A Walk in Walthamstow Forest: Geology and Building Materials on Forest Road and Leyton Flats

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This walk will look at the building materials and geology in the NE part of Walthamstow and in the southern (and narrowest) parts of Epping Forest, known as Walthamstow Forest and Leyton Flats. This is a write up of a guided walk led by the author for the Geologists' Association as part of their Festival of Geology on the weekend of the 6th-7th November 2021.

Epping Forest, which occupies a low, roughly N-S trending strip between the valleys of the River Lea and River Roding, has been woodland since the return of trees after the end of the last Ice Age. However, although there are areas of natural woodland, much of the Forest has been fairly intensively managed over the last thousand or so years as a royal hunting ground and as common land. It has also had a chequered history of skirmishes between commoners, local lords of the manor and the Crown who have vied for grazing, hunting, 'lopping' (wood cutting), recreational and quarrying rights. Hoy (2010) provides a lively and informative history of Epping Forest as well as detailed guides to the various sections from south to north, and this book is recommended reading for those with a further interest in the history of the forest and walking the forest paths. For those with an interest in the psychogeography and subculture of this unique ancient forest in an intensely urbanised setting, Will Ashon's Strange Labyrinth has much to reveal (Ashon, 2017). Epping Forest now belongs to and is administered by the Corporation of the City of London who took on its management in 1878 in order to preserve the place, predominantly for recreation, albeit under a series of fairly strict byelaws[1]. These including '*[d]ancing in such a manner or accompanied by such a noise that it may be a nuisance or annoyance to the public*.' With the exception of the collection kindling wood, nothing can be taken from the Forest except photographs. The forest, and particularly this southern part, has shrunk considerably, mainly by illegal enclosure prior to the 1878 Epping Forest Act and thus the London suburbs of Walthamstow, Highams Park, Woodford and Snaresbrook have significantly encroached upon Forest land.

This guide focuses on both bedrock geology and the geology of building materials in the area of the northern part of Walthamstow as it borders with Highams Park and Woodford; an area known locally as 'Top o'the Forest'. The route then takes us towards Leyton Flats and Snaresbrook. Along with bedrock and superficial geology, it will also demonstrate the extent of 'made ground' which is so typical of city development and often creates easily overlooked landforms, which in turn may be assumed to be natural. In this area, such areas of open ground can represent the major re-routing of roads and indeed the scars of the Wars of the 20th Century.

The underlying geology is typical of much of the London Basin, being composed of the Eocene London Clay Formation. This passes up unconformably, on the higher ground to Pleistocene river terrace deposits, the Pre-Anglian, pre-diversionary Thames Woodford Gravels and the post-Anglian, post-diversionary Thames Boyn Hill Gravels. The area lacks any good building stone although the London Clay and the Holocene 'Brickearth' loess deposits around Ilford to the East of the River Roding have historically furnished a number of brickworks in the region. Old local place

[1] https://www.cityoflondon.gov.uk/things-to-do/green-spaces/epping-forest/epping-forest-byelaws

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names such as Clay Farm and Clay Road (the old name for a section of Forest Road, the A503) indicate both soil quality and the propensity for brick and tile works in the area.

Human occupation in the area stretches back to prehistory, with stone tools as early as c. 400 ka (Marine Isotope Stage [MIS] 10) found in gravel deposits (Bridgland & White, 2014; Juby, 2011). Middle Palaeolithic tools have been found in the Boyn Hill gravels and there is a cluster of finds where these units outcrop in the Roding Valley. Such tools were made by hominins who were living in the area following the Anglian Glaciation, perhaps *Homo neanderthalensis* but possibly earlier humans. Evidence of Later Palaeolithic, Neolithic and Bronze Age, Iron Age and Roman occupation having been uncovered by archaeologists, including recent excavations in the grounds of the Holy Family School on Shernhall Street. Cherry et al. (2007) provide a review of the prehistoric and Roman occupation of East London and small collections of artefacts are housed in the Vestry House Museum in Walthamstow Village. The area which is now Walthamstow was certainly occupied in the Medieval era; there are the remains of a moated manor house in Lloyd Park and St Mary's Church in Walthamstow Village and Chingford Old Church date from the 12th Century. However the area remained rural, predominantly woodland and marshland with scattered hamlets and small farms up until the 16th Century and was mostly in the ownership of the monastery at Waltham Abbey to the north. There were no major settlements in the area though Walthamstow Village has buildings (i.e. The Ancient House) dating from the 15th Century.

From the 16th to 18th Centuries, development in this area was mainly in the form of country estates belonging to London's bankers and wealthy merchants, however none of the houses belonging to the 16th and 17th centuries still exist. A few of the large 18th Century houses remain (indeed more in Walthamstow than in other areas; see Vestry House Museum, 2016), but their associated parkland has in some cases returned to the Forest or was developed in the 19th Century as lower to middle class domestic housing. Several surviving buildings on Forest Road were built in the 18th Century and have now been converted and incorporated into hospital buildings and a school (Thorpe Combe House of 1775, Walthamstow House and Brookscroft, c 1762). William Morris's family home and its gardens (now Lloyd Park) is now a museum and art gallery. These houses are brick built with dressings constructed from stucco (whitewashed lime and Portland-type cements). There is little in the way of stone associated with their building though a few items of decorative stonework from garden ornaments and incongruous stones from Victorian rockeries as scattered along Forest Road and in Lloyd Park.

The railway came to Walthamstow in 1840 and by the 1860s the area had become much less gentrified with the construction of working to middle class housing, the latter mainly in the Forest Road area around Shernhall Street and The Drive. Development of the Warner Estates in the borough in the 1880s was initiated by Thomas Courtenay Warner, a major local landowner. His companies constructed good quality housing aimed at working class families, many in the form of flats each with their own entrance door and their own patch of garden. These were brick built with (Welsh) slate roofs and remain much sought-after properties to the present day.

Unless cited otherwise, architectural information is derived from Cherry et al. (2007) and the key reference for the geology of the area has been Ellison et al. (2004). Somewhat frustratingly, the area of greatest geological exposure lies precisely on the junction of the two Geological Survey maps which cover north London; BGS Sheets 256 North London and 257 Romford (herein cited as BGS, 2006 and BGS, 1996 respectively).

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This walk starts at Fellowship Square in front of Waltham Forest Town Hall, at OS grid reference TQ 377898. This is 10-15 minute walk from Walthamstow Central Station. Leave the station by turning right onto Selbourne Road and then walk north along Hoe Street. Turn left at the junction with Forest Road; the Town Hall is located on the north side of Forest Road, set back from the road in a park. Alternatively bus number 275 can be taken from Central Station which stops outside the Town Hall. The total walk distance is around 6 km (4 miles) and will finish at Snaresbrook Underground Station (Central Line). Locations visited are shown in Figure 1.

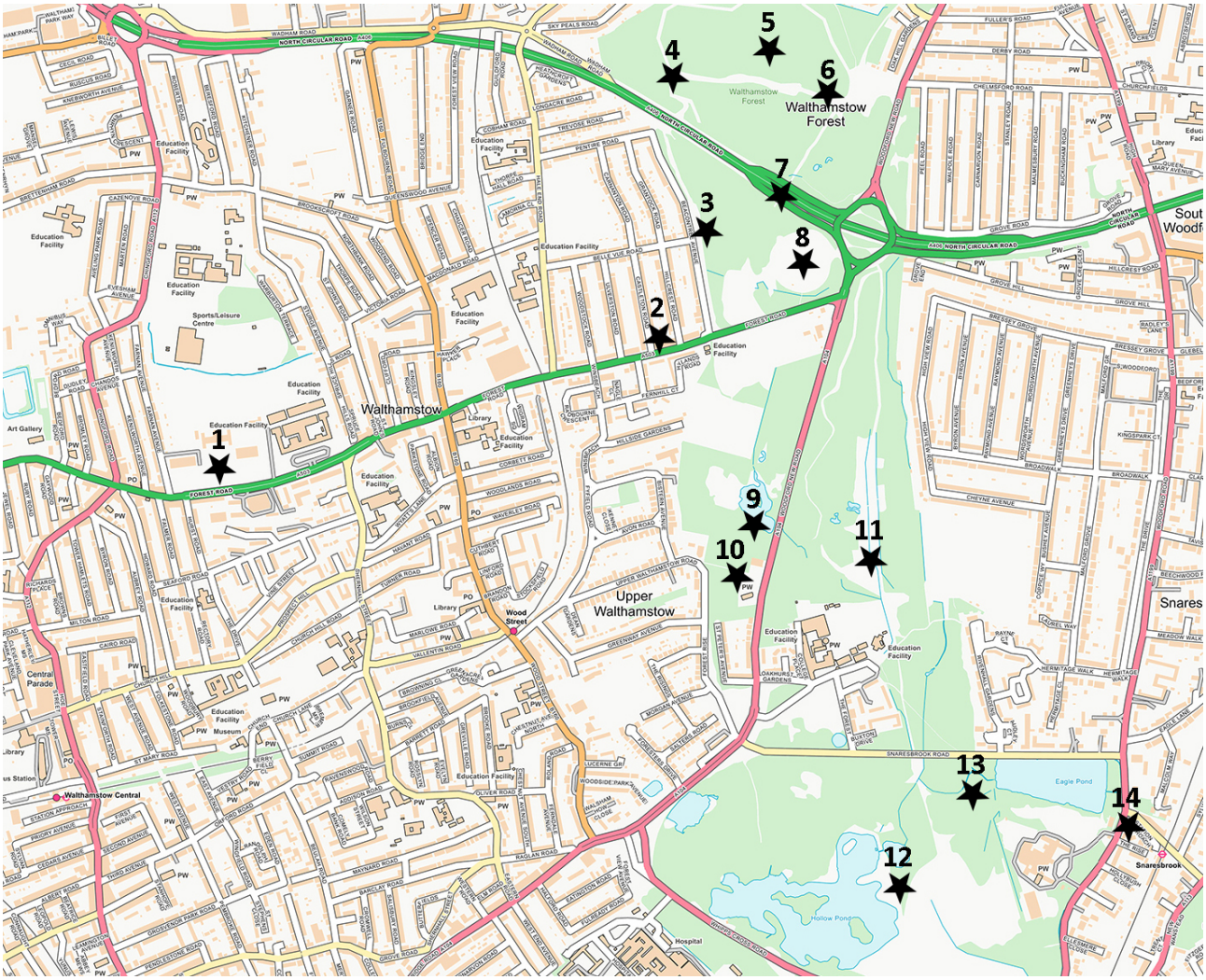

Figure 1. Route of the walk showing locations 1-14. Map data from OS OpenMap – Local v. 2021-10. Used under Open Government Licence https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/

1. Walthamstow Town Hall and Fellowship Square

Although the main centre of Walthamstow had developed around what is now called Walthamstow Village near to St Mary's Church (formerly known as Church End) and then, with the coming of the railway, this shifted slightly to the west to the area around Walthamstow Central Station at the junction of Hoe Street, Church Hill Road and High Street (Walthamstow Market), the civic centre of Walthamstow was constructed on Forest Road from the late 1930s onwards. The land had previously been agricultural land belonging to Clay Farm. The Technical College (1938 by Essex County Architect, John Stuart), Town Hall (completed 1941) and Assembly Hall (1943) were all constructed following the establishment of Walthamstow (now Waltham Forest) as a new

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London Borough in 1929. The architect of the Town Hall was P. D. Hepworth. It is often assumed by visitors and locals alike that the 'fascist' modernist architecture of Italy and Spain were the major influences here, but this is not true. Hepworth was actually inspired by the reduced classicism of Scandinavia, and indeed he had visited an exhibition of Swedish design and architecture in London in 1931 and he submitted his design for the Town Hall the following year, although building work did not start until the end of the decade. Hepworth was also responsible for Fellowship Hall and it seems plans were in place for a building on the west side of Fellowship Square. World War II and diversion of funds stymied these plans and they were abandoned following a V2 rocket attack on Farnan Avenue, which killed 6 people on 14th September 1944. The Magistrates Court was not built until 1973, designed by architect Geoffrey Horsfall and the GLC Special Works Department, following plans for the construction of ideal, modern courts. Pevsner describes it as 'a tough nephew beside a maiden aunt' (Cherry et al., 2007). All three buildings use Portland Stone Whitbed as either the main building stone or as dressing stone. This is an upper Jurassic oolitic limestone quarried on the Isle of Portland in Dorset. Prized as a building stones since it was first used in London in the early 17th Century, Portland Stone has become the building material most associated with civic architecture in the capital.

Fellowship Square was renovated and paved using Purbeck Stone in the Summer of 2021 by architects and landscape architects Hawkins/Brown & Churchman Thornhill Finch, commissioned by the London Borough of Waltham Forest. The stone was supplied by Lovell Stone Group from their Downs Quarry in Langton Matravers on the Isle of Purbeck, Dorset.

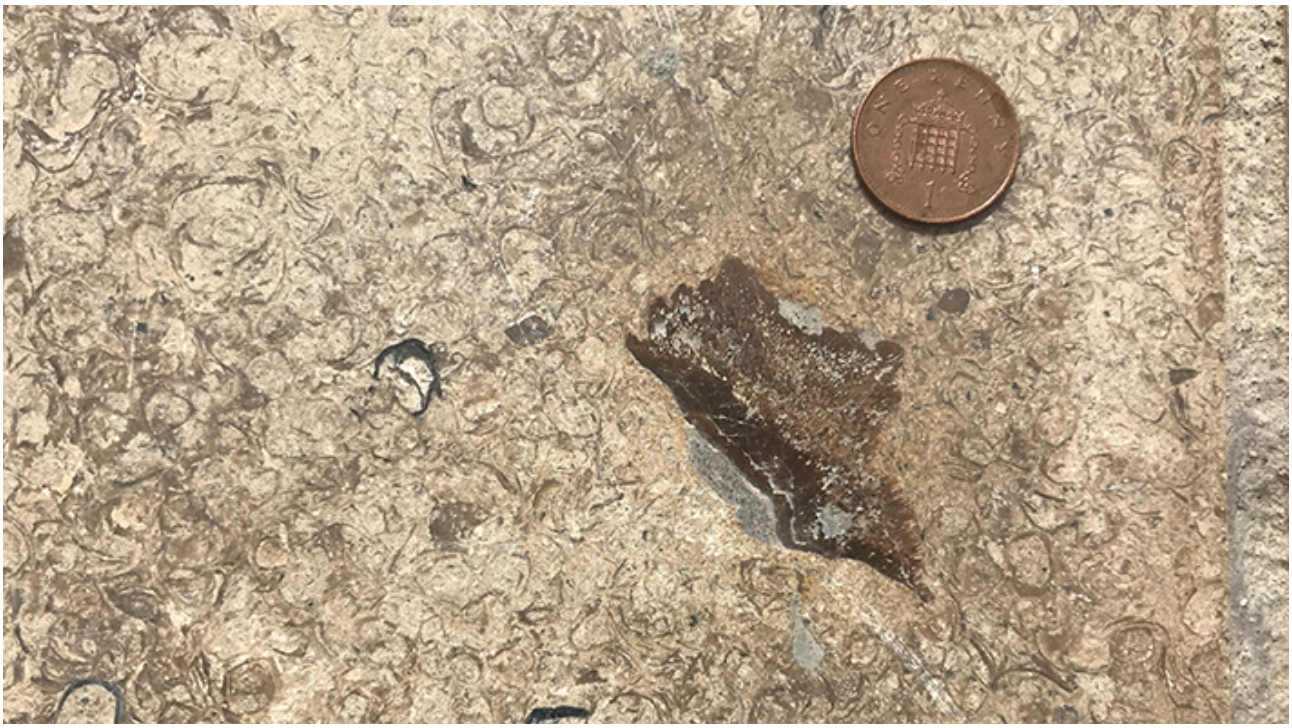

Figure 2. A fragment of fossilised bone, probably that of a reptile such as a crocodile or turtle, or maybe even a dinosaur, in a slab of Purbeck Whetson limestone, packed with shell fragments of fossil freshwater mussels.

Most of the varieties of the Purbeck Stone building stone members are used here. The entire sequence represent the lowermost Cretaceous in the British Isles. The Purbeck Limestone Group are freshwater limestones, mudstones and calcareous clays laid down in a shallow freshwater to littoral environment, with a climate changing from semi-arid to humid upwards through the

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sequence. Fossils of mammals, reptiles, insects and plants have been found in these limestones as well as dinosaur footprints. Most of the beds are dominated by a fauna of freshwater mussels (*Unio* sp.) and snails (*Viviparus* sp.). There is some considerable variation in the facies of the different beds of Purbeck limestone, from the fine-grained, more or less fossil free Cap to the Inland Freestone which is packed with fossils. The different beds, known as 'veins' to the quarrymen, their uses and their properties have been described by Haysom (2020). Typical lithologies used in Fellowship Square are from the Grub, Thornback, Whetson (sometimes spelled Wetsun), Cap, Feather, Inland Freestone, Brassy Bed and Vie Bed. In such a large expanse of Purbeck Stone, a search for dinosaur prints and bones is always worthwhile. Although prints have not been found, a couple of slabs do contain fragments of reptile bone which is brown in contrast to the cream to blue-grey coloured limestones (Figure 2).

Walkways on either side of the plaza are paved with honed Jura Limestone. This is a Jurassic marine limestone from the Bavarian Jura of Germany which has a rich fossil fauna of ammonites, belemnites and sponges which can be picked out on the surface of these stones.

The Borough War Memorial is located in the park in south of Fellowship Hall. It represents a grieving woman standing by a Roman-style shrine (*aedicula*). It is a solid memorial, constructed from a two-mica leucogranite, probably Kemnay Granite from Aberdeenshire, with its prominent books of mica. The head appears to be of another stone, perhaps Dumfireshire Granodiorite. Constructed in 1929, the architect/sculptor of this monument is unknown.

2. Forest Road

Forest Road used to be called Clay Street from the 15th to the 17th Century, named from the underlying London Clay but also Clay Farm (later the Chestnuts) which was the land now occupied by the Town Hall. Clay Street and its continuation up to the Forest, Hagger Lane (again named after a local farm) were renamed Forest Road in 1886 (Powell, 1973). By the 17th and 18th Centuries, Walthamstow had become a desirable address for London merchants and bankers, and a number of large houses were built along the northern edge of the higher ground, commanding the views over the Lea Valley and Epping Forest to the north. Opposite the Town Hall is Brookscroft and Thorpe Combe and Walthamstow Houses are situated on the corner with Shernhall Street. The unexpected occurrence of quartzite boulders outside Hallingbury Court and Brookscroft are unexplained, but it is most likely that they are derived from Victorian rockeries which were once in the gardens of these large houses.

From the Town Hall, the land can be seen rising gently upwards to the 'Top o'the Forest' reaching an elevation of 65 m. There is little of geological interest along this stretch, the land on either side of Forest Road is either shop parades or modern housing development. At the time of writing, demolition and excavation have begun on the site between Fulbourne Road and the railway track from Wood Street to Chingford. Unfortunately site access is not possible to view any exposures of local geology that may have been revealed.

After crossing Hale End Road, five residential streets developed around the turn of the 19th Century occupy a plot which was once forest and subsequently enclosed for the building of Belle Vue House and its estate, which included an ornamental lake (see below). Garden walls along Forest Road and the streets leading north from it often feature brick wasters ('single roughs') as building materials. Their presence indicates local brickworks wherein bricks were fired in clamps. Such structures were not permanent kilns, but piles of bricks and fuel which would have been set

on fire and left to burn for several days. Inevitably bricks in the centre of the pile would be overfired and sinter whereas bricks on the outside of the clamp would be underfired and too soft, and these would have been moved into the centres of the next clamp to be constructed. The best bricks for building came from a 'just right' Goldilocks zone within the clamp. These contorted, overfired, brick wasters were used for walls and foundations. The early 20th Century terraces in this area are faced with red rubbers made from Kent brick clays, however the backs of these houses are London stock bricks, probably made locally from the Brick Earth deposits around Ilford.

3. Beacontree Avenue

The block of land along Forest Road between Hale End Road and Beacontree Avenue was initially built up as a residential area around the turn of the 19th Century. Up until this time, this plot had been the parklands of Belle Vue House, a fanciful Palladian-style house designed by Edward Gyfford in 1810 for his client the bookseller Charles Cooke; the house became known as Cooke's Folly (Figure 3). From Cooke's own account (Dunhill, 2019), the house was built of London stock brick with Portland Stone dressings. This house remained standing until the mid-1930s when it was demolished and the land given over to housing development in the 1950s. From 19th Century OS maps, it would seem the house was located at OS grid reference TQ 388902, between Hillcrest Road and Beacontree Avenue.

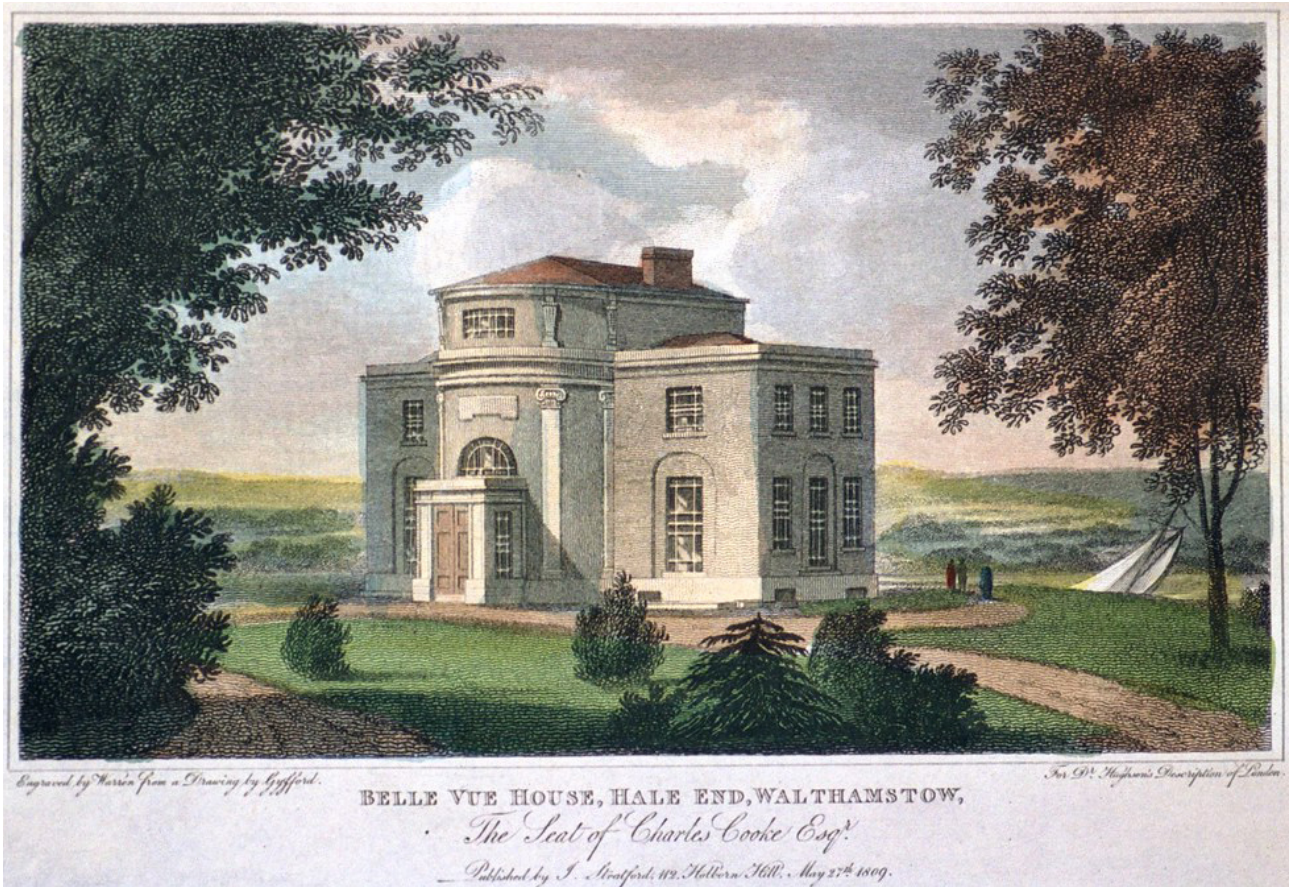

Figure 3. Belle Vue House. This view is apparently drawn looking westwards from the driveway of the house which was located on Beacontree Avenue. The park had an ornamental lake behind the house; the white sails of a small yacht are seen on the right of the illustration. Engraved by Ambrose Warren after a drawing by Edward Gyfford. Image Source: Wikimedia https://www.flickr.com/photos/architec/410459020

Turning into Beacontree Avenue, it is difficult to believe that the wide, unforested verge on the right (east) side was once the main North Circular Road which once skirted around the edge of the

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Forest (Fig. 4). This original section of the North Circular Road from Edmonton to Woodford was constructed between 1927-1930 and ran through a series of right angled turns and dog legs around the perimeter of Walthamstow Forest and was in use until the early 1970s. In 1970-71, this section was replaced by the motorway-like section of the A406 we know today which cuts from the Lea Valley straight through Walthamstow Forest with a new junction with Forest Road and Woodford New Road created at Waterworks Corner.

At the junction of Beacontree Avenue with Belle Vue Road there is a memorial to three ARP Fire Guards who lost their life on the night of the 19th April 1941 when a German parachute mine exploded of Beacontree Avenue (Figure 4). William Arthur Shadbolt (c. 1907-1941), Sidney John Lee (c. 1891-1941) and Edward Manning (c. 1884-1941) were all residents of Beacontree Avenue and the memorial was unveiled by their families and neighbours on 19th April 2018[2].



Figure 4. Beacontree Avenue and the ARP Fire Guards Memorial. The photo shows the broad, unforested verge which was once the route of the old North Circular Road.

The memorial inscription is on a plaque of Blue Pearl larvikite from the Permian aged (292-297 Ma) Larvik Plutonic Complex in SW Norway. This is a high quality and very popular decorative stone, which is also hard wearing. The Larvik pluton rocks are well-known for the spectacular 'schillerescence' of the feldspars which are oligoclase antiperthites (feldspar minerals which are a mixture of two minerals), with exsolution lamellae as well as cleavage and twin planes producing thin layers which are responsible for the refraction of light and the subsequent play of colours. The rock is also composed of magnetite, biotite and augite (calcium-rich pyroxenes) with an overall alkaline geochemistry. Such a rock is a monzonite according to its mineralogical composition.

[2] Imperial War Museum War Memorials Register 76525 https://www.iwm.org.uk/memorials/item/memorial/76525

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Box 1. Geological Formations in Walthamstow Forest

London Clay Formation

The latest Palaeocene and earliest Eocene was a time of a warm climate and sea-level rise across the London Basin. The main lithology associated with this marine transgression is the London Clay Formation (57-52 Ma) which is the dominant rock in outcrop across much of the central London Basin. The sequence thins to the west, from a thickness of some 150 m in coastal Essex to just a few metres in Wiltshire (Sumbler, 1996, Ellison et al., 2004). Boreholes drilled on Forest Road in 1892 recovered a thickness of 31 m (Whitaker & Thresh, 1916). The London Clay is subdivided into five Units, labelled A to E and based on fossil fauna. Each Unit represents a transgression followed by shallowing-up cycle, typically with a silty uppermost boundary, and indeed these units become more sandy and more clearly defined as the sequence shallows westwards. In East London and West Essex, the London clay is a thick sequence of blue-grey clays which weather brown to yellow brown. They are highly fossiliferous, though when encountered in museum collections, the wealth of fossil finds often comes as a surprise to most Londoners as none are encountered in surface or even near surface exposures. The fossil content is highly susceptible to the weathering of the Clay which has become decalcified in its upper few metres; they are dissolved and leached away in the higher levels. King & King (1976) in their study of the London Clay excavated at Waterworks Corner in Walthamstow only found well-preserved fossils at a depths 17 m. Nevertheless, they found 12 species of fish (Teleost fish and *Elasmobranchii* sharks), three species of crabs and lobsters, 39 species of molluscs as well as brachiopods, bryozoa, echinoids, ostracods, foraminifera, annelida (worms) and plants. The borehole recorded by Whitaker & Thresh (1916) revealed 23 m of 'brown clay' with a thin layer of petrified wood, and below this 6.5 m of mottled clay and a 1.2 m thick basal layer rich in shells, septaria and pebbles.

Elsewhere fossilised bones of mammals, reptiles and birds have been found. This rich fauna represents a well-developed marine ecosystem; the presence of plant fossils indicate material washed in from the forested, tropical shorelines.

Also present in the London Clay are layers of calcareous concretions known as septarian nodules (or septaria) which can be up to 40 cm diameter. These were known as 'cementstones' as they could be calcined for the production of hydraulic limes. Pyrite is abundant and occurs both pseudomorphing fossils as well as in the form of nodules. These too tend to break down and become oxidised in the upper few metres of the clay. Phosphate nodules and baryte are also common. The clay is dominated by the minerals smectite, illite and kaolinite.

Woodford Gravel Formation

The c. 550 ka Woodford Gravels Formation are sandy river gravels associated with the ancestral River Thames which flowed northwards towards the North Sea across East Anglia. They were deposited in a cool but not glacial climate. The gravels are composed of angular flint (83%), rounded flint (14%), quartz (1%) and Lower Greensand Chert (1%) (Ellison et al., 2004). The matrix is sandy and a yellow-brown to grey colour and there is scant evidence of stratification in the area to be visited. Grey, Greensand cherts were eroded from the Weald and indicate that the ancestral Thames flowed across the modern Thames Valley from the south. The Woodford Gravels attain a maximum thickness of 3-4 m in the vicinity of Woodford where they are only found at elevations of 50-80 m.

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Box 1 (continued).



A typical Landscape of Walthamstow Forest: Ponds on the London Clay in Walthamstow Forest, formed from clay and gravel pits as well as possible WWII bomb craters.



A 'Robinson Pit' named after geologist Eric Robinson; Sandy Woodford Gravels are exposed in the root ball of a fallen tree. In London, geological outcrops are often hard won!

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At the north end of Beacontree Avenue, an underpass takes pedestrians under the new North Circular Road and into Walthamstow Forest. Climbing up out the road cutting, a major path leads north towards the Highams Park but a junction takes us right along another wide path leading east.

4. Made ground in the Forest: Brick pits, Anti-Tank Defences and Vegetation

The geology of the Forest is described in Box 1 above. All areas of Epping Forest are well-known for their labyrinthine network of paths which all too easily can lead walkers around in circles. However a few broad paths are representative of old roads and other structures. According to Hoy (2010), this wide E-W path follows the line of an anti-tank ditch which was constructed in the Second World War. Now filled in, it was once part of the London Defence Rings which were designed to protect the capital from the threat of German invasion. Because of these defensive earthworks, this strip of the forest is made ground. However just north of it we are on more predictable geology. There is a distinct change in tree vegetation as we walk from the underpass towards the west. London Clay tends to support a flora of oak and hornbeam, whereas birches are indicative of more sandy soils.

A number of small pools and pits cover the ground in this area, where clays for brick-making were excavated from close to the boundary with the overlying gravels, which are very thin in this locality. However, some of these may also be WWII bomb craters (Dunhill, 2019). London Clay mixed with the Woodford Gravel sands would have made a good brick ceramic body. These bricks would have been fired in clamps (as described above) and used for local building in the 18th and 19th Centuries. This area of the forest, and that to the north across Oakhill Road were intensely worked for brick clays and were known as the 'Waste' (Hoy, 2010).

5. The Woodford Gravels: Birch Trees and Robinson Pits

To the north of the anti-tank path a thinly-wooded glade in the forest is underlain by the Woodford Gravels which unconformably overly the Clay. These are best exposed in several Robinson Pits (the roots of fallen trees) in this area. These typically sandy, pale brown and flint-rich gravels support a flora of birch and oak trees which is distinct from the hornbeams which are typical of the London Clay.

Returning back to the anti-tank path, follow it eastwards towards Mill Plain and the Gypsy Stone, a memorial at the junction with the path that was once the Old Woodford Road.

6. Rodney Smith Memorial ("The Gipsy Stone") and Mill Plain

The Gipsy Stone commemorates Rodney 'Gipsy' Smith (1860-1947) who was reputedly born on this site on Mill Plain (Figure 5). Smith joined the Salvation Army but then went on to be a celebrated evangelist who travelled the world, but in particular worked in the USA. He died on the Queen Mary in 1947. The memorial is a quarry-dressed block of Cornish Granite of the Carnmenellis-Bodmin Moor type, a two mica granite with brick-shaped feldspars.

According to Lloyd (1953), the stone was erected in 1949 and it is reputed that Smith's ashes were interred beneath it. The memorial fund was organised by Colonel Sir Stuart Sidney Mallinson (1888-1981), the son of Smith's Sunday school teacher, William Mallinson.

The open area adjacent to Woodford High Road was once the site of a windmill, constructed in the 17th Century and destroyed in a storm in 1800. The large, non-native Turkey oak (*Quercus cerris*)

was planted in 1932 by the Lord Mayor of London, to commemorate the 50th anniversary of the forest coming under the care of the City of London (Hoy, 2021). The block has a relief carving of a Romani *vardo* (caravan) and is set with an inscribed slate plaque.

Turning south, we follow the route of Woodford Old Road and this leads to the footbridge over the deep road cutting of the A406.



Figure 5. The Gipsy Stone (left) and Rodney 'Gipsy' Smith c. 1900 (right).

7. A406 Road Cutting

From the footbridge, there are good views westwards to the industrial areas and reservoirs of the Lea Valley and west towards the western flanks of the Roding Valley. This stretch of the North Circular Road was built in the early 1970s. Excavations for the road cutting revealed a rich London Clay fossilised flora and fauna which was studied by Chris King and is discussed further below and in Box 1 above. Otherwise the main geological interest of the cutting is that this stretch of the North Circular lies very close to the edge of the Anglian Ice Sheet (see Box 2), according to the reconstruction in Ellison (2004). Looking north, there would have been a cliff of ice, and to the

Box 2. The Anglian Glaciation

The Anglian Glaciation (480 - 424 ka) was the most harsh on record and represents the glacial maximum for the Pliocene-Pleistocene Ice Ages. The ice sheet extended south to North London, and the region of the capital between Finchley and Hornchurch are important for preserving evidence supporting this event. There are several outcrops of glaciofluvial and outwash deposits, glaciolacustrine deposits and tills (the 'chalky boulder clay') that could only have formed either under the ice sheet or very close to its edge. Although not exposed in the area visited in these walk, Anglian deposits are abundant in the Roding Valley and north of Hornchurch in Essex, where a valley glacier extended southwards. It is also postulated that an ice lobe could have extended into the Lea and Roding Valleys too and Ellison et al. (2004) plot the southern limit of the ice sheet close to the route of the North Circular Road as it passes through Walthamstow Forest, having flowed around the margins of the Epping Forest Ridge which may well have been a nunatak.

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south there would have been a periglacial tundra falling down to a wide, braided, periglacial river a proto Thames which had been diverted south; its original course having been blocked by the encroaching ice.

On re-entering the forest on the south side of the road, take one of the paths up to the left onto a flat, open, grassy area.

8. Reservoirs and Waterworks Corner

Easily mistaken for a well-maintained cricket pitch, this is in fact the roof of an underground reservoir, constructed at the same time as the road junction between 1969 and 1971 for the Metropolitan Water Board. Excavations of between 7 and 17 metres depth were required both for the construction of the reservoir and the cutting for the A406. This provided an opportunity for geologist and London Clay expert Chris King to investigate the sections and the fossil fauna exposed by the works (King & King, 1976, see also Essex Field Club, 2006-2021). Surface exposures of London Clay in this area are decalcified and all traces of fossils have been leached away. However two 17 m deep shafts and a linking tunnel provided a highly fossiliferous layer with well-preserved material.

As described in Box 1 above, molluscs, mainly bivalves but also nautilus species, shark (identified from fossilised teeth) and innumerable fish bones were found. Septarian concretions as well as pyrite and phosphate nodules were also common, the latter sometimes containing fossil crustaceans (crabs and lobsters). Fossilised, subtropical, terrestrial seeds and fruits were also found derived from a tropical, forested shoreline of the London Clay sea. Based on the fossil evidence, King & King (1976) were able to place the London Clay at Waterworks Corner into Division C, which lies at the middle of the full succession.

It was also discovered that the upper section of clay was folded here. These structures were not continuous to any depth and the London Clay typically shows (close to) horizontal bedding, and therefore they cannot reasonably related to plate tectonic events. These structures can only have been formed by ice-deformation of permafrost at the end of the last Ice Age (c. 12 ka).

Waterworks Corner is named for the pumping station and reservoirs originally built by East London Waterworks Company (ELWC) and now owned by the Metropolitan Water Board. The original water works were enclosed from the Forest in 1876-7, this area had been granted to the ELWC in 1855 (Hoy, 2010). The water supply to the area of Woodford had, up until the 1870s, been supplied by a series of natural springs and wells which arise at the junction of the Woodford Gravels with the underlying London Clay. Mineral water springs at Woodford Wells on the southern flanks of Buckhurst Hill to the north, were exploited as a small spa in the earliest 19th Century. Elsewhere, water supply was restricted to hand pumps (and the wells at Woodford had gone into decay by the mid 19th Century). Modernisation of the water supply was required. The Waterworks pumped water to Buckhurst Hill from an adjacent reservoir (at TQ 392901).

The woodland to the west of the reservoir is underlain by (probably disturbed) London Clay and is dominated by hornbeam (*Carpinus betulus*) and various species of oak.

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Leave the reservoir from the path to the east and follow this into a grove of apple and willow trees along with newly planted oaks turning left along a path which leads across a footbridge over Forest Road (A503) and into the southern section of the Forest.

9. Bulrush Pond

This section of Walthamstow Forest is underlain by London Clay, as the land drops away from the higher ground where the Woodford Gravels are preserved. A number of shallow ponds and pools exist on these impermeable strata and the larger Bulrush Pond, which now much overgrown was once a small boating lake (now the only boating lake in Epping Forest is Hollow Ponds, discussed below). According to Hoy (2010) the pond fulfilled this function from 1920 to 1950. Bulrush Pond was hit by a V2 rocket on 1st February 1945. Luckily no one was killed in this attack, and the rocket narrowly missed St Peter's Church and the nearby pub. Its only damage was to the pond, the shape of which was, in the words of Hoy (2010) 'somewhat modified'. It was claimed that the level of the water in Bulrush Pond was directly related to pumping activity at the Waterworks but there is little evidence to support this.

Bulrush and other (smaller) ponds in this area of the Forest sit directly on the London Clay and the surface of the water is often seen to have developed a thin film of bacteria and the rusty-looking iron oxide hydroxide mineral ferrihydrite. This phenomena is often wrongly assumed to be oil pollution, but this is a natural formation of ochres through the process of natural acid rock drainage (NARD). Ferrihydrite is unstable. Much produced here is washed away, but when it collects in pools and pockets in the landscape it can transform over time to the more stable iron oxide hydroxide mineral goethite. Acid rock drainage largely occurs by the oxidation of pyrite (FeS) which is abundant as nodules in the London Clay and it is catalysed by certain bacteria. Acid waters drive these reactions; the pyrite is broken down to form Fe^{2+}, sulphate and hydrogen ions and the ferrous (Fe^{2+}) iron is further oxidised to form ferric (Fe^{3+}) iron. The release of hydrogen (H^{+}) ions further accelerates the reaction by increasing the acidity of the waters. A pH of 3 is optimum for this reaction to take place, and evidence of this is more prevalent during dry conditions, when there water is less diluted.

The entrance to the graveyard of the church of St Peter-in-the-Forest lies just to the south of the Pond.

10. St Peter-in-the-Forest Graveyard

The church of St Peter-in-the-Forest is sited on land enclosed from Epping Forest in 1831, and this is why the church and the adjacent restaurant (formerly the Rising Sun Public House; Hoy, 2010) are located on Forest land. The Church was designed and built by architect John Shaw in the 'Lombard Romanesque' style in 1840 from local yellow stock brick. It was slightly damaged in WWII, probably by the V2 rocket which landed nearby on Bullrush Pond. Although the exterior of the church itself features no building or decorative stones of interest, the graveyard has some interesting stones typical of the fashions in Victorian and 20th Century funerary memorials. The following have been identified by the author as of interest, they are best seen in order by entering the graveyard from the Forest gate and leaving by the main gate on Woodford New Road, and for ease of location are illustrated in Figure 6.

Caroline Louisa Bass's Memorial (c. 1900, Fig. 6a). A Carrara Marble pillar topped with an urn standing on a bolt of cloth. White Carrara marble was a popular ornamental stone and was abundant and affordable. The marble comes from the Tuscan Nappe in Italy and comprises a sequence of lower Mesozoic marbles metamorphosed during Alpine collision in the Cretaceous.

George Lambert's Gravestone (c. 1868, Fig. 6b); is also in white Carrara Marble. One of the older grave markers in the cemetery, its inscription rendered almost illegible by the weathering of the stone. ***Mary Brown's Memorial*** (c. 1888, Fig. 6c) is a large, plain, red granite cross made from Corrennie Granite from Tillyfourie, Aberdeenshire. From the 1880s, granite became very popular as gravestones (amongst other things) and this rock dominates later Victorian funerary monuments. This trend carried on well into the 20th Century and ***Arthur W. Atkinson's Memorial*** (c 1935, Fig. 6d) is a Celtic Cross in white granite. This is Cornish Granite probably from the Carnmenellis or Bodmin Moor Granites. These wheel-headed Celtic crosses became very fashionable and were mass-produced by the John Freeman & Sons Cornish granite company.



Figure 6. Grave markers and memorial stones at St Peter-in-the-Forest. a). Caroline Louisa Bass; b). George Lambert; c). Mary Brown; d). Arthur Atkinson; e). Arthur Martyn; f). Frederick Carter; g). Thomas Armstrong; h). Joseph Ludbrook and i). Frederick Augustus Snow.

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Arthur G. R. Martyn's Grave Marker (c. 1937, Fig. 6e) is an Art Deco-style slab in pink granite made from Finnish Balmoral Granite. Scandinavian Granites were imported from the late 19th Century and often shipped initially to Aberdeen for cutting and polishing. All things Scottish were bang on trend in Scandinavia at the time and thus the Proterozoic granites of Vehmaa in western Finland acquired a Scottish name. ***Thomas Nelson's Memorial*** and ***Frederick W. Carter's Memorial*** (c. 1883, Fig. 6f) are both grey, granite chest tombs. This is probably Aberdeen's Dancing Cairns Granite, lighter in colour and less foliated than Rubislaw Granite. A pink granite cross, inscribed with the words 'Waiting' and 'Resting' is ***Thomas Armstrong's Memorial Stone*** (c. 1903, Fig. 6g) carved from Peterhead Granite, also from Aberdeenshire. A very striking grave marker is Joseph Ludbrook's Memorial Stone (c. 1900, Fig. 6h). A brick red, very coarse-grained granite pillar made from the Proterozoic Swedish pyterlite, Uthammar Granite. Finally, ***Frederick Augustus Snow's*** memorial is a large grey granite cross, almost horizontal but propped on a stone. The granite contains schlieren of biotite; these features and the pale grey colour are typical of Dancing Cairns Granite (Fig. 6i).

Leave the churchyard by the main gate and cross Woodford New Road and then walk east into the forest towards Gilbert's Slade, a glade following the route of the old Woodford Road.

11. Gilbert's Slade

Gilbert's Slade marks the continued line of the Old Woodford Road, running southwards. A 'slade', a word derived from the old English *slead*, is described by the Oxford English Dictionary as '*a valley, dell, or dingle; an open space between banks or woods; a forest glade; a strip of greensward or of boggy land*'[3]; this is an absolutely spot-on description for this section of Epping Forest. The Slade is underlain by London Clay, however sandy seams must be present giving rise to a number of springs which for streams draining south towards into the Snares Brook. The southern part of Gilbert's Slade was enclosed in the 18th Century for the construction of the Oakhurst estate. It is now the Forest School (opened 1834). The area was also a site of clay quarrying and brick kilns in the 18th Century according to John Rocque's map of 1741 (Rocque, 1746).

Turn right (south) and follow the path until it crosses Snaresbrook Road and enters the Leyton Flats section of Epping Forest via the Eagle Car Park. From here, follow paths south west to Hollow Ponds.

12. Leyton Flats and Hollow Ponds

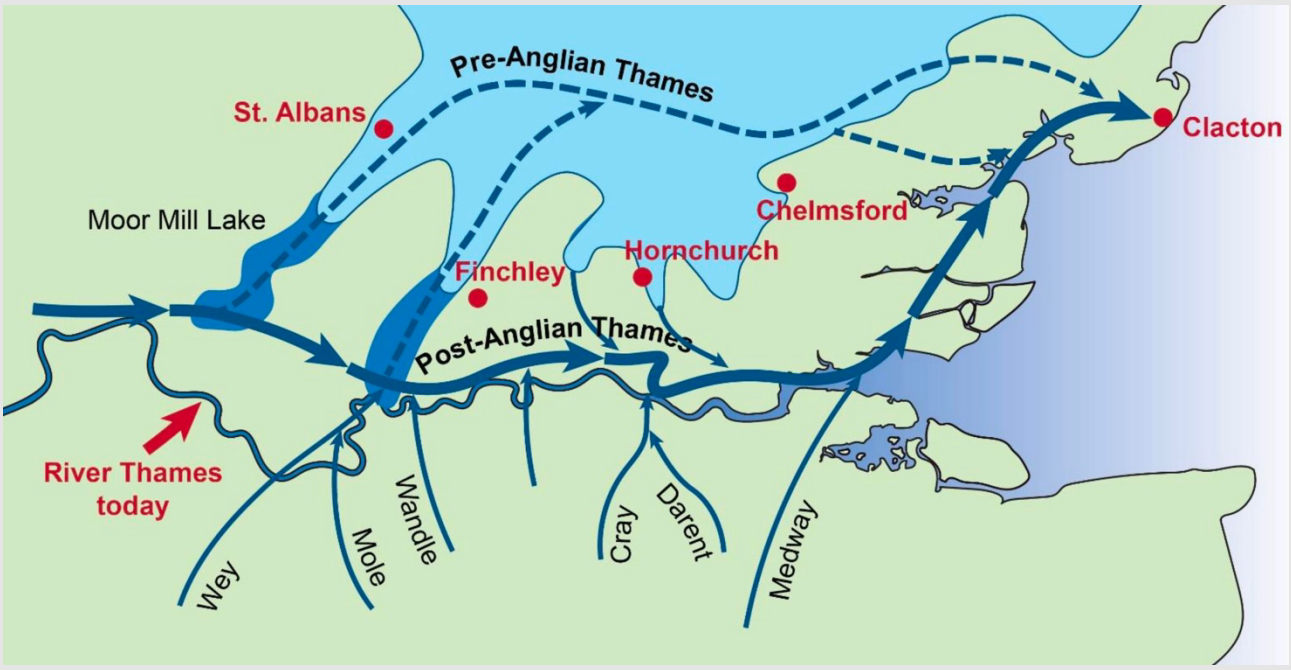
Hollow Ponds is an artificial lake, albeit fed by natural springs, which was created by forest enclosure and the extraction of the Boyn Hill Gravels during the late 18th Century (Figure 7). This aggregate was mainly used for road building. It is therefore sometimes difficult to determine whether the surrounding gravel deposits are *in situ* or made ground. Nevertheless, examples of clearly stratified and sometimes cemented ferricrete layers are encountered on this area of flat ground at an elevation of 30 m, formed as a flood plain of the post-diversionary Thames. Geologically, the pond is in Boyn Hill Gravels which unconformably overly London Clay (see Box 3 below). This junction gives rise to the springs that feed the ponds.

Previously called 'Buxton Water' the pond was enlarged by connecting a series of smaller gravel pits in the 19th Century under the direction of the Forest Conservators, at least two further enlargements were made in the first half of the 19th Century (Hoy, 2010).

[3] https://www.oed.com

Box 3. Geological Formations on Leyton Flats

The Boyn Hill Gravel Formation post-date the Anglian glaciation and are dated to Marine Isotope Stage (MIS) 10-11 (c. 400 - 424 ka). The southerly growth of ice at around 500 ka blocked the course of the Thames and diverted it south of the ice sheet, eventually reaching its current position. Post-Anglian, post-diversionary Thames gravels are mainly classified by their elevation, with the older gravels occurring at the higher altitudes and the youngest in the current Thames floodplain. The Boyn Hill Gravels are some of the oldest of the Anglian to post-Anglian river gravels. Cold and cool climates will produce the most erosion and the preserved river gravels were mainly deposited in such conditions on the floodplain of the ancestral Thames. The river would have been broad and braided with extensive floodplains. The modern Saskatchewan River (below), which drains the Columbia Ice Sheet in the Rocky Mountains is a similar environment, albeit one in an area of recently active mountain building, which is in marked contrast to the low elevation, passive continental margin which was occupied by Walthamstow in the Pleistocene.



Above, diversion of the River Thames by the Anglian Ice Sheet (Dee McLean, after Bridgland & Gibbons, 1997)

The Boyn Hill Gravels sit unconformably on London Clay. They are orange-coloured, ochre-rich sediments composed of clasts of angular flint (77-81%), rounded flint (5-10%), vein quartz (4-7%), quartzite (1.5-5%), Greensand chert (2.5-4%) and less than 1% of other lithologies (Strange, 1992). Lenses of silt, mottled red and grey clay and secondary ochres in the form of ferricretes are interbedded with coarse grained, poorly-sorted gravels (Clements et al., 2013). A number of lithic tools of the biface 'twisted ovate' type have been found in the Boyn Hill Gravels (Juby, 2011) revealing that hominins were living and hunting in this area at the time (and indeed, tools of this type are considered to be restricted to MIS 10-11. These people were probably early *Homo neanderthalensis* (the oldest UK remains of *H. neanderthalensis* have been found in the overlying MIS 11 Swanscombe interglacial deposits). Mammal fossils have not been found in this unit. The base of the Boyn Hill Gravels occur 20-34 m above the present Thames floodplain, extending upwards to a maximum elevation of 40 m above this datum. This unit is probably 5-6 m thick in this locality, one of the main reasons that this unit was extensively quarried in the 19th century.

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Box 3 (continued).



The Saskatchewan River in Alberta, Canada is a large, braided river system which is a similar environment (with the exception of the mountains!) to the ancestral River Thames which deposited the Boyne Hill Gravels.

Hollow Ponds is today the only boating lake in Epping Forest and is a haven for waterfowl and a large number of species have been recorded here. At the time of writing a black swan is in residence on the pond. This species (*Cygnus atratus*) is a native of Australia, and this one has probably escaped from a park. Freshwater pearl mussels (*Margaritifera margaritifera*) are common in the pond and shells can often be found on the shores of the pond.



Figure 7. Ochreous and cemented Boyn Hill Gravels on the margins of Hollow Ponds, Leyton Flats.

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From Hollow Ponds return NE, crossing the Flats towards the SW corner of Eagle Pond.

13. Eagle Pond

Eagle Pond probably dates from as early as 1715 when it was constructed by damming the Snares Brook, which drains from Gilbert's Slade into the River Roding. It is clearly shown on John Rocque's maps (Rocque, 1735; Rocque, 1746), where it is named Snares Pond or Snaresbrook Pond (Figure 8). Rumour has it that this was made to provide a head for fountains of the gardens of Wanstead Park, overseen by the gardener Adam Holt (Hoy, 2010) however this story is contested (see Hughes, 2014) on the grounds that the water would have needed to flow uphill to the Basin in Wanstead Park along an elusive 'Holt Channel' which occurs on some 'old maps' of the area. This is not necessarily true as Eagle pond is at 30 m OD and the Basin at 25 m. A direct route could have taken the water on an incline from the pond to a site just east of the Basin, and a long drive follows such a route is on Rocque's map. A watercourse is not marked but could have been culverted or could have flowed to the east of the drive. A link with the pond to the Basin cannot be proved, but from the evidence of Rocque (1735), such a link is hard to ignore.

Box 4. Wanstead House and Park

Wanstead House (completed 1722) once occupied Wanstead Park until it was demolished in 1825. It was one of the greatest country houses built in Georgian England. The landowner Sir Richard Child, 1st Viscount Castlemain and 1st Earl Tylney, commissioned the architect Colen Campbell to design the house in the Neo-Palladian style on a grand scale. The gardens – incorporating spectacular fountains and other water features, which rivalled those of the Palace of Versailles - were designed by George London. The park was further modified by Humphrey Repton in the early 19th Century. The Estate was inherited by Catherine Tylney-Long who unwisely married the notorious rake, William Wellesley-Pole (the nephew of the Duke of Wellington). William squandered his wife's money and as a consequence, the contents of the house were auctioned off, the house was demolished and the building materials were also sold to pay debts – it remains a devastating loss to the architectural heritage of NE London.



Wanstead House (detail) by William Havell, 1815
https://en.wikipedia.org/wiki/Wanstead_House#/media/File:Richard_Westall_-_Wanstead_House_-_B1977.14.5186_-_Yale_Center_for_British_Art.jpg

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The SW corner of Eagle Pond sits on the unconformable boundary of the Boyn Hill Gravel Formation with the London Clay and a spring arises here called the Birch Well, which was an important source of drinking water. Birch Well spring-water was always available (albeit at a price) during times of drought (Hoy, 2010).

Across the pond is the imposing pile of Snaresbrook Crown Court, a building inaccessible to the general public without a summons. This Jacobean-style, early Victorian building was originally an 'Infant Orphanage Asylum', an early work by the prominent Victorian architect George Gilbert Scott completed in 1843 (Cherry et al., 2007). It was converted into a court of law in the 1970s. Its building materials are potentially of interest; Pevsner describes it as being built of a 'grey limestone from near Whitby' with dressings of Bath Stone and Caen Stone. Pevsner's geology sometimes miss the mark so without direct observation, it is impossible to confirm this provenance. Limestones from the Jurassic Ravenscar Group (which outcrops around Whitby) may potentially have been used for construction here, but far better 'grey' building limestones are derived from the Corallian (i.e. Malton Oolite) which in NE Yorkshire outcrops further south extending inland from Scarborough with an east-west strike (Powell, 2012).

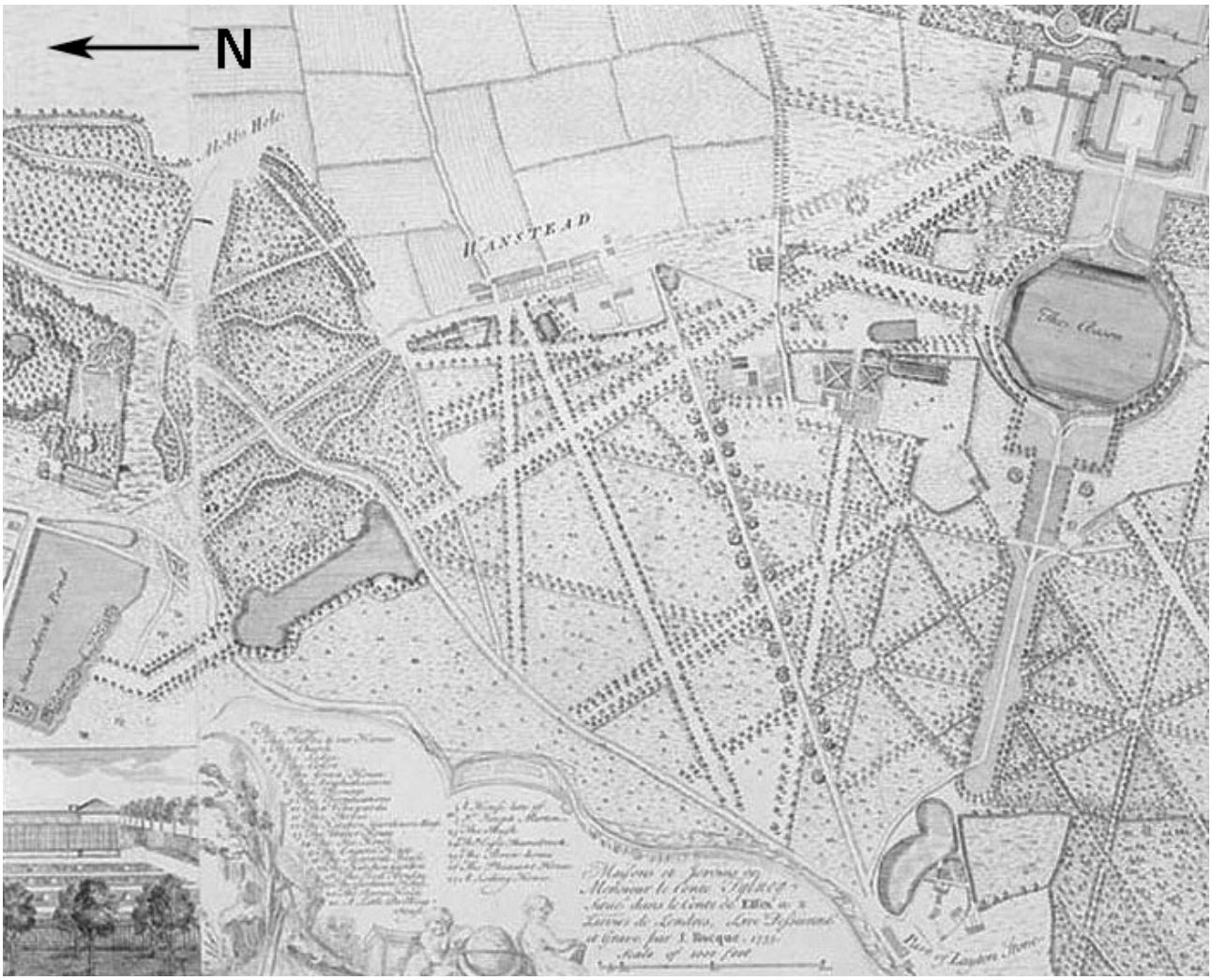

Figure 8. John Rocque's map of Wanstead Park published in 1735. The map is orientated with East to the top. Eagle Pond (Snaresbrook Pond is on the far left. The octagonal basin in Wanstead park is on the right. The map seems to indicate that the two water features are connected, though this cannot be proven. Available from the British Library: http://www.bl.uk/onlinegallery/onlineex/maps/uk/004954015.html

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The Eagle was a coaching inn at the junction with Snaresbrook Road and Hollybush Hill. The current building dates from the 18th Century, with the balcony added in the 19th Century.

Return to Snaresbrook Road and turn left to walk eastwards to Hollybush Road. Turn right at the junction, and cross over Hollybush Road at the junction with Snaresbrook High Street.

14. Hollybush Hill Drinking Fountain

This small drinking fountain was constructed in 1872 (Cherry et al., 2007) using grey Cornish Granite of the Carnmenellis-Bodmin type for plinths and troughs of pink Peterhead Granite from Stirlinghill, Aberdeenshire. It has a distinctive wooden clapperboard 'spirelet'.

The walk finishes at Snaresbrook Station (Central Line) which is on Snaresbrook High Street, just beyond the drinking fountain. Connections into Central London and beyond may be made by taking the southbound service to Stratford. Snaresbrook High Street is a very pleasant suburban shopping street and prior to departure, one might recommend refreshments at one of the many coffee shops or at The Cuckfield public house. From bus stop SH on Snaresbrook High Street, an extremely leisurely and circuitous journey on the W12 bus service will return walkers to Walthamstow Central underground and overground stations. Alternatively, walking back across Leyton Flats to the bus stand outside Whipps Cross Hospital provide a larger range of transport destinations.

References

Ashon, W., 2017, Strange Labyrinth: Outlaws, Poets, Mystics, Murderers and a Coward in London's Great Forest., Granta Books, London, 416 pp.

BGS, 1996, Geological Survey of England and Wales 1:50,000 geological map series, Sheet 257 Romford, Bedrock and Superficial., https://largeimages.bgs.ac.uk/iip/mapsportal.html?id=1001751

BGS, 2006, Geological Survey of England and Wales 1:50,000 geological map series, Sheet 256 North London, Bedrock and Superficial., https://largeimages.bgs.ac.uk/iip/mapsportal.html?id=1001750

Bridgland, D. R. & White, M. J., 2014, Fluvial archives as a framework for the Lower and Middle Palaeolithic: patterns of British artefact distribution and potential chronological implications. Boreas, 43, 543–555.

Cherry, B., O'Brien & Pevsner, N., 2007, London 5: East., Pevsner's Architectural Guides to the Buildings of England, Yale University Press, New Haven & London., 864 pp.

Clements, D., Collins, P. & Davidson, A., 2013, GLA 71 Hollow Ponds, Leyton Flats. London Geodiversity Partnership, 3 pp. http://londongeopartnership.org.uk/wp/wp-content/uploads/2018/08/GLA71.pdf

Dunhill, M. J., 2019, A History of Highams Park and Hale End., The History Press, Stroud., 168 pp.

Ellison, R. A., Woods, M. A., Allen, D. J., Forster, A., Pharaoh, T. & King, C., 2004, Geology of London. Special Memoir for 1: 50 000 Geological sheets 256 (North London), 257 (Romford), 270 (South London) and 271 (Dartford) (England and Wales)., British Geological Survey, Keyworth, Nottingham., 114 pp.

Essex Field Club (2006-2021), Geology Site Account; Waterworks Corner. https://www.essexfieldclub.org.uk/portal/p/Geology+Site+Account/s/Waterworks+Corner+(road+excavations)/o/Waterworks+Corner+(road+excavations)

Haysom, T., 2020, Purbeck Stone, Dovecote Press, Dorset, 310 pp.

Hoy, K., 2010, Getting to know Epping Forest., Friends of Epping Forest, London, 214 pp.

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Hughes, B., 2014, Wanstead Watercourses: the "River Holt"., Wanstead Wildlife. https://www.wansteadwildlife.org.uk/index.php/en/leyton-flats73?id=136

Juby, C., 2011, London before London; reconstructing a Palaeolithic Landscape. *Unpublished PhD Thesis*, Royal Holloway, University of London., 484 pp.

King C. & King A. D., 1976, A London Clay Section at Waterworks Corner, Woodford, Essex, Tertiary Research 1, 1, 21-24

Lloyd, H. B. W. S., 1953, Gipsy Smith's Memorial Stone. Journal of the Gipsy Lore Society, Series 3, 32, 74-75.

Powell, J., 2012, A Building Stone Atlas of North Yorkshire East and York., Strategic Stone Study, English Heritage, 19 pp.

Powell, W. R. (Ed.), 1973, 'Walthamstow: Introduction and domestic buildings', in *A History of the County of Essex: Volume 6*, pp. 240-250. *British History Online* http://www.british-history.ac.uk/vch/essex/vol6/pp240-250

Rocque, J., 1735, A Plan of the House, Gardens, Park, and Plantations of Wanstead, the Seat of the Earl of Tylney. http://www.bl.uk/onlinegallery/onlineex/maps/uk/004954015.html

Rocque, J., 1746, An Exact Survey of the citys of London Westminster ye Borough of Southwark and the Country near ten miles round: begun in 1741 & ended in 1745 by John Rocque Land Surveyor; & Engrav'd by Richard Parr (Sheet 3 of 6). https://en.wikipedia.org/wiki/John_Rocque%27s_Map_of_London,_1746

Strange, P. J., 1992, A new nomenclature for the River Terrace Deposits of North London. British Geological Survey Technical Report, WA/92/52., British Geological Survey, Keyworth, Nottingham., 22 pp.

Sumbler, M. G., 1996, London and the Thames Valley; Fourth Edition, British Regional Geology, British Geological Survey/HMSO, London., 173 pp.

Vestry House Museum, 2016, The big houses: part 1., The E-List, May 1, 2016, 30-31., https://issuu.com/e17_listings/docs/e_list_may_16/32

Whitaker, W. & Thresh, J. C., 1916, The water supply of Essex from underground sources., Memoirs of the Geological Survey of England and Wales., HMSO, London, 509 pp.

Further information on the building stones encountered on this walk, as well as other building stones used in the area is available at http://londonpavementgeology.co.uk

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This walk is also available as a Geotrail on London Geodiversity Partnership's website.

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