GeoEssex

Promoting the geology and landscape of Essex

Rochford District Council
Report on Local Geological Sites

Prepared for Rochford Council by

Gerald Lucy FGS GeoEssex

Ros Mercer BSc. GeoEssex

with the assistance of:

John More EWT

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Cover photographs:
Above: Barling Gravel Pit in 1973.
Below: Alluvial loam and 'brickearth' overlying Rochford Gravel seen in the disused pit at Doggetts in 1973. *Photos © British Geological Survey*

1. Introduction

The rocks beneath the Essex landscape are a record of the county's prehistory. They provide evidence for ancient volcanoes, deserts, glaciers and deep seas. Some rocks also contain remarkable fossils, from subtropical sharks and crocodiles to Ice Age hippos and mammoths. The geology of Essex is a story that stretches back over 100 million years.

GeoEssex

GeoEssex is the primary source of information about the geology and physical landscape of Essex. The GeoEssex team, or 'Steering Group', consists of professional and amateur geologists, representatives from local authorities, geological and natural history societies, and from Natural England, the Government's nature conservation body.

GeoEssex promotes geology in all its aspects, from quarries, cliffs and boulders to spas, springs and building stones. The fascinating and often magical world of geology is all around us, if only we know where to look.

A primary task of GeoEssex is to identify the best places in Essex to find out about the Earth's distant past and the landscape processes going on today. These sites are called Local Geological Sites, or LoGS (formerly called Regionally Important Geological Sites or RIGS).

GeoEssex aims to advocate and represent geodiversity in planning processes and other initiatives.

Spectacular chalk cliff at Chafford Gorges Nature Park, Thurrock. The cliff represents a section through an ancient sea floor that existed across England about 80 million years ago.

The Chalk is present beneath the whole of Essex, appearing at the surface only in the north and south of the county.

Geodiversity

What is geodiversity and why is it important?

Geodiversity is an integral part of the natural environment. It is the variety of rocks, fossils, minerals, landforms and soil, and all the natural processes that shape the landscape.

The only record of the history of our planet lies in the rocks beneath our feet. Here, and only here, can we trace the cycles of change that have shaped the Earth in the past, and that will continue to do so in the future. This is particularly true in Essex, where the record of climate change during the Ice Age is preserved in our quarries and coastal cliffs. The record is unique and much of it is surprisingly fragile.

Apart from the obvious benefits of providing mineral resources such as sand, gravel, chalk and clay, the diversity of the geology is what shapes the landscape, influencing soils, and in turn influencing all of our habitats and species. Geodiversity also has a cultural role to play, influencing the character of our built environment through building stones, providing inspiration to art, and helping to define where we live and our 'sense of place'. It is the link between geology, landscape, nature and people.

Local and national Geodiversity Action Plans

The UK Geodiversity Action Plan (UKGAP) sets out a shared framework for geodiversity action across the UK. It establishes a common aim, themes and targets which link national, regional and local activities. It encompasses how geodiversity can inspire people and what needs to happen to conserve Britain's geodiversity. The Plan for Essex has been drawn up within this framework.

A Local Geodiversity Action Plan (LGAP) has been produced for Essex. It sets out a framework for geodiversity action in Essex. It is an essential document to conserve the County's geodiversity.

The Essex Local Geodiversity Action Plan aims to:

- *Identify, conserve and enhance the best sites that represent the geological history of an area in a scientific, educational, recreational and cultural setting.*
- *Promote geological sites and make geoconservation relevant to people.*
- *Provide a local geodiversity audit (an audit of sites and skills).*
- *Influence local planning policy.*

2. The Geology of Essex

Compared to most other parts of Britain the rocks of Essex and adjoining counties are young in geological terms. Even the oldest surface rock in Essex (the Chalk) is only about 80 million years old. Much older rocks are, however, present at depth. We have some idea about these ancient rocks because of the records of boreholes that have been sunk in search of coal and oil.

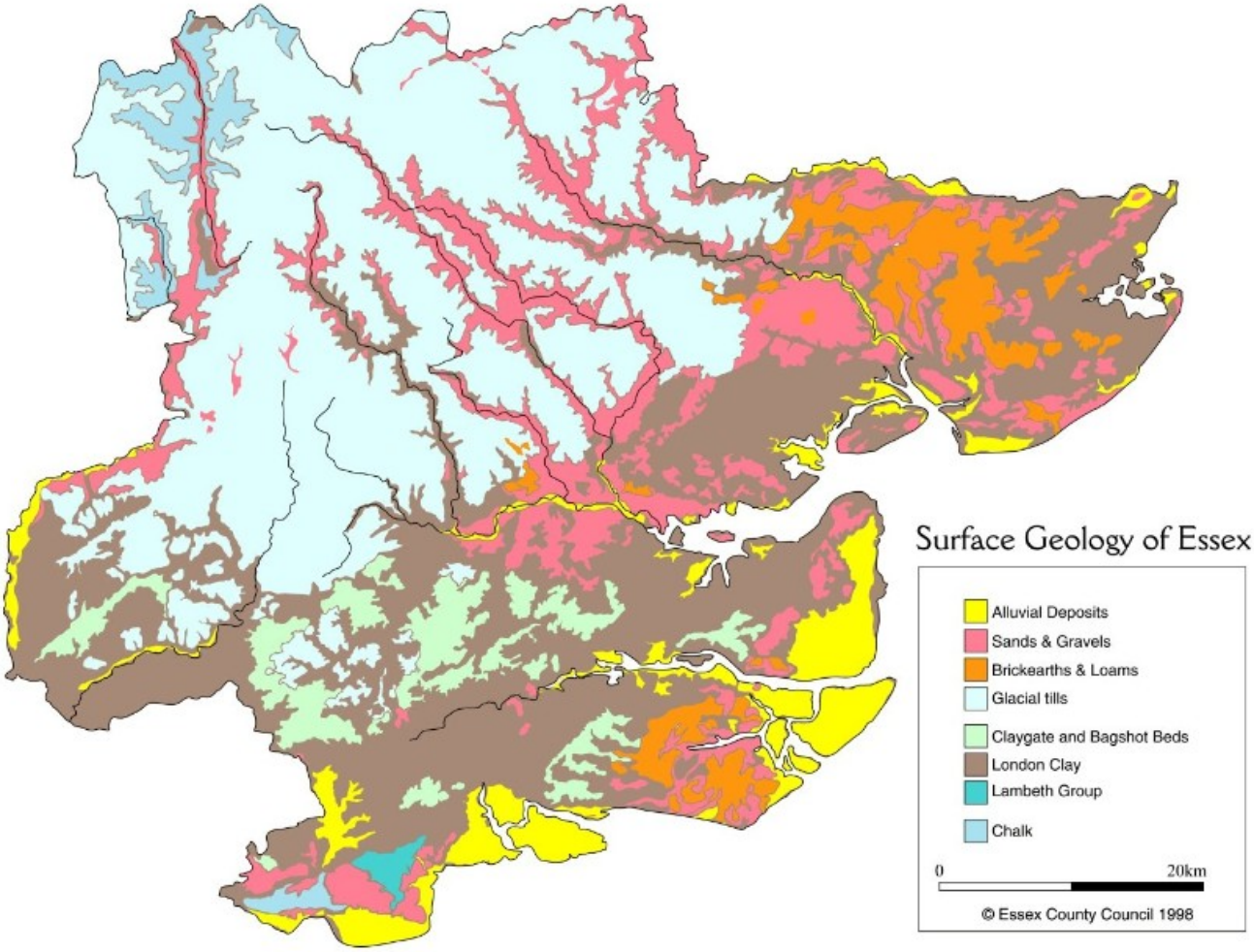
The surface rocks of Essex that were formed before the Ice Age (from the Chalk to the Red Crag) are described as the 'bedrock' or 'solid' geology. Much of this bedrock geology is concealed beneath the deposits left behind by glaciers and rivers during the Ice Age. The material laid down during the Ice Age is known as 'Superficial' or 'drift' deposits.

Era	Period or Epoch		Approx. age in millions of years	Geological formations in Essex
Caenozoic	Quaternary Ice Age	Holocene	0.01	Recent peat and alluvium
		Pleistocene	0.45	River terrace deposits and brickearth (loess)
				Boulder clay (till) and glacial gravel
			1	Kesgrave (Thames) sands and gravels
				Norwich Crag (Chillesford Sand)
			2.4	Red Crag
	Pliocene		10	*No evidence of rocks of this age in Essex but derived Miocene and Pliocene fossils are found in the Red Crag*
	Miocene			
	Oligocene		20	
	Eocene		50	Bagshot Sand
				Claygate Beds
				London Clay (includes the Harwich Formation)
	Palaeocene		55	Lambeth Group (Woolwich and Reading Beds)
				Thanet Sand
Mesozoic	Cretaceous		80	Chalk
			100	Gault and Upper Greensand (Beneath Essex)
	Jurassic		150	*No evidence of rocks of these ages beneath Essex with the exception of Jurassic Oxford Clay in a graben (a sunken part of the crust bordered by faults) beneath East Tilbury.*
	Triassic		220	
Palaeozoic	Permian		250	
	Carboniferous		300	
	Devonian		400	Shales and mudstones dating from these periods occur at depth (about 300 meters) beneath Essex
	Silurian		420	
	Ordovician		450	*No evidence beneath Essex, however, boreholes have not been drilled deep enough to confirm.*
	Cambrian		500	
Pre-Cambrian	Precambrian		Age of Earth 4,600	

Geological Map of Essex

Geological map of Essex showing all the rocks exposed at the surface - bedrock and superficial deposits. An example of a superficial deposit is boulder clay or glacial till left behind by the Anglian Ice Sheet during the Ice Age (shown in pale blue).

Map based on published maps with the permission of the British Geological Survey



Essex through geological time

It is difficult to know where to begin with our geological story but the earliest evidence we have is the hard rocks deep beneath Essex that were formed some 400 million years ago in the Silurian and Devonian periods (part of the Palaeozoic era) and form what is known as the 'Palaeozoic basement' of Essex.

Deserts to Dinosaurs

- For a very long time (and before the age of the dinosaurs) these hard Silurian and Devonian rocks formed the surface of the land that was eventually to become Essex. During the Permian and Triassic periods Essex was a desert upland in the middle of a vast continent known as Pangea.
- By 200 million years ago, at the start of the Jurassic period, tropical seas had spread around this land forming a dinosaur-infested, forested island.

Buried Island

- If you could dig down 1000 feet (300 metres) under Essex you would reach the hard rocks of that dinosaur island.
- All trace of forests and animals from this time have been swept away from the eroded surface of the island, so there are no dinosaur fossils in Essex.
- By 100 million years ago, in the Cretaceous period, the sea flooded across the island to spread **Gault** Clay and **Greensand**. The sea then deepened to deposit hundreds of metres of soft white limestone known as **Chalk** all over the island as well as much of what is now Britain.

Pebbles and Clay

- The North Atlantic Ocean, which did not previously exist, began to open out to the west, the land of Essex lifted, chalk hills were worn down and flints were eroded out. Billions of these flints were tumbled on beaches to form layers of sand and beautifully-rounded pebbles across our area.
- Around 50 million years ago, in the Eocene period, a deep sea fed by muddy rivers spread across what is now Essex and London depositing a great thickness of clay known as **London Clay** on the sea floor, together with the remains of many plants such as palms and cinnamon, and animals including birds, sharks, turtles, and tiny horses. Atlantic volcanoes poured their ash into this sea.

The Alps and the Thames

- Colliding continents pushed up the Alpine mountain chain, bending the crust to form the vale of the Thames river system through mid Essex. About 2.4 million years ago offshore sandbanks formed red shelly sandstone layers across north Essex known as the **Red Crag**.
- Global cooling led to the present Ice Age, with many warm periods such as the one we are in right now. As the sea retreated, the ancestral River Thames spread a succession of flint-rich river gravels across the middle of Essex, through Harlow, Chelmsford and Colchester, and out across the area where the North Sea is now.

Ice and people cover Essex

- During an exceptionally cold stage 450,000 years ago a gigantic ice sheet covered most of Britain and Essex as far south as Hornchurch. The moving ice diverted the Thames towards its present-day course and dumped its load of boulder clay, or till, on top of these old Thames gravels.
- During the past million years of the Ice Age, there have been numerous cold and warm stages and humans have migrated to and from Essex, together with the animals they have hunted. They have left thousands of flint tools and tool-making debris on the banks of the ever-changing Thames and its tributaries.

3. Background to Geological Site designation in Rochford

What is special about Essex Geodiversity?

Essex is an area of predominantly subdued relief with gentle slopes, the result of its underlying geology of soft, relatively young rocks. These generally yield fertile soils. The result is an attractive 'lived in' landscape dominated by arable agriculture, but still retaining forested and heathland areas, particularly where gravels and sands, many of glacial and fluvial origin, have yielded poorer soils.

Although lacking the more dramatic geology and landforms of many 'hard rock' areas, Essex geology and geomorphology is still of great interest, possessing abundant evidence of the huge environmental and biodiversity changes that our area has witnessed over the last 100 million years. Among the key themes are dramatic and sometimes long-lasting changes in the distribution of land and sea, major shifts in climate, and mass species extinctions. Many of these phenomena are of great relevance today, and so an understanding of our past is essential in interpreting the challenges to come.

A mammoth tooth from Essex

Geodiversity's influence on Essex's development

Essex's geodiversity has exerted a major influence on land use, agriculture and landscape:

The distribution of less fertile ancient river and glacial gravels has been a major influence on historical land use, resulting in the preservation through to the present day of extensive tracts of woodland and to a lesser extent heathland, in a predominantly arable county. These are of great significance both for biodiversity and recreation.

London Clay outcrops south of Chelmsford, providing fertile soils for arable agriculture, especially wheat. The chalky till found in north and west of Chelmsford is also highly suitable for cereal cultivation.

In earlier times rivers penetrating deep inland, together with proximity to the Continent, provided a succession of invaders and colonisers – from Palaeolithic peoples, through to Roman, Viking and Saxon - with easy access.

The deposits of the ancestral Thames and its tributaries have provided Essex with a source of gravel and sand for construction since Roman times. A special kind of gravel naturally cemented by iron called ferricrete was used extensively as a building stone and is found in many medieval churches.

The geology of Rochford district

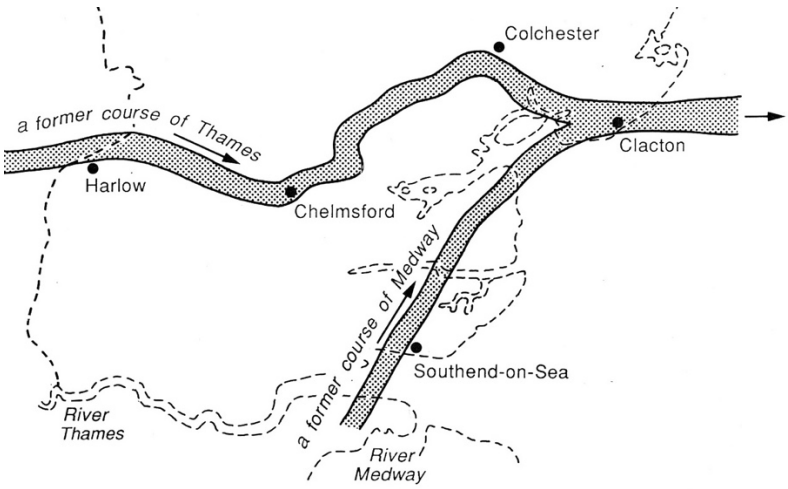
The bedrock geology of the district is London Clay, laid down on the floor of a subtropical sea in the Eocene period some 50 million years ago. The Claygate Beds occur above the London Clay and represent a period of geological time when the London Clay Sea was becoming shallower and the clay was becoming increasingly sandy as the shoreline came closer. This culminated in deposition of the Bagshot Sand as the sea became very shallow. Following extensive erosion during the Ice Age, the Claygate Beds and overlying Bagshot Sand are now only exposed on the high ground such as the Rayleigh Hills. These hills are capped by a complex series of gravels laid down at various times by rivers during the Ice Age.

The Rayleigh Hills

Research has shown that the River Medway in Kent is a very ancient river and before the diversion of the Thames to its present course the Medway flowed across eastern Essex to join the Thames in what is now north Essex or Suffolk. The route of this river has left behind evidence of its existence as layers and patches of gravel between Hadleigh and Bradwell-on-Sea. The higher the altitude of this gravel the older it is, and the highest of this gravel (known as Daws Heath Gravel and Claydons Gravel) is on the Rayleigh Hills between Hadleigh and Hockley which, in places, is over 80 metres (240 feet) above sea level.

It is difficult to believe that this gravel, which caps some of the highest ground in south Essex, was originally the floor of an ancient river valley. However, this must have been the situation over 700,000 years ago in the middle of the Ice Age. Like the gravel on the summit of the Langdon Hills (which was deposited by another northward-flowing tributary of the ancient Thames), the Rayleigh Hills gravel contains distinctive pebbles of chert from the Lower Greensand of The Weald, together with other rock types that could only have been deposited by a river flowing from the south. It also contains boulders of sarsen stone which must also have originated in Kent.

The existence of this high level river gravel may even have contributed to the creation of the Rayleigh Hills by protecting the Bagshot Sands and Claygate Beds from erosion while the surrounding areas were slowly reduced to the present lowland. It is a vivid reminder of the immense erosion that has taken place during the ice age and how the land surface can be considerably reshaped in relatively short periods of geological time.



Former courses of the Thames and the Medway before the arrival of the Anglian ice sheet in Essex. The ice sheet diverted the Thames to its present course and a combined 'Thames-Medway' river then flowed northeast along the former course of the Medway.

Gravels laid down by the Medway and the Thames-Medway rivers are found in Rochford district and enable geologists to build up a surprisingly accurate picture of the Essex landscape during the Ice Age.

Geodiversity and National Planning Policy

The importance of geodiversity as an integral part of nature conservation and the planning system is reflected in The National Planning Policy Framework (NPPF), and in legislation – Wildlife & Countryside Act 1981 and Countryside and Rights of Way Act 2000.

The NPPF states that:

(1) "the planning system should contribute to and enhance the natural and local environment by protecting and enhancing valued landscapes, geological conservation interests and soils" (Paragraph 109);

(2) "local planning authorities should set criteria based policies against which proposals for any development on or affecting protected wildlife or geodiversity sites or landscape areas will be judged" (Paragraph 113); and

(3) "to minimise impacts on biodiversity and geodiversity, planning policies should aim to prevent harm to geological conservation interests" (Paragraph 117).

Site designations

The most important geodiversity sites have been declared as **Sites of Special Scientific Interest** (SSSIs) which are statutorily protected for their scientific importance (see below for a list of the geological SSSIs in the Rochford district).

The next tier of geodiversity sites are known as **Local Geological Sites** (LoGS) These have replaced the earlier 'Regionally Important Geological Sites' (RIGS) terminology in line with government guidance.

Local Geological Sites (LoGS) are broadly equivalent to Local Wildlife (species and habitats) Sites ('LoWS') but have a broader remit as they can be designated for their scientific, educational, historical and recreational benefits. Typical Essex LoGS include quarries, pits, walls, boulders, cliffs, springs, and river meanders. Local Wildlife Sites and Local Geological Sites are both designed to provide a system of locally-valued, non-statutory sites.

Most importantly, the NPPF gives Local Geological Sites a weighting equal to Local Wildlife Sites, and both are collectively referred to as 'Local Sites'. However, in actuality the attention and priority afforded to the designation and management of LoGS has historically lagged, and continues to lag well behind that of LoWS.

A photograph of the bed of the River Crouch at Hullbridge taken before the First World War

Photo © Essex Field Club

4. Objectives of current report

Supporting Local Planning Authorities

"Local and neighbourhood plans and planning decisions have the potential to affect biodiversity or geodiversity outside as well as inside designated areas of importance for biodiversity or geodiversity" (extract from: www.gov.uk/guidance/natural-environment)

Biodiversity protection is familiar to planning authorities but geodiversity less so. This report will assist planning authorities in meeting their obligations under the National Policy Planning Framework and helping them identify potential development impacts on LoGS.

GeoEssex is therefore seeking to help Local Planning Authorities fulfil their responsibilities with respect to geodiversity.

Further guidance on statutory obligations is given in Circular 06/2005 (*Biodiversity and Geological Conservation*). Geodiversity should be therefore included alongside biodiversity in local authorities' Local Plans. Identifying these non-statutory sites therefore helps local authorities to meet their obligations.

LoGS can also contribute to *sustainability* programmes by providing information about a key element of the environment that contributes to our natural heritage. In addition, the *awareness raising* and *education* function fits well with the principle of community involvement and enabling people to regain their sense of place.

A fine cliff of cross-bedded Bagshot Sand in a disused brickworks pit on Hambro Hill near Rayleigh in 1973 (at TQ 8132 9191). It was infilled in the 1980s.

Local sites like these are valuable for research and education but they can easily be obscured or destroyed.

Photo © British Geological Survey

5. Site selection

Site selection and notification to planning authorities

LoGS in Essex are identified by **GeoEssex**, a largely voluntary group composed of representatives from the major Essex geological and conservation bodies and supported by Essex Wildlife Trust, Natural England and Essex County Council (Place Services). The site selection process is based on clearly defined criteria (see below) and includes scientific, educational, historical and aesthetic values. When selecting sites GeoEssex aims to gain the support of landowners whenever possible. The majority of LoGS are on private land and site selection does not infer any right of access.

Like LoWS, proposed LoGS are presented to the Local Sites Partnership (chaired by Essex Wildlife Trust) for endorsement and then passed to local authorities for inclusion in their Local Plans. Local authorities receive a citation and boundary map.

The sites selected as LoGS in the Rochford district are summarised below, together with a list of other sites which are potential LoGS. Other sites may be identified in the future, occasioned by housing or other development and restoration following mineral extraction.

Site protection

Like their biodiversity counterparts, LoGS have no statutory protection and the conservation and management of individual sites relies heavily on the support of landowners. Inclusion within local plans also forms a vital role in the protection of LoGS. An example of a comprehensive natural environment policy incorporating geodiversity can be provided on request.

It is recommended that the Local Sites Partnership (c/o Essex Wildlife Trust) should be consulted if any development is proposed that would affect a LoGS.

Hockley Spa Pump Room in the 1990s. While buildings such as this are not geological sites as such, they contribute to an understanding of the geodiversity of a district.

If they do not have statutory protection it would be appropriate for them to be designated as Local Geological sites

Photo © G. Lucy

Site Assessment Criteria

The assessment criteria used for identifying LoGS are based on DEFRA document *Local Sites: Guidance on their identification, selection and site management* (2006). The guidance states that assessment is a matter of judgement but must be based on an understanding of geological principles and processes, and the distribution and abundance of the resource (national, regional and local). Those sites selected must be 'of substantive importance to the geodiversity of the local area'.

There are four value categories: scientific, educational, historical and aesthetic. A site qualifies for notification as a Local Geological Site if it fulfils the criteria under one or more of these categories. Each site is also given a site assessment score. This score is not a measure of the site's value or importance but a relative assessment of the usefulness of the site in promoting geodiversity.

Land Ownership Notification

Where the landowner is identified as a public body eg. a local authority, Forestry Commission etc., notification is by letter to that authority. For sites under private ownership, where the landowner can be identified, they will be informed by letter.

Exposure of orange-coloured loess adjacent to the lake on the site of Star Lane Brickworks, Great Wakering. A unique and valuable geological site in Rochford district.
Photo © G. Lucy

6. Additional Sources of Information

Scientific literature
If a LoGS has been referred to in the scientific literature these references are of given in the LoGS citation. The fact that a site has been referred to in the scientific literature means that the site is of historical interest and some of these sites will have potential for future research.

Interpretation
If a site is accessible or simply visible to the general public, it is the aim of GeoEssex to provide interpretive information where possible and practical. This could be in the form of interpretive boards or leaflets. Such interpretation will be with the cooperation of landowners and other interested parties.

GeoEssex www.geoessex.org.uk
Background geological information for Essex, together with a selection of sites in each district (SSSIs and public accessible sites) can be found on the GeoEssex website

Essex Field Club www.essexfieldclub.org.uk
The Essex Field Club, founded in 1880, exists to promote the study of the county's natural history, and includes geology amongst its many activities. The club has a centre for Biodiversity and Geodiversity in Wat Tyler Country Park at Pitsea, near Basildon. It is open to the public most weekends. Their website provides comprehensive data on a large number of wildlife and geological sites which can be searched in a number of ways. Details of several hundred geological sites across Essex can be found here which includes LoGS and potential LoGS.

British Geological Survey www.bgs.ac.uk
Other geological resources, maps and borehole information are available on the website of the British Geological Survey.

Essex Rock & Mineral Society www.erms.org.
The Essex Rock and Mineral Society, founded in 1967, is the club for Essex amateur geological enthusiasts.

GeoEast
GeoEast is the East of England Geodiversity Partnership. It is a partnership of organisations active in conserving and promoting Earth heritage in the six counties of the region (including Essex).

Earth Heritage Magazine www.earthheritage.org.uk
Earth Heritage magazine is produced twice a year for the geological and landscape community by Natural England, Scottish Natural Heritage, the Countryside Council for Wales and The Wildlife Trusts.

Geologists' Association www.geologistsassociation.org.uk
The Geologists' Association, founded in 1858, is Britain's largest society for amateur geologists.

Books

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7. List of Sites

The following is a representative list of geological sites in the district. For completeness it includes geological SSSIs but these sites are statutory sites and do not form part of this report.

The list gives an idea of the range of sites that can qualify as Local Geological Sites (LoGS). It includes those LoGS that have already been approved by the Local Sites Partnership.

Note: *Not all of the sites here described are accessible. Some sites are on private land and can only be viewed from footpaths that pass through or alongside the site. Inclusion of a site on this list does not, therefore, imply any right of access.*

Sites of Special Scientific Interest (SSSIs)

(included in this report for completeness)

FOULNESS ISLAND AND MAPLIN SANDS (part of Foulness SSSI) (TR 048 954)
The Foulness coastline is of considerable geomorphological interest with evidence for sea level change over the last 10,000 years. At Foulness Point, saltmarsh is fringed by a prominent bank of empty cockle shells known as a 'chenier ridge' similar to that at Bradwell-on-Sea. These masses of empty shells have been eroded from tidal flats and built into ridges by waves and storms. They slowly migrate landwards until they are stabilised by salt marsh vegetation. They form the most extensive shell beach in Britain. Maplin Sands is an extensive area of mudflats and sand banks off the coast of Foulness.

Local Geological Sites (LoGS) *Sites agreed by Local Sites Partnership to date.*

GREAT WAKERING. Star Lane Pits (TQ 939 872)
Loess (brickearth)was once extensively excavated for brick making in this area and the last surviving brickworks was at Star Lane, Great Wakering, which closed in 2005. The former brickworks pit is now the only place in Essex where a visible section of loess can be found. Low cliffs of loess can be seen adjacent to footpaths in this pit which is important for its wildlife. Loess is a fine silt which originated as a wind-blown (aeolian) dust carried great distances from cold, dry land close to an ice sheet to settle and be compacted to form a sedimentary rock. It was probably deposited during the most recent glaciation of Britain (at least 20,000 years ago) although it is very difficult to date and some may be older.

HULLBRIDGE. Hullbridge Foreshore (TQ 804 955)
River erosion at several places around the coast has exposed evidence of human occupation dating from the Mesolithic period. These settlements are now below high tide level and the most important of these is at Hullbridge and South Woodham Ferrers where a prehistoric land surface, possibly as much as 7,000 years old, is exposed at the base of a low cliff on the foreshore of the River Crouch. The site then lay well inland, adjacent to a freshwater river, and the abundance of flint flakes and blades sug-gests that this was a ‘base camp’ to exploit the wildlife of the then-existing North Sea lowlands. Hull-bridge is therefore an exceptionally important site with many fine sections of recent alluvial deposits, resting on London Clay, beautifully exposed and constantly being eroded. However, the sites can on-ly be examined at low tide..

Other sites of geological interest in the district.

(Some of these sites are being considered as potential LoGS).

BARLING. Former Baldwins Farm and Barling Hall Pits (TQ 935 899)
The former gravel pits at Barling excavated the Barling Gravel, an extensive spread of gravel and sand laid down by the Thames-Medway river when it was a large, braided river flowing north across this part of Essex.

The Barling Gravel is about 250,000 years old and is part of the Low Level East Essex Gravel and forms the lowest 'tread' in this staircase of terrace deposits fringing the Essex coast. Fossils found in the gravel have included the bones of elephant, mammoth, horse, aurochs, bison, red deer, giant deer and possibly rhinoceros. However, of most importance was the discovery, in 1983, of interglacial sediments rich in animal and plant fossils in a channel cut into London Clay bedrock and overlain by the Barling Gravel. The channel sediments yielded molluscs and plant remains that imply that they were deposited in fully interglacial conditions about 300,000 years ago. The presence of humans on the banks of the Thames-Medway river at this time is indicated by the discovery of numerous Palaeolithic flint implements including at least 10 hand-axes.

HOCKLEY Hockley Spa Pump Room. (TQ 841 925)
The original pump room of Hockley Spa is a prominent building in the town and one of the finest pump rooms in Britain. A grade 2 listed building. Building is privately owned but can be seen from the road. According to the geological map the source of the water appears to be the junction of the sandy Claygate Beds and the underlying impervious London Clay.

HOCKLEY. Hockley Woods (TQ 833 924)
The foundations of Hockley Woods is London Clay overlain by Claygate Beds and Bagshot Sand. The high ground of Hockley Woods is a continuation of the Rayleigh Hills and, like Hadleigh and Thundersley, the highest points are capped with patches of ancient gravel which were deposited by a northward-flowing Medway river during the middle of the Ice Age. On the highest ground there are patches of Oakwood Gravel, laid down by the River Medway perhaps as much as 700,000 years ago.

PAGLESHAM. Ferricrete boulder (TQ 9235 9323)
A boulder of ferricrete (approx 120 x 60 cm in size) sits on the verge on the south side of a surfaced farm track (public footpath) that runs northwest from Paglesham Churchend, under some Poplars. Ferricrete is an iron-cemented flint gravel, formed from the evaporation of groundwater that contains dissolved iron compounds.

RAYLEIGH. Former Hambro Hill Sand Pits (TQ 8150 9194)
Hambro Hill, just north of Rayleigh town centre, consists of the sandy clay of the Claygate Beds over-lain by a thick and extensive outcrop of Bagshot Sand. There have been several sand pits here over the years. One of the many pits working the clay and the sand here was Hambro Hill Brickworks, which was active between about 1899 and 1920. These pits have provided some of the most magnificent exposures of Bagshot Sand to be seen anywhere in Essex, with as much as 10 metres thickness of sand sometimes being visible. This sand is a truly marine deposit and distinctly different in character to the equivalent rocks at Bagshot in Surrey, after which the formation is named. There are still some exposures of Bagshot Sand on Hambro Hill but the land is private land with no public access. It now consists of several industrial units and a wood yard.

RAYLEIGH. Former Rayleigh Brick and Tile Works (Down Hall Brickworks) (TQ 810 918)
During an Essex Field Club visit to Rayleigh in April 1925 members visited the pit then worked by the Rayleigh Brick and Tile Company south-east of the railway line. An extensive section through the sandy clay known as Claygate Beds was then visible. A large number of fossils were recovered from this pit, including corals, fish remains and at least 30 species of molluscs. The site of the brickworks has now been developed and is now occupied by roads called Lower Lambricks and Upper Lambricks. The fossils from here are in the Natural History Museum, London and the Essex Field Club's collection.

RAYLEIGH. Rayleigh Geological trail (TQ 807 909)
Rayleigh Town Centre is the subject of a small 'geological trail guide' published in 1995 in aid of the Rayleigh Parish Centre. The trail starts with Holy Trinity Church at the northern end of the High Street and takes in several other buildings in the town centre. The stones used in the construction of the buildings are described and we learn how and when they were formed and where in the world they are likely to have come from. Churches and high streets in Essex a full of natural stones from local rocks used hundreds of years ago to modern, highly polished decorative stone from quarries on the other side of the world. Rayleigh is one of the few places in Essex with a published building stones guide.

ROCHFORD. Doggetts Pit. (TQ 880 915)
Doggetts Pit has some very limited exposures of Rochford Gravel. Rochford Gravel is an infilling of the Rochford Channel which is thought to have been cut by the Thames-Medway river about 400,000 years ago shortly after the diversion of the Thames by the Anglian ice sheet. The Rochford Channel is therefore an upstream equivalent of the famous Clacton Channel (see under Tendring District). Patterned ground with fossil ice-wedge polygons are present in the adjacent fields and can be seen on aerial photographs taken during dry Summers. The site is now a popular fishing lake with sandy gravel exposed in the banks..

Members of the Essex Field Club and the Geologists' Association being conveyed at low tide in farm wagons across the Maplin Sands towards Foulness Island. The photograph was taken in 1911 on the Broomway, a highway that, until 1926, was the main access to the island.

Photo: © The Geologists' Association.