman times and at least the 4th Century AD.

The Romans are responsible for the earliest, most significant structure in the Broads during this period. Burgh Castle fort (probably called Gariannonum by the Romans) was built during the 3rd and 4th century AD and was one of a chain of "forts of the Saxon Shore" sited at

intervals around the coast of south east England. It is probably one of the most impressive Roman buildings to survive anywhere in Britain. As evidenced from aerial photographs and surveys, the fort was originally surrounded to the east by a large trading settlement.

The landscape of the Broads was very different during this period with river systems part of a vast "Great Estuary". Relict shorelines of this estuary, with distinct breaks of slopes and some complex and interesting geological and soil structures, can be found at a number of locations in the Broads.

It was on the southern cliff edge of this estuary where Burgh Castle fort was built. Breydon Water is now the only remnant of this strategically important and imposing estuary that the fort guarded.



Circa 400 AD to 1100 AD

Settlement patterns and settlement names become established and round tower churches so characteristic of the Broadland villages are being built.

In the course of the Anglo-Saxon period, the coastline was very slightly further east than its present line and in early Saxon times the 'Great Estuary' was still an area of tidal waters and mudflats, but as the bank of sand and shingle built across its mouth – where Yarmouth now stands – the extent of tidal influences was reduced. This allowed silts and clays to be deposited inland and areas of salt-marsh to form. (see previous section for more detail)

The estuary of the River Thurne, in contrast, was already largely closed by the movement of sand and gravel, so that deposits of peat, as well as estuarine clays, accumulated behind it. At this time the Thurne flowed north into the sea, rather than south into the River Bure as it does today, and its waters appear to have percolated slowly out through the accumulated bank of material.

Its course at this time is marked today by the line of the 'hundred dyke', a minor watercourse which forms the boundary between the parishes of Somerton and Horsey and marks the ancient administrative divisions of Happing and West Flegg. The 'island' of Flegg was thus still at this time an actual island, bounded to north and south by estuaries, and was surrounded on all sides by water or marsh.

Between the mid-7th and late-9th century,

it is possible that the higher ground was more densely wooded than other areas of Norfolk at the time. Place names such as Acle the ac leah "the oak wood", Fishley "the wood of fishermen" and East Ruston, which incorporates the term hris tun "the settlement amongst the brushwood", all indicate the presence of woodland.

Other place names indicate the importance of grazing at that time as part of the local economy. Examples in the Broads include Horsey "the horse island" Woodbastwick and Bastwick both incorporating wic "a grazing farm, ranch" while Winterton and Somerton suggest the seasonal movement of grazing animals to different pastures.

During the latter part of this period in 9th and 10th centuries East Anglia was affected by Viking raiding and settlement. Historians continue to argue over the character of the Viking settlement: about whether it involved the take-over of eastern England by a small warrior elite, or a mass migration by soldiers and peasants from Denmark.

However what we do know is that the Isle of Flegg boasts the highest density of Old Scandinavian place-names in East Anglia, especially those bearing the suffix by, meaning a farm or settlement. Hemsby, Ormsby, Filby, and the rest suggest that in this area, at least, large numbers of Danish people settled. They may have been placed here for military reasons, for the island occupied an important strategic position, at the mouth of the 'Great Estuary', which provided the gateway to northern East



▲ *St. Peter's at Repps with Bastwick, one of the distinctive round tower churches, built during this period. Photo by Evelyn Simak - geograph.org uk*

Anglia for raiders coming by water.

It is during the middle Saxon periods that the current pattern of Broad's local settlements became established and it is quite probable that most parish boundaries were fixed by circa 1100 -1150 AD. The location of the Broads settlements often provided direct links to the river systems of the area as these were to provide the major transport networks for the next few centuries.

By the time of Domesday Book in 1086, the higher land around the Broads, especially in the northern areas, was one of the most densely settled areas in the whole of England. In part this was due to the fertility of the soil and how easy it was to cultivate. Great Yarmouth, at this time, was already a small but flourishing royal borough with a church and a population of perhaps 400 people.

The density of population is reflected by the large number of churches, and small size of parishes. Many of these churches – such as those at Repps, Barsham, Horsey, and Potter Heigham, Thorpe next Haddiscoe, Norton Subcourse – have round towers, a distinctive feature of East Anglia, and especially of East Norfolk and north east Suffolk. They may have been a fashion introduced from north Germany

and southern Scandinavia in the eleventh century – reflecting the close links between the countries bordering the North Sea at this time. But if so, the style was probably enthusiastically taken up by local people because the only available building stone in the locality is flint, and this cannot easily be used on its own to create the corners of buildings. For this, as for door and window openings, better-quality freestone – usually limestone brought from the English Midlands, or northern France – needs to be employed. In this populous region, many churches were erected by small local landowners, rather than my wealthy magnates.

During the 10th and 11th centuries the continued development of the shingle spits across the mouths of the two estuaries ensured a further reduction in tidal influence.

Relative land sea levels were also more than 1.5 metres below those of today. This led to the establishment of very extensive areas of salt-marsh in much of the former extents of the “Great Estuary”. It tended to remain dry, except when inundated by the highest tides.

These marshes were dissected by numerous creeks which filled and emptied with the daily tides. Some of these ancient creeks were later ‘fossilized’ when the land was drained, being adapted as drainage channels: many others are still visible from the air, as darker lines in the pastures. The most striking survivor is the Halvergate Fleet (from the Old English word *fleot*, ‘a stream or watercourse’), which sweeps in bold curves across the Halvergate marshes from Halvergate itself to Breydon Water. By this time, Breydon was probably the only area of truly open water in the estuary, albeit perhaps rather larger than today. The name Breydon thought to come from the Scandinavian word *Breithing* or *Bredening*, describing the broadening of a waterway.

The grazing marshes of the late Saxon period were valuable pastoral resources and valuable due to the potential for salt-making. The Domesday Book of 1086 provided some important clues as to land use on the marshes. Many parishes had areas of grazing land totally “detached” from their parish boundary.

A number of examples can be found on the

◀ *On the marshes the ‘curvilinear’ dykes that can be seen from the air or on maps are remnant ancient creeks. Photo by Mike Page.*



marshes of Halvergate and Haddiscoe Island.

People also exploited the “islands” of slightly higher ground in the marshes for settlement. Sometime in the tenth or eleventh century a monastery, dedicated to St Benet, or Benedict, was founded on one such island called Cowholm near where the Thurne now enters the river Bure. By the time of Domesday, it owned many of the manors, or estates, in the surrounding district. Heigham Holmes is another example, a slightly raised area lying in the valley of the Thurne between Martham and Hickling.

Again the influence of Scandinavian speakers can be found as the Scandinavian term *holm*, ‘as island’ is particularly common on the local marshes.

Boat travel would have been one of the only methods of travelling through some parts of this area during this time. To date there is little knowledge about the types of boats that may have been used in the area. However the Chet boat, unearthed as part of the Broadland Flood Alleviation Project may be able to shed more light on river travel. Historians have had the opportunity to analyse the boat in more detail since it was found. They have established the clinker boat was built of oak, by a skilled craftsman using limited resources which were probably locally sourced. Wooden frames and a mast step were present in the remains; the latter indicating that the boat could have been propelled by sail, although it could also have been rowed or quanted (pushed with a long pole). Iron nails and wooden pegs fixed the timbers and frames together and moss was

placed between the boat strakes to act as water-proofing.

The boat itself was originally abandoned in a small channel in the Chet. Pollen evidence also provides an insight to the landscape of the period. It suggests that this body of water was shallow and very slow moving side channel of the main river. This channel appeared to have rapidly infilled becoming choked with emergent aquatic vegetation. The immediate surroundings were probably alder carr and perhaps reed beds with arable and pastoral fields beyond.

A single Radiocarbon date from the moss luting of the Chet boat gives a date range AD 1020-1155; this is backed up by two other radio-carbon dates taken from the silts within the channel in which the boat was abandoned. Overall this is an extremely early date which makes this a unique discovery.

Archaeological evidence from a second site just 150m east of where the boat was found indicates a further old channel. Deposits from this channel have also been dated using radiocarbon; the results of which indicate a probable 8th century date for the infilling of this second channel. Between these two sites we can see that the River Chet has a complex history which experts have still to unravel.

Although the rivers provided the main routes for moving people around the area, foot, horse and cart traffic was also needed. The river systems tended to impede movement across them. In the early middle ages river crossing points became established. These include those at



▲ *Potter Heigham Bridge – rising water levels over the centuries have limited the size of boat that can pass underneath. Photo by Tom Mackie.*

Ludham, Potter Heigham, Wroxham, near Acle and Wayford Bridge. The water levels of this time were relatively lower, therefore making them easier to ford.

But many bridges were built including that at Potter Heigham, which was potentially initially constructed during this period but later modified. Potter Heigham is testament to the difference in water levels that existed in earlier times as only a portion of the height of the bridge arches are now visible. The lack of room between river and bridge makes it extremely difficult to navigate under with larger boats. At other places in the Broads where the rivers were too wide to bridge or too deep to ford, river ferries were established.

Circa 1100 AD -1700 AD

Marshland improvement for pasture took place through river engineering, land drainage and flood protection schemes. Whilst peat extraction to provide fuel has left a permanent legacy in the form of “broads”; the artificial lakes for which the area is famous.

In the course of the 12th and 13th centuries, a period of rapid population growth and economic expansion throughout England, local communities made strenuous efforts to improve the quality of the marshes.

By surrounding portions of the low-lying wetlands with low ‘walls’, or embankments, they could prevent the daily ingress of the tides, and thus convert them from salt marsh to ‘fresh’ marsh. Drainage within each embanked area was assisted by the provision of surface drains (often adapted from the natural creek pattern) which led to ‘flap sluices’, held shut by water pressure at high tide, but which opened to allow the egress of water at low.

The quality of the vegetation rapidly improved, with grasses and pasture weeds replacing the kind of salt-tolerant plants, such as sea fern-grass (*Catapodium marimum*) and red fescue (*Festuca rubra*), which had formerly provided feed for the sheep.

Many of the ‘walls’ have since been levelled, but some of these ancient earthworks remain. Those beside the major rivers have been added to and augmented over the centuries; examples now left isolated within drained marsh are generally lower, although still often impressive.



▲ It is thought that the monks of St Benet's Abbey dug new channels which connected the river Bure to the river Ant to help with drainage. The above plan illustrates the original routes and the aerial shows what exists today. Plan image, Sue White. Google earth - Image © getmapping plc.

Many areas of the low lying areas of the marshes were already in private ownership by the middle ages. These in the main, being in the areas of land lying in the lower reaches of the valleys of the silty clay soils of the former areas of estuary.

In the valley of the Thurne a more complex scheme of hydraulic engineering appears to have been carried out in this period, perhaps directed by St Benet's Abbey – monks who had a long history of land reclamation and water management as the Abbey held numerous properties along its valley, the value of which they were doubtless keen to protect.

The River Thurne's direction of flow was reversed, probably in the thirteenth century, from north to south. Quite how this was achieved remains uncertain, but it is probable that originally the Thurne and Ant were a single river. Water flowed down the Ant but, when it

reached Ludham, instead of continuing straight on to the Bure it turned to the east, passing along a watercourse now called (confusingly) the Hundred Dyke, just to the north of the Abbey, and then into the Thurne: the lower course of that river did not then exist. The waters from the Ant were diverted by digging a new course for the river due south, into the Bure; the end of the Thurne, now left isolated by the effective closure of the Hundred Dyke, was then likewise connected to the Bure, encouraging – in this flat land – its waters now to flow southwards. This endeavour was assisted by the fact that the river's old outfall to the sea was now effectively blocked by accumulated sand and gravel. It was probably also motivated by this fact, for with its outfall clogged the Thurne must have flooded the surrounding marshes with increasing regularity.

Not all the low-lying wetlands of the Broads comprised salt marsh. Inland, away from the former estuaries, large areas of peat accumulated in the lower reaches of the principal rivers, giving rise to waterlogged freshwater fens.

Because the mouth of the Thurne estuary was sealed earlier than that of the Great Estuary, significant areas of peat were also to be found here, especially to the west of the old course of the river. Peatlands were seldom improved in the middle ages, by embanking and draining, and most remained as common land. They were used by local communities in a number of ways. The drier portions were grazed in the summer months, or cut for marsh hay, which was used to feed livestock over the winter when the grass does not grow. Other areas were cut to provide bedding for cattle, while the wetter portions were mown for reeds or saw sedge (*Cladium mariscus*), which were used to thatch farms and cottages.

The region at this time was one of the least wooded and one of the most densely populated areas of England, with Norwich being the second largest city in the country. The fen areas came to provide an important source of domestic fuel in the form of peat.

This was usually extracted from shallow excavations in the fen surface but, probably in the period from the 11th to the early 14th centuries, it was sometimes excavated from deeper pits averaging between 1.5 – 5 metres in depth.



▲ This aerial illustrates the huge industry that must have existed for peat extraction. Wroxham, Hoveton Great Broad, Pound End, Hoveton Little Broad, Decoy Broad, Ranworth and Hickling in the very distance can be made out. Image by Mike Page.

The man-made origin of the broads was finally established in the 1960's. Before then, most scientists and academics believed that they had formed naturally, although the idea that they were old peat cuttings had, in fact, been circulating locally from at least the nineteenth century. Their artificial character was proved by the fact that they often have vertical sides, and parallel networks of underwater ridges, representing the edges of separate cuttings, which change direction suddenly where – as is often the case – a parish boundary runs through

the middle of a broad. The local peat comes in a variety of forms and these deep cuttings were evidently made to reach the so-called 'brushwood peat', which lies at a depth of between two and five metres, and which burns more slowly, and in a manner more akin to coal, than the material lying at higher levels. In many places this better-quality peat lies beneath layers of clay laid down when much of the area was an estuary, so that the broads are only found where this deposit is thin or absent – in the higher reaches of the rivers, or along the

margins of the wider valleys. There are around 50 individually-named broads still surviving: others once existed in the past but have been lost from the landscape, including Gages Broad, Wigg's Broad and Hare Park Broad in Hickling, and Honing Broad in Honing. Hickling, the largest of these artificial lakes, covers an area of around 140 hectares.

The deep peat cuttings filled with water in the 13th and 14th century which saw the open excavations flooded. It is thought that a rise in

sea levels and climatic changes which brought more storm events were the cause of the flooding. However, the Black Death saw the local population decline and perhaps there was a much reduced demand for fuel which also rendered it uneconomic to keep excavations free of water.

There is still much that we do not understand about the broads: about why, when and in particular how they were dug.

It is often assumed that, when first dug, the broads resembled large empty pits which were only subsequently flooded, perhaps as result of high tides and surges. But although those responsible for digging them were at pains to leave banks of solid uncut peat between the workings and the main watercourses, they must nevertheless have filled with water fairly rapidly through natural seepage. Rather than being dug out at one go, like a modern gravel pit, the peat was probably taken out in small strips, which slowly filled with water as extraction proceeded.

The peat, although bulky, could be transported with ease along the network of local waterways, especially to Norwich. It is possible, however, that not all the broads were excavated to extract peat. In the valley of the Thurne, in particular, while Hickling was evidently a peat pit, Martham, and to some extent Horsey, appear to have been dug in an area largely occupied by marine silts and clays. They may represent clay pits, used to supply a local medieval tile or pottery industry, preserved in the name of nearby Potter Heigham.

Rivers continued to be the main transport routes for cargo, produce and even people. Areas for offloading and on loading from boats became established. To become known as Staithes (from the old English *steath* , " landing place"). Public and private ones, appear to have been in existence in some numbers since mediaeval times.

◀ *Hickling Broad was the largest area excavated for peat. Image by Mike Page.*



Circa 1700 AD – 1800 AD

Patterns of drainage dykes changed in the landscape as new linear dykes networks were constructed to supplement or replace the older creek networks and drainage mills started to appear in the landscape.

Although enclosure of land was already taking place in the early middle ages it took place more rapidly in the course of the 16th, 17th and 18th century. Where enclosure occurred by planned agreement roughly rectilinear dyke patterns were created such as you can see in many of the marshes. Occasionally this partitioning of land incorporated the original creeks which formed the natural patterns of watercourses when the area was an estuary.

The effects of parliamentary enclosure were greatest in the common grazing marshes of the lower Bure and Thurne valleys. Here new networks of dykes were established across what had formally been open land.

▼ “Water Frolics” at Burgh Castle. Artist unknown, photo courtesy of Gt Yarmouth Museum Service.



In addition to the dykes dug around and within individual allotments, there was usually a mill drain, mill dyke or “Commissioners Drain” which led to a drainage mill which lifted water into a higher level dyke leading to the river or more usually directly into the river itself.

The Enclosure Act for an area not only stipulated the erection of a new drainage mill but also established a Drainage Commission for its maintenance and for that of other drainage works. No less than 17 such Commissions were set up between 1800 and 1820. Today there are two internal drainage boards that serve the needs of the Broads area.

The drainage schemes on the peat areas in the Broads were far less successful than of the silty clay soils which marked the extent of the estuary. In 1870 there was a severe agricultural depression and many of the previously drained peat soils areas were abandoned. However, many of these areas continued provide traditional crops hay, litter, sedge and reed.

A significant feature of the Broads landscape even today are the drainage mill structures that were built in greater numbers during the course of the 18th century. The large drainage mill built within the abbey gatehouse at St Benet’s is believed to have been erected around 1740. Information about these early mills is somewhat sketchy, but experts consider that there was a slow improvement in agricultural prosperity after 1760 which led to the construction of more drainage mills.

Tourism in the Broads during this period had not yet become established, but there was local use of the broads and the rivers for entertainment and recreation. By the late 18th Century “water frolics” at Wroxham, Yarmouth and Thorpe St Andrew were social events of some importance and many landowners owned pleasure craft which they kept in boathouses on the river.

▼ *St Benet’s Mill c. 1818 engraving by J. Grieg from a sketch by L. Francis Hulme or St. Bene’t-at-Holme Abbey drainage mill was possibly originally built around 1740 to crush cole seed to make colza oil for lamps before being converted to a drainage pump and is one of the oldest tower mills in Norfolk and the oldest in the Broads.*



Circa 1800 AD - 1900AD

The Victorian period saw a boom in the number of drainage mills built as well as major transport infrastructure projects.

Land Drainage

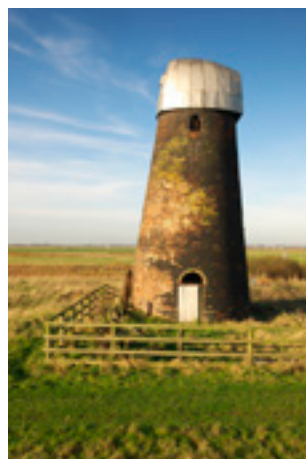
At the turn of the century drainage mills were already a common feature in the landscape of the Broads but there was a rapid proliferation in numbers during the early part of the 19th century. Map evidence of the time seems to indicate that by 1825 there were probably in excess of 80 in the Broads. This proliferation is believed to be a direct result of the Enclosure Acts. 72 drainage mills still survive in the Broads, most of these are those constructed from brick. Many of these have had alterations over the years they were in use. One such practice was to increase the brick tower structures in height "hained" (to allow longer sails- therefore more powerful) which were, prior to the invention of the fantail, relatively low in height to allow the cap and sail to be winched around by their tailpole to face the wind.

The fantail was an ingenious innovation. It is a small vaned wheel attached to the back of the cap. It is connected through gears to a winding mechanism and as the wind changed direction the fan tail rotated and turned the cap into the wind thereby saving on the manual work.

Some mills were constructed in timber. Herringfleet Mill is a surviving example of a wooden smock mill. Other types of wind pumps existed in the form of "skeleton" or trestle mills



▲ Clayrack Windpump, How Hill, Ludham is an example of hollow post mill. Image by Danscape



▲ Halvergate Lockgate drainage mill is also known as Freethorpe Mill and in the past as Banham's Black Mill or Duffel's Mill. In 1988 a protective aluminium cap was fitted. Image courtesy of Norfolk Mills

and the hollow post mill which were relatively cheap. This design was used to drain smaller areas of marshland.

Steam drainage began to supplement wind power in Broadland in the first half of the 19th century and around 30 seem to have been working in 1930. They were housed in sheds of brick or corrugated iron with chimneys. But they were more expensive to build and run so they didn't entirely replace the wind powered drainage mills which were still being repaired and renewed until the early 1900's.

▼ Runham Swim north wind pump built in 1851, had a 3 storey tarred red brick tower, 30ft high to its curb, containing two doors, one window and a Norfolk boat shaped cap with a petticoat. Power to the internal scoop wheel designed to pump water from the marshes into the River Bure was supplied by patent sails and the cap was turned to wind by an 8 bladed fantail with a Y wheel. The name 'Swim' was coined by virtue of cattle being herded down the track to the river where they swam across to graze on the marshes on the opposite side. Image courtesy www.norfolk Mills.co.uk



River transport

The river system, in the earlier part of this period were still providing vital transport routes for goods and produce around the area and beyond. This gave rise to the construction of facilities to support this type of transport such as boat building yards, warehouses and hostleries to cater for the passing trade. The staithe continued to provide the focal points in settlements for the transfer of goods from water to land and vice versa. The Enclosure Awards tended to ratify the existing customary landing places of the staithe stipulating that the staithe were to be used "for the laying and depositing of... corn, manure and other things belonging to landowners and proprietors".

Impressive navigation projects were undertaken in this period to improve the network of the river system. They include the construction of the North Walsham and Dilham Canal which was nearly 14 km long with six large locks to cater for the wherries.

Water mills lying adjacent to the canal utilised the surplus water to generate power. Waxham New Cut ran from the northern end of Horsey Mere partly to facilitate drainage and partly to provide access to the villages in the area and a number of industrial concerns such as the brickworks at Lound Bridge. On the river Waveney the river section between Beccles and Bungay was improved involving the construction of three locks; one lying between Shipmeadow and Geldeston; the second at Ellingham and the third at Wainford.



▲ *Haddiscoe New Cut completed in 1832 to provide the port of Norwich with links to the sea via Lowestoft. Image by Mike Page.*

The most ambitious scheme was the New Cut which created Haddiscoe Island through driving a ruler straight channel through the marshes to join up the river Waveney at St Olaves to a point on the river Yare just east of Reedham. This major construction, completed in 1832, was part of an ambitious scheme to provide Norwich with direct links to the sea via Lowestoft. The

tidal influence necessitated the construction of the Mutford Lock. However the New Cut was not a financial or commercial success as the average size of ocean going vessels was increasing and they became too large to use the Cut which was only 21 metres wide. Water transport was also starting to lose out to rail.

Chalk, Lime, Bricks and Cement

There are certain cargoes that were transported around the area which had a direct connection with the Broads landscape as they spawned industries adjacent to the water where they had direct access to transport. One of these was the excavation and use of chalk and lime. From mediaeval times the process known as marling (the spreading of a calcareous subsoil on agricultural land to neutralise acidity) became more widespread and was adopted in an ever increasing scale in the 17th and 18th Century.

Chalk which underlies most of the Broads area only becomes readily accessible in a two areas of the Broads where it lies closer to the surface. At these locations major industries became established to exploit the resource. They were focused around Whitlingham and Thorpe-next-Norwich in the Yare valley and at Horstead,

▼ *A postcard of "Little Switzerland" on the river Bure which were abandoned chalk workings which became a tourist attraction.*



Wroxham and Coltishall in the Bure. The chalk extraction created a very industrial landscape. Chalk and lime were very bulky to transport. At Horstead the workings were served by a network of canals, so the wherries could be brought right into the pits.

These extensive areas of quarries, spoil heaps and waterways became known as Little Switzerland and in the mid 1800's they actually became a tourist attraction.

In the 19th century chalk was burnt in kilns to produce lime which was used to make mortar and plaster for building. Raw chalk was also spread on sandy fields adjacent to the Broads area, to 'sweeten' the acidic soils. Riverside kilns sprang up in the 18th and 19th century.



Locations included Acle bridge, Barton Turf, Reedham, Ludham, Stalham, Dilham and Yarmouth.

The largest concentration of industrial activity relating to the production of bricks and cement was in the Waveney valley near Breydon Water where there were three businesses. One of the former brickyards at Somerleyton (now occupied by boatyards) supplied bricks to construct the Somerleyton estate cottages and parts of Liverpool Street station.

Perhaps more strangely was the use of the five storey drainage mill at Berney which was used to grind cement. Chalk from Whitlingham was mixed with mud from the river; it was then baked in kilns and then reground into a cement powder. The original mill was replaced by the present structure in 1865. It then doubled as a drainage mill. A sizeable settlement had developed by the late 19th century with kilns, cottages, a pub, and a chapel and the railway line with a station ran close by. Of the buildings only the pub and the mill remain.

Other buildings which reflect the industrial use of the area in this period are maltings, which were located next to the rivers for the easy transport of the raw material (barley) for the process and ultimately the transportation of malt out. Notable examples of these buildings can be seen beside: Malthouse Broad at Ranworth, the River Waveney at Wainford, Oulton Broad, Beccles and Ditchingham.

◀ *Berney Arms was originally built to grind cement.*
Photo by Julian Claxton

Road and rail transport

The most important road route established during this period was the “Acle straight” which was a turnpike roads established in the 1830’s. Prior to this the main route from Norwich to Great Yarmouth followed the route of the meandering Halvergate fleet.

It comprises of two straight sections of road; one 7 km in length and one 4 km. These join at the Stracey Arms drainage mill and close to this point is a branch road which provides an interesting switchback ride in a car to Halvergate village. Construction methods of this period often used what we would call today, bio-engineering techniques. It is reputed that the road was constructed on “faggots” which are bundles of cut branches, which enabled the weight of the road and traffic to be spread out more evenly. In addition historians and locals believe that willows were planted on the edge of the roads in order that their root systems helped bind the soils on the embankment. Some of these willows survive to this day and are regularly pollarded by the County Council. They provide an interesting landscape feature along some of the roadways in the Broads.

The construction of the railway lines through the areas must have been a difficult task, given the soft terrain involved. A flurry of activity took place from the mid to late 1800’s to establish a number of routes across the Broads area some of which involved the construction of river crossings. Those surviving today include those at Reedham, Trowse and Somerleyton. The bridges needed to open to allow fixed mast craft

to travel along the waterways. These structures were replaced in the Edwardian period and have served well up until relatively recently. However, mechanically they have become less reliable and there is the possibility that they may ultimately be replaced.

As elsewhere in the country the Beeching cuts saw the closure of many of the railway lines. The

▼ *The Acle “straight” (to the left in the photo) established in the 1830’s and the railway line (to the right) was opened in 1844. The increasing volume of traffic on the A47 allied to traffic safety issues mean that highway engineers have to continually adapt this Georgian construction to meet modern day needs. Photo by Mike Page.*



alignment of old routes and abutments of bridge crossings can still be traced within the area. One of the more remarkable rail bridge structures in the area which was demolished in 1962 was the Breydon viaduct rail bridge which was opened in 1903. This was a 240 metre bridge of five spans with an opening section in the middle. Boat traffic on the River Yare had in those days, priority over rail.



▲ *Construction of Breydon viaduct started in 1899 and was finished in 1903. It was eventually demolished in 1962 now a road bridge lies along its route.*

▼ *Willows planted on the edge of the road to “hold it up”*



Tourism

The tourism industry in the Broads developed gradually from the 1850's following the construction of the main railway lines to and across the area. The attractions of the area such as its beauty and the recreational activities that could be undertaken (shooting, fishing and sailing) were being widely written about by a number of authors of the period. Boats became available for hire including trading wherries which were adapted for the tourist period and reverted back for trading purposes at other times in the year. Purpose built pleasure wherries were also built including all the mod cons of the period, some including a small piano.

1900 AD – 1950 AD

The tourism industry

The expansion of the tourism industry continued apace with the range of craft available for hire extending to motorised craft. The first of the boats powered by the internal combustion engine was hired out in the 1920' by Alfred Ward from a boatyard in Thorpe. With the increase in tourists came settlement expansion with the need to provide facilities for the construction and maintenance of the craft, riverside public houses and the construction of holiday homes. Much of the development took place in the upper reaches of the river, which



▲ *Holidaying on the Broads 1910. Image courtesy of Broadland Memories.*

◀ *Five of the remaining pleasure Wherries passing St Benet's Abbey. At first they simply featured hammocks and a stove in the hold of a 'trader' but later, boat builders began to make craft specifically for pleasure sailing and holidays, incorporating living quarters instead of a cargo hold.*

allied to the greater ease of access by rail, were also thought to be more attractive to the visitor than the lower reaches of the wide open grazing marshes.

The more affluent built villas on edges of broads can be seen at Wroxham and Oulton Broad. Another style of development are the smaller holiday chalets which sprang up in the interwar years alongside the river's edge.



Often accompanied by a small boat dyke they can be found lining the river banks as at Potter Heigham, Repps and Brundall. Many of the smaller distinctive chalets were built on tight plots. Some were constructed from kits supplied by a Norwich company Boulton and Paul who built prefabricated buildings which they exported over all the empire. They tended to have a distinctive style often with verandas facing the river.



▲ 'Dancing Light' 1930s. Image courtesy of Broadland Memories Broadland Memories.



▲ Riverside bungalows and villas at Wroxham in the 1930/40s. Image courtesy of Broadland Memories



▲ Many of the riverside homes have verandas and some use local reed for the roofing material. Photo by Steve Daniels - geograph.org.uk.

▼ The view looking downstream from Wroxham Bridge in the 1930's. Image courtesy of Broadland Memories



▼ The chalets established on the River Thurne by the 1950's. Image courtesy of Broadland Memories.



Drainage Mills

The establishment of the national grid and use of electric pumps hand in hand with the reorganisation of the internal drainage meant that the wind powered drainage mills were starting to become obsolete. Electric pumps were smaller and more powerful and could drain larger areas. These pumps tended to be housed in small brick building with pantile roofs more often than not standing in close proximity to the original mill structure because the original outfalls to the river were still used. Some of the drainage mills which were privately owned were still in use up to the Second World War.



▲ Ashtree Farm mill was built in 1912 in an area known as Nowhere, on the site of an earlier mill. The boat shaped cap held a fantail and a tailpole. Nowhere, is a name that was officially given to the part of the Bure Loop just west of Yarmouth in 1862 when the area was annexed to the parish of Acle in the Assessment Act of that year. Ashtree Farm mill was only abandoned when in 1953 a storm badly damaged it. Image courtesy www.norfolk Mills.co.uk



▲ Norton Marsh drainage mill (built in 1863) was built on the south bank of the River Yare just to the east of the mouth of the River Chet and to the south of Reedham Ferry. This photo shows an example of the small red brick buildings constructed to house the pumping gear which was used once electricity had replaced wind as the power source. Recent modernisation of the water management here has meant that the pumphouse is now obsolete and has been demolished. Image courtesy www.norfolk Mills.co.uk

1950 AD to the current day

Tourism

Through the 1950's and 60's the Broads became increasingly congested and the wash from boats caused erosion to the banks. The solution at this time was to install wooden or metal piling which had a canalising, urbanising effect on the Broads rivers and was not helpful for the local wildlife. Today different methods of bank protection are encouraged, aimed at restoring the natural edges to the river. An increase in the boating numbers mid to late 1900's contributed to declining water quality as more chemicals used on boats ended up in the water. This allied to the sewerage and agricultural runoff which added nutrients upset the natural ecological balance and waters became murky effecting plants and animals. Today through various measures such as phosphate stripping at sewerage works and

▼ *Potter Heigham in the 1960's. Building constructed to cater for the booming tourism industry were starting to urbanise the landscape and river edges were piled for boat moorings. Broadland Memories*



education programmes about use of chemicals on boats, water quality is gradually improving. However, recently Nutrient Neutrality and the capacity of some sewage treatment works and the effect on the quality of the area's waterways have become an issue. There are many factors which contribute to good water quality, some of these not yet fully understood by scientists, so there is much work to be done to get back to the pristine rivers and broads of centuries ago.

Boat recreation has had an effect on the landscape in that over the years, the drive to have bigger, more luxurious boats has required larger facilities for construction, maintenance and mooring. It is inevitable that when companies want to expand at locations which may lie in the open country or within the transitional zone between settlement and the countryside, there are pressures exerted on the natural and historic features in these areas.

Other pressures come from the need to accommodate car use. Holiday makers, who would have once come by train, now drive to the Broads. This has resulted in the expansion of car parking facilities on or near boat hire companies.

Farming, land use and management

The 1970's saw a real threat to the grazing marshes of the Broads and the wildlife it supports. This was a result of changes to food pricing structures which meant that farmers could make more money from growing cereals than raising cattle. Allied to this, the national grant schemes offered at the time to deep

drain and plough marshland saw many acres transformed from open marsh grassland with their dyke networks to arable fields where many of the dykes were filled in.

A major public row ensued in the 1980's involving conservation and government bodies. Ultimately it resulted in new government legislation which instigated the Broads Grazing Marshes Conservation Scheme. This scheme spawned the first iteration of a national scheme which rewarded farmers for farming in the traditional manner and protecting the landscape and wildlife. The latest scheme is called Environmental Stewardship. Changes to farming practices and government incentives continue to influence the Broads landscape.



▲ *Drainage Mills are no longer used to drain the marshes. Those that are left provide a nationally and potentially internationally important grouping. They are not only important in historic terms; they are landscape features closely associated with the Broads which are often the subject matter of photographers and artists. Image by Julian Claxton.*

Settlement development

Some settlements in the Broads are of ancient origin, having become established at convenient points to provide access to the water (at a river crossing point or staithe for instance) or the grazing marshes. Either way, there are continuing pressures exerted for further development in these areas. This may be to cater for improved living standards, commercial, farming reasons or recreational pressures. Climate change and increases in water levels is also having an effect by requiring the increase in floor level heights for development. These changes are in the main tightly controlled by planning processes. The Planning Authority however has the unenviable job of having to balance the needs of the local economy and residents and the requirements stipulated in the Broads Act to safeguard the special qualities of this nationally designated landscape.

▼ *Traditional grazing techniques and sympathetic water management in the dyke networks can improve the habitat value of the grazing marsh environment.*



▲ *Larger properties and the desire to have more outside space has led to pressures on the environment in the Broads and the sub-urbanisation of the river frontage. Photo by Mike Page.*

◀ *Commercial reed cutting is still undertaken in the Broads. It provides reed for thatching (sustainable building product) prevents scrub encroachment and contributes to the mosaic of habitats in the Broads. Photo by Mike Page.*

Flood defence

In 2001 The Environment Agency awarded Broadland Environmental Services Ltd (BESL) a contract to implement a 20 year programme of flood defence improvements and maintenance to the Broads area. The main aim of the project was to strengthen existing flood defences (established and modified over centuries) and restore them to a height that existed in 1995. It is interesting to note that the techniques developed over the centuries were closely mirrored in this contract. Material was “won” from soke dykes that lie to the landward side of the flood banks. These dykes were widened and made deeper to provide sufficient material

▼ *One of the most significant changes to the Broads landscape is the result of the Broadland Flood Alleviation Project. Flood banks have been made wider and taller and sometimes completely relocated. The material required has normally involved the enlargement of the soke dykes. The effects are softened once vegetation has become re-established in the dykes and on the banks. Photo by Mike Page.*



to undertake the bank strengthening. This replicates what would have happened centuries ago but on a much larger scale.

The construction works initially leave a raw scarred landscape, but within two seasons the areas recovered.

The legacy, as well as the improved flood defence, is a greater volume of water within the soke dykes which is better for wildlife and in some areas the establishment of wide reed fringes on the river's edge to replace piled structures that were removed. Further detail can be found in the landscape types section.

The Broadland Futures Initiative (BFI) is currently developing a longer-term strategy for managing flood risk in the Broads.

Conservation

The Broads area is renowned as a haven for rare plants and animals. A significant proportion of the land in the area is owned by nature conservation bodies such as the Norfolk and Suffolk Wildlife Trusts and the RSPB. The nature conservation bodies tend to use traditional land management techniques to protect and enhance the landscape in accordance with the aims of their individual organisations. Some practices, such as the creation of scrapes and the waterlogging of areas over the winter period however, can also have the effect of changing the landscape. As with many aspects which relate to the Broads environment, there is a balance to be achieved between recognising and

▼ *Conservation activities can sometimes have dramatic effects on the landscape. These are foot drains created by the RSPB Photo by Mike Page.*



protecting the historic landscape features which are important elements in defining the character of the Broads landscape and improving habitats for wildlife.

Infrastructure

The 20th and 21st century has seen rapid technological advancement. Communications and the supply and production of electricity are industries where this advancement has, and will continue to have an effect on the landscape of the Broads. Their requirements can lead to the installation of masts, pylons, cables, turbines all of which have the propensity to impact on open views within the Broads. They can also influence the landscape character. Where 20th / 21st



▲ Telephone and electricity cables and poles clutter the landscape and affect the landscape character.

► The tall pylons over the cut at Haddiscoe feature in views over many kilometres. Photo by Evelyn Simak - geograph.org.uk.

century development is not readily apparent visitors are transported back to a time when life was perhaps simpler and more tranquil. This tranquillity is one of the key features of much of the Broads area which is important to safeguard.

It is quite likely that pressures for infrastructure requirements over the next few decades are likely to increase. However, some opportunities exist to remove at least the clutter of overhead electricity wires as UKPN allowances are currently available to underground the cables, thereby allowing the removal of the poles and this has successfully been carried out in some parts of the Broads.

An evolving landscape



The preceding sections set the scene of how the present Broads landscape came to be. The change seen in this landscape has largely been unmanaged until recent times, with the key drivers predominantly being economic or as a result of national changes in statute such as enclosure.

The Broads status equivalent to a National Park was granted relatively recently in 1988, since this time European, national and local policy has begun to recognise the multifaceted values contained in our landscapes. This was most notably by the European Landscape Convention (2000), from which flowed the UK legislation we see today, landscape protection policies and of course, the production of supporting documents such as this.

The crucial role that Protected Landscapes have in delivering Government commitments to tackling climate change, restoring nature and supporting health and wellbeing has been monitored since 2024 by targets set out in the Protected Landscapes Targets and Outcomes Framework. Most recently, the Government's Environmental Improvement Plan (2025) set out a framework for improving England's natural environment, with goals and commitments that again make clear the integral part the Broads and other protected landscapes can play in meeting these objectives

Whilst the level of statute for recognition and protection of the landscape continues to expand, it is important to understand that the landscape is never static. With many layers of interest and an intricacy of moving parts, fundamentally

the aim cannot be to prevent, but to manage change in as balanced way as possible.

Managed change in the Broads is likely to require further planning and consideration over the next 50 years, as we respond to climate change and the environmental and ecological changes that result.

Physical changes of sea level rise, coastal and river flooding, and changes in the climate, will dramatically alter the Broads landscape within our lifetime.

Like all species, we will also need to adapt to the changing environment. Tourism, farming, land use and management, development, flood defence, conservation and infrastructure will all be reconsidered.

In the late modern period, wind power was commonly used to drain the marshes and processing produce. Structures which would have been alien when constructed and in context are relatively modern structures, are now accepted as a functional part of the

landscape and beloved landmarks of the Broads.

Development of renewable technologies and the energy needs of both existing populations and new development will need to be carefully balanced against the special and protected characteristics of the Broads, with particular consideration of the permanence of these protected features in an evolving landscape. Management of these changes in the landscape for people and nature will require a collaborative approach and careful consideration of the interactions of the different natural environment and human needs.

Steps have already been made. In December 2024 the Broads Authority declared Biodiversity Emergency. The aim of the declaration is to raise public and political awareness, emphasising the urgency for immediate action to protect and restore the environment. It will foster stronger partnerships with local stakeholders, encouraging collaboration on critical issues.

Partnership working to support farmers with

financial initiatives to develop and adopt practices that adapt to climate change, conserve and enhance the environment without cost to farming are already in place, including Broads Biodiversity Partnership, Broads Peatland Partnership and Farming in Protected Landscapes.

Alongside the biodiversity emergency, other commitments, policies and strategies include Race to Zero, Broads Biodiversity and Water Strategy 2019-2024 monitored by the BBP, and the Broads Nature Recovery Strategy 2024-2029 all have potential to alter our landscape. Meanwhile other environmental pressures associated with development, and policies indited to address them, such as Nutrient Neutrality, the National Planning Policy Framework (NPPF) and Biodiversity Net Gain (BNG) requirements are already altering our approach to development and inevitably climate change will impact how BNG can be applied locally.

Given the low-lying nature and the presently known effects of climate change, the Broadland landscape is likely to see more significant change sooner than most. How we manage this change and our human needs from this environment is yet to be determined. The landscape is constantly evolving, the process cannot be stopped, but we can choose to manage change in a collaborative, informed and considered way.

◀ Views from Howards drainage Mill towards Scroby Sands wind farm. Photo by Tim Heaton - geograph.org.uk

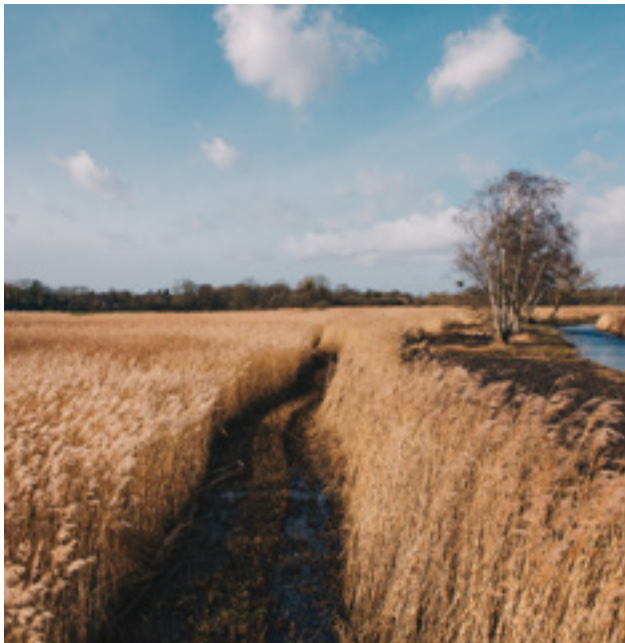


Section 2

Landscape Types

2.1 The landscape types of the Broads

Landscape types are distinct types of landscape that are relatively homogeneous in character. They are generic in nature in that they may occur in different areas, but wherever they occur they share broadly similar combinations of geology, topography, drainage patterns, vegetation, historical land use and settlement pattern.



▲ *Commercial reedbed at Irstead.*

► *Malthouse and Ranworth Broad with wherries sailing.*



1. Tidal estuary

The tidal estuary landscape type is only found within one location in the Broads, at Breydon Water. During Roman times the 'Great Estuary' would have covered areas occupied by Halvergate Marshes, Haddiscoe Island and extended a significant distance up the Rivers Bure, Yare and Waveney.

Breydon water is a hugely imposing and unique gateway to the Broads network heavily influenced by the tides. At high tide a vast water body, low tide reveals extensive mud flats, sinuous creeks and the narrowness of the navigable channel which is marked by coloured marker posts. The character of the tidal estuary remains stark, isolated and remote. At the western end of Breydon the waters of the River Yare and Waveney join forces, ultimately meeting the River Bure in the east at Vauxhall Bridge in Great Yarmouth to discharge into the North Sea.



► *Berney Arms mill looking out towards Breydon Water and the North Sea. Photo by Mike Page.*

Its distinctive landscape characteristics are:

- Only example of tidal estuary in the Broads is at Breydon Water;
- A hugely imposing unique waterbody;
- International, national and local designations;
- Stark isolated character and remote feel, particularly away from the urban edge of Great Yarmouth;
- Character heavily influenced by the tides. Low tides reveal extensive mud flats, associated vegetation and fauna;
- Historically cultural associations with



▲ Broads Authority Ranger launch 'Spirit of Breydon'.
Photo by Julian Claxton.

wildfowling and naturalists;

- Enclosure by continuous floodbanks;
- Vast skylines and uninterrupted views, varied from relic estuary cliff to the south at Burgh Castle to modern buildings, offshore vessels and urban infrastructure including river crossing in the east around Great Yarmouth;
- Transient quality to the colour and texture of the water;
- Activity on the water mainly from tourist boats;
- Navigation channel marked by coloured marker posts;

- The history of waterborne trade and cultural interest has declined, with the loss over the years of many of the wreck sites, houseboats, marsh farms and mill cottages.
- Cultural significance of Breydon Water as a remnant of the 'Great Estuary' that in Roman times would have spanned the gap between Caister-on-Sea and Burgh Castle.

Forces for change include:

- Development on the edges of Great Yarmouth urban area;
- Farms located on adjacent grazing marsh.

▼ *Sunset over Breydon Water.*



2. Rivers, ronds and floodbanks

Three principle rivers, the Yare, Bure and Waveney and their tributaries, the Wensum, Chet, Ant and Thurne plus the canal at Dilham and the Cut at Haddiscoe create the physical link to all parts of the Broads and provide corridors for movement for people, plants and animals.

These rivers form part of a larger network of rivers and streams extending far beyond the Broads forming the Broadland Rivers Catchment. This catchment which includes two thirds of Norfolk and part of north Suffolk, funnels the rain falling within its area eastwards, either above or below ground, ending up in the rivers flowing through the Broads.

Its distinctive landscape characteristics are:

- The rivers lie at or below sea level;
- The rivers and their valleys become wider the closer they get to the coast, are slow flowing and for the most part subject to the tides;
- The nearer the coast, the river becomes saltier;
- Different plants and animals are associated with the differing water conditions (salty/freshwater/muddy/clear);
- The rivers provide 200 kilometres of navigable water waterways which are popular for recreation attracting many different types of boats;

- The rivers provide an important national fishery resource;
- Over centuries the sections of rivers that lie closer to the coast have had flood banks constructed on the edges of the river to protect the land beyond;
- The flood banks become taller the closer the river gets to the coast;
- The flood banks can limit views from the river to the landscape beyond especially at low tide;
- The sections of the rivers within the estuarine marshes can have wide ronds on which reeds grow;
- Carr woodland or fen enclose the stretches of the river in the upper reaches where there are some of the undrained peat soils;
- Where the river flows through grazing marsh there are “big skies” whilst there is a more enclosed feel and limited views through sections of river flowing through carr woodland and fen;
- Where there is settlement, the river bank edges are often retained by quay heading (steel and wood) which can give more urban feel to the river;
- The modifications to the river systems and banks within the settlements of Gt. Yarmouth and Norwich hint at their past industrial /transportation links and importance;



▲ *The hard edges to the river in towns and villages contrast dramatically with well vegetated river edges in the countryside.*

- Different types of settlement (see Settled Broads type) can influence the character of the river.

The rivers flow in a west-east direction ultimately joining up at Great Yarmouth where they enter the North Sea. The majority of the river system within the Broads area is subject to the twice daily tides.

The river systems downstream nearer the coast (also called the lower reaches) are subject to far greater changes in the water levels in the rivers than those upstream which are inland (also called the upper reaches). The water of those sections of rivers nearer the coast are also saltier (brackish). The brackishness of the water results in different types of plants and animals (fish especially) to those in freshwater areas upstream. The quality of the water can differ throughout the Broads which will influence the type and amount of vegetation and animals within it.

On extremely high tides or in tidal flooding conditions salt water goes further up the otherwise freshwater rivers and can overtop the river banks and into the natural floodplain. Saltwater can kill freshwater fish. However fish can detect these changes and they actively seek out freshwater. The Environment Agency and a boatyard operates a fish refuges on the Thurne.

An Environment Agency project that started in the early 2000s has seen flood banks restored to the height they were in 1995. To do this material was often locally sourced by increasing the width and sometimes the depth of the adjacent soke dyke. Generally one of three options were chosen for the re-design of the bank. The flood bank could be strengthened on its existing alignment (taller wider); it could be

“rolled back” meaning that it was made taller wider but moved back from the river’s edge or it could be “setback”. The last two options potentially allowed the roud widths to be increased. Ronds are the areas of low lying land which lies between the river and the floodbank. They are important as not only do they provide space for river water, the reed which becomes established on them acts to protect the flood bank from erosion from waves caused by wind and boats thereby providing a more sustainable solution to flood protection. Reed (*Phragmites australis*) tends to be the dominant plant species that becomes established on the ronds. Its height, feathery nature and changing seasonal colour add both visual interest and provides habitat for Broads wildlife.

Only where there was no other option or where it was found beneficial to have moorings, has the Environment Agency had to re-pile sections of bank.

More recently, the Broadland Futures Initiative has been established. This is a partnership developed in order to produce a strategic framework for future flood risk management in the Broads area. The Broads Internal Drainage Board (IDB) also maintain drainage infrastructure in order to manage water levels in the Broads.

The character of the of the different stretches of river are greatly influenced by;

- The proximity of the river valley sides which can provide a sense of enclosure within the narrower valleys of the upper reaches or, as in the lower reaches, be so far away that the

view from the river are expansive and the famed “big skies” are dominant;

- The proximity of settlement which can both detract from the peace and quiet normally associated with the Broads but can also add interest and variety;
- The types of vegetation is generally dictated by the soils. The estuarine marshland areas of silt and clay soils supporting marshland vegetation and reeded ronds and the peat soils supporting fen and carr woodland;
- The past use of the river for trade and transport and the infrastructure that supported this activity.

▼ *Common reed, home to many iconic Broads species such as the Bearded Reedling pictured here.*



Forces for change include:

- Continuing maintenance of flood banks and investment in water management infrastructure;
- Climate change influencing water resources, water levels, and frequency of storm events;
- Implementation of the Water Framework Directive helping to improve water quality;
- Continuing pressure from property owners with land fronting the rivers to protect their land from flood water;
- Continued pressure from recreation businesses for quay headed frontages for boat moorings;
- Bank and reed rond erosion;
- Changes in levels of boating activity.

▼ “Crest” piling is one of the methods used to increase the height of the flood banks. Photo by Lesley Marsden.



▲ “The dramatic effects of flood alleviation works. The existing soke dykes (landward side of the river) have been excavated to provide material for the flood banks. Large reed ronds will develop over time on the river’s edge as the Broads Authority will use the area for dredged material and these will gradually reed over helping to “soften” the rawness of the engineering works. Photo by Mike Page.

3. Coastal dunes

This landscape type is confined to a low lying coastal strip between Eccles-on-Sea and Winterton-on-Sea. However the Broads has a strong connection to the coast as it influences the local climate and the saline waters can affect water quality within the freshwater environment of the marshes especially during surge tides and storm events.

This section of coastline is vulnerable to coastal erosion, Sea Palling has engineered off shore reefs to prevent storm waves reaching the beach. Work is ongoing to replace delapidated timber and steel groynes with rock groynes between Waxham Gap and Horsey Gap. The dunes and associated beach systems provide a valuable natural defence that along with others along the coast helps to shield the large area of low-lying hinterland from coastal flooding during storms. They are also a valuable habitat adding to the diversity in the Broads. The unusual dunes at Winterton are more similar to those in the Baltic than other sites on the Norfolk coast, as acid-loving plants grow here. Within the wet slacks of the dunes, natterjack toads breed in shallow pools, whilst nightjar, barn owl, skylark and stonechat breed nearby.

Down on the beach, harbour seal and grey seal can be seen swimming and basking. The grey seal breeding colony is monitored with the help of volunteers, who also work to ensure visitors do not disturb them. On the open shingle beach little terns build their nests.

The area is within the Norfolk Coast a National



▲ *The dune systems stand many metres above the surrounding land. They form an effective visual screen between two very different landscapes. The dunes can be easily damaged as a result of foot traffic. This makes them more vulnerable to erosion.*

Landscape, the special qualities of which can be found in the Norfolk Coast Protected Landscape Management Plan here. It is both impacted by and highly vulnerable to recreational pressures from visitors and local residents. These include widespread trampling of sensitive dune and grassland habitats – key features of the designated Special Area of Conservation – as well as disturbance to threatened species such as adders, amphibians, birds and seals, often caused by people and dogs.

To address these challenges, the Norfolk Recreation Avoidance and Mitigation Strategy (RAMS) supports local authorities in fulfilling their obligations under the Habitats Regulations. It facilitates collective action and co-ordinated mitigation efforts, providing a flexible and well-governed framework to ensure long-term environmental protection and regulatory compliance, particularly in relation to new residential development in the area.

Its distinctive landscape characteristics are:

- There are three internationally important dune habitats;
- Embryonic Shifting Dunes, these are early succession stage dunes, located on the frontline near the shore, consisting of dry, sandy, nutrient poor soil, on which pioneer species vegetation grows. These dunes are unstable and shifting;
- Dune Slacks, these are mid (dynamic) succession stage dunes, located between dune ridges, consisting of wet, peaty or silty moist or waterlogged soils, on which moisture loving vegetation grows. These dunes are semi-stable;
- Coastal Dune Heaths, these are later succession stage dunes, located inland on older dunes, consisting of dry acidic, nutrient poor soils, on which heathland species vegetation grows. These dunes are stable;
- They are dynamic in nature and vulnerable to fast change as a result of storm damage and damage by people;
- The dune systems form a physical and visual barrier between the sea (with its saline characteristics) and the freshwater marshland environment of the Broads hinterland;
- Much of the area is designated for nature conservation;
- The area generally tends to feel remote and tranquil. This characteristic is impacted upon



▲▼ Engineered structure in the form of access routes (which can be defended in times of storm events), concrete flood walls and groynes (to help reduce longshore drift) are common features in this landscape type area. Photo above by Evelyn Simak, photo below 'dunes at Maram Hills, Winterton-on-sea' by Hugh Venables - - geograph.org.uk



by the vast number of visitors during the seal breeding period in winter;

- Flood defence and access structures.

Forces for change include:

- The impacts of sea level rise and increasing storminess on the dune habitats and the freshwater systems;
- Increased visitor numbers and the impacts on dune systems and wildlife. Visitor numbers are especially high during the winter grey seal breeding period when thousands visit to see the new seal pups;
- Pressures for farming/leisure development on the hinterland.

4. Estuarine marshland

This landscape type, which covers up to 40% of the Broads, is so called as the marsh occupies the extent of the former great estuary and rivers beyond.

See the video **The Great-Estuary-Story**.

www.broads.co.uk/videos/the-great-estuary-story/

The known history of the marshland and its people is fascinating. But there are many mysteries to unravel about how people have used this area over the centuries.

It is a landscape at risk as its use as traditional grazing marsh with its wildlife friendly water management systems is subject to changing economic drivers and stretched farming subsidy systems. The drainage mills, an integral part

of this landscape, are a nationally and perhaps internationally important group but no longer have an economic function which has led to their neglect.

Its distinctive landscape characteristics are:

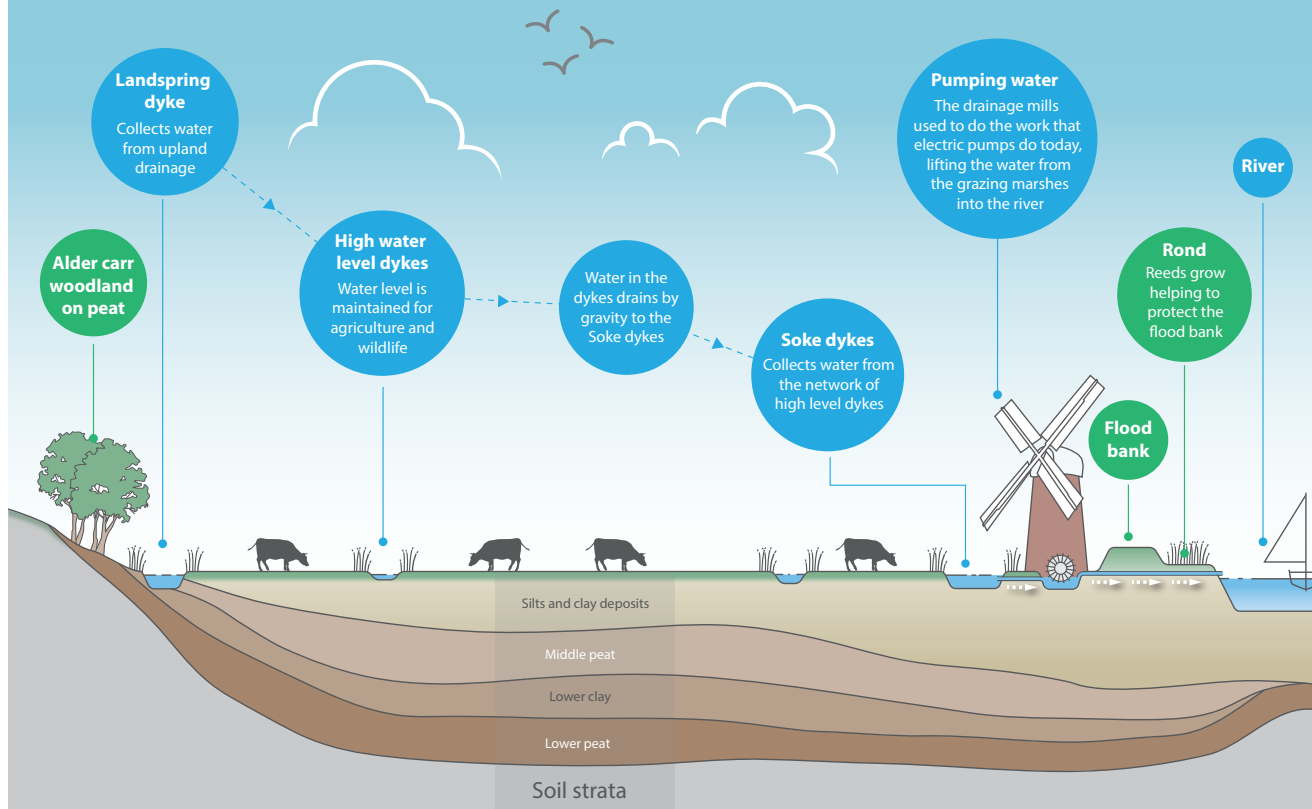
- Very low lying flat land which is all at or below sea level;
- Silty clay soils and peat on the surface with alternating layers of clay and peat deposits;
- The marshes are divided into “fields” by water filled dykes and ditches;
- Extensive cattle grazing marshes;
- Drainage mills – in various states of repair;
- Arable reversion concentrated in certain areas;

- Little tree or shrub vegetation except at the boundary with the valley sides, where carr woodland may exist and adjacent to the isolated buildings on the marshes;
- Expansive views often to locations outside the Broads area and “big skies”;
- Isolated farmsteads;
- A sense of isolation in the broader valley reaches;
- Flood banks along the river valleys with their associated soke dykes, foldings and reed ronds;
- Internal drainage board structures such as pump houses, weed clearance devices and outfalls;
- An abundance of wildlife making use of both land and water where conditions are met.

▼ *Muttons Mill and the surrounding estuarine marshland.*



Typical geographic features of Broads grazing marsh



History of the marshes

In the 10th century (over 1000 years ago) relative land/sea levels were more than 1.5m below those of today allowing grazing through much of the year; originally this was for sheep. Between the late thirteenth century and late fifteenth century wool production was the backbone and driving force of the medieval English economy. At the time the trade was described as “the jewel in the realm”.

But eventually cattle came to dominate the marshes. In 1722 Daniel Defoe described the importance of this function of the marshes in

the following terms,

“in this vast tract of meadows are fed a prodigious number of black cattle which are said to be fed up for the fattest beef, though not the largest in England: and the quantity is so great, as they not only supply the city of Norwich, the town of Gt Yarmouth, and the county adjacent, but send great quantities of them weekly in all the winter season to London.”

Over the centuries the land /sea levels changed and today, the marshland landscape relies on the water levels in the marsh to be managed through human actions through embankment

and drainage to keep them viable for agriculture. The latter is achieved through the use of dyke networks which not only act as water carriers but provide the same role as a hedge or fence would have on drier land for cattle control. The crossing points between the individual fields are often identified by the presence of gates and angled wing walls that stand out in isolation in the marshland environment.

The dyke networks on the marshland have either a curvilinear or rectilinear form. These patterns are not necessarily apparent from the ground level, but become very distinct when looking at a map or aerial photographs. The former are the more ancient of the two types formed from natural creek patterns, the latter are planned and straight and are often blocks of former wet common associated with and enclosed by individual parishes. Some of these ownerships were at a great distance from the individual parishes.

The dyke networks are divided into a series of “levels” usually separated from each other by low earth banks. In the main each of these levels was drained by one drainage mill but as these divisions pre-date the building of the mills it is not always the case.

While the Broads stores vast amounts of carbon, locked up in its wet fen and peatlands, nearly a quarter of its deep peat soils are drained for agriculture, which releases greenhouse gases. In fact, around one million tonnes of carbon have been lost from the Broads in the past 40 years. With the Broads Peat Discovery Project and its

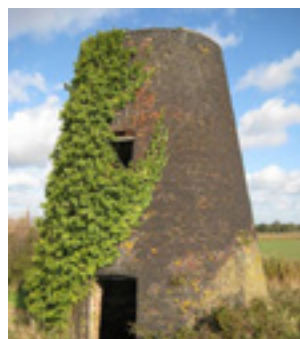
partnership, we have helped some farmers and land managers tackle the barriers to peatland restoration. Since 2018 the Broads Authority and partners have engaged with farmers and restored sites. The aim is to enable peatland restoration on suitable sites, as healthy peatlands provide remarkable services to society: carbon store, water filtration, flood prevention, habitats for wildlife, historic landscape. This approach also aims to create new income streams for farmers and landowners seeking to reduce their emissions, improve the quality of their land and support biodiversity.

Drainage mills

Located next to the main rivers or along the route of main drains, the drainage mills within this marshland are a significant and important landscape and heritage feature adding to the mystery and evocative nature of the marshland landscape. They were used to pump out water from the main drainage dykes into the rivers in order to manage the water levels on the marshes.

Although present in the upper reaches of the river systems, their landscape significance is more obvious in the open landscape of the marshes. The concentration of 70 recognisable mill sites within the Broads represent a nationally if not internationally important historic assemblage, as similar types of mills within other parts of the country have almost entirely disappeared.

Many of the drainage mills on the silty clay soils which form the soils of the marshland were built



during the late 18th and early 19th century, as can be seen from examining map evidence of that era. Research seems to indicate that the new mills erected during this period would seem to be as a direct consequence of the Enclosure Act. From the middle to the later part of the 19th Century many mills were extensively modified or rebuilt. It is these mills that have tended to survive to the present day.

Their use ultimately waned being replaced by steam, diesel and then in the 1930s and 1940s by electric pumps which are managed by the internal drainage boards. The electric pumps are housed in modest brick buildings however even these are declining in number as more powerful pumps are used and water management arrangements are rationalised.

Today, although some of the drainage mills have had the benefit of conservation work, many are in a derelict state and are in danger of disappearing from the marshland landscape entirely.

Dotted more infrequently around the area are the sizable buildings with their chimneys which housed the steam mills which started to take over from the wind powered mills from the mid 1800's.

Grazing marshes

The “Battle of Halvergate Marshes”, part of the most extensive block of marshland in the Broads, became a cause celebre in the 1980’s when a proposed scheme for deep drainage of the marshes to allow the conversion of the grassland to arable crops pitted private and state agricultural interests against conservation and landscape interests. This turned into a national debate which after a number of years produced a revolutionary new concept of paying farmers to maintain the landscape.

The 1985 Broads Grazing Marsh Conservation Scheme paved the way for the later payment systems set up in the environmentally sensitive area (ESA’s) schemes. This payment scheme evolved through various agri-environment schemes that incentivise management of water and land to protect biodiversity. The UK’s own Environmental Land Management Scheme (ELMS) marks a fundamental change in how farmers are supported. Under the new scheme farmers in England will be rewarded for: Environmental Stewardship, Sustainable farming practices and animal welfare improvements. This shift represents a move away from area based payments and towards a “public money for public goods” approach

The grazing marshes are a considerable wildlife resource and the dyke network is of outstanding importance for its plant communities. Amongst the species found are frogbit, water soldier and broadleaved pondweed. Great water parsnip and cowbane may be seen growing along the dyke edges. The Broads is a stronghold for water

voles, which are widespread in many of the marsh dykes.

An ongoing flood alleviation project has benefited the freshwater marsh dykes through providing an appropriate standard of protection

against flooding from river water that can be high in nutrients and/or salt content. Additional enhancements have resulted from high level water carriers bringing in freshwater when it is available to supply livestock and benefit wildlife.



▲ Mill with grazing sheep and dyke, typical features of the Broads grazing marsh landscape.

Grazing marsh timeline

13th century

Marsh reclamation started. Sea levels at that time were about a metre below present. Sheep grazing predominated.

16th century

By this time many areas had been reclaimed through improvement to existing flood banks, driven by increases in sea level rise and a wish to increase agricultural production. There was a move towards cattle production in preference to sheep.

18th century

Most of the grazing marshes of today had been drained by the 18th century through the introduction of drainage mills and they were still grazed predominantly by cattle. Transient flooding occurred frequently due to the inefficiency of land drainage pumps.

19th century

Enclosure of land took place during the early part of this century, and this paid for improvements to the land drainage infrastructure. From this time onwards, drainage became ever more efficient and flooding became rare.

20th century

Further major improvements to the drainage infrastructure were achieved through technological developments, driven by the wish to maximise agricultural production. In 1913,

the first diesel pump was installed. During the 1930's the 18 Internal Drainage Boards within the Broads came into existence. During the late 1930's and 1940's highly efficient electric pumps became widespread.

21st century

One of the most significant shifts in post-Brexit agriculture has been the restructuring of farm subsidies. The transition from the EU's Common Agricultural Policy (CAP) to the UK's own Environmental Land Management Scheme (ELMS) marks a fundamental change in how farmers are supported

In 2001 the 20 year Broadland Flood Alleviation Project (BFAP) was commissioned by the Environment Agency to restore flood banks on the rivers to the heights they were in 1995.

The forces for change include:

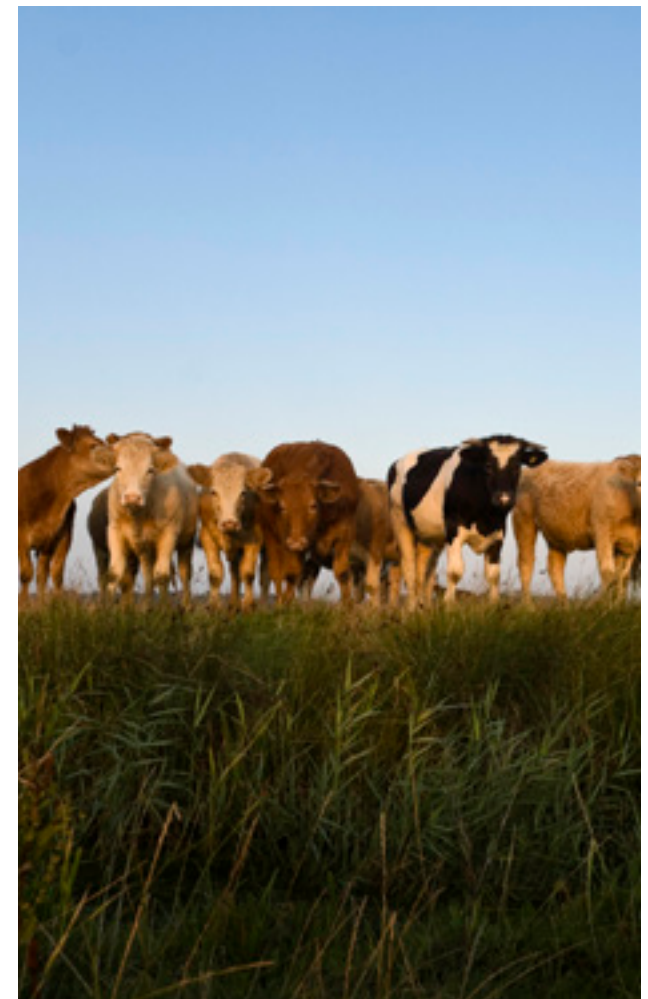
- Climate change and sea level rise and future responses;
- Agricultural economic drivers including changes to farm subsidy systems;
- Decline of traditional grazing marsh practices with increasing numbers of horse grazing and changes to land use such as reversion to arable or grassland as floodplains get wetter;
- Investment in water management infrastructure and increasing costs to maintain dry floodplain;
- Continuing decline of the drainage mill structures and loss of skills and knowledge

relating to their conservation;

- Increasing lack of resources for organisations that help act as landscape custodians;
- Potential impacts on the landscape as a result of highway initiatives on the A47.

▼ *Cows grazing on Halvergate Marsh.*

Photo by Ian Aitkin



5. Fen

The Broads has the largest expanse of species-rich fen in lowland Britain. Approximately 3200 hectares has been identified representing about 11% of the Broads area.

It is a landscape type strongly associated with peat soils and it tends to occupy marginally higher ground than the estuarine marshland. Aerial photographs and ordnance survey maps provide a good indication where this peat fen community with its associated carr woodland can be found.

Historically they are often formed from former wet common or poors allotment land. At some locations the relict medieval dole pattern of subdivision /drainage has been retained. At other locations evidence of attempts to drain the land, usually undertaken through the 19th century, can be found in the form of remnant rectilinear dyke networks. Occasionally the remnants of drainage mills can be found.

Through years of human management, cutting sedge for thatching, taking a hay crop and light grazing, the fens have developed a diverse vegetation mosaic, which is rich in invertebrates and plant species. Fens are strongly dependent on water supply; most are not embanked and many are therefore in direct contact with river water.

► *A Norfolk Naturalist surveying a fenland turf pond at Horning Marsh Farm (Site of Special Scientific Interest)*

Its distinctive landscape characteristics are:

- It is associated with alluvial and peat soils;
- It can contain a mosaic of valuable habitats as a result of human intervention both currently and historically;
- If left unmanaged woodland and scrub will encroach (natural succession);
- It can be remarkably rich in plant species

which supports a range of invertebrate species;

- Many sites were provided common or poor's allotments land around settlement;
- Previous attempts to drain the land can be seen in the remnant dyke network and mill structures;
- Dykes provided boat access for materials and hunting on the fens and reedbeds.



The peat fen areas may contain a mix of broads or former broads and decoy sites, reed and sedge beds, scrub, successional carr woodland and fen meadow. Management regimes or the lack of them can have a significant impact on the appearance of fen areas as natural succession, a process by which plant communities evolve over time, means that those areas that are not managed tend to develop more shrub/scrub and tree growth. In the upper Thurne where the soils are more mixed and saltier waters can be found there are some significant expanses of open fen.

There are four different types of locations where deep peat soils can predominantly be found.

Firstly, the gravity fed meadows of the upper

▼ *The Reed and Sedge harvesting process helps keep trees and scrub from becoming established.*



reaches that are usually characterised by woodland or grazing meadows and under previous development through Norwich. These can occasionally flood at times of high fluvial river flows, but are mainly damp habitats sitting above the current river levels and are restricted in nature due to their position in the river valley and these extend far beyond the Broads in the Bure, Wensum and Waveney valleys.

The undrained fens in the upper and middle reaches of the main valleys in the Broads. Characterised by UK's largest extent of calcareous fen forming extensive landscape of open mixed species fen, scrub, broads and wet woodlands. Examples of these can be found at Wheatfen on the river Yare and Sutton Fen on the river Ant.

The third area of peat lies within pump drained fens, consisting of the side valley tributaries and extensive areas of deep peat grazing marshes with some blocks of woodland. Some of the narrow incised valleys of peat marsh have names like 'Beck', 'Fleet' or 'Run'. They also typically form parish boundaries. These often contain small broads or decoy sites.

The fourth location is narrow fringes around the great estuary, most of which have become carr woodland. These areas lie where the silty clay soils of the estuarine marshland thin and narrow ribbons of peat deposits can be found.

Fen vegetation can be very rich in plants and includes species such as common reed, saw sedge, bottle sedge, hemp agrimony, marsh cinquefoil and milk parsley with characteristic

fen meadow plants black bog rush, blunt flowered rush, marsh thistle, and purple moor grass.

Milk parsley provides the food plant for swallowtail butterfly caterpillars. Adult swallowtails feed on a range of other fen herbs, such as ragged robin and marsh birdsfoot trefoil.

Forces for change include:

- The fortunes of the reed and sedge cutting industry;
- Changes and the development of management techniques;
- Cost of intervention to prevent natural succession;
- Climate change and sea level rise and future responses;
- Agricultural economic drivers including changes to agri-environment support/schemes systems;
- Increasing lack of resources for organisations that help act as landscape custodians;
- Brackish (salty) water intrusion and water quality generally;
- Development pressures for recreational use;
- Increasing land ownership by nature conservation organisations.
- Invasive non native species;
- Water and air quality (eutrophication).

6. Upper river valley marshlands

Upper river valley marshland relates to the upper levels within the Broads Authority executive boundary, the upper parts of the river network extend beyond the Broads Authority area. This type can be found where the soils type, generally silty clay or clay /peat mix, become more assorted. They are often in a transitional zone between the peat soils at the upper end and sides of the valleys within the area and the silty clays of the estuarine marshes. Occasionally the soil mix includes sand and gravels.

Superficially they can exhibit similar characteristics to the estuarine marshes landscape type; however over time these areas have been subjected to subtle land use differences. The two largest areas of this type in the Broads lie in the upper reaches of the River Thurne in the northern Broads and the area of land to the west of Beccles.

Historically these areas have the established land use of grazing. In the River Thurne however a significant proportion of the area has been deep drained and is used for arable production. In the Waveney the predominant use is still grazing.

Where these mixed soils conditions exist on the valley sides they can provide the location for settlement fringe activities as the ground can be very marginally drier than the adjacent marshland encouraging more “domestic” types of use of the areas. Ironically though if clay soils are present they can provide a location for ponds and scrapes as the water will be more



▲ One of the larger areas of this landscape type can be found in the upper reaches of the River Thurne. Deep drainage in this area has led to shrinkage of the peat lowering overall ground levels.

▼ Much of the Waveney Valley to the west of Beccles (within the Broads area) is of this type. Traditionally these areas have tended to be used for grazing.



readily retained.

Its distinctive landscape characteristics are:

- Located in the upper reaches of the rivers within the Broads areas or on the valley sides where soils types are mixed;
- The marshes are divided into “fields” by drainage dykes and ditches. Some areas are deep drained;
- Vegetation patterns are varied;
- Landscape patterns tend to be fragmented;
- Land use predominantly grazing;
- Arable reversion concentrated in some areas;
- Expansive views often to locations outside the Broads area and “Big skies”;
- Some settlement fringe activities.

Forces for change include:

- Climate change and sea level rise and future responses;
- Agricultural economic drivers including changes to agri-environment support/ schemes systems;
- Land shrinkage (Thurne);
- Decline of traditional grazing marsh practices and changes to land use such as revision to arable;
- Fen creation on agricultural land;



▲ *The landscape patterns formed by field sizes, vegetation and colours; tend to be more complex than those of the estuarine marshes. Valley edges are often transitional areas where the mix of soils types found can lead to a more fragmented landscape character and result in different vegetation types.*

- Increasing lack of resources for organisations that act as landscape custodians;



▲ *Where this landscape type type exists in close proximity to settlement and coincides with soils types which are either more readily drained (sandy gravels), or water retentive (clays), pressures for recreational or leisure activities can be significant forces for land use change.*

- Increased pressures for leisure/recreational activities especially on the valley side locations.

7. Broads

Broads, which give the area its name, are in the main only found in the middle to upper reaches of the northern river valleys in the Broads. There are 63 broads covering 841 hectares. Hickling is the largest of the broads and Sotshole is the smallest.

They were originally thought to be natural features but in 1834, from his observations at Barton, Samuel Woodward first suggested the broads were not natural but dug by human hand. It wasn't until research in the 1950s and 60s by Joyce Lambert however, that it was established that these broads were in fact man-made features created as a result of excavation of the peat for fuel.

The majority of the broads surviving today were the result of these peat excavations becoming flooded, but some are the result of flooded sand clay and gravel extraction pits such as the relatively recently excavated Whitlingham Broad.

Its distinctive landscape characteristics are:

- They are bodies of open water of varying size;
- The majority are located within the peat soils of the middle to upper reaches of the river systems and mainly in the northern broads rivers of the Yare, Bure and Ant, and at Thurne, where the Thurne pits are thought

to have been dug for clay (Williamson and Yardy, 2024);

- They can either be isolated water bodies (not navigable) from the main rivers e.g. the Trinity Broad, accessed via a channel linking them to the main river e.g. Malthouse and Wroxham Broad or they actually lie on the line of the main river e.g. Barton;
- Over time vegetation tends to encroach from the edges on many broads reducing their size;
- Some have the tendency to silt up affecting water quality and biodiversity;
- A number have been completely lost over time;
- The wet soils on the margins of those

broads in the peat areas support fen/carr vegetation;

- Their character is greatly influenced by the size of broad and the type of and management regime for the vegetation surrounding the broads;
- The water quality (nutrients/ salinity/ turbidity) of the individual broads can vary significantly influencing the presence and type of water plants;
- Where they are open for navigation, they provide a popular destination for boat traffic providing a sense of activity especially during the height of the tourist season;
- Where they are closed to navigation they can provide tranquil refuges for wildlife;



▲ *Hardley Flood.*

- The majority of broads have little or no visible development fronting the edge of the broad adding to their sense of seclusion.

History of peat broads

Turberies (areas where there is a legal right to cut peat for fuel) are likely to have existed in the 11th century but probably as shallower extractions of surface phragmites peat (peat formed from decomposed reed). Population increases and the use of peat in the salt industry are thought to have led to an increased demand for fuel in the 12th century. Historic records indicate that the industry was immense. In the

1960's it was estimated that approximately 900 million cubic feet of peat was been removed through peat digging. However, this is likely to be an underestimate as the national mapping project (a project to map historic features from aerial photos) established that the extent of broads actually exceeded the available map based evidence at that time.

It is quite likely that the peat excavations were subject to flooding during the second half of the 13th century and the 14th century when there were periods of severe storms and flooding in the North Sea basin, with frequent

records of flooding in Eastern England and Holland. For example, in 1287 the sea broke through between Sea Palling and Horsey on the northeast coast and also in the Yarmouth area, and inundated the marshes and villages, with floods reaching beyond St Benet's Abbey. Peat extraction appeared to be on the decline from the 15th century onwards as a result of the decrease in population and therefore decreased need for fuel and rising sea levels.

Gradually the excavated areas filled with water to be used as fisheries and large scale duck ponds. The term "broad" was not used frequently as a land assessment term until the 14th and 15th century.

Research has found that the peat was often cut to a depth of up to 3-5 metres and that within the areas excavated there were islands and strips of untouched peat. These are called peat baulks. Some of these remain today although many have disappeared as a result of erosion and dredging activities.

The character of the broads

Each broad has its' own individual character. But two landscape characteristics when combined can provide a rough division into two sub types of "open" and "enclosed" broads. These are the size of the broad and the nature of the vegetation which surrounds the broad.



◀ *Hickling Broad, the largest of the lakes in the Broads. Photo by Mike Page.*

“Enclosed” broads such as Ranworth, South Walsham and Cockshoot are characterised by a far greater sense of enclosure as a result of their size combined with the surrounding carr woodland, than those of the “open” broads such as Hickling, Horsey and Martham, which are embanked and reed fringed.

Other factors contributing to their individual character include water quality. Where it is good and the water is clear healthy aquatic communities can be found supporting a greater range of wildlife.

The sense of tranquillity experienced on the broads is influenced by the lack of visible development from the broad, the availability of boat access and other recreational activities that may take place on the water. During the summer months those broads which are navigable can be exceptionally busy with holiday boating traffic. The winter season brings a reduction in human activity but an increase in wildlife activity as many birds travel to the UK and use the broads as winter refuges.

Forces for change include:

- Changes to water quality both positive and negative thereby improving/ reducing biodiversity value;
- Encroachment of carr woodland fringe shading out the water body and reducing its size;
- Recreational and development pressures which can reduce the sense of tranquillity and isolation;

- Invasive non native plant and animal species which can change the natural ecological balance;
- Erosion/management of reed margins;
- Siltation of broads can effect biodiversity value and recreational activities;
- Dredging/mudpumping operations and



▲ A dredging rig and mud wherry on Hickling Broad.

▼ Example of Carr woodlands encroachment.



disposal of sediment for management for navigations and water quality.

8. Carr woodland

Carr woodland is the name given to wet woodland.

The Broads has the most extensive tracts of wet woodland in lowland Britain and covers approximately 5% of the area. They are in the main located on the river flood plains and along smaller streams. Ribbons of carr woodland can be found however, on the valley sides at the outer extents of where the silty clays of the estuarine marsh give way to peat soils.

The biodiversity of these woodlands is of international importance and in the UK wet woodland is identified as a UK Biodiversity Action Plan (UK BAP) priority habitat in order to recognise the great significance of the habitats the woodland supports. Some of the areas have been wooded for over a hundred years, and they were once coppiced for wood products. Other wooded areas are relatively recent having regrown from areas previously cleared.

In the wetter locations the woodland floats on "hover" which is a crust of peat soils under which lie liquid soils. This creates very unstable conditions and trees often fall over making it very unsafe to walk on.

Many of the woodlands are now unmanaged and comprise an almost untouched plant and animal community subject to little disturbance.



▲ *Wet woodland at Decoy Carr.*

► *Barton Broad boardwalk is a great place to see Carr woodland on the edge of Barton Broad.*

Its distinctive landscape characteristics are:

- It is associated with wet, peat soils;
- Much of it is now unmanaged providing undisturbed areas for wildlife;
- The woodland edges provide valuable habitats;
- They provide a sense of enclosure for users of the rivers;
- Located within the narrower valley reaches their presence often provides an important visual buffer of river users to the more developed areas beyond.





▲ Carr woodland fringing the river Bure between Hoveton and Belaugh.

The woodland mosaic includes willow scrub, birch scrub and alder carr woodland, in relatively even-aged stands with oak woodland on higher ground. Alluvial alder woodland is considered of international importance.

The different stand types have an associated

ground flora which includes great tussock sedge, yellow loosestrife and yellow pimpernel. In some places woodland grades subtly into scrub, fen, marginal vegetation and open water.

Alderwoods are particularly noted along the Waveney Valley, which were once coppiced

regularly to supply straight poles to make charcoal for the gunpowder industry. Today alder is re-coppiced in some woodlands providing straight poles for piling, which is used to give a more natural edge to protected banks.

The Carr woodlands are a key landscape feature in the middle to upper sections of the Broads rivers. As well as their importance as a habitat they provide a sense of enclosure, contain views both into and out from the Broads and rivers and help to buffer the visual effects of development on the Broads. They are not always a welcome feature however, as they tend to limit sailing opportunities and the shade they create can be at the expense of some of the more species rich communities that can be found in the Broads.

Forces for change include:

- Climate change and water level rises;
- Disease (Phytophthora) which has seen the loss of significant areas of alder;
- Coppicing which can have temporary visual effects;
- Conservation management involving tree removal to promote other habitats;
- Clearance for sailing purposes;
- Clearance as a result of development and/or land raising.
- Gradual encroachment and clearance due to the intensification of use and domestication of the woodlands, for example at Crabbetts Marsh, Horning.

9. Heathland

Around 1% of the Broads area is heathland or dry acid grassland. It occurs on the higher land and valley sides above wet woodland and fen and reed bed habitat.

Heathland is characterised by the presence of shrubs such as ling heather and European gorse, forming a mosaic with acid grassland and bracken. Acid grassland is characterised by grasses such as sheep's fescue and common bent with sheep's sorrel, heath bedstraw and tormentil. The drier land with gorse and bracken is particularly favoured by adder.

Many of the "upland" areas of the Broads were previously heathland prior to the land being cleared for farming centuries ago, and still contain the soils and conditions suitable for heathland.

▼ *Herringfleet Hills is an area of open access land.*
Photo by Evelyn Simak - geograph.org.uk



Its distinctive landscape characteristics are:

- It is associated with sandy soils so they are free draining;
- They have a distinctive type of vegetation e.g. bracken, gorse birch;
- They are often areas of dry common land;
- They occur in a fragmentary way around the periphery of the Broads system extending into the adjacent districts;
- Some areas have been the subject of recreational development such as golf courses;
- Some areas have been used for plantations.



▲ *Former heathland at Outney Common has been developed in part as a gold course.*
Photo by Evelyn Simak - geograph.org.uk

Forces for change include:

- Pressure for sand and gravel extraction;
- Pressures for recreational or other leisure development, for example golf course extensions or facilities;
- Potential heathland restoration;
- Conifer plantation management.

▼ *The Waveney forest is an area of plantation forest.*
Photo by Evelyn Simak - geograph.org.uk



10. Settled Broads

Although there are a number of isolated farms and cottages that are located in the marsh landscape, the majority of settlement associated with the Broads area lies on the edges of the floodplain. These settlements are normally a mix of holiday/residential properties and commercial and agricultural development. They can be broadly separated into a series of sub groups which are set out in the following text. Many of the developed areas fringing the rivers and marsh areas can be a mix of these sub types.

Generally the location of settlement was dictated by the need to be close to the river systems which used to provide the main links for transporting goods and materials around the area and to places further afield.

Many of the towns and villages have staithe which are areas of land providing access to the river or broad where the loading and unloading of cargo used to take place. The name comes



from the Anglo-Saxon word *stæth*.

Today the staithe tend to be used for recreational purposes although reed and sedge harvests are sometimes still offloaded from boats.

Its distinctive landscape characteristics are:

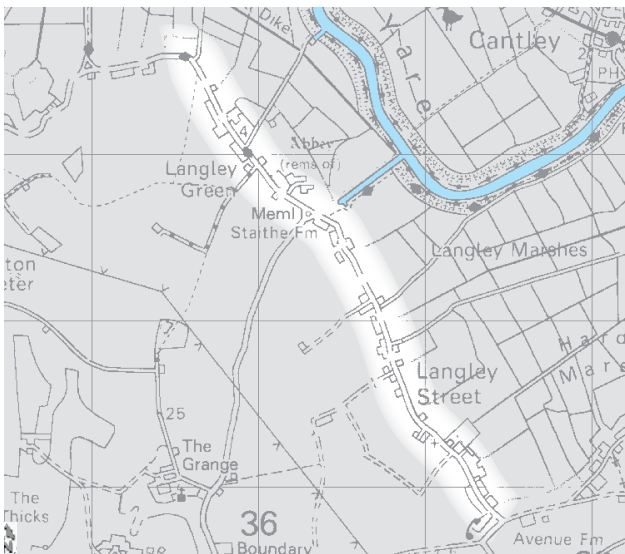
- Traditional building materials for residential properties were originally locally sourced and included Norfolk brick, flint and thatched roofs;
- There is a range of building styles and materials used within the Broads dictated by period of construction and location;
- Buildings constructed after better rail and road connections were established have tended to be constructed from materials from further afield;
- The majority of residential property is located on the slightly higher ground of the

◀ *Langley lies along the northern side of the River Bure.*
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▲ *Horning lies along the northern side of the River Bure.*
Photo by Mike Page.

valley side outside the floodplain;

- Settlements tend to be nucleated (clustered around a river crossing or staithe) or linear in nature following the roads that skirt around the edge of the river valley or the river itself;
- At certain locations, poor ground conditions and the potential of flooding has dictated the need for structures to be piled and the use of lighter weight building materials;
- The interwar popularity of the area for holidays saw the emergence of contrasting scales of development from small chalets to substantial dwellings with large plots;
- The smaller traditional boatyards have declined in number whilst extensive modern boatyards and marinas to accommodate much larger craft have increased in number;
- Many of the settled broad's areas have resulted in the canalising of the river frontages through the use of quay heading.



Settled Broads Subtypes

Linear “Low Road” settlements – which predominately comprise farmsteads and cottages located at the upland edge of the floodplain following the roads that hug the valley. Examples include Langley, Hardley, Rockland, Burgh Castle, Horning and Haddiscoe.

Waterside village settlements – clustered around a communal access point to the river system, broad or at one of the river crossing points. Examples range from the larger settlements of Beccles, Bungay, Wroxham, Hoveton and Reedham, to the smaller ones of Thurne, Belaugh, Geldeston, Bramerton, Irstead and West Somerton.

Areas of substantial dwellings with large plots.

Examples of these types can be found at Lime Kiln Dyke Barton Turf /Neatishead and at Beech Road at Wroxham/Hoveton. These dwellings have been built on the dryer land often with well wooded gardens extending down to the river. They often have their own moorings and boat-houses.

Individual holiday chalets/houses – many of these established during the interwar period and range in scale of the building and size of the plot. The properties can lie in vulnerable locations undefended by a flood bank but have been designed to cope with flood incidents. Many are built on piles because of the poor ground conditions. This is a technique which allows them to be elevated above likely flood levels. The smaller chalets are occasionally “jacked up” to counter subsidence.



▲ River crossing points are few and far between in the Broads. Where they exist settlements have developed. The bridge at Wroxham links the settlement to Hoveton lying on the north bank of the River Bure. Photo by Stacey Harris – geograph.org.uk



▲ Stokesby on the River Bure, one of two locations where most if not all of the settlement is within the Broads. Photo by Mike Page.

No new properties can be developed in these areas, but applications are made for redevelopment, with the general trend being to increase the size of the property. Examples of larger properties can be found on the River Bure at new Hoveton/Wroxham, and Crabbett’s Marsh, Horning.



▲ Geldeston is situated on the side of the Waveney valley and connected to the main river by a navigable dyke. Photo by Mike Page.



▲ *Contrasting house styles and sizes can be seen in the same location. When plots are redeveloped there is a tendency to increase the size of the property with the potential to impact on the opportunity to incorporate or retain trees within the gardens. The presence of trees helps to “soften” the hard lines and scale of the buildings.*

More modest properties can be found on the River Thurne at Potter Heigham / Repps and the River Yare at Brundall and on the River Waveney at St Olaves and Burgh Castle.



▲ *The riverside chalets at Potter Heigham/Repps and Brundall tend to be more modest in size.*

Small Boatyards and associated mooring facilities – small traditional boatyards still exist often building and maintaining the smaller sailing vessels. Traditionally the workshops tended to be of

▼ *Traditional wooden sailing crafts require smaller buildings for storage and maintenance.*



▲ *The modern motor cruiser is now much larger bringing about development pressures to build larger buildings to house waterside boat operations.*
Photo by Evelyn Simak – geograph.org.uk

timber construction and many have a wet dock inside the building. Examples of smaller types of boatyards can be found at Sutton, Somerleyton, Womack Staithe and Ludham Bridge.

Extensive modern Boatyard/marina developments

– much like the modern car, boats (motor cruisers in particular) have tended to increase in size as holiday makers have come to desire all the mod cons of home living on a boat. Larger boats have led to an increase in the size of facilities needed to service crafts. There has also been an increase in private boat ownership and with it a pressure for additional boat moorings.

The boat building industry is less reliant on waterside locations due to advancements in transportation methods, but extensive modern boatyards remain at Brundall, St Olaves, Wroxham, Horning, Stalham and Burgh Castle.

Modern land based holiday and leisure areas

The Broads is a popular tourist and recreational area which has resulted in the development of a range of commercial developments to accommodate the local population and visitors alike. The larger camping and caravan sites and mobile home parks can be found in the main around the periphery of the Broads on the higher ground of the valley sides where the soils are freer draining. Examples can be found around Burgh Castle, Fleggburgh St Margaret and Burgh St Peter. Golf courses have become established on the sandier heathland areas that exist on the periphery of the area within the Waveney valley. Bewilderwood, an adventure playground, has made use of existing woodland areas on the Bure.

▼ *The hard quay headed frontage in Norwich and riverside buildings were once commercial, today many of them have been converted into residential. Modern infill development is also residential.*



Designed landscape and ornamental gardens

A number of these exist around the Broads area and each has a different character. Crown Point Park, Hoveton House, Brundall Gardens, Fairhaven Gardens and How Hill are all gardens which were or still are associated with large properties. The unusual one in the mix is garden of Long Gores at Hickling which contains an island created in the shape of a double headed eagle by ecologist and botanical artist Marietta Pallis who bought the property in the 1930's.

Major towns or cities

The main rivers of the Broads flow through Norwich, Great Yarmouth and Lowestoft (Oulton Broad). Great Yarmouth still has a port function especially in relation to offshore industry. Norwich and Lowestoft

(Oulton Broad) are now home to holiday boat traffic. The warehouses and buildings that serviced the river trade are gradually disappearing or are being converted or redeveloped for mainly residential purposes.

Forces for change include:

- Effects of climate change and water level rises affecting finished floor levels (overall height of development and plot levels) and access provision;
- Loss of traditional settlement patterns due to continuing pressures for both commercial and residential property;

- Larger residential landholdings being subdivided potentially leading to pressures on mature vegetation;
- The increase size and numbers of boatyard and marina development which has the potential to encroach on the natural/ semi natural environment;
- Settlement expansion and the increased recreational pressures it causes;
- Increased numbers of boat owners who require mooring either in marinas or adjacent to properties;
- Economic pressures for land use change from business purposes e.g. small boatyards to higher value residential/holiday accommodation;
- Re-development of the smaller leisure plots and their chalets to be replaced by larger properties;
- Loss of buffering vegetation between properties or plots;
- The design of buildings and use of building and quay heading materials which have an incongruous effect on the local setting;
- Expansion of leisure facilities presents opportunities for enhancement which need to be balanced with adverse effects.

11. Settlement Fringe

This landscape type represents those areas of land found repeatedly throughout the Broads where development pressures of all types and semi natural/natural environment converge. Invariably at these locations pressures for land use other than for traditional agricultural exist. Many of these are generated as a result of activities associated with increased recreational and leisure time. The types of land use pressures are varied and include garden extensions with their associated fencing and features; allotments, poultry keeping, horse keeping, sports pitches, pond construction (fishing and wildfowling) and storage of scrap items etc.

Additionally the proximity of a settlement can influence the presence and extent of strategic infrastructure such as the poles and cables for telecoms and electricity supply.

The land which is subject to these types of development pressure will generally have the basic underlying characteristics of the prevailing landscape type within the locality but invariably if used for such activities can become heavily modified through the annexation; subdivision; change of use; introduction of ancillary buildings and structures which meet the needs of the activity.

Its distinctive landscape characteristics are:

- The basic underlying landscape characteristics are the same as the prevailing landscape type within the character area i.e.



▲ *Phone and electricity poles and cables can create visual clutter.*

- estuarine marshland/heathland etc.;
- The basic landscape characteristics associated with the existing natural/semi natural environment have been compromised;
- They are always located in close proximity to existing settlement;
- The landscape has been modified in some way to accommodate the intended use;
- Features may have been added that look out of character with the semi natural environment of the Broads;

- The activities may have the potential to impact on the soils, vegetation, water quality and tranquillity of an area.

The changes on the areas of land which are subject to these activities can both individually, (depending on their scale and nature) and cumulatively (if it is following a trend in an area), have an effect on the landscape character of an area, through changes to the traditional land use and land cover.



▲ Quay headed frontages installed in the countryside can impact on wildlife habitat by creating an unnatural bank edge.

Many activities and land use changes will require planning approval. As part of that process, consideration to their likely effects (both positive and negative) on the landscape character of an area will be one of the many aspects that the planning authority will need to consider.

However, there are many areas in the Broads where traditional landscape features and elements are being eroded as a result of unauthorised and unsympathetic development or by activities that do not require specific permissions.

Different activities have the potential to affect landscape in different ways. They may cause direct impacts on both the landscape (soils, water, vegetation etc.) and/or the perceptual qualities of an area including views. Overall the effects may be so great that they may have the effect of urbanising the semi natural/natural environment.

What follows are some examples of landscape issues which may have an adverse impact on the

local landscape character.

Excavations for ponds for wildfowling /fishing etc.

- The shape, depth and profile of the excavations can look unnatural;
- Pond edges not designed to support

▼ Different fencing styles, storage containers, summer houses and types of planting can together start to urbanise a location lying within the countryside.



marginal plant species;

- Material dug out is not disposed of in an appropriate manner;
- Peat, (which is a valuable landscape resource) is excavated;
- Ancillary structures introduced to support the activity look out of character;
- Inappropriate planting.

Garden extensions:

- Inappropriate ornamental planting introduced into a semi natural/natural environment;
- Layout, the materials used and manicured appearance can look out of character;
- Garden buildings, fencing and features can look out of character;
- Loss of natural/semi natural habitat.

Horse keeping:

- Loss of natural/ semi natural habitat from changing to grazing management and construction of ménages;
- Introduction of fencing can look cluttered and out of character;
- Water quality – storage of used bedding materials adjacent to waterways;
- Buildings for storage of feedstuffs and equipment;
- Stabling blocks;
- Lighting.

Forces for change include:

- An increase in housing development in close proximity to the Broads area and therefore recreational / leisure pressures generated on agricultural land;
- An increase in horse ownership;

- Land values which may dictate the economic viability of land use;
- Increasing popularity for coarse fishing leading to more excavations for ponds;
- Wildfowling increasing the number of pond excavations;
- Projects to underground overhead electricity cables.



▲ *Animal keeping/smallholdings on the edges of settlements can create piecemeal development.*



▲ *Ménage under construction – An increase in horse ownership has led to agricultural (often grazing marsh) land being developed to provide stabling and exercise facilities.*

◀ *Horse grazing requirements can lead to additional fencing and shelter requirements.*

12. Industrial and post industrial

Industrial and post-industrial – disturbed or made up ground type, relates to more recent disturbance through landfill, commercial, quarrying and dredging operations. Most of these areas of disturbed ground which fall within this category lie on the outer edges of the Broads area at locations where mineral deposits are located close to the surface and/or close to the larger areas of settlement.

Its distinctive landscape characteristics are:

- The soils and sub strata could have been significantly disturbed;

▼ *Sections of the River Ant have seen the setback of the floodbanks so providing sites for material dredged from the river.*

- Ground levels could have been altered;
- Some are still in a state of change;
- Some areas have been restored or reclaimed;
- Most sites within this type, other than dredging sites, lie on the river valley sides;
- Some of the commercial operations within this type require ancillary buildings and plant.

The exception to this are those areas which are being or have been used for dredging disposal sites. The Broads Authority undertakes the majority of dredging operations in the area as they have a responsibility to maintain the main rivers within the executive boundary for navigation purposes. There is one large disposal site at Postwick, but most material is disposed

of in areas within relatively close proximity to where it is dredged from. These dredging operations are completed in a relatively short timescale, are small in area and are transitory in nature. For the purposes of the landscape character assessment process they have been included as part of the river, ronds and floodbanks types but require some elaboration in this type because of the nature of the land disturbance involved.

In 2001 a major contract was awarded by the Environment Agency to undertake works to strengthen the existing floodbanks resulting in perhaps the greatest amount of landscape change for centuries to certain areas in the Broads. The Broadland Flood Alleviation project (BFAP) provided opportunities for new dredging disposal sites throughout the Broads. In certain areas the flood defences were re-aligned or “setback” (up to 30m) behind the existing bank via the construction of a new floodbank in the adjacent grazing marshes. This technique results in a substantial increase in rond width (the vegetated area between the flood embankment and the river).

Once the integrity of the new floodbank is established, the dilapidated erosion protection materials along the river front (usually sheet metal piles) are removed, and the old bank is re-profiled to a low level earth platform just above the height of mean (average) high tide. The area in front of the new bank (a lagoon) is ideally suited to receive river dredgings. Once dredging disposal has ceased, emergent vegetation (usually dominated by reed), quickly colonises



the shallow aquatic margins and expands across the area where dredged silt has been placed, to produce a mosaic of reedbed and tidally controlled open water habitats.

All extraction operations for gravel and sand have now ceased within the Broads. The last of these were at Whitlingham/Thorpe Marshes, near Norwich and at Earsham on the River Waveney. Each of these operations have resulted in large expanses of water (new broads) which are now used for recreational purposes but through gradual re-colonisation by plants and animals they will add to the diversity of habitats in the Broads.

Cantley Sugar factory is the largest commercial operation within the Broads area. The sugar beet industry as we know it today began in the 1900's and resulted in the construction of the factory being built in 1912 at Cantley. The scale of the current operational areas is



▲ *Emergent vegetation expands across the shallow aquatic margins of the setback lagoon following disposal of dredged material from the river by the Broadland Authority on the River Ant.*

▼ *Cantley sugar factory was established in 1912 now covering around 200 hectares, the buildings tanks, lagoons and other elements are the most significant commercial operation in the Broads. Photo by Mike Page*



significant with vast buildings, storage tanks, plant, lagoons and stockpiles extending to around 200 hectares. The processing "campaign" begins in the autumn when the sugar beet is lifted from the fields. Today the operation also involves reclaiming and recycling the soil and the stone that come in with the beet loads as well as the "waste" energy generated by parts of the operation. The steam plumes which come from the tall chimneys during the winter period can be seen for kilometres.

Closer to settlement, land uses include water treatment works e.g. Ormsby and landfill sites e.g. Cary's Meadow at Thorpe St Andrew. The former covers a relatively extensive area incorporating lagoons, bunds and treatment plants some of which are prominent features in

▼ *The Little and Great Broads at Whitlingham, are significant landscape features within the character area within which they are located lying at the heart of the country park which is a popular recreational area lying on the outskirts of Norwich. Photo by Evelyn Simak - geograph.org.uk*



the area. The latter, the site at Cary's Meadow, you would be hard pressed to know of its past use as a dumping ground for building materials subsequently covered by a thin layer of topsoil. An area of around 9 hectares have been managed for many years for nature conservation, the resulting mix of grassland habitats now supporting such a variety of plants it has been designated a Local Nature Reserve.

On a smaller scale the construction of new mooring basins or dykes also requires large amounts of materials to be excavated and disposed of. These tend to be on a smaller scale compared to other land uses but depending on their location have the potential to affect the local landscape character and can also impact peat where it is present. The Broads Authority have adopted a guide to addressing the impact of new development on peat soils, the guide



▲ Ormsby Water works is located next to settlement and the Trinity Broads which act as drinking water reservoirs.
Photo by Mike Page

recognises the role of peat as an ecosystem service, as a carbon store, habitat supporter and its role in water management.

Forces for change include:

- Increased controls and limitations over commercial operations within a nationally designated landscape;
- Increasing pressures on those areas now used for recreational and leisure purposes;
- Increasing pressure for mooring facilities;
- The future of the sugar industry, beet supplies, transport requirements, agricultural sector;
- Water demand and supply;
- Water quality including sediment management initiatives.



◀ Cary's meadow is a former tip site and is now managed for nature conservation purposes and has relatively recently been designated as a Local Nature Reserve.

13. Uplands

This landscape type refers to “upland” only in the relative sense of the ground level differences between much of the Broads floodplain area (normally around 0 OD or less) and the valley sides and ridge lines ranging from around 1– 40 metres OD.

Its distinctive landscape characteristics are:

- The ground levels are at a higher level (OD) than other types;
- They are often potentially rich areas for archaeology;
- Soils tend to be different to the adjacent areas;
- They are often in arable use;
- They do not exhibit the same types of drainage networks associated with wetland areas;
- Vegetation types reflect the drier conditions and the different soil types.

This type can be split into two; their linking characteristic is that they do not tend to exhibit the general characteristics found in the wetter landscapes. The areas typically have brown soils and they are usually in arable use. They have sometimes been included within the Broads Authority’s area where the executive area boundary has for example followed a road or railway. However, despite not exhibiting those wetland characteristics associated with the Broads, they are still subject to the same protection afforded to the rest of the area.



Valley sides

The first sub type includes those areas which form the gently sloping land from near to the valley floor to the valley crest. The landscape characteristics tend to be more in keeping with those areas of land which often lie outside the Broads Authority's executive area. For this reason certain parts of the Broads area are more naturally associated with those areas which have been described in the adjacent Local Authority's own landscape character assessment.



▲ Sutton's Farm (Valley sides), Aldeby.
Image by Evelyn Simak - Geograph.org.uk



▲ The Close (Valley sides), Barsham.
Image by Evelyn Simak - Geograph.org.uk

Islands or Holmes

The second sub type are slightly higher areas of ground within a low-lying situation. They have been formed by glacial deposits which are of a different soils/geology. Isolated farmsteads (or former sites) are often associated with them.

Forces for change include:

- The natural functioning of rivers may impact on the setting of the Islands or Holmes;
- Changes to agricultural funding could slow or limit positive management of land - such as reverting arable land to more habitat rich grassland;
- Certain areas provide valuable sand/gravel extraction opportunities;
- There are significant development pressures from settlement of different types within upland areas which may have implications for the "setting" and skylines of the Broads area.



▲ Heigham Holmes.
Image by Evelyn Simak - Geograph.org.uk



▲ (Island)Thunder Hill, Martham.
Image by Evelyn Simak - Geograph.org.uk



▲ Cow Holm. Image by Evelyn Simak - Geograph.org.uk



▲ Somerton Holmes.
Image by Evelyn Simak - Geograph.org.uk