APPENDIX 5 – SITE ASSESSMENTS

The following types of site are

	Site of Special Scientific Interest (SSSI)	7
	Regionally Important Geological Site (RIGS)	29
	Locally Important Geological Site (LIGS)	34

CONTENTS

Sites in London's Foundations 2012, reviewed by LGP 2021

Sites in London's Foundations 2012, reviewed by LGP 2021

Sites recommended by London Geodiversity Partnership in 2021

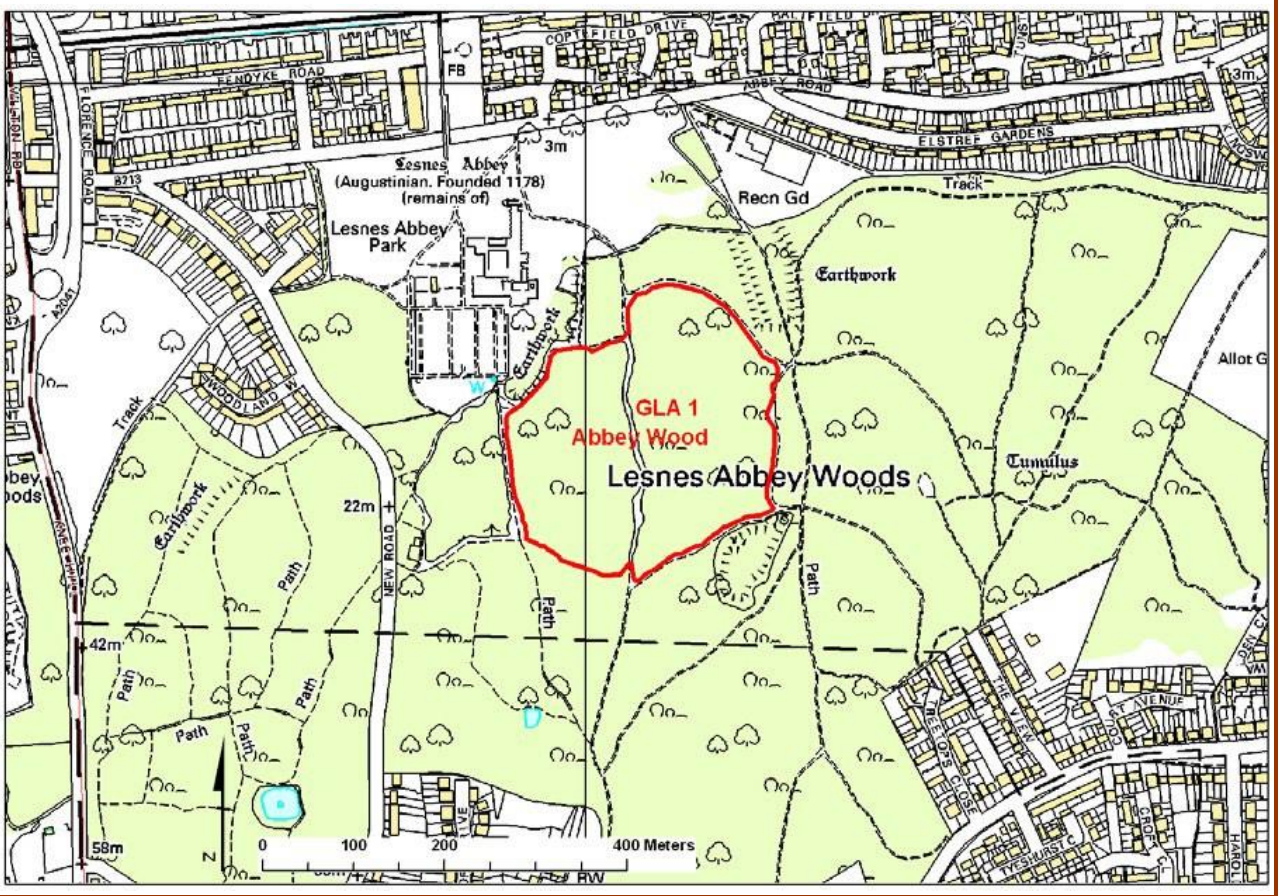
Sites GLA 10, 11, 13, 16, 21, 23, 27 and 28 were originally described in the 2009 edition of *London's Foundations* but were deleted in the 2012 edition in favour of better sites elsewhere.

BGS – British Geological Survey
LGP – London Geodiversity Partnership
MIS – Marine Isotope Stage, sometimes referred to as Oxygen Isotope Stages (OIS)
MOL – Metropolitan Open Land
LNR – Local Nature Reserve
NNR – National Nature Reserve
SAC – Special Area of Conservation
SINC – Site of Importance for Nature Conservation (divided in Metropolitan, Borough Grade I and II and Local)

GLA 1 Abbey Wood

Grid Reference: TQ 480 786 [SE2 0AX]	Site Type: Natural exposure
Site Area (hectares): 6.89	Current use: Recreational land
Site ownership: London Borough of Bexley	Borough: London Borough of Bexley
Field surveyor: Joanna Brayson Last visited: Diana Clements/Laurie Baker	Date: December 2007 Date: March 2020
Current geological designation: SSSI Citation: 1003513.PDF (naturalengland.org.uk)	Other designations: LNR; Metropolitan SINC (Lesnes Abbey Woods and Bostall Woods)

Site Map OS Topography © Crown Copyright



Stratigraphy and Rock Types

Time Unit: Eocene	Rock Unit: Lessness Shell Bed (Blackheath Beds, termed Blackheath Formation by Hooker, 2010; Blackheath Member of the Harwich Formation by the BGS); base of the Thames Group
Rock Type: Sand and Gravel	Details: Medium-fine-grained sand containing numerous black rounded pebbles with a mainly brackish fauna but including marine species and occasional bones of rare land mammals.
Time Unit: Paleocene-Eocene	Rock Unit: Lambeth Group
Rock Type: Sand, silt and clay	Details: There is no evidence that the Lambeth Group underlies the SSSI, in fact for much of Lesnes Abbey Wood it seems that the Lambeth Group is absent. The Blackheath Beds have channelled down through these strata and much of the Thanet Formation as well. The marine sand of the Upnor Formation has been located at Knee Hill.
Time Unit: Paleocene	Rock Unit: Thanet Formation (formerly Thanet Sand)
Rock Type: Sand	Details: Glauconitic coated nodular flint at base, overlain by pale yellow-brown, fine-grained sand that can be clayey and glauconitic. Can be seen at Chalky Dell (GLA 38) within Lesnes Abbey Woods

Site Description

Abbey Wood contains some of the most fossiliferous deposits in the Greater London area providing remains of a rare but diverse mammal assemblage of early Tertiary age. The deposits are also important for studies in the evolution of bird faunas. It also contains a large number of marine molluscs and sharks' teeth.

The site covers deposits of early Eocene age (Lesnes Shell Bed within the Blackheath (Beds) Formation). Excavations of these Beds have yielded an important mammalian fauna of 46 species of which 15 have been named for specimens from the site, described by Jerry Hooker (2010). Additional species are still being added during most excavations. This is comparable to sites in the Paris Basin, and contains elements resembling those of the Wasatchian faunas of North America. Upnor Formation (base of the Lambeth Group, latest Paleocene) and Thanet Formation are present but the Woolwich Formation (early Eocene) is cut out by the unconformity at the base of the Blackheath beds which represents incised channel fill. Over much of Lesnes Abbey Woods, the Upnor Formation is also cut out.

This site also yields remains of one of only two birds described from the Paleocene of Great Britain. A lower mandible has been reconstructed as the holotype of *Marinavis longirostris*, which is the only bird of this type known from this period. It appears to have been a large Procellariiform sea bird and would seem to indicate a coastal fauna. The site has great potential in that it might help solve the problem of Procellariiform - Pelecaniform ancestry.

Hooker, J.J. 2010. The mammal fauna of the Early Eocene Blackheath Formation of Abbey Wood, London. *Monograph of the Palaeontographical Society.* London. (Publ. No. 634, part of Vol. 154, 1-162).

Information can be found on www.lesnesabbeywoods.org

Assessment of Site Value

Geodiversity topic: Palaeontology, sedimentology lithostratigraphy, evolution and palaeobiogeography.

Access and Safety

Aspect	Description
Safety of access	Paths run through the park and woods from the roadside. Fossil collecting site is situated a short distance from a path in the woods and surface collecting is permitted. Fairly level and obstruction free.
Safety of exposure	Fossil collecting area consists of a flat fenced off area with an open entrance way. Safety procedures must be followed when excavating.
Permission to visit	The fossil beds can be visited at any time but if fossil collecting, you may remove no more than 2kgs of material from the site and do not dig more than two feet deep. Please refill any large or deep holes. Finds of vertebrate material should be taken to the Natural History Museum. All groups, schools and professional digs should contact the Council at least one month in advance to book their visit, please note there is a charge for this, email: lesnesabbey@bexley.gov.uk
Current condition	As an SSSI, the site is very well maintained by the park rangers.
Current conflicting activities	None.
Restricting conditions	Excavation and group visits only by prior permission. Feature only visible with excavation.
Nature of exposure	Flat fenced off area within woods within which Palaeontology of the Lessness Shell Bed can be excavated from the sediment.

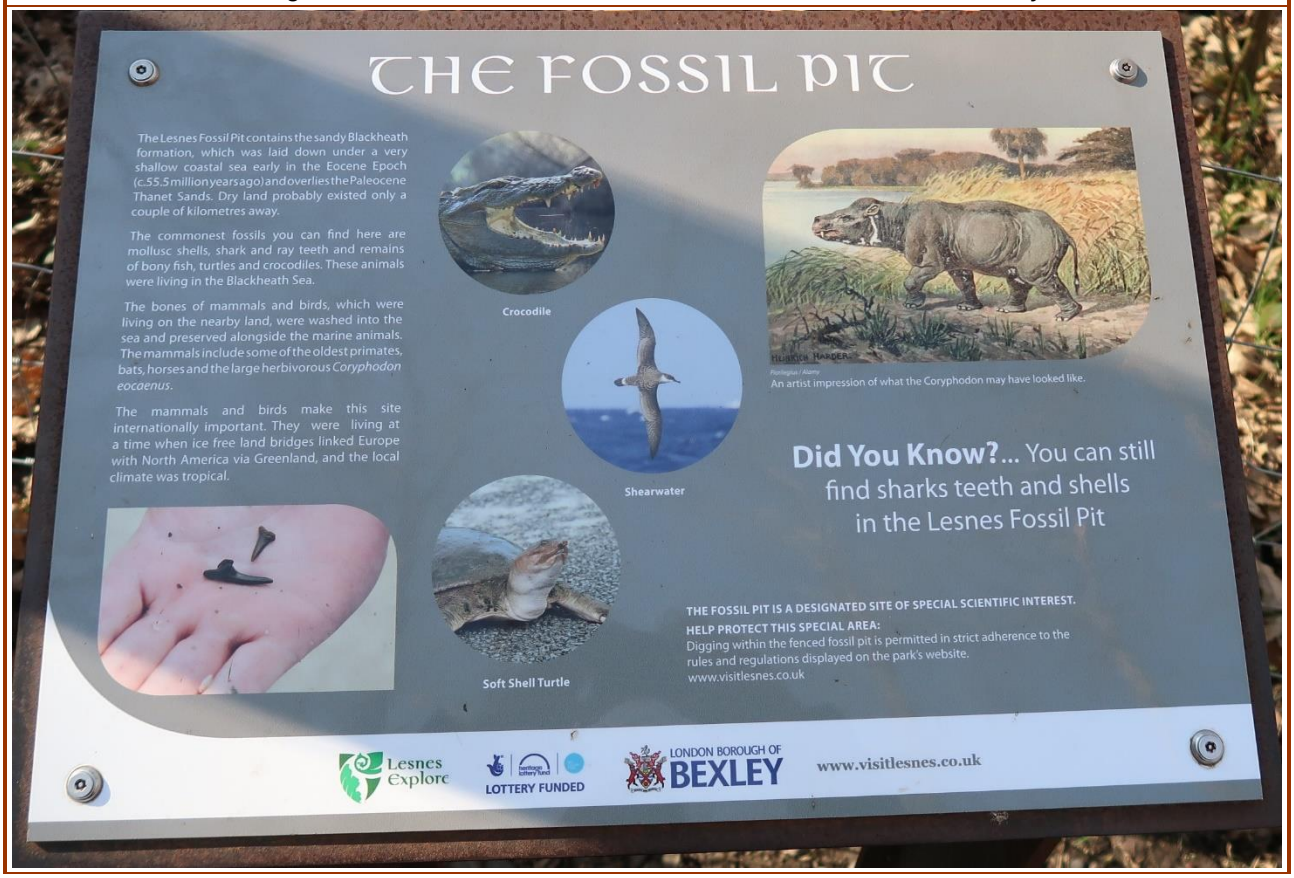
Culture, Heritage & Economic

Aspect	Description	Rating
Historic, archaeological & literary associations	The park in which the SSSI is situated also contains the remains of Lesnes Abbey which was established in 1178. Much research has been carried out on the site.	10
Aesthetic landscape	The park provides an important green space within the local area and spectacular views towards Canary Wharf and beyond. A new Centre, Lesnes Lodge, was opened in September 2017 with café and toilet facilities as well as a hall used for events. The Green Chain Walk runs through the park.	8

History of Earth Sciences	Evolution of early mammal and rare bird faunas; Procellariiform – Pelecaniform ancestry. Details in Hooker, 2010.	8
Economic geology	Within the park there was an old chalk quarry, Chalky Dell (GLA 38), which was of local economic importance. At the top of the quarry, the contact with the overlying Thanet Sand has been exposed. No Lambeth Group is evident.	4
GeoScientific Merit		
Geomorphology	None within the SSSI but it is evident that the Blackheath Beds have channelled down, cutting out the Lambeth Group	4
Sedimentology	Sedimentary processes leading to preservation of fauna.	6
Palaeontology	Diverse mammalian assemblage; rare bird fauna within a marine shell bed	7
Igneous / mineral / metamorphic geology	None.	0
Structural Geology	None.	0
Lithostratigraphy	Junctions between three stratigraphic units lie within the larger area of Lesnes Abbey Wood	6
Potential use	Research, Higher/further education, School education, On-site interpretation.	
Fragility	Finite resource; natural overgrowing. The extent of the Lessness Shell Bed has already extended beyond the fenced off area. It is opened up each year by the Tertiary Research Group to excavate, in the search for the rare mammal fauna. It is dependent on the co-operation of the TRG for this access.	
Current Site Value		
Community	Area is used daily by the local community. In the 2017 upgrade of Lesnes Abbey Woods a wooden model of the large extinct early mammal *Coryphodon* was erected on the path to the fossil site.	10
Education	This site is available for group and school use by a wide range of users. See “Permission to visit” above. Included in GA Guide 68, Itinerary 6 (see references) and it is In the Green Chain Walk Geotrail: www.londongeopartnership.org.uk/geotrails/.	8
Geodiversity value		
SSSI: An excellently maintained site, with much research potential and educational value.		10
GLA 1 Abbey Wood		

The extinct mammal *Coryphodon* on the path leading to fossil enclosure. Photo: Laurie Baker, May 2016

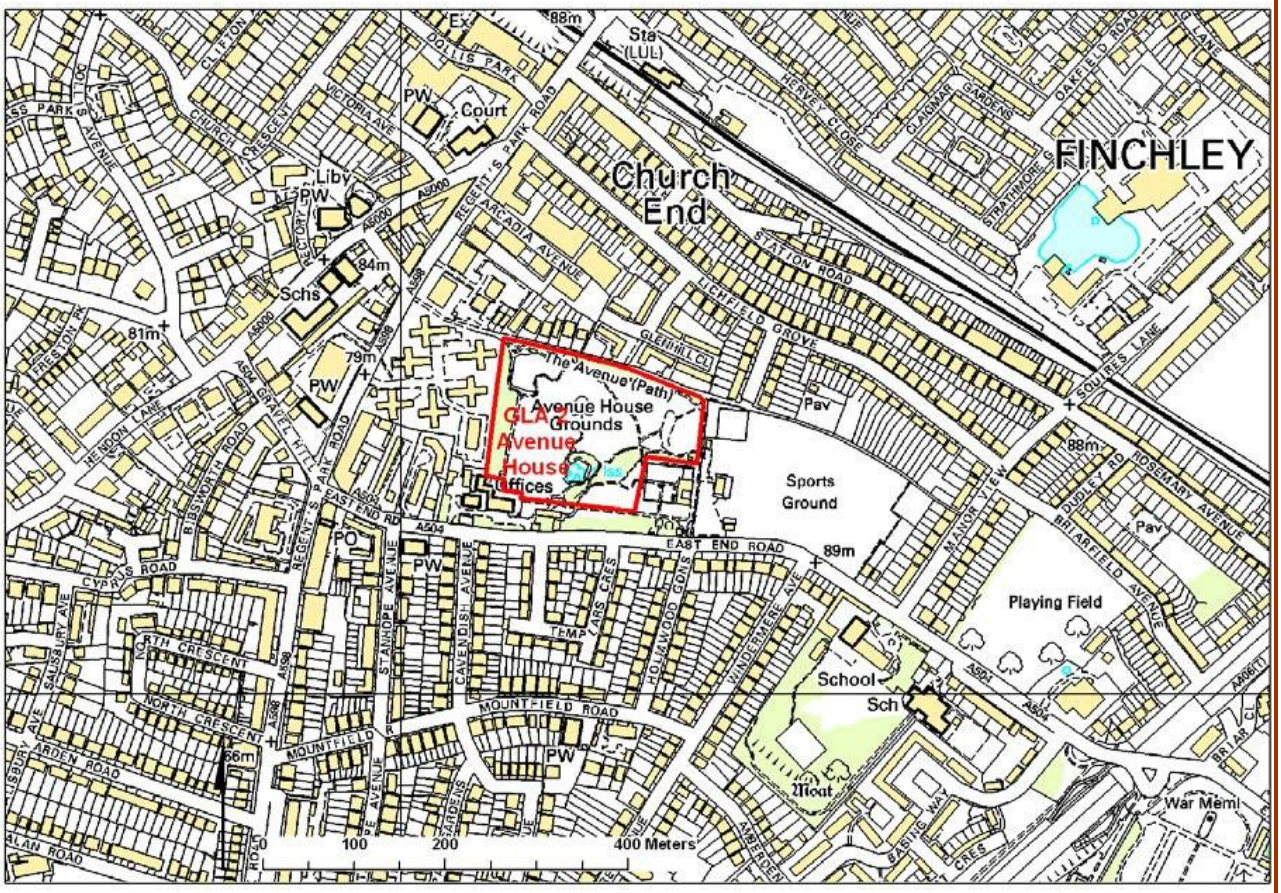
Collecting within the fenced fossil bed area. Photo: Diana Clements, May 2017



GLA 2 Stephens House (formerly known as Avenue House), Finchley

Grid Reference: TQ 2521 9026 (N3 3QE)	Site Type: Natural Exposure
Site Area (hectares): 3.17	Current use: Recreational Land
Site ownership: Avenue House Estate Trust	Borough: London Borough of Barnet
Field surveyor: Joanna Brayson Latest visit: Peter Collins	Date: January 2008 Date: 2019
Current geological designation: LIGS	Other designation: Listed Grade II; Local SINC (Avenue House Grounds)

Site Map OS Topography © Crown Copyright



Stratigraphy and Rock Types

Time Unit: Quaternary	Rock Unit: Lowestoft Formation, Albion Glacigenic Group
Rock Type: Till	Details: Chalky till, together with outwash sands and gravels, silts and clays. The till is characterised by its chalk and flint content.

Site Description

Park area with pebbly clay exposures (Till) beneath trees and in temporary exposures. One of the most southerly exposures of till deposited by the largest of the Pleistocene glaciations, the Anglian, c.450,000 years ago.

Assessment of Site Value

Geodiversity topic: Lithostratigraphy, sedimentology.

Access and Safety

Aspect	Description
Safety of access	Public park area, footpaths and open areas.
Safety of exposure	Some exposures adjacent to steps, care should be taken.
Permission to visit	Site has open access, contact Stephens House and Gardens for information on access for groups. www.stephenshouseandgardens.com
Current condition	Landscaped ground, exposures are small and mainly in wooded areas.

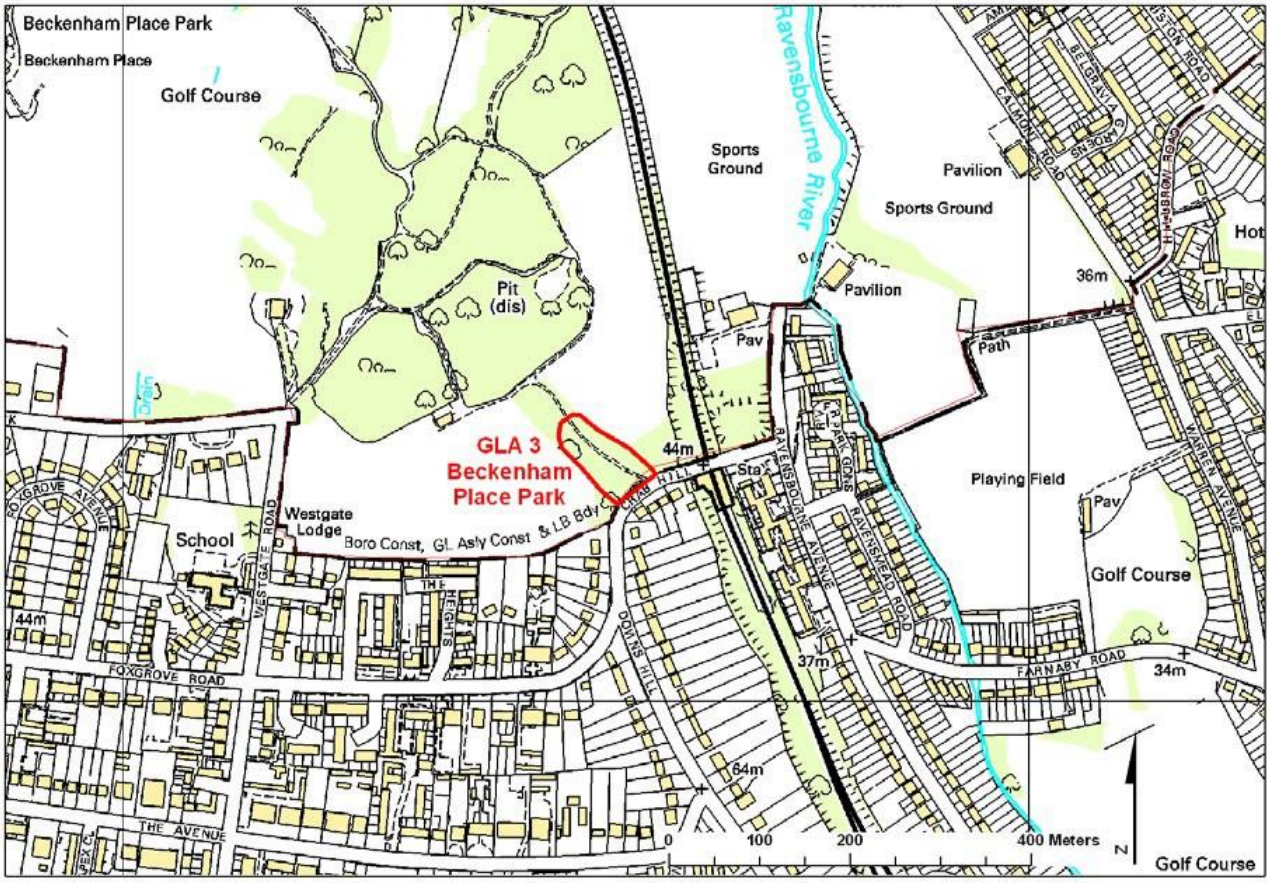
Current conflicting activities	Landscaping activities.	
Restricting conditions	Disturbance of grounds for further investigation would need permission.	
Nature of exposure	Patches of till in open areas between trees.	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	The site is the grounds of a Victorian Mansion which has a rich history. There is a museum about writing ink and the original owner, Henry Charles 'Inky' Stephens MP of the Stephens' Ink Company.	6
Aesthetic landscape	The park is very well maintained and well used by the community with wedding and other ceremonies being held in the house and grounds.	7
History of Earth Sciences	Relationship of various till units in Essex, East Anglia and the East Midlands.	8
Economic geology	None.	0
GeoScientific Merit		
Geomorphology	None.	0
Sedimentary	Till composition.	5
Palaeontology	None.	0
Igneous/mineral/ Metamorphic Geology	None.	0
Structural Geology	None.	0
Lithostratigraphy	Correlation of till with other locations.	6
Potential use	On-site interpretation; research.	
Fragility	Natural overgrowing; landscaping.	
Geodiversity value		
LIGS:	Small exposures in area with good potential for information for local community. Described in LGP Bus Pass Geology 1, *Round the southern limits of the Anglian Ice Sheet*	3
GLA 2 Stephens House		

Till exposure in grounds of Stephens House and Gardens

GLA 3 Beckenham Place Park

Grid Reference: TQ 3853 7026	Site Type: Natural exposure
Site Area (hectares): 0.51	Current use: Recreational land
Site ownership: London Borough of Lewisham	Borough: London Borough of Lewisham
Field surveyor: Joanna Brayson Latest visit: Paul Rainey	Date: January 2009 Date: 2019
Current geological designation: RIGS	Other designation: LNR and Metropolitan SINC (Beckenham Place Park)

Site Map OS Topography © Crown Copyright



Stratigraphy and Rock Types

Time Unit: Eocene	Rock Unit: London Clay Formation, Thames Group
Rock Type: Clay and silt	Details: Fine, sandy, silty clay/ clayey silt. Glauconitic at base.
Time Unit: Eocene	Rock Unit: Blackheath Member, Harwich Formation, Thames Group
Rock Type: Sand and gravel	Details: Sandy clays and sands; marine fauna; locally brackish; cemented pebble bed.

Site Description

Exposure of Harwich Formation (rounded flint pebbles with calcareous cement) near the entrance to the park.

Assessment of Site Value

Geodiversity topic: Sedimentology; lithostratigraphy.

Access and Safety

Aspect	Description
Safety of access	Exposures are either side of a Green Chain Walk within a public park.
Safety of exposure	Surrounding area is muddy, care should be taken near the exposures.
Permission to visit	Public space, recently regenerated park, many new paths with signs, Swimming lake added, Interactive map and many boards on website. Contact

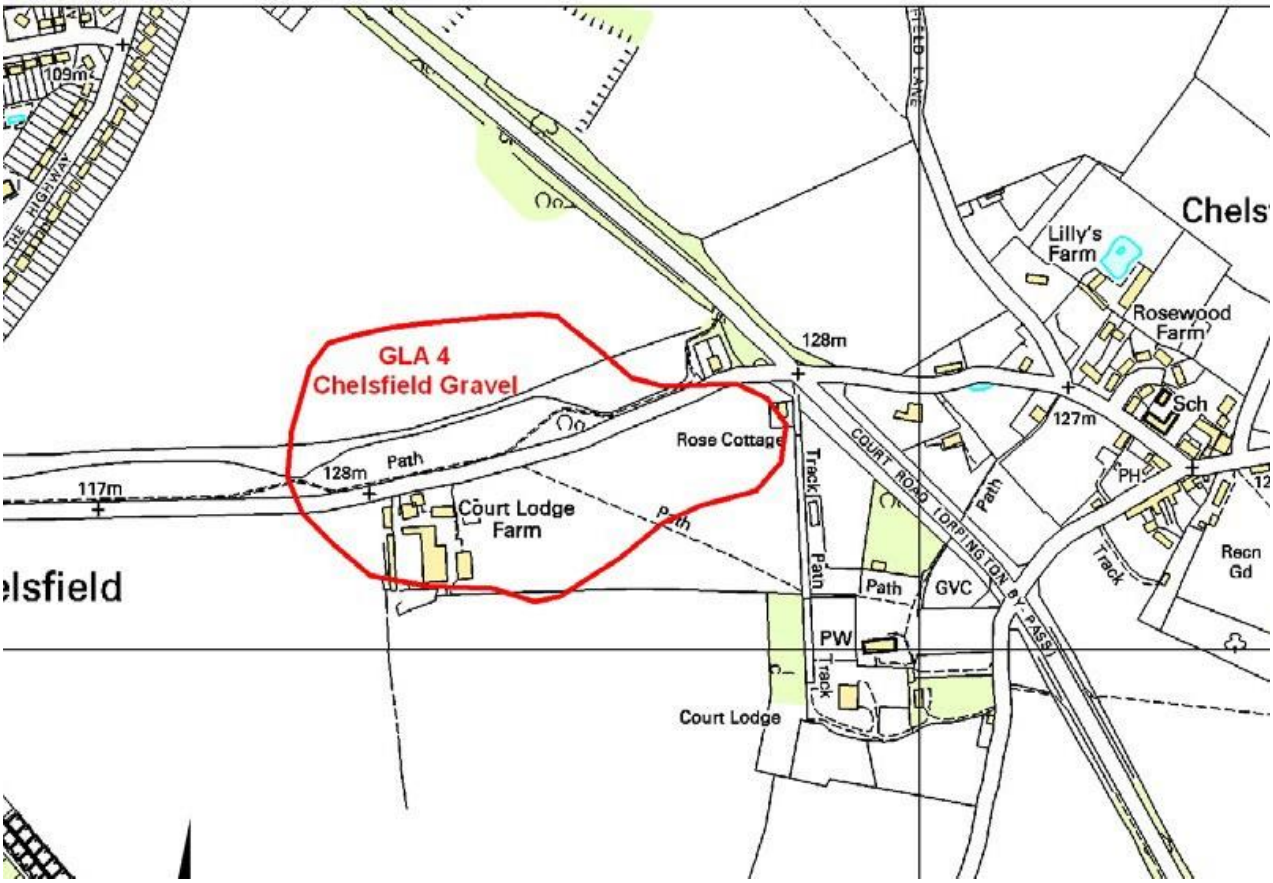
	Lewisham Borough for details.	
Current condition	Good – leaf cover in autumn means exposures slightly covered, possibly also by vegetation in summer.	
Current conflicting activities	None.	
Restricting conditions	None.	
Nature of exposure	Cemented blocks of rounded flint pebbles with calcareous cement near the entrance to the park.	
Culture, Heritage & Economic		
Aspect	**Description**	Rating
Historic, archaeological & literary associations	The park contains a Grade II listed Mansion which houses a golf club house.	4
Aesthetic landscape	Provides interesting entrance to park.	4
History of Earth Sciences	Cementation of conglomerate – environmental inferences.	6
Economic geology	None.	0
GeoScientific Merit		
Geomorphology	Slope beside the path exposes small outcrops	4
Sedimentology	Depositional environment.	6
Palaeontology	None.	0
Igneous/mineral/ Metamorphic Geology	None.	0
Structural Geology	None.	0
Lithostratigraphy	Correlation between outcrop and other outcrops of Harwich Formation.	6
Potential use	Research; higher further education; school education; on-site interpretation. Geotrail on Green Chain Walk and Capital Ring.	
Fragility	Natural overgrowing; weathering/erosion.	
Geodiversity value		
RIGS: Good exposure with easy access and good local facilities.		5
GLA 3 Beckenham Place Park		

Harwich Formation boulders and outcrop

GLA 4 Chelsfield Gravel

Grid Reference: TQ 476 642	Site Type: Natural exposure
Site Area (hectares): 9.55	Current use: Recreational land/agricultural land
Site ownership: Court Lodge Farm	Borough: London Borough of Bromley
Field surveyor: Joanna Brayson Last visited: Paul Rainey	Date: February 2008 Date: 2019
Current geological designation: RIGS	Other designation: Local SINC (Chelsfield Green)

Site Map OS Topography © Crown Copyright



Stratigraphy and Rock Types

Time Unit: Pliocene-Pleistocene	Rock Unit: Chelsfield Gravel Formation, Residual Deposits Group
Rock Type: Sand and gravel	Details: Well-rounded flint pebble gravels, sandy gravels, pebbly sands and sands. Lithologies similar to those in the Blackheath Member of the Harwich Formation from which it is thought to have been mainly derived.

Site Description

This is the type locality for the Chelsfield Gravel which has been reworked from the Harwich Formation. The deposit is interpreted as a head, partly let down with the underlying Thanet Sand into dissolution hollows in the Chalk below.

This outcrop covers an area of grassy footpaths frequented by dog walkers who use the nearby station car park. It also extends into farmland on either side which is where the gravel can be seen in ploughed fields. A viewpoint of the local area is situated at the edge of the open area. The Chelsfield Gravel can be viewed from here and geological information could be added to the existing sign.

Assessment of Site Value

Geodiversity topic: Lithostratigraphy; sedimentology.

Access and Safety		
Aspect	**Description**	
Safety of access	Footpaths leading to site from car park. Part of exposure across main road, caution should be taken crossing road.	
Safety of exposure	Exposure in ploughed fields on/adjacent to public footpaths. Be aware of farm machinery.	
Permission to visit	Access to some of the site is open, contact farm for access to remainder of site.	
Current condition	Mostly grassed over or part of ploughed fields. Disturbed where ploughed.	
Current conflicting activities	Farming.	
Restricting conditions	Site partially on working farmland.	
Nature of exposure	Gravel seen in ploughed fields.	
Culture, Heritage & Economic		
Aspect	**Description**	Rating
Historic, archaeological & literary associations	This is a newly defined unit as described in The Geology of London (Ellison 2004)	2
Aesthetic landscape	Located within public footpath area – well used by public.	6
History of Earth Sciences	Evidence of the erosion and re-working of the Harwich Formation.	4
Economic geology	None.	0
GeoScientific Merit		
Geomorphology	Distribution of deposit along with the Thanet Sand in hollows of the underlying Chalk.	6
Sedimentology	Reworking of Harwich Formation – surface processes.	6
Palaeontology	None.	0
Igneous/mineral/ Metamorphic Geology	None.	0
Structural Geology	None.	0
Lithostratigraphy	Relationship between bedrock and superficial deposits.	6
Potential use	Research; Higher Education; School Education; On-site Interpretation	
Fragility	Natural overgrowing; weathering/erosion.	
Current Site Value		
Community	Valuable open space for the local community.	10
Education		3
Geodiversity value		
RIGS: Only exposure of this local deposit with good access.		5

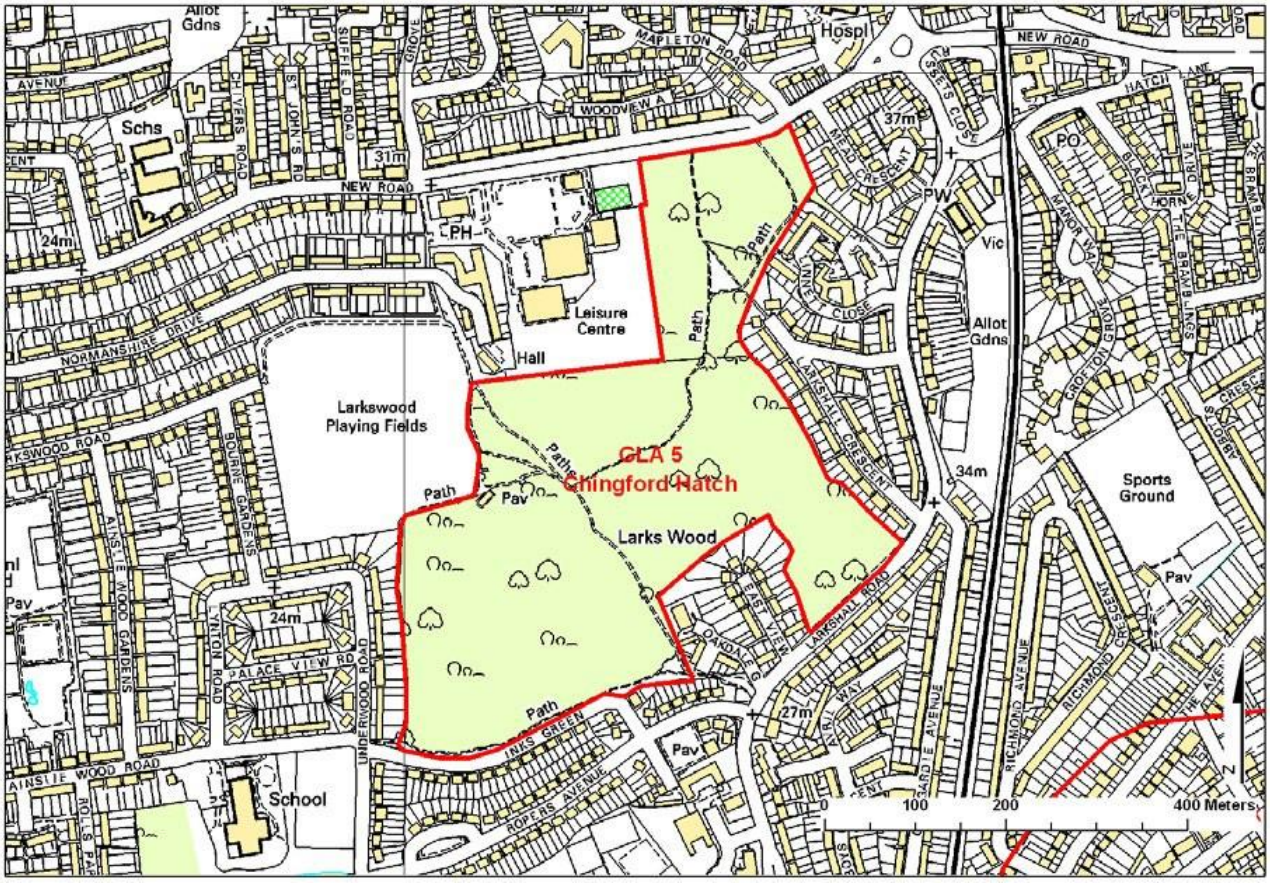
GLA 4 Chelsfield Gravel

View of feature forming edge of Chelsfield Gravel outcrop

GLA 5 Chingford Hatch

Grid Reference: TQ 3827 9259	Site Type: Natural Landform
Site Area (hectares): 17.87	Current use: Recreational Land
Site ownership: London Borough of Waltham Forest	Borough: London Borough of Waltham Forest
Field surveyor: Joanna Brayson Latest visit: Ruth Siddall, Diana Clements	Date: December 2010 Date: 2017
Current geological designation: LIGS	Other designation: Borough Grade I SINC (Larks Wood)

Site Map



Stratigraphy and Rock Types

Time Unit: Pleistocene	Rock Unit: Woodford Gravel Formation
Rock Type: Sand and gravel	Details: Sand and gravel, locally with lenses of silt, clay or peat and organic material.
Time Unit: Eocene	Rock Unit: London Clay Formation, Thames Group
Rock Type: Clay, silt, sand	Details: Fine, sandy, silty clay/ clayey silt. Glauconitic at base.

Site Description

A London Clay hillock in woodland (Larks Wood) near Chingford Hatch with a capping of Woodford Gravel at the highest point. The Woodford Gravel has been interpreted as the river terrace deposits of south-bank tributaries of the ancestral Thames. The gravel consists of angular flint (83%), rounded flint (14%), quartz (1%) and Lower Greensand Chert (1%) and is 3–4 m thick. It can be seen when the leaves are not abundant but it only covers a small area and there is no very obvious spring line.

Assessment of Site Value

Geodiversity topic: Lithostratigraphy; sedimentology; geomorphology.

Access and Safety

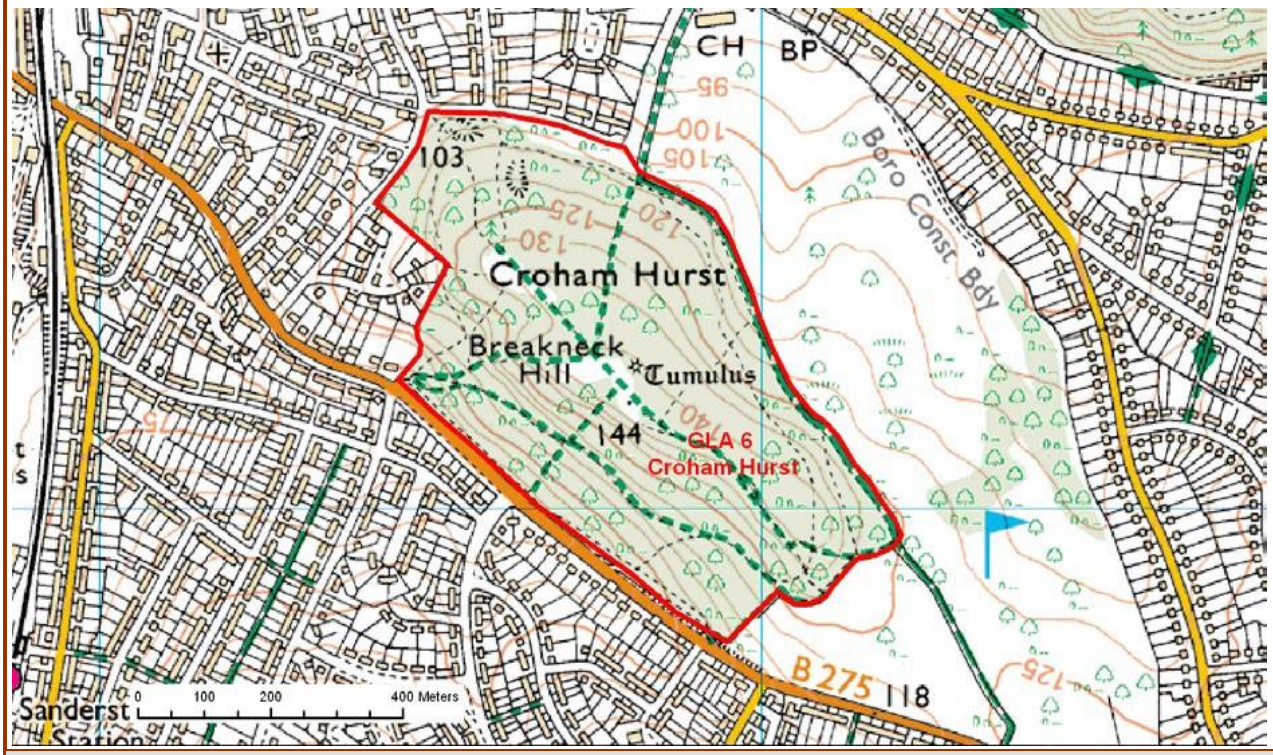
Aspect	Description
Safety of access	Footpaths through woodland.

Safety of exposure	Exposure in woodland – observe general safety in woodlands.	
Permission to visit	Open access.	
Current condition	Ok – exposures small and scattered.	
Current conflicting activities	None.	
Restricting conditions	Trees and Leaf cover in autumn.	
Nature of exposure	Small exposures in woodland.	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	Mentioned in London Borough of Waltham Forest information.	2
Aesthetic landscape	Footpaths through woods used by local community.	4
History of Earth Sciences	Distribution of gravels used to determine location and behaviour of ancestral Thames.	6
Economic geology	None.	0
GeoScientific Merit		
Geomorphology	Distribution of exposures of Woodford Gravel used to determine location relative to ancestral Thames.	6
Sedimentology	Research into composition of the gravels could give more information on the provenance of the gravels and therefore the river that deposited them.	6
Palaeontology	None.	0
Igneous/mineral/ Metamorphic Geology	None.	0
Structural Geology	None.	0
Lithostratigraphy	Relationship of river terrace deposits.	6
Potential use	Research; further education; on-site interpretation.	
Fragility	Dumping; natural overgrowing; weathering/erosion.	
Current Site Value		
Community	Valuable green space.	8
Education		2
Geodiversity value		
LIGS: Small exposures with reasonable access for local community.		4
GLA 5 Chingford Hatch		

GLA 6 Croham Hurst

Grid Reference: TQ 338 630	Site Type: Natural exposure
Site Area (hectares): 34.57	Current use: Recreational land
Site ownership: London Borough of Croydon	Borough: London Borough of Croydon
Field surveyor: Joanna Brayson Last visited: Paul Rainey, Frequently visited by Paul Sowan, CNHSS	Date: April 2010 Date: 2016
Current geological designation: RIGS	Other designation: SSSI (Biological); Metropolitan SINC (Croham Hurst)

Site Map



Stratigraphy and Rock Types

Time Unit: Eocene	Rock Unit: Blackheath Member, Harwich Formation, Thames Group
Rock Type: Sand and gravel	Details: Sandy clays and sands; marine fauna, locally brackish; Pebble bed cemented in places
Time Unit: Paleocene-Eocene	Rock Unit: Lambeth Group NB Not seen and probably absent, channelled into by Blackheath Member.
Rock Type: Sand and gravel	Details: Glauconitic sands overlain by grey clays and sands with Brackish fauna and interleaved red and variegated clays and sands.
Time Unit: Paleocene	Rock Unit: Thanet Formation
Rock Type: Sand	Details: Glauconite-coated, nodular flint at base, overlain by pale yellow-brown, fine-grained sand that can be clayey and glauconitic.
Time Unit: Late Cretaceous	Rock Unit: Seaford Chalk Formation, White Chalk Subgroup**.**
Rock Type: Chalk	Details: Chalk

Site Description

Small exposures of calcite cemented rounded flint pebbles belonging to the Harwich Formation can be found at the top of this steep inlier. Evidence of chalk and Thanet Formation can also be found in landslips, animal holes, eroded surfaces and in fallen tree roots. The disused Chalk and Thanet Sand quarries are rather overgrown. Although the Lambeth Group should also be visible, it has been very elusive and it is possible that the Blackheath Beds are within a channel that has cut it out, at least for much of the hill. There are several information boards erected by Croydon Natural History and Scientific Society showing the location of the disused quarries and outcrops.

Assessment of Site Value		
Geodiversity topic: Sedimentology; lithostratigraphy, geomorphology.		
Access and Safety		
Aspect	**Description**	
Safety of access	Footpaths through woods. Slippery in autumn with leaf cover.	
Safety of exposure	As above.	
Permission to visit	Open access, check with local borough for organised visits.	
Current condition	Patchy exposures, hard to find in autumn due to leaf cover.	
Current conflicting activities	None.	
Restricting conditions	Small exposures in woods.	
Nature of exposure	Small exposures on floor of woodland.	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	Evidence of a Mesolithic settlement and occupation up until Bronze age burials.	6
Aesthetic landscape	Valuable green space.	6
History of Earth Sciences	Three different formations have been located at this site. Excavation could provide information on these formations and their boundaries, and confirm that the Lambeth Group is absent throughout.	6
Economic geology	None.	0
GeoScientific Merit		
Geomorphology	Shape of hill due to the properties of different formations.	6
Sedimentology	Depositional environment of four different formations.	6
Palaeontology	Possible in the chalk if excavated.	6
Igneous/mineral/ Metamorphic Geology	None.	0
Structural Geology	None.	0
Lithostratigraphy	Relationships between formations.	8
Potential use	Research; higher education; on-site interpretation.	
Fragility	Natural overgrowing; weathering/erosion.	
Current Site Value		
Community	Valuable green space.	10
Education	Information boards have been erected by the Croydon Natural History and Scientific Society but a leaflet published about the site is no longer available. Included in GA Guide 68, 2012, Itinerary 9 (see references). A friends group set up in 2002 has a website and organise events. See: https://friendsofcrohamhurstwoods.com/	4
Geodiversity value		
RIGS: Small exposures of a range of lithologies in woodland with adequate access.		6

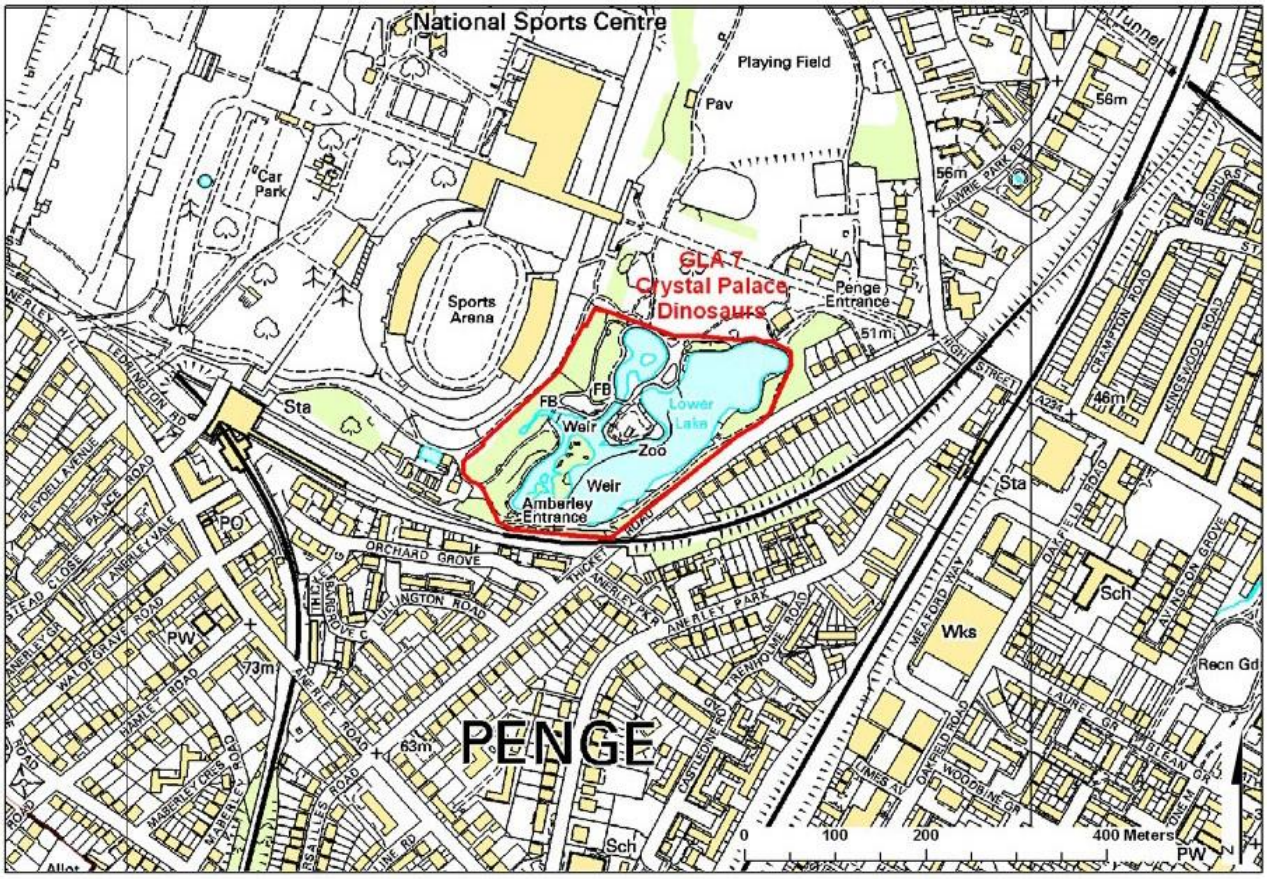
GLA 6 Croham Hurst

Exposure of cemented Blackheath pebbles within woodland at top of the hill

GLA 7 Crystal Palace Geological Illustrations

Grid Reference: TQ 3455 705	Site Type: Man-made artefact
Site Area (hectares): 5.37	Current use: Recreational land
Site ownership: London Borough of Bromley	Borough: London Borough of Bromley
Field surveyor: Joanna Brayson Last visited: Laurie Baker	Date: January 2011 Date: March 2020
Current geological designation: RIGS	Other designation: Listed building Grade I (At Risk); Borough Grade I SINC (Crystal Palace Park)

Site Map OS Topography © Crown Copyright



Stratigraphy and Rock Types

Time Unit: N/A	Rock Unit: N/A
Rock Type: N/A	Details: N/A

Site Description

The Crystal Park Dinosaurs and other extinct animals are distributed across several islands in lakes at the southern edge of Crystal Palace Park. These life-sized sculptures were designed and built by Benjamin Waterhouse Hawkins between 1852 and 1854 with some input from Sir Richard Owen. The collection includes 30 sculptures of 15 taxa of dinosaurs, other reptiles and mammals, although more had been planned until funding was cut. The models were the cutting edge of palaeontological knowledge at the time, giving the first glimpse of extinct animals 'in the flesh', the first 'walk through geologic time' and the first large scale public 'educational-entertainment', or 'visual education' for science. Although the reconstructions are now considered outdated and some of the taxa are no longer recognised, they provide insight into how scientific knowledge was built on insights from scant remains. The site also includes 40 constructed geologic illustrations, made from original material, that demonstrate geological processes and fossil outcrops in time series. The sculptures and landscapes remain a globally significant site for the history of science.

The models are made of mixed materials including concrete, fossils and metal, needing regular maintenance. Although a full restoration project was completed in 2002, subsequent lack of maintenance has left the site needing urgent work again. Recent conservation has been piecemeal, with the Standing

Iguanodon and eight more models worked on in 2016-2017, but most of the other 21 animal models and all of the geological illustrations are still badly in need of conservation, showing major cracks and losing significant parts. New interpretive signs have improved visitors' appreciation of the site. As a result of seven years campaigning and raising the public profile of the site by Friends of Crystal Palace Dinosaurs, they were added to the UK's official 'Heritage at Risk Register' by Historic England in February 2020. This is critical first step to gaining needed support for further works.

Public engagement has been key to bringing the site back to life. The Palaeo Planting Project brings volunteers on site to replant the islands with historically appropriate vegetation for the evolutionary narrative, The Friends also stepped in to remediate the unfortunate removal of access to the site during hydrological works in 2017. A global campaign allowed the re-building of bridge to allow conservation of the sculptures, landscape maintenance and guided public access. Support from over 700 individual, business, celebrity and institutional donors resulted in an award-winning bridge installed in 2021 after three years of work.

Assessment of Site Value

Geodiversity topic: Palaeontology, geology; public outreach of science, history of science

Access and Safety

Aspect	**Description**
Safety of access	Very good – pathways suitable for wheelchairs. Fencing around lakes.
Safety of exposure	Models are viewed from pathways.
Permission to visit	Public park, 24-hour access on foot, parking and toilets available during park opening hours.
Current condition	The Grade I listed sculptures and site have deteriorated badly since the last major conservation project in 2002-3, with some subsequent piecemeal interventions. The Friends of Crystal Palace Dinosaurs (cpdinosaurs.org) have been actively campaigning for restoration work which began with the *Iguanodon* in 2017, continued with work on eight water-based sculptures in 2017, and a stabilisation intervention of the iconic *Megalosaurus* in 2021. In February 2020 all 30 models, 40 geological illustrations and landscapes were added to the Heritage 'At Risk' Register of Historic England.
Current conflicting activities	None.
Restricting conditions	None.
Nature of exposure	Dinosaur and other extinct animal models with interpretation panels within a public park. The models are surrounded by appropriate planting.

Culture, Heritage & Economic

Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	Extensive historic links with all the significant palaeontologists of the 19th C including Buckland, Mantell, Cuvier, Anning, Owen, Ansted, Paxton, Queen Victoria and Prince Albert, recurrent in literature including Dickens, and in popular culture of the 20-21st Century. Grade I Historic Asset listing, thus among the UK's most internationally significant sites.	10
Aesthetic landscape	Situated in a well-used public park, well maintained, landscape constructed to tell narrative and provide aesthetic experience.	8
History of Earth Sciences	History of palaeontology, highlights the increase in information since the models were made but also the interest in geology at the time.	8
Economic geology	Man-made illustrative sections explaining economic geology.	8
GeoScientific Merit		
Geomorphology	Illustrates faulting, limestone cliffs and waterways.	2
Sedimentology	Man-made illustrative models explaining sedimentation in relation to economic geology. Rocks of appropriate ages are included within the display.	8
Palaeontology	Dinosaur, other reptile, mammal, plant models, including a few real specimens, e.g., Purbeck fossil tree.	8

Igneous / mineral / metamorphic geology	Some aspects of illustrative sections illustrate metamorphism.	6
Structural Geology	Faults are illustrated in the man-made sections.	6
Lithostratigraphy	Illustrated in the man-made sections.	6
Potential use	School education; tourist attraction.	
Fragility	Needs continuous care and maintenance.	
Current Site Value		
Community	Valuable open space used every-day. On Capital Ring and Green Chain Walk	10
Education	Excellent introduction to geology and palaeontology, history and philosophy of science with on-site interpretation. Included in GA Guide 68, Itinerary 8 (see references).	8
Geodiversity value		
RIGS: Excellent educational site accessible and interesting to all age groups.		8
GLA 7 Crystal Palace Dinosaurs		

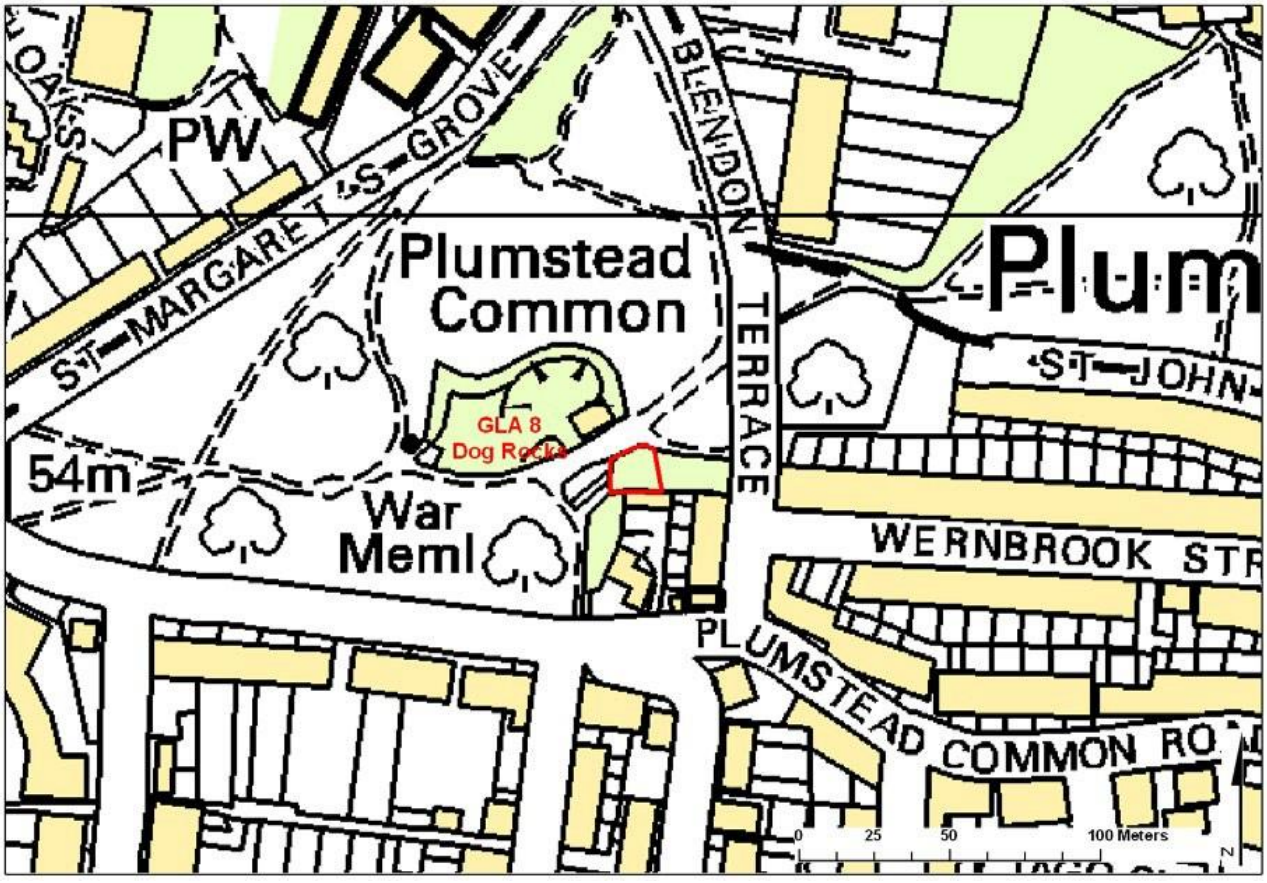
Restored Iguanodon sculptures, lived 139.8–124 million years ago. Photo: Laurie Baker, March 2020

Geological strata: Carboniferous coal measures. Photo: Diana Clements, November 2012

GLA 8 Dog Rocks

Grid Reference: TQ 448 778	Site Type: Natural Exposure
Site Area (hectares): 0.02	Current use: Recreational land
Site ownership: Royal Borough of Greenwich	Borough: Royal Borough of Greenwich
Field surveyor: Joanna Brayson Last visited: Paul Rainey, Laurie Baker, Diana Clements	Date: Summer 2011 Date: January 2016
Current geological designation: RIGS (Adopted)	Other designation: MOL

Site Map



Stratigraphy and Rock Types

Time Unit: Eocene	Rock Unit: Blackheath Member, Harwich Formation, Thames Group
Rock Type: Sand and gravel	Details: Sandy clays and sands; marine fauna, locally brackish; : Black rounded pebbles locally cemented

Site Description

Large boulders of Harwich Formation in a public park in the shrubbery opposite the entrance to the Adventure Playground. The boulders consist of rounded flint pebbles with a calcareous cement and are named Dog Rocks for their similarity in silhouette. The steep bank crossing the common here is one side of a former quarry and the blocks were probably put on one side by the quarry men.

Assessment of Site Value

Geodiversity topic: Sedimentology.

Access and Safety

Aspect	Description
Safety of access	In public park, adjacent to footpath.
Safety of exposure	Boulders stable.
Permission to visit	Open access.
Current condition	Exposure can easily become overgrown and obscured.

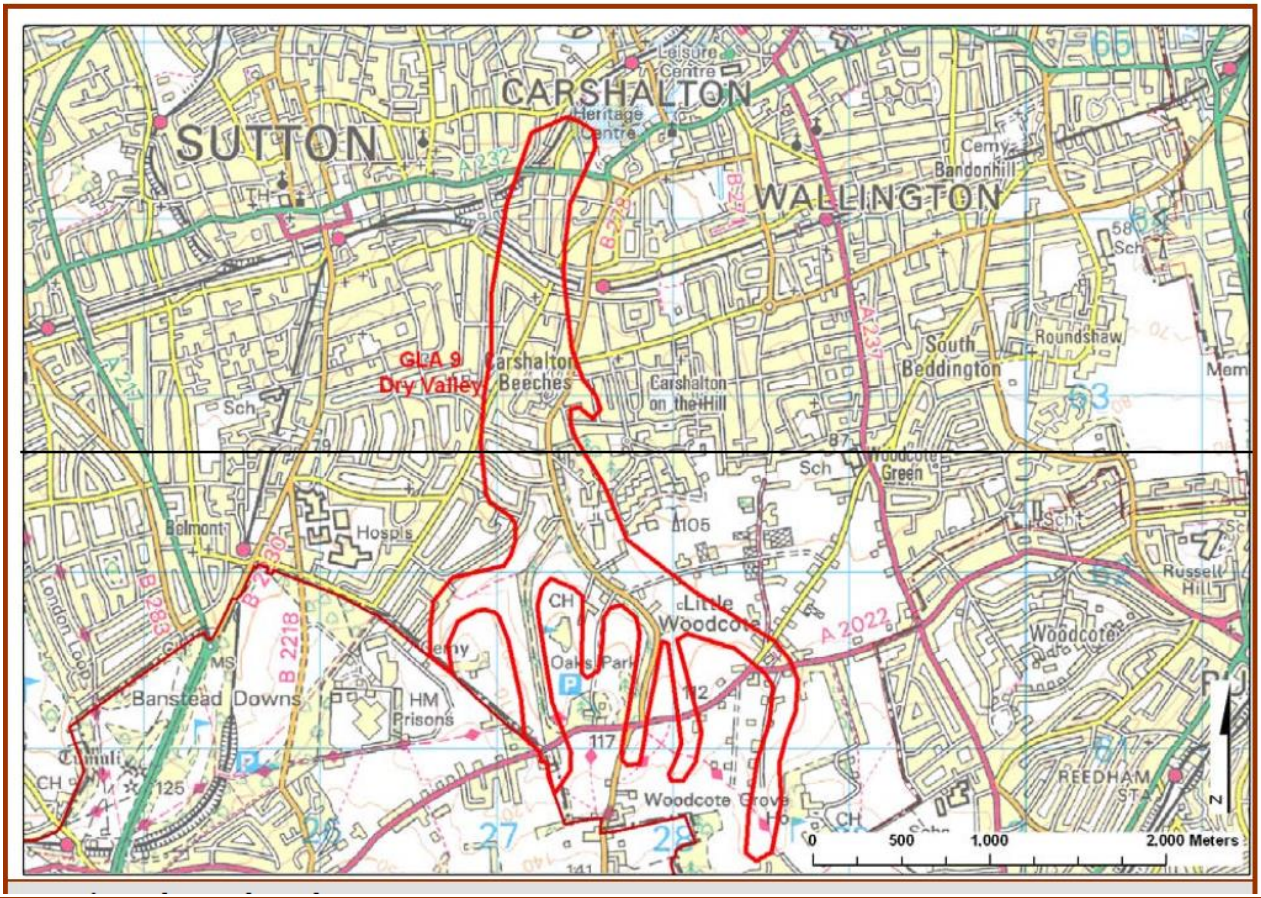
Current conflicting activities	None.	
Restricting conditions	None.	
Nature of exposure	Boulders in public park.	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	None.	0
Aesthetic landscape	Valuable open space.	6
History of Earth Sciences	Environment of deposition and history – cementation.	4
Economic geology	None, probably a former quarry.	0
GeoScientific Merit		
Geomorphology	None.	0
Sedimentology	Deposition and cementation of the Harwich Formation.	6
Palaeontology	None.	0
Igneous / mineral / metamorphic Geology	None.	0
Structural Geology	None.	0
Lithostratigraphy	Position of exposure within Harwich Formation.	6
Potential use	School education; on-site interpretation.	
Fragility	Weathering/erosion; vandalism.	
Current Site Value		
Community	Area used by local community every-day.	10
Education	Included in Geotrail along the Green Chain Walk, see www.londongeopartnership.org.uk/geotrails; Included in GA Guide 68, Itinerary 9 (see references).	4
Geodiversity value		
Adopted RIGS: Good exposure in an urban area; suffers from vandalism.		5
GLA 8 Dog Rocks		

Dog Rocks (Harwich Formation). Photo: August 2008

GLA 9 Carshalton Urban Dry Valley

Grid Reference: TQ 272 629	Site Type: Natural landform
Site Area (hectares): 228.20	Current use: Urban area
Site ownership: Urban area	Borough: London Borough of Sutton
Field surveyor: Joanna Brayson Latest visit: Diana Clements, Paul Rainey	Date: December 2009 Date: February 2018
Current geological designation: LIGS	Other designation: Borough Grade I SINC (partially in seven)

Site Map **OS Topography © Crown Copyright**



Stratigraphy and Rock Types

Time Unit: Late Cretaceous	Rock Unit: Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation Undifferentiated, Chalk Group
Rock Type: Chalk	Details: Chalk

Site Description

A dry valley in the Chalk running through the area of Carshalton Beeches.
Dry valleys are formed during periods of glaciation when the normally permeable chalk becomes frozen and water is forced to run over the surface, eroding the rock and creating a valley. Now the chalk has thawed, the water is once again able to flow underground leaving the valley dry. In this case, the Dry Valley pinpointed (TQ 272 629) has been completely urbanised but remains remarkable as a deeply incised valley running to the west of Beeches Avenue and best seen along Harrow Road, Downside Road, Staplehurst Road and Fullerton Road. It continues beyond Sutton into the Surrey countryside.

Assessment of Site Value

Geodiversity topic: Geomorphology

Access and Safety

Aspect	Description
Safety of access	Feature runs through urban area – visible from side of road.

Safety of exposure	Urban area – beware of traffic.	
Permission to visit	Urban area – feature does not require access to private land.	
Current condition	Feature is built upon but clearly visible.	
Current conflicting activities	Buildings and roads cover the area but still visible.	
Restricting conditions	None.	
Nature of exposure	Dry valley in urban area.	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	None.	0
Aesthetic landscape	Forms the landscape.	8
History of Earth Sciences	Paths of old rivers can be determined by the dry valleys.	6
Economic geology	None.	0
GeoScientific Merit		
Geomorphology	Shape and location of valley can be used to interpret periglacial processes.	8
Sedimentology	None.	0
Palaeontology	None.	0
Igneous / mineral / metamorphic geology	None.	0
Structural Geology	None.	0
Lithostratigraphy	None.	0
Potential use	School education.	
Fragility	Development (already occurred).	
Current Site Value		
Community	Urban area – forms part of living environment.	10
Education		4
Geodiversity value		
LIGS: Good feature in an urban area but with little open space.		4
GLA 9 Dry Valley		

Dry Valley within urban setting: Staplehurst Road, Carshalton. Photo: Geoff West, 2020

GLA 12 Finsbury Gravel, Sadler's Wells

Grid Reference: TQ 3147 8281	Site Type: Natural exposure
Site Area (hectares): 0.23	Current use: Recreational land
Site ownership: London Borough of Islington	Borough: London Borough of Islington
Field surveyor: Joanna Brayson Latest visit: Diana Clements	Date: January 2008 Date: September 2019
Current geological designation: LIGS	Other designation: Local SINC (Spa Green Garden)

Site Map OS Topography © Crown Copyright

Stratigraphy and Rock Types

Time Unit: Pleistocene	Rock Unit: Finsbury Gravel Member, Maidenhead Formation, Thames Catchments Subgroup
Rock Type: Sand and gravel	Details: Sand and gravel, locally with lenses of silt, clay or peat.

Site Description

Small park area with gravel in borders. The Finsbury Gravel may be related to a phase of deposition of the Lynch Hill Gravel close to the confluence of the rivers Lea and Thames. Site of Islington Spa, famous for chalybeate water from the gravels.

Assessment of Site Value

Geodiversity topic: Sedimentology; Lithostratigraphy, water source.

Access and Safety

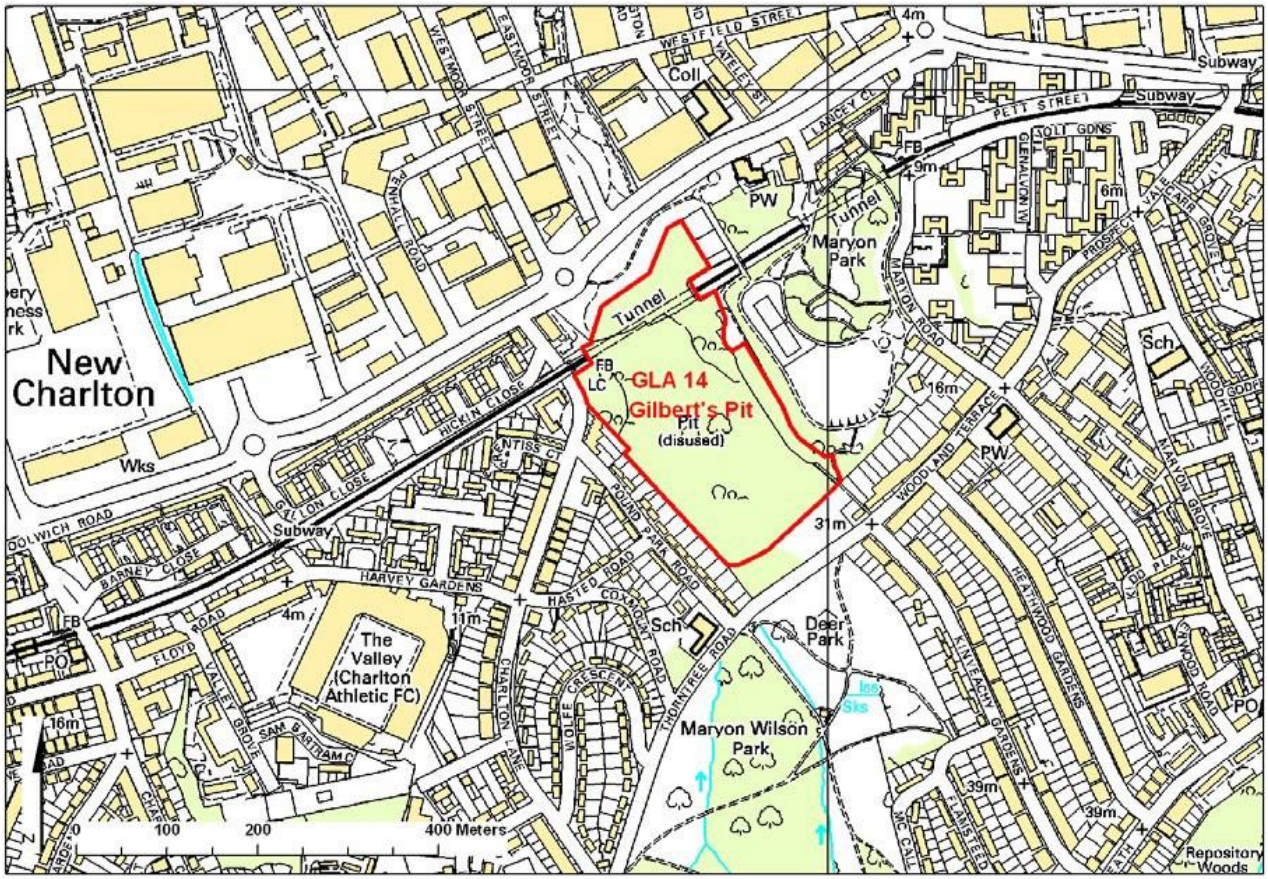
Aspect	Description
Safety of access	In public park – footpaths.
Safety of exposure	Exposure adjacent to and level with paths.
Permission to visit	Open space – contact Islington Borough Greenspace division at greenspace@islington.gov.uk or 020 7527 2000.
Current condition	Landscaped, probably disturbed.
Current conflicting activities	Landscaping.

Restricting conditions	None.	
Nature of exposure	Exposures in borders of park.	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	Spa Green is the site of the historic Islington Spa. It highlights importance of the gravels as a source of water for early development.	6
Aesthetic landscape	Park of valuable open space.	6
History of Earth Sciences	Evolution of local river systems. Influence of geology on development.	6
Economic geology	Water and associated tea gardens and spa	0
GeoScientific Merit		
Geomorphology	Position of gravels – reconstruct river systems. Thames terrace at 30m.	6
Sedimentology	Environment of deposition, provenance.	6
Palaeontology	None.	0
Igneous/mineral/ Metamorphic Geology	None.	0
Structural Geology	None.	0
Lithostratigraphy	Relationship between different terrace gravels.	6
Potential use	Research; school education; on-site interpretation.	
Fragility	Natural over-growing.	
Current Site Value		
Community	Local community pass through site every day. There is opportunity for interpretation board.	10
Education		4
Geodiversity value		
LIGS: Very small exposures in small park in urban area. The Finsbury Gravel is of very limited extent. It is an important part of Islington water story.		3
GLA 12 Finsbury Gravel		

Exposure of gravel in borders in Spa Green

GLA 14 Gilbert's Pit

Grid Reference: TQ 418 786	Site Type: Former quarry works
Site Area (hectares): 5.20	Current use: Fenced area within recreational land
Site ownership: London Borough of Greenwich	Borough: Royal Borough of Greenwich
Field surveyor: Joanna Brayson Latest visit: Laurie Baker/Diana Clements	Date: January 2008 Date: December 2018
Current geological designation: SSSI Citation: 1003340.PDF (naturalengland.org.uk)	Other designation: Borough Grade I SINC (Maryon Park, Gilbert's Pit and Maryon Wilson Park)
Site Map	OS Topography © Crown Copyright



Stratigraphy and Rock Types	
Time Unit: Eocene	Rock Unit: Blackheath Member, Harwich Formation (per BGS); Blackheath Formation of Hooker (2010), Thames Group
Rock Type: Sand and gravel	Details: rounded Blackheath pebbles within sands; marine fauna, locally brackish.
Time Unit: Paleocene-Eocene	Rock Unit: Woolwich (Charlton Member of King, 2016), Reading and Upnor Formations, Lambeth Group
Rock Type: Sand and gravel	Details: Glauconitic marine sands of the Upnor Formation overlain by grey clays and sands with Brackish fauna and interleaved red and variegated clays and sands.
Time Unit: Paleocene	Rock Unit: Thanet Formation
Rock Type: Sand	Details: Glauconite-coated, nodular flint at base, overlain by pale yellow-brown, fine-grained sand that can be clayey and glauconitic. Visible on south face only.

Site Description

Gilbert's Pit provides the most complete sections through Paleogene beds in the Greater London area. It forms a key Tertiary site for stratigraphic studies and is particularly important for a palaeographic reconstruction of the Woolwich and Reading and Upnor Formations as well as providing visual evidence of the strata beneath London for engineers working on projects beneath the Metropolis.

The site covers a disused pit cut into a sequence of Paleogene sediments dating from approximately 55 million years ago. Faces are present on the eastern and southern sides and rise to over 20 metres above the pit floor. A narrow causeway separates the eastern and southern exposures from an abutting face of a second pit at Maryon Park.

The faces formerly provided a sequence from the Chalk, through the overlying Thanet Formation and Woolwich Reading & Upnor Formations (Lambeth Group). Now only the Lambeth Group is visible on the east face where steps and a viewing platform have been erected. The capping of Blackheath Beds is best viewed from the ridge along the top. The south face reveals all the lithologies except the Chalk (which is covered by wartime rubble) but the Blackheath Beds are much reduced (lower level). Some of the beds are highly fossiliferous, yielding mollusc, rare fish, plant and reptile remains. Within the Woolwich Formation, the Woolwich Shell Bed (Charlton Member) in particular is noted for an abundant but very low-diversity brackish water molluscan fauna. The Woolwich Formation also includes the Striped Loams (Leaf-bed of Lewisham) where occasional plant material can be found.

The site has attracted scientific study for over 120 years and a substantial amount of literature has been published on the various geological features present. The fossil fauna has been described in particular detail.

Assessment of Site Value

Geodiversity topic: Palaeontology; sedimentology; lithostratigraphy.

Access and Safety

Aspect	Description
Safety of access	Access to actual site is restricted by a fenced area but site can be viewed from footpaths adjacent to fenced off area or more closely by obtaining a key from the Park Rangers at Greenwich Council. Steps and a viewing platform have been erected up the east face which is the most accessible.
Safety of exposure	Exposure at the top of the quarry, along the ridge above the east face, dividing Gilbert's Pit from the adjacent Maryon Park is eroding rapidly and there is a danger that it will break through obscuring the exposed face and making access to the Blackheath Beds at the top more difficult. There are currently proposals to construct a bridge across the danger area. The south face is fenced off but with access can be reached; climbing the slope is dangerous with risk of failure of a large cavity in the Thanet sand.
Permission to visit	Entry is via gates to (a) steps to the east face, (b) to the slope on the south face (not advised) and (c) at north end of site for ridge along the top (to view Blackheath Beds). Access can be obtained from Park Rangers at Greenwich Council: parks@royalgreenwich.gov.uk or 020 8856 0100.
Current condition	Conserved on a regular basis but vegetation and slumping can obscure the faces of the pit if not maintained.
Current conflicting activities	Lack of maintenance; locked gates on fence.
Restricting conditions	Controlled access.
Nature of exposure	Old pit faces, fenced off, with information boards on both the east face and south face. Further details of the pit can be viewed on LGP website: www.londongeopartnership.org.uk/informationboardsandleaflets/#charlton

Culture, Heritage & Economic

Aspect	Description	Rating
Historic, archaeological & literary associations	Many	8
Aesthetic landscape	Highest point of site provides excellent view over much of Greater London. Also part of the Green-chain network of footpaths.	7
History of Earth Sciences	Environment of deposition.	6
Economic geology	Sand from the pit was used for glass making and for the Woolwich Arsenal. The pit is now viewed by engineers working on tunnelling projects under London.	5

GeoScientific Merit		
Geomorphology	None.	0
Sedimentology	Various formations – sedimentary environments. The variable nature of the beds can be compared in the two visible faces	8
Palaeontology	Highly fossiliferous beds containing brackish water fauna	8
Igneous/mineral/ Metamorphic Geology	None	0
Structural Geology	None	0
Lithostratigraphy	Succession of formations at one site.	8
Potential use	Research; further education; school education; on-site interpretation; an important training site for engineers tunnelling under London.	
Fragility	Natural overgrowing; geohazard; weathering/erosion.	
Current Site Value		
Community	Site passed by on a daily basis.	10
Education	Particularly important for engineers to learn about the variable nature of the Lambeth Group; part of the Green Chain Walk Geotrail – www.londongeopartnership.org.uk/geotrails. Included in GA Guide 68, Itinerary 6 (see references).	8
Geodiversity value		
SSSI: Excellent exposure of several lithologies with economic history. Information signs already present. Great potential for research and further site improvement allowing greater access to the top of the pit.		8

GLA 14 Gilbert's Pit

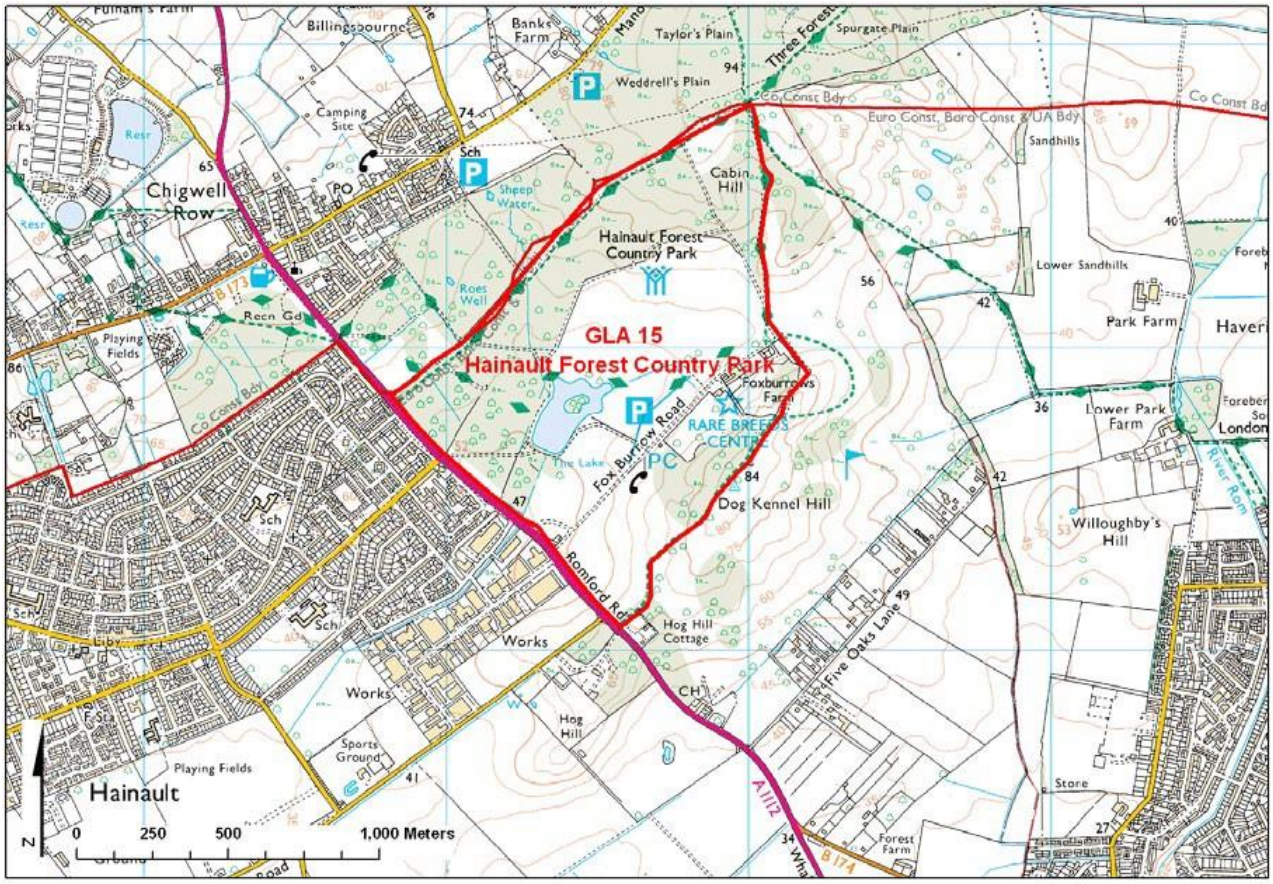
East face showing details of the Woolwich and Reading Formations from the viewing platform

South face seen from the bottom of the slope with the beds superimposed on the lithology

GLA 15 Hainault Forest Country Park

Grid Reference: TQ 4751 9294	Site Type: Natural exposure
Site Area (hectares): 119.45	Current use: Recreational land
Site ownership: London Borough of Redbridge	Borough: London Borough of Redbridge
Field surveyor: Joanna Brayson Latest visit: Ruth Siddall	Date: May 2011 Date: May 2019
Current geological designation: LIGS	Other designation: Metropolitan (Hainault Forest) and Borough Grade I (Hainault Country Park and Golf Course) SINCs

Site Map



Stratigraphy and Rock Types

Time Unit: Quaternary	Rock Unit: Head
Rock Type: Clay, silt, sand and gravel	Details: Polymictic deposit comprising poorly sorted and poorly stratified deposits formed mostly by solifluction and/or hill wash and soil creep.
Time Unit: Quaternary	Rock Unit: Lowestoft Formation, Albion Glacigenic Group
Rock Type: Till	Details: Chalky till, together with outwash sands and gravels, silts and clays. The till is characterised by its chalk and flint content.
Time Unit: Eocene	Rock Unit: Bagshot Formation, Bracklesham Group
Rock Type: Sand, silt and clay	Details: Pale yellow-brown to pale grey or white, locally orange or crimson, fine- to coarse-grained sand that is frequently micaceous and locally clayey, with sparse glauconite and sparse seams of gravel. The sands are commonly cross-bedded but some are laminated.
Time Unit: Eocene	Rock Unit: London Clay Formation Claygate Member at top, Thames Group
Rock Type: Clay, silt, sand	Details: Bioturbated or poorly laminated, blue-grey or grey-brown, slightly calcareous, silty to very silty clay, clayey silt and sometimes silt, with some layers of sandy clay. It commonly contains thin courses of carbonate

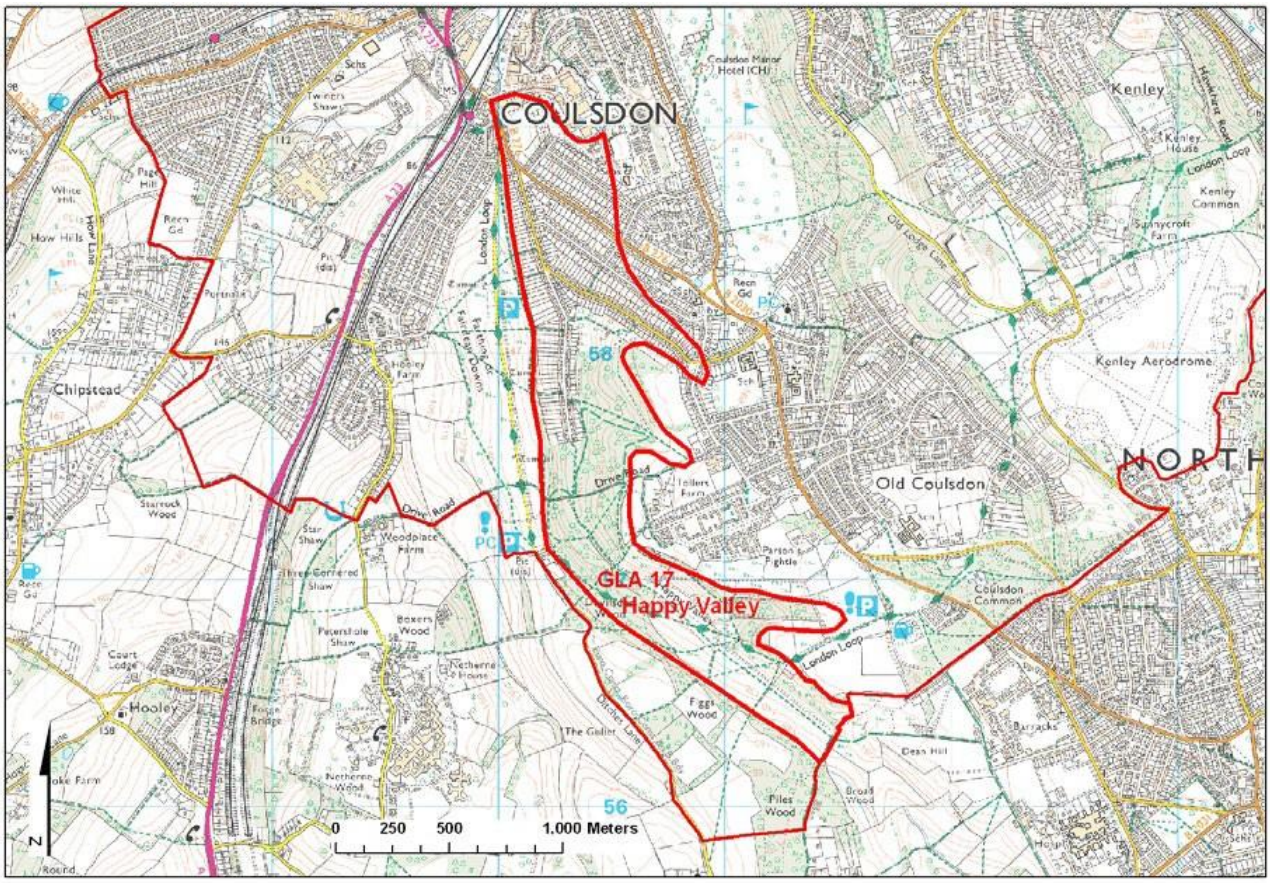
	concretions ('cementstone nodules') and disseminated pyrite. Claygate Member consists of thin alternations of clays, silts and fine-grained sand	
Site Description		
Large public park showing the geomorphology of Claygate Member capped London Clay. Cabin Hill offers a large variety of rock types. At the base, in the valley between Cabin Hill and Dog Kennel Hill, the lake lies at the lowest point, about 50m OD, in London Clay, surrounded by 'head' which extends up the small streams that run into the lake. On the lower part of the hill the London Clay is overlain by 'Glacial Gravel' which in turn is overlain by till deposited during the Anglian Glaciation. Toward the top of the hill, the top of the London Clay Formation remains briefly unburied by the gravel and till but this is the sandier facies known as the Claygate Member. Above this the variable sands and gravels of the Bagshot Formation cap the hill with two very small patches of Pre-Anglian Stanmore Gravel lying at the summit (both in Essex).		
Assessment of Site Value		
Geodiversity topic: Geomorphology; Lithostratigraphy.		
Access and Safety		
Aspect	**Description**	
Safety of access	Large open space with footpaths, some suitable for wheelchairs.	
Safety of exposure	No specific exposure.	
Permission to visit	Open access, check with park rangers before group visits.	
Current condition	Well maintained as open space.	
Current conflicting activities	None.	
Restricting conditions	None.	
Nature of exposure	No specific exposure – geomorphology.	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	None.	0
Aesthetic landscape	Valuable open space.	8
History of Earth Sciences	Weathering and erosion of London Clay Formation / Claygate Member to current landscape.	4
Economic geology	None.	0
GeoScientific Merit		
Geomorphology	Landscape in relation to underlying geology.	6
Sedimentology	Underlying geology.	4
Palaeontology	None.	0
Igneous/mineral/ Metamorphic Geology	None.	0
Structural Geology	None.	0
Lithostratigraphy	Relationship between the London Clay and the Claygate Member.	6
Potential use	Higher further education; school education; on-site interpretation; on- site geotrail.	
Fragility	Weathering/erosion; natural overgrowing.	
Current Site Value		
Community	Site well used by local people for dog walking, jogging, family outings etc. Large car park, and well sign-posted walks to the summit etc. and around the lake. Café and a reasonably large children's zoo. Maps and information boards on the woodlands but nothing on the geology. The Redbridge webpage: www.redbridge.gov.uk/leisure-sport-and-the-arts/parks/hainault-forest-country-park/	10
Education		4
Geodiversity value		
LIGS: Good feature in country park very well used by local community. Potential to add		4

information on geology on boards and/or website	
GLA 15 Hainault Forest Country Park	
	View towards London
	A general view of the wooded Cabin Hill summit area – the colour of the clay-rich sands is typical of Claygate Member
	Bagshot Sand at the summit of Cabin Hill
Photos: Ruth Siddall, May 2019	

GLA 17 Happy Valley

Grid Reference: TQ 304 577	Site Type: Natural Landform
Site Area (hectares): 142.21	Current use: Recreational land
Site ownership: London Borough of Croydon	Borough: London Borough of Croydon
Field surveyor: Joanna Brayson Revisited: Paul Rainey	Date: January 2008 Date: 2008
Current geological designation: RIGS	Other designation: SSSI (Biological); NNR (South London Downs); Metropolitan SINC (Farthing Down, Devilsden Wood and Happy Valley)

Site Map OS Topography © Crown Copyright



Stratigraphy and Rock Types

Time Unit: Late Cretaceous	Rock Unit: Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation Undifferentiated, Chalk Group
Rock Type: Chalk	Details: Chalk

Site Description

Dry valley in the Chalk. Much of the valley is open access land with footpaths and woodland. Excellent views from the higher parts.

Assessment of Site Value

Geodiversity topic: Geomorphology.

Access and Safety

Aspect	Description
Safety of access	Footpaths cover area, some steep and slippery.
Safety of exposure	N/a.
Permission to visit	Open access.
Current condition	Well maintained as Happy Valley Park.
Current conflicting activities	None.

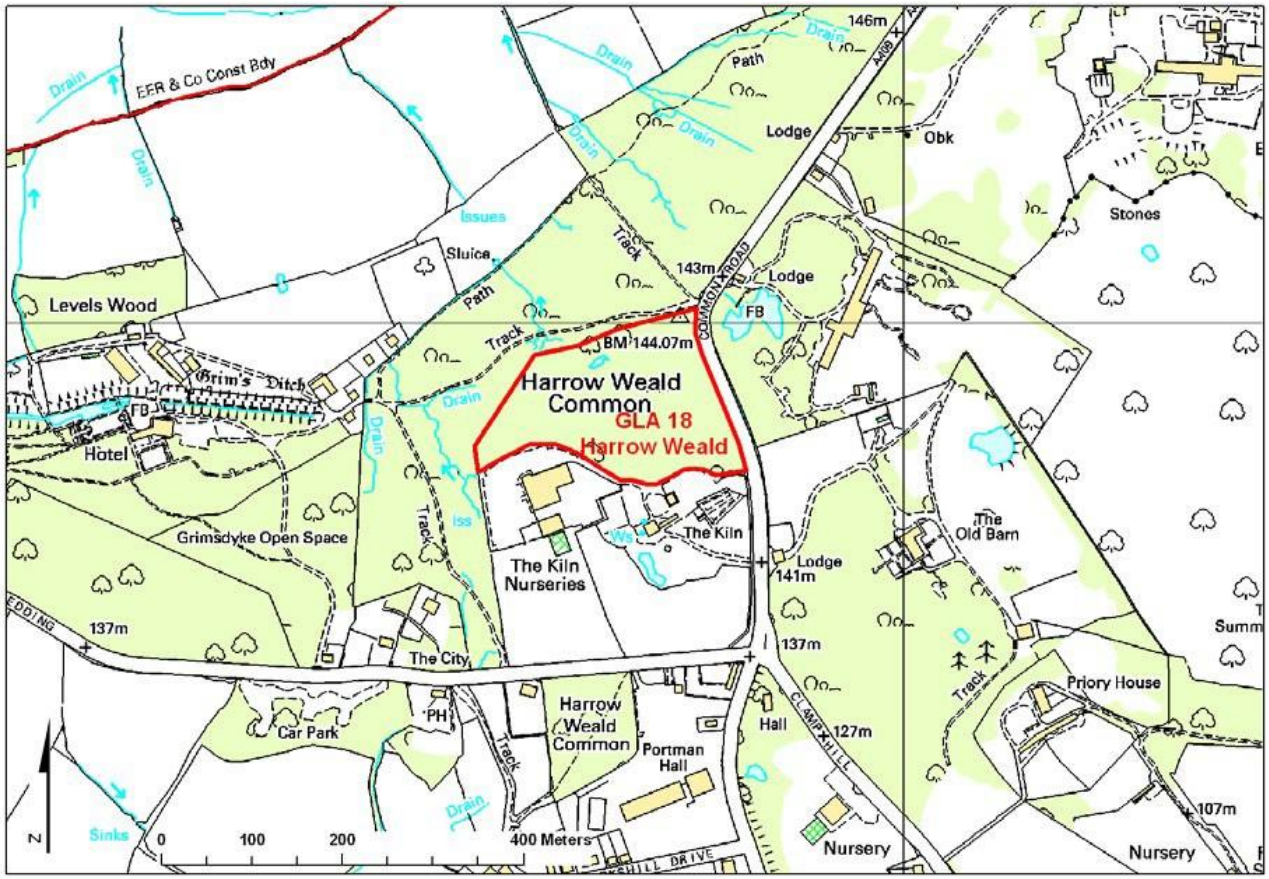
Restricting conditions	None.	
Nature of exposure	Landform.	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	Nearby Saxon settlement.	4
Aesthetic landscape	Valuable open space with great views and topography.	8
History of Earth Sciences	Position of water courses.	6
Economic geology	None.	0
GeoScientific Merit		
Geomorphology	Excellent example of a dry valley.	6
Sedimentology	None.	0
Palaeontology	None.	0
Igneous/mineral/ Metamorphic Geology	None.	0
Structural Geology	None.	0
Lithostratigraphy	None.	0
Potential use	Research; school education; on-site interpretation.	
Fragility	Well maintained.	
Current Site Value		
Community	Well used by the local community for exercise/dog-walking etc. Neighbouring downland on west is managed by City of London Corporation. Area is crossed by London Loop footpath.	10
Education		6
Geodiversity value		
RIGS: Excellent feature with good access and well used by local community.		6
GLA 17 Happy Valley		

View of trees in bottom valley from valley side

GLA 18 Harrow Weald

Grid Reference: TQ 147 929	Site Type: Natural exposure
Site Area (hectares): 3.52	Current use: Private country
Site ownership: Private owner	Borough: London Borough of Harrow
Field surveyor: Joanna Brayson Latest visit: Allan Wheeler, Peter Collins, Diana Clements	Date: February 2008 Date: June 2018
Current geological designation: SSSI Citation: 1003687.PDF (naturalengland.org.uk)	Other designation: Borough Grade II SINC (Harrow Weald Common)

Site Map



Stratigraphy and Rock Types

Time Unit: Pleistocene	Rock Unit: Stanmore Gravel Formation, Crag Group
Rock Type: Sand and gravel	Details: Gravel and sand, clayey near base. Gravel mostly composed of flints, up to 150mm in diameter, with a little quartz, quartzite and Lower Greensand chert in the fine fractions. Matrix of orange-brown, pale grey, red mottled clay and sandy clay, with pockets of coarse sand. Locally with layers of silt, clay or peat. Interpreted as offshore or beach gravels (Ellison et al 2004), or possibly fluvial (Bridgland 1994).
Time Unit: Eocene	Rock Unit: Claygate Member, London Clay Formation (not seen)
Rock Type: Sand, silt and clay	Details: Interbedded fine-grained sand, silt and clay.

Site Description

Harrow Weald is a small but important geological site which exhibits the most complete exposure of the Stanmore Gravel Formation overlying the Claygate Member of the London Clay. The Stanmore Gravel Formation is of uncertain origin and this has been the subject of much controversy over the past century. Recent research has cast doubt on their marine origin which was inferred by most early workers. The Harrow Weald section is important as a key site on which to base further studies of these deposits.

Assessment of Site Value		
Geodiversity topic: Lithostratigraphy; sedimentology.		
Access and Safety		
Aspect	**Description**	
Safety of access	Site accessed from gate from A409, Common Road, just north of garden centre. In 2018 a tree growing through the gate prevented it from opening. The site is on private property.	
Safety of exposure	Wooded area, take care – rough under foot.	
Permission to visit	Contact Natural England for access: ProtectedSites@naturalengland.org.uk	
Current condition	Neglected but easily re-excavated on small slope (probably edge of former quarry)	
Current conflicting activities	Possible overgrowth	
Restricting conditions	Access.	
Nature of exposure	Exposure in private wooded area – probably a former small quarry	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	Much research has been done here over the last century.	6
Aesthetic landscape	Not accessible to public but is adjacent to open access area where the same lithology can be seen, particularly in the sides of streamlets	4
History of Earth Sciences	Marine origin versus fluvial.	6
Economic geology	None known but possibly former small quarry	0
GeoScientific Merit		
Geomorphology	Now forms a ridge of high ground (highest point locally 144 m).	0
Sedimentology	Depositional environment (marine/fluvial).	7
Palaeontology	None.	0
Igneous / mineral / metamorphic geology	None.	0
Structural Geology		0
Lithostratigraphy	Relationship between superficial deposits and bedrock.	6
Potential use	Research; higher further education.	
Fragility	Possible overgrowth	
Current Site Value		
Community	Not accessible.	0
Education	Could be included in a geotrail of the area which would include the view site from the car park, former brickworks (Clamp Hill, and kiln) and nearby evidence of gravel digging and a rare ‘Pulhamite’ feature. There is already a Nature Trail through Harrow Weald Common and, in 2018, new notice boards detailing the extent of the geological SSSI	0
Geodiversity value		
SSSI: Exposures of units valuable for research but with poor access.		6

GLA 18 Harrow Weald

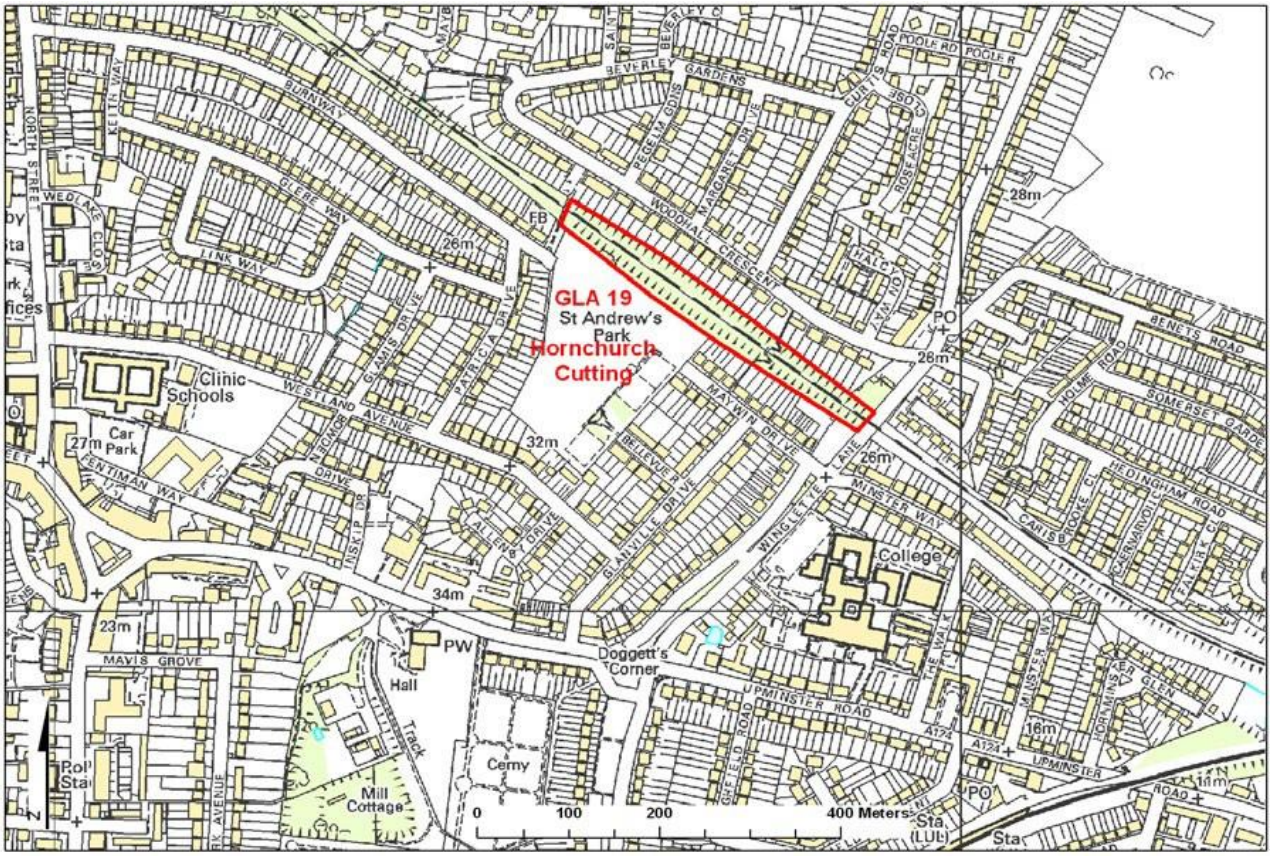
Exposures are mostly easily seen in the slope that was probably the edge of a former small quarry

Photos: Diana Clements, July 2011

GLA 19 Hornchurch Cutting

Grid Reference: TQ 547 874	Site Type: Artificial section
Site Area (hectares): 1.57	Current use: In railway cutting next to live line.
Site ownership: Network Rail	Borough: London Borough of Havering
Field surveyor: Joanna Brayson Latest visit: Peter Collins/Diana Clements	Date: January 2008 Date: October 2010
Current geological designation: SSSI Citation: 1002354.PDF (naturalengland.org.uk)	Other designation: Borough Grade II SINC (Romford to Upminster Railsides)

Site Map



Stratigraphy and Rock Types

Time Unit: Pleistocene	Rock Unit: Black Park Gravel Member, Thames Valley Formation (also described as Boyn Hill/Orsett Heath Gravel, Maidenhead Formation by Bridgland, 1994)
Rock Type: Sand and Gravel	Details: Sand and gravel, with possible lenses of silt, clay or peat. Matrix supported gravel with thin tabular cross-bedded sand channels. Gravel assemblage is characterised by abundant flint (75-89%), sparse rounded flint (3- 9%), sparse vein quartz (4-10%) and sparse quartzite (1-6%).
Time Unit: Pleistocene	Rock Unit: Lowestoft Formation, Albion Glacigenic Group
Rock Type: Till	Details: Chalky till, together with outwash sands and gravels, silts and clays. The till is characterised by its chalk and flint content.
Time Unit: Eocene	Rock Unit: London Clay Formation, Thames Group
Rock Type: Clay, silt, sand	Details: Fine, sandy, silty clay/clayey silt

Site Description

Hornchurch Cutting provides unique sections through a series of deposits which are of great stratigraphical importance for studies of the Pleistocene. In particular the site is of considerable significance for correlating the formation of the Thames terrace sequence with the glacial stratigraphy of Southern Britain.

The sections revealed by the cutting show a channel cut into the London Clay and infilled with a glacial till –

laid down at the southern extremity of the Anglian ice sheet. This till is overlain by the Black Park Gravel (the first post-diversionary terrace of the Thames). Hornchurch is the only area where glacial deposits are known to come into contact with the Lower Thames Terrace gravels. This relationship, first demonstrated when the railway cutting was excavated in the last century, indicates that the highest terrace in the Hornchurch area is more recent than the most extensive glaciation of Eastern England. The Hornchurch Cutting is thus clearly a site of prime stratigraphic and also historical importance.		
Assessment of Site Value		
Geodiversity topic: Lithostratigraphy; sedimentology; geomorphology.		
Access and Safety		
Aspect	**Description**	
Safety of access	Access to site itself would require full railway safety procedures.	
Safety of exposure	Access to site itself would require full railway safety procedures.	
Permission to visit	Contact Network Rail via Natural England: ProtectedSites@naturalengland.org.uk.	
Current condition	Maintained as part of railway network. Last opened up and investigated in 2010 following clearance of the slope of vegetation by Network Rail.	
Current conflicting activities	Railway.	
Restricting conditions	Next to operating railway.	
Nature of exposure	Railway cutting.	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	The site was discovered when the Romford to Upminster branch line was constructed through a ridge of gravel-capped land and was first described by T.V. Holmes in 1893 (Proceedings of the Geologists' Association, Vol 13, p.83). A section wasn't opened up again until nearly a century later when Colin Whiteman and David Bridgland began respectively to study till genesis and fluvial history in the area which gave insights into the processes.	8
Aesthetic landscape	None.	0
History of Earth Sciences	Cutting allowed timings of glaciations/river evolution to be suggested at an early time in investigations.	5
Economic geology	None.	0
GeoScientific Merit		
Geomorphology	Relationship between till and overlying terrace gravels.	8
Sedimentology	Depositional environment and provenance of sediments.	7
Palaeontology	None.	0
Igneous / mineral / metamorphic geology	None.	0
Structural Geology	None.	0
Lithostratigraphy	Allows correlation of terrace gravels and till.	8
Potential use	Research.	
Fragility	Overgrowing.	
Current Site Value		
Community	None.	0
Education	Not suitable for educational visits.	0
Geodiversity value		
SSSI: Exposure of rarely seen boundary between tills and terrace gravels. Excellent site for research but very difficult access.		6

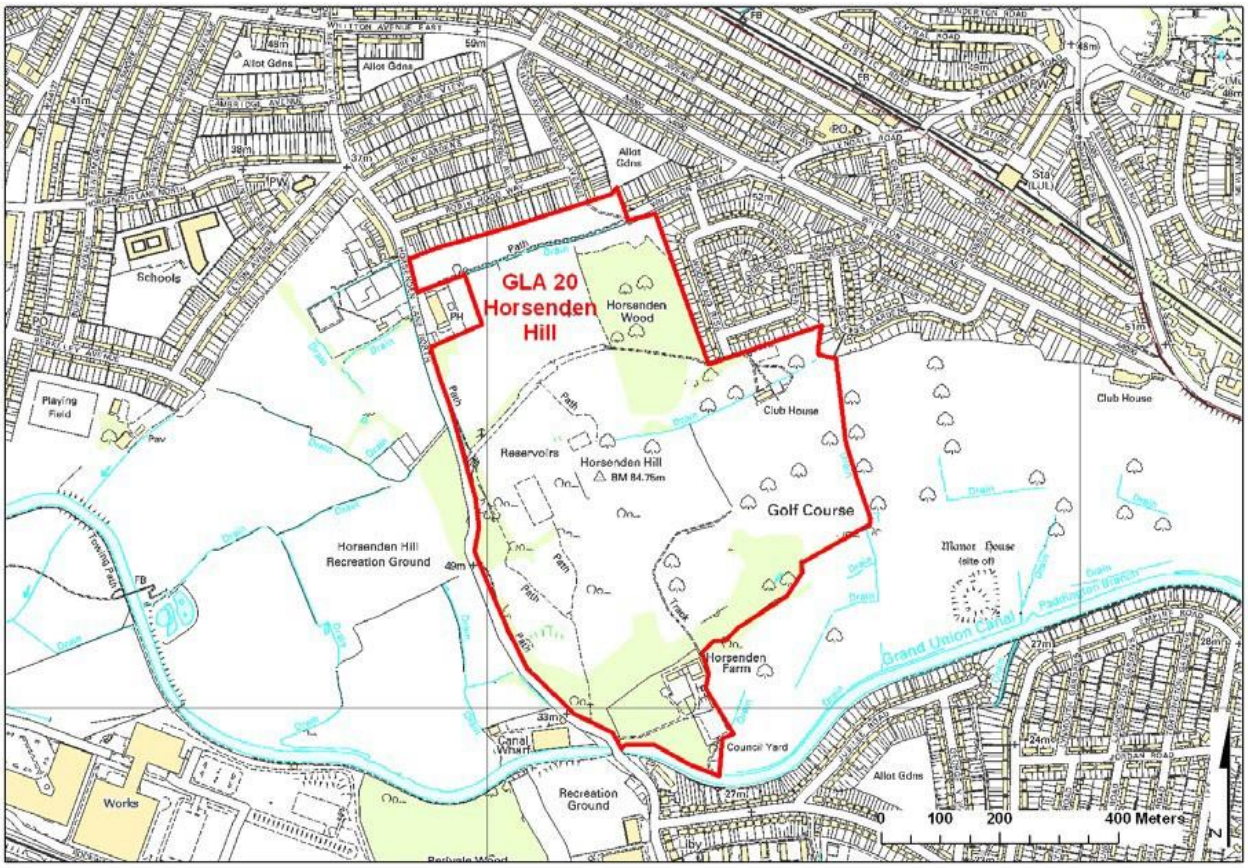
GLA 19 Hornchurch Cutting

Hornchurch Railway Cutting when opened in 2010. Photo: Emily Dresner, Natural England

GLA 20 Horsenden Hill

Grid Reference: TQ 1656 8438	Site Type: Natural exposure
Site Area (hectares): 43.15	Current use: Recreational land
Site ownership: London Borough of Ealing	Borough: London Borough of Ealing
Field surveyor: Joanna Brayson Revisited: Ann Davidson	Date: December 2007 Date: May 2016
Current geological designation: Adopted RIGS	Other designation: Metropolitan SINC (Horsenden Hill)

Site Map OS Topography © Crown Copyright



Stratigraphy and Rock Types

Time Unit: Pleistocene	Rock Unit: Dollis Hill Gravel, Member of the Sudbury Formation
Rock Type: Sand and gravel	Details: Gravel, sandy and clayey in part, with some laminated silty beds. Sand and gravel, locally with lenses of silt, clay or peat and organic material.
Time Unit: Eocene	Rock Unit: Claygate Member, London Clay Formation, Thames Group
Rock Type: Sand, silt and clay	Details: Interbedded fine-grained sand, silt and clay.
Time Unit: Eocene	Rock Unit: London Clay Formation. Thames Group
Rock Type: Clay, silt, sand	Details: Fine, sandy, silty clay/clayey silt. Glauconitic at base.

Site Description

This site is a hill in the London Clay capped by the Claygate Member and Dollis Hill Gravel Formation. The Dollis Hill Gravel is a river terrace deposit from the pre-diversionary Thames. It forms hill-caps that decline in elevation northwards, indicating deposition in south-bank tributaries of the ancestral Thames. The gravel is composed of angular flint (58%), rounded flint (32%), quartz/quartzite (1.8%) and Lower Greensand chert (7%).

Horsenden Hill is the highest point in North West London with excellent views of the surrounding area. There are information boards explaining the view, this would be an ideal position to explain the geological landscape.

Assessment of Site Value		
Geodiversity topic: Geomorphology; lithostratigraphy; sedimentology.		
Access and Safety		
Aspect	**Description**	
Safety of access	Footpaths from car park up hill, through woods and some fields with livestock – care should be taken.	
Safety of exposure	Mostly adjacent to footpaths, some slippery due to clay nature of London Clay.	
Permission to visit	Open access, contact the ranger's office for group visits.	
Current condition	Outcrops are small, mostly grassland or woods.	
Current conflicting activities	None.	
Restricting conditions	None.	
Nature of exposure	Small exposures in fields and in woodland.	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	Site of an ancient hillfort.	8
Aesthetic landscape	Excellent views of surrounding area from this highest point in north-west London (site of a trig point).	8
History of Earth Sciences	Composition of gravel – provenance of material.	4
Economic geology	None.	0
GeoScientific Merit		
Geomorphology	Formation of hill.	4
Sedimentology	Sedimentary environments and provenance.	4
Palaeontology	None.	0
Igneous/mineral/ Metamorphic Geology	None.	0
Structural Geology	None.	0
Lithostratigraphy	Relationship between bedrock and terrace gravels.	4
Potential use	Research; on-site interpretation; on-site geotrail.	
Fragility	Natural overgrowing.	
Current Site Value		
Community	Used daily by local community. On the Capital Ring	10
Education		6
Geodiversity value		
RIGS: Small exposures of units accompanied by good geomorphological features and good access.		5

GLA 20 Horsenden Hill

View to the north with spire of St. Mary's, Harrow-on-the-Hill.

View slightly north of east with Wembley Stadium.

Photos: Ann Davidson, May 2016

GLA 22 Keston Common

Grid Reference: TQ 419 640	Site Type: Natural exposures on scarp slope, springs & sinks
Site Area (hectares): 11.82	Current use: Recreational
Site ownership: London Borough of Bromley	Borough: London Borough of Bromley
Field surveyor: Joanna Brayson Re-surveyed: Paul Rainey/Diana Clements Last visited: Paul Rainey	Date: March 2011 Date: 2014 Date: 2017
Current geological designation: RIGS	Other designation: Keston and Hayes Commons SSSI (Biological); Metropolitan SINC (River Ravensbourne, Ravensbourne Valley Woodlands, Hayes and Keston Commons); Scheduled Ancient Monument

Site Map

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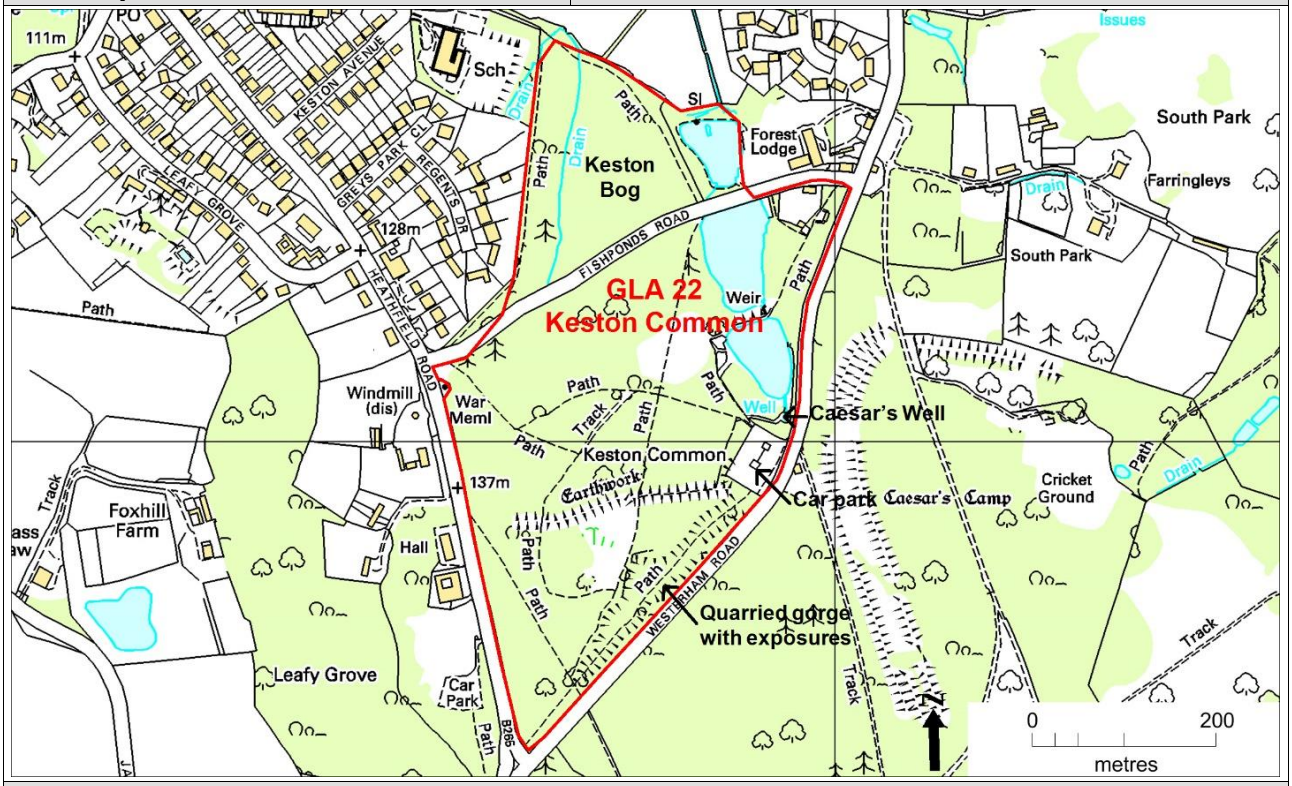


Stratigraphy and Rock Types

Time Unit: Pleistocene	"Darwin's bog"
Rock Type: Sand and gravel	Peat
Time Unit: Eocene	Rock Unit: Blackheath Member, Harwich Formation, Thames Group
Rock Type: Sand and gravel	Details: Sand and pebbles (mostly round, black), widespread.
Time Unit: Paleocene-Eocene	Rock Unit: Lambeth Group
Rock Type: Clay, silt, sand	Details: Laminated beds have been revealed in past in animal excavations close to the ponds.

Site Description

Best exposure of the Harwich Formation is on the steep bank to the east of the London Loop trail to the south of the car park (TQ 4190 6395), at the top of the slope adjacent to Westerham Road. They lie at the top of a gully formed by gravel extraction. In places the small rounded black pebbles are cemented by calcite. The ubiquitous black pebbles of the Harwich Formation are found all over the common.

On the west side of the middle pond, small exposures of a sandy facies may belong to the top of the Lambeth Group or the base of the Harwich Formation.

The most southerly, top pond is fed from Caesar's Well, the spring probably enforced by a clay layer within the Lambeth Group.

Darwin's bog (valley mire) lies to the north of the Fishpond Road that bisects the common. Here Darwin studied various aspects of natural history and observed sundews in this boggy area underlain by clay.

Assessment of Site Value

Geodiversity topic: sedimentology, lithostratigraphy, groundwater processes

Access and Safety		
Aspect	**Description**	
Road access & parking	Car parks off Westerham Road (and Heathfield Road)	
Safety of access	Paths through wood and around lake	
Safety of exposure	Best exposure at top of steep slope, seasonally muddy	
Permission to visit	Open access	
Current condition	Small exposures at top of steep embankment	
Current conflicting activities	none	
Restricting conditions	Possibly masked by vegetation	
Nature of exposure	Small exposures on slope and in woodland. Spring at Caesar's well and along east side of ponds.	
Culture, Heritage & Economic		
Aspect	**Description**	Rating
Historic, archaeological & literary associations	Drain includes bog crossing common immediately to north was source of insectivorous plant, round-leaved sundew for Darwin. There are Iron Age fortifications within the area	6
Aesthetic landscape	Valuable green spaced used by local community	6
History of Earth Sciences	Caesar's Spring described by Tertiary Research Group	4
Economic geology	Gravel extraction created the gully where the exposure can be seen. The two top ponds were used as reservoirs to feed Holwood House.	6
GeoScientific Merit		
Geomorphology	Springs arising from beneath Harwich pebbles (and or sand)	5
Sedimentology	Environment of deposition	6
Palaeontology	None seen	0
Igneous/mineral/ Metamorphic Geology	None	0
Structural Geology	None	0
Lithostratigraphy	Correlation of Harwich Formation	5
Potential use	Points of Interest on London Loop; on-site interpretation; higher further education	
Fragility	Natural overgrowth producing shade and reducing temporary exposures.	
Current Site Value		
Community	Used daily by dog walkers etc; London Loop; Ravensbourne Trail; Keston Trail	10
Education	Darwin connections	6
Geodiversity value		
RIGS: Good small exposures with adequate access; springs; Darwin's Bog		6

GLA 22 Keston Common

Exposure at top of slope in gully

Cemented layer

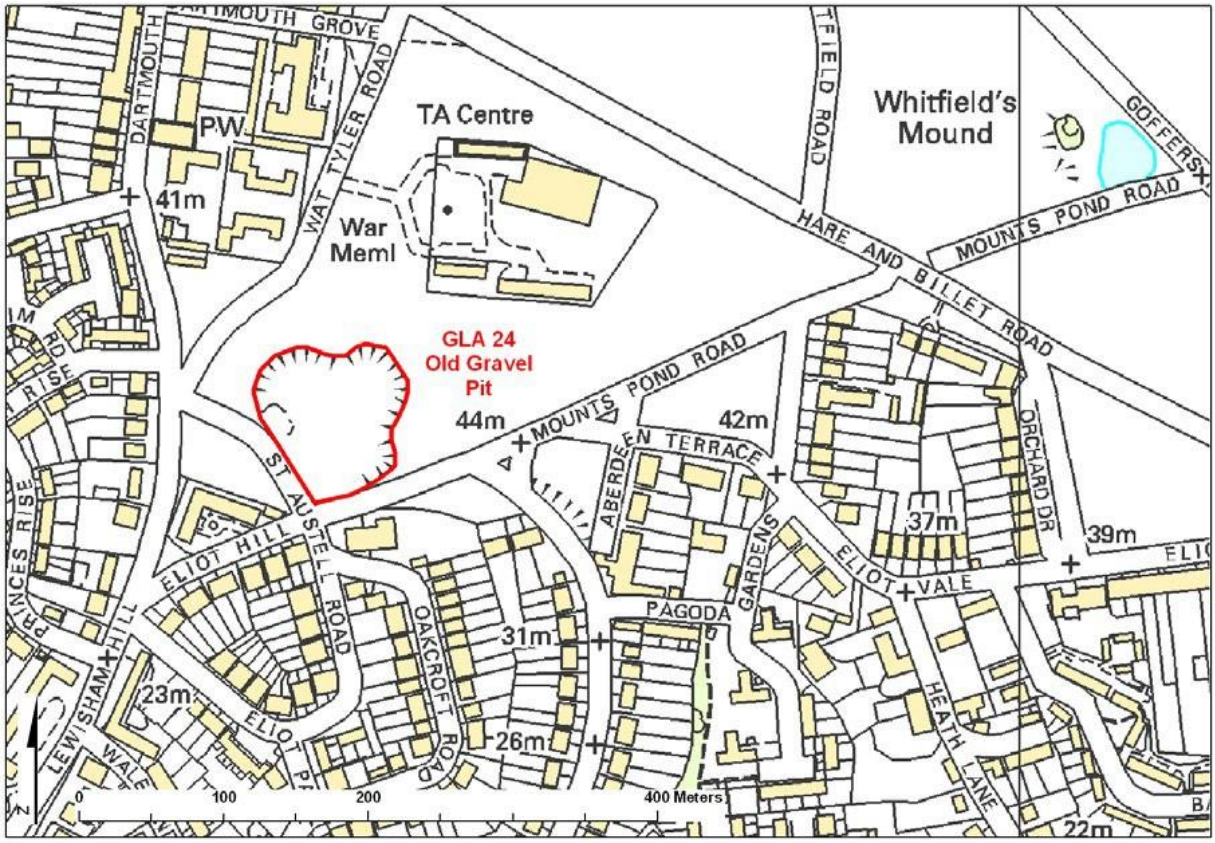
Photos: Diana Clements, 2014

Caesar's Well leading to lake and River Ravensbourne.
Photo: Laurie Baker, February 2016

GLA 24 Old Gravel Pit, Blackheath (Eliot Pits)

Grid Reference: TQ 385 763	Site Type: Former quarry works
Site Area (hectares): 0.84	Current use: Recreational land
Site ownership: London Borough of Lewisham	Borough: London Borough of Lewisham
Field surveyor: Joanna Brayson Visited: Laurie Baker, Diana Clements, Paul Rainey Latest visit: Laurie Baker	Date: March 2011 Date: January 2016 Date: February 2021
Current geological designation: LIGS	Other designation: Metropolitan SINC (Blackheath and Greenwich Park)

Site Map OS Topography © Crown Copyright



Stratigraphy and Rock Types

Time Unit: Eocene	Rock Unit: Blackheath Member, Harwich Formation, Thames Group
Rock Type: Sand and gravel	Details: Rounded black pebbles, sandy clays and sand; marine fauna, locally brackish.
Time Unit: Paleocene-Eocene	Rock Unit: Lambeth Group (not seen)
Rock Type: Sand and gravel	Details: Glauconitic sands overlain by grey clays and sands with Brackish fauna and interleaved red and variegated clays and sands.

Site Description

Old gravel pit at the edge of open space in Blackheath.

Assessment of Site Value

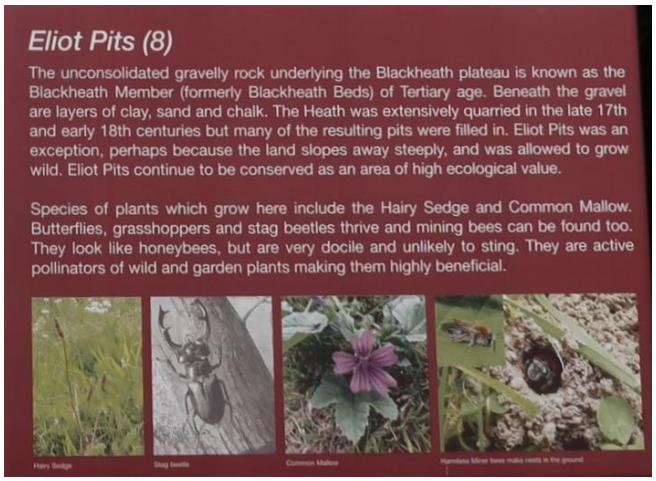
Geodiversity topic: Lithostratigraphy; economic geology.

Access and Safety

Aspect	Description
Safety of access	Adjacent to small road, grassy area with no significant dangers.
Safety of exposure	Pit sides are short and grassed over, little risk of falling.
Permission to visit	Open access.

Current condition	Grassed over but shape visible.	
Current conflicting activities	None.	
Restricting conditions	None.	
Nature of exposure	Old grassed over pit.	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	Shown on 1896 OS Historic map as Old Gravel Pit.	8
Aesthetic landscape	Part of large open space.	6
History of Earth Sciences		0
Economic geology	Gravel extraction.	6
GeoScientific Merit		
Geomorphology	None.	0
Sedimentology	If excavation could be carried out, environment of deposition.	4
Palaeontology	None.	0
Igneous/mineral/ Metamorphic Geology	None.	0
Structural Geology	None.	0
Lithostratigraphy	Correlation with other units.	4
Potential use	On-site interpretation; research.	
Fragility	Natural overgrowing.	
Current Site Value		
Community	Valuable open space	8
Education	A board detailing the geology and local plants has been erected. One of 12 sites on the Green Chain walk featured in the audio on London Geodiversity Partnership website	6
Geodiversity value		
LIGS: Good example for economic history in local area. A second example can be found at the east end of Blackheath at GLA 65 Vanbrugh Pit in Royal Borough of Greenwich.		4

GLA 24 Old Gravel Pit (Eliot Pits)



Photos: Laurie Baker, February 2021

Part of panel

GLA 25 Putney Heath

Grid Reference: TQ 233 731	Site Type: Natural exposure
Site Area (hectares): 35.30	Current use: Recreational land
Site ownership: London Borough of Wandsworth	Borough: London Borough of Wandsworth
Field surveyor: Joanna Brayson Latest visit: Diana Clements (LB PR AW)	Date: May 2011 Date: July 2018
Current geological designation: LIGS	Other designation: Metropolitan SINC (Wimbledon Common and Putney Heath)

Site Map

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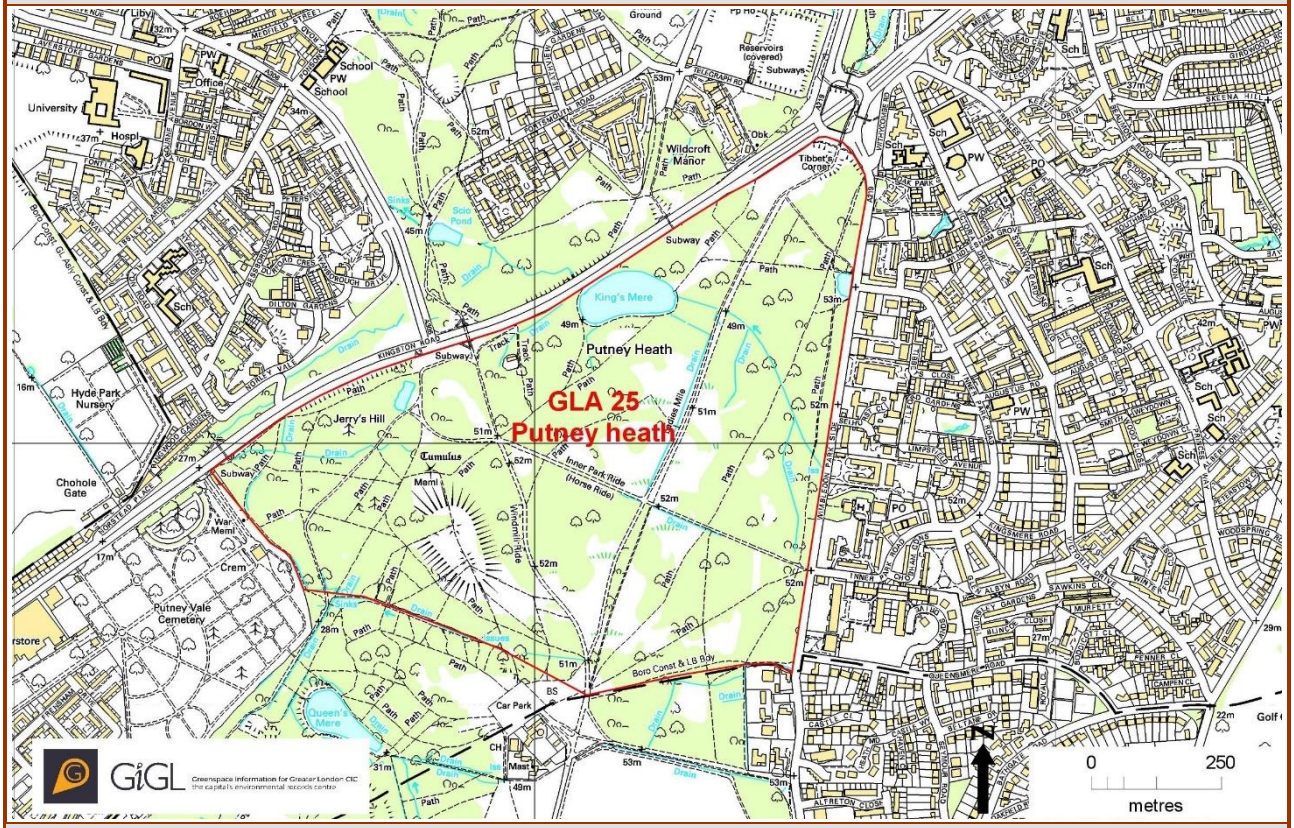


Stratigraphy and Rock Types

Time Unit: Pleistocene	Rock Unit: Black Park Gravel Formation
Rock Type: Sand and Gravel	Details: Sand and gravel, with possible lenses of silt, clay or peat. [Generic description]. Horizontally stratified, matrix supported gravel with thin tabular cross-bedded sand channels. Gravel assemblage is characterised by abundant flint (75-89%), sparse rounded flint (3-9%), sparse vein quartz (4-10%) and sparse quartzite (1-6%) which includes both Lower Greensand Chert and Bunter pebbles
Time Unit: Eocene	Rock Unit: London Clay Formation
Rock Type: Clay, silt, sand	Details: Fine, sandy, silty clay/clayey silt. Glauconitic at base.

Site Description

Small exposures of Black Park Gravel (Thames river terrace) on the heath. Putney Heath is included as a LIGS site for its small exposures of Black Park Gravel. The best exposure can be seen round the edges of King's Mere Lake. The area cited is a plateau on the top of the wider parkland area which becomes Wimbledon Common to the south. The plateau also extends into the adjacent Richmond Park to the west. The Black Park Gravel is the oldest of the Thames terraces, deposited immediately after the retreat of the Anglian Ice Sheet about 400,000 years ago. On Putney Heath they overlie London Clay formation but further south they overlie the sandier Claygate member at the top of the London Clay and in the southwest, the overlying Bagshot Formation. London Clay can be seen around the perimeter of the Curling Pond, particularly in summer when the water level is low.

Drakeford A. & Sutcliffe U. (Eds) 2000. *Wimbledon Common & Putney Heath. A Natural History.* Wimbledon and Putney Commons Conservators.

Assessment of Site Value		
Geodiversity topic: Lithostratigraphy' sedimentology.		
Access and Safety		
Aspect	**Description**	
Safety of access	Footpaths, some rough.	
Safety of exposure	Felt unsafe alone, fine in groups.	
Permission to visit	Open access.	
Current condition	Well managed by conservators, some landscaping (paths etc).	
Current conflicting activities	None.	
Restricting conditions	None.	
Nature of exposure	Patchy exposures under bushes, in tracks.	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations		
Aesthetic landscape	Part of large open space in urban area.	8
History of Earth Sciences		
Economic geology	None.	0
GeoScientific Merit		
Geomorphology	None.	0
Sedimentology	Composition and depositional environment of gravels.	6
Palaeontology	None	0
Igneous / mineral / metamorphic geology	None.	0
Structural Geology	None.	0
Lithostratigraphy	Relationship of terrace gravels and bedrock.	6
Potential use	On-site interpretation; research; include in geotrail around Wandsworth Common/Putney Heath	
Fragility	Natural overgrowing.	
Current Site Value		
Community	Valuable open space used daily.	10
Education		4
Geodiversity value		
LIGS: Small exposures in large open area with good access.		3
GLA 25 Putney Heath		

Black Park Gravel surrounding King's Mere.

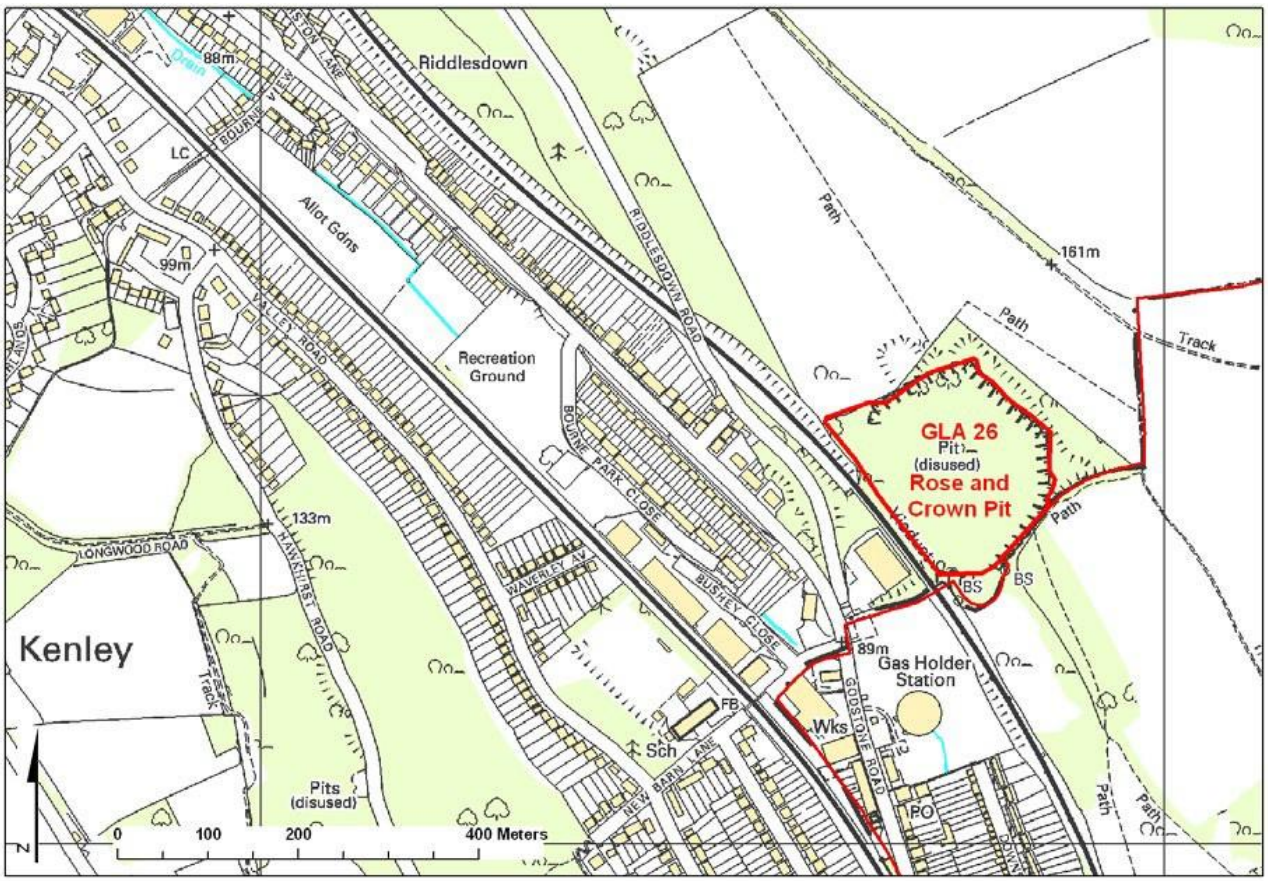
London Clay exposed in the base of Curling Pond.

Photos: Diana Clements, July 2019

GLA 26 Riddlesdown Quarry (formerly Rose and Crown Pit)

Grid Reference: TQ 3375 5941	Site Type: Former quarry works
Site Area (hectares): 3.66	Current use: Disused
Site ownership: City of London Corporation	Borough: London Borough of Croydon
Field surveyor: Joanna Brayson Latest visit: Diana Clements	Date: November 2010 Date: October 2018
Current geological designation: RIGS	Other designation: NNR (South London Downs); Biological SSSI; Metropolitan SINC (Riddlesdown and The Rose an Crown Chalk Pit)

Site Map OS Topography © Crown Copyright



Stratigraphy and Rock Types

Time Unit: Late Cretaceous	Rock Unit: New Pit Chalk Formation; Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation Undifferentiated, Chalk Group
Rock Type: Chalk	Details: Chalk

Site Description

Large abandoned chalk quarry (also called Riddlesdown Quarry) in area called Riddlesdown. The finest chalk exposure in London and well-maintained by the City of London Corporation who lead guided tours around the quarry. Features include nearly 50m of chalk lithology from the Glynde marls (New Pit Chalk Formation) to the Seaford Chalk Formation, different styles of fracturing within the chalk, characteristic of each Chalk formation with associated faults, conspicuous large flint bands forming marker beds across the face of the quarry, marl and dissolution pipes filled with clay-with-flints. It is one of the few remaining Chalk exposures in the Lewes Nodular Chalk Formation in this part of the North Downs and exposes the contact with the underlying New Pit Chalk Formation and the overlying Seaford Chalk Formation.

Assessment of Site Value

Geodiversity topic: Lithostratigraphy; sedimentology.

Access and Safety		
Aspect	**Description**	
Safety of access	Access is restricted – fence surrounds site. Close to and beneath railway line, care should be taken. Quarry visible from footpaths surrounding site – these are steep and slippery in places.	
Safety of exposure	Quarry contains steep faces and slumped material.	
Permission to visit	Permission for access via City of London Corporation ranger 01372 279 083	
Current condition	Partially overgrown but many faces clear.	
Current conflicting activities	None.	
Restricting conditions	Fenced off, safety concerns.	
Nature of exposure	Disused quarry.	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	Roman road built across downs. Saxon burial sites close by.	8
Aesthetic landscape	Extremely well used surrounding area – chalk downlands.	8
History of Earth Sciences	Described by Caleb Evans in1870. *On some sections of Chalk between Croydon and Oxted, with observations on the classification of the Chalk*. Geo. P. Bacon, Lewes, for the Geologists' Association Publication.	
Economic geology	Chalk quarry.	8
GeoScientific Merit		
Geomorphology	None.	0
Sedimentology	Chalk succession – environment of deposition.	8
Palaeontology	Chalk Stratigraphy determined in part by macro and micro palaeontology.	8
Igneous/mineral/ Metamorphic Geology	None.	0
Structural Geology	Nature of jointing and faulting is important for engineers	8
Lithostratigraphy	Chalk succession.	8
Potential use	Research; training for engineers' higher further education; school education; on-site interpretation; on-site geotrail.	
Fragility	Natural overgrowing; geohazard.	
Current Site Value		
Community	Surrounding area is a valuable open space, used daily. Pit is restricted acess	10
Education	Good site for fieldwork, with appropriate safety. Included in GLA Guide 68, Itinerary 9.	8
Geodiversity value		
RIGS: Excellent outcrop with great potential for research and education. This quarry should really be an SSSI because of the number of features listed above. It is a valuable teaching aid for engineers tunnelling under London. There are many accessible sites on the South Downs but the North Downs are not well served.		8

GLA 26 Riddlesdown Quarry

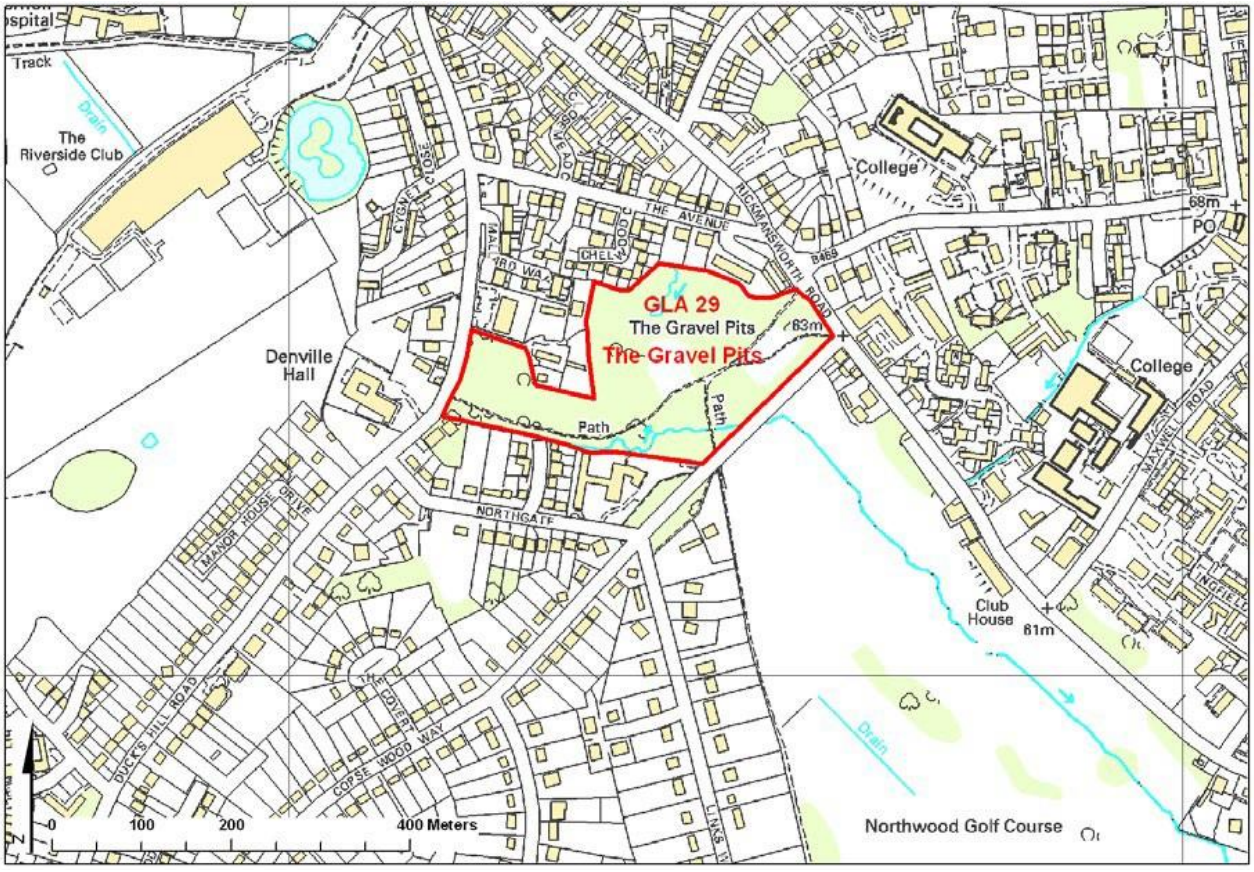
View of north east quarry face

Geo-conserved south west face in 2016, the youngest exposure; photo: N. Stevenson

GLA 29 The Gravel Pits, Northwood

Grid Reference: TQ 0839 9135	Site Type: Former quarry works
Site Area (hectares): 5.47	Current use: Recreational land
Site ownership: London Borough of Hillingdon	Borough: London Borough of Hillingdon
Field surveyor: Joanna Brayson Revisited: Allan Wheeler	Date: September 2010 Date: September 2020
Current geological designation: RIGS	Other designation: Borough Grade II SINC (Gravel Pit, Northwood)

Site Map



Stratigraphy and Rock Types

Time Unit: Paleocene-Eocene	Rock Unit: Lambeth Group (Upnor and Reading Formations)
Rock Type: Sand and gravel	Details: Interleaved red and variegated clays and sands.

Site Description

An area of woodland covering old gravel pits in the Lambeth Group. The gravel from these pits was used for several hundred years for road mending in the area. This has created an interesting landscape of numerous hillocks and hollows. The gravel was described as 'worked out' in 1898 and the area was saved as a public amenity in commemoration of Queen Victoria's Diamond Jubilee the previous year.

Assessment of Site Value

Geodiversity topic: Lithostratigraphy; sedimentology; economic geology.

Access and Safety

Aspect	Description
Safety of access	Footpaths and steps (installed 2014) into one of the pits. There are four access points to the Gravel pits and on street parking is available on Copse Wood Way and Buttsmead. Railway access is available via Northwood Station (London Underground Metropolitan Line), which is about 1km away and bus 282 provides local links to Eastcote.
Safety of exposure	In the tops of the hillocks kept exposed by trampling and occasional larger

	exposures of gravel from badger spoil.	
Permission to visit	Open access.	
Current condition	Overgrown; some sand exposed as badger spoil.	
Current conflicting activities	None.	
Restricting conditions	None.	
Nature of exposure	Old gravel pits in woods.	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	Historic pits (information from Ruislip, Northwood and Eastcote Local History Society).	8
Aesthetic landscape	Valuable green space for the local community.	8
History of Earth Sciences		
Economic geology	Gravel pits used for road mending.	8
GeoScientific Merit		
Geomorphology	None.	0
Sedimentology	Composition of sands and gravels.	6
Palaeontology	None.	0
Igneous/mineral/ Metamorphic Geology	None.	0
Structural Geology	None.	0
Lithostratigraphy	Correlation with other units.	6
Potential use	Research; school education; on-site interpretation.	
Fragility	Natural overgrowing.	
Current Site Value		
Community	Used daily by local community. There are boards describing a Nature Trail through the woods and further information on the website of the Northwood Residents Association: www.northwoodresidents.co.uk/index.php/northwood-gravel-pits The Gravel Pits also feature on https://archive.hillingdon.gov.uk/thegravelpits	10
Education	Good site for local schools – history and geology.	4
Geodiversity value		
RIGS: Well used local site with information.		4
GLA 29 The Gravel Pits, Northwood		

Sand from Reading Fm - typical hummock and hollow landscape

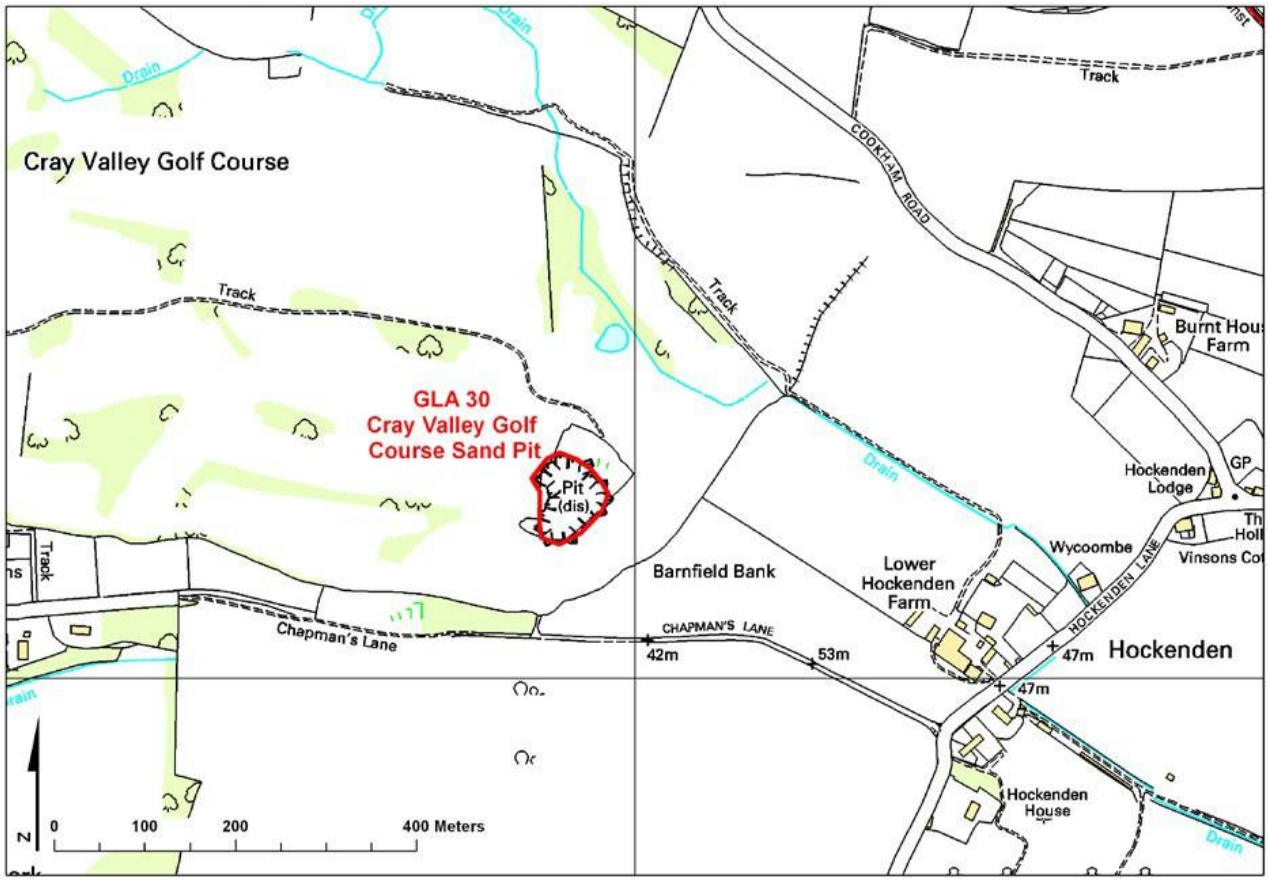
Rounded black pebbles on the paths may relate to the top of the Upnor Formation (Lambeth Group)

Photos. A. Wheeler, 2020

GLA 30 Cray Valley Golf Course Sand Pit

Grid Reference: TQ 489 690	Site Type: Former quarry works
Site Area (hectares): 0.57	Current use: Golf Course
Site ownership: Cray Valley Golf Club	Borough: London Borough of Bromley
Field surveyor: South London RIGS Group Latest visit: Steve Tracey, Diana Clements, Laurie Baker	Date: Summer 2008 Date: December 2019
Current geological designation: RIGS	Other designation: Borough Grade I SINC (Hockenden Sand Pit)

Site Map OS Topography © Crown Copyright



Stratigraphy and Rock Types

Time Unit: Paleocene	Rock Unit: Thanet Formation
Rock Type: Sand	Details: fine-grained sand, iron-stained (from the decay of glauconite)

Site Description

Clean large vertical exposures of Thanet Formation in disused sand pit. They have been left after previous mineral extraction stopped (for the construction of A20). The exposures are situated towards the eastern end of Cray Valley Golf Course. Approximately 64 sand martin holes are present in the north-west facing cliff – the only known breeding colony of sand martins within the Borough of Bromley, and one of the largest in London. Since 2012, the faces have become somewhat degraded but are still accessible despite the pit being used as a dump for green waste.

Assessment of Site Value

Geodiversity topic: Lithostratigraphy and sedimentology.

Access and Safety

Aspect	Description
Safety of access	Site is on the edge of a golf course. Access normally by golf buggy hired from the club or by walking straight ahead down the path from the car park, almost to the far end of the green but beware of golf balls..

Safety of exposure	The quarry is not on the course and is not exposed to golf ball hazard.	
Permission to visit	Access is by permission of the owners. Cray Valley Golf Club – telephone secretary on 016898 39677. Management at the course are helpful and permit controlled access.	
Current condition	The exposed face is still visible although there has been some overgrowth and the pit is now used as a green waste dump.	
Current conflicting activities	Possibility of reuse as a sand quarry or change in golf course layout	
Restricting conditions	Private Golf Course	
Nature of exposure	Semi vertical face of disused sand pit Cliffs in disused sand pit	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	None known but site is near a Victorian rubbish dump with period relics such as glass bottles.	1
Aesthetic landscape	Sand martin nesting colony.	5
History of Earth Sciences	No associations known, but site is a very rare clear exposure of Thanet Sand. No other site of this importance is known to exist in the South London area.	5
Economic geology	Sand from this pit was used in the construction of the A20 motorway.	3
GeoScientific Merit		
Geomorphology	None.	0
Sedimentology	The sand was deposited in a coastal environment. The yellowish sand shows some evidence of weathering. No clay or silt deposits exist in the exposure. Evidence of podsoil formation is confined to the top 100mm of the formation. No detailed analysis of the sand is currently available. Sand is well sorted.	4
Palaeontology	No macrofossils are evident in the formation.	0
Igneous/mineral/ Metamorphic Geology	None.	0
Structural Geology	None.	0
Lithostratigraphy	Thanet Formation.	5
Potential use	Research, school and higher education as well as its interest as a sand martin colony.	
Fragility	Natural overgrowth, potential as sand source and exposed to changes in the course layout	
Current Site Value		
Community	Available to the community under careful control.	4
Education		5
Geodiversity value		
RIGS:	The best Thanet sand exposure in the area. The working quarry at Bourne Wood had ceased operating in 2019 and the face is in danger of disappearing under landfill. The exposure at the Klinger site (GLA 41) has been developed and the face is hidden and so that site has been deleted leaving the Cray Valley Golf Course sand pit as possibly the best Thanet sand exposure in the area in the near future.	**5-6**

GLA 30 Cray Valley Golf Course Sand Pit

Quarry Face with Sand Martin burrows,

Face in December 2019. Photo: Laurie Baker

GLA 31 North End Pit (Erith Park)

Grid Reference: TQ 515 771	Site Type: brick pit
Site Area (hectares): 0.43	Current use: Housing Estate
Site ownership: LB Bexley	Borough: London Borough of Bexley
Field surveyor: South London RIGS Group Last visited: Laurie Baker, Paul Rainey	Date: March 2011 Date: September 2015
Current geological designation: RIGS	Other designation: none

Site Map

Stratigraphy and Rock Types

Time Unit: Pleistocene	Rock Unit: Crayford Silt Formation
Rock Type: Brickearth (silt)	Details: Fine-grained ‘rock-flour’ suitable for brick-making as it contains Chalk.

Site Description

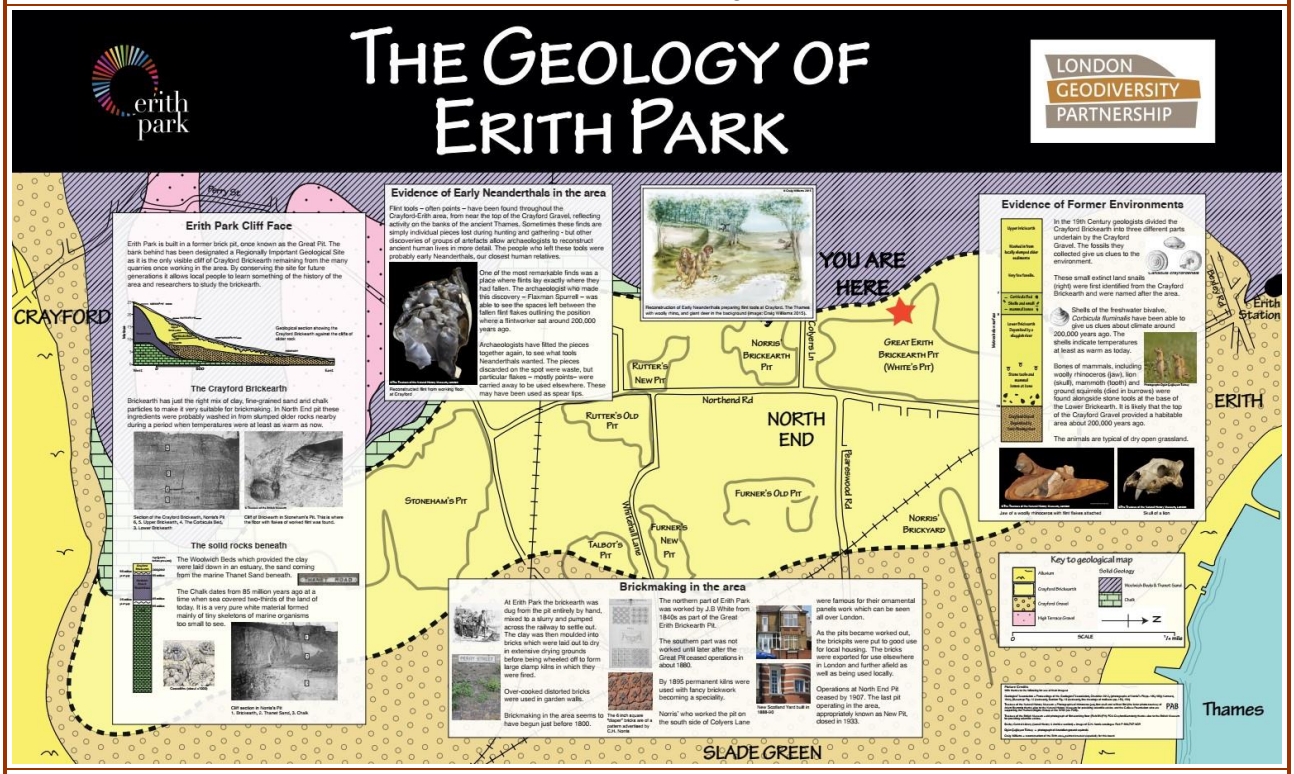
A rare site of brickearth. The present housing estate was built on the site of one of the large quarries in the area digging the Crayford Silt. Brickmaking in the area seems to have begun just before 1800. The northern part of Erith Park was worked by J.B White from 1840s as part of the Great Erith Brickearth Pit. The southern part was not worked until later after the Great Pit ceased operations in about 1880. By 1895 permanent kilns were used with fancy brickwork becoming a speciality. Norris’ brickyard was famous for their ornamental panel work which can be seen all over London. As the pits became worked out, the brickpits were put to good use for local housing. Operations at North End Pit ceased by 1907. The last pit operating in the area closed in 1933

The Crayford Silt in the area was made famous for its archaeology. Flint tools – often points – have been found throughout the Crayford–Erith area, from near the top of the Crayford Gravel, reflecting activity on the banks of the ancient Thames. The people who left these tools were probably early Neanderthals, our closest human relatives. One of the most remarkable finds was a place where flints lay exactly where they had fallen. The archaeologist, Flaxman Spurrell was able to see the spaces left between the fallen flint flakes outlining the position where a flintworker sat around 200,000 years ago. Archaeologists have fitted the pieces together again, to see what tools Neanderthals wanted. The pieces discarded on the spot were

waste, but particular flakes were carried away to be used elsewhere. Unfortunately, the original site of the flint floor is no longer accessible and the RIGS site was moved to the current cliff-face at the back of the re-built Erith Park. During the rebuilding the developers invited a mixture of professionals, the London Geodiversity Partnership and local residents to create a board to be erected explaining the geology		
Assessment of Site Value		
Geodiversity topic: Palaeontology, sedimentology and lithostratigraphy.		
Access and Safety		
Aspect	**Description**	
Safety of access	Site is fenced in currently without any access gate. Site can be viewed from outside fence. A six-foot board explains the significance of the site.	
Safety of exposure	Exposure is steep and slightly unstable.	
Permission to visit	Site is in a new housing estate and is owned by the London Borough of Bexley.	
Current condition	Considerable overgrowth has occurred, which helps to stabilise the slope but a small amount of exposure remains visible.	
Current conflicting activities	The need to protect the residents from the potentially unstable cliff face has necessitated in a fence being erected around the site	
Restricting conditions	Difficult access.	
Nature of exposure	Site is the last relic of a large brickworks that covered the area now devoted to housing. It is located on a steeply sloping bank and is fenced off.	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	Brickearth has been used for brick making since Roman times. Few exposures now exist. The site was part of a large brickworks, now demolished. Considerable literature is published on the flint worked floor.	8
Aesthetic landscape	An interesting feature within a housing estate. The board has input from the residents and so there is a sense of ownership.	4
History of Earth Sciences	The last major exposure of Crayford Silt Formation.	5
Economic geology	Former brickworks and pit.	4
GeoScientific Merit		
Geomorphology	None.	0
Sedimentology	The deposit is banked up against a steep bedrock slope and consists of fine sand and silt.	4
Palaeontology	Crayford brickearth has long been famous for mammalian and molluscan remains as well as Palaeolithic implements.	4
Igneous/mineral/ Metamorphic Geology	None.	0
Structural Geology	None.	0
Lithostratigraphy	Rare site for brickearth.	6
Potential use	Education and research.	
Fragility	Natural overgrowth and slumping	
Current Site Value		
Community	Site passed by on a daily basis.	7
Education	High value. Details of the 6-foot board can be seen on LGP website: www.londongeopartnership.org.uk/informationboardsandleaflets/#erith	5
Geodiversity value		
RIGS: An interesting and rare exposure.		**6**

GLA 31 North End Pit

Photo: Laurie Baker, August 2015

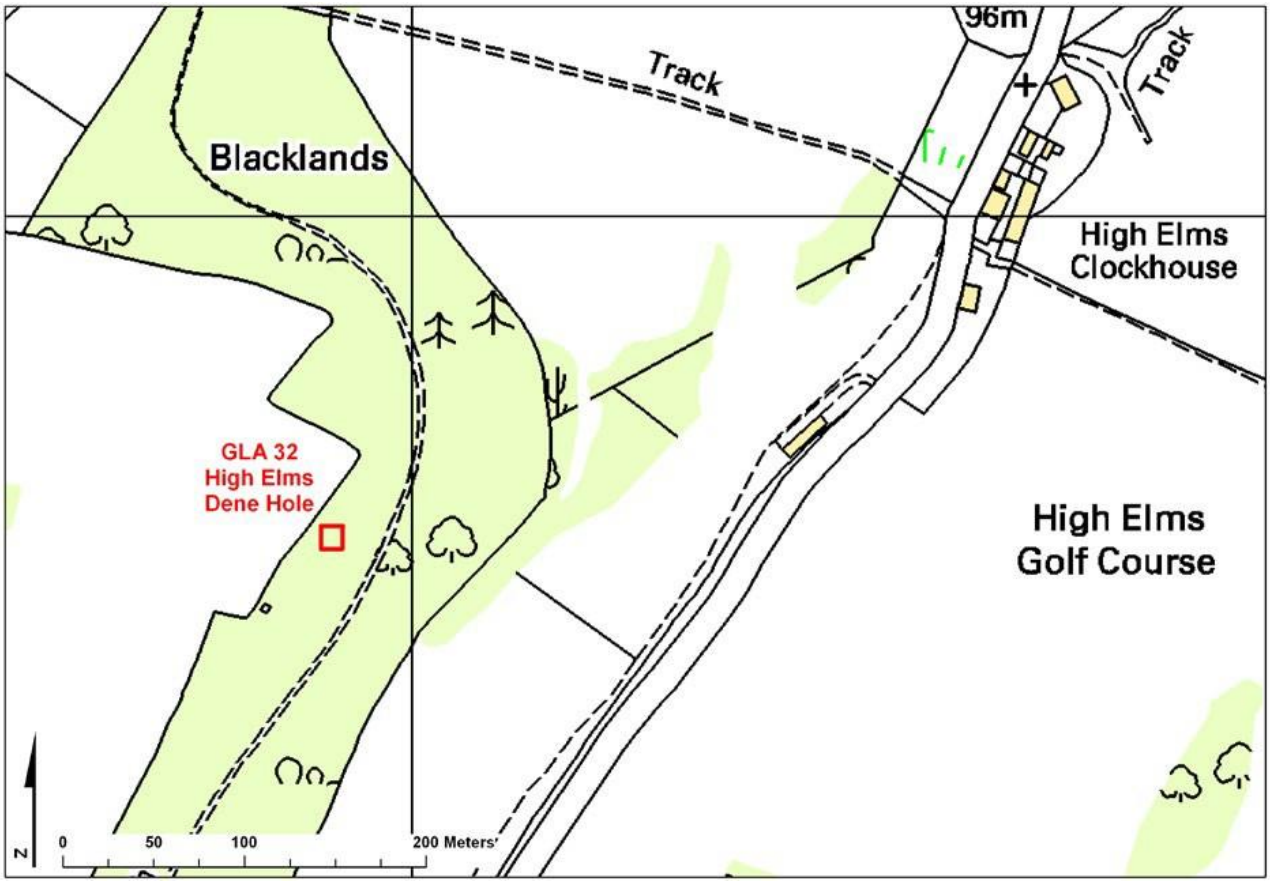


Information board unveiled in September 2015

GLA 32 High Elms Dene Hole

Grid Reference: TQ 4395 6282 (BR6 7JH)	Site Type: Small underground Chalk mine, possible ancient
Site Area (hectares): 0.02	Current use: Country Park
Site ownership: LB Bromley	Borough: London Borough of Bromley
Field surveyor: South London RIGS Group Last visited: Paul Rainey	Date: January 2008 Date: 2008
Current geological designation: RIGS	Other designation: LNR; Metropolitan SINC (High Elms)

Site Map OS Topography © Crown Copyright



Stratigraphy and Rock Types

Time Unit: Late Cretaceous	Rock Unit: Seaford Chalk Formation and Newhaven Chalk Formation Undifferentiated, Chalk Group
Rock Type: Chalk	Details: Chalk extends to surface

Site Description

This is a well preserved and protected underground Chalk pit. It is located in the High Elms Country Park. Very few, if any, of the over 200 chalk pits in the area are preserved. The pit is used for bat hibernation in winter.

Assessment of Site Value

Geodiversity topic: Palaeontology, sedimentology and lithostratigraphy.

Access and Safety

Aspect	Description
Safety of access	Level ground from nearby footpath.
Safety of exposure	The mine is securely protected by a steel grille.
Permission to visit	The site has open access. Permission to enter the mine must be obtained from the Head Ranger who would consult with other interested parties.

Current condition	Well preserved.	
Current conflicting activities	The mine is an important bat roost.	
Restricting conditions	Access to the mine workings is controlled by LBB.	
Nature of exposure	Disused trefoil type of shallow chalk mine.	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	Rare survivor of over 200 chalk mines in the area. Mining by this method to get chalk for marling land began in Roman times	6
Aesthetic landscape	Point of interest on popular walk route	5
History of Earth Sciences	Historic mining system	5
Economic geology	Former chalk mine	4
GeoScientific Merit		
Geomorphology	None.	0
Sedimentology	Environment of deposition.	2
Palaeontology	None	0
Igneous / mineral / metamorphic Geology	None.	0
Structural Geology	None.	0
Lithostratigraphy	Seaford Chalk Formation and Newhaven Chalk Formation Undifferentiated, Chalk Group.	2
Potential use	Onsite interpretation.	
Fragility	Natural overgrowth.	
Current Site Value		
Community	Site passed by on daily basis. The London Loop passes just to the north of the site.	8
Education	High value.	8
Geodiversity value		
RIGS: Rare survivor of an agricultural system in use for centuries.		7
GLA 32 High Elms Dene Hole		

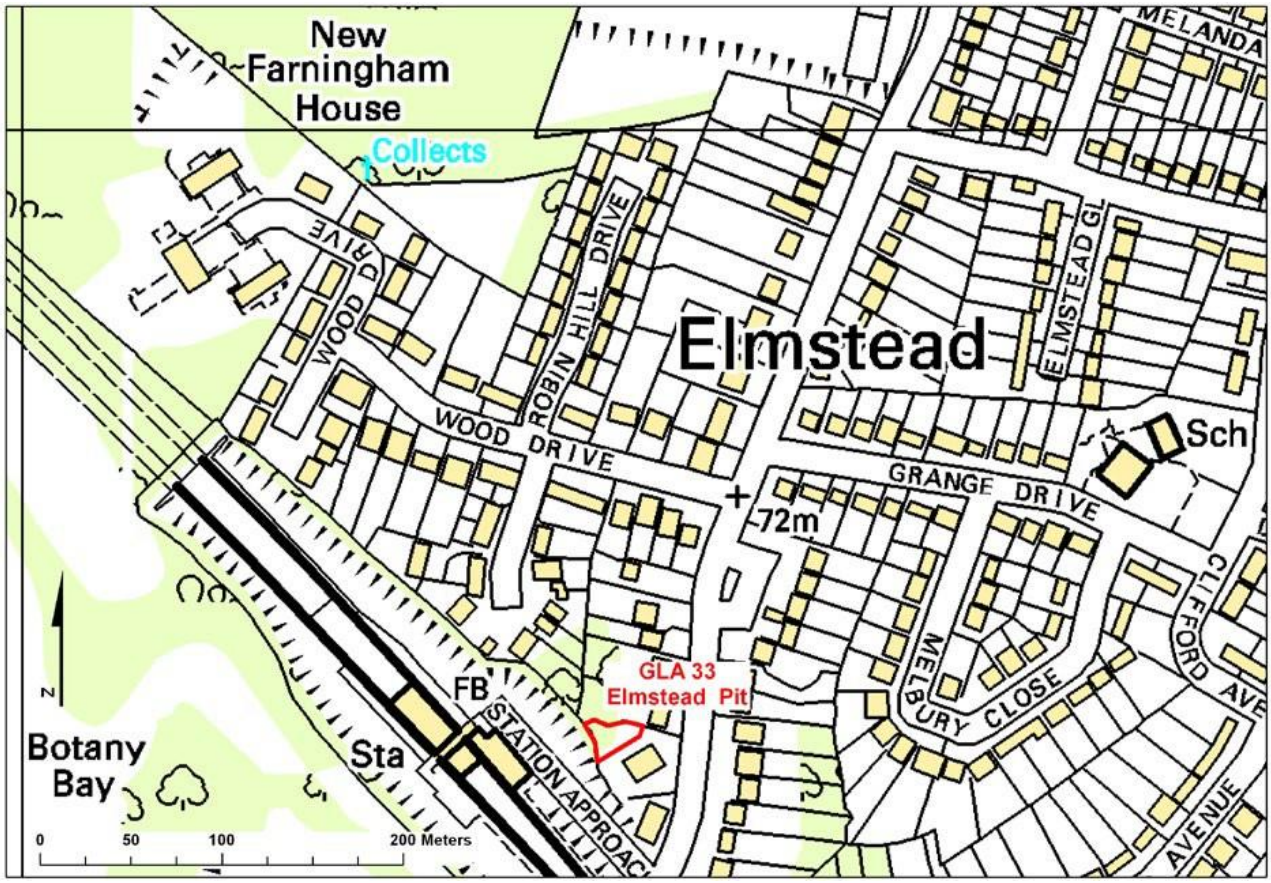
High Elms Dene Hole

GLA 33 Elmstead Pit

Grid Reference: TQ 4232 7066	Site Type: Former quarry works
Site Area (hectares): 0.05	Current use: Private garden behind 41 Elmstead Lane
Site ownership: Private resident	Borough: London Borough of Bromley
Field surveyor: Natural England website Latest visit: Diana Clements	Date: November 2002 Date: 2005
Current geological designation: SSSI Citation: 1003603 (naturalengland.org.uk)	Other designation: Borough Grade I SINC (Sundridge Park Golf Course, Elmstead Wood and Lower Marvels Wood)

Site Map

OS Topography © Crown Copyright



Stratigraphy and Rock Types

Time Unit: Eocene	Rock Unit: Blackheath Member, Harwich Formation, (Thames group); Blackheath Formation of Hooker, 2010.
Rock Type: Sand and gravel	Details: a rare occurrence of calcite cemented Blackheath Beds, including oysters, other shells and rounded black pebbles

Site Description

Elmstead Pit provides a nationally important exposure of the Blackheath Beds through a section containing an unusually rich fossil fauna. A wide range of geological features are present providing information on the changing disposition of land and sea in the Greater London area during Eocene times.

The current exposure covers a c.2 m high remnant of pit face cut into a series of Blackheath Beds consisting of fine quartz sands and an abundance of flint pebbles. These beds accumulated as sub-tidal bars in an estuarine environment during Eocene times approximately 50 million years ago. They are particularly noted for very large-scale 'cross-bedding' with angles of dip of up to 25 degrees.

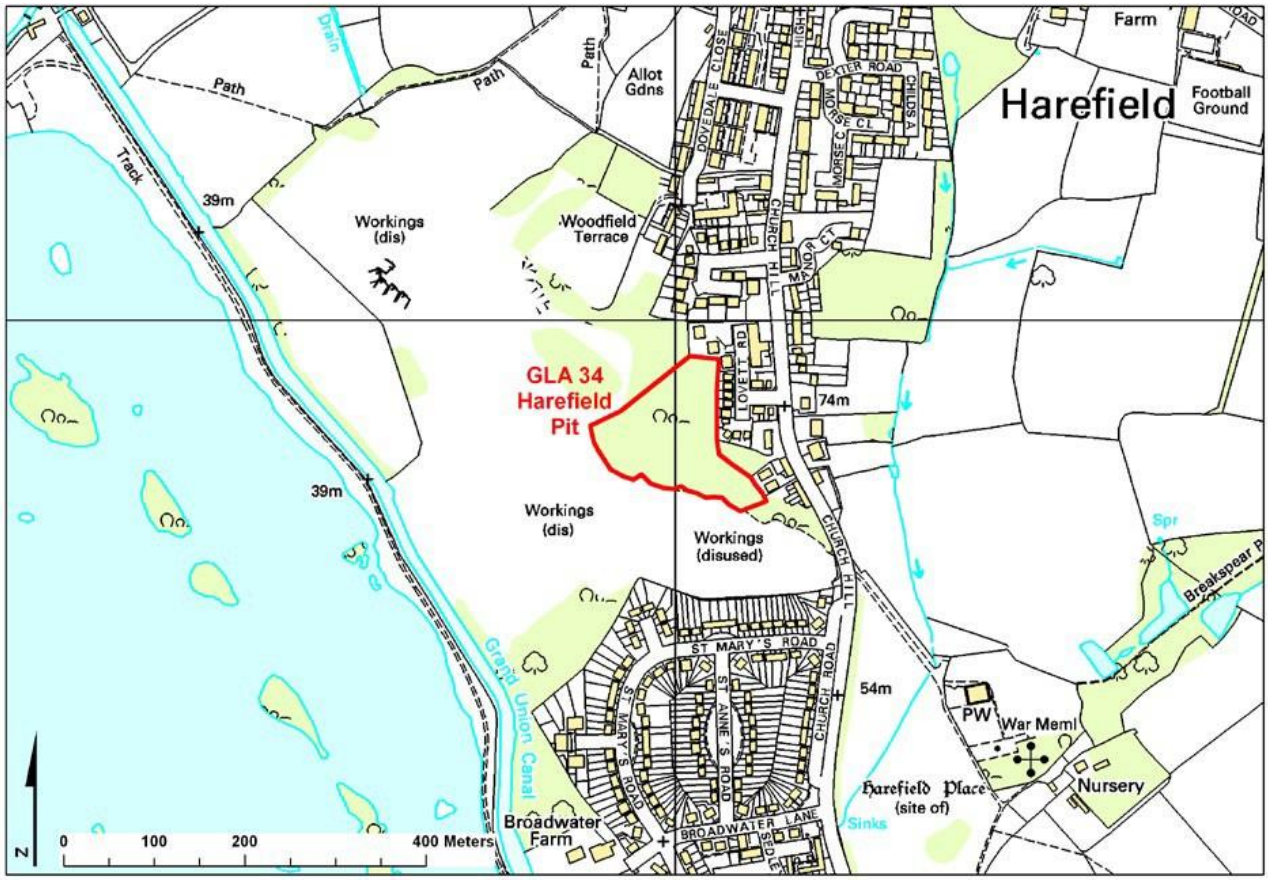
The sediments are bound by a heavy calcite cement which has preserved an unusually abundant and diverse fossil fauna. Pits at Elmstead have yielded a substantial part of the known molluscan fauna from the Blackheath Beds and a number of sharks teeth and fish scales have also been recovered. The site is now the only exposure in this locality of these highly fossiliferous beds.

Assessment of Site Value		
Geodiversity topic: Palaeontology, sedimentology and lithostratigraphy.		
Access and Safety		
Aspect	**Description**	
Safety of access	Access to site over level ground.	
Safety of exposure	Site has consolidated vertical face and level area at bottom of face.	
Permission to visit	Permission needed from house owner, normally requested through Natural England: ProtectedSites@naturalengland.org.uk.	
Current condition	Some encroaching ivy and shrubs that may in the long-term cause obstruction. In the long-term there may also be issues of instability of the rock face.	
Current conflicting activities	Site in a private garden.	
Restricting conditions	None.	
Nature of exposure	Vertical section of face of former pit	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	The area had a number of chalk and sand pits, all of which are now filled in for housing. This and Chislehurst caves are the only examples left. Other old pits of Blackheath Beds are known from other sites in Elmstead Lane and in Sundridge Park, to the west of the railway.	8
Aesthetic landscape	Private garden	2
History of Earth Sciences	The area has strong association with Whitaker. Described and sketched in his 1889 edition of The Geology of London	8
Economic geology	Former building stone pit, probably worked in Victorian times	5
GeoScientific Merit		
Geomorphology	None.	0
Sedimentology	Large scale cross bedding. Imbricated flint pebbles occur in bands.	6
Palaeontology	Abundant fossil molluscs, plus sharks' teeth.	6
Igneous / mineral / metamorphic geology	None.	0
Structural Geology	None.	0
Lithostratigraphy	Blackheath Formation.	8
Potential use	Research and education.	
Fragility	Natural overgrowth and weathering of face.	
Current Site Value		
Community	None, Access is difficult.	2
Education	High value. Included in GA Guide 68, 2012, Itinerary 7 (see refs).	5
Geodiversity value		
SSSI: Importance for its history and potential for research.		6
GLA 33 Elmstead Pit		
	Face detail of sand with flint pebbles. Photo: Diana Clements, June 2005	

GLA 34 Harefield Pit

Grid Reference: TQ 049 898	Site Type: Land filled former quarry works
Site Area (hectares): 1.80	Current use: Fallow field, formerly dairy herd grazed
Site ownership: Private ownership, contact Natural England	Borough: London Borough of Hillingdon
Field surveyor: Information from Natural England Revisited: Allan Wheeler, Diana Clements, Laurie Baker, Steve Tracey and Lucy Flower (NE)	Date: October 2002 Date: January 2018 with further visit by NE in 2019
Current geological designation: SSSI Citation: 1001658.PDF (naturalengland.org.uk)	Other designation: Borough Grade I SINC (Harefield Chalk Pit)

Site Map OS Topography © Crown Copyright



Stratigraphy and Rock Types

Time Unit: Eocene	Rock Units: Harwich Formation, London Clay Formation (Thames Group)
Rock Type: sands and clays	Details: fossiliferous marine alternating sands and clays of both the Swanscombe Member and Tilehurst Member (of King, 1981) of the Harwich Formation. The Walton Member of the London Clay Formation overlies the Harwich Formation.
Time Unit: Paleocene-Eocene	Rock Unit: Lambeth Group (Upnor and Reading Formations)
Rock Type: sands and clays	Details: variable sands showing cross-stratification in places; nodular glauconite-covered flints at base.
Time Unit: Late Cretaceous	Rock Unit: White Chalk Subgroup, Chalk Group
Rock Type: Chalk	Details: Seaford Chalk with large flints near the top

Site Description

A key section in the London Basin for a sequence through the Upper Chalk, Upnor and Reading Formation, Harwich and London Clay Formations. It is also the only known site for calcareous charophytes in the Reading Formation. The site covers part of a disused chalk quarry which has been infilled leaving only the upper faces exposed. These display a superb Paleogene section including the contact between the Upper

Chalk and Upnor Formation, which has here been intensively bored by crustaceans to leavethe trace fossil *Glyphichnus harefieldensis*. The faces also show a full section through the Reading Formation, up into mottled fluviatile clays of the Upper Reading Formation. These are overlain by sandy clays with a diverse marine fauna, comprising both the Swanscombe Member and the Tilehurst Member (of King, 1981) of the Harwich Formation for which this is the stratotype locality. Harefield Pit is additionally of particular interest as the only known source of

Charophytes in the Reading Formation. These are important palaeo-environmental indicators, and have potential for correlation with other coeval localities in Europe. An old description (Whitaker 1889) states that the overlying London Clay 'Basement Bed' has yielded plant material. This probably refers to Harwich Formation.

Assessment of Site Value

Geodiversity topic: Palaeontology, sedimentology and lithostratigraphy.

Access and Safety

Aspect	Description
Safety of access	Access via track from Church Hill (opposite sign to St. Mary's Church) and across private field to the base of the face (difficult to find when the grass and thistles are high). The top section of the exposure is also difficult to find through the wood at the top of the main section. Access from the gully on the north side is overgrown.
Safety of exposure	Collapse has occurred in one section.
Permission to visit	Permission to visit required via Natural England: ProtectedSites@naturalengland.org.uk
Current condition	Scrub grows up on part of site with brambles making access to geological sections difficult without regular clearance
Current conflicting activities	Access to site through private land and overgrown vegetation
Restricting conditions	Site becomes easily overgrown and access to the Harwich Formation and London Clay at the top of the section is difficult to access.
Nature of exposure	Infilled chalk quarry. Top of chalk quarry protected during landfill.

Culture, Heritage & Economic

Aspect	Description	Rating
Historic, archaeological & literary associations	One of the major Colne valley chalk quarries developed beside the Grand Union Canal to serve the 19th Century building expansion of London.	
Aesthetic landscape	Good view across the Colne valley to proto-Thames terraces.	
History of Earth Sciences	Site is well documented, earliest reference 1864, throughout working life as a quarry and subsequently. A critical source of both palaeontological and stratigraphical information	7
Economic geology	Former chalk quarry local interest	4
GeoScientific Merit		
Geomorphology	None.	
Sedimentology	Important locality for understanding the sedimentology of the Reading Formation and its relationship with the overlying Swanscombe & Tilehurst Members of the Harwich Formation and the London Clay Formation above that. Also exposed is the unconformable relationship with the underlying Late Cretaceous Chalk	8
Palaeontology	Only known locality to have yielded fossil charophytes (stoneworts) from the Reading Formation. – important environmental indicator and for comparison with similar aged sites across Europe. Interesting burrows of Upnor Formation into the top of the Chalk, originally described as *Terebella harefieldensis (now Glyphichnus harefieldensis)*.	9
Igneous/mineral/ Metamorphic Geology	None.	

Structural Geology	None.	
Lithostratigraphy	Has been and remains a critical site in understanding Upnor and Reading Formation lithostratigraphy. Former type section of the Tilehurst Member of the Harwich Formation	8
Potential use	Research, higher education and potential for wider interpretation (subject to access arrangements)	
Fragility	Threatened by vegetation and build-up of scree	
Current Site Value		
Community	Access by permission only	2
Education	Restricted access but potentially an important field locality for university students. Keen local group interest. Included in GA Guide 68, Itinerary 1 (see references).	6
Geodiversity value		
SSSI: Of high scientific value for Tertiary palaeobotany and Tertiary stratigraphy		8
GLA 34 Harefield Pit		

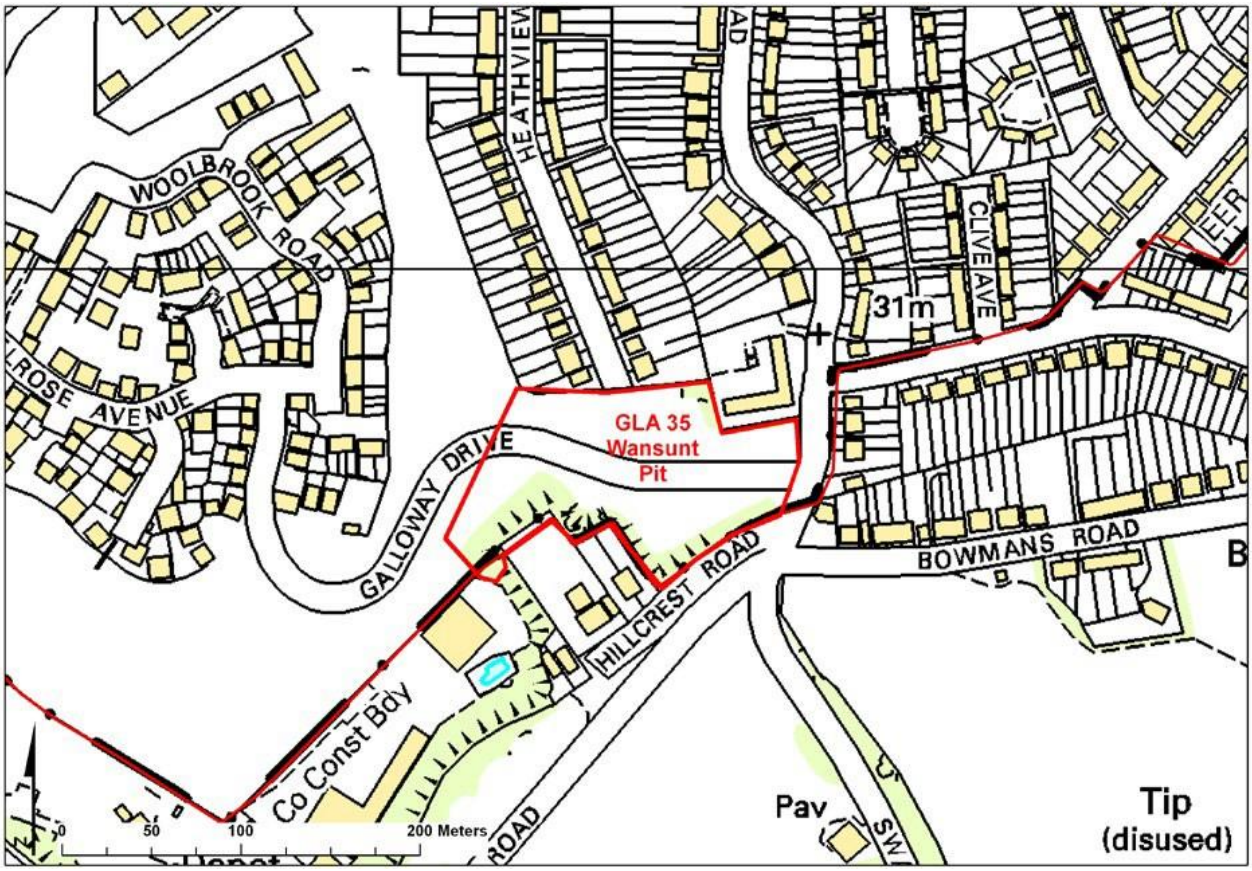
South end of the face prior to 2003

The same face in January 2018. Photo: Diana Clements

GLA 35 Wansunt Pit (in Braeburn Park)

Grid Reference: TQ 515 738	Site Type: Free public access
Site Area (hectares): 1.95	Current use: Free public access
Site ownership: The Land Trust; managed by London Wildlife Trust for the Land Trust	Borough: London Borough of Bexley
Field surveyor: Natural England Revisited: Diana Clements (with QRA Field Trip)	Date: October 2001 Date: July 2019
Current geological designation: SSSI Citation: 1003328.pdf (naturalengland.org.uk)	Other designation: MOL; Borough Grade I SINC (Braeburn Park)

Site Map



Stratigraphy and Rock Types

Time Unit: Pleistocene	Rock Unit: Dartford Heath Gravel (a local term for the Boyn Hill Gravel Member of the Thames Valley Formation). The local 'Wansunt Loam' overlies the gravel in the north edge of the former pit.
Rock Type:	Details: Dartford Heath Gravel is a predominantly layered flint gravel of small rounded pebbles in a sandy matrix of red colouration. Occasional clasts of rounded vein quartz were observed.

Site Description

This site provides exposures in the Dartford Heath Gravel, a deposit which has been the subject of considerable controversy since the turn of the century. It has been variously attributed to the Boyn Hill Terrace, part of the Swanscombe sequence or to an older, higher terrace.

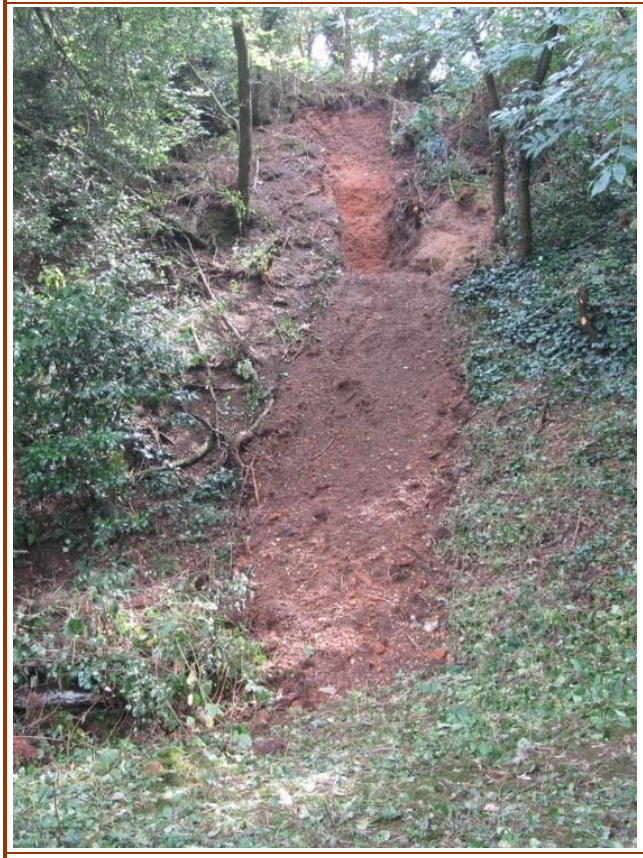
The presence or absence of archaeological material in the gravel itself is questionable, but a working floor of Acheulian age has been discovered in the Wansunt Loam overlying the gravel in Wansunt Pit. The question of whether or not the Dartford Heath gravel is equivalent to any part of the Swanscombe sequence, and what its relationship is to the Thames Terraces, has long been debated in the Thames Pleistocene studies, and therefore the exposures here are of considerable importance. It is now considered to be a local variation of the Boyn Hill Gravel (Bridgland et al., 2019).

Assessment of Site Value		
Geodiversity topic: Sedimentology and lithostratigraphy.		
Access and Safety		
Aspect	**Description**	
Safety of access	Publicly accessible site via Galloway Drive	
Safety of exposure	Possibility of slumping and likelihood of overgrowth if not conserved	
Permission to visit	It is on publicly accessible land but permission required for any detailed work through Natural England: ProtectedSites@naturalengland.org.uk	
Current condition	Part filled former gravel pit. Part developed for local industrial units with access roads. Enclosed by housing and mainly over grown. Recent development of land within the pit has resulted in land raising up to the base of the SSSI and construction of a new access road into the development site. Several exposures have been created on the northern face of the SSSI as part of the planning conditions which are refreshed by the Quaternary Research Association when they make periodic visits. The main exposure in the SE face of the former quarry is less accessible but can be reached by a rudimentary path along the edge of the woodland. It is refreshed from time to time.	
Current conflicting activities	Possible future animal/plant conservation issues as managed by London Wildlife Trust (LWT mention importance of the geology in their site information).	
Restricting conditions	Vegetation and fly-tipping	
Nature of exposure	Overgrown in southern part of the site when not recently exposed. Managed exposures in northern part of the site	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	Source of palaeolithic artefacts	7
Aesthetic landscape	Part of Braeburn Park managed by London Wildlife Trust	
History of Earth Sciences	Significant history of research and a critical (and controversial) site in the interpretation of the Thames Gravel sequence. Site is described in Field Excursion Guides of the Quaternary Research Association (see Bridgland et al, 2019)	7
Economic geology	Former gravel pit – local interest	4
GeoScientific Merit		
Geomorphology	Not rated.	
Sedimentology	Not rated.	
Palaeontology	Mammalian remains and flint artefacts	7
Igneous/mineral/ Metamorphic Geology	None.	
Structural Geology	None.	
Lithostratigraphy	Critical site for the interpretation of the Thames Gravel sequence and for correlation across Europe (esp. development of the Rhine River system). Presence of Palaeolithic artefacts adds significant value.	8
Potential use	High research interest, potential local and regional educational value	
Fragility	Vegetation management necessary, critical sections in northern part of site	
Current Site Value		
Community	Publicly accessible site but exposures may not be visible unless conserved	2
Education	Important educational locality especially university level and research, possible regional and local interest in collaboration with London Wildlife Trust	10

Geodiversity value	
SSSI: High scientific value for its Thames Terrace sequence, critical site for interpreting Thames Terraces and for comparison across Europe	9

GLA 35 Wansunt Pit

Recently conserved exposures at Quaternary Research Association Field Excursion, July 2019



South-east face: Dartford Heath Gravel

North-east face: Wansunt Loam

Photos: Diana Clements

GLA 36 Pinner Chalk Mines

Grid Reference: TQ 1154 9048	Site Type: Former mine workings
Site Area (Hectares): 3.44	Current use: mine is under recreational land
Site ownership: London Borough of Harrow	Borough: London Borough of Harrow
Field surveyor: Harrow & Hillingdon Geol. Soc. Revisited (surface): Allan Wheeler	Date: November 2011 Date: April 2019
Current geological designation: RIGS	Other designation: Borough Grade II SINC (Grim's Ditch and Pinner Green)
Site Map	OS Topography © Crown Copyright

Stratigraphy and Rock Types

Time Units: Paleocene-Eocene	Rock Units: Upnor and Reading Formations (Lambeth Group)
Rock Types: puddingstone	Details: Hertfordshire Puddingstone in situ in mine shaft; Reading Formation sand at surface
Time Units: Late Cretaceous	Rock Units: Chalk Group
Rock Types: Chalk with flints	Details: Seaford Chalk Formation, White Chalk Sub-group

Site Description

Pinner Chalk Mines extend over a large area, with mixed extraction methods recorded from the 14th century. Access to the majority is no longer possible, and this survey is of the 1830-70 'Dingles' mine. When accessible, it is one of the few locations still existing in London where the chalk can be examined without being masked by vegetation. It is also important for the extremely rare *in situ* Hertfordshire Puddingstone that can be seen in the shaft to the mine and in small roof falls. Its presence allowed the quarrymen to utilise the Chalk almost to the top as it provided a hard roof. There are small exposures of Reading Formation sand near the top of the mineshaft.

Assessment of Site Value

Geodiversity topic: Sedimentology; Palaeotology; Lithostratigraphy;.

Access and Safety

Aspect	Description
Safety of access	Public footpath steep/slippery in places. Mine shaft enclosed in security fence with locked cover.

Safety of exposure	Accessible galleries with pillar and stall in good condition (only two roof falls in last 160 years, one caused by contractors during construction of latest shaft access cover). Access currently suspended for Health & Safety reasons.	
Permission to visit	By request to Council Licensee.	
Current condition	Unknown, but good when last accessed (early 2000s).	
Current conflicting activities	None	
Restricting conditions	Availability of Caving Group that provides means of access by 35m caving ladder with safety harness.	
Nature of exposure	Old mine workings.	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	Well documented with summary and references in Pinner Local History Society's publication "Pinner Chalk Mines" ISBN 0 9507955 6 9 and Harrow & Hillingdon Geological Society's "A guide to Pinner Chalk Mine" ISBN 0 9520325 0 3. It is described at Itinerary 2 in Clements, 2012	10
Aesthetic landscape	Potential for Interpretation Board, subject to survey of surface safety and vandalism history.	3
History of Earth Sciences		
Economic geology	Local economic importance	8
GeoScientific Merit		
Geomorphology		
Sedimentology	Chalk with flint and overlying puddingstone	8
Palaeontology	Chalk with flint	7
Igneous/mineral/ Metamorphic Geology		
Structural Geology		
Lithostratigraphy	Chalk and puddingstone succession	8
Potential use	Continued research; Higher and further education; School education.	
Fragility	Roof potentially, as in most mines, due to external influences. Surface overgrown and subject to vandalism.	
Current Site Value		
Community	Under recreational space access.	6
Education	Long-standing and continuing research, education and public interest. Training 'ground' for Fire Service and Met. Police. Included in GA Guide 68, Itinerary 2 (see references).	9
Geodiversity value		
RIGS: Rare regional example of 'deep' chalk mining with well-documented history and wide educational value. It is important scientifically for its exceedingly rare *in situ* exposure of Hertfordshire Pudding stone. Fairly good exposures of Lambeth Group (mainly sand with some clay) on the surface (The Dingles) above Pinner Chalk Mine at TQ 1160 9052 and of the former Pinner Hill Farm at TQ 1102 9076. There is a plaque on wall on farm building nearest road.		9

GLA 36 Pinner Chalk Mines

Pinner Chalk Mine visit in 1999

The Dingles. Reading Formation sand.
Photo: Allan Wheeler, March 2019

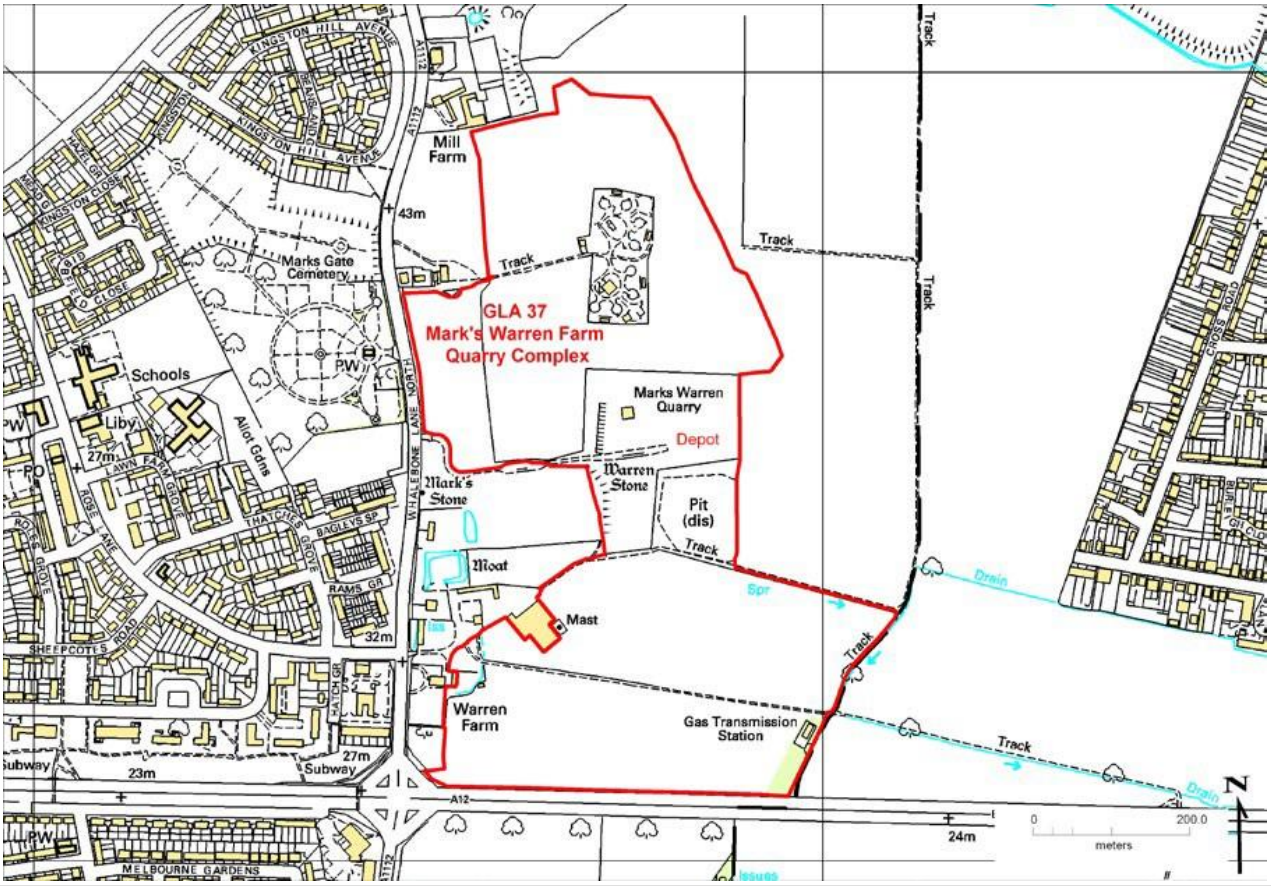
Hertfordshire Puddingstone from roof collapse

GLA 37 Mark's Warren Farm Quarry Complex

Grid Reference: TQ 488 895	Site Type: aggregate quarry site
Site Area (hectares): 31.06	Current use: potential land fill
Site ownership: Brett Lafarge	Borough: London Borough of Barking & Dagenham
Field surveyors: Diana Clements / Peter Collins / Bill George	Date: July 2011 (ceased operation soon after)
Current geological designation: LIGS (Originally RIGS, but now backfilled and landscaped with nothing to be seen.)	Other designation: Borough Grade I SINC (Marks Hedge and Hainault Road Allotments Wood)

Site Map

Map shows former area of workings, now restored to agricultural land



Stratigraphy and Rock Types

Time Unit: Pleistocene	Rock Unit: Black Park Gravel Member, Maidenhead Formation
Rock Type: Sand and gravel	Details: Sand and pebbles (mostly flint),

Site Description

The quarry was on its last days of extraction of Thames Terrace Black Park Gravel (MIS12-11) in July 2011 and landfill had already commenced on the west side of the quarry. It has subsequently been backfilled and returned to agricultural use but as it is the only area of Black Park Gravel in the area it was thought to be worth retaining as a LIGS (demoted from the original RIGS status. Information from Brett is that it will not be developed further. A glacial erratic boulder was found within the gravels. It is reported to be dolerite, originating from the Carboniferous Whin Sill in Northumbria, and, if confirmed, will be the furthest south boulders of this nature have travelled. Original transportation was by ice within the Anglian ice sheet with subsequent emplacement within the earliest of the Thames Gravels as the ice melted. Brett Lafarge kindly moved this boulder to Bedfords Park Visitor Centre for display purposes. Other former quarries from the Mark's Warren complex were being used for processing but they have also been landfilled and re-established as agricultural land.

Assessment of Site Value

Geodiversity topic: Lithostratigraphy; sedimentology, glaciotectonics

Access and Safety		
Aspect	**Description**	
Safety of access	The quarry can only no longer be visited and is now restored to agricultural land.	
Safety of exposure	No longer visible	
Permission to visit	Brett Tarmac have taken over from Brett Lafarge and are now operating the Fairlop Site (GLA 49)	
Current condition	The site finished operations in 2011 and is now landfilled and restored to agricultural use (as per planning permission)	
Current conflicting activities	Landfill and land reclamation.	
Restricting conditions	Nothing to be seen.	
Nature of exposure	Former quarry for Black Park Gravel (only exposure in area).	
Culture, Heritage & Economic		
Aspect	**Description**	Rati
Historic, archaeological & literary associations	The area has been quarried from c.1898-1921 but literature has not been researched. The glacial erratic boulder is an important find, scientifically.	4
Aesthetic landscape	Private land	0
History of Earth Sciences	Other gravel pits in East London have been important for Archaeological remains but none have been reported from the Mark's Warren complex as far as can be ascertained	2
Economic geology	Gravel extraction has been an important industry in east London	8
GeoScientific Merit		
Geomorphology	Flat terrace at 35-40m above OD	2
Sedimentology	Further research into far-travelled clasts recommended	6
Palaeontology	None known	0
Igneous/mineral/ Metamorphic Geology	Inclusion of igneous boulder within predominantly flint gravel	6
Structural Geology	None.	0
Lithostratigraphy	The boulder provides added interest to the study of the Black Park Gravel	6
Potential use	Research into boulder; (off-site education on Thames Terraces and Anglian ice sheet)	
Fragility	landfill	
Current Site Value		
Community	.	2
Education		8
Geodiversity value		
LIGS:	Should any adjacent pits be opened in future, it is important for Barking & Dagenham to consider designating a face within the complex a RIGS for the Black Park Gravel as there are no other exposures in east London, and in particular because of the importance of the discovery of the glacial erratic boulder within the gravel. In the meantime, as there is nothing to be seen it should be demoted to LIGS.	4

GLA 37 Mark's Warren Quarry Complex

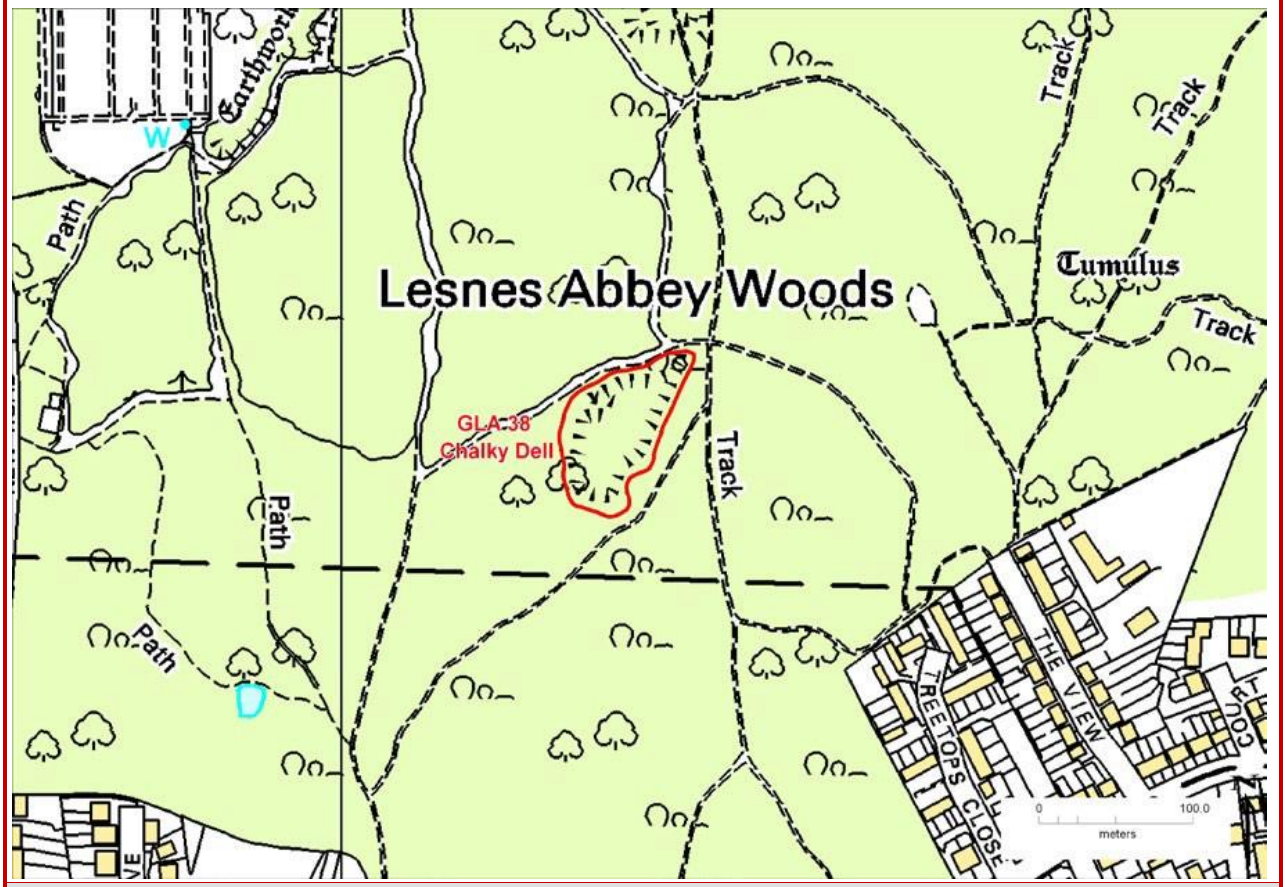
Very red nature of the Black Park Gravel when operating in 2011.
Photo: Diana Clements

GLA 38 Chalky Dell, Lesnes Abbey Woods

Grid Reference: TQ 48147846	Site Type: Former Chalk Pit with Thanet Sand at top
Site Area (hectares): 0.54	Current use: within recreational land of Lesnes Abbey Woods
Site ownership: L.B. of Bexley	Borough: London Borough of Bexley
Field surveyor: Diana Clements Re-visited: Diana Clements, Laurie Baker	Date: October 2010 Date: March 2020
Current geological designation: RIGS	Other designation: Metropolitan SINC (Lesnes Abbey Woods and Bostall Woods

Site Map

OS Topography © Crown Copyright



Stratigraphy and Rock Types

Time Unit: Paleocene	Rock Unit: Thanet Formation with Blackheath Formation above
Rock Type: Clay, silt, sand	Details: Pale yellow-brown fine-grained sand that can be clayey and glauconitic. Bullhead Bed of nodular green glauconite-covered flints at base.
Time Unit: Late Cretaceous	Rock Unit: Probably Seaford Chalk Formation, White Chalk Subgroup
Rock Type: Chalk	Details (Seaford Chalk): Firm white chalk with conspicuous semi-continuous nodular and tabular flint seams. Hardgrounds and thin marls are known from the lowest beds. Some flint nodules are large to very large.

Site Description

Small, partially-overgrown Chalk pit that formerly exposed the junction with the Thanet Formation above including the un-weathered glauconite-covered flints of the Bullhead Beds at the base. The quarry is included as Stop 10 on the Green Chain Walk Geotrail but at present only small exposures of Chalk are visible close to the floor of the pit, the rest is covered in scree. A small section was exposed near the top of the section to reveal the top of the Chalk, the Bullhead Bed at the base of the Thanet Sand with the Blackheath Formation sand above (the BGS map marks this as Head). There is potential for re-excavating steps up the scree slope still just visible to make the exposure a more permanent feature. More research required to confirm that the top of the Chalk is within the Seaford Chalk Formation (the norm for the London region).

Reference: Marriott, St J. 1925. *British Woodlands as illustrated by Lessness Abbey Woods*. George Routledge & Sons Ltd. London.

Assessment of Site Value

Geodiversity topic: Lithostratigraphy; sedimentology; geomorphology; palaeontology.

Access and Safety

Aspect	Description
Safety of access	Fenced off and gated area within Lesnes Abbey Woods.
Safety of exposure	It is not safe to climb the scree slope to access the top of the quarry.
Permission to visit	All individuals or groups wishing to visit should contact the Council, email: lesnesabbey@bexley.gov.uk
Current condition	Thanet Sand scree covers the vegetation-bare area of the quarry. Elsewhere vegetation obscures the faces. A small patch of chalk with large flints is kept cleared on the low cliff on the slope down to the quarry floor.
Current conflicting activities	Fly-tipping.
Restricting conditions	Present non-visibility of face, except for the small Chalk exposure e
Nature of exposure	The quarry was cleared of rubbish in 1992 and a section cut in 2014. It is currently inaccessible but simple steps could be created to the top if the fly-tipping problem could be overcome.

Culture, Heritage & Economic

Aspect	Description	Rating
Historic, archaeological & literary associations	Described by Marriott, 1925 with a photograph of the Bullhead Bed junction	6
Aesthetic landscape	Distinct quarry on Green Chain Walk Geotrail	4
History of Earth Sciences		0
Economic geology	Chalk used for agricultural purposes and in construction of the road through the woods. Possibly used sparingly in the walls of Lesnes Abbey	4

GeoScientific Merit

Geomorphology	Research potential in establishing the thickness of the overlying Thanet Formation and the true nature of the overlying sand at this point. At the SSSI the Blackheath Beds channel down through the Lambeth Group and the sub-surface geology can provide useful evidence to the palaeo-structures. It is likely to be part of the Blackheath Beds but is labelled 'Head' by the BGS.	4
Sedimentology	Details not known but the site offers an opportunity to examine the Chalk, Bullhead Bed and Thanet Sand.	5
Palaeontology	None known about	
Igneous/mineral / Metamorphic Geology	None.	0
Structural Geology	Local sub-surface structure needs resolving	4
Lithostratigraphy	Junction between Thanet Formation (Bullhead Bed) and Chalk is main lithology of interest. Only Chalk exposure in Bexley.	6
Potential use	Research; education;	
Fragility	natural overgrowing; weathering/erosion;	

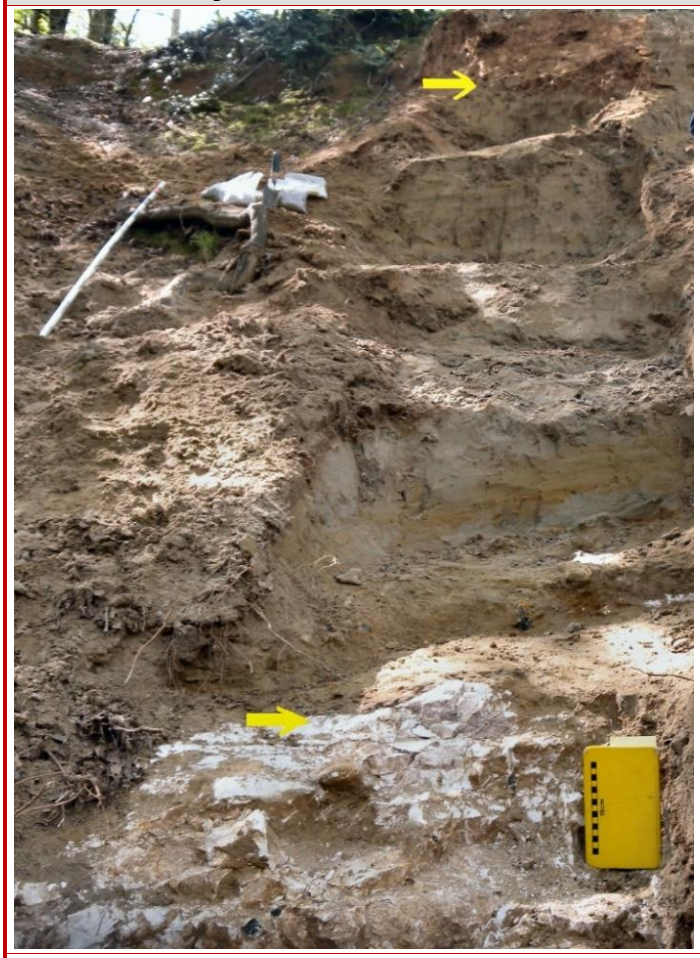
Current Site Value

Community	On Green Chain Walk Geotrail: www.londongeopartnership.org.uk/geotrails	7
Education	There is an interpretation board at the entrance to the quarry. It will be included in a proposed leaflet on the geology of Lesnes Abbey Wood.	8

Geodiversity value

RIGS:	worth conserving for an introduction to the geology of the area and specifically for the Bullhead Beds. Controlled public access.	6

GLA 38 Chalky Dell



Full section – top and base of Thanet sand arrowed.
Photo: Steve Tracey, April 2014

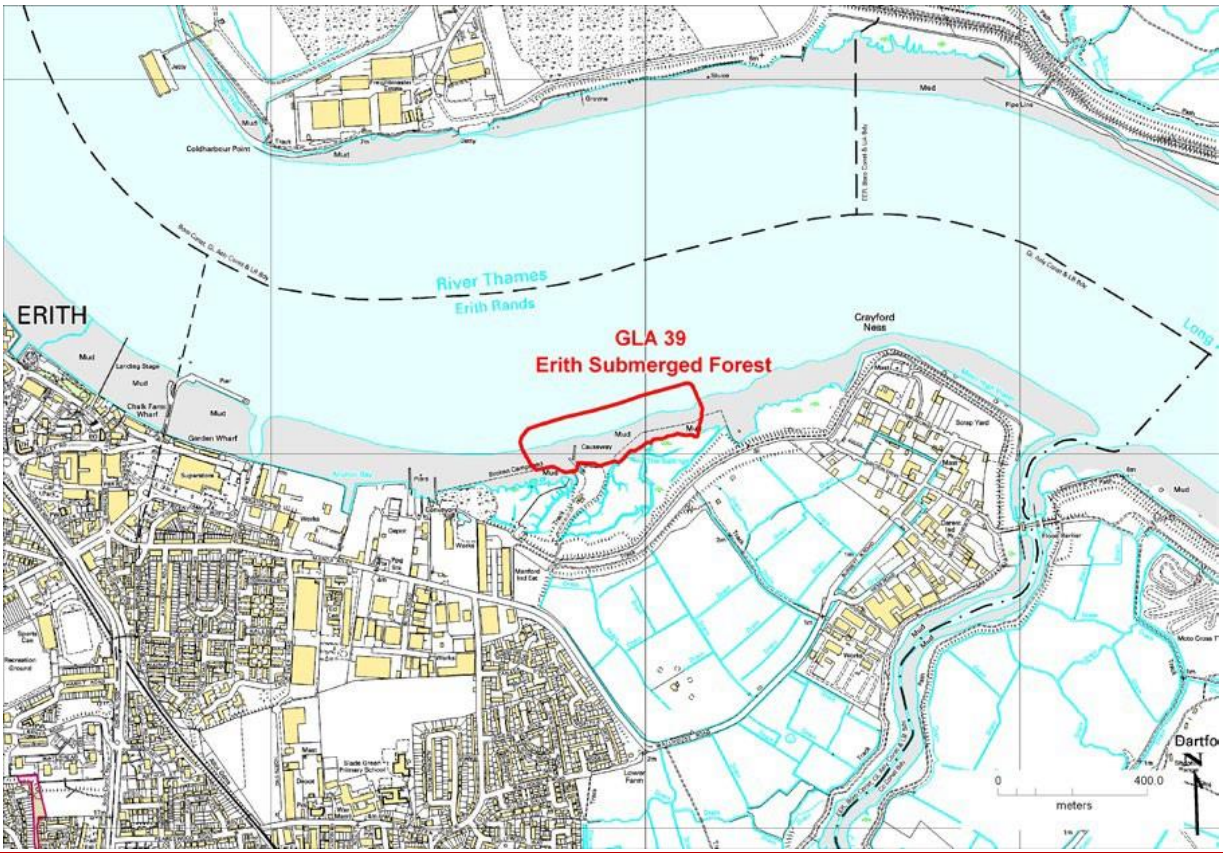
Cross-bedded base of Thanet sand on bullhead bed. Photo: Steve Tracey, April 2014

Chalk exposure with flints.
Photo: Laurie Baker, February 2016

GLA 39 Erith Submerged Forest and Saltings

Grid Reference: TQ 526 776	Site Type: Natural foreshore exposure of submerged forest
Site Area (hectares):6.28	Current use: Natural marsh land and foreshore
Site ownership: Port of London Authority	Borough: London Borough of Bexley
Field surveyor: Laurie Baker, Diana Clements Re-visited: Laurie Baker, Diana Clements, Paul Rainey	Date: 2010 Dates: January 2016
Current geological designation: RIGS	Other designation: Metropolitan SINC (River Thames and tidal tributaries)

Site Map



Stratigraphy and Rock Types

Time Unit: Holocene	Rock Unit: Alluvium & peat
Rock Type: Alluvium	Details: peat at varying horizons.

Site Description

This is the best place on the Thames Estuary within Greater London for viewing the Neolithic/Bronze Age submerged forest. At low tides whole tree trunks are revealed amongst the root balls and occasional nuts and seeds can also be found. Peat beds are also found on the banks above mean high tide level. At least five different ages of peat and trees have been dated ranging from over 5,000 years ago to approximately 3,000 years ago. Fifteen different tree and shrub species have been recognised of which the majority are alder. Other species include birch, willow, poplar, yew, maple, ash, oak, holly and elm. Shrubs include dogwood, alder buckthorn and buckthorn. The site represents a change from a drier environment when the yew and other 'dry' species were growing, to the wetter environment, produced by rising sea levels, leading to the dominance of alder.

Assessment of Site Value

Geodiversity topic: Holocene processes in the Thames

Access and Safety

Aspect	Description
Safety of access	Access to the Thames foreshore is via a path (signed to Erith Yacht Club at

	TQ 527 779) leading from Manor Road, off the A2016 Bronze Age Way, Erith. After about 150m turn right onto the Thames Cycle Route along the top of a barrier as far as a concrete structure with a steel covering and then down to the foreshore (TQ 532 781). The submerged forest can only be seen at low tide. Access to the foreshore itself is potentially dangerous and slippery and should only be attempted on a falling tide **and never alone**.	
Safety of exposure	Storms could potentially damage the exposure as could any development along this stretch of the Thames	
Permission to visit	Open access. A further exposure just to the west requires permission from the Erith Yacht Club.	
Current condition	The foreshore is muddy, slippery and dangerous and should not be attempted alone.	
Current conflicting activities	None known	
Restricting conditions	Tide, weather, mud	
Nature of exposure	Natural foreshore exposure of Neolithic submerged forest	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	Details can be found in Seel, 2000 and Sidell & Haughey, 2007. Described in GA Guide 68, 2012, Itinerary 10.	8
Aesthetic landscape	Public viewing from cycle route	7
History of Earth Sciences	Described in early editions of the Proceedings of the Geologists' Association	4
Economic geology	None	0
GeoScientific Merit		
Geomorphology	Record of changing sea levels in the Thames Estuary and an example of existing saltmarsh.	6
Sedimentology	At least five peat horizons have been dated between 3,000 and 5,000 years old	6
Palaeontology	At least 15 different species of plant	6
Igneous/mineral/ Metamorphic Geology	None.	0
Structural Geology	None.	0
Lithostratigraphy	Holocene alluvium and associated peat horizons	6
Potential use	Research; further education; on-site interpretation.	
Fragility	Storms; human engineering of Thames estuary	
Current Site Value		
Community	Valuable, as can be seen from cycle route	8
Education	Excellent evidence for teaching about past environments of the Thames Estuary and about global warming and sea-level rise	9
Geodiversity value		
RIGS: The best exposure of the Neolithic submerged forest with reasonable access for local community.		6

GLA 39 Erith submerged forest

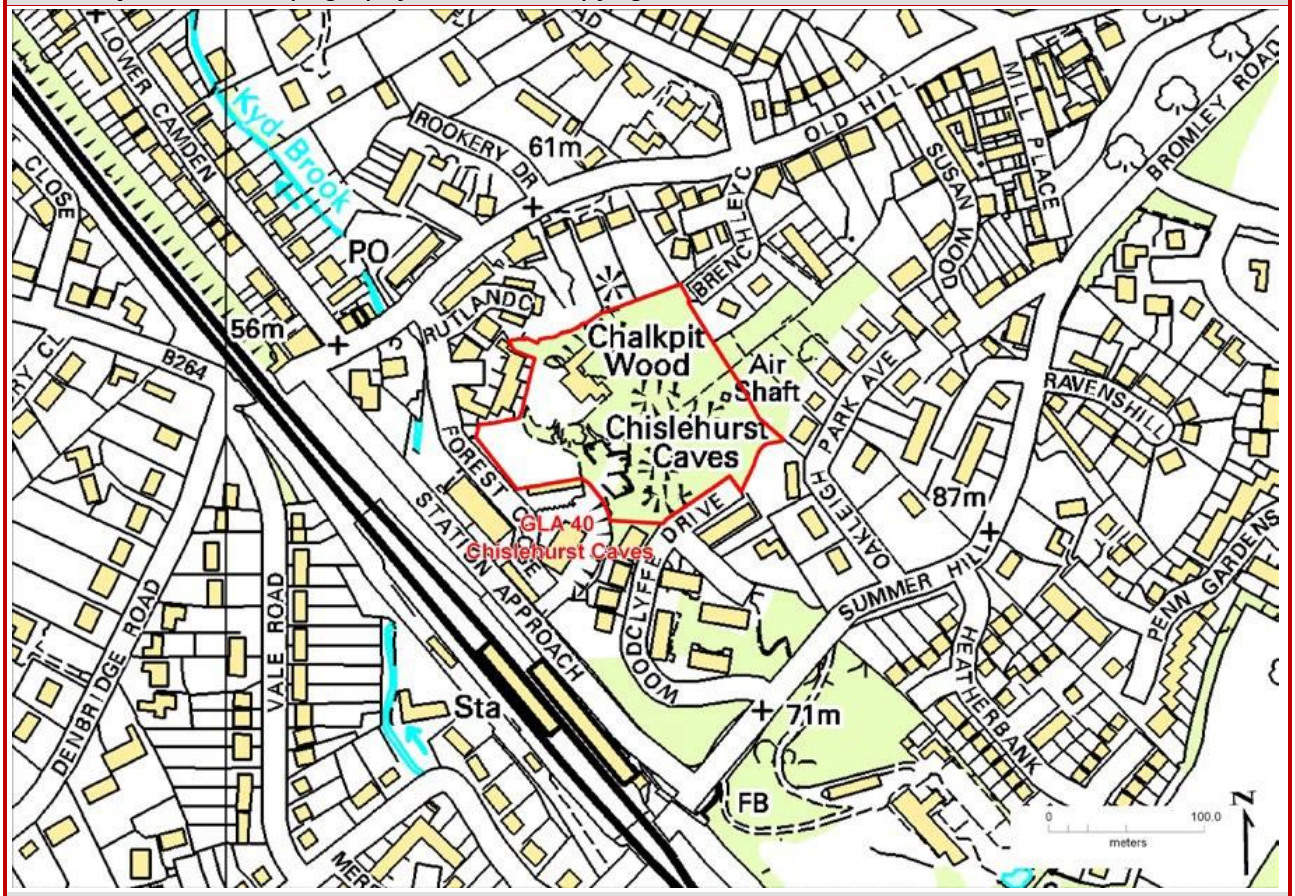
Photo: Jane Sidell

Detail, September 2009. Photo: Laurie Baker

GLA 40 Chislehurst Caves

Grid Reference: TQ 431 696 Site Area (hectares): 1.74 (c.8 underground)	Site Type: Manmade chalk caves Current use: privately owned tourist feature
Site ownership: Private owner	Borough: London Borough of Bromley
Field surveyor: Diana Clements Latest visit: Diana Clements/Laurie Baker	Date: November 2011 Date: February 2016
Current geological designation: RIGS	Other designation: None

Site Map OS Topography © Crown Copyright



Stratigraphy and Rock Types

Time Unit: Paleocene	Rock Unit: Thanet Formation
Rock Type: Sand	Details: Sand with some clay. At the base of the formation there is a layer of rounded green coloured flint known as The Bullhead Bed
Time Unit: Late Cretaceous	Rock Unit: Seaford Chalk Formation, White Chalk Subgroup, possibly running up to base of Newhaven Chalk Formation at the top
Rock Type: Chalk	Details (Seaford Chalk): Firm white chalk with conspicuous semi-continuous nodular and tabular flint seams. Hardgrounds and thin marls are known from the lowest beds. Some flint nodules are large to very large.

Site Description

A manmade subterranean chalk mine dating from mediaeval times but mostly exploited during the 1800's. Mining chalk from a drift mine entrance at the bottom of a valley using a pillar and stall technique has been carried out for over 100 years. The site is famous for its use as an air-raid shelter in World war two. The site is privately owned and has regular guided tours; a leader with geological knowledge can be requested.

Geologically the main point of interest is the well exposed junction between the eroded top of the Upper Chalk and the Thanet Sand. It is one of the rare good exposures of the Bullhead Bed. With a full exposure of the top of the chalk there is a potential for more research on the detailed age at the top of the section. The geologist can point out a large ammonite in the roof.

Assessment of Site Value		
Geodiversity topic: Lithostratigraphy; sedimentology; geomorphology.		
Access and Safety		
Aspect	**Description**	
Safety of access	Good	
Safety of exposure	Well maintained by Owner.	
Permission to visit	Regular paid tours available, see: www.chislehurst-caves.co.uk	
Current condition	Good	
Current conflicting activities	None.	
Restricting conditions	Opening hours; route of standard guided tours does not pass the exposure of the Bullhead Bed and Thanet Sand	
Nature of exposure	Good underground exposures	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	Well known historical site. Featured in GA Guide 68, 2012.	8
Aesthetic landscape	Popular visit feature	6
History of Earth Sciences	Useful educational location	6
Economic geology	Of great past importance.	8
GeoScientific Merit		
Geomorphology	Chalk close to the surface along the valley floor	2
Sedimentology	High quality rare exposure of Bullhead Bed	6
Palaeontology	External mould of *Parapuzosia* ammonite visible in roof of Middle Section. Macro and Microfossil potential.	4
Igneous/mineral/ Metamorphic Geology	None.	0
Structural Geology		2
Lithostratigraphy	Relationship of formations	6
Potential use	Research; further education; on-site interpretation.	
Fragility	Well protected.	
Current Site Value		
Community	Excellent tourist attraction	8
Education	Valuable.	5
Geodiversity value		
RIGS. High geodiversity value because of junction with overlying Thanet Sand and the only publicly accessible mine in Greater London. Potential for more detailed research on the Chalk stratigraphy.		6

GLA 40 Chislehurst Caves

Photo: Laurie Baker, February 2016

Ammonite in roof of caves, February 2016. Photo: Laurie Baker

GLA 41 Klinger Pit, Foots Cray	
Grid Reference: TQ 478 703	Site Type: Disused sand pit
Site Area (hectares): 0.69	Current use: business park
Site ownership: Managing agents M&G Real Estate	Borough: London Borough of Bromley
Field surveyor: Diana Clements/Vernon Marks Last visited: Diana Clements, Steve Tracey, Laurie Baker	Date: January 2012; (more thoroughly in 2008) Date: December 2019
Current geological designation: Deleted as RIGS site was redeveloped in 2019 with no access to face. Bourne Wood Sand Pit (GLA 60) and nearby Crayford Golf Course (GLA 30) have exposures of the Thanet Formation. Both are in the London Borough of Bromley	

GLA 42 Kenwood House quarry, Hampstead Heath

Grid Reference: TQ 2685 8745	Site Type: Small quarry for Bagshot Sand (within larger area of Bagshot Sand on Hampstead Heath)
Site Area (hectares): 0.07	Current use: Fenced area behind recreational land
Site ownership: English Heritage	Borough: London Borough Camden
Field surveyors: Diana Clements Latest visit: Diana Clements	Date: October 2010 (LGAP launch) Date: May 2019
Current geological designation: RIGS	Other designation: Metropolitan SINC (Hampstead Heath)
Site Map	OS Topography © Crown Copyright

Stratigraphy and Rock Types

Time Unit: Eocene	Rock Unit: Bagshot Formation Bracklesham Group
Rock Type: iron-rich sand	Details: predominantly fine sand showing stratification and locally iron Rich; iron-cemented in places.
Time Unit: Eocene	Rock Unit: London Clay Formation with Claygate Member at the top, Thames Group
Rock Type: Clay, silt, sand	Details: Fine, sandy, silty clay/ clayey silt, clay.

Site Description

Former quarry of Bagshot Formation exploited in the building of Kenwood House. This site close to Kenwood House would make an ideal location for cutting a face into the slope to create a conserved face and adding some interpretation. Unfortunately the most promising section of the slope that was stripped bare in the 1987 storm has been re-planted during 2010. (A second quarry can be seen within the gardeners' compound at TQ 2670 8735). In the meantime the small exposures on Sandy Heath around the natural ponds, purportedly floored by iron pan, provide an opportunity of minor observation of the Bagshot Sand. In 2011 an interpretation board was placed on Sandy Heath by LGP with a picture of the area being actively quarried in 1867. A spring line occurs at the base of the Bagshot Sand at the junction with the underlying Claygate Member at the top of the London Clay Formation. A lower spring line occurs at the base of the Claygate Member. These springs give rise to the Fleet, Westbourne and Tyburn Rivers flowing into the Thames and the Mutton Hall Brook flowing into the River Brent.

Rudler, F.W. 1913. *The Geology of Hampstead, Highgate and the Neighbourhood.* In: *Hampstead Heath: its Geology & Natural History.* Hampstead Scientific Society, T. Fisher, Unwin.

Assessment of Site Value

Geodiversity topic: lithostratigraphy, sedimentology; geomorphology.

Access and Safety

Aspect	Description
Safety of access	The area suggested for conservation is currently fenced off and inaccessible on a steep slope. Sandy Heath has footpaths through woodlands with areas of open grassland and the Bagshot Sand can be seen well adjacent to the largest pond
Safety of exposure	Vegetation prevents slipping on the proposed site but large storms can bring down trees providing better exposure. Exposures on Sandy Heath are aided by 'people erosion'.
Permission to visit	The proposed conservation site (shown as 'Old Quarry' on the map) requires permission from English Heritage at Kenwood House. Sandy Heath has open access.
Current condition	The proposed site has had trees planted in 2010 so permission to clear might now be more difficult. Scree at base of slope could also be more problematical so any exposure created higher up the slope would require step access. A board showing a photograph of the face when operating, taken in 1913 could be an alternative.
Current conflicting activities	Wildlife and aesthetic planting
Restricting conditions	Fenced off area, vegetation
Nature of exposure	1913 photograph shows a vertical quarry face.

Culture, Heritage & Economic

Aspect	Description	Rating
Historic, archaeological & literary associations	Quarries within Kenwood are described in Rudler, 1913; extraction of sand on Sandy Heath by Sir Thomas Marion Wilson for construction of St. Pancras railway is described in many books on the heath and painted by Constable in 1867. There are a number of photographic records. More recently GA Guide 68, Itinerary 3 (see references) describes a guided walk around the Heath.	8
Aesthetic landscape	Footpaths through woods and heath used by local community; good views over London	9
History of Earth Sciences	Descriptions of field trips in Proceedings of the Geologists' Association but not much mention of Bagshot Sand, e.g. 1873, 1877, 1989, 1993; Also Lobley, 1889, Rudler, 1913	4
Economic geology	Extraction of sand (poor quality)	8

GeoScientific Merit

Geomorphology	Highest hill in inner London (134m) with fine views to the south; One of several isolated hills remaining; part of the 'Northern Heights'	6
Sedimentology	A conserved section would potentially be the best exposure of Bagshot Sand in Greater London (only otherwise found at Harrow-on-the-Hill and Havering Ridge in north London and Wimbledon Common in south London). Although photographs exist showing bedding and cross stratification (Rudler, 1913), no written description has been found from Hampstead Heath. An iron-pan is described within the Bagshot Sands, underlying the ponds on Sandy Heath.	6
Palaeontology	None recorded from Bagshot Sands	0
Igneous/mineral/ Metamorphic Geology	None.	0
Structural Geology		
Lithostratigraphy	Hampstead Heath is an excellent location for identifying the different lithologies from clues in the landscape – spring lines,	6

	vegetation, small exposures. The Bagshot Sands lie above the Claygate Member of the London Clay Formation with the London Clay below. The same lithologies are described in Waterlow Park (GLA 64).	
Potential use	Research; education; on-site interpretation.	
Fragility	Natural overgrowing	
Current Site Value		
Community	Valuable woodland and green space.	8
Education	Visitors centre in Highgate Wood has a display on the local geology.	4
Geodiversity value		
RIGS: Bagshot Sand was not represented in the first edition of *London's foundations*: this is the best location and warrants a permanent accessible exposure. The Heath in general is an excellent educational tool to demonstrate geomorphology, particularly the spring lines; access for local community.		6

GLA 42 Kenwood House Quarry, Hampstead Heath

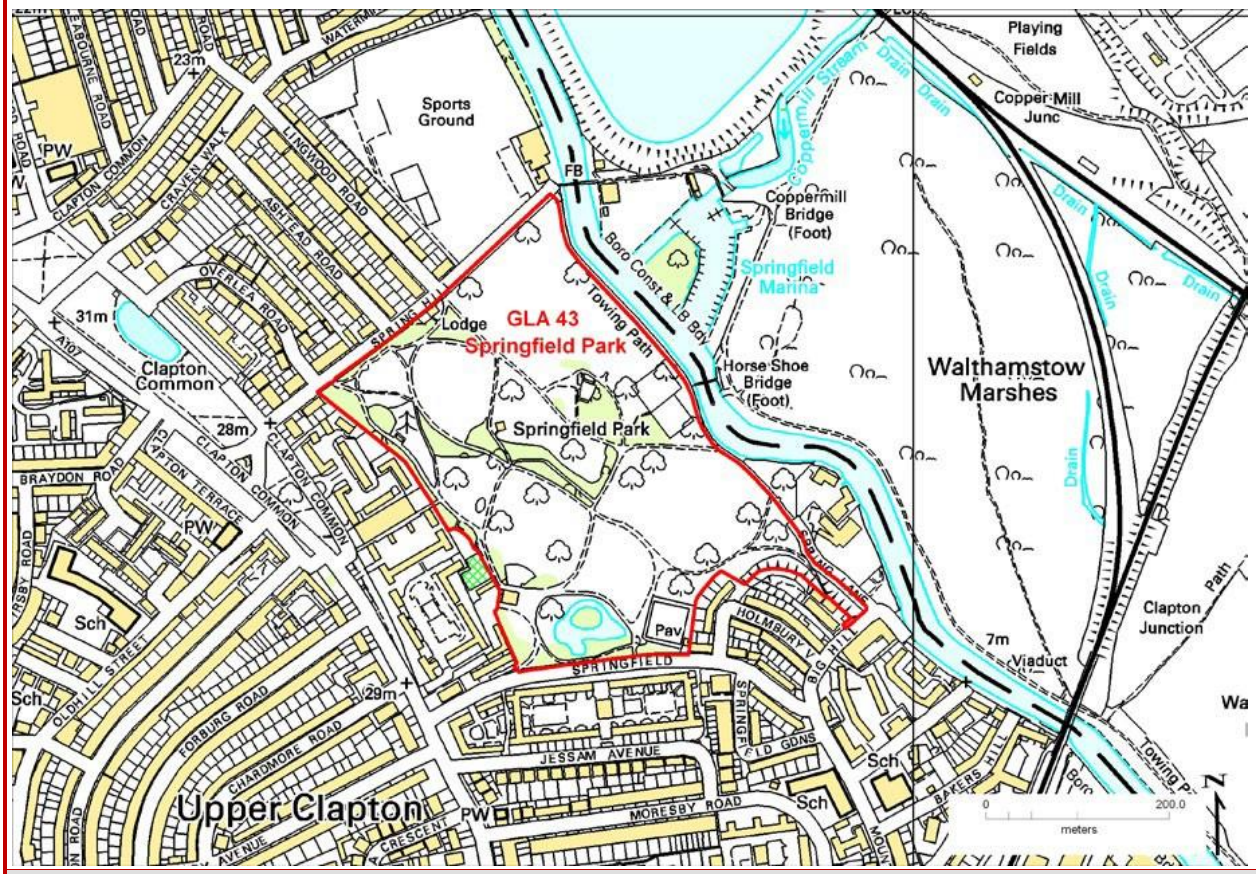
Kenwood House Quarry

1913 section in Kenwood House Quarry

Sandy Heath exposures of Bagshot Sand
Photo: Diana Clements

GLA 43 Springfield Park, Hackney

Grid Reference Main Park entrance TQ 345 873	Site Type: Public park on east facing slope down to the River Lea
Site Area (hectares): 13.58	Current use: Recreational land with information centre & café
Site ownership: London Borough of Hackney	Borough: London Borough of Hackney
Field surveyors: Diana Clements Last visited: Diana Clements	Date: 2009 Date: 2019
Current geological designation: Local Geological Nature Reserve; RIGS	Other designation: LNR; Borough Grade I SINC (Springfield Park)
Site Map	OS Topography © Crown Copyright



Stratigraphy and Rock Types

Time Unit: Pleistocene	Rock unit: Langley Silt Member, Maidenhead Formation
Rock Type: brickearth	Details: fine clay containing chalk; pebble stringers & laminations
Time Unit: Pleistocene	Rock unit: Hackney Gravel Member, Maidenhead Formation (beneath Langley Silt)
Rock Type:	Details: predominantly flint gravel within range base 6-15m, top16-18m above floodplain of River Lea
Time Unit: Eocene	Rock Unit: London Clay Formation, Thames Group
Rock Type: Clay, silt, sand	Details: Fine, clayey silt, clay.

Site Description

Springfield Park was designated London's only Geological Nature Reserve in 1997. It is on the west bank of the River Lea and slopes down to the tow path. The name Springfield is the key to the reason for its designation with the spring line along the junction of the Hackney Gravels and underlying London Clay emerging along the slope. A small pit within the park supplied sufficient clay for the building of the three villas originally there (now only one remains). There are fine views from the top of the park over the wide Lea Valley to the Epping Forest Ridge on the far side. In 1999 the interpretation boards for the geology that were placed at several sites disappeared but to be replaced as part of the renovations. A leaflet *Wild about Springfield Park* (available at https://hackney.gov.uk/springfield-park) includes a section on the geology.

The London Geodiversity Partnership has ensured these geological interpretations are retained in the park with a geotrail to be published once the renovations are completed. It will include information on the melting Anglian ice sheet, which created the valley.

Assessment of Site Value

Geodiversity topic: lithostratigraphy, sedimentology; geomorphology.

Access and Safety

Aspect	Description
Safety of access	On street car parking is adjacent to the park and there is also access from the towpath of the Lea. Park is open daily 24 hours a day. Buses 253 and 254 run along Clapton Common to stop 'Jessam Avenue'. The main entrance is a short walk along Springfield.
Safety of exposure	There are well-marked footpaths throughout the park but actual exposures are mostly not seen. Instead the geology is inferred by the topography with springs near the break of slope and with plants denoting the springs that bubble up lower down in the grassy slopes, particularly on Wilson's Hill.
Permission to visit	Open access.
Current condition	The park is well maintained with rough grass areas allowing access to the position of several of the springs. There is an excellent view over the Lea Valley. Conservation of boards and leaflets need to be regularly assessed. In 2019 renovations to Springfield Mansion and in the park were underway. There is to be a new café, toilets and Visitor Centre.
Current conflicting activities	none
Restricting conditions	Vegetation, limited exposures
Nature of exposure	Natural slope allowing geomorphological interpretation.

Culture, Heritage & Economic

Aspect	Description	Rating
Historic, archaeological & literary associations	Created as a geological nature reserve in 1997 backed by information leaflets and interpretation boards initiated by Eric Robinson of the Geologists' Association. Brick pit on old maps	7
Aesthetic landscape	Footpaths through woods and meadows and around ponds used by local community; good views over London. Green Flag Award.	9
History of Earth Sciences	unknown	2
Economic geology	Brick pit for use on site. Over-burnt bricks used in walls around trees within parks.	4

GeoScientific Merit

Geomorphology	Steep eastward-sloping bank of the River Lea with spring lines denoting changes in morphology. Wide nature of the Lea Valley carved during the retreat of the Anglian Ice Sheet can be observed.	6
Sedimentology	None visible	4
Palaeontology	None recorded	
Igneous/mineral/ Metamorphic Geology	none	0
Structural Geology		
Lithostratigraphy	Only location demonstrating Langley Silt & Hackney Gravel. Geological nature reserve has interpreted the different lithologies from clues in the landscape – spring lines, vegetation, small exposures	6
Potential use	education; interpretation panels & leaflet exists but LGP needs to ensure that the geological aspects are maintained. Could be included in a possible Geotrail in the Lea Valley as well as around the Park itself.	
Fragility	Draining of springs for other amenity users	

Current Site Value

Community	Valuable green space. The Capital Ring runs through the site.	9

Education	Plenty of potential for geological education; Hackney has published a geotrail devised by LGP and information board on the geology.	9
Geodiversity value		
RIGS: As this is already a geological nature reserve it deserves protection as a designated RIGS. It is the only location with Langley Silt and Hackney Gravel. Spring line prominent.		6
GLA 43 Springfield Park, Hackney		

Beneath the break of slope, wet patches with willow trees

View across the Lea Valley down Wilson's Hill. Vegetation near the base of the slope probably indicates a layer of septarian nodules in the underlying London Clay.

Photos: Diana Clements

GLA 44 Highgate Wood and Queen's Wood

Grid Reference: Highgate Wood TQ 280 885 Queen's Wood TQ 285 885	Site Type: Natural Landform
Site Area (hectares): 51.16 (HW c.28; QW c.21)	Current use: Recreational land
Site ownership: Highgate Wood is City of London Corporation and Queen's Wood is LB Haringey	Borough: London Borough of Haringey
Field surveyors: Peter Collins, Diana Clements and Mike Hacker	Date: 2011
Current geological designation: RIGS	Other designation: LNR; Metropolitan SINC (Parkland Walk, queen's Wood and Highgate Wood)

Site Map

Stratigraphy and Rock Types

Time Unit: Pleistocene-Holocene	Rock Unit: Head, solifluction and glacigenic deposits
Rock Type: Sand and gravel	Details: Polymict comprising poorly sorted silt, sand and gravel, with some pebbles, probably glacigenic deposits formed by fluvio-glacial processes
Time Unit: Eocene	Rock Unit: London Clay Formation with Claygate member at the top, Thames Group
Rock Type: Clay, silt, sand	Details: Fine, sandy, silty clay/ clayey silt, clay.

Site Description

Two wooded areas with London Clay underlying the hillocks of the Claygate member on higher land (Highgate Wood). Archaeological linked excavation in Highgate Wood found Claygate Member deposits extending beyond the limit shown in BGS maps. There are deeply cut ravines in Queen's Wood that may be related to the Anglian and later glaciations. There is a key north-south interfluve dividing the watershed to the Brent in the west and the Lea in the east. It is an important site located between the glacial till to the north and the Bagshot Formation and Stanmore Gravel Formation on the higher land of Highgate and Hampstead Heath to the south. There is potential for research into composition of the gravels found on and near the surface which could give more information on the provenance of the gravels and therefore

possible glaciogenic processes that deposited them. There is also potential for research into the fluvial or glacial processes causing the formation of the deeply-cut gorges in Queen's Wood.		
Assessment of Site Value		
Geodiversity topic: lithostratigraphy, sedimentology; geomorphology.		
Access and Safety		
Aspect	**Description**	
Safety of access	Footpaths through woodlands with areas of open grassland. Two woods divided by main road. Some step slopes	
Safety of exposure	Observe general safety in woodlands.	
Permission to visit	Open access.	
Current condition	Very good. Highgate Wood well looked after by City of London Corporation. Includes Visitor Centre. Cafés in both woods.	
Current conflicting activities	None.	
Restricting conditions	Trees and leaf cover in autumn.	
Nature of exposure	Exposures in woodland.	
Culture, Heritage & Economic		
Aspect	**Description**	Rating
Historic, archaeological & literary associations	Mesolithic/Neolithic flint surface finds Romano-British pottery kilns utilising Claygate member, quarrying of sands and gravels (formerly named Gravel Pit Wood). Over 800 fragments of worked flint have been found in Highgate and Queen's Wood. Though many of these are waste flakes known as 'debitage', they include a number of scrapers, blades and points. They date from the late Mesolithic or early Bronze Age, between 7,000 and 4,000 years ago.	9
Aesthetic landscape	Footpaths through woods used by local community.	9
History of Earth Sciences	.	2
Economic geology	Extraction of clay, sand and gravels. Over-burnt bricks in local garden walls	7
GeoScientific Merit		
Geomorphology	Gorges within Queen's Wood.	6
Sedimentology	Detailed analysis of the clay in Highgate Woods indicates that it belongs to the Claygate Member of the London Clay Formation	4
Palaeontology	None observed but the Highgate railway tunnel runs beneath the SW corner where Whitaker (1889) found fossils of the 'Highgate Fauna' in Division E2 of King (1981) which underlies the Claygate Member of the London Clay.	(6)
Igneous/mineral/ Metamorphic Geology	None.	0
Structural Geology		0
Lithostratigraphy	Revision of surface London Clay as mapped by BGS to Claygate Member (pers. comm. with Don Aldiss BGS)	6
Potential use	Research; further education; on-site interpretation.	
Fragility	Natural overgrowing; weathering/erosion.	
Current Site Value		
Community	Valuable woodland and green space.	8
Education	Visitors centre in Highgate Wood has a display on the geology. The story boards are reproduced on LGP website. See: https://www.cityoflondon.gov.uk/things-to-do/green-spaces/highgate-wood and	4
Geodiversity value		
RIGS: Well-maintained woodlands with much research potential on Claygate Member, gravel exposures and deeply-cut gorges; excellent access for local community. Described in LGP Bus Pass Geology 1, *Round the southern limits of the Anglian Ice Sheet*		6

GLA 44 Highgate Wood and Queen's Wood

Making bricks.
Photo: Cindy Blaney

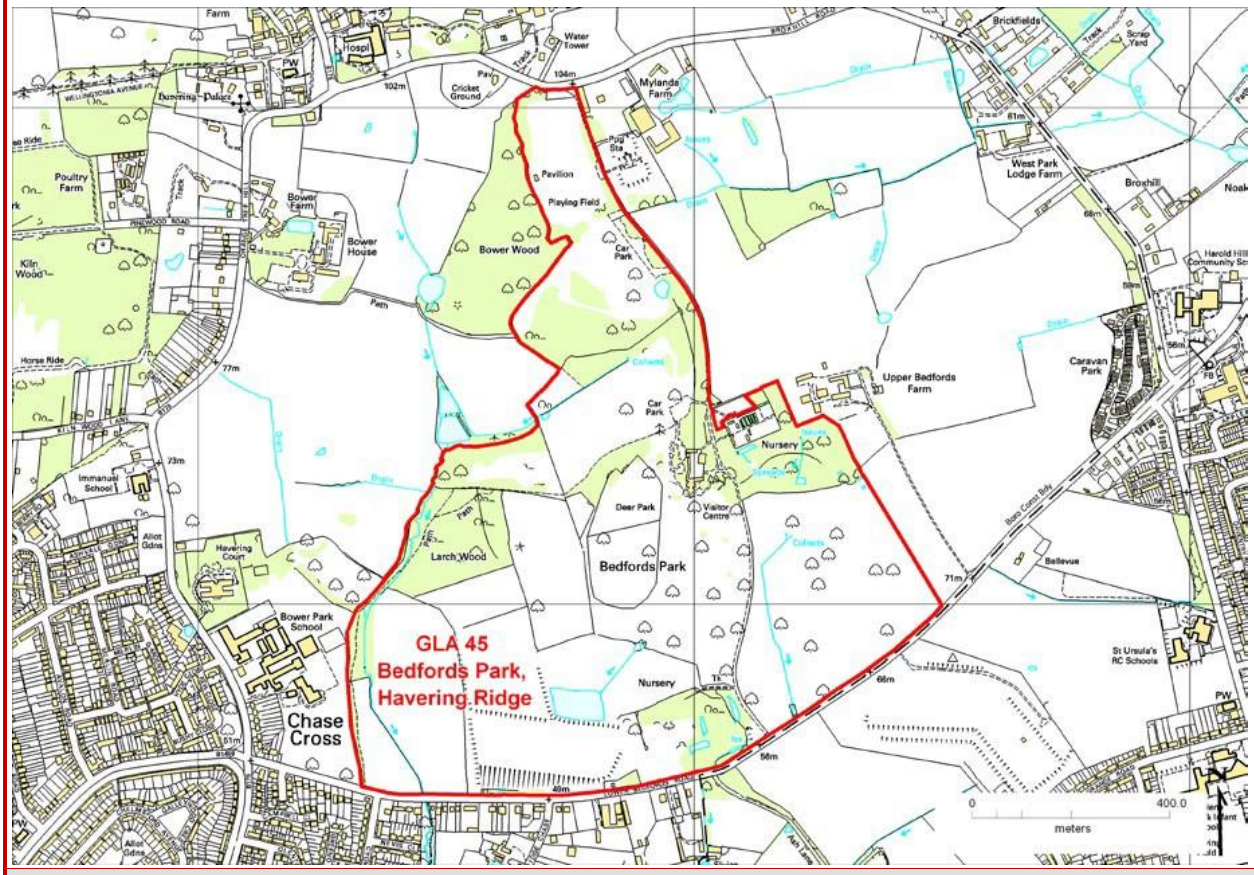
Small exposures of Claygate Member.
Photo: Diana Clements

Gorges in Queen's Wood

GLA 45 Bedfords Park, Havering Ridge

Grid Reference Park entrance TQ 517 930 Visitor Centre TQ 519 922	Site Type: south-facing aspect of natural ridge
Site Area (hectares): 86.82 acres	Current use: Recreational Land with Visitor Centre
Site ownership: London Borough of Havering	Borough: London Borough of Havering
Field surveyors: Diana Clements/Peter Collins	Date: June 2011
Current geological designation: RIGS	Other designation: LNR; Metropolitan SINC(Bedfords Park) ; Green Flag status

Site Map



Stratigraphy and Rock Types

Time Unit: Pleistocene	Rock unit: Lowestoft Formation, Albion Glacigenic Group
Rock Type:	Details: Chalky till, together with outwash sands and gravels, silts and clays. The till is characterised by its chalk and flint content
Time Unit: Quaternary	Rock unit: Stanmore Gravel Formation, Crag Group
Rock Type:	Details: Gravel & sand, clayey near base. Contains quartzite & Lower Greensand chert (see GLA 18 for full details of clast analysis).
Time Unit: Eocene	Rock Unit: Bagshot Sand Formation
Rock Type: iron-rich sand	Details: predominantly fine sand showing stratification and locally iron rich. Pebble stringers reported but none seen
Time Unit: Eocene	Rock Unit: London Clay Formation and Claygate member, Thames Group
Rock Type: Clay, silt, sand	Details: Fine, sandy, silty clay/ clayey silt, clay (sandier near top).

Site Description

Havering Ridge displays five different lithologies and so is an excellent location for studying the geology of London and Bedfords Park is the best place to study the geomorphology. Essex Wildlife Trust runs a Visitor Centre where an interactive computer terminal describes the various units and they also publish a Trail Guide. With some small detours this could provide the basis for a parallel Geotrail. The glacial erratic boulder (probably from the Whin Sill) discovered in the quarry extracting Black Park Gravels at Mark's Warren Farm (GLA 37) is on display at the Visitor Centre to add to the geological interest. The Visitor

Centre is situated at over 90 m and affords spectacular views over Canary Wharf to Shooters Hill on the south side of the Thames and beyond. The entrance is at the top of Havering Ridge at 90 m where there are more extensive outcrops of Stanmore Gravels extending through Havering-atte-Bower to Havering Park. There is potential for identifying the different lithologies from clues in the landscape – spring lines, vegetation, small exposures. Exposures are otherwise a bit difficult to find unless excavations were to be made.

Assessment of Site Value

Geodiversity topic: lithostratigraphy, sedimentology; geomorphology.

Access and Safety

Aspect	Description
Safety of access	There is a car park and public access to Bedfords Park during opening times (dawn to dusk). Visitor Centre open 9-5 Tuesday to Sunday, (November, December & January 9am - 4pm). Closed Christmas Day & Boxing Day. The VC includes toilets, a shop and a café.
Safety of exposure	There are well-marked footpaths throughout the park but actual exposures are limited to temporary exposures. The Trail of c. 2½ miles follows some steepish hills which can be slippery.
Permission to visit	Open access.
Current condition	The park is well maintained with a range of habitats including a small overgrown quarry at the top of the hill and ponds in London Clay at the bottom. There is an excellent view over London to Shooters Hill from the Visitor Centre. In 2019, the boulder was still waiting for an explanatory plaque.
Current conflicting activities	none
Restricting conditions	Vegetation, limited exposures
Nature of exposure	Natural hill showing range of rock units.

Culture, Heritage & Economic

Aspect	Description	Rating
Historic, archaeological & literary associations	Deer park acts as a reminder that this was a royal hunting ground from 11th to 16th centuries. The Visitor Centre sells copies of the Trail Guide and other local information	3
Aesthetic landscape	Footpaths through woods and meadows and around ponds used by local community; good views over London	9
History of Earth Sciences	unknown	4
Economic geology	Small quarry above car park used for sand or gravel (?Stanmore or Bagshot)	4
GeoScientific Merit		
Geomorphology	Part of the Havering Ridge with sloping landscape to the south and ponds within the London Clay at the bottom of the Hill.	6
Sedimentology	Observations were not made except for the London Clay at the lowest point in the park where a pond is situated. The clay exposed around the perimeter is thick and sticky and is iron-stained.	4
Palaeontology	None recorded	
Igneous/mineral/ Metamorphic Geology	The outside area of the Visitor Centre displays the 'Whin Sill' boulder from the Black Park Gravel at Mark's Warren Quarry down the hill. If correctly identified, this will be the furthest south such boulders have travelled	8
Structural Geology		
Lithostratigraphy	Important as the area contains five distinct rock units	6
Potential use	education; Geotrail to parallel Trail Guide.	
Fragility	Natural overgrowing	
Current Site Value		
Community	Valuable woodland and green space.	9
Education	Geology featured in Visitor Centre; the centre provides plenty of	9

	potential for geological education	
Geodiversity value		
RIGS:	This is the best location for such a variety of rock types. The installation of the glacial erratic ('Whin Sill') boulder gives it an added attraction	6
GLA 45 Bedfords Park, Havering Ridge		

Exposure of London Clay around lake. Photo: Diana Clements

GLA 46 Rainham submerged forest

Grid Reference: TQ 516 795	Site Type: Natural foreshore exposure of submerged forest
Site Area (hectares): 2.29	Current use: Foreshore exposure adjacent to London Loop Thames footpath
Site ownership: Port of London Authority	Borough: London Borough of Havering
Field surveyor: Diana Clements, Peter Collins, Bill George	Date: July 2011
Current geological designation: RIGS	Other designation: Metropolitan SINC (River Thames and tidal tributaries)

Site Map

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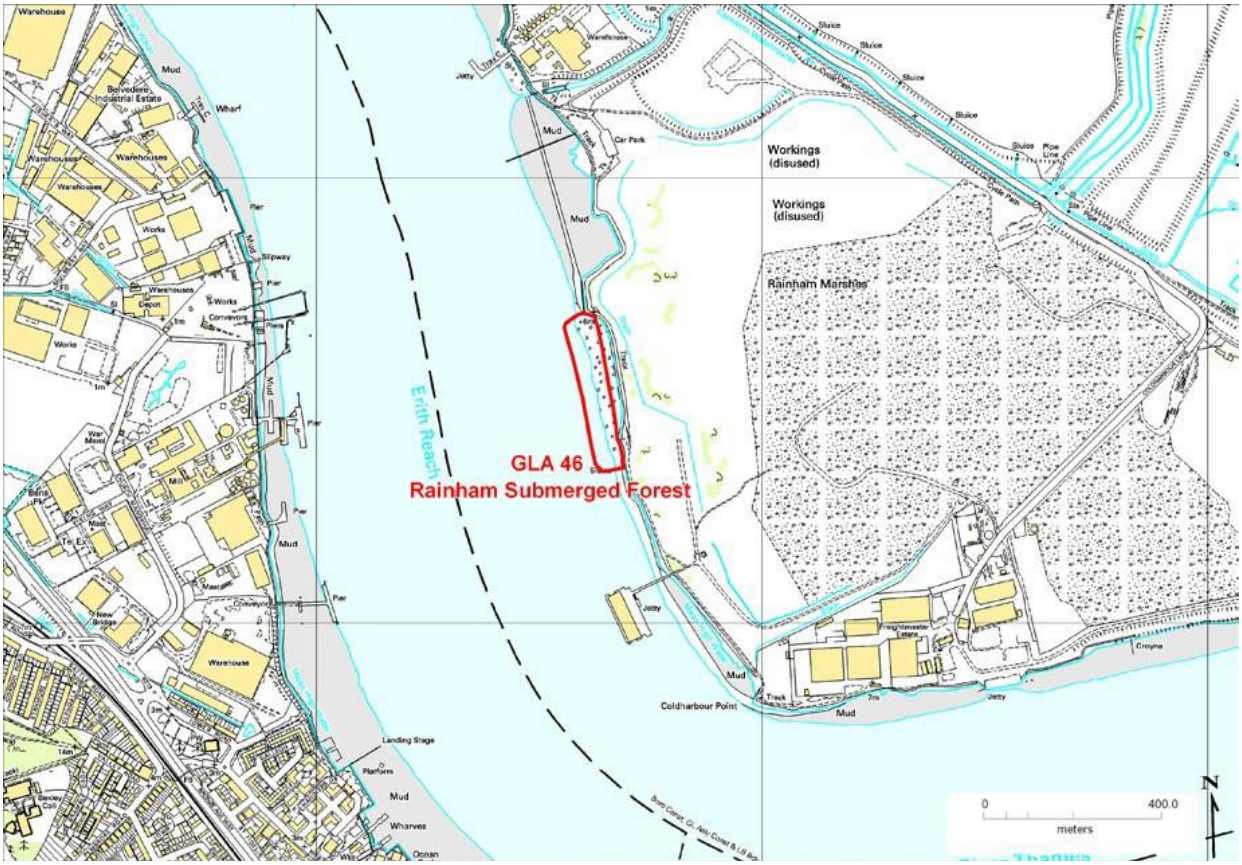

Stratigraphy and Rock Types

Time Unit: Holocene	Rock Unit: Alluvium & peat
Rock Type: Alluvium	Details: peat horizons at varying horizons

Site Description

This is the best place on the north bank of the Thames Estuary for viewing the Neolithic peat exposures and submerged forest. At low tides whole tree trunks are revealed amongst the root balls. Within the RSPB site, during drainage maintenance logs from the forest bed are found, possibly older than those occurring on the foreshore – one is on permanent display on the northern side of the RSPB site – unfortunately the RSPB charge to enter the site.

Assessment of Site Value

Geodiversity topic: Holocene processes in the Thames.

Access and Safety

Aspect	Description
Safety of access	Can be viewed from the adjacent Thames Walk footpath, part of the London Loop but access to the foreshore down the steep bank is slippery and awkward and should only be attempted on a falling tide. For safety it is inadvisable to access the foreshore alone.
	The site is only visible at low tide and in future may not be visible at all if it is

Safety of exposure	covered in sediment. Storms could potentially damage the exposure as could any development along this stretch of the Thames	
Permission to visit	Open access to the path and not required for the foreshore	
Current condition	Good except for access to the foreshore	
Current conflicting activities	None observed	
Restricting conditions	High tide and bad weather	
Nature of exposure	Natural foreshore exposure of Neolithic submerged forest	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	Submerged forest on the north bank of the Thames is referred to in Bates & Barham, 1995; Sidell et al., 2001; Meddens & Beasley, 1990.	7
Aesthetic landscape	Visible at low tide from London Loop foot and cycle route.	7
History of Earth Sciences	Dereham, 1712	4
Economic geology	None	0
GeoScientific Merit		
Geomorphology	Record of changing sea levels in the Thames Estuary	6
Sedimentology	Intercalated peats, organic muds and alluvial and estuarine clays	4
Palaeontology	Probably several species of trees and shrubs as at Erith	4
Igneous/mineral/ Metamorphic Geology	None.	0
Structural Geology	None.	0
Lithostratigraphy	Holocene alluvium and associated peat horizons	4
Potential use	This site warrants further research; potential for further education and on-site interpretation (possible London Loop Geotrail)	
Fragility	Storms; human engineering of Thames estuary; SL rise	
Current Site Value		
Community	Valuable, as can be seen from cycle route.	8
Education	Excellent evidence for teaching about global warming and sea-level rise	6
Geodiversity value		
Potential RIGS: Best example of Neolithic submerged forest on north bank of the Thames		5
GLA 46 Rainham Submerged Forest		

Photo: Diana Clements, July 2011

GLA 47 Rainham Quarry complex

Grid Reference Depot: TQ 543 827	Site Type: aggregate quarry site
Site Area (hectares): 50.86	Current use: processing/potential land fill
Site ownership: Brett Aggregates Ltd.	Borough: London Borough of Havering
Field surveyor: Peter Collins, Diana Clements and Bill George Last visited: Diana Clements and Bill George	Date: July 2011 Date: 2019
Current geological designation: RIGS	Other designation: Borough Grade II SINC (Brett Havering Aggregates west0

Site Map

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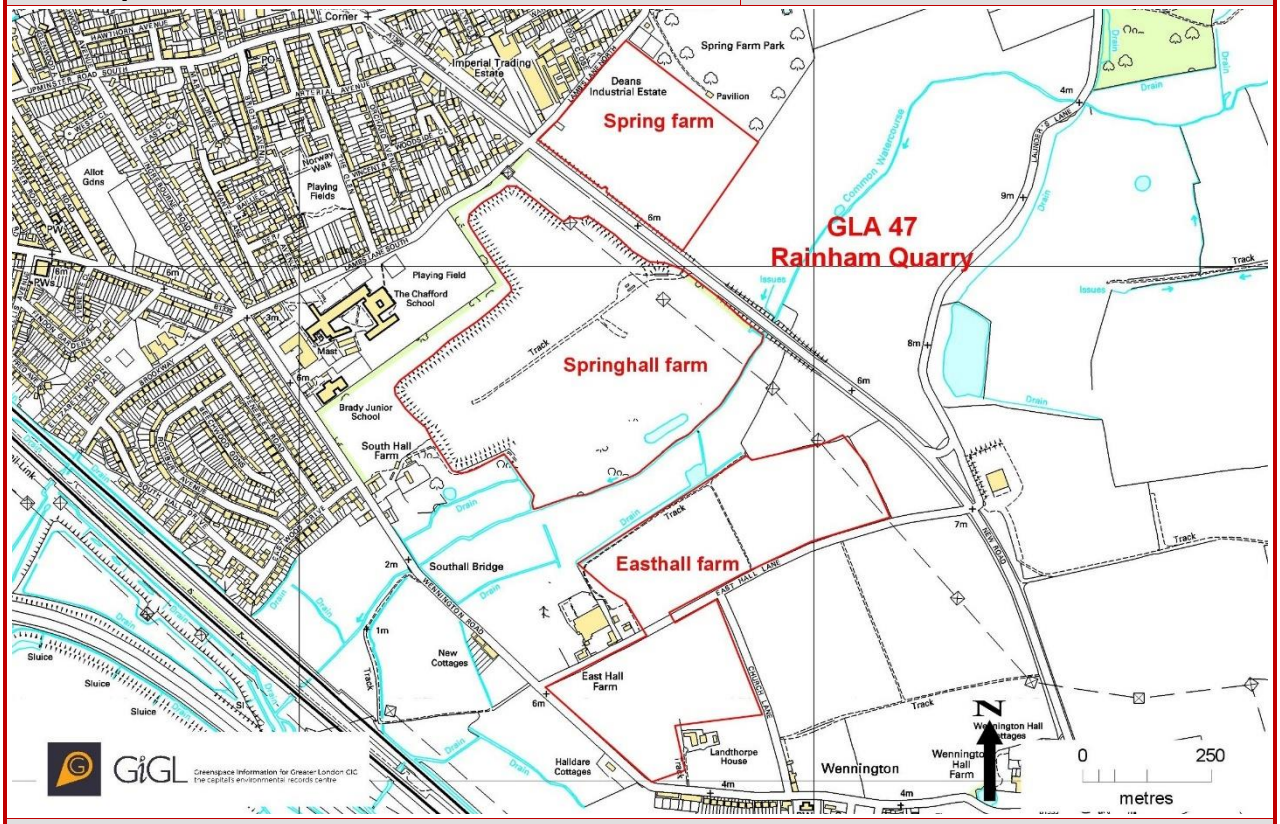


Stratigraphy and Rock Types

Time Unit: Pleistocene	Rock Unit: Taplow Gravel Member, Maidenhead Formation
Rock Type: Sand and gravel	Details: Sand and pebbles (mostly flint), Bunter pebbles, vein quartz and Lower Greensand Chert all found plus one clast of tourmaline granite

Site Description

In 2019 excavations had moved on from Spring Farm to a new exposure at East Hall Farm. Processing was taking place adjacent to the offices in nearby Launders Lane. A second quarry had recently opened adjacent, called Wennington. A large number of other former quarries in the area have been landfilled and returned to agricultural use. As this is the only area in east London still quarrying Taplow Gravel, it is hoped that future planning permissions in the area will designate a permanently exposed face for geoconservation purposes. Currently there is a requirement to restore to agricultural use.

Assessment of Site Value

Geodiversity topic: Lithostratigraphy; sedimentology.

Access and Safety

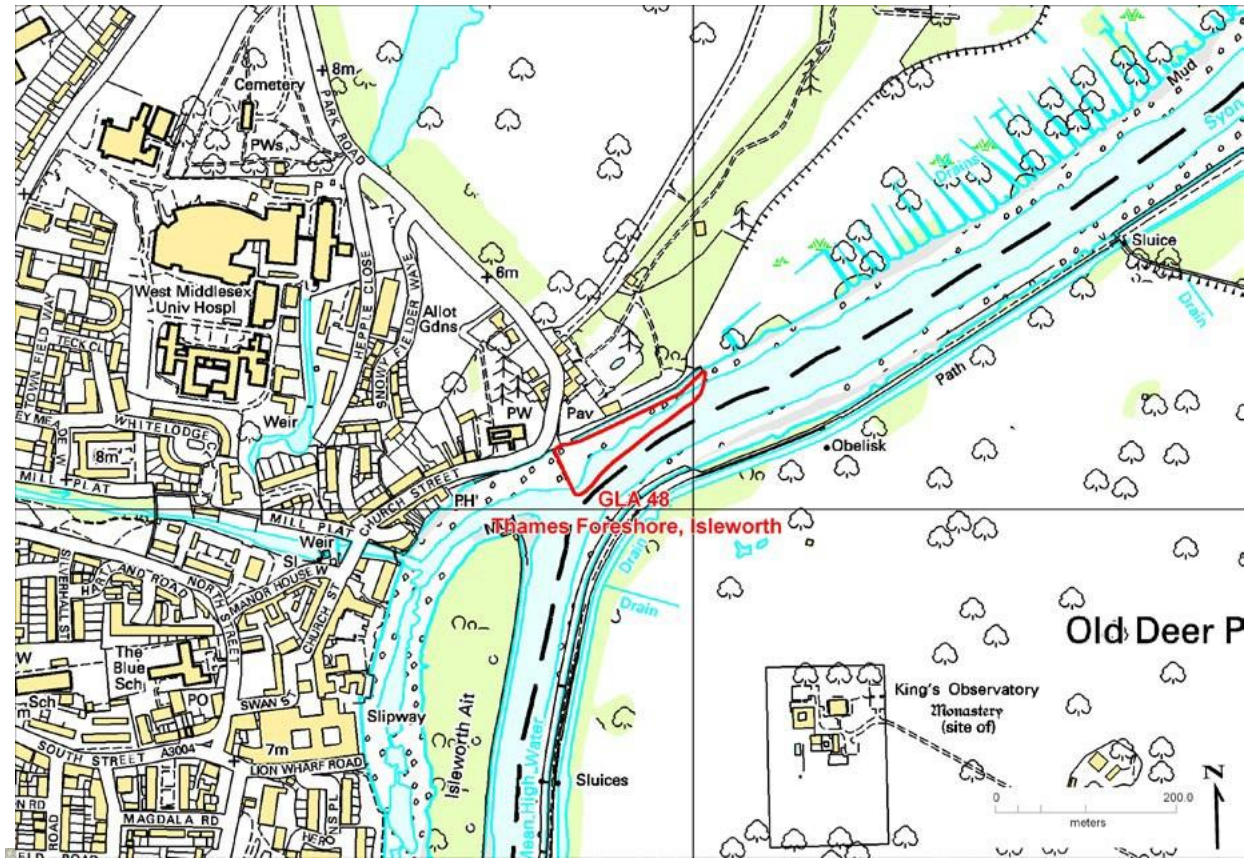
Aspect	Description
Safety of access	The quarries can only be visited when accompanied by a representative of the quarry owner.
Safety of exposure	Danger from machinery
Permission to visit	Brett Aggregates Ltd. Depot: Launders Lane, RM13 9GJ

	Tel no: 01708 552138 (Site Manager Tom Shenton, 2019) Brett Aggregates is the trading name of Brett Aggregates Limited Reg No 316788, Brett House, Bysing Wood Road Faversham, Kent ME13 7UD.Registered office: 150 Aldersgate Street, London, EC1A4AB.	
Current condition	East Hall Farm site was operational in 2019 with three more years supply.	
Current conflicting activities	Landfill and land reclamation	
Restricting conditions	Imminent disappearance of this site; It will probably cease operation in three years.	
Nature of exposure	Man-made quarry for Taplow Gravel.	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	The area has been quarried from at least between 1898 and 1921 but literature has not been researched.	2
Aesthetic landscape	Private land	0
History of Earth Sciences	Other gravel pits in East London have been important for Archaeological remains but none have been reported from this complex as far as could be ascertained.	2
Economic geology	Gravel extraction has been an important industry in east London but is rapidly disappearing	8
GeoScientific Merit		
Geomorphology	Flat river terrace cut by tributary stream close to the Thames. The Ingrebourne Valley Visitor Centre is close by	2
Sedimentology	Potential detailed description of the gravels possible.	6
Palaeontology	None known	0
Igneous/mineral/ Metamorphic Geology	None	0
Structural Geology	None	0
Lithostratigraphy	Opportunities for future research	6
Potential use	Research; (off-site education on Thames Terraces)	
Fragility	Landfill then restore to agriculture (to be lined with London Clay delivered from excavations elsewhere)	
Current Site Value		
Community		2
Education		6
Geodiversity value		
RIGS: Although we would like to see an accessible face once extraction has ceased, the present planning application dictates total restoration. We would ask Havering to consider designating a face within the area for the Taplow Gravel as there are no other exposures in east London.		6
GLA 47 Rainham Quarry complex		

East Hall Farm.
Photo: Bill George, 2019

GLA 48 Thames Foreshore, Isleworth

Grid Reference TQ 168 760	Site Type: Thames Foreshore (low tide necessary)
Site Area (hectares): 0.56	Current use: public access at low tide used by local people to feed ducks & view Thames
Site ownership: Port of London Authority	Borough: London Borough of Hounslow
Field surveyors: Diana Clements Revisited: Allan Wheeler	Date: June 2010 Date: April 2019
Current geological designation: RIGS	Other designation: Metropolitan SINC (River Thames and tidal tributaries)
Site Map	OS Topography © Crown Copyright



Stratigraphy and Rock Types

Time Unit: Eocene	Rock Unit: London Clay Formation, Thames Group
Rock Type: Clay, silt, sand	Details: Fine, clayey silt, clay; includes septarian nodules

Site Description

There are a number of sites in the upper tidal reaches of the Thames where the river gravels have been eroded away to expose small patches of London Clay at low tide. For the most part a spring tide is required to see them. They are easily distinguished from the alluvium by the presence of *in situ* and broken septarian nodules. The best exposure is at Isleworth where access is easy and pale pink fossil *Ditrupa* point the way to other molluscs which are mostly preserved as black pyrite (golden if fresh) (Division C2-D1 of King, 1981). Other exposures can be seen under Hammersmith Bridge (N. side) and upstream from Kew Railway Bridge (southside). They provide a rare opportunity of seeing in situ London Clay with septaria other than in temporary sites.

Assessment of Site Value

Geodiversity topic: lithostratigraphy, sedimentology; palaeontology

Access and Safety

Aspect	Description
Safety of access	On street car parking is adjacent to the steps down to the foreshore
Safety of exposure	The exposure can be very slippery in places and the rock fragments on the

	foreshore are difficult to walk over. A low tide is essential.	
Permission to visit	Open access.	
Current condition	The exposure at Isleworth is on the outside of a bend and is best seen by continuing downstream from the steps towards Syon House. The area is approximately 80 m long and c. 4.5 m wide.	
Current conflicting activities	None	
Restricting conditions	Silt covering; high tides	
Nature of exposure	Natural foreshore exposure	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	Described by Rundle, 1970 and GA Guide 68, Itinerary 10, 2012	5
Aesthetic landscape	Opposite Kew & frequented by locals. Adjacent to good pub	7
History of Earth Sciences	Unknown	
Economic geology		0
GeoScientific Merit		
Geomorphology	Outside of bend in Thames causing Thames gravels to be eroded	2
Sedimentology	Recognised by septarian nodules within the London clay which is mostly weathered orange	6
Palaeontology	Mostly microfossils recorded by Rundle, 1970 but the tube-worm *Ditrupa* is easily picked out. Occasional small gastropods & bivalves mostly pyritised and weathered dark. Rare fresh golden examples can be found.	4
Igneous/mineral/ Metamorphic Geology	None	0
Structural Geology		
Lithostratigraphy	Rare exposures of *in situ* London Clay & septaria	6
Potential use	Education; research	
Fragility	Covering by silt or rising water levels	
Current Site Value		
Community	Accessible foreshore	6
Education	View of local bedrock	6
Geodiversity value		
RIGS: Rare example of permanent exposure of in situ London Clay with septarian nodules and fossils, albeit only exposed at low spring tides.		6
GLA 48 Thames foreshore, Isleworth		

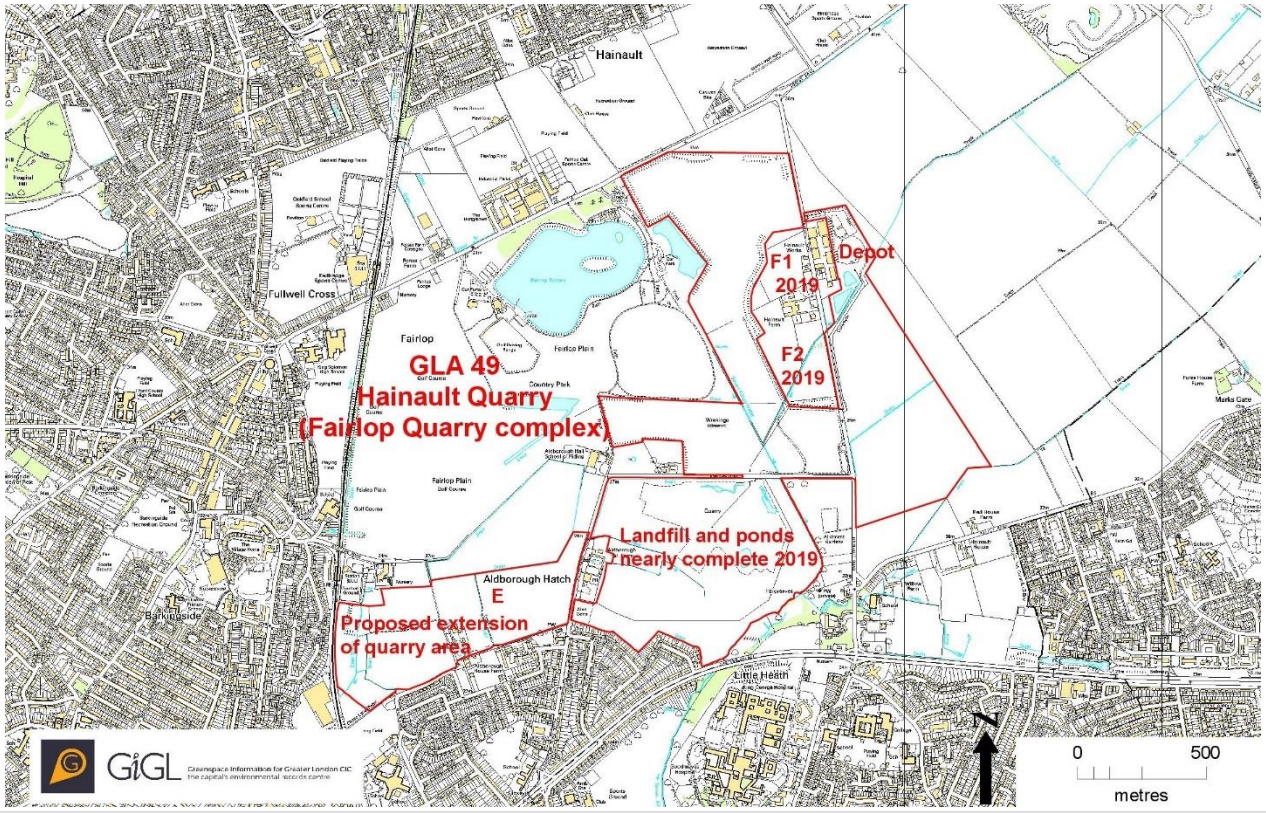
Foreshore in 2008
Photo: Diana Clements

GLA 49 Fairlop Quarry Complex (Hainault Quarry)

Grid Reference: TQ 462 896	Site Type: aggregate quarry site
Site Area (hectares): 173.32	Current use: potential land fill
Site ownership: Brett Tarmac Ltd.	Borough: London Borough of Redbridge
Field surveyor: Diana Clements/Peter Collins Revisit: Diana Clements/Bill George	Date: July 2011 Date: 2019
Current geological designation: RIGS	Other designation: Borough Grade I SINC (Fairlop Plain and Fairlop Water)

Site Map

OS Topography © Crown Copyright



Stratigraphy and Rock Types

Time Unit: Pleistocene	Rock Unit: Boyn Hill Gravel Member, Maidenhead Formation
Rock Type: Sand and gravel	Details: Sand and pebbles (mostly flint)

Site Description

In 2019 the working quarry F1 had recently begun. Diggers had stripped off the top soil and put into bunds round the perimeter and were now extracting up to 2m of clay that overlies the gravel. No evidence of this was seen in our previous visit in 2011 and we are mystified as to what it might be. It is very slightly silty but apparently of no use for the gravel workers. We pondered whether it was a clay-rich layer on top of the Boyn Hill Gravel (Thames Terrace MIS 11), or a later layer of Brickearth not shown on the BGS maps. This needs more investigation. The working quarry in July 2011 is now currently being used for landfill. The quarries are naturally ephemeral with a stipulation that they need to be restored for agricultural use. The final undug area in the SW corner of the Fairlop Complex will see active working for another ten years. We would request that a small exposure is retained in either sector E or F, if not for the public, then for research. The complex includes the Hainault Road depot/processing plant.

Previous excavations in the area include the landscaped water feature that is now used for public recreation as Fairlop Waters. Other former quarries have been landfilled and re-established as agricultural land. As this is the only area in east London still quarrying Boyn Hill Gravel, it has been designated a RIGS site.

Assessment of Site Value

Geodiversity topic: Lithostratigraphy; sedimentology.

Access and Safety		
Aspect	**Description**	
Safety of access	The quarry can only be visited when accompanied by a representative of the quarry owner. It is locked when not operating.	
Safety of exposure	Danger of working machinery needs to be considered when visiting PPE required	
Permission to visit	Brett Tarmac Ltd. Fairlop Quarry, Hainault Road, Little Heath, Romford, Essex, RM6 5SS (Rick Napier site manager – Tel no: 0208 599 6509 See: https://fairlop.tarmac.com/contact-us/	
Current condition	The site is active.	
Current conflicting activities	Landfill and land reclamation	
Restricting conditions	Access and imminent disappearance of this site; we would request that a small exposure is made accessible somewhere within the complex once operations cease.	
Nature of exposure	Quarry for Boyn Hill Gravel.	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	The area has been quarried from at least 1938 (BGS GDI old OS maps) but other literature not yet researched	2
Aesthetic landscape	Private land	0
History of Earth Sciences	Other gravel pits in East London have been important for archaeological remains but only minor evidence has been reported from the Fairlop, e.g. postholes. An archaeologist was onsite checking the removal of topsoil.	2
Economic geology	Gravel extraction has been an important industry in east London	8
GeoScientific Merit		
Geomorphology	Flat terrace feature at 25m above OD	2
Sedimentology	Potential detailed description of the gravels possible	6
Palaeontology	None known	0
Igneous / mineral / metamorphic geology	None.	0
Structural Geology	None.	0
Lithostratigraphy	Potential better exposure when Areas F, and then E become operational	6
Potential use	Research; (off-site education on Thames Terraces). Investigations into clay layer required.	
Fragility	landfill	
Current Site Value		
Community	.	2
Education		4
Geodiversity value		
RIGS: It will be important to maintain an accessible face once extraction has ceased and for Redbridge to consider designating a face within the complex a RIGS for the Boyn Hill Gravel as there are no other exposures in east London		6

GLA 49 Fairlop Quarry Complex (Hainault Quarry)

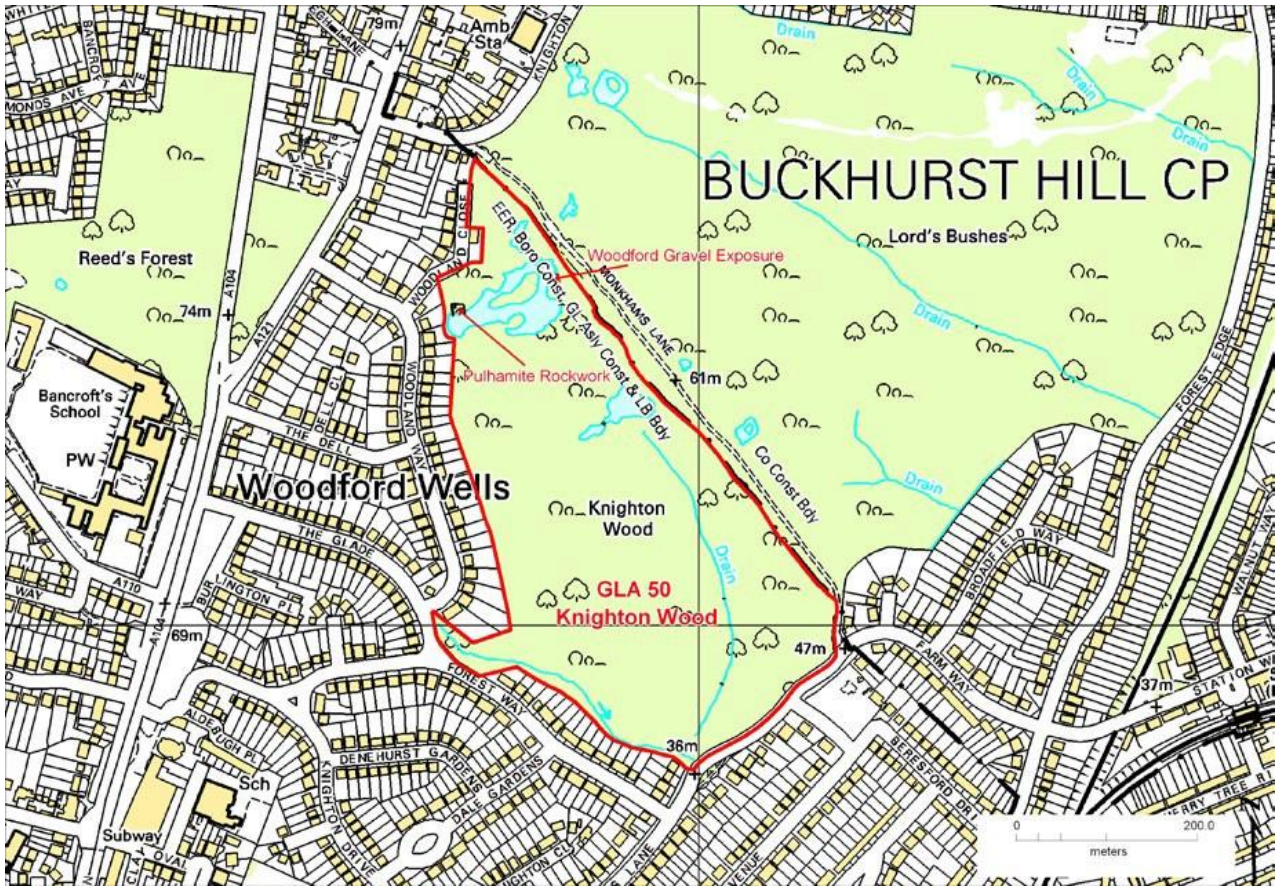
Clay being removed from above the gravel. Photo: Bill George, 2019

Small temporary exposure dug for visit in 2019. Photo: Diana Clements 2019

GLA 50 Knighton Wood

Grid Reference: TQ 413 935	Site Type: Exposures of Woodford Gravel in public park
Site Area (hectares): 14.92	Current use: Open access public space
Site ownership: Part of Epping Forest, managed by the City of London Corporation.	Borough: London Borough of Redbridge, with the adjoining Lord's Bushes in Essex.
Field surveyor: Diana Clements, Peter Collins	Date: May 2011
Current geological designation: RIGS	Other designation: Part of Epping Forest SAC; SSSI; Metropolitan SINC (Epping Forest North)

Site Map



Stratigraphy and Rock Types

Time Unit: Pleistocene	Rock Unit: Woodford Gravel Member, Sudbury Formation
Rock Type: Sand and gravel	Details: Sand and gravel, locally with lenses of silt, clay or peat and organic material.
Time Unit: Eocene	Rock Unit: London Clay Formation, Thames Group
Rock Type: Clay, silt, sand	Details: Fine, sandy, silty clay/ clayey silt.

Site Description

Pleistocene/pre-Anglian Woodford Gravel overlies Eocene London Clay Formation with the junction between the two covered by 'Head' (run off from the gravels). The Woodford Gravel is well-exposed around the edge of Knighton Lake, particularly on the east side, close to the path. Junction with London Clay not seen.

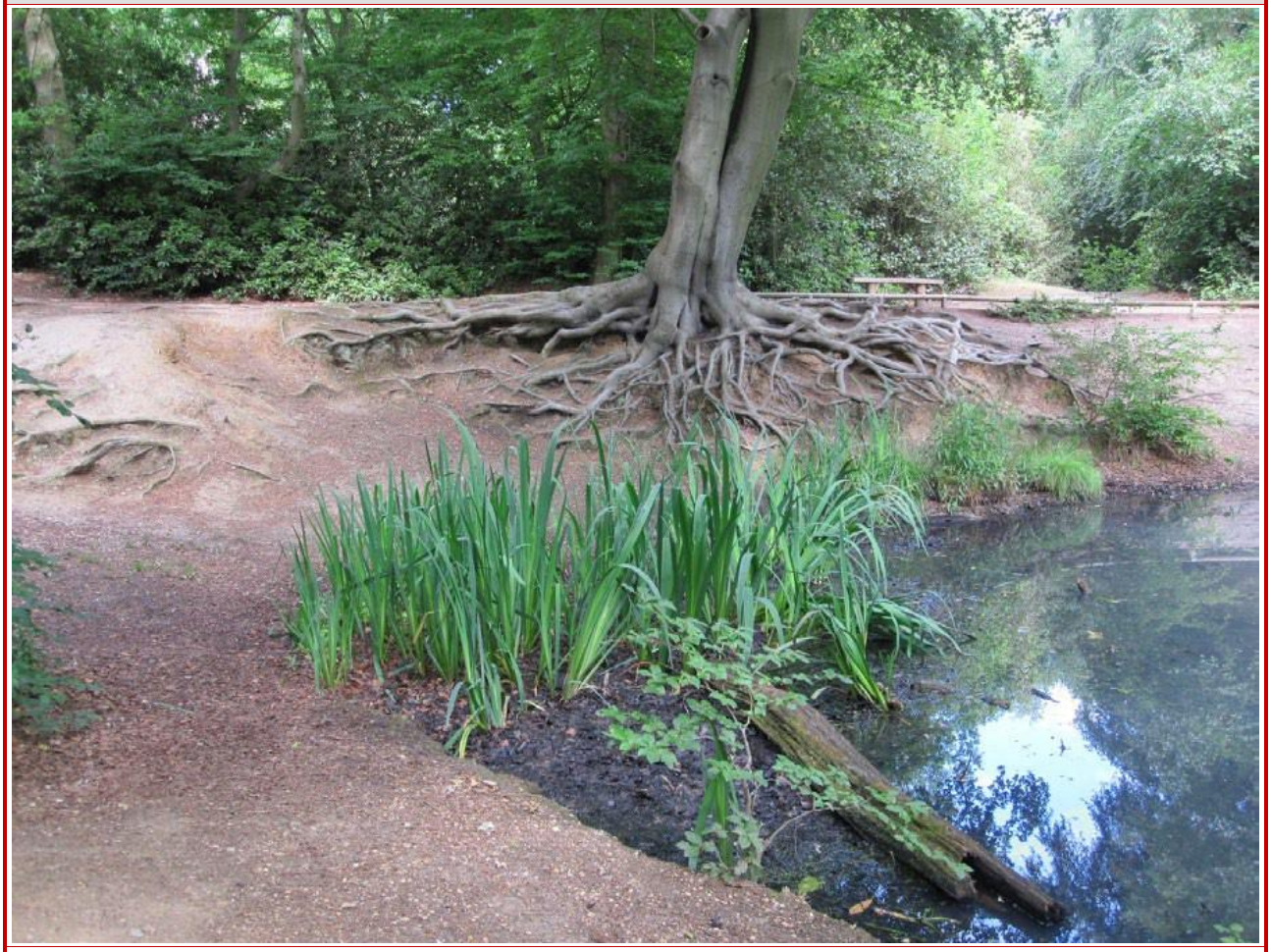
A good example of Pulhamite (manufactured rock face) can be seen at the western end of the Lake.

Assessment of Site Value

Geodiversity topic: Lithostratigraphy; sedimentology; geomorphology.

Access and Safety		
Aspect	**Description**	
Safety of access	Car park in Monkham's Lane, off Knighton Lane. A well-maintained path runs directly to Knighton Lake. Nearest station is Roding Valley on Central Line.	
Safety of exposure	Exposure in public woodland at the edge of a lake – observe general safety in woodlands and slope towards water.	
Permission to visit	Open access.	
Current condition	Good. Pulhamite needs some maintenance and vegetation clearing	
Current conflicting activities	None.	
Restricting conditions	High water levels may restrict viewing. People erosion will probably protect from overgrowth and good management by CoL from dumping, but the need for geoconservation should be communicated to CoL	
Nature of exposure	The Woodford Gravel is well-exposed around the edge of Knighton Lake, particularly on the east side, close to the path.	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	Pulhamite Rock face (none known for Woodford Gravel)	4
Aesthetic landscape	Pleasant open space with easy public access. 'Maintain Rock Exposure' is mentioned in the CoL Management Plan for 2004-10. This may refer to the Pulhamite at the other end of the lake.	8
History of Earth Sciences	No specific reference to Knighton Wood known.	2
Economic geology	Evidence of quarrying in 1883 (CoL Management Plan 2004-10). Several pits are located in the adjacent Lord's Bushes	5
GeoScientific Merit		
Geomorphology	Distribution of exposures of Woodford Gravel used to determine location relative to the pre-diversionary Thames and its tributaries flowing over the current London Basin from the Weald. Rests on top of London Clay hillocks 50 – 80 m OD (Ellison et al. 2004 cite adjacent Lords Bushes in Essex, as example)	6
Sedimentology	Research into composition of the gravels could give more information on the provenance of the gravels and therefore the river that deposited them. Woodford Gravel covers a restricted area and includes clasts from the Weald.	6
Palaeontology	None.	0
Igneous / mineral / metamorphic geology	None.	0
Structural Geology	None.	0
Lithostratigraphy	One of several exposures of Woodford Gravel in the area and probably the best within Greater London (type section from borehole data)	6
Potential use	Research; further education; on-site interpretation.	
Fragility	Dumping; natural overgrowing; weathering/erosion.	
Current Site Value		
Community	Site passed on a daily basis	10
Education		6
Geodiversity value		
RIGS	Woodford Gravel is described from borehole data and is of limited extent. This would appear to be the best exposure in the area although there are others not far away at Lord's Bushes (Essex) and within Epping Forest.	6

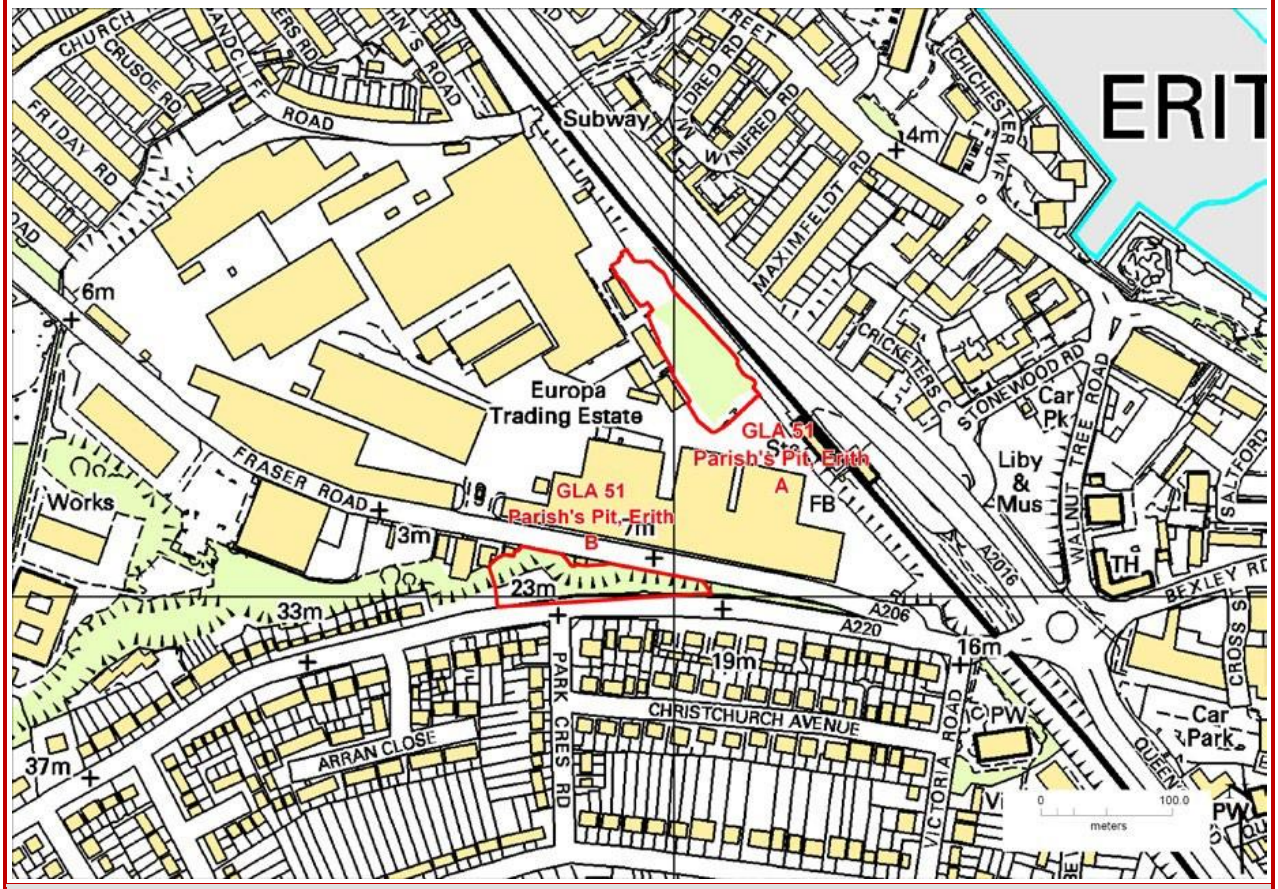
GLA 50 Knighton Woods



Exposure of Woodford Gravel on the east perimeter of Knighton Lake. Photo: Diana Clements

GLA 51 Parish's Pit, Erith

Grid Reference: a) TQ 510 781 b) TQ 509 780	Site Type: Former aggregate site
Site Area (hectares): 0.98 (Site A = 0.6, Site B = 0.3) Original pit c. 40)	Current use: Steep inaccessible cliffs.
Site ownership: Mainly private estates securely guarded by high fences	Borough: London Borough of Bexley
Field surveyor: Paul Rainey Last visited: Viewed from afar at Erith Railway Station. Paul Rainey, Laurie Baker, Diana Clements	Date: November 2011 Date: February 2016
Current geological designation: LIGS	Other designation: Borough Grade I SINC (Erith Quarry and Fraser Road)
Site Map	OS Topography © Crown Copyright



Stratigraphy and Rock Types

Time Unit: Eocene	Rock Unit: Blackheath Member, Harwich Formation, Thames Group
Rock Type: Sand and gravel	Details: Sand and pebbles (mostly round, black), marine fauna, locally brackish. Calcitic conglomerate found at certain horizons.
Time Unit: Paleocene-Eocene	Rock Unit: Upnor and Woolwich Formations, Lambeth Group
Rock Type: Clay, silt, sand	Details: Glauconitic sands overlain by interleaved grey clays and sands with brackish fauna. Marine Upnor sand at the base.
Time Unit: Paleocene	Rock Unit: Thanet Formation
Rock Type: Clay, silt, sand	Details: Pale yellow-brown fine-grained sand that can be clayey and glauconitic.

Site Description

This is a large, half a square kilometre, former pit that mainly worked Thanet Sand between 1805 and about 1970. Strata are horizontal. The natural site was a north east facing slope rising from the top of the Chalk at Thames river level some 30m to the Harwich Formation plateau. The base of the pit was at about the top of the Chalk. The Thanet Sand can stand in near vertical cliffs, some still visible. Other strata do

not stand so steeply and are mainly hidden by impenetrable vegetation, scree and fences. About half the pit floor has been backfilled, the other half has been built over as industrial estates, formerly the Vickers works.

One still spectacular rectangular “Lost World” type of “island” (Site A) is surrounded on three sides by high vertical Thanet Sand cliffs and on its fourth side by a railway cutting This is shown on a painting and a photograph of the 1870s when the former quarry floor was a cricket ground. Another high Thanet cliff (Site b) is marked by “Danger Falling Rocks” signs as Fraser Road climbs across it. Elsewhere the geology is completely hidden.

Assessment of Site Value

Geodiversity topic: Lithostratigraphy; sedimentology; palaeontology.

Access and Safety

Aspect	Description
Safety of access	Within industrial estate
Safety of exposure	The faces are within private estates securely guarded by high fences but they do slip occasionally
Permission to visit	Probably individual unit owners within the industrial estate
Current condition	The southern faces of the site are heavily overgrown but vertical cliffs of Thanet Sand are still visible from the public highway in two areas (a), (b) on map). In area (a) the lower parts of the cliffs are heavily overgrown. In area (b) lower parts of the cliffs are covered by brickwork and concrete. The upper parts of the cliffs form prominent landmarks.
Current conflicting activities	Industrial estate activities
Restricting conditions	Access
Nature of exposure	Only remaining sections of former large quarry

Culture, Heritage & Economic

Aspect	Description	Rating
Historic, archaeological & literary associations	Site of great interest to local history and industrial archaeology.	5
Aesthetic landscape	Best viewed in winter	4
History of Earth Sciences		2
Economic geology	No longer operational	6

GeoScientific Merit

Geomorphology	North east facing slope rising c. 30m from chalk at the base to the Harwich Formation plateau. The base of the pit was at about the top of the Chalk and all that is visible now are remnant Thanet Sand near- vertical cliffs at the perimeters of the old quarry. Other strata do not stand so steeply.	0
Sedimentology	Thanet Formation still visible, mostly stained orange, but in one area quite pale. Glauconite observed in small slipped area at site (b). Strata above are obscured.	4
Palaeontology	None known about	
Igneous/mineral/ Metamorphic Geology	None.	0
Structural Geology	None.	0
Lithostratigraphy	Paleocene Thanet Formation, Paleocene-Eocene Lambeth Group, Eocene Harwich Formation all formerly visible at this site	3
Potential use	Research; education;	
Fragility	Natural overgrowing; weathering/erosion; future development	

Current Site Value

Community	Limited access as industrial site, but visible from roadsides and railway station platforms	2
Education	Site of great interest to local history and industrial archaeology	5

Geodiversity value	
LIGS: worth protecting the remaining faces from developers as currently only exposure of Thanet Formation in Bexley (NB Chalky Dell also, if conserved)	3-4

GLA 51 Parish's Pit, Erith

Area A within industrial estate from railway station

Area B south side of Fraser Road

Photos: Diana Clements, 2012

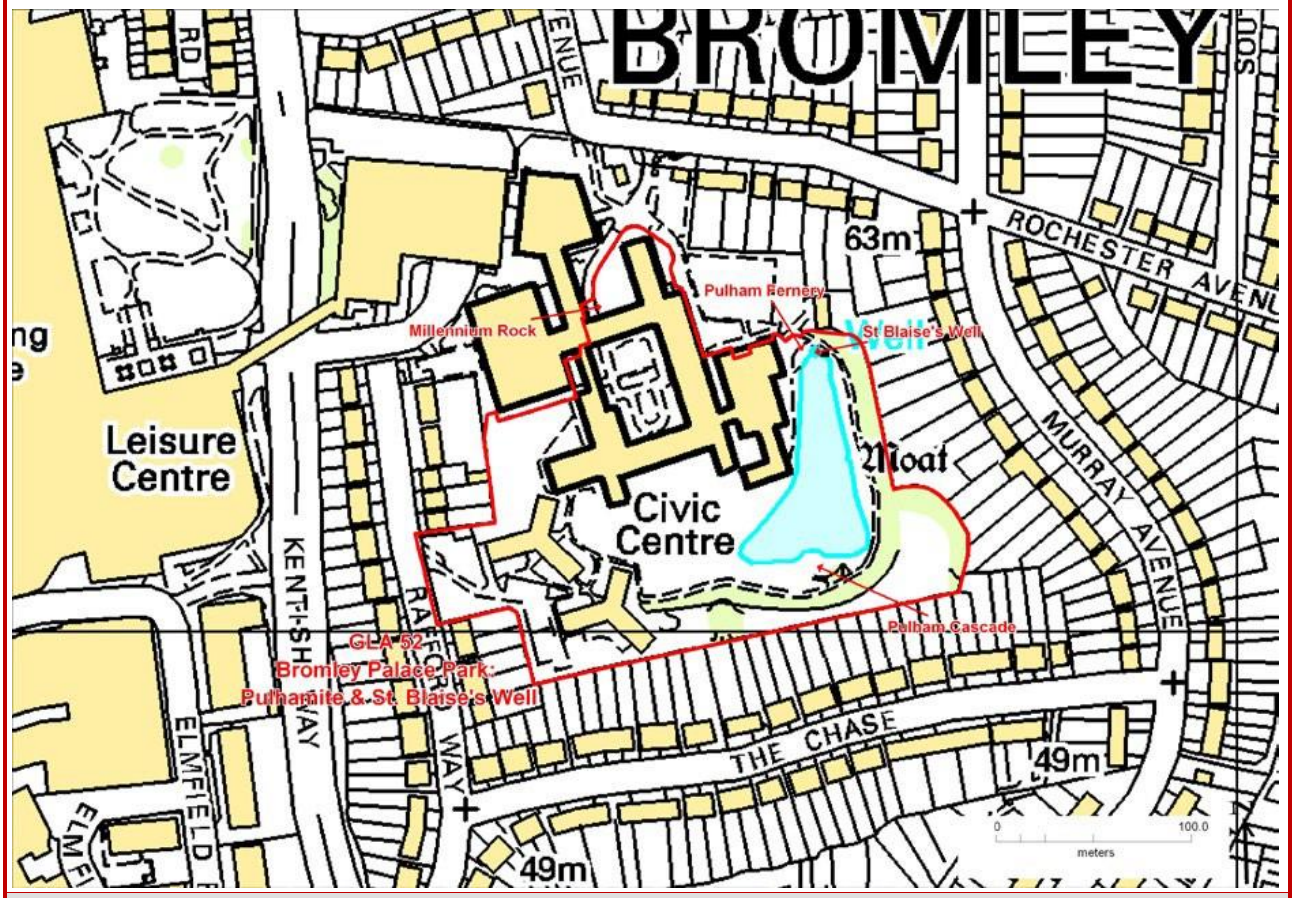
Area A from Erith railway station, February 2016. Photo: Laurie Baker

GLA 52 Bromley Palace Park, Pulhamite and St. Blaise's Well

Grid Reference: TQ 408 691	Site Type: Man-made artefacts on lake inflow and outflows
Site Area (hectares): 3.55	Current use: Recreational Land
Site ownership: London Borough of Bromley	Borough: London Borough of Bromley
Field surveyor: Paul Rainey Last visited: Paul Rainey	Date: November 2011 Date: 2018
Current geological designation: LIGS	Other designation: Listed Buildings, Grade II; Local SINC (Bromley Civic Centre Grounds)

Site Map

OS Topography © Crown Copyright



Stratigraphy and Rock Types

Time Unit: N/A	Rock Unit: N/A
Rock Type: N/A	Details: Artificial (Pulhamite) but incorporating blocks of Hythe Beds (Cretaceous, Lower Greensand Group).

Site Description

The sites are waterfall structures at the inflow (Pulham Cascade) and an outflow (Pulham Fernary) of a lake (part of a former mediaeval moat) in the grounds of the former Bishop's Palace now the Bromley Civic Centre. They are formed of Pulhamite and were constructed by the Pulham Family business in 1865. The inflow structure is adjacent to a modern fountain in a circular basin on the site of St Blaise's Well, a chalybeate spring which was used for its curative properties in the 18th century. A large plaque tells the story of St Blaise's Well. To the north of the Palace is the Millennium Rock, a boulder of Lewisian Gneiss presented to Bromley by the Highland Council.

The site is listed in *Durability Guaranteed: Pulhamite rockwork – its conservation and repair.* English Heritage, 2008 and with a little more detail in *Rock Landscapes: The Pulham Legacy* by Claude Hitching, 2012.

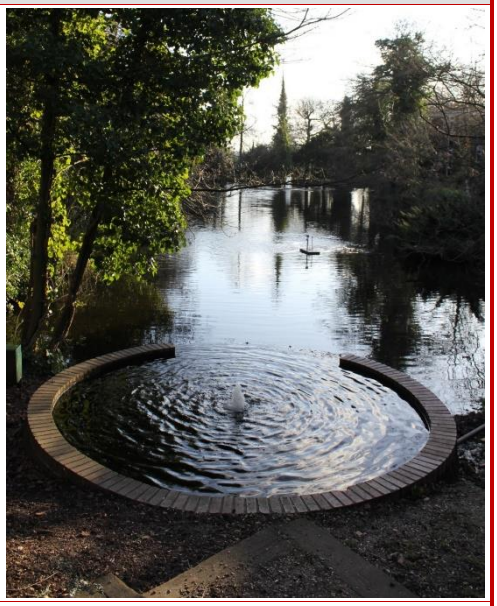
Assessment of Site Value

Geodiversity topic: Geology, hydrogeology

Access and Safety		
Aspect	**Description**	
Safety of access	Within public park	
Safety of exposure	The site is well cared for by the London Borough of Bromley	
Permission to visit	Open access.	
Current condition	The Pulhamite rockeries are damaged by tree roots and are somewhat overgrown. English Heritage have surveyed the structures and Bromley Council is seeking funds for restoration (see https://bromleytownparks.wordpress.com/our-parks/bromley-palace-park-aka-civic-centre/)	
Current conflicting activities	None	
Restricting conditions		
Nature of exposure	Artificial rockeries over small streams. A modern fountain in a brick basin.	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	At the site of a chalybeate spring, formerly of local economic significance. Examples of Victorian landscape architecture. Listed by English Heritage in *Durability Guaranteed* (Ref. to Pulham, c.1877, Festing, 1984)	5
Aesthetic landscape	Attractive lakeside features.	5
History of Earth Sciences	N/A	0
Economic geology	Former chalybeate spring exploited by local doctor	4
GeoScientific Merit		
Geomorphology	None	0
Sedimentology	Manmade features incorporating blocks from the Weald	3-4
Palaeontology	None	0
Igneous/mineral/ Metamorphic Geology	Lewisian Gneiss (Millennium Stone)	2
Structural Geology	None	0
Lithostratigraphy	Site of chalybeate spring	4
Potential use	Aesthetics, education	
Fragility	natural overgrowing	
Current Site Value		
Community	Valuable green space.	8
Education	Explaining springs	8
Geodiversity value		
LIGS: the site is interesting historically and aesthetically and is in a public place that has a story to tell about Pulhamite (see www.pulham.org.uk) and the chalybeate spring		4

GLA 52 Bromley Palace Park, Pulhamite and St. Blaise's Well

Pulhamite cascade



St. Blaise's Well and lake

Photos: Laurie Baker, January 2012

GLA 53 Charmwood Farm Chalk Mine

Grid Reference: TQ 4616 6244	Site Type: Subterranean chalk pits
Site Area (hectares): 1.64	Current use: Woodland on private farm land
Site ownership: Part of GK Denniss Farms	Borough: London Borough of Bromley
Field surveyor: Vernon Marks, Paul Rainey	Date: February 2011
Current geological designation: LIGS	Other designation: Metropolitan SINC (Norsted Valley Woods)

Site Map

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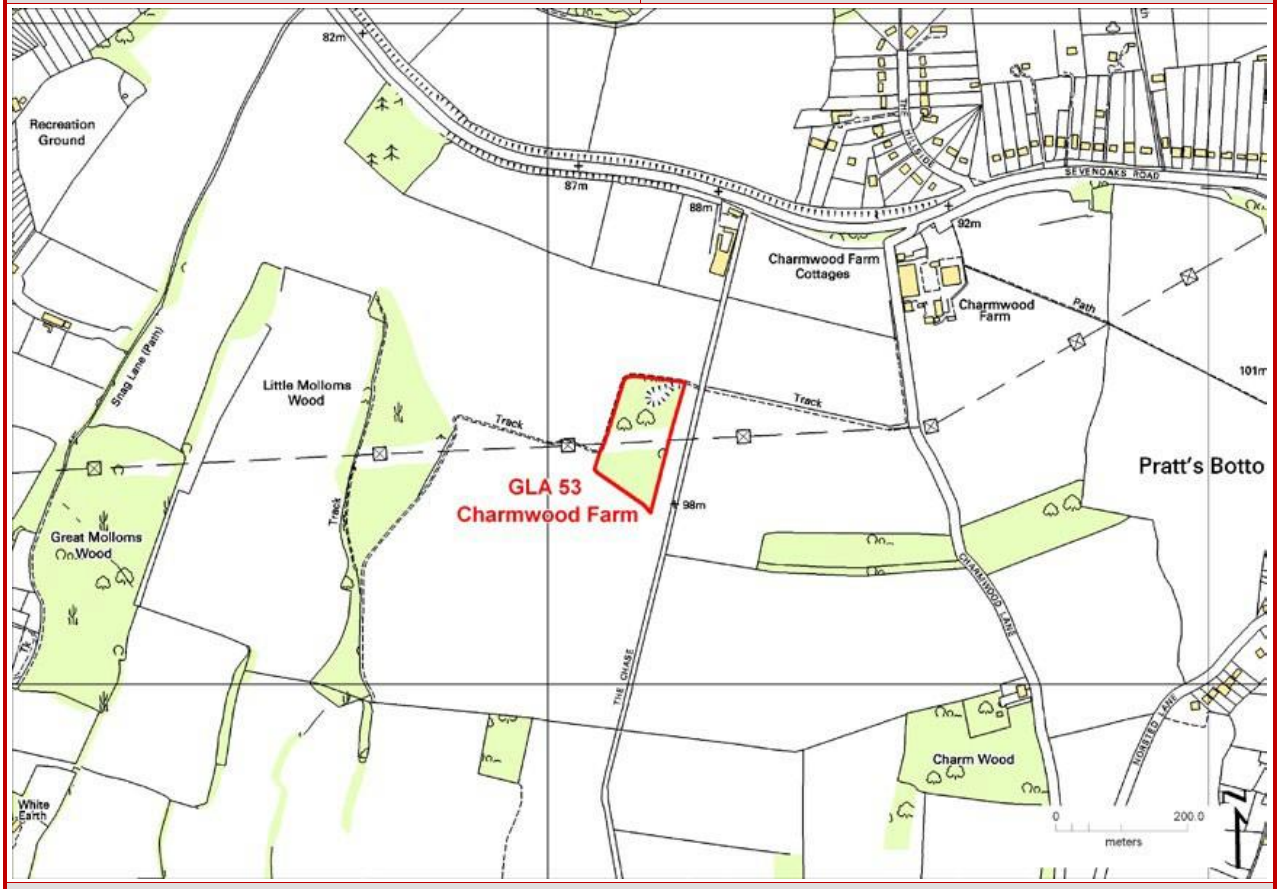


Stratigraphy and Rock Types

Time Unit: Late Cretaceous	Rock Unit: probably Seaford Chalk Formation, White Chalk Subgroup
Rock Type: Chalk	Details (Seaford Chalk): Firm white chalk with conspicuous semi-continuous nodular and tabular flint seams. Hardgrounds and thin marls are known from the lowest beds. Some flint nodules are large to very large.

Site Description

In a small wood midway between Little Molloms Wood and Charmwood Farm, there are a series of associated depressions and a half-filled open cast chalk quarry. The entrance arch is 1.5m by 1.5m. A steep descent follows into a chamber 4.5m high. A short (9m) blind tunnel leads off on the right and there are two connections, about 3m long, on the left to a parallel tunnel which once had its own entrance. The two parallel tunnels are each about 25m long. In 1992 the Kent Underground Research Group dug a deep exploratory trench but only found loose chalk rubble, probably part of a roof collapse. The site is gated by a metal grille. As most of the surface exposures of chalk in the London area are in Seaford Chalk, this is the likely horizon here although this has not been confirmed.

Assessment of Site Value

Geodiversity topic: Lithostratigraphy; sedimentology; palaeontology

Access and Safety

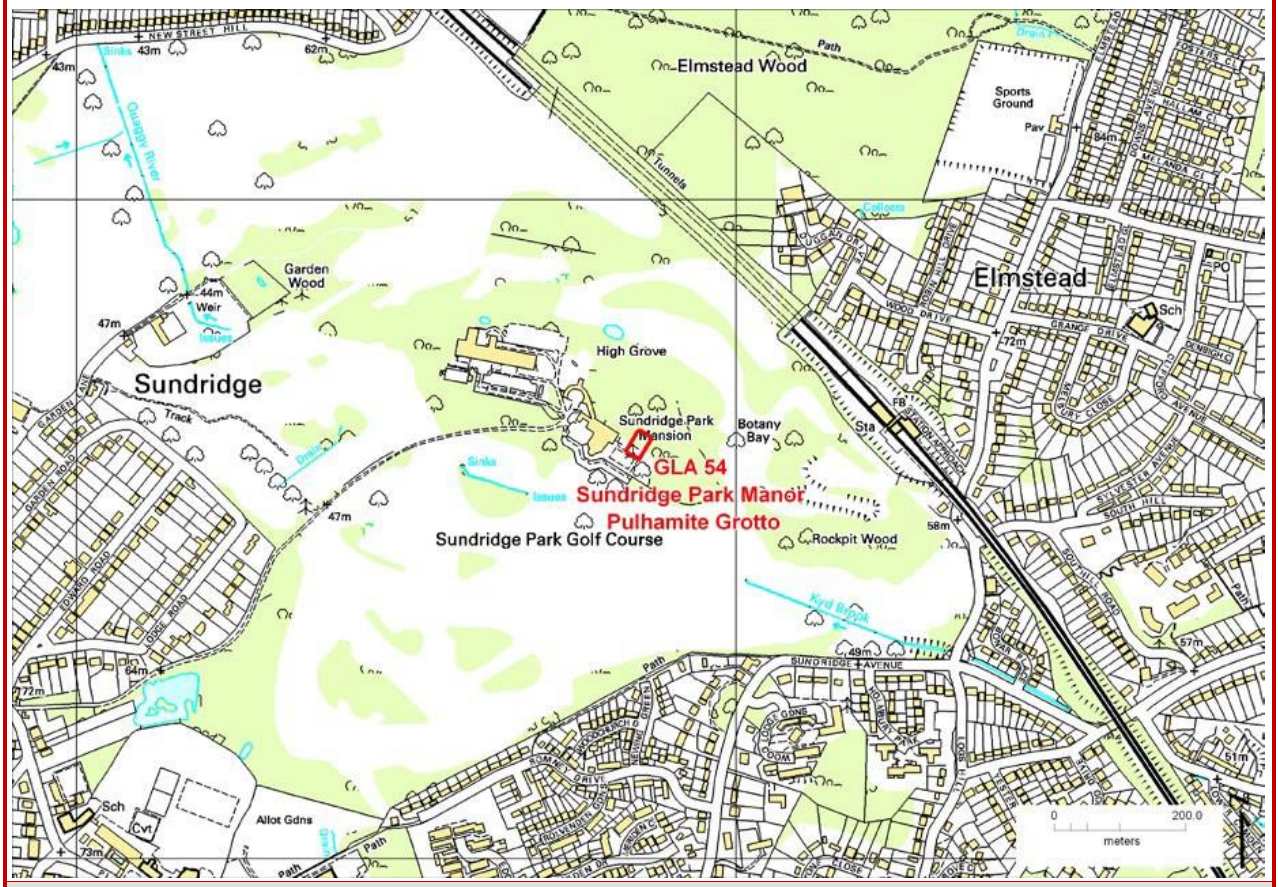
Aspect	Description
Safety of access	Woodland on private farm land. Entrance to mine covered by a grille
Safety of exposure	The mine is securely protected by a steel grille but access inside could be

	dangerous	
Permission to visit	In 2012, the contact was GK Denniss Farms tel. 01892 770931	
Current condition	Entrance to mine has been cleared of vegetation	
Current conflicting activities	It is managed as a bat hibernation site.	
Restricting conditions	Access and possible overgrowth. Grilles prevent access to mine.	
Nature of exposure	Chalk mine and small open cast chalk quarry. Adits have been driven into the hillside.	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	Underground site description and history closely based on: Pearman, H,, 1973 in: Caves and Tunnels of Kent. Records of Chelsea Spelaeological Society and Le Gear,R.F,1992 and 1993, Newsletters 32 and 37, Kent Underground Research Group.	8
Aesthetic landscape		2
History of Earth Sciences	Research required (Bromley ref. Library)	4
Economic geology	Former chalk mine	9
GeoScientific Merit		
Geomorphology	None	4
Sedimentology	Environment of deposition	3
Palaeontology	possibly	1
Igneous/mineral/ Metamorphic Geology	None.	0
Structural Geology	Regional structure of Chalk	3
Lithostratigraphy	Seaford Formation, White Chalk Subgroup	6
Potential use	Research; further education; website interpretation.	
Fragility	natural overgrowing around entrance; falling chalk within mine; dumping	
Current Site Value		
Community	Limited value because of private access	4
Education	Possible asset if access & information made accessible	6
Geodiversity value		
LIGS: Fresh chalk provides material for research and there is potential for local education		4
GLA 53 Charmwood Farm chalk pit		

Entrance to mine with Paul Rainey. Photo: Vernon Marks, 2011

GLA 54 Sundridge Park Manor Pulhamite grotto

Grid Reference: TQ 4184 7063 (BR1 3FZ)	Site Type: Man-made artefact
Site Area (hectares): 0.09	Current use: Grounds of residential apartments
Site ownership: Sundridge Park Manor**,** Residential apartments run by agents City & Country: www.cityandcountry.co.uk.	Borough: London Borough of Bromley
Field surveyor: Diana Clements/Vernon Marks	Date: September 2010
Current geological designation: LIGS	Other designation: Listed in English Heritage's *Durability Guaranteed*; Borough Grade I SINC (Sundridge Park Golf Course, Elmstead Woods and Lower Marvels Woods)
Site Map	OS Topography © Crown Copyright



Stratigraphy and Rock Types

Time Unit: N/A	Rock Unit: N/A
Rock Type: N/A	Details: Artificial but incorporating blocks, probably of Tunbridge Wells sandstone (Early Cretaceous, Wealden, Hastings Beds) and making use of the immediately local Blackheath Beds (Harwich Formation, Eocene)

Site Description

The Pulhamite Grotto at Sundridge Park Manor was completed in 1874 and remains in good repair. It is a good, walk-in example of the artificial rockwork of the Pulham family incorporating blocks of sandstone amongst the artificial blocks to give it a more authentic look. Where the surface of the artificial blocks has eroded blocks of the local cemented Blackheath Beds can be seen but these are better displayed in an arch to the west of the manor house but still within the grounds. A temporary exposure between the two revealed in situ Blackheath Beds. There were former quarries for the Blackheath Beds within Sundridge Park and at Elmstead Lane and it would appear that this local material was used for creating the grotto.

Assessment of Site Value

Geodiversity topic: Geology

Access and Safety		
Aspect	**Description**	
Safety of access	Within private estate so permission needs to be sought	
Safety of exposure	Appears stable	
Permission to visit	Residential apartments run by the agents City & Country: www.cityandcountry.co.uk.	
Current condition	Unknown. The site has not been visited since it was converted to residential apartments. Some of the surface render is damaged but reveals blocks of local Blackheath Beds which is an asset.	
Current conflicting activities		
Restricting conditions	Access	
Nature of exposure	An artificial grotto set at the bottom of the slope above the flat lawns of the Manor gardens. A path winds up between the rockwork which is set within woodland	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	Completed in 1874 and one of a number of examples of rockwork fashionable with the Victorians. Listed by English Heritage in *Durability Guaranteed* (Ref. to Pulham, c.1877). Featured in GA Guide 68, Itinerary 7, 2012	5
Aesthetic landscape	Very attractive 'surprise' inviting viewers to walk up the path	9
History of Earth Sciences	N/A	
Economic geology	N/A	
GeoScientific Merit		
Geomorphology	None	0
Sedimentology	Man-made rockwork using local materials	3-4
Palaeontology	Oyster fossils and other molluscs visible in the blocks of the cemented Blackheath Beds visible in places	2
Igneous/mineral/ Metamorphic Geology	None.	0
Structural Geology	None.	0
Lithostratigraphy	Ex-situ blocks of Blackheath Beds and probably Tunbridge Wells Sandstone incorporated within the structure	3
Potential use	Aesthetics; education;	
Fragility	Natural overgrowing; weathering/erosion	
Current Site Value		
Community	Limited access but hopefully enjoyed by the residents.	4
Education	In the context of explaining Pulhamite; examples of local 'rock'	4
Geodiversity value		
LIGS: worth conserving as an excellent example of the Pulhamite rockwork		3-4

GLA 54 Sundridge Park Manor Pulhamite

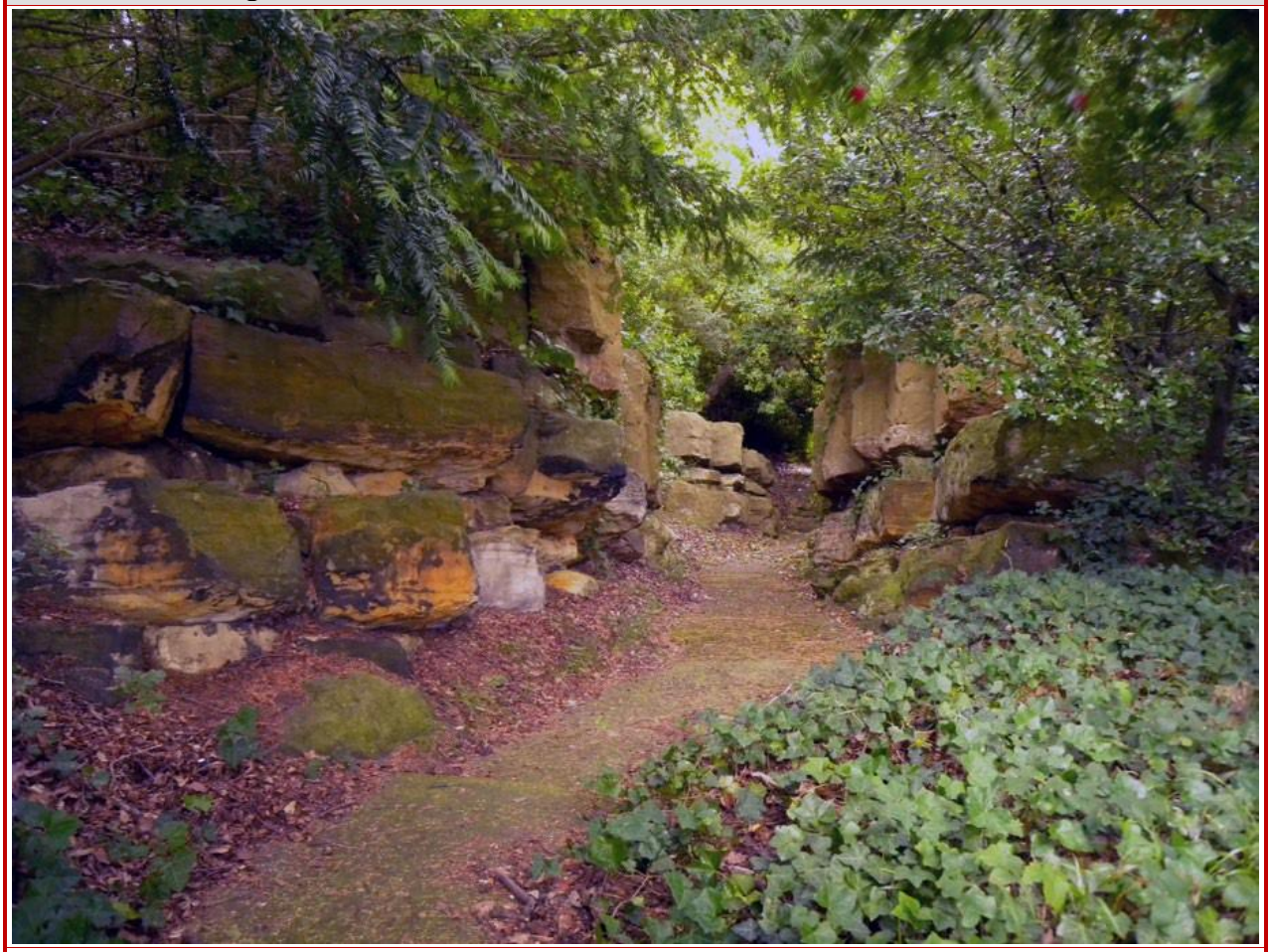


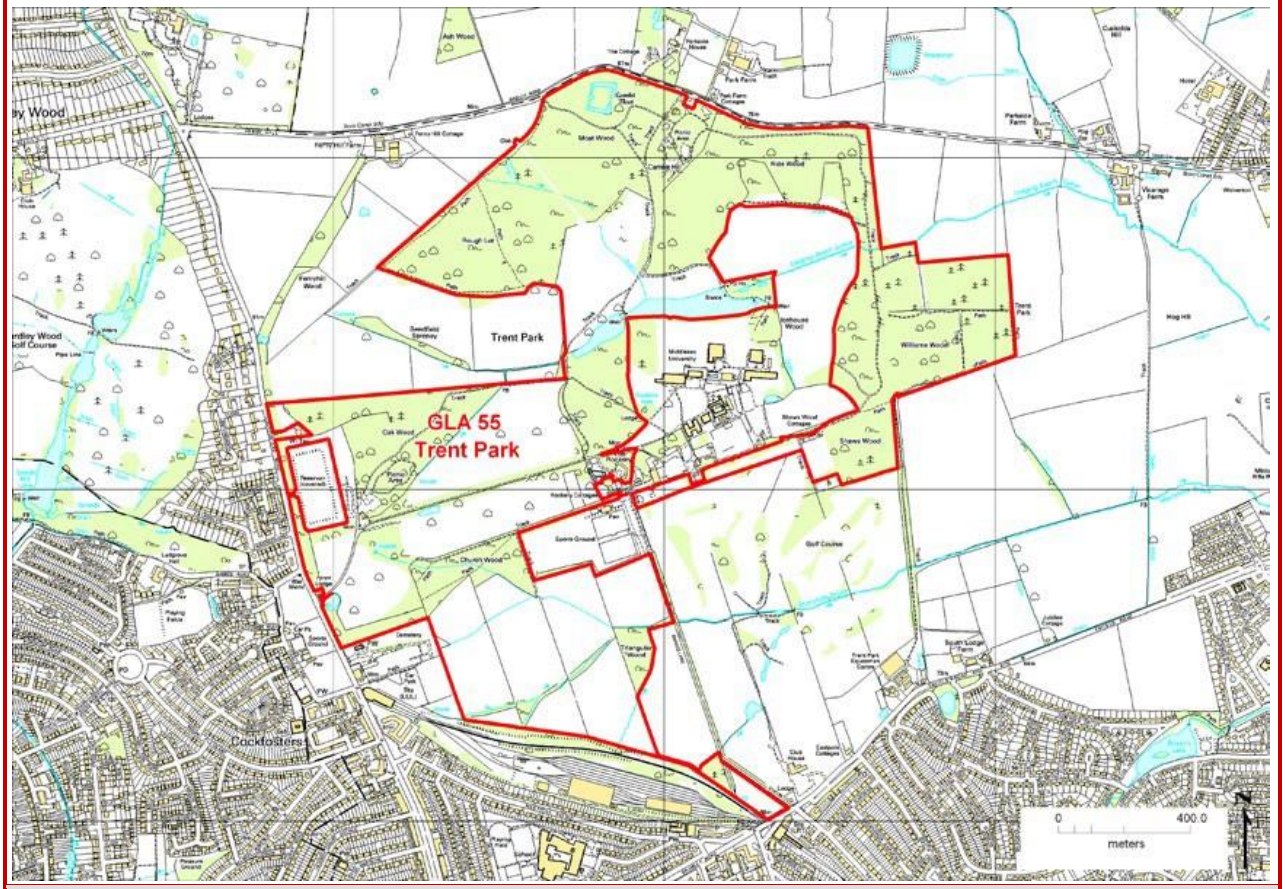
Photo: Steve Tracey

GLA 55 Trent Park

Grid Reference Park entrance TQ 281 969	Site Type: large public park
Site Area (hectares): 183.83	Current use: Recreational Land with Visitor Centre within London's Green Belt
Site ownership: London Borough of Enfield	Borough: London Borough of Enfield
Field surveyors: Diana Clements Revisited: Allan Wheeler	Date: Summer 2009 Date: March 2019
Current geological designation: LIGS	Other designation: Metropolitan SINC (Trent Park)

Site Map

OS Topography © Crown Copyright



Stratigraphy and Rock Types

Time Unit: Quaternary	Rock unit: Lowestoft Formation, Albion Glacigenic Group
Rock Type:	Details: Chalky till, together with outwash sands and gravels, silts and clays. The till is characterised by its chalk and flint content
Time Unit: Quaternary	Rock unit: Dollis Hill Gravel Member Sudbury Formation, Kesgrave Catchment Subgroup
Rock Type:	Details: Gravel, sandy and clayey in part, with some laminated silty beds. Sand and gravel, locally with lenses of silt, clay or peat and organic material
Time Unit: Eocene	Rock Unit: London Clay Formation and Claygate Member, Thames Group
Rock Type: Clay, silt, sand	Details: Fine, sandy, silty clay/ clayey silt, clay.

Site Description

Trent Park displays four different lithologies and so is an excellent location for studying geomorphology. Spring lines pick up the junctions between the lithologies and the small streams emanating from them have, in places, cut deep ravines. This must have happened as the ice sheet retreated at the end of the Anglian glaciations, and permafrost in subsequent stadials, when the ground would have been frozen. Evidence of till can be seen on the ploughed fields at the top of the hill, just outside the enclosed park. The London Loop runs through the park.

Assessment of Site Value		
Geodiversity topic: lithostratigraphy, sedimentology; geomorphology.		
Access and Safety		
Aspect	**Description**	
Safety of access	There is a car park and public access to Trent Park during opening times (8.30 am to dusk). There are toilets, a cafe and a small Visitor Centre. Also small café by animal sanctuary (in lodge alongside tarmac drive to Trent Park House). Nearest station: Cockfosters on Piccadilly Line.	
Safety of exposure	There are well-marked footpaths throughout the park but actual exposures are limited to temporary exposures and erosion around the fish ponds, by the tarmac drive and approaching the obelisk, and also in some of the streams.	
Permission to visit	Open access.	
Current condition	The park is well maintained with a range of habitats including a series of fish ponds through which the Leeging Beech Gutter flows. Angler erosion have helped expose patches of London Clay. Patches of Dollis Hill Gravel on ground surface alongside tarmac drive towards Trent Park House; also on path up to and around the Obelisk.	
Current conflicting activities	None	
Restricting conditions	Vegetation, limited exposures	
Nature of exposure	Natural hill showing range of rock units.	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	Enfield Council, the Friends of Trent Park and Historic England websites all detail the history of the Park which came into public ownership in 1951 to safeguard the Green Belt. It was originally a royal hunting forest before passing into private hands.	3
Aesthetic landscape	Footpaths through woods and meadows and around ponds used by local community. Car park, toilets, cafés and Visitor Centre within the Park. Sports facilities on the periphery.	8
History of Earth Sciences	Geotrail described in GA Guide 68, Itinerary 4, 2012, pp 57-64	4
Economic geology	None apparent	0
GeoScientific Merit		
Geomorphology	Ridges and valleys provide potential for identifying the different lithologies from clues in the landscape – spring lines, vegetation, small exposures	4
Sedimentology	Exposures of London Clay around the Fish Ponds but other lithologies are a bit more difficult to find unless excavations are made, though gravel is exposed on foot-eroded areas and in streams. Lumps of chalk found in ploughed fields to the north of the public enclosure indicate Lowestoft Till.	4
Palaeontology	None recorded	
Igneous/mineral/ Metamorphic Geology	None	
Structural Geology		
Lithostratigraphy	Important as the area contains four distinct rock units	4
Potential use	Education; use can be made of the existing Geotrail	
Fragility	Natural overgrowing but some exposures maintained by footfall erosion	
Current Site Value		
Community	Valuable woodland and green space.	8
Education	Geotrail in GA Guide 68, 2012. Possible additional information could be displayed in the small Visitor centre. The park is on the London Loop.	6

Geodiversity value	
LIGS: This is a good location for demonstrating the geomorphology of a variety of rock types. The deep gullies emphasise the importance of successive ice ages in creating the landscape seen today.	4

GLA 55 Trent Park

1. Exposure around London Clay lake

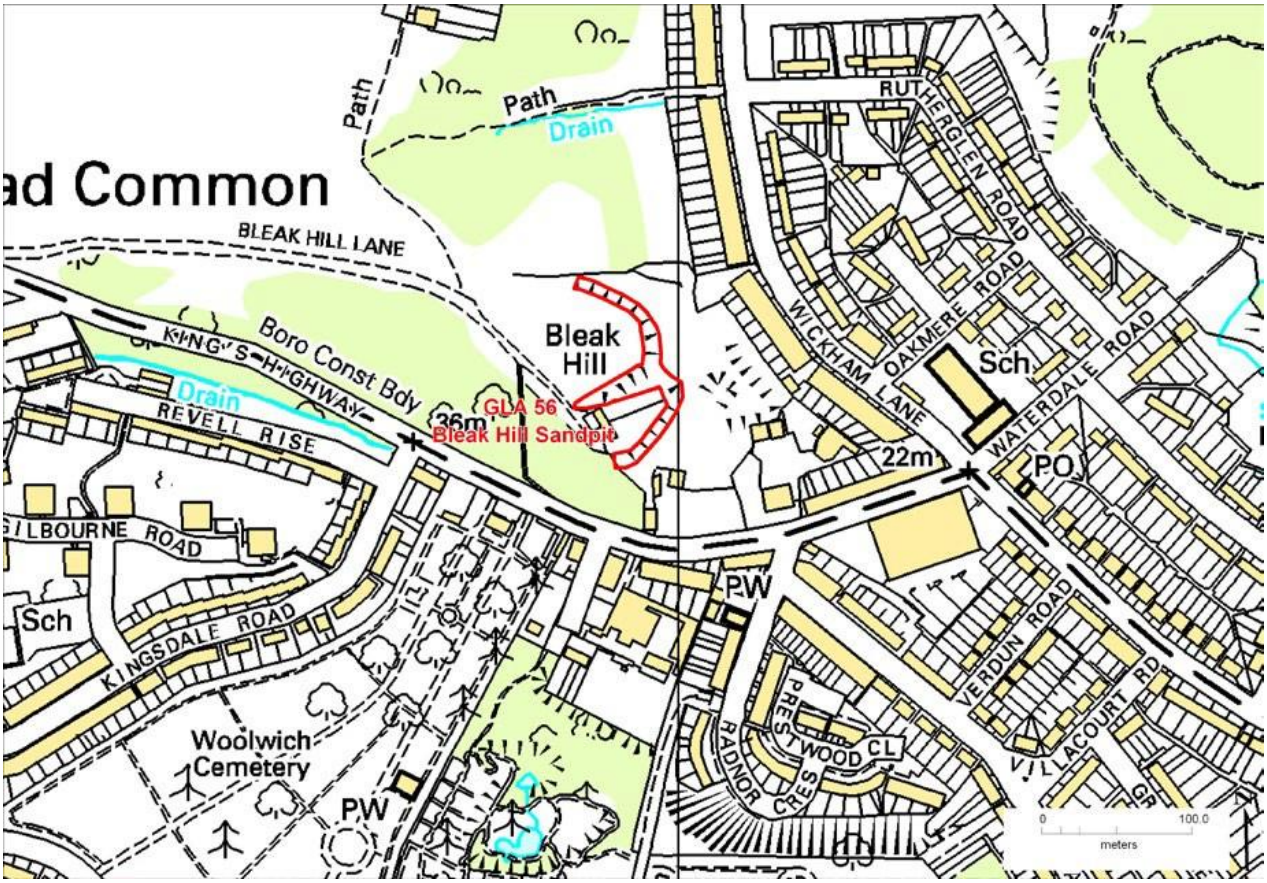
2. Deep gully

Photos: Diana Clements

GLA 56 Bleak Hill Sandpits

Grid Reference: TQ 4606 7776	Site Type: Former aggregate site
Site Area (hectares): 0.23	Current use: Recreational Land
Site ownership:	Borough: London Borough of Greenwich
Field surveyor: Vernon Marks, Paul Rainey, Laurie Baker Last visited: Paul Rainey, Diana Clements	Date: November 2010 Date: 2014
Current geological designation: LIGS	Other designation: Borough Grade I SINC (Plumstead Common)

Site Map



Stratigraphy and Rock Types

Time Unit: Eocene	Rock Unit: Blackheath Member, Harwich Formation, Thames Group
Rock Type: Sand and gravel	Details: Sand and pebbles (mostly round, black), marine fauna, locally brackish. Calcitic conglomerate found at certain horizons.
Time Unit: Paleocene-Eocene	Rock Unit: Upnor and Woolwich Formations, Lambeth Group
Rock Type: Clay, silt, sand	Details: Glauconitic sands overlain by interleaved grey clays and sands with brackish fauna. Marine Upnor sand at base.
Time Unit: Paleocene	Rock Unit: Thanet Formation
Rock Type: Clay, silt, sand	Details: Pale yellow-brown fine-grained sand that can be clayey and glauconitic.
Time Unit : Late Cretaceous	Rock Unit: Seaford Chalk, White Chalk Subgroup
Rock Type: Chalk	Details Chalk with flints (unseen)

Site Description

The site is the remains of three pits:
1) Hope Cottage pit (TQ 4600 7768) (visited 1887, 1906) only in the strata above the Chalk, the floor is now a car park;
2) Jenner's (Hoar's) pit (TQ 4606 7766) (visited 1894, 1906, 1908) only in Thanet Sand and Chalk), floor is

now a car park. Today it is a very steep, inaccessible face with mainly obscured geology;
3) Tuff and Hoar's pit (TQ 4598 7776) (visited 1908, 1919, 1929).

A photo (Priest, 1919) shows 25m high face to upper pit with Blackheath, Lambeth and Thanet strata and, lowering its floor, a 3m deep lower pit in Chalk. This area is now heavily overgrown and is accessed with difficulty by several minor footpaths from the Green Chain Walk to the north. There is still clear evidence of quarrying activities in the steep central valley. Several lumps of calcitic conglomerate were found (presumably from the Blackheath Beds). One appeared to be natural but a several cylindrical pieces were manmade possibly as test pieces?

The geology is believed to be similar to Gilbert's Pit but few clear exposures were found.

Assessment of Site Value

Geodiversity topic: Lithostratigraphy; sedimentology; palaeontology.

Access and Safety

Aspect	**Description**
Safety of access	A matter of scrambling on steep slopes for Tuff and Hoar's pit. Other pit faces inaccessible near property boundaries
Safety of exposure	The faces are heavily overgrown.
Permission to visit	Open access.
Current condition	The faces are heavily overgrown.
Current conflicting activities	Development
Restricting conditions	Vegetation and leaf cover in autumn.
Nature of exposure	Disused pits in woodland and behind car parks.

Culture, Heritage & Economic

Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	There is scope for a geological/industrial archaeology walk through this area and neighbouring former brick pits and chalk mines to the south and chalk pits to the east.	6
Aesthetic landscape	Mainly forming high wooded background "island" to otherwise built up area.	4
History of Earth Sciences	Geologist Association excursions to the quarries are described in the Proceedings (PGA): Goodchild, 1887; Leach & Polkinghorne,1906; Priest,1919; Baker & Priest,1919; Leach, 1929. Hope Cottage Pit (King's Highway Garage) is also described in GA Guide No. 68, 2012.	4
Economic geology	In 19th century worked for sand. In 20th century worked for sand and chalk.	4
GeoScientific Merit		
Geomorphology	Steep valley beneath Harwich Formation plateau.	4
Sedimentology	Thanet Formation, Upnor Formation, Woolwich Formation (and probably) Blackheath Beds (Harwich Formation) were all originally quarried at this site and illustrate the variability in the succession from marine to estuarine and back to marine with alternating sands, clays and shell bed, with the rounded Blackheath Pebbles at the top. Now it is only orangey sand that is visible, probably from the Thanet &/or Upnor Formations but without access it is difficult to confirm. The Chalk is buried beneath the car park.	4
Palaeontology	None observed but probably to be found in Woolwich Formation and possibly in Harwich Formation.	4
Igneous/mineral/ Metamorphic Geology	None.	0
Structural Geology	None.	0
Lithostratigraphy	Succession of lithology at one site (better seen at GLA 14, Gilbert's Pit, SSSI). Historically pits were of much interest for displaying the variability within the Lambeth Group and researching the divisions	4

	between the Formations.	
Potential use	Research; further education; on-site interpretation.	
Fragility	natural overgrowing; weathering/slumping	
Current Site Value		
Community	Near paths on Green Chain Walk	6
Education		6
Geodiversity value		
LIGS: Disused quarry included because of the possibility of informing walkers on the Green Chain Walk.		4
GLA 56 Bleakhill Sandpits		

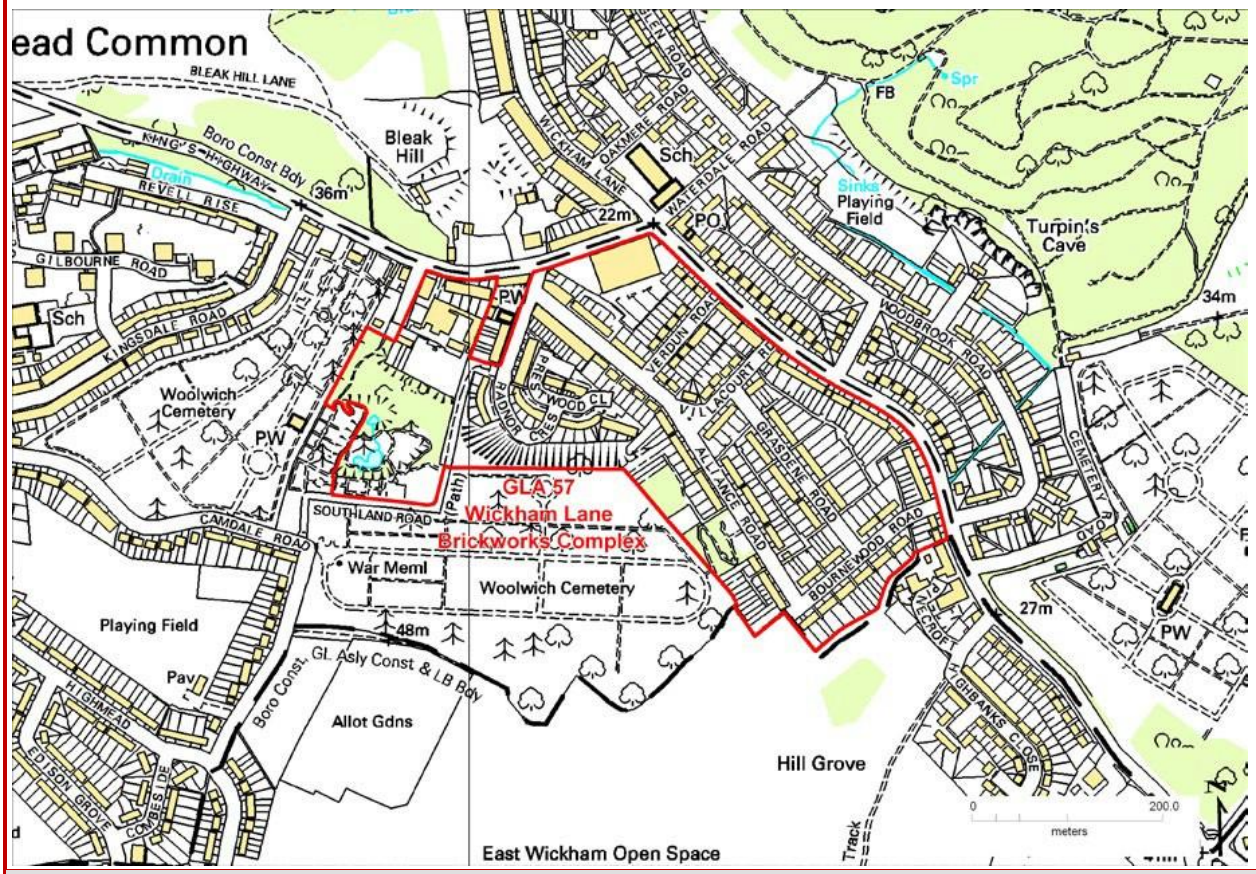
Photo: Diana Clements 2012

GLA 57 Wickham Valley Brickworks Complex

Grid Reference: Best exposure at TQ 4604 7743	Site Type: Former aggregate sites
Site Area (hectares): 14.67	Current use: Steep inaccessible cliff in front of and behind residential area
Site ownership: Various	Borough: London Borough of Greenwich
Field surveyor: Vernon Marks, Paul Rainey, Laurie Baker Last visited: Paul Rainey, Diana Clements	Date: November 2010 2014
Current geological designation: LIGS	Other designation: Borough Grade II SINC (Woolwich Cemeteries and Rockliffe Gardens)

Site Map

OS Topography © Crown Copyright



Stratigraphy and Rock Types

Time Unit: Quaternary	'Undifferentiated Thames Gravels'
Rock Type:	Includes 'Brickearth'
Time Unit: Eocene	Rock Unit: Blackheath Member, Harwich Formation, Thames Group
Rock Type: Sand and gravel	Details: Sand and pebbles (mostly round, black), with a fragile brackish marine fauna locally. Calcitic conglomerate found at certain horizons.
Time Unit: Paleocene-Eocene	Rock Unit: Upnor and Woolwich Formations, Lambeth Group
Rock Type: Clay, silt, sand	Details: Glauconitic sands overlain by a unit of blue-grey sand followed by interbedded grey clays and sands with a well-preserved brackish mollusc fauna. Marine Upnor sand at base.
Time Unit: Paleocene	Rock Unit: Thanet Formation
Rock Type: Clay, silt, sand	Details: Pale yellow-brown fine-grained sand
Time Unit : Late Cretaceous	Rock Unit: White Chalk Subgroup
Rock Type: Chalk	Details: Chalk with flints (unseen)

Site Description

The complex is the remains of three adjacent pits:

1) Cemetery Brickyard (1861-1908, now Rockcliff Gardens),
2) South Metropolitan Brickyard (1880-1912, reworked for sand in 1940s and 50s) (now Radnor Crescent and Prestwood Close) and
3) Gregory's Pit, also known as Wickham Lane Brick Pit (c. 1840-1930) (now between Alliance Road and Wickham Lane.

The area has been entirely built over but behind the garages in Radnor Crescent the tall cliff forming the southern edge of the South Metropolitan Quarry can still be seen through the trees (best viewed in winter). The geology of this cliff is similar to Gilbert's Pit SSSI (GLA 14) except for an unusual unit of blue- grey sand at the top of the Upnor Formation. Woolwich Cemetery is at the top of the cliff but allows no access. A recently installed fence surrounding the base of the c.100m long exposure, perhaps to discourage dumping, allows no access from the bottom either but with binoculars small patches of exposure in mid- and upper- cliff could still be seen in 2014. All three Brick Works were mixing clay and sand from Upnor, Woolwich and Thanet Formations from their open pits with chalk from their own underground mines but also exploited local 'Brickearth'.

In the 1950s the underground mines were filled with fly-ash slurry and sealed off. Rockcliffe Gardens are of interest as an attempt to develop a major area of subsidence into the mine in 1937.

Assessment of Site Value

Geodiversity topic: Lithostratigraphy; sedimentology; palaeontology.

Access and Safety

Aspect	Description
Safety of access	Access no longer possible; scree at the base, still vertical at the top
Safety of exposure	The remaining cliff is fenced off and overgrown; the rest of the complex is built over.
Permission to visit	Private land with no access
Current condition	Overgrown.
Current conflicting activities	Access and vegetation.
Restricting conditions	Vegetation
Nature of exposure	Residual cliff in former quarry complex

Culture, Heritage & Economic

Aspect	Description	Rating
Historic, archaeological & literary associations	There is scope for a geological/industrial archaeology walk through this area and neighbouring former brick pits and chalk mines to the north and chalk pits to the east.	6
Aesthetic landscape	A fairly striking cliff visible to local residents	4
History of Earth Sciences	Whitaker, 1889 describes the pits. Geologist Association excursions to the quarries are described in the Proceedings (PGA): Leach & Polkinghorne,1906; Baker & Priest,1919; Leach, 1929, Pitcher, 1948, Epps, 1956. Leach, 1910 and Pearman, 1973 describe the mines. South Metropolitan Brickyard (Radnor Crescent) is also described in GA Guide No. 68, 2012.	4
Economic geology	Brickmaking in 19th century and up to 1930. Underground chalk mining until 1920. One pit reworked for sand in 1950s.	4

GeoScientific Merit

Geomorphology	Steep valley beneath Harwich Formation plateau which has been quarried leaving a residual cliff	4
Sedimentology	Upnor Formation, Woolwich Formation and Blackheath Beds (Harwich Formation) are all still visible on the cliff-face, albeit sporadically and illustrate the variability in the succession from marine to estuarine and back to marine with alternating sands, clays and shell bed, with the rounded Blackheath Pebbles at the top. The prominent white band, visible from the base is the shell bed within the Woolwich Formation.	4
Palaeontology	Brackish fauna in the Woolwich Formations, probably also in	4

	Blackheath Beds.	
Igneous/mineral/ Metamorphic Geology	None.	0
Structural Geology	None.	0
Lithostratigraphy	Succession of lithology at one site (more accessible at GLA 14, Gilbert's Pit, SSSI). Historically pits were of much interest for nature of unconformities.	4
Potential use	Research; further education; on-site interpretation.	
Fragility	natural overgrowing; weathering/slumping.	
Current Site Value		
Community	Green background.	6
Education	Close to route of Green Chain Walk Geotrail	6
Geodiversity value		
LIGS: Disused quarries included because of their historical significance in the area and the possibility of informing walkers on the Green Chain Walk.		4
GLA 57 Wickham Valley Brickworks Complex		

From Radnor Crescent.. Photo: Diana Clements 2012

GLA 58 Coldfall Wood

Grid Reference Park entrance TQ 277 901	Site Type: small public park
Site Area (hectares): 13.43	Current use: woodland paths with Nature Trail
Site ownership: London Borough of Haringey	Borough: London Borough of Haringey
Field surveyors: Diana Clements Revisited: Diana Clements	Date: 2009 Date: November 2018
Current geological designation: LIGS	Other designation: Borough Grade I SINC (Coldfall Wood)

Site Map

OS Topography © Crown Copyright

Stratigraphy and Rock Types

Time Unit: Quaternary	Rock unit: Lowestoft Formation, Albion Glacigenic Group
Rock Type:	Details: Chalky till, together with outwash sands and gravels, silts and clays. The till is characterised by its chalk and flint content
Time Unit: Quaternary	Rock unit: Dollis Hill Gravel Member, Sudbury Formation, Kesgrave Catchment Subgroup
Rock Type:	Details: Gravel, sandy and clayey in part, with some laminated silty beds. Sand and gravel, locally with lenses of silt, clay or peat and organic material. Predominantly flint but contains clasts of Lower Greensand Chert and vein quartz.
Time Unit: Eocene	Rock Unit: London Clay Formation, Thames Group
Rock Type: Clay, silt, sand	Details: Fine, sandy, silty clay/ clayey silt, clay.

Site Description

Coldfall Wood is a small area of ancient woodland still surviving in an area that is mostly built over. It slopes down to the north cutting a gully. The three rock types of glacial till, underlying pre-Anglian Dollis Hill Gravel and Eocene London Clay within the area are not easy to see but there is potential for geological interpretation, particularly in relation to the deep gullies cut as successive ice ages melted. The area was originally part of the Finchley depression that allowed the Anglian ice sheet to come close to London and it is the site of the discoveries which first led to the recognition that glaciation had once reached the south of England. Evidence of till can be seen more easily in the adjacent St. Pancras & Islington Cemetery.

Haringey publish a nature trail aimed at Primary school children. There is potential for identifying the different lithologies from clues in the landscape – spring lines, vegetation and small exposures, although they are not so obvious as elsewhere. London Clay is best seen in the eroded banks where the main bridge crosses the stream from the south. Clasts washed out of the Dollis Hill Gravel can be observed in the stream beds.

Assessment of Site Value

Geodiversity topic: lithostratigraphy, sedimentology; geomorphology.

Access and Safety		
Aspect	**Description**	
Safety of access	Access is from two entrances in Creighton Avenue and via the adjacent Muswell Hill Playing Fields	
Safety of exposure	There are rough footpaths through the wood but actual exposures are difficult to see under the vegetation.	
Permission to visit	Open access.	
Current condition	The park is maintained by the Friends of Coldfall Wood. There is a tendency for flooding at the base of the wood but a wooden walkway over the boggy area allows access.	
Current conflicting activities	none	
Restricting conditions	Vegetation, limiting exposure	
Nature of exposure	Woodland with a stream running through and a gully at the bottom of the hill.	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	The Friends of Coldfall Wood has a website detailing the history of the wood and highlighting what biodiversity can be found there	6
Aesthetic landscape	Footpaths through the wood used by local community and as a teaching asset for Primary School Children. There is an interpretation board for the biodiversity at the entrance.	8
History of Earth Sciences	Site of the discoveries which first led to the recognition that glaciation had once reached the south of England.	8
Economic geology	None	0
GeoScientific Merit		
Geomorphology	The till-topped ridges were formerly the ‘Finchley depression’ through which the glacier forged its path. The gullies provide evidence of the ice ages, created as the ice melted and subsequently when permafrost melted during succeeding ice ages.	3
Sedimentology	Exposures are poor but Lowestoft Till and London Clay are easily distinguishable on newly-dug graves in the adjacent cemetery. Chalk fragments in clay provide a common and easy indicator of till.	3
Palaeontology	Jurassic fossils have been found in both the Finchley cemeteries, transported by the Anglian glacier	4
Igneous / mineral / metamorphic geology	Igneous rock fragments have been found in both cemeteries carried by the glacier and deposited as erratics	4
Structural Geology		2
Lithostratigraphy	Lowestoft Till, Dollis Hill Gravel, London Clay located mainly by spring lines and vegetation as exposure is poor.	3
Potential use	education; there is a potential to add information to the existing educational materials available for the wood	
Fragility	Well maintained by the Friends but the lithology is not normally exposed	
Current Site Value		
Community	Valuable woodland in an urban setting. The Friends of Coldfall Wood are very active and for several years have organised a geotrail around the Wood which has been well attended.	7
Education	Nature trail and interpretation boards for biodiversity already exist	6

	and a leaflet explaining the geology of Coldfall Wood is available at: www.londongeopartnership.org.uk/informationboardsandleaflets/#coldfall. It is also described in LGP Bus Pass Geology 1, *Round the southern limits of the Anglian Ice Sheet*, which may be seen at: www.londongeopartnership.org.uk/geotrails/#buspass	
Geodiversity value		
LIGS:	This is a good teaching location for explaining the extent of the Anglian glaciations particularly as it is the site of the discoveries which first led to the recognition that glaciation had once reached the south of England. Actual evidence is best seen in the newly-dug graves in the adjacent cemetery. The deep gullies emphasise the importance of successive ice ages in creating the landscape seen today.	4
GLA 58 Coldfall Wood		
		
Photo: Diana Clements		

GLA 59 Pole Hill

Grid Reference: TQ 3835 9485	Site Type: Natural hillock within Epping Forest
Site Area (hectares): 7.02	Current use: Recreational Land
Site ownership: City of London Corporation	Borough: London Borough of Waltham Forest
Field surveyor: Diana Clements, Peter Collins Revisited: Ruth Siddall	Date: June 2011 Date: 2017
Current geological designation:	Other designation: part of Epping Forest SAC

Site Map OS Topography © Crown Copyright

Stratigraphy and Rock Types

Time Unit: Eocene	Rock Unit: Claygate Member, London Clay Formation, Thames Group
Rock Type: Sand silt and clay	Details: Interbedded sand silt and clay
Time Unit: Eocene	Rock Unit: London Clay Formation, Thames Group
Rock Type: Clay, silt, sand	Details: Fine, sandy, silty clay / clayey silt.

Site Description

The site is a natural hillock of London Clay Formation capped by Claygate Member. There was formerly (mid-19th Century until 1930) a large brick pit situated on the south side of the site; the Claygate Member was much favoured by brick makers. It is now a westerly lobe of Epping Forest and is publicly accessible. Although not the highest point of Epping Forest, at 91m it affords fine views over the Lea Valley and the City of London. It lies on the Greenwich Meridian that is marked by an obelisk (erected in1824). Claygate Member exposed at the top due to erosion by walkers and run off.

Assessment of Site Value

Geodiversity topic: Lithostratigraphy; sedimentology; geomorphology

Access and Safety

Aspect	Description
Safety of access	accessed by several footpaths and is close to the London Loop.
Safety of exposure	The site is well cared for by the City of London Corporation
Permission to visit	Open access.

Current condition	The top of the site is open but the views towards Greenwich along the meridian are obscured by trees growing in the area that was probably a brickfield in former times. It would be marvellous to re-open this vista	
Current conflicting activities	None	
Restricting conditions	Most of the hillock is covered by vegetation (grass or trees)	
Nature of exposure	The viewing area is denuded of grass allowing a glimpse of the underlying Claygate Member. This can be slippery when wet. In the woods just to the northwest small dips indicate minor digging of the Claygate Member	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	More research required into old maps for exact position of brick pit. Meridian passes through top of the hill and an obelisk has been erected in 1824. Included in Epping Forest Guides e.g. Hoy, 2010	8
Aesthetic landscape	Footpaths through woods and in open ground used by local community.	9
History of Earth Sciences	PGA visit 1948. Potentially more information on the brickpits locally and the surface processes that have left the Epping Forest Ridge between the valleys of the Lea and Roding	3
Economic geology	Brick pit worked from mid-19th C to 1930 (probably the Claygate Member)	6
GeoScientific Merit		
Geomorphology	Westward lobe of the Epping Forest Ridge with fine views over the Lea Valley	4
Sedimentology	No details seen but silty nature of surface Claygate Member of the London Clay Formation is evident	2
Palaeontology	None recorded	
Igneous/mineral/ Metamorphic Geology	None.	0
Structural Geology		0
Lithostratigraphy	London Clay Formation capped by Claygate Member at the top of the hill	4
Potential use	education; on-site interpretation on the geological structure of the hillock and possibly the rest of Epping Forest to NE. Anglian ice sheet probably stopped just to the north at the lower-lying Yardly Hill where Lowestoft Till can be found. There is already a plaque about the Meridian; there is scope for information about the brick pits. Could be included in a geotrail, climbing up the 'staircase' of gravels through Epping Forest from Wanstead Flats to High Beech.	
Fragility	natural overgrowing	
Current Site Value		
Community	Valuable green space.	8
Education		8
Geodiversity value		
LIGS:	Small exposures of Claygate Member with good access for local community and a story of brickmaking. This site is considered to be a better 'London Clay hillock' than the former GLA 13, Friday Hill which it replaces as a LIGS	4

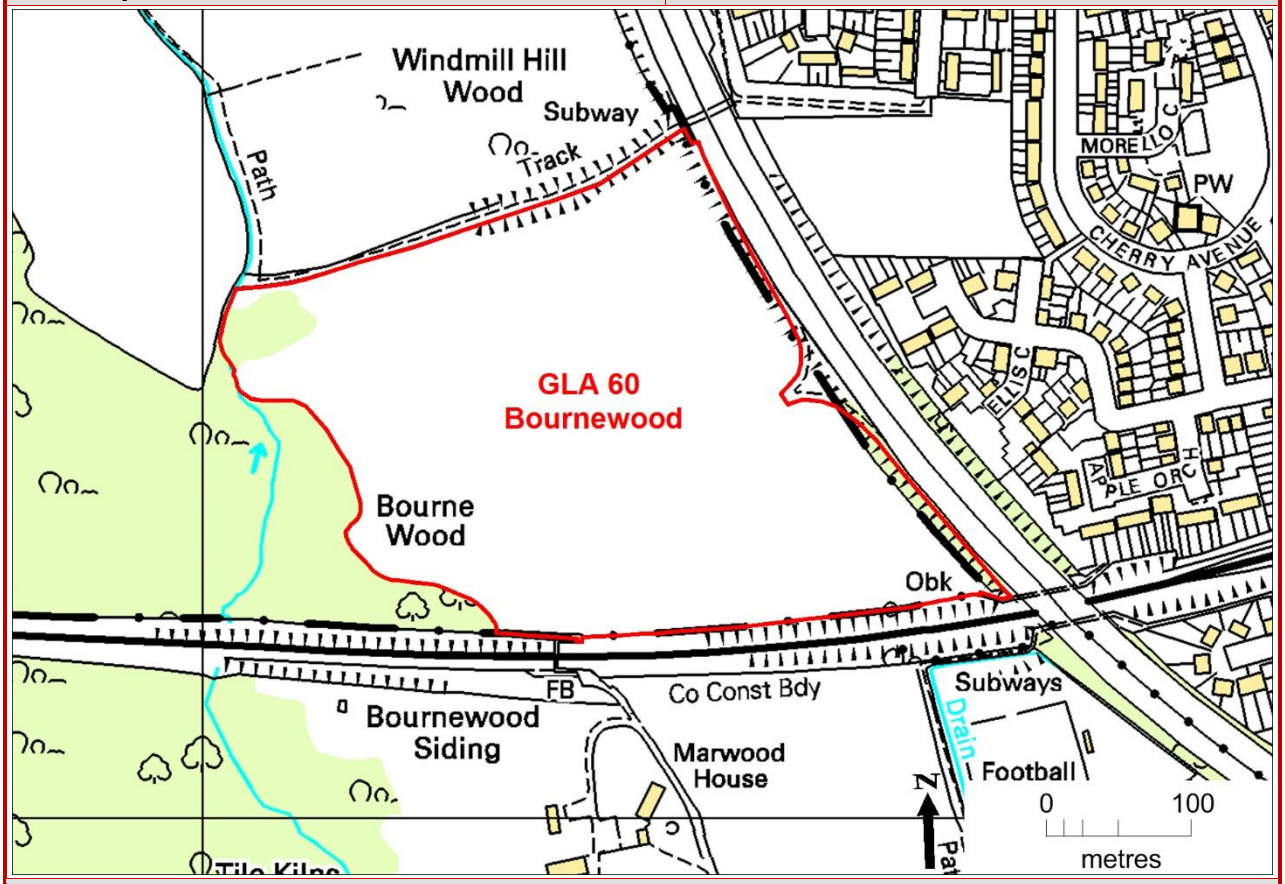
GLA 59 Pole Hill

View from Pole Hill 2011. Photo: Peter Collins

GLA 60 Bourne Wood Quarry

Grid Reference: TQ 503 683 (access)	Site Type: Working Thanet Sand pit
Site Area (hectares): 10.46	Current use: aggregates
Site ownership: Bourne Wood Sand & Gravel	Borough: London Borough of Bromley
Field surveyor: Diana Clements Revisited: Steve Tracey	Date: May 2013 Date: 2019
Current geological designation: Recommended by Partnership as a RIGS	Other designation: Metropolitan SINC (Bourne Wood)

Site Map



Stratigraphy and Rock Types

Time Unit: Paleocene	Rock Unit: Thanet Formation
Rock Type: Sand	Details: well-bedded fine yellow sand

Site Description

The Thanet Sand within the pit is fine-grained and it is not easy to see any stratigraphy within it. One sample showed evidence of burrowing and probably the c.9m face had been thoroughly bioturbated. No glauconite was evident in samples studied with the hand lens and for the most part it was a pale yellow.

BWS&G had formerly extracted Thanet Sand to the south of the present excavation, adjacent to the railway. That pit went deeper than the present one and although Thanet Sand has been proven at depth here they are worried about the water table as one area of the quarry was prone to flooding.

Trials have taken place in an adjacent field to the north where a greater thickness of sand has been proven and the 'grade' is more suitable for construction. It is possible that this includes Upnor Formation. The maximum depth of Thanet Sand in this area is between 20 and 25m (BGS Memoir, Fig. 9). In 2020 planning permission has not yet been sought for extraction from the adjacent site.

The current pit in 2013 was 14 acres and we were told that they began excavations in 1997 with permission for extraction until 2018 after which it will be used as landfill with an obligation to return for use as agricultural land. There seems little likelihood of being able to conserve a face in the current pit but Bromley Council has been alerted to the fact that a Potential RIGS exists in their borough with the aim to

include an element of conservation on future planning permissions. A visit in 2019 confirmed that the extraction was completed but no information on future plans was gathered.

Assessment of Site Value

Geodiversity topic: Lithostratigraphy; sedimentology;

Access and Safety

Aspect	Description
Safety of access	Small slip road off the northbound A20. Hard hats, visi vest and boots essential.
Safety of exposure	Minimal danger of falling sand.
Permission to visit	Bourne Wood Sand & Gravel, Quarry Drive, A20 Swanley Bypass, Swanley, Kent, BR8 7QH.
Current condition	Temporary exposure scheduled for landfill and then returned to agricultural use after 2018 It is not known if an extension will be sought.
Current conflicting activities	Need to be aware of moving machinery; piles of landfill already on floor of pit. Obligation to backfill so RIGS should be sought in next round of planning permission with a requirement to leave a viewable face.
Restricting conditions	Anxiety of water table impeding deeper quarrying
Nature of exposure	In 2013 this was a working quarry with full 9m face visible and accessible. It was entirely Thanet Formation although BGS map implies it is overlain by Harwich Formation. The face was not revisited in 2019, although it was understood to be still visible.

Culture, Heritage & Economic

Aspect	Description	Rating
Historic, archaeological & literary associations	None known about	0
Aesthetic landscape	Small rural area remaining close to urban conurbations	2
History of Earth Sciences	None known	0
Economic geology	Sand quarrying	8
GeoScientific Merit		
Geomorphology	None	0
Sedimentology	There is an ambiguity about the top few metres in this quarry that warrant research, otherwise it is fine-grained Thanet Sand	6
Palaeontology	None seen	0
Igneous/mineral/ Metamorphic Geology	None	0
Structural Geology	At southern edge of the London Basin Syncline	2
Lithostratigraphy	Until it was worked out in (c.2018) this was the only working Thanet Formation quarry in GLA. There is a possibility that planning permission will be sought to extend the area.	6
Potential use	Research; working quarries are difficult for school-age education	
Fragility	Landfill.	
Current Site Value		
Community	Future planning permission should include an element of conservation for future generations	6
Education	Quarry owners would give permission for researchers and probably students	6

Geodiversity value

Recommended by Partnership as a RIGS:	The only Thanet Sand quarry in GLA	6

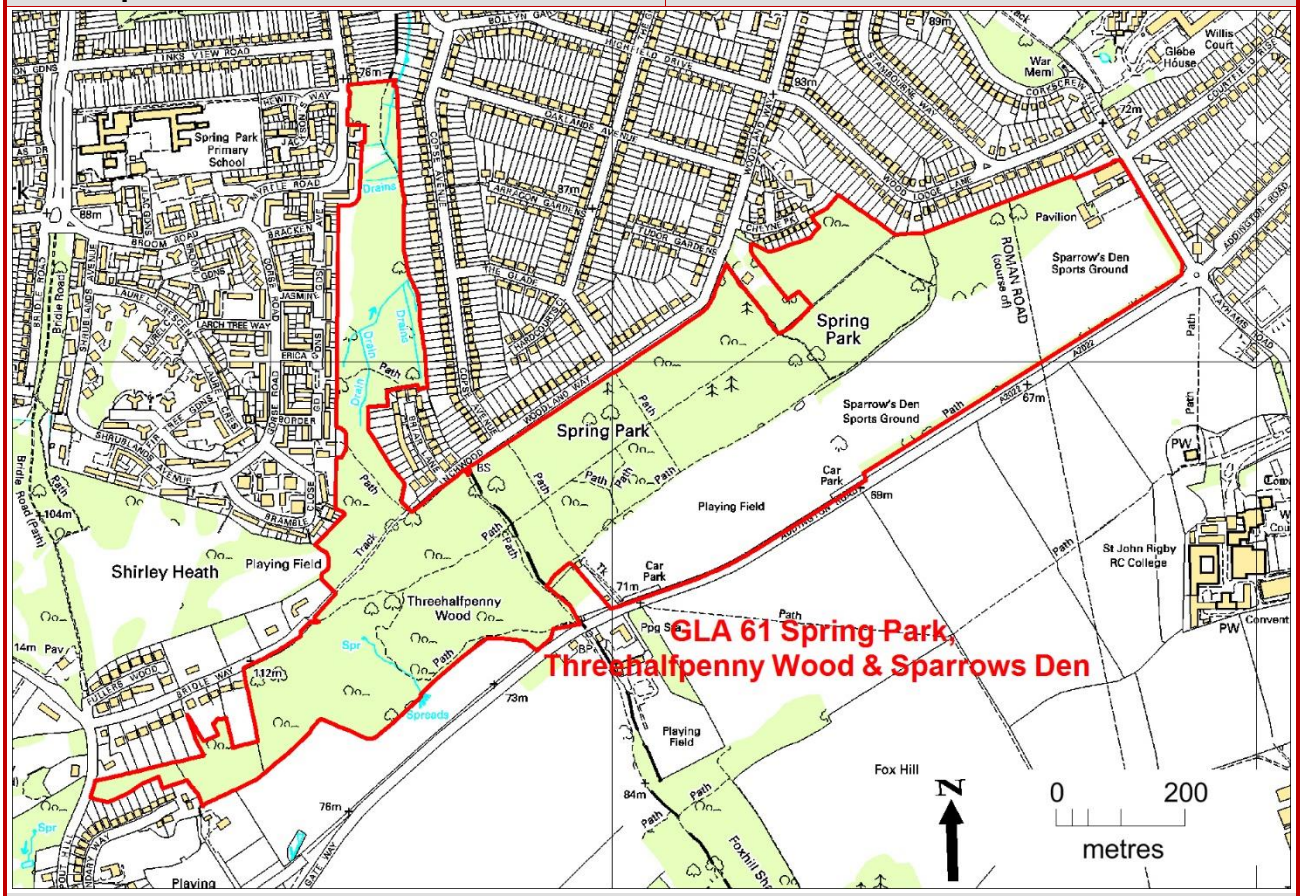
GLA 60 Bourne Wood

Main face of Bourne Wood in May 2013.
Photo: Diana Clements

GLA 61 Spring Park, Threehalfpenny Wood & Sparrows Den

Grid Reference: TQ 381 649	Site Type: Natural exposures on scarp slope, springs & sinks
Site Area (hectares): 52.31	Current use: Recreational
Site ownership: Spring Park: City of London Corporation: Threehalfpenny Wood, London Borough of Croydon; Sparrows Den Playing Fields: London Borough of Bromley.	Boroughs:: Bromley (Spring Park & Sparrows Den), Croydon (Threehalfpenny Wood)
Field surveyor: Paul Rainey Last visited: Paul Rainey, Diana Clements and Laurie Baker	Date: February 2014 Date: May 2018
Current geological designation: Recommended by Partnership as a RIGS	Other designation: All woodland is a Metropolitan SINC (Shirley Heath, Spring Park and Threehalfpenny Wood)

Site Map



Stratigraphy and Rock Types

Time Unit: Eocene	Rock Unit: Blackheath Member, Harwich Formation, Thames Group
Rock Type: Sand and gravel	Details: Sand and pebbles (mostly round, black), with a fragile brackish marine fauna locally. Calcitic conglomerate found at certain horizons.
Time Unit: Paleocene-Eocene	Rock Unit: Upnor, Woolwich and Reading Formations, Lambeth Group
Rock Type: Clay, silt, sand	Details: Glauconitic sands overlain by a unit of blue-grey sand followed by interbedded grey clays and sands with a well-preserved brackish mollusc fauna. Marine Upnor sand at base.
Time Unit: Paleocene	Rock Unit: Thanet Formation
Rock Type: Clay, silt, sand	Details: Pale yellow-brown fine-grained sand
Time Unit : Late Cretaceous	Rock Unit: White Chalk Subgroup (not seen, but inferred from sinks)
Rock Type: Chalk	Details: Chalk with flints (not seen)

Site Description

Spring Park Wood and Threehalfpenny Wood are adjacent sections of a south east facing scarp slope formed by Paleocene strata overlying the Chalk. Paths in the highest part of Spring Park Wood, towards its NE border, are dominated by Harwich Formation pebbles. The steepest part of the slope is formed of the clayey strata of the Lambeth Group. Thanks to many mole hills the lowest less steep parts of the slope reveal the fine sand of the Thanet Formation.

Groundwater emerges as springs from the base of the Harwich Formation, flows as shallow streams over the Lambeth Group and then sinks into the Thanet Sand. In Spring Park many streams have been artificially joined to fill a pond just below the lower edge of the wood. In Threehalfpenny wood a more natural sink is still visible. Sparrows Den and the lowest part of Spring Park are mainly on the flat valley bottom with gravelly alluvium. In exceptionally wet years (e.g. 2001, 2014) much of Sparrows Den is covered by a spectacular lake formed from springs in the Chalk on the south (Addington Road) side of the site. This is a bourne of the Ravensbourne and was much visited and studied in 1904 and 1916 by the Geologists' Association and others. Addington Road Pumping Station – a Thames Water Chalk borehole with galleries – is immediately to the south of the site.

Assessment of Site Value

Geodiversity topic: geomorphology and groundwater processes

Access and Safety		
Aspect	**Description**	
Road access	Entrance to Spring Park from Addington Road is adjacent to the TfL bus stop "Addington Road Pumping Station" served by buses 314 and 353. Free parking is available.	
Safety of access	Paths through wood	
Safety of exposure	Ancient woodland, steep slopes, seasonally muddy	
Permission to visit	Open access, managed by City of London Corporation, Croydon & Bromley	
Current condition	Gravel, sandy and muddy footpaths	
Current conflicting activities	none	
Restricting conditions	none	
Nature of exposure	Small exposures in woodland, visible spring lines & sink holes	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations		3
Aesthetic landscape	Attractive woods (rare lime), meadow. Views	5
History of Earth Sciences	Described by Lucas and other pioneers of British Hydrogeology	6
Economic geology	Value/cost of springs, bournes, floods.	4
GeoScientific Merit		
Geomorphology	Springs arising from beneath Harwich pebbles, flowing over Lambeth Group and then sinking into Thanet Sands: the Bourne of the Ravensbourne	5-6
Sedimentology	Daily use by people and moles helps to keep footpaths clear and to reveal geology	2
Palaeontology	None seen	0
Igneous/mineral/ Metamorphic Geology	None	0
Structural Geology		0
Lithostratigraphy	Harwich Formation, Blackheath Member, Lambeth Group, Thanet Formation.	5-6
Potential use	Points of Interest on London Loop; add geological interest to City of London map	
Fragility	Natural overgrowing, reducing temporary exposures	
Current Site Value		
Community	Local interpretation; London Loop	10

Education	Potential for geomorphology & hydrology study	6
Geodiversity value		
Recommended by Partnership as a RIGS: exposures, also springs.	Three lithologies, which can be seen in temporary	6

GLA 61 Spring Park, Threehalfpenny Wood & Sparrows Den

Crest of steep slope

View downhill showing Harwich pebbles in foreground and springs on Lambeth Group in distance

Sparrows Den lake on 15 February 2014. Spring Park Wood forms horizon

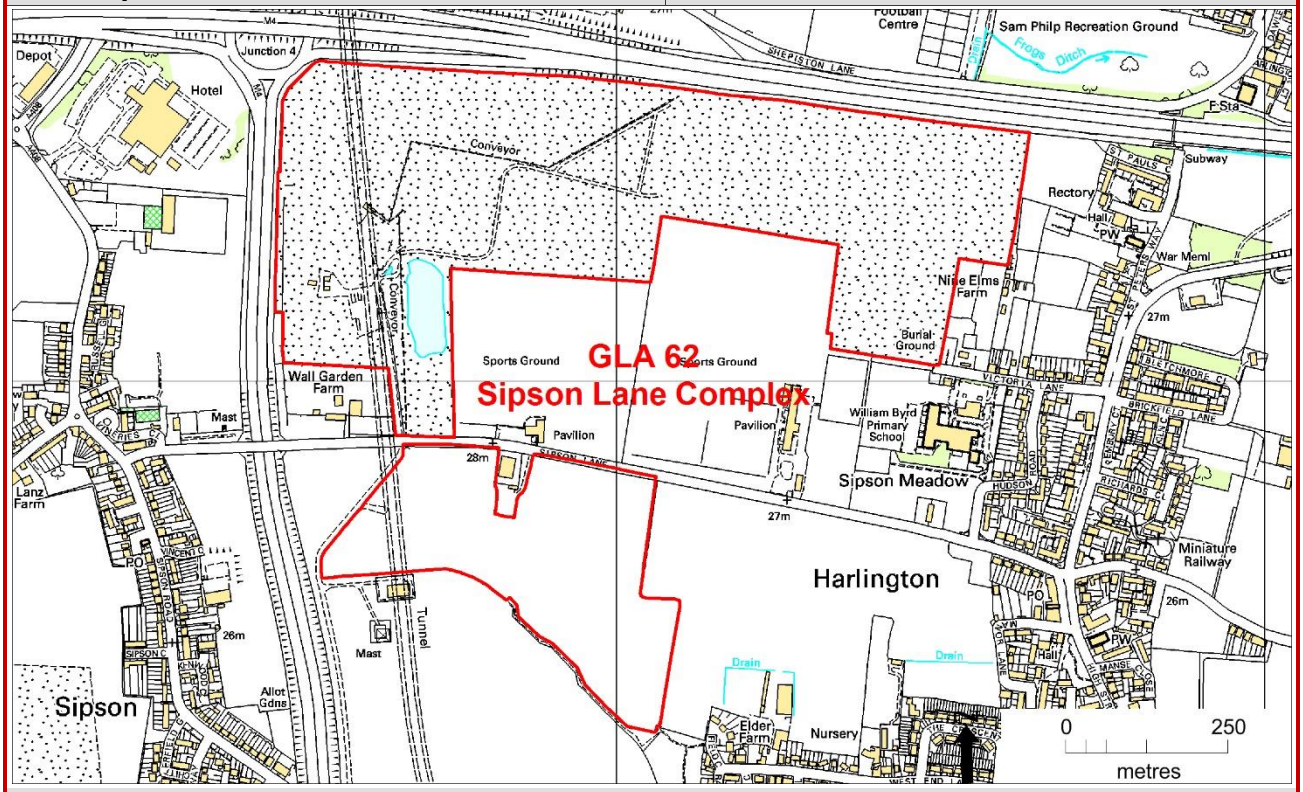
Photos: Paul Rainey

GLA 62 Sipson Lane Quarry Complex

Grid Reference: TQ 076 779	Site Type: aggregate quarry site
Site Area (hectares): 49.48	Current use: active and disused gravel quarries
Site ownership: AABC Group	Borough: London Borough of Hillingdon
Field surveyor: Diana Clements/Peter Collins Revisited: Allan Wheeler	Date: June 2012 Date: 2019
Current geological designation: Recommended by Partnership as a RIGS	Other designation: Borough Grade I SINC (Wall Garden Farm Sand Heaps)

Site Map

OS Topography © Crown Copyright



Stratigraphy and Rock Types

Time Unit: Pleistocene	Rock Unit: Langley Silt Member, Maidenhad Formation
Rock Type: Brickearth (silt)	Details: Fine-grained silt suitable for making bricks
Time Unit: Pleistocene	Rock Unit: Taplow Gravel Member, Maidenhead Formation
Rock Type: Sand and gravel	Details: Sand and pebbles (mostly flint)

Site Description

In 2012 this was newest development on Sipson Lane on the site of the potential third runway for Heathrow. When visited, the excavation was observed continuously by a MOLAS archaeologist while the Langley Silt was being stripped to reveal the Taplow Gravel beneath. This was a five year-project and had been found to be a multi-period site. Descriptions of the finds of the first three years can be found in *London Archaeologist* round-up of fieldwork for 2010, 2011, 2012. The site was re-visited in 2017, mainly to discuss any additional finds with the archaeologists who were actively working on the site. In 2019 it was ascertained that two sites were operated by London Concrete; they are both within the M25 but the second is in Denham, outside the GLA.

The Langley Silt is c.1m and the Taplow Gravel dug to reveal 2m. On the north side of Sipson Road quarrying had revealed a depth of c. 9m in the Taplow Gravel without reaching the London Clay. The gravel is used as aggregate and is the only remaining GLA working quarry in the Colne Valley. In 2021 the site was operated by AABC Group.

Assessment of Site Value

Geodiversity topic: Lithostratigraphy; sedimentology.

Access and Safety		
Aspect	**Description**	
Safety of access	The working quarry can only be visited when accompanied by a representative of the quarry owner. It is locked when not operating. The owner is reluctant to allow visitors.	
Safety of exposure	Danger from machinery	
Permission to visit	AABC Group operate the site: 020 8897 0222.	
Current condition	The site began excavation in early 2012 and is being actively quarried but coming close to the end of being actively quarried.	
Current conflicting activities	Currently an operating quarry; likely to be restored once extraction ceases.	
Restricting conditions	Difficulty of access	
Nature of exposure	Quarry of Taplow Gravel overlain by Langley Silt (Brickearth)	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	The current quarrying activity is the latest of a number of quarries in the area, some of which have important archaeological finds (e.g. under Terminal 5 and Holloway Lane); this has proved to be a multi-period site and excavations are on-going.	7
Aesthetic landscape	Private land (formerly agricultural), flat within view of Heathrow Airport	4
History of Earth Sciences	Part of Thames Terraces which tell a story	5
Economic geology	Gravel extraction has been an important industry in the Colne Valley; as far as could be ascertained, this is the only remaining working quarry in west London within the GLA area.	8
GeoScientific Merit		
Geomorphology	Flat terrace feature close to the Thames	2
Sedimentology	Potential detailed description of the gravels possible	6
Palaeontology	Langley Silt being investigated by MOLA	7
Igneous/mineral/ Metamorphic Geology	None	0
Structural Geology	None	0
Lithostratigraphy	Taplow Gravel	6
Potential use	Research; (off-site education on Thames Terraces)	
Fragility	Landfill	
Current Site Value		
Community	(gazetteer information only)	2
Education	Access not possible so only off-site discussions	2
Geodiversity value		
Recommended by Partnership as a RIGS: It is unlikely that an accessible face can be maintained on this site but should be considered in the next round of planning applications. This is the only working quarry within the GLA in the Colne Valley.		6

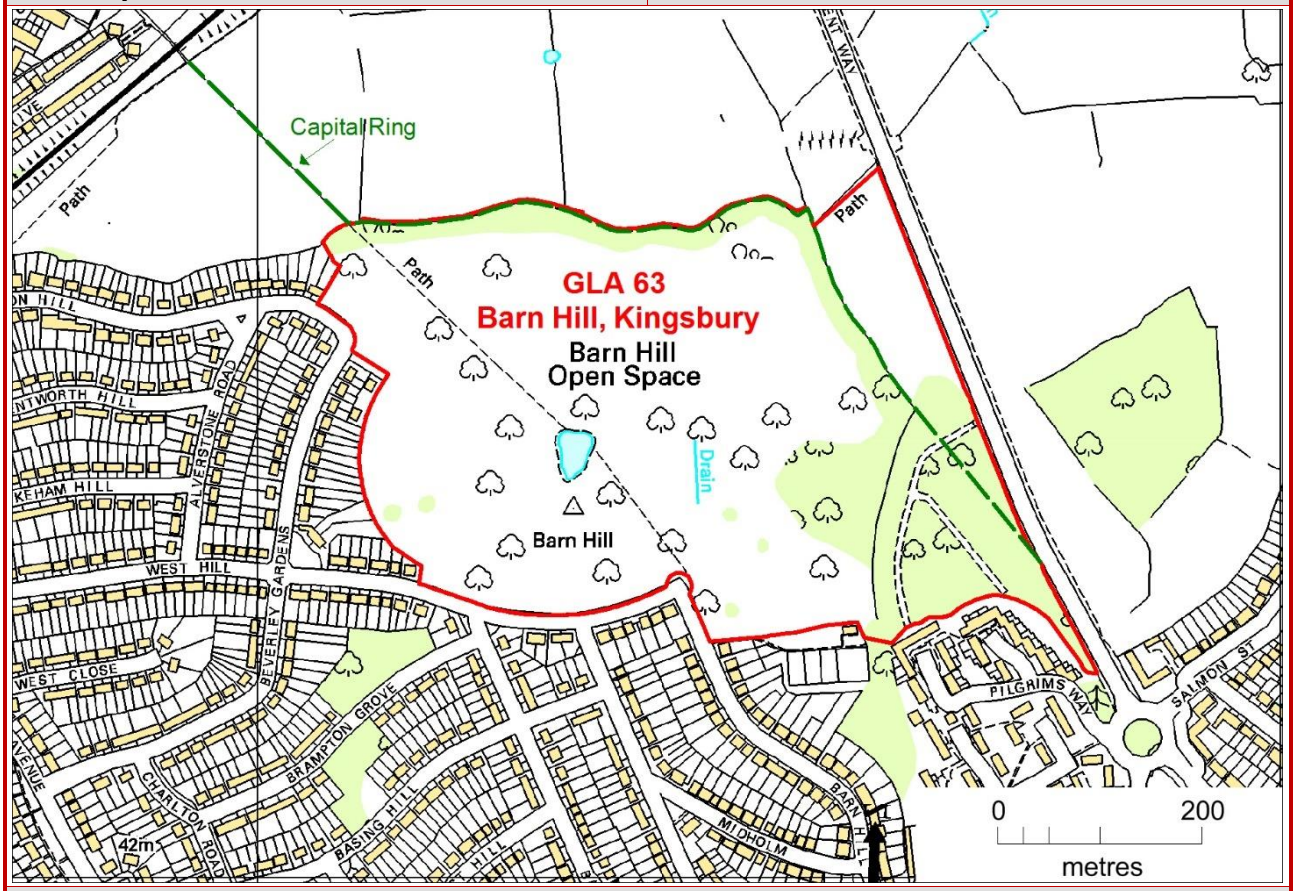
GLA 62 Sipson Lane Quarry Complex

Southern quarry: Taplow Gravel Member. Langley Silt Member exposed above the bench
Photo: Peter Collins, June 2012

GLA 63 Barn Hill, Wembley

Grid Reference TQ 193 874	Site Type: hill within large public park
Site Area (hectares): 23.58	Current use: Recreational Land
Site ownership: London Borough of Brent	Borough: London Borough of Brent
Field surveyors: Diana Clements/Peter Collins Last visited: Allan Wheeler	Date: June 2012 Date: 2019
Current geological designation: Recommended by Partnership as a LIGS	Other designation: Metropolitan SINC (Fryent Country Park)

Site Map



Stratigraphy and Rock Types

Time Unit: Quaternary	Rock unit: Dollis Hill Gravel Member Sudbury Formation, Kesgrave Catchment Subgroup
Rock Type:	Details: Gravel, sandy and clayey in part, with some laminated silty beds. Sand and gravel, locally with lenses of silt, clay or peat and organic material
Time Unit: Eocene	Rock Unit: London Clay Formation, Thames Group
Rock Type: Clay, silt, sand	Details: Fine, silty clay/ clayey silt, clay.

Site Description

London Clay is capped by Dollis Hill Gravel at the top of the hill (top c.6m). There is apparently no Claygate Member present; the summit of Barn Hill is 86m which is just beneath the Claygate Member further east. However, Horsenden Hill (GLA 20) 2½km to the southwest does have Claygate Member as well as Dollis Hill Gravel, with a slightly lower summit at 85m. Dollis Hill Gravel is exposed on the path at the top of Barn Hill just before the pond is reached on the east side.

As well as including this site for its Dollis Hill Gravel, it is thought to be the subject of a painting entitled *Harrow Hill Sand Pit* by Francis Jukes (1798), The painting depicts a quarry with a view behind to St. Mary's, Harrow on the Hill. Barn Hill seems to be the only candidate with the appropriate angle for the view. It would have been Dollis Hill Gravel rather than sand that was being dug. The area is now a pond at the crest of the hill and trees now obscure the view although it can be seen from the open space to the north of the hill. Boards by the pond and the view with the painting and an explanation of the geology could

provide a local interest. The Stanmore Gravel ridge beyond Harrow can also be seen. The painting belongs to the British Library.

Assessment of Site Value

Geodiversity topic: lithostratigraphy, sedimentology; geomorphology.

Access and Safety		
Aspect	**Description**	
Safety of access	Open access. Nearest public car park is to west of A4140 through Fryent Country Park, close to the Capital Ring. No amenities. Boards show the footpath up to the summit of Barn Hill; through woods, which may be slippery and is reasonably steep.	
Safety of exposure	Dollis Hill Gravel can best be seen beside the path near the summit of the hill and around the perimeter of the pond where exposed.	
Permission to visit	Free open public access. Permission would be required to dig or erect boards.	
Current condition	Old quarry is now a pond, the view is now obscured by woods. The Friends have expressed an interest in opening up a vista to St Mary's from the pond.	
Current conflicting activities	none	
Restricting conditions	Diversion from Capital Ring involves a steep climb to the top of the hill	
Nature of exposure	Mostly overgrown	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	Old quarry identified by painting 1798 in British Library (link on next page)	8-9
Aesthetic landscape	Public open space with delightful pond and excellent view from north side	8-9
History of Earth Sciences		0
Economic geology	gravel extraction from pond area	5
GeoScientific Merit		
Geomorphology	Hill landscaped by Repton in 1792	4
Sedimentology	London clay and Dollis Hill Gravel but exposures only on path edges on steep slopes near the top of the hill. Former Quarry painted by Jukes, 1798	3
Palaeontology	None recorded	
Igneous/mineral/ Metamorphic Geology	none	
Structural Geology	Surprising that there are no Claygate Member here when there is at Horsenden Hill nearby at similar elevation	
Lithostratigraphy	Dollis Hill clasts predominantly flint, noted for the high proportion of rounded flints; 7% Lower Greensand Chert.	4
Potential use	education; use can be made of the existing Geotrail	
Fragility	Natural overgrowing	
Current Site Value		
Community	Valuable woodland and green space.	6
Education	Potential for two boards, one by pond, the other near the bench on the north side of the hill to include the painting of former quarry and view to St. Mary's Harrow on the Hill. The east and north sides of the hill are on the Capital Ring so the view would require a small (but worthwhile) diversion.	6

Geodiversity value

Recommended by Partnership as a LIGS: For local interest, particularly historical. Would require a small diversion from Capital Ring. Adjacent Horsenden Hill is already a RIGS for the same lithology but that includes Claygate Member.	4

GLA 63 Barn Hill

An aquatint of Harrow Hill sand pit in 1798 by Frances Jukes can be found on https://tinyurl.com/9mfutztx

View from near the top of Barn Hill, looking west to Harrow on the Hill, June 2012
Photo: Diana Clements

The pond (TQ 193 874) on top of Barn Hill.
Photo: Laurie Baker, August 2014

GLA 64 Waterlow Park, Highgate

Grid Reference: TQ 2857 8722	Site Type: Public laid-out gardens on Highgate Hill
Site Area (hectares): 10.1	Current use: Recreational
Site ownership: London Borough of Camden	Borough: London Borough of Camden
Field surveyors: Ann Davidson, Peter Collins, Diana Clements Revisited: Diana Clements	Date: March 2014 Date: January 2021
Current geological designation: Recommended by Partnership as a LIGS	Other designation: Borough Grade I SINC (Waterlow Park)

Site Map

Stratigraphy and Rock Types

Time Unit: Eocene	Rock Unit: Bagshot Formation at the base of the Bracklesham Group
Rock Type: sand	Details: thick-bedded, fine-grained sands, with a basal fine gravelly sand developed in places.
Time Unit: Eocene	Rock Unit: London Clay Formation and Claygate Member, Thames Group
Rock Type: Clay, silt, sand	Details: Fine, sandy, silty clay/ clayey silt, clay.

Site Description

The length of the park covers three lithologies: London Clay at the base, with the more sandy Claygate Member above and topped by the Bagshot Sand at the Highgate end. The park slopes downwards, approximately from NW to SE, and is artificially terraced. This site includes land which was formerly landscaped as gardens for several large houses, including historic Lauderdale House, which still stands within the park and is presently used as arts centre and café. There are three ponds, fed from natural springs, of which there are several. During a recent visit, one spring was visible at TQ 2864 8721.The ponds have been landscaped and excavated, since being incorporated within the gardens in the sixteenth century.

The top of the middle pond, at TQ 2871 8706, has an elevation of approximately 90m. This equates approximately to the base of the Claygate Member. No obvious exposure was noted, even around the ponds. As far as could be ascertained, the drinking fountain, at TQ 2866 8726, is sited on the boundary between Bagshot Sand and Claygate Member at c. 110m.

There are spectacular views of London especially from the level of uppermost of the three ponds. The

plaque near the statue of Sir Sydney Waterlow, TQ 2872 8722, states that this viewpoint is at the same elevation (100m) as the top of the dome of St. Paul's.		
Assessment of Site Value		
Geodiversity topic: lithostratigraphy, geomorphology.		
Access and Safety		
Aspect	**Description**	
Road access and parking	From Dartmouth Park Hill, Highgate Hill and Swains Lane. Restricted parking. Buses 271, 210 and 143 stop outside Lauderdale House	
Safety of access	Good. Park is open all year during daytime	
Safety of exposure	N/A	
Permission to visit	Open access	
Current condition	Well-maintained public park	
Current conflicting activities	None	
Restricting conditions	Lack of exposure	
Nature of exposure	Implicit	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations		3
Aesthetic landscape	Beautifully laid out park with stunning views of London	9
History of Earth Sciences	Borehole section at adjacent St. Aloysius College (Tracey et al, 2002)	(7)
Economic geology	(Brick making close by on the Archway Road from the clay excavated from the Archway 'tunnel'.)	(7)
GeoScientific Merit		
Geomorphology	Although landscaped, inferences can be made with reference to springs, ponds and topography.	4
Sedimentology	No exposures of sand, clay or gravel but spring-lines infer. When seen on the adjacent Hampstead Heath the Bagshot Sand is predominantly fine sand showing stratification and locally iron rich. Below, the Claygate Member of the London Clay is usually laminated, clays/silts/sands, coarsening upwards. The London Clay is clay becomes progressively siltier close to the Claygate Member.	2
Palaeontology	The adjacent Archway Road was the site for many of the fossils from the London Clay now in the Natural History Museum 'Highgate Collection'. They come from Division E2 of King (1981), immediately beneath the Claygate Member (Division E3)	(6)
Igneous/mineral/ Metamorphic Geology		
Structural Geology		
Lithostratigraphy	Three strata: Bagshot Sand, London Clay and Claygate Member.	4
Potential use		
Fragility		
Current Site Value		
Community	Park is close to Highgate Village, and is well-used. Arts Centre and restaurant/café in Lauderdale House. Hornsey Historical Society has produced local trails: geology could possibly be added.	10
Education	There is an education centre within the park (currently under discussion) and educational activities on the geology could include information on the Archway Road brickmaking and 'Highgate Fauna' fossils as well as the different lithologies within the park and occurrence of spring lines	(7)

Geodiversity value

Recommended by Partnership as a LIGS: Because of the three separate lithologies within the park denoted by spring lines

GLA 64 Waterlow Park

Probable spring lines

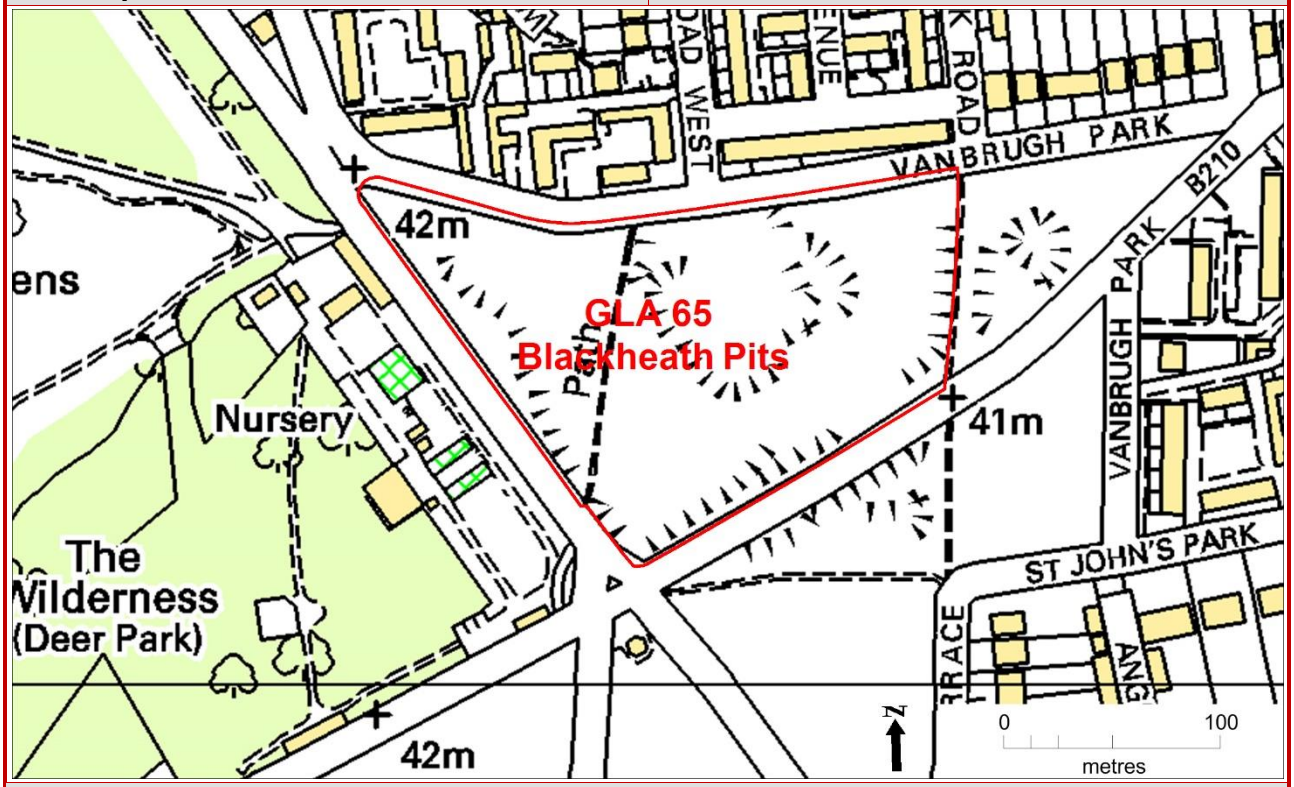
View across London

Photos: Diana Clements 2014

GLA 65 Old Gravel Pit, Blackheath (Vanbrugh Pits)

Grid Reference: Exposure best seen at TQ 3980 7715	Site Type: Series of small disused gravel pits on Blackheath plateau
Site Area (hectares): 3.02	Current use: Recreational as part of Blackheath open space
Site ownership: Royal Borough of Greenwich	Borough: Royal Borough of Greenwich
Field surveyor: Laurie Baker, Diana Clements Visited: Laurie Baker, Diana Clements, Paul Rainey Revisited: Laurie Baker	Date: June 2012 Date: January 2016 Date: November 2020
Current geological designation: Recommended by Partnership as a LIGS	Other designation: Metropolitan SINC (Blackheath and Greenwich Park)

Site Map OS Topography © Crown Copyright



Stratigraphy and Rock Types

Time Unit: Eocene	Rock Unit: Blackheath Member, Harwich Formation, Thames Group
Rock Type: Sand and gravel	Details: Sand and pebbles (mostly round, black), with a fragile brackish marine fauna locally. Calcitic conglomerate found at certain horizons.

Site Description

These small pits were made by quarrying the rounded pebbles of the Blackheath Member that form the Blackheath plateau (Harwich Formation). Many have since been back-filled with wartime rubble These are better exposures than GLA 24 on the south side of Blackheath (in Lewisham) which is very overgrown. The pebbles can be well seen in the worn paths, enhanced by BMX bikes. In 2021, both sites had acquired interpretation boards; the one at GLA 24 included information on the geology. GLA 24 is shown as Eliot Pits and the Greenwich pits are shown as Vanbrugh Pits. There is scope to link these pits to the nature trail.

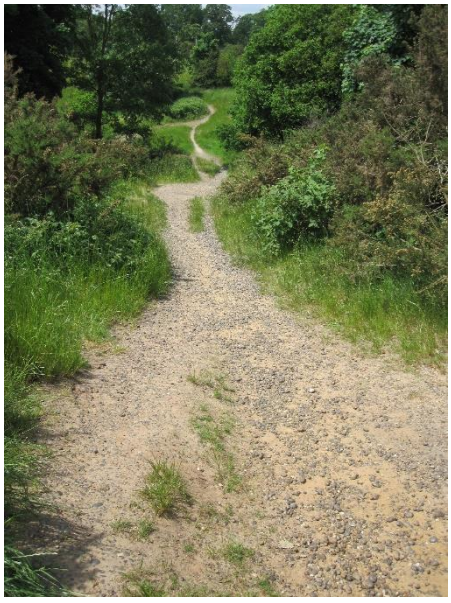
Assessment of Site Value

Geodiversity topic: Lithostratigraphy; sedimentology; palaeontology.

Access and Safety

Aspect	Description
Safety of access	The paths through Vanbrugh Pit is rough and sometimes steep-sided. The rounded nature of the pebbles can make the paths slippery.

Safety of exposure	Walkers and BMX bikers help the small exposures not to become vegetated	
Permission to visit	Open access at all times. Vanbrugh Park, Charlton Way and Prince Charles Road provide parking possibilities (2 hours free in Vanbrugh Park at least).	
Current condition	Mostly vegetated, only small windows of gravel where eroded	
Current conflicting activities	Walkers and bikers aid exposures.	
Restricting conditions	Many of the former pits have been filled with wartime rubble	
Nature of exposure	Small disused pits where Blackheath Gravel has been dug	
Culture, Heritage & Economic		
Aspect		**Rating**
Historic, archaeological & literary associations	Shown on 1896 OS Historic map as Old Gravel Pit. Both are shown on 1863-7 map that is included within the Greenwich Park Geotrail: www.londongeopartnership.org.uk/geotrails/#greenwich	?
Aesthetic landscape	Open space remaining close to urban conurbations	8
History of Earth Sciences	'Type' area for the Blackheath Member of the Harwich Formation	7
Economic geology	Formerly locally important source of gravel	7
GeoScientific Merit		
Geomorphology	Part of the plateau that runs along to Lesnes Woods with the higher ground at Shooters Hill	4
Sedimentology	The small round black pebbles gave the plateau its name	4
Palaeontology	None described from here	0
Igneous/mineral/ Metamorphic Geology	None.	0
Structural Geology	None.	0
Lithostratigraphy	The Blackheath Beds are best viewed at Gilbert's Pit SSSI GLA 14 although this is the Type locality	4
Potential use	Research; further education; on-site interpretation.	
Fragility	Natural overgrowing; weathering/slumping.	
Current Site Value		
Community	Combined with Eliot's Pit (GLA 24) it is one of 12 sites on the Green Chain audio on London Geodiversity Partnership website	6
Education		6
Geodiversity value		
Recommended by Partnership as a LIGS: Combined with GLA 24 (Eliot's Pit) they provide local interest of the Blackheath Beds from which the Blackheath area is named.		4
GLA 65 Old Gravel Pit (Vanbrugh Pits)		



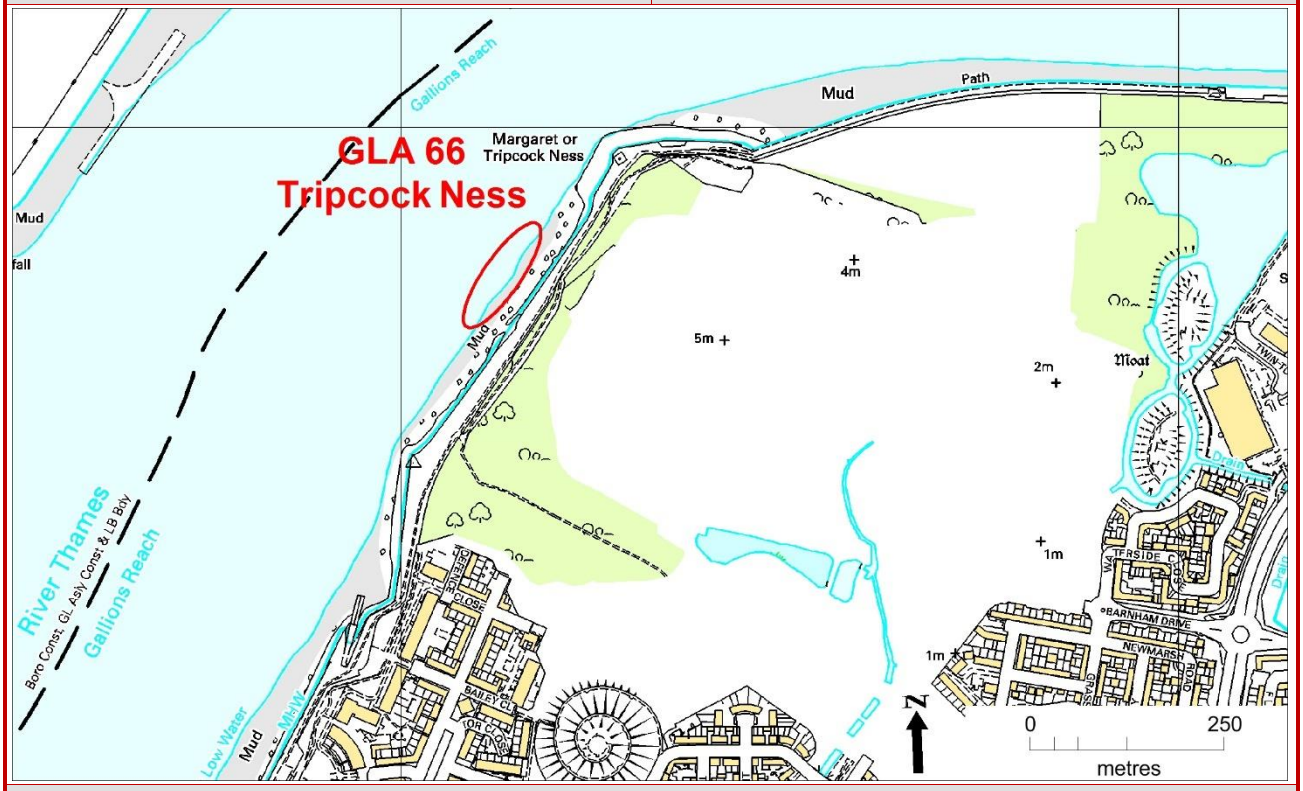
Photos: Diana Clements 2012

General view of pit in November 2020.
Photo: Laurie Baker

GLA 66 Tripcock Ness Submerged Forest

Grid Reference: TQ 4527 8096	Site Type: Natural foreshore exposure of submerged forest
Site Area (hectares): 0.61	Current use: foreshore
Site ownership: Port of London Authority	Borough: Royal Borough of Greenwich
Field surveyor: Laurie Baker, Diana Clements, Paul Rainey	Date: May 2013
Current geological designation: Recommended by Partnership as a LIGS	Other designation: Metropolitan SINC (River Thames and tidal tributaries)

Site Map



Stratigraphy and Rock Types

Time Unit: Holocene	Rock Unit: Alluvium & peat
Rock Type: Alluvium	Details: peat horizons at varying horizons

Site Description

The submerged forest is visible at low tide at several places along the Thames Estuary. The best exposure is at Erith (GLA 39) but the exposure at Tripcock Ness is the best within the Royal Borough of Greenwich and is rather more accessible with steps down to the foreshore from the Thames Path. At Erith whole tree trunks are revealed amongst the root balls and occasional nuts and seeds can also be found. It has been extensively researched and trees have been dated ranging from approximately 3,000 years to over 5,000 years ago. Tripcock Ness is likely to be of a similar age. The exposure is more modest with tangles of root balls and only the occasional trunk. Low tides are required to view the submerged forest which can be seen from the tow path when not masked by vegetation.

Assessment of Site Value

Geodiversity topic: Holocene processes in the Thames

Access and Safety

Aspect	Description
Safety of access	The exact location can only be reached on foot along the Thames Path. Nearest parking in Princess Ave. to SW with steps leading to the foreshore, 130m east of the GR 144 post. The path from GR 144 can be obscured by overgrown vegetation. Access should only be attempted on a falling tide and

	never alone as there are slippery boulders to negotiate. The path to the steps from the Thames Path need to be maintained for ease of access.	
Safety of exposure	Storms could potentially damage the exposure as could any development along this stretch of the Thames	
Permission to visit	Permission is not required to visit.	
Current condition	The foreshore is muddy, slippery and dangerous and should not be attempted alone.	
Current conflicting activities	None known	
Restricting conditions	Tide, weather, mud	
Nature of exposure	Natural foreshore exposure of Neolithic submerged forest	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	Details of Erith can be found in Sidell & Haughey (Neolithic Archaeology in the Intertidal Zone) 2007.	7
Aesthetic landscape	Not a particularly attractive stretch of the Thames Path but useful for locals	6
History of Earth Sciences		3
Economic geology	None	0
GeoScientific Merit		
Geomorphology	Record of changing sea levels in the Thames Estuary	4
Sedimentology	Peat horizon with tree roots and trunks	4
Palaeontology	Potential for research, possible nuts as well as roots & trunks	4
Igneous/mineral/ Metamorphic Geology	None	0
Structural Geology	None.	0
Lithostratigraphy	Holocene Submerged Forest probably dating between 5,000 and 3,000 BP	4
Potential use	Research; further education; on-site interpretation.	
Fragility	Storms; human engineering of Thames estuary	
Current Site Value		
Community	Valuable, as can be seen from tow path	6
Education	Evidence for teaching about past environments of the Thames Estuary and about global warming and sea-level rise	6
Geodiversity value		
Recommended by Partnership as a LIGS: The best exposure of the Neolithic submerged forest in Greenwich with reasonable access for local community.		4

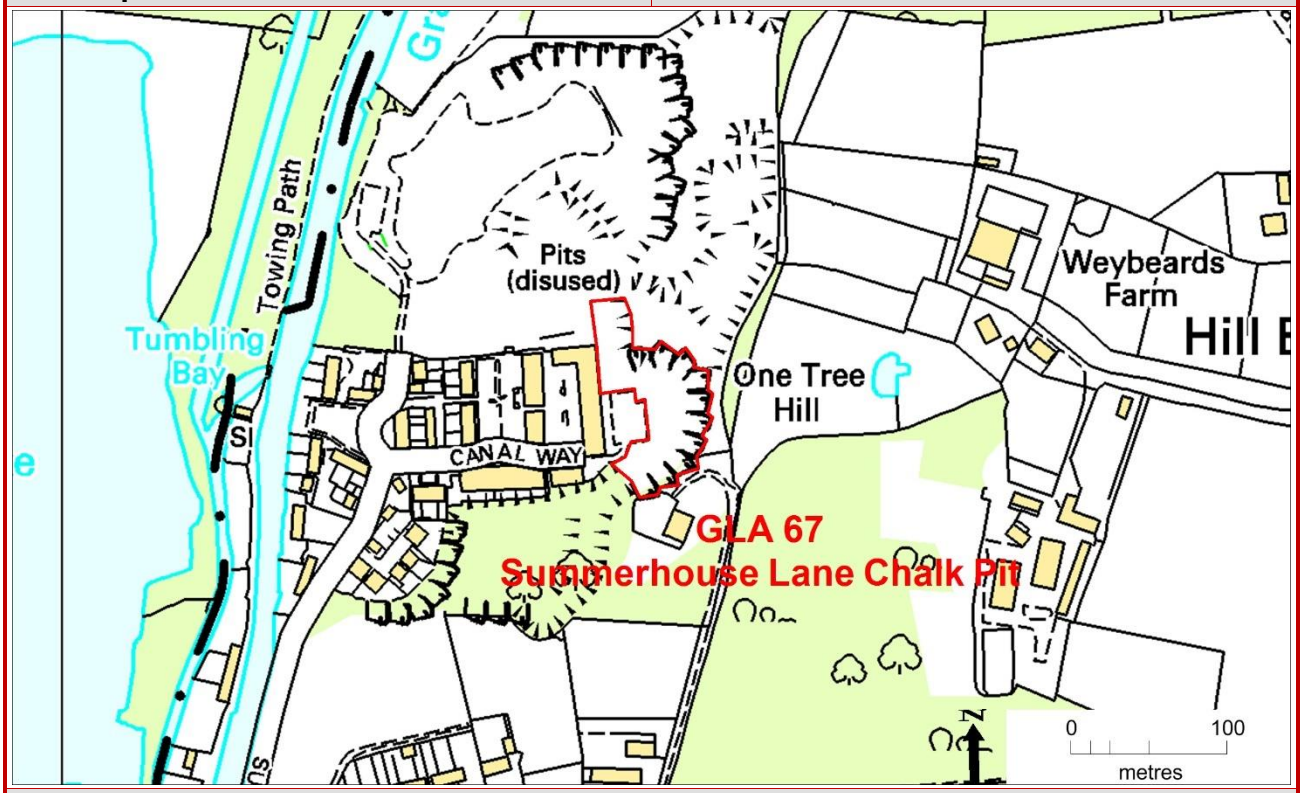
GLA 66 Tripcock Ness submerged forest

Photo: Diana Clements, May 2013

GLA 67 Summerhouse Lane Chalk Pit

Grid Reference: TQ 043 916	Site Type: Former Chalk Pit
Site Area (hectares): 0.52	Current use: Housing Estate and Business Park
Site ownership: Coppermill Lock Management Company Limited of Thamesbourne Lodge, Station Road, Bourne End SL8 5QH; bought the from Linden Homes Chiltern Ltd in June 2018	Borough: London Borough of Hillingdon
Field surveyor: Diana Clements, Ann Davidson and Members of HHGS Revisited: Allan Wheeler	Date: October 2013 Date: July 2020
Current geological designation: Recommended by Partnership as a LIGS	Other designation: Borough Grade I SINC (Summerhouse Lane Chalk Pit)

Site Map



Stratigraphy and Rock Types

Time Unit: Late Cretaceous	Rock Unit: White Chalk Subgroup, Seaford Chalk Formation
Rock Type: Chalk	Details (Seaford Chalk): Firm white chalk with conspicuous semi-continuous nodular and tabular flint seams. Hardgrounds and thin marls are known from the lowest beds. Some flint nodules are large to very large.

Site Description

Of the chalk pits along the Colne, apart from Harefield that only exposes 2m (GLA 34,SSSI), the only one that is still at all accessible (now utilised as a housing estate) is at the end of Summerhouse Lane (see below). There were at least three other pits running north along this stretch of the Colne. Very small exposures can still be seen high up in the wooded slopes of the adjacent 'Water Meadows' at the extreme end of Summerhouse Lane. These are not accessible and nor are the two quarries further along adjacent to the Springwell Lane bridge over the Grand Union Canal beside the lock. At Summerhouse Lane the Seaford Chalk has well-displayed solution hollows that run from the top to reappear at the base. A path exists close to the face allowing views and access but becomes progressively more overgrown and blocked by rubbish. The quarry is described with a logged section in GA Guide 68, 2012, pp 25-28

The Colne Valley Chalk pits provide details of the Chiltern succession.

Assessment of Site Value

Geodiversity topic: Lithostratigraphy; sedimentology; geomorphology; palaeontology.

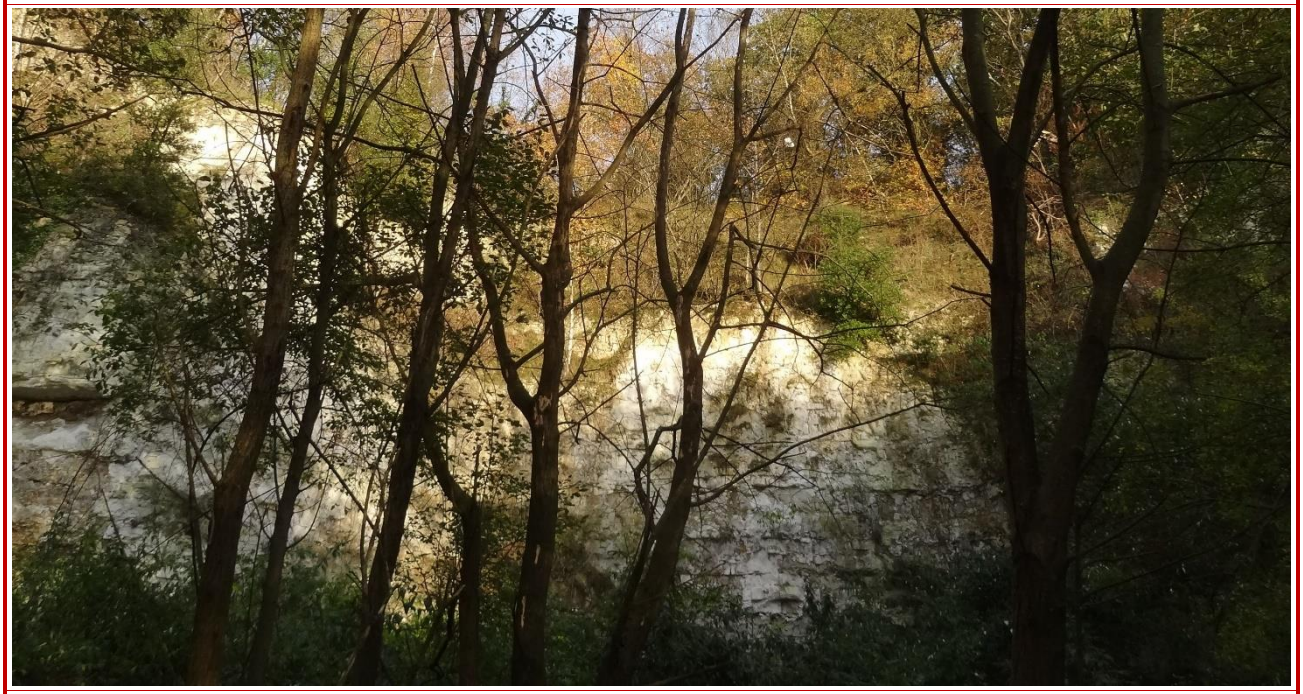
Access and Safety		
Aspect	**Description**	
Safety of access	Path adjacent to the face at the back of the pit becomes progressively overgrown. Fallen block from vertical face highlights the safety issues	
Safety of exposure	The exposure is becoming increasingly vegetated particularly with tree growth, buddleia, brambles and nettles; other pits along the Colne have become extensively wooded.	
Permission to visit	Private land so permission should be sought from Coppermill Lock Management Company Limited, Thamesbourne Lodge, Station Road, Bourne End SL8 5QH	
Current condition	The impressive chalk face is still visible through the scrub, both natural and planted, with the spectacular solution hollow on the north face.	
Current conflicting activities	Industrial rubbish bins for the business park.	
Restricting conditions	Scrub vegetation	
Nature of exposure	Remaining visible face of large Chalk Pit	
Culture, Heritage & Economic		
Aspect	**Description**	Rating
Historic, archaeological & literary associations	Published on old maps, BGS memoir;	5
Aesthetic landscape	Interesting recreational space for the housing estate; close to the Hillingdon Canal Trail	5
History of Earth Sciences	Local quarrying. GA Guide 68 (2012) Itinerary 1 shows a vertical logged section with details of the stratigraphy	8
Economic geology	Chalk used for lime and distemper	8
GeoScientific Merit		
Geomorphology		
Sedimentology	Seaford Chalk Formation	2
Palaeontology	Important for dating (see GA Guide 68)	4
Igneous/mineral/ Metamorphic Geology	None	0
Structural Geology	Local sub-surface structure needs resolving	4
Lithostratigraphy	Flint bands still visible and solution hollow spectacular	4
Potential use	Research; education;	
Fragility	natural overgrowing; weathering/erosion;	
Current Site Value		
Community	Within housing estate; close to Hillingdon Canal Trail	6
Education	Possible local use	6
Geodiversity value		
Recommended by Partnership as a LIGS: The chalk quarries of the Colne Valley were once important both locally and to the capital. This is the least overgrown and most accessible currently.		4

GLA 67 Summerhouse Lane Chalk Pit

2005

2013

Photos: Diana Clements

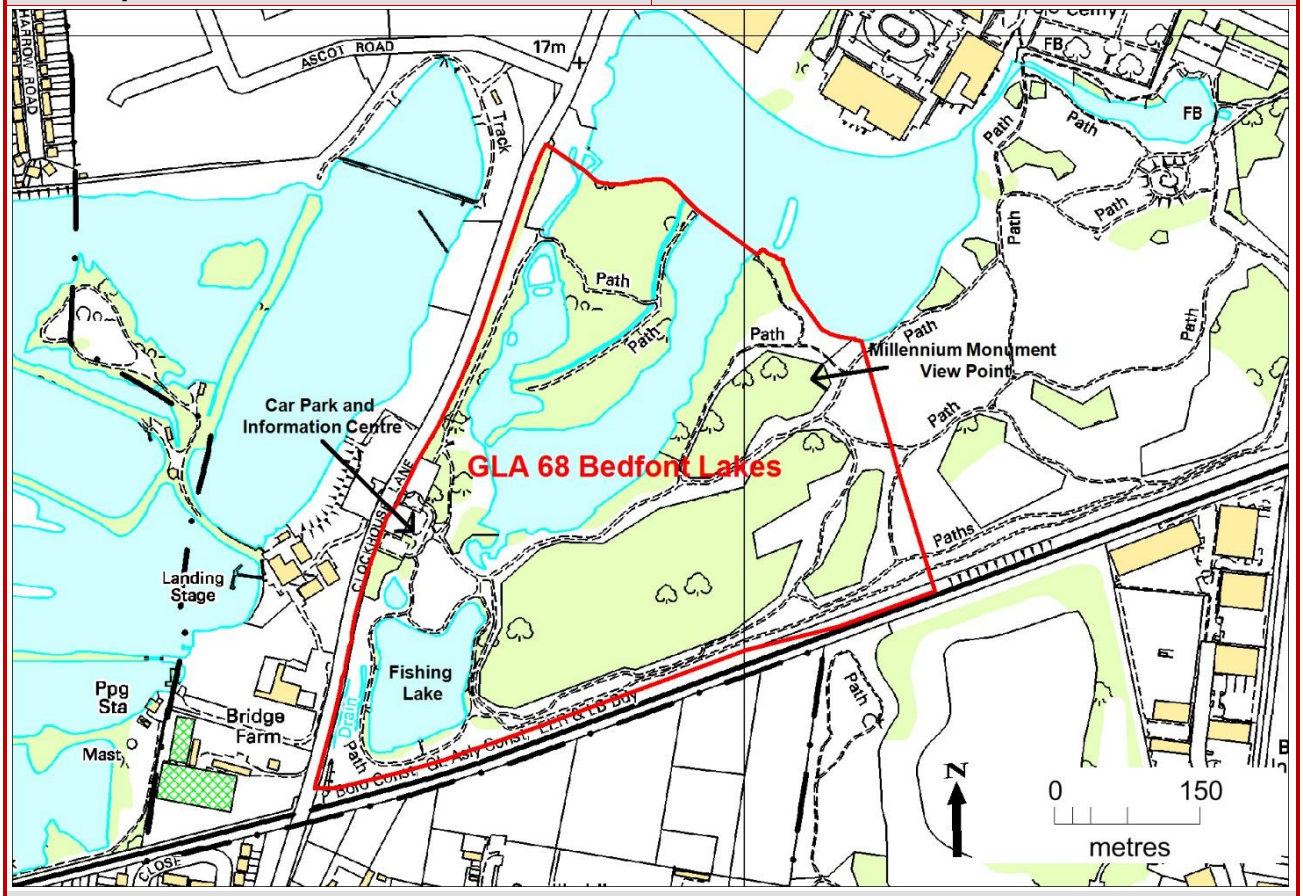


Summerhouse Lane Quarry (White Chalk Subgroup)
Photo: Allan Wheeler, November 2019

GLA 68 Bedfont Lakes

Grid Reference: TQ 076 724	Site Type: Former gravel quarries
Site Area (hectares): 23.82	Current use: Recreation Country Park with Fishing Lake and a number of Keep Fit routes through the park.
Site ownership: London Borough of Hounslow, Managed by Carillion	Borough: London Borough of Hounslow
Field surveyor: Barbara Silva/Diana Clements Revisited: Barbara Silva	Date: June 2015 Date: 2018
Current geological designation: Recommended by Partnership as a LIGS	Other designation: LNR; Metropolitan SINC (Bedfont Lakes Country Park); Green Flag status.

Site Map



Stratigraphy and Rock Types

Time Unit: Devensian	Rock Unit: Kempton Park Gravel Member, Maidenhead Formation
Rock Type: Sand and gravel	Details: Sand and gravel, locally with lenses of silt, clay or peat

Site Description

Bedfont Lakes Country Park formed part of a large orchard that supplied Covent Garden market until the 1920s.The area was then worked for sand and gravel until the 1950s and used as a refuse site until 1973 leaving a mixture of polluted lakes, wasteland and abandoned machinery. To make the former landfill areas safe, two million cubic metres of soil and refuse were relocated. Much of the soil and landfill was used to form the hills running through the middle of North Side, creating one of the highest points in the borough, Monolith Hill (Millennium Monument View Point), at 29m above sea level is the highest point in Hounslow. From the Millennium Monolith at the top there are views south to the North Downs and east to Wembley Stadium and the Shard. The monolith is made of a 3-ton block of York Sandstone, atop of which is a circular brass disc showing the direction and distances to many cities and landmarks of interest within the borough and beyond. The existing lakes were extended and footpaths were laid out around the site. The park, opened to the public in July 1995, is the second largest open space to be created in London in the 20th century. Since then it has won several national awards for its design and management, which include the

Green Flag Award, Millennium Marque and London in Bloom trophies.

The Park, although heavily affected by quarrying and subsequently modified by landfill, was originally underlain by the Kempton Park Gravel and the Lakes are the former quarries. This is interesting geologically as *London's foundations* has not previously included the Kempton Park Gravel. It is one of the youngest of the Thames 'Staircase' of gravels – comprising the 'upper floodplain terrace – and is located at the base of the staircase close to c.16m OD. Bridgland (1994) suggests that this gravel was deposited during the early to mid-Devensian, between 122-70,000 years BP (MIS 5d-2). Gibbard (1985) suggests that the aggradation probably began at 45-44,000 BP and ended at 32-30,000 BP, i.e. the unit is of Middle Devensian age.

Since the park opened in 1995, the vegetation has flourished and exposures are sparse. The best were seen round the Fishing Lake (e.g. at TQ 076 722) where fishermen have kept the vegetation down by walking to the platforms created for them. There is a path close to the lake in parts. Other exposures were seen on a bund that separates the west side of the Fishing Lake from Clockhouse Lane. This was probably placed there when the quarry was in operation as is common practice. Temporary exposures such as burrows, excavations and an old upturned tree hollow provided views. None of the gravel seen showed any stratification and is probably all ex situ. The gravel seen is predominantly flint but some quartzite and quartz was observed. Cobble-size clasts were also commonly observed.

Assessment of Site Value

Geodiversity topic: Lithostratigraphy; sedimentology.

Access and Safety

Aspect	Description
Safety of access	Best access via Clockhouse Lane (by Information Centre) where there is also a car park (TQ 076 724). Public access Bus H46 to NW tip of the park. Open during daylight hours. Most paths suitable for pushing buggies/wheelchairs
Safety of exposure	Small exposures easily overgrown. Best seen around Fishing Lake where frequent access to lakeside
Permission to visit	Open Access. Permission would be required to dig
Current condition	Well maintained by Carillion Services for LB Hounslow. Snack bars at both car parks. Vegetation well-established after initial opening as public open space in 1995
Current conflicting activities	Fishermen are an asset! Possible wildlife conflicts
Restricting conditions	Digging would not normally be permitted
Nature of exposure	Ex gravel pits with very little exposure except rare glimpses around Fishing Lake and on bund separating area from Clockhouse Lane. Elsewhere landfill has been piled to make a pleasantly hilly topography including the 29m high Monument Hill with fine views

Culture, Heritage & Economic

Aspect	Description	Rating
Historic, archaeological & literary associations	Needs research	
Aesthetic landscape	Well used park, wonderful view point and several awards	9
History of Earth Sciences	In relation to Thames Terrace	4
Economic geology	Former Gravel extraction	8

GeoScientific Merit

Geomorphology	Thames Terrace at 16m OD related to MIS 5e-3c.100,000 years to between 32-30,000 years old (note MIS 5e-2 changed to MIS 5e-3).	4
Sedimentology	Predominantly flint (some quartzite and quartz) rounded cobble-size clasts of both seen.	2
Palaeontology	None described from Bedfont Lakes but MIS 5e is uniquely associated with Hippo bones	0
Igneous/mineral/ Metamorphic Geology	None	0
Structural Geology		0
Lithostratigraphy	Kempton Park Gravel (First GLA site recorded).	4

Potential use	Educational with school groups / families visiting the Information Centre	
Fragility	Overgrown by moss or vegetation	
Current Site Value		
Community	If the geological designation could be included in the management plan this could lead to inclusion in some outreach.	8
Education	Aspects of the gravel could be included in some of the educational projects already on offer by showing small exposure of gravel on walks and discussing what the clasts are made of and the environment of deposition and subsequent extraction and landscaping.	6
Geodiversity value		
Recommended by Partnership as a LIGS: Worthy of LIGS status as Kempton Park Gravel is not yet represented in *London's Foundations.* Although exposure is poor there is enough around lake edge to see the nature of the gravel.		4
GLA 68 Bedfont Lakes		

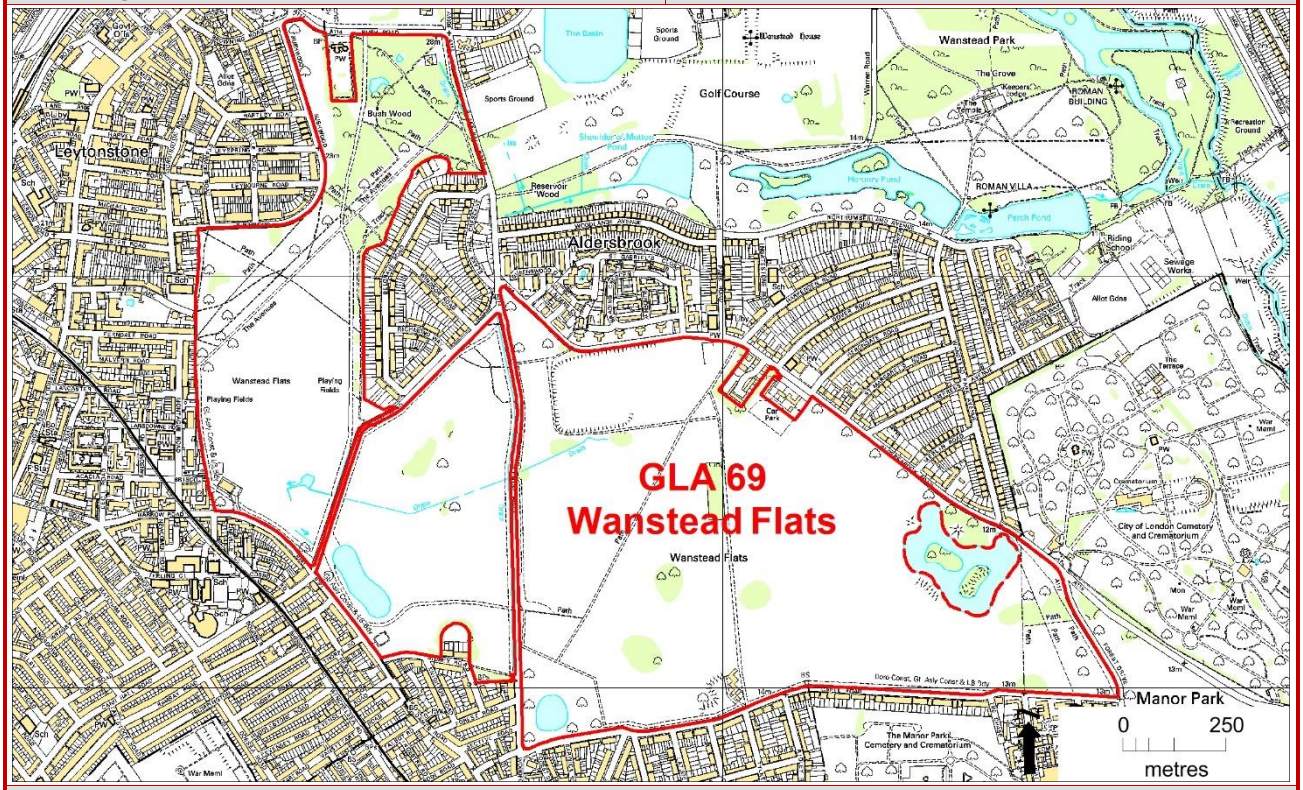
note cobbles c.10-15 cm

Photos: Diana Clements, June 2015

GLA 69 Wanstead Flats

Grid Reference: TQ 405 865	Site Type: Former gravel quarries
Site Area (hectares): 167.09	Current use: recreational ponds within public open space
Site ownership: City of London Corporation	Borough: London Borough of Redbridge
Field surveyor: Diana Clements/Peter Collins	Date: April 2015
Current geological designation: Recommended by Partnership as a LIGS	Other designation: part of Epping Forest SAC

Site Map



Stratigraphy and Rock Types

Time Unit: Pleistocene	Rock unit: Hackney Gravel Member, Maidenhead Formation
Rock Type: Sand and gravel	Details: Sand and gravel, locally with lenses of silt, clay or peat.
Time Unit: Pleistocene	Rock Unit: Lynch Hill Gravel Member, Maidenhead Formation
Rock Type: Sand and gravel	Details: Sand and gravel, locally with lenses of silt, clay or peat.
Time Unit: Eocene	Rock Unit: London Clay Formation, Thames Group
Rock Type: Clay, silt, sand	Details: Fine, clayey silt, clay.

Site Description

The open flat ground of Wanstead Flats is formed by the terrace of the Hackney Gravel which overlies the London Clay. There are exposures all around the edges of Alexandra Lake but they are mostly ex-situ. The pond was created as an ornamental pond between 1882 and 1911 from an existing small quarry 'brick pit'. The gravel was piled up around the perimeters and to create two islands. The exposure near the car park at TQ 414 864 may be in situ. The Hackney Gravel is predominantly flint gravel within topographical range base 6-15m, top 16-18m above floodplain of River Lea.

At the northwest tip of Wanstead Flats, in the area around Bush Wood the older Lynch Hill Gravel replaces the Hackney Gravel and beyond that, the London Clay lies at the surface. As the name implies, the whole area is extremely flat and although there is a gentle increase in height OD from < 15 m round Alexandra Lake to 20m at the southern extremity of Bush Wood and 25m in the middle of the wood, it is very difficult to find any clues as to where these junctions lie. The Thames Terraces in this area do not display the obvious steps in the topography noted elsewhere. This is possibly because the ground was artificially levelled to create sports facilities. Springs were only detected in the adjacent road names such as Leybourne and Leyspring Roads which align with the junction of the Lynch Hill Gravel and the London Clay as shown on the

BGS map.		
Assessment of Site Value		
Geodiversity topic: Lithostratigraphy; sedimentology.		
Access and Safety		
Aspect	**Description**	
Safety of access	Good access, public space, free parking, buses & tube nearby. Manor Park railway station approximately 5 mins walk to Alexandra Lake. Car Park for pond TQ 414 864. Slippery when wet, mostly unmade paths, flat area.	
Safety of exposure	Exposures at Alexandra Lake are kept exposed by park users	
Permission to visit	Open Access	
Current condition	Well maintained by City of London Corporation	
Current conflicting activities	none	
Restricting conditions	Permission required to excavate	
Nature of exposure	Ex-Quarry for Hackney Gravel, extended and filled by natural springs. Piles of excavated gravel around perimeter	
Culture, Heritage & Economic		
Aspect	**Description**	Rating
Historic, archaeological & literary associations	Historically important in the story of preserving Epping Forest as open space	3
Aesthetic landscape	Not very attractive as so flat and open but provides playing fields and space for fairs and circuses so is well-frequented. Area around Alexandra Lake more interesting.	5
History of Earth Sciences	In relation to Thames Terrace	4
Economic geology	Possible former Gravel extraction	3
GeoScientific Merit		
Geomorphology	Thames Terrace (Hackney Gravel) related to MIS 9-8 c. 250,000 years old at <15m OD. Older Lynch Hill Gravel at c. 20 m OD (MIS 10-9). London Clay at c. 25m	4
Sedimentology	Hackney Gravel predominantly flint, including Tertiary flint (Bridgland, et al, 1995). Almost entire ex situ	2
Palaeontology	None known	0
Igneous/mineral/ Metamorphic Geology	None	0
Structural Geology		0
Lithostratigraphy	Hackney Gravel exposed (unlike Springfield Park GLA 43 where it is inferred by the spring line). Lynch Hill Gravel and London Clay also represented but no exposures seen.	4
Potential use	Research; (off-site education on Thames Terraces)	
Fragility	Overgrown by moss or vegetation	
Current Site Value		
Community	Potential geotrail on Epping Forest Centenary Walk up the staircase of Thames Gravels starting here at Wanstead Flats to High Beech. Alexandra Lake could become Stop 1 (slight diversion) with Stops 2 and three within Bush Wood, particularly if any temporary exposures could reveal the presence of Lynch Hill Gravel and London Clay.	7
Education	Possible activities in Visitor Centre in Queen Elizabeth Hunting Lodge	5
Geodiversity value		
Recommended by Partnership as a LIGS: This warrants a LIGS rating for the exposure of Hackney Gravel (there is no exposure at GLA 25, Springfield Park). Lynch Hill Gravel and London Clay are also represented although no exposures were seen.		4

GLA 69 Wanstead Flats

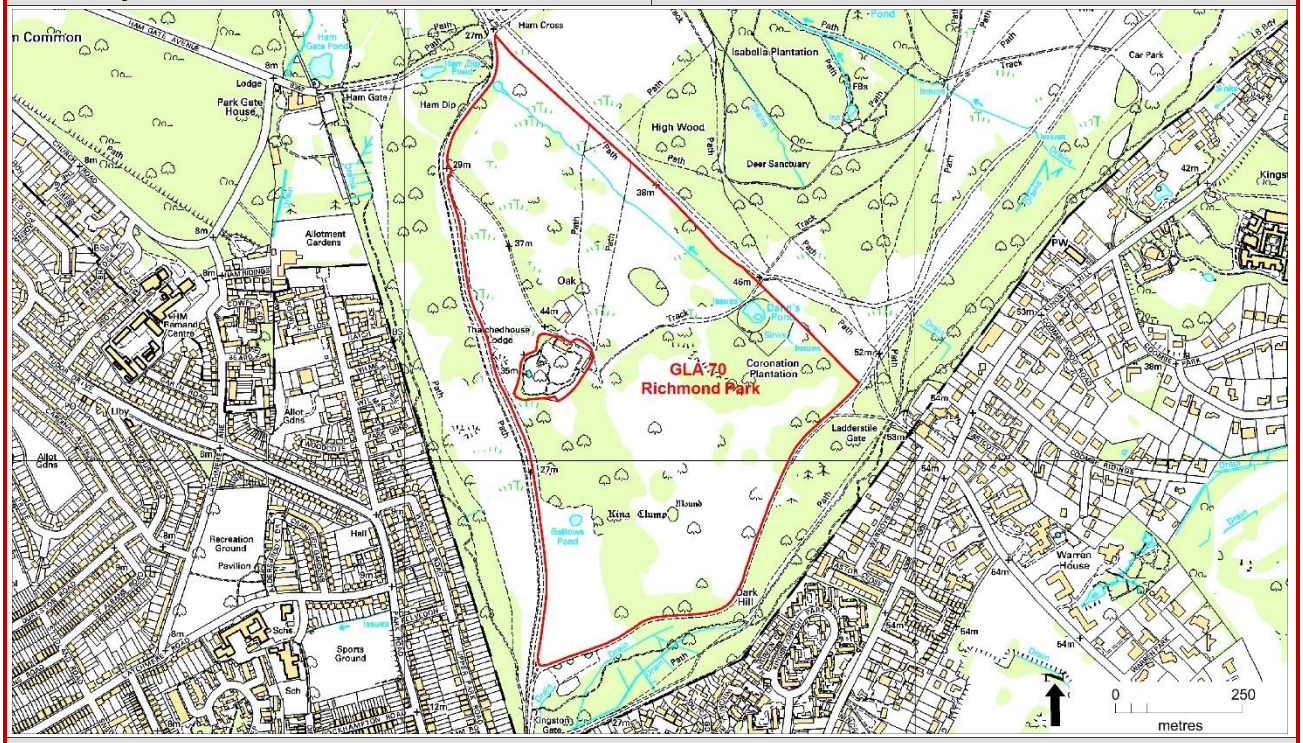
Photos: Diana Clements, April 2015

GLA 70 Richmond Park

Grid Reference: TQ 194 706 (Kingston Gate car park)	Site Type: Natural exposures within large public park
Site Area (hectares): 50.76	Current use: Recreational
Site ownership: The Royal Parks	Borough: London Borough of Richmond Upon Thames
Field surveyors: Peter Collins, Diana Clements Revisited: Diana Clements, Laurie Baker, Paul Rainey	Date: March 2014 Date: May 2017
Current geological designation: Recommended by Partnership as a LIGS	Other designation: SSSI (biological); European SAC (UK0030246); NNR and Metropolitan SINC (Richmond Park)

Site Map

OS Topography © Crown Copyright



Stratigraphy and Rock Types

Time Unit: Pleistocene	Rock Unit: Thames Valley Formation, Black Park Gravel Member
Rock Type: sand & gravel	Details: Sand and gravel, with possible lenses of silt, clay or peat.
Time Unit: Eocene	Rock Unit: London Clay Formation and Claygate Member, Thames Group
Rock Type: Clay, silt, sand	Details: Fine, sandy, silty clay/ clayey silt, clay.

Site Description

Richmond Park includes three predominant lithologies: London Clay at the base, with the more sandy Claygate Member above and, on the highest ground, the Black Park Gravel, the oldest of the Thames Gravels following the retreat of the Anglian Ice Sheet. An area of the park has been chosen where all three of these lithologies are present. It is in the extreme south west between Ham Gate, Kingston Gate and Ladderstile Gate, joined into a more or less rectangular shape by the track leading to Ham Cross. A fault crossing NE/SW is marked by the line of the gully from Ham Gate that crosses the main N/S road and continues beyond to Pen Ponds (outside the designated area). The block to the south is downthrown with respect to the north as no Claygate Member underlie the Black Park Gravel in the northern part of the park.

Actual exposures are rare but to the west of Thatched House Lodge and between there and the road there is a slipped area (TQ 1905 7115) where Claygate Member are exposed. From the ridge above these are seen to be rotated slips bringing the Claygate Member to a lower level than the *in* situ outcrop, On the climb up the slope from this exposure to the track leading from the north up to Thatched House Lodge there are exposed areas of *in situ* Claygate Member in the gullies. They are covered by a surface blanket of clasts eroded from the Black Park Gravel and it is probable that the top half metre of gravel is *in* situ. Any

temporary exposures above 50m should expose *in situ* Black Park Gravel (e.g. at Kings Clump). The BGS map shows a small patch of worked ground on the NE edge of this plateau. Sand was observed on the slope (<45m) up to Kings Clump, just west of the *Mound* at c. TQ 1945 7090 which is a little low for the mapped area of Black Park Gravel. The adjacent Wimbledon Common shows Bagshot Formation above the Claygate Member and underlying the Black Park Gravel in the most southerly area. It is tempting to think this small exposure could be Bagshot Sand but more investigation would be required to prove it. The probability is that it is a sandy facies at the top of the Claygate Member.

The Capital Ring runs through Richmond Park, around the high ground at Pembroke Lodge further north than the designated area and crosses the fault at Pen Ponds. A Geotrail through the designated area is available on the LGP website: www.londongeopartnership.org.uk/geotrails.

Grist C.I., 1917. Excursion to Richmond Park, Kingston Hill and Wimbledon Common, May 19th, 1917 (Proc. Geol. Assoc. Vol. 28 Part 2). Accessed 10/2019.

Assessment of Site Value

Geodiversity topic: lithostratigraphy, geomorphology.

Access and Safety	
Aspect	**Description**
Road access and parking	Parking is available in designated car parks around Richmond Park at a charge. The car park at Kingston Gate is recommended for the designated area.
Safety of access	Footpaths, some rough with slopes and wet/slippery areas on areas of best exposure
Safety of exposure	Evidence of slippage, vegetation mostly kept down by deer
Permission to visit	Open access during daylight hours
Current condition	Well maintained by the Royal Parks
Current conflicting activities	Deer erosion could be an asset
Restricting conditions	Lack of exposure; permission to dig may not be granted.
Nature of exposure	Patchy exposure on path and where slipped

Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	Richmond Park generally: possible barrows, hand axes found (Wymer Collection), a strategic historic view to St. Paul's	7
Aesthetic landscape	Welcome large area of open space in urban setting. Deer an additional attraction. Much used.	8
History of Earth Sciences	Needs researching, particularly borehole data and hand axes	
Economic geology	Localized digging of gravels and Claygate Member	2
GeoScientific Merit		
Geomorphology	Relationship of geology to topography; comparisons with neighbouring Wimbledon Common and Putney Heath. NB GLA 25 Putney Heath is at the north end of Wimbledon Common	4
Sedimentology	Encompasses a variety of gravel, sand, silt & clay	4
Palaeontology	Handaxes found in the Black Park Gravel are in the Wymer Collection Nos. 2011 & W242	2
Igneous/mineral/ Metamorphic Geology		
Structural Geology	Fault runs through centre controlling level of underlying Eocene deposits (north edge of designated area)	2
Lithostratigraphy	Three strata: London Clay and Claygate Member and overlying them, the much younger Black Park Gravel	4
Potential use	Possible research in respect of levels of different lithologies; potential for Geotrail (close to Capital Ring)	
Fragility	Temporary exposures can easily become overgrown	

Current Site Value		
Community	Much used park crossed by the Capital Ring. Catering facilities at Pembroke Lodge (north end) and a small shop outside the Lodge selling books etc. but no potential for a geology display.	10
Education	Geotrail is available on www.londongeopartnership.org.uk/geotrails	6
Geodiversity value		
Recommended by Partnership as a LIGS: On account of three different lithologies; a Geotrail is available. Wimbledon Common (GLA 78 in Merton) and Putney Heath (GLA 25 in Wandsworth) on the other side of Beverley Brook have similar lithology.		4
GLA 70 Richmond Park		

Rotational slip beneath Thatched House Lodge

Exposure probably Claygate Member at top of rotational slip

Exposures up to track leading N from Thatched House Lodge

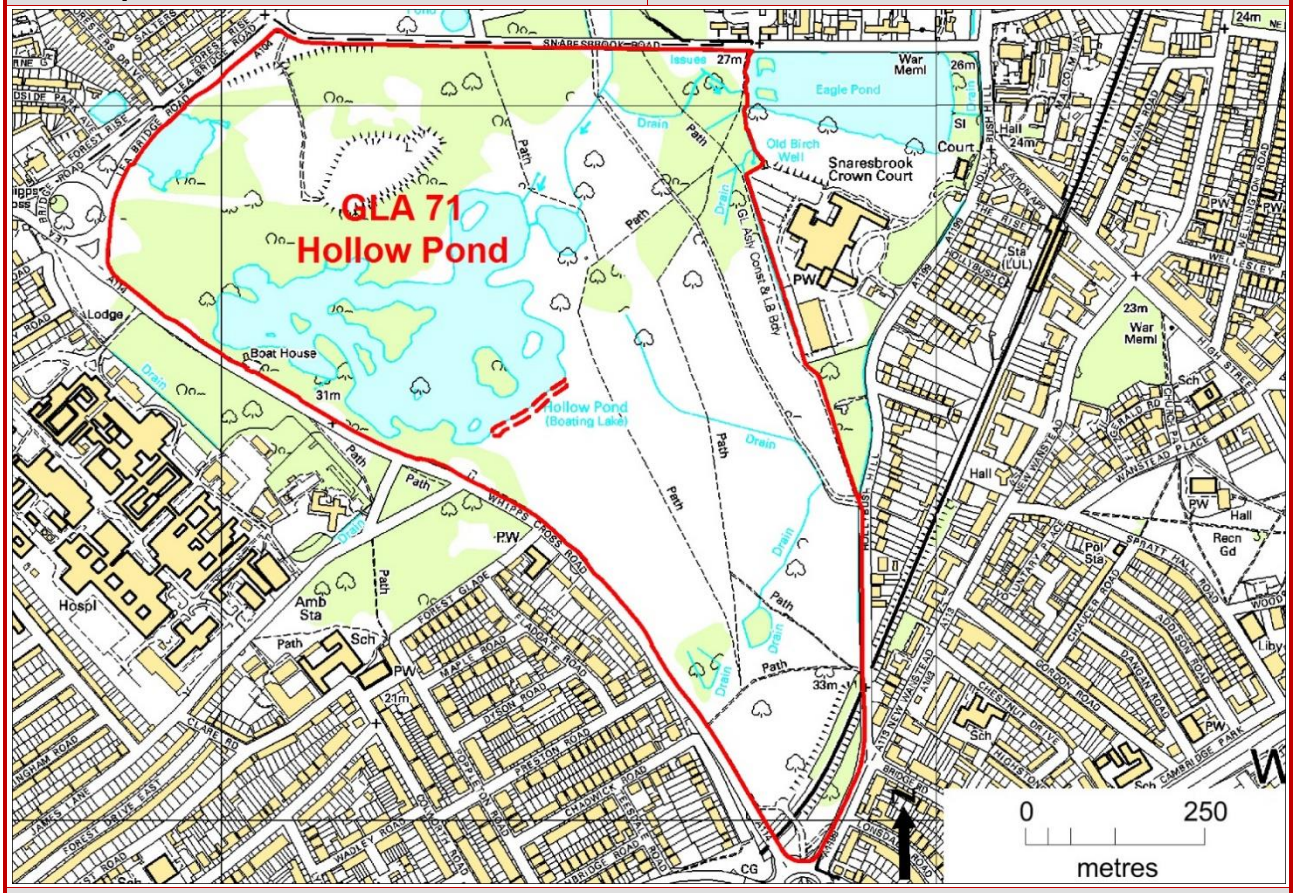
Surface gravel (mostly eroded) underlain by Claygate Member

Photos Diana Clements 2014

GLA 71 Hollow Pond, Leyton Flats

Grid Reference: TQ 393 889	Site Type: Former gravel quarries
Site Area (hectares): 63.53	Current use: recreational ponds within public open space
Site ownership: City of London Corporation	Borough: London Borough of Waltham Forest
Field surveyors: Diana Clements / Peter Collins / Ann Davidson Revisited: Ruth Siddall	Date: November 2013 Date: January 2020
Current geological designation: Recommended by Partnership as a LIGS	Other designation: part of Epping Forest SAC; Metropolitan SINC (Epping Forest North)

Site Map



Stratigraphy and Rock Types

Time Unit: Pleistocene	Rock Unit: Boyn Hill Gravel Member, Maidenhead Formation
Rock Type: Sand and gravel	Details: Sand and pebbles (mostly flint)

Site Description

Former gravel pits in Boyn Hill Gravel are still visible around the perimeter of the boating pond, particularly where it has been piled up when the gravel pits were joined to make one large pond. The water is fed by natural springs. At TQ 3942 8857 (exposure closest to the big car park on the south side) the gravel appears to be in situ with at least two small ridges within the c.1.5m exposure. The top surface is the same level as Leyton Flats stretching behind to the south. The higher of the two ridges is formed of clasts consolidated into a ferricrete. Some of the clasts are vertical and are likely to have been subject to periglacial processes. The lower of the ridges contained layers of pale and reddish clay. The analysis given for Boyn Hill Gravel (Bridgland, et al, 1995) estimates total flint fraction of 88.9% including 6.6% Tertiary flint, 6.6% quartz, 2.1% quartzite and 2.5% Lower Greensand chert. Observation of the 'in situ' area supported the occurrence of Tertiary flint but the majority of quartz was of a smaller fraction than the analysis. Lower Greensand chert was observed at the mounds 'Beach' area on the north perimeter of Hollow Pond. The flint is approximately half rounded and half angular, and the majority is stained brown. There is an unusually high proportion of red-stained clasts.

Assessment of Site Value		
Geodiversity topic: Lithostratigraphy; sedimentology.		
Access and Safety		
Aspect	**Description**	
Safety of access	There are two car parks on the south side of Hollow Pond, the largest at TQ 3935 4648 is closest to the geological interest at TQ 3942 8857	
Safety of exposure	Public access and frequent dog walkers and fishermen keep the exposures clear of vegetation. There is danger of decay of the best in situ exposure.	
Permission to visit	Open access	
Current condition	Well maintained by City of London Corporation. Snack bars at both car parks	
Current conflicting activities	none	
Restricting conditions	Permission required to dig	
Nature of exposure	Ex-Quarry for Boyn Hill Gravel now extended and filled with water. Piles of excavated gravel on northern perimeter	
Culture, Heritage & Economic		
Aspect	**Description**	Rating
Historic, archaeological & literary associations	Potential research in local archives	3
Aesthetic landscape	Public open space	8
History of Earth Sciences	In relation to Thames Terrace	4
Economic geology	Former gravel extraction	8
GeoScientific Merit		
Geomorphology	Thames Terrace related to MIS 11-10 c. 400,000 – 350,000 years old. Flat terrace feature at 30m above OD (and around perimeter of Pond)	4
Sedimentology	Predominantly flint, including Tertiary flint (Bridgland, et al, 1995). Only small exposure is in situ with ferricrete layer	2
Palaeontology	None known	0
Igneous/mineral/ Metamorphic Geology	None	0
Structural Geology		0
Lithostratigraphy	Boyn Hill Gravel (also visible at Fairlop Complex RIGS GLA 49)	4
Potential use	Research; (off-site education on Thames Terraces)	
Fragility	Overgrown by moss or vegetation	
Current Site Value		
Community	Potential geotrail on Centenary Walk up the staircase of Thames Gravels from Wanstead Flats to High Beech	8
Education	Possible activities in Visitor Centre in Queen Elizabeth Hunting Lodge	6
Geodiversity value		
Recommended by Partnership as a LIGS: This is the best exposure of gravel in the Epping Forest ponds so deserves at least LIGS rating. As Boyn Hill Gravel at Fairlop complex, not far away, is already a RIGS, it is not warranted here		4

GLA 71 Hollow Pond, Leyton Flats

Note cemented horizons. Photo Diana Clements, November 2013

Photos: Ruth Siddall, January 2020

GLA 72 Monken Hadley Common

West end TQ 252 973; East end TQ 270 968	Site Type: large public common
Site Area (hectares): 74.98	Current use: Wooded recreational land on London Loop
Site ownership: Trustees of Hadley Common, a Statutory Corporation established under the Enfield Chase Act 1777	Borough: London Borough of Barnet
Field surveyors: Diana Clements, Peter Collins, Theresa Ball	Date: 2015
Current geological designation: Recommended by Partnership as a LIGS	Other designation: Borough Grade I SINC (Monken Hadley Common)
Site Map	OS Topography © Crown Copyright

The Site Map shown edged in red is indicative only of the general location and not to be taken as accurately representing the entirety of Monken Hadley Common

Stratigraphy and Rock Types

Time Unit: Quaternary	Rock unit: Stanmore Gravel Formation, Crag Group
Rock Type:	Details: Gravel and sand, clayey near base. Gravel mostly composed of flints, up to 150mm in diameter, with a little quartz, quartzite and Lower Greensand chert in the fine fractions. Matrix of orange-brown, pale grey, red mottled clay and sandy clay, with pockets of coarse sand. Locally with layers of silt, clay or peat. Interpreted as offshore or beach gravels (Ellison, 2004) or possibly fluvial (Bridgland 1994)
Time Unit: Quaternary	Rock unit: Dollis Hill Gravel Member Sudbury Formation, Kesgrave Catchment Subgroup
Rock Type:	Details: Gravel, sandy and clayey in part, with some laminated silty beds. Sand and gravel, locally with lenses of silt, clay or peat and organic material
Time Unit: Eocene	Rock Unit: London Clay Formation with Claygate Member at top, Thames Group
Rock Type: Clay, silt, sand	Details: Fine, sandy, silty clay/ clayey silt, clay.

Site Description

Along the length of Monken Hadley Common four different lithologies have been recognised but only two can readily be examined without excavating. Stanmore Gravel overlies London Clay at the west end of the common. It can be seen in small erosion exposures within a pit on the open area of the Common. There is a spring line at approximately the junction with the London Clay which has carved a gully. There is a question of why the gravel is not underlain by Claygate Member at this point (120-125m). At the east end of the Common the Claygate Member is shown between 85-95m and further west along the Stanmore Gravel Ridge around Arkley it is shown to underlie the gravel at about 125m. This would bear further investigation.

At the east end of the Common the Junction of the London Clay and the Claygate Member is shown at

c.85-90m and above that the junction with the Dollis Hill Gravel, at c.95m. Ponds at the low point and the stream 'cliffs' from bottom pond (Jack's Lake) provide exposures of London Clay but exposures of the other lithologies are difficult to see. At the top of the hill the ground levels out and feels more spongy. Sponginess and pebbles encountered by digging suggest presence of Dollis Hill Gravel. The Claygate/London Clay junction may be inferred by the break of slope. The bridge over the Pymmes Brook is made of contorted bricks implying the Claygate Member was exploited locally for brick making. All three of these lithologies are encountered in the adjacent Trent Park (LB Enfield).

Assessment of Site Value

Geodiversity topic: lithostratigraphy, sedimentology; geomorphology.

Access and Safety

Aspect	Description
Safety of access	At the western end the nearest station is High Barnet (Northern Line). Walk north c.1½km to enter via the open space between Camlet Way and Hadley Common Road. From the eastern end the nearest station is Cockfosters (Piccadilly Line), c.600m from the Common. There is a car park on Baker's Hill. London Loop Section 16 passes through the Common.
Safety of exposure	There are well-marked footpaths throughout the Common but actual exposures are limited to temporary exposures and erosion around the small disused gravel pit (west end) and fish ponds (east end)
Permission to visit	Open access.
Current condition	The Common is well maintained with a range of habitats including Jack's Lake at the head of the Pymms Brook trail
Current conflicting activities	none
Restricting conditions	Vegetation, limited exposures
Nature of exposure	Natural habitat containing four different rock units.

Culture, Heritage & Economic

Aspect	Description	Rating
Historic, archaeological & literary associations	The Monken Hadley Common website www.monkenhadleycommon.net gives details of the history of the Common. It is the only part of the former Enfield Chase which remains as common land to this day.	5
Aesthetic landscape	Footpaths through woods and around lake used by local community.	6
History of Earth Sciences	None known	0
Economic geology	Small pit in Stanmore Gravel (west end). Overburnt bricks at the east end imply local brickmaking from the Claygate Member	6
GeoScientific Merit		
Geomorphology	Ridges and valleys provide potential for identifying the different lithologies from clues in the landscape – spring lines, vegetation, break of slope and small exposures. The absence of Claygate Member at the west end needs investigation.	4
Sedimentology	Exposures of London Clay beneath Jack's Lake and eroded surface revealing Stanmore pebbles at west end but other lithologies are a bit difficult to find unless excavations are made.	3
Palaeontology	None recorded	
Igneous/mineral/ Metamorphic Geology	none	
Structural Geology	The possibility of a fault between Arkley and Hadley and the west and east ends of the common need investigating to explain the absence of Claygate Member at the west end	2
Lithostratigraphy	Designated as the area contains four distinct rock units	4
Potential use	Education; Geological points of interest could be added to the London Loop and the Pymms Brook trail.	
Fragility	Natural overgrowth	
Current Site Value		
Community	Valuable woodland and green space.	8

Education	The common is on the London Loop and Pymms Brook Trail	6
Geodiversity value		
Recommended by Partnership as a LIGS: The different lithologies at either end of the common provide geological interest both for walkers on the London Loop and Pymms Brook Trail and education possibilities for local schools. Research opportunities to explain the lack of Claygate Member at the west end.		4
GLA 72 Monken Hadley Common		

West end: Stanmore gravels beneath the acid-loving gorse surrounding old pit

East end: London Clay beneath the weir from Jack's Lake; over-burnt bricks on the bridge over Pymms Brook coming from Jack's Lake – an indication of local brickmaking probably from the silty Claygate Member.

Photos: Diana Clements

GLA 73 Greenwich Park

Grid Reference: TQ 390 774	Parkland with escarpment, springs, conduit system, former quarries, viewpoints, dry valley, tumuli, well.
Site Area (hectares): 72.44	Current use: Public park with important historic buildings (see below)
Site ownership: The Royal Parks	Borough: Royal Borough of Greenwich
Field surveyors: Ann Davidson / Theresa Ball	Date: March-and April 2017
Current geological designation: Recommended by Partnership as a LIGS	Other designation: Royal Park; within UNESCO World Heritage Site; Historic England – Grade I listed park; Metropolitan SINC (Blackheath and Greenwich Park)
Site Map	OS Topography © Crown Copyright

Stratigraphy and Rock Types

Time Unit: Recent	Rock Unit: Head
Rock Type: pebbles sand and clay	Details: Mix of pebbles sand and clay eroded from the slope above, deposited since the end of the last ice age about 10,000 years ago, mostly as the periglacial surface melted.
Time Unit: Eocene	Rock Unit: Harwich Formation, Thames Group, Blackheath Member
Rock Type: pebbles in sand matrix	Details: The Blackheath Member is dominated by black, rounded flint gravel, partly clast-supported, in a matrix of fine- to coarse-grained sand, with lenses of sand and thin clay layers. The gravels are interlayered with pale-coloured fine-grained non-glauconitic quartz and flint sands.
Time Unit: Paleocene-Eocene	Rock Unit: Lambeth Group – Upnor, Reading and Woolwich Formations
Rock Type: sands, clays, shell beds	Glauconitic sands overlain by grey clays and sands with Brackish fauna and interleaved red and variegated clays and sands. Underlying the Blackheath Member on the slope.
Time Unit: Paleocene	Rock Unit: Thanet Formation
Rock Type: sands, flint nodules at base	Details: Glauconite coated, nodular flint at base, overlain by pale yellow-brown, fine-grained sand that can be clayey and glauconitic. Only at the surface at the base of the slope in the extreme northeast of the Park.
Time Unit: Late Cretaceous	Rock Unit: Chalk Group, White Chalk Subgroup, Seaford Formation
Rock Type: chalk with flint layers	Details: white chalk with flint layers, not visible as beneath Head at the base of the slope

Site Description

Greenwich Park is situated on the southern limb of the London Basin syncline, with the Greenwich Fault adjacent to the north, just outside the Park perimeter. The Greenwich Fault is one of the three main en echelon faults in the southern part of the Basin. The north-west facing escarpment provides fine views of the city skyline, and beyond.

West of Greenwich, the chalk of the London Basin makes a rare appearance near the surface (in the Ravensbourne Valley) and is then overlain by Paleocene and Eocene strata, the oldest being Thanet Sands which form a relatively narrow band running across the lawns on the lower plain in the north, beneath the Head, and lying just beneath the surface at the northeast tip of the park. Overlying these to the south is the Lambeth Group which outcrops along the lower slopes of the escarpment. These beds are composed of a variable series of impermeable clays, loams, sands and pebble beds. The most extensive deposits capping the whole of the southern plateau of the Park are the Blackheath beds of the Harwich Formation, which are composed of pebble beds and sand which can contain fossils although none is recorded from Greenwich Park. The beds have been worked extensively for gravel both on Blackheath Common and the southern part of Greenwich Park and the workings are manifest in the landscape as small hollows some of which have been utilised as ponds. The permeable Blackheath beds are more resistant to erosion and form the high ground and top of the steep scarp slopes within Greenwich Park. The youngest stratum just beyond the northern edge of the park is the Kempton Park Gravel, a Pleistocene drift deposit which sits on the Thames flood plain terrace. The gravels extend from the edge of the River under the Royal Naval College and the Queen's House, and forms a narrow band just outside, and parallel with the northern boundary of the Park. Head (mixed material derived from the slope) covers the artificially levelled former parade ground to the south of the National Maritime Museum. Chalk would have appeared in the valley of the Thames in the northern limits of the park but a fault line that runs northeast/southwest beneath the National Maritime Museum takes the Chalk to greater depths to the north. Within the park it is covered by Head. On the plateau in the southern part of the park, Blackheath pebbles can be found on eroded paths from the sand and gravel of the Harwich Formation.

There are springs between the Harwich and Lambeth Group, which have been used, historically, via a conduit system and reservoir, to supply water to Greenwich Palace and the Royal Military Hospital. (One conduit was used as an air raid shelter during WW2.) The 'Standard Reservoir' storage building still stands in the park (TQ 3863 7727). Several quarries were once excavated for gravel, at least one of which can be identified in the Dell near to the Ranger's House (TQ 3905 7672). Another has been used to create the Lake. A dry valley – East Combe - can be identified in the park (TQ 3898 7746), a few yards to the north east of the One Tree Hill viewpoint (TQ 3891 7739).

https://www.royalparks.org.uk/parks/greenwich-park

Greenwich Park: An Archaeological Survey March 1994, Royal Commission on the Historical Monuments of England

Aspect	Description
Safety of access	There are some designated cycle routes within park, and many tarmac paths. Blackheath Avenue often busy with cars and coaches. There are several flights of stairs and steeply-sloped paths. Grass slopes can become slippery when wet.
Safety of exposure	Quarry face, currently vegetated
Permission to visit	Access available during park opening hours. There is restricted access to some areas, e.g. the deer enclosure. The park is open every day from 6am. Closing times vary from 6pm Nov-Feb to 9.30pm June-July. Buses 129, 177, 180, 188, 199, 202, 286, 386 all pass close to the park. Nearest rail stations are Greenwich to the west, Maze Hill to the north-east, Blackheath to the south and Cutty Sark (DLR), all a short walk from the park. The park can be accessed by riverboat to Greenwich Pier from Westminster, Embankment or Tower Piers, and on foot from the north ban of the Thames via the Greenwich Foot Tunnel.
Current condition	Park is well-maintained, but extensive improvements have received planning permission. The granting of Heritage Lottery Grant gives potential for

	temporary disruption but also provides an opportunity to add a geological interpretation element into the improvements	
Current conflicting activities	Inability to dig within the Royal Park	
Restricting conditions	Only one prospective exposure, the rest is covered by vegetation	
Multiple features, prospects for trail	Springs, Standard Reservoir building, conduit entrances, breaks of slope, quarry, dry valley and escarpment with city views and beyond, on the far horizon, (including octagonal chimneys of Greenwich Power Station, which provides backup power solely to the London Underground system). The points of interest have been included in a geology trail: www.londongeopartnership.org.uk/geotrails/	
Culture, Heritage & Economic		
Aspect		**Rating**
Historic, archaeological & literary associations	The whole park, neighbouring properties and part of Greenwich town centre was inscribed onto UNESCO's list of World Heritage sites in 1997. The Royal Greenwich Observatory, a Grade I listed building, lies within the park. Croom's Hill Gate is a group of 31 tumuli or barrows dating from the Anglo Saxon period. Remains of possibly a Roman Temple in the East of the Park. Under the Tudors Greenwich was the pre-eminent royal palace. The National Maritime Museum lies just to north of the park.	9
Aesthetic landscape	The park commands a unique position on the only hill flanking London's Thames approaches and offers an unequalled prospect over the river, the docklands, the City of London and the West End. Important views include the protected strategic view to St. Paul's Cathedral from the Wolfe monument and the Grand Axis progression from the River to the Queen's House, Wolfe Statue and along Blackheath Avenue terminating at All Saints Church, Blackheath. Views of the other side of the Thames include the distant hills of Epping Forest (due north) with Hampstead Heath to the northwest and the Stanmore Ridge beyond and further west.	10
History of Earth Sciences	An account of the water supply of Greenwich from 1780 describes eight conduit systems based on springs between the Blackheath Beds and Lambeth Group. The Standard Reservoir Conduit House, The Conduit Head at One Tree Hill within the park and the Hyde Vale Conduit Head immediately outside the park are all listed buildings by Historic England.	4
Economic geology	Many former gravel pits and a possible pre-Tudor quarry, i.e. prior to the development of the conduits. There is also an old quarry on the edge of Flamsteed's Well (shown as Garden on the maps)	3
Geoscientific Merit		
Geomorphology	Plateau, steep escarpment, with drop of up to 30 metres, river terraces	4
Sedimentology	None visible but one prospective site	(2)
Palaeontology	None recorded	0
Igneous/mineral/ Metamorphic Geology		0
Structural Geology	Locally the Greenwich fault and Greenwich anticline although there is little evidence at the surface	2
Lithostratigraphy	Chalk (overlain by Head), Thanet Formation, Lambeth Group, Harwich Formation (Blackheath Member) and Head	4
Potential use	School education; geotrail	
Fragility	Natural overgrowth, future development	
Current Site Value		
Community	Attracts local, national and international visitors	6
Education	Geomorphology, and water supply and how water features affect land use. A Geotrail is on the LGP website: http://londongeopartnership.org.uk/geotrails/#greenwich	6

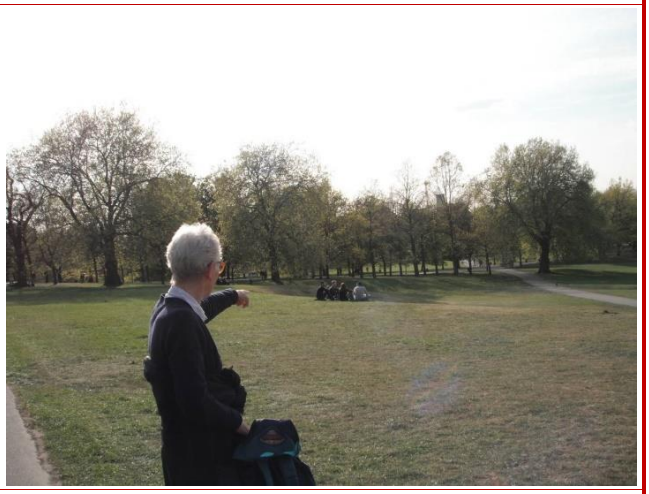
Geodiversity value	
Recommended by Partnership as a LIGS: Greenwich fault, escarpment, springs and conduit system, quarries, four distinct strata provide enough interest for a LIGS designation.	4

GLA 73 Greenwich Park

Site of possible quarry face exposure at The Dell (also beneficial for bees if cleared) TQ3903 7671

View across London from One Tree Hill

Indicating one of several springs near to ‘Standard Reservoir’ building TQ 3863 7727

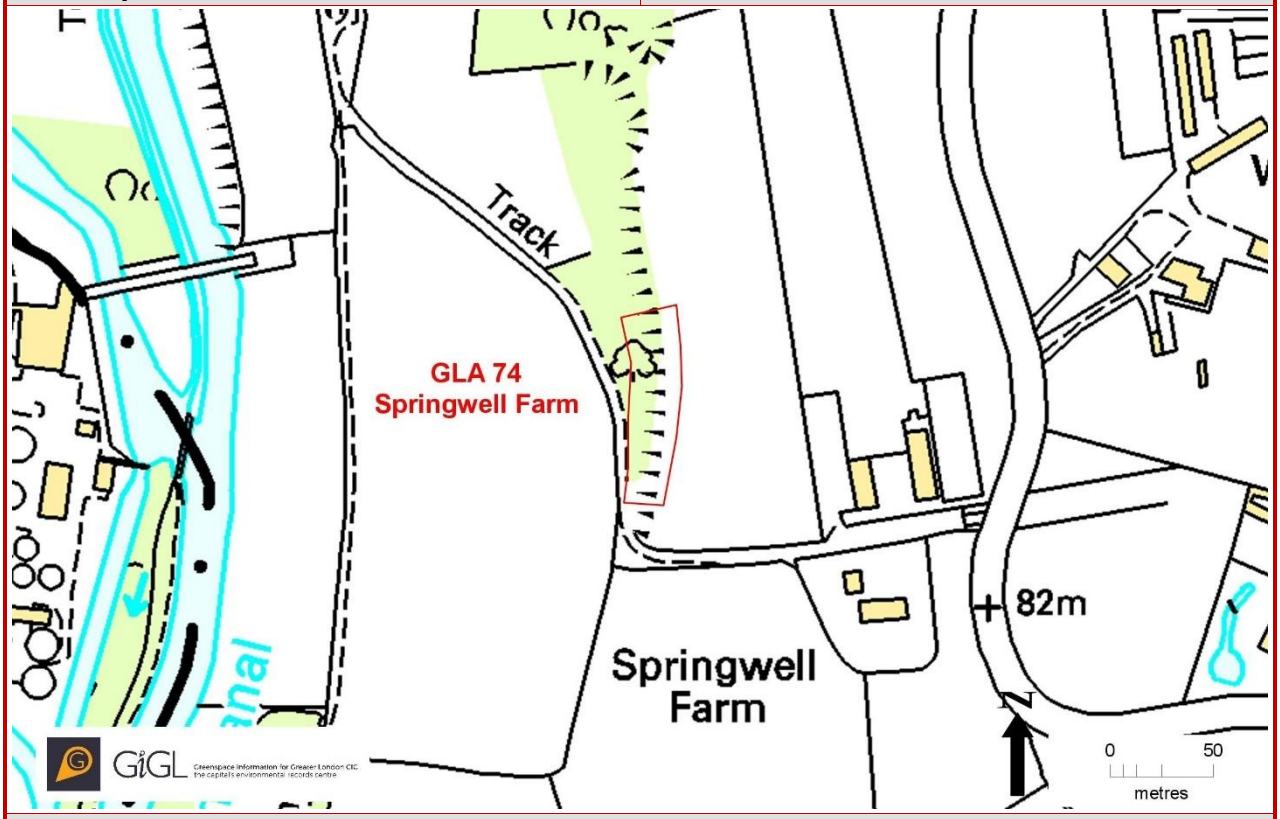


Indicating break of slope above parade ground

GLA 74 Springwell Farm

Grid Reference: TQ 0446 9223	Site Type: Small exposures in left and right banks on Hillingdon Trail
Site Area (hectares): 0.22	Current use: Public footpath U8
Site ownership: Hall family. Wood, Hall and Heward, a commercial barge hire company, operates from there.	Borough: London Borough of Hillingdon
Field surveyors: Di Clements, Allan Wheeler	Date: June 2018
Current geological designation: Recommended by Partnership as a LIGS	Other designation: Borough Grade I SINC (Springwell Pit Wood)

Site Map



Stratigraphy and Rock Types

Time Unit: Quaternary	Rock unit: Winter Hill Gravel (Anglian)
Rock Type:	Details: Gravel, variably clayey and sandy; some pebbles of quartz-arenite (origin – prob. Chester Formation of Sherwood Sandstone. Group, Triassic). The majority are flint.
Time Unit:	Rock Unit:
Rock Type:	Details:

Site Description

Small exposures of Anglian but pre-Thames diversion (see Bridgland (1994)), Winter Hill Gravel on bank to L and R of path (which is cut into a slope, formerly the side of a gravel pit). The exposures are c. 75m from the apex of the bend just walked. Situated on the Harefield side of the Colne Valley, the main face of the gravel pit was above the east of the path and the pit extended west part-way towards the Grand Union Canal. As the track descends, it crosses the underlying Lambeth Group and the Seaford Chalk Formation. The pit has been filled in but the upper part of the eastern side carrying the path remains, covered in by the vegetation.

Assessment of Site Value

Geodiversity topic: lithostratigraphy, mineralogy, geomorphology

Access and Safety		
Aspect	**Description**	
Safety of access	From south: Harefield village centre to Hill End Road. Roadside parking just before children's play equipment on L. Access by stretches of road and public footpath. Two sections lack footway.	
Safety of exposure	Can be seen from track on vegetated banks	
Permission to visit	None required (public footpath) but would be if excavated	
Current condition	Only small patchy exposures on surface under shrubbery and other vegetation	
Current conflicting activities	None known	
Restricting conditions	Access to decent exposure	
Nature of exposure	Only small patchy exposures on surface under shrubbery and other vegetation.	
Culture, Heritage & Economic		
Aspect	**Description**	Rating
Historic, archaeological & literary associations	Former gravel pit worked at least until 1960s; closed by mid-1980s, detailed on old maps	5
Aesthetic landscape	View across Colne valley	7
History of Earth Sciences	No records located	
Economic geology	Former gravel pits shown on OS maps	3
GeoScientific Merit		
Geomorphology	Located on eastern slopes of the Colne Valley. The Winter Hill Gravel blankets the top of valley side – no expression in landscape	1
Sedimentology	Winter Hill Gravel (exposures poor)	2-3
Palaeontology	None seen but literature not explored	0
Igneous/mineral/ Metamorphic Geology		
Structural Geology	Blankets top of valley side – no know structural features in the area.	
Lithostratigraphy	Winter Hill Gravel – pits on old maps at least until 1960. Ceased by 1989.	3-4
Potential use	As part of potential geotrail utilizing the Hillingdon Trail	
Fragility	Former gravel pit, backfilled; vegetated and degraded upper bank remaining on east side. Would benefit from trowelling and vegetation clearance; lower bank exposures more difficult to reach. They are more visible in winter and early spring.	
Current Site Value		
Community	On Hillingdon Trail	2
Education		
Geodiversity value		
Recommended by Partnership as a LIGS: Winter Hill Gravel is the last Thames gravel terrace aggradation before Anglian glaciation and resultant diversion of River Thames (age of deposit early Anglian). This is the best location found in the small area where it exists within GLA and should be represented		3-4

GLA 74 Springwell Farm

1 & 2: Upper bank, taken December 2013. 14cm pen for scale.

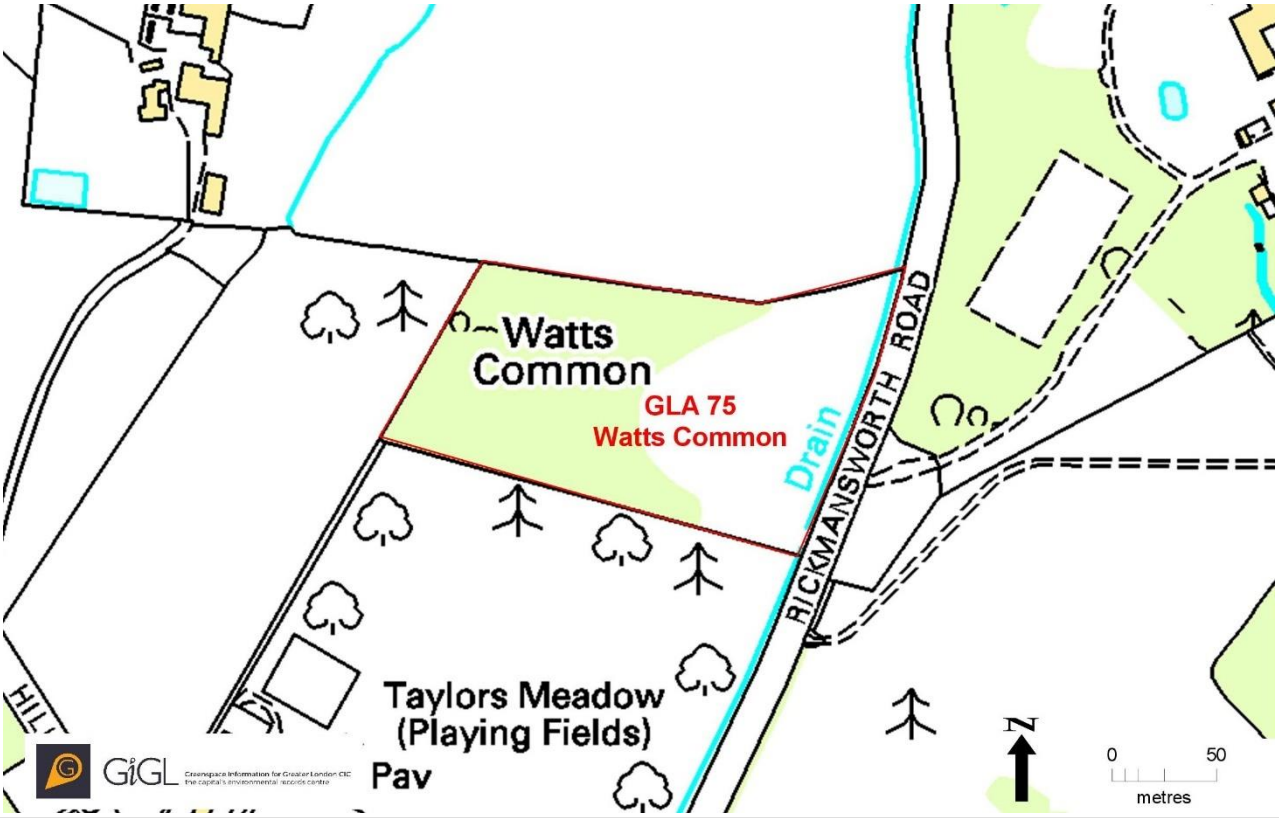
3. Looking uphill towards site from north (June 2018). Backfilled gravel pit at right. Exposures are near the top of the hill

4. Pebbles from lower bank arranged for photo (June 2018).Top two are 'quartzite' (quartz-arenite) pebbles and lower two are flint; 13cm pen for scale.

Photos: Allan Wheeler

GLA 75 Watt's Common

Grid Reference: TQ 0539 9147	Site Type: Small exposures and shallow pits
Site Area (hectares): 2.24	Current use: Public wood
Site ownership: London Borough of Hillingdon	Borough: London Borough of Hillingdon
Field surveyors: Di Clements, Allan Wheeler	Date: June 2018
Current geological designation: Recommended by Partnership as a LIGS	Other designation: Borough Grade II SINC (White Heath Farm and Harefield Grove)
Site Map	OS Topography © Crown Copyright



Stratigraphy and Rock Types

Time Unit: Pleistocene pre-Anglian	Rock unit: Gerrards Cross Gravel, Sudbury Formation (Cromerian – Anglian)
Rock Type:	Details: Ancestral Thames terrace deposit; Sand and gravel, locally with lenses of silt, clay or peat and organic material. [Generic description].

Site Description

Small surface exposures of Gerrards Cross Gravel (Pleistocene, pre-Anglian) in wood. Ancestral Thames terrace deposit. Shallow pits mainly in NW parts of wood. Banks can easily be scraped for more exposure. Standing water in a couple of pits in June implies that clays of the Lambeth Group are not far below the surface. A fallen tree provides the best exposure with a mixture of sand with silt/clay lenses and pockets of gravel.

Assessment of Site Value

Geodiversity topic: : lithostratigraphy, mineralogy, structural

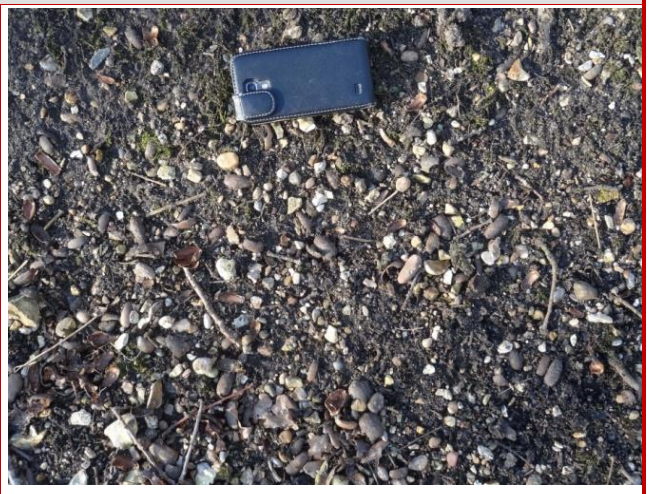
Access and Safety

Aspect	Description
Safety of access	Cross Rickmansworth Road (moderate traffic) & go through stymie gates opposite. Immediately turn R & follow path to kissing gate on to playing fields. Aim for point on far boundary (with woodland) 50m to R of far LH corner of field. Enter wood through gap in hedge. Nettle hazard within woodland in summer.
Safety of exposure	Nettle hazard in summer (as above). Uneven ground, can be slippery when wet. Small amount of brick and concrete dumped in one area.

Permission to visit	None	
Current condition	Condition of exposures in shallow pits would benefit from scraping.	
Current conflicting activities	None apparent	
Restricting conditions	Nettles made access more difficult in summer	
Nature of exposure	Exposures in sides of shallow pits	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	Best site for Gerrards Cross Gravel found in the neighbourhood of Harefield - other sites to west outside GLA. Best visited in winter/early spring as nettles abound in the summer. General description of Gerrards Cross Gravel in literature including: Strange, P J, 1992. A new nomenclature for the River Terrace Deposits of North London. British Geological Survey Technical Report, WA/92/52.	5
Aesthetic landscape	Small woodland surrounded by fields	5
History of Earth Sciences	unknown	
Economic geology	Former small gravel pits	3
GeoScientific Merit		
Geomorphology	Outcrop area is flat	
Sedimentology	Mainly flint, with some pebbles of quartz-arenite and vein-quartz	2
Palaeontology	No evidence found	0
Igneous/mineral/ Metamorphic Geology		
Structural Geology	Part of Pre-Anglian Thames sequence. Shallow pits in wood are evidence of small-scale digging	2
Lithostratigraphy	Gerrards Cross Gravel	3-4
Potential use	Multiple small exposures (preferably one or two scraped) could be included on a trail.	
Fragility	Overgrowth. Access to exposures hampered by tall nettles in the summer but the exposures themselves are reasonably clear of vegetation.	
Current Site Value		
Community		
Education	Moderate	
Geodiversity value		
Recommended by Partnership as a LIGS: Owing to rarity of Gerrards Cross Gravel in area even though the exposures are poor.		3-4

GLA 75 Watt's Common

1. Shallow pits



2. Gravel on rim of one of the pits (phone case 130mm long)

3. Fallen tree giving exposure of sand and pockets of gravel

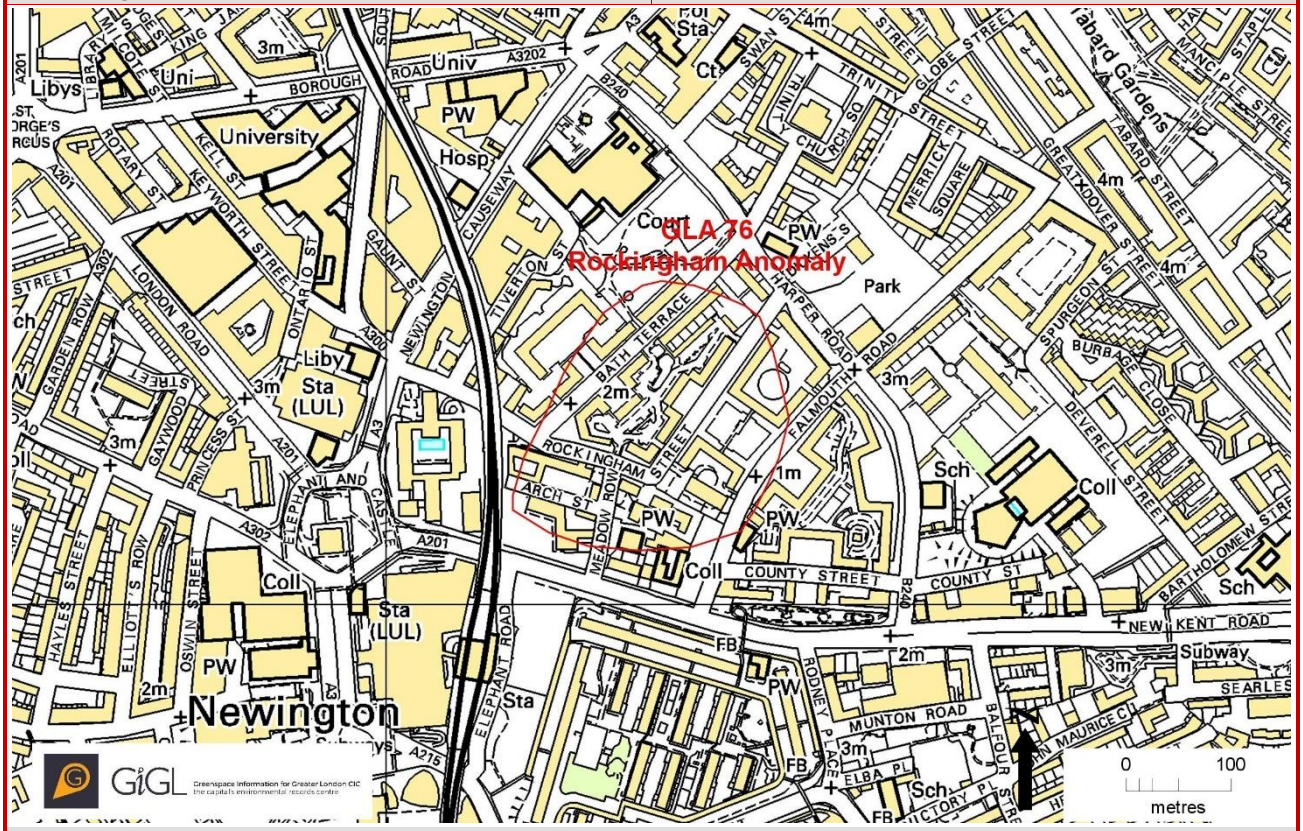
4. Part of (3) showing lenses/streaks of grey silt or sand (camera case 130mm long)

Photos: Allan Wheeler, February.2018

GLA 76 Rockingham Anomaly

Grid Reference TQ 3215 7915	Site Type: depression in an urban area
Site Area (hectares): 4.95	Current use: local authority housing estate
Site ownership: London Borough of Southwark	Borough: London Borough of Southwark
Field surveyors: Paul Rainey, Peter Collins, Laurie Baker, Di Clements, Gail Dickerson	Date: November 2017 (field auguring May 2017)
Current geological designation: Recommended by Partnership as a LIGS	Other designation: none

Site Map



Stratigraphy and Rock Types

Time Unit: Holocene	Rock unit: Peat
Rock Type: Peat	Details: accumulation of wet, dark brown, partially decomposed vegetation [generic description]
Time Unit: Devensian	Rock Unit: Kempton Park Gravel Member, Maidenhead Formation
Rock Type: Gravel	Details: Sand and gravel, locally with lenses of silt, clay *or peat* [generic description]
Time Unit: Eocene, Ypresian	Rock unit: London Clay Formation, Thames Group
Rock Type: clay	Details: bioturbated or poorly laminated, blue-grey or grey-brown, slightly calcareous, silty to very silty clay, clayey silt and sometimes silt, with some layers of sandy clay [generic description]

Site Description

The Rockingham Anomaly is visible on the surface as a roughly circular depressed area about 300m across due to significant surface subsidence. It is underlain by an accumulation of peat up to 5.5m deep. This is the upper part of the fill of a deep scour hollow, one of a number of similar hollows close to the Thames in central London. Whilst deposits of peat are common in the flood plain deposits bordering the middle and lower Thames in some places, associated with buried forests, there are few peat deposits inland. The hollow cuts through the Kempton Park gravel and into the London Clay. It is at least 15m deep.

In May 2017 LGP obtained permission to auger and extracted peat from about 2m depth, primarily for Gail Dickerson to use in her artworks. It has been dated between Late Neolithic to Middle Bronze Age (c.5,500 -

3,500 years before the present (BP), typical for London). It is thought to be the remains of an alder carr woodland. The presence of lime and elm pollen has been used to date it (see full details in report on LGP website). It is probable that the water came to the surface via a fault that may have penetrated the Lambeth Group sands beneath the London Clay feeding both the peat and osier wetlands. The area is now drained and the peat has compacted to give the 1.5m depression. The current housing estate was built in 1914 but there was earlier housing on the site, some of which was encountered on the auger.

Assessment of Site Value

Geodiversity topic: Rare occurrence of inland peat overlying disrupted Kempton Park Gravel and London Clay, overlying a drift filled (scour) hollow, (ascertained by borehole data, but not mixed up as usually found in most drift filled hollows). A fault appears to cross the area which may have been the cause of the hollow and disturbed sediments, as well as supplying a source of water for peat formation (see cross-section at end).

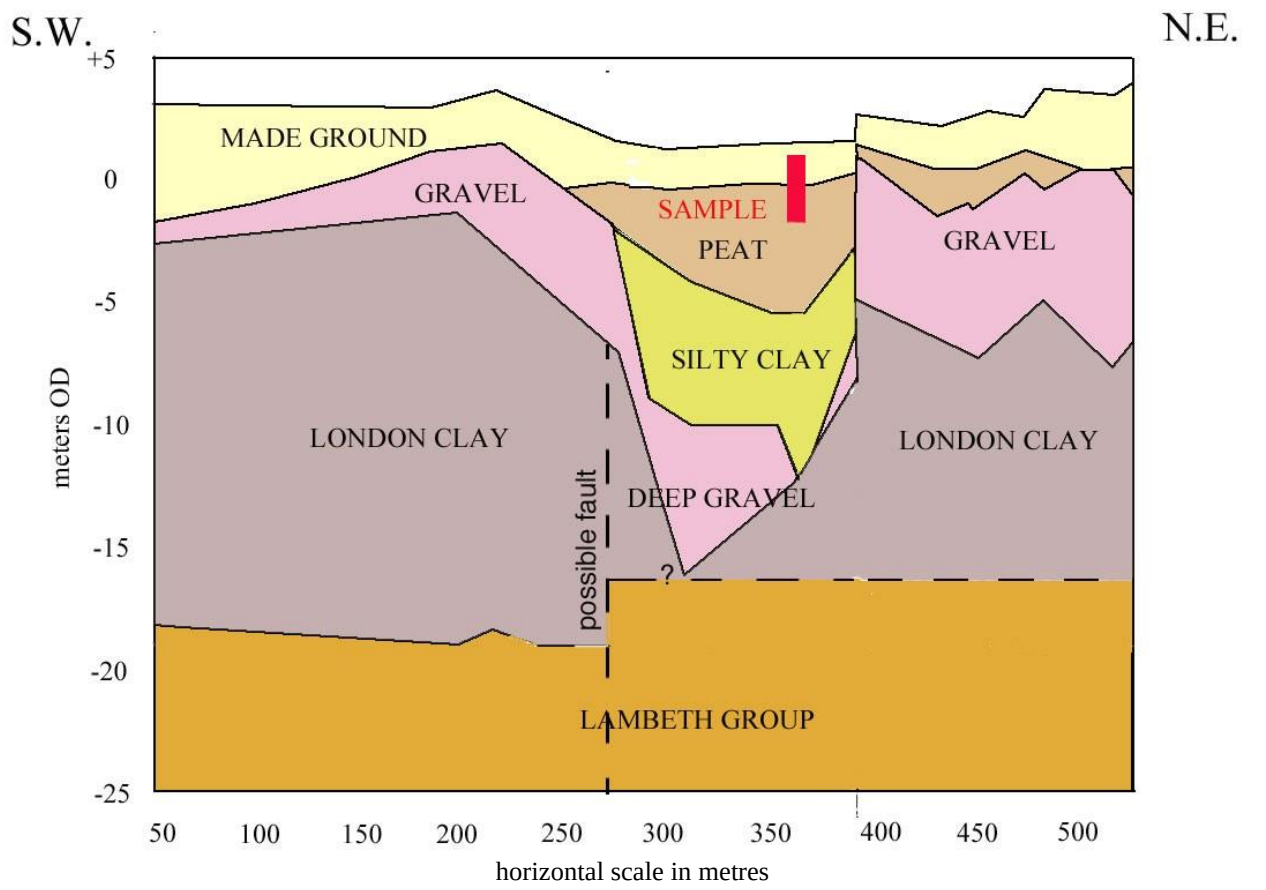
Access and Safety

Aspect	Description
Safety of access	The site is a short walk from Elephant & Castle. Parking is residents only but there are some public pay bays
Safety of exposure	A local authority housing estate is built over the site which lies in a depression c.1.5m deep.
Permission to visit	None required but permission was obtained from the local authority to auger
Current condition	buried
Current conflicting activities	N/A
Restricting conditions	Buried beneath housing estate
Nature of exposure	Previous wetland now drained so that peat has contracted and sunk

Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	‘Stewfen’ shown on 1861 map; 'Newhalfpenny Hatch' shown on John Fairburn's 1802, Map – a well-defined circular area in the location of the anomaly that may have been a riding school or circus, The underlying peat may have been particularly suitable for horse riding. five archaeological sites in the area (see detailed report on LGP website).	5
Aesthetic landscape	A 1960s housing estate	2
History of Earth Sciences	None recorded	
Economic geology	None recorded	
GeoScientific Merit		
Geomorphology	Depressed area in otherwise flat landscape – probably because of contraction of drained peat	3
Sedimentology	Rare occurrence of inland peat	4
Palaeontology	Pollen dates between 5,500-3,500 BP (common for London) dated on lime & elm. Seeds and insect remains well-preserved (see detailed report on LGP website)	4
Igneous/mineral/ Metamorphic Geology	N/A	
Structural Geology	Overlying a Drift Filled Hollow. A fault appears to cross the area.	3
Lithostratigraphy	Peat overlying Kempton Park Gravel overlying London Clay (borehole data shows considerable disruption)	4
Potential use	The anomaly is adjacent to a proposed route of anomalous ‘River Neckinger’ and spring from the fault in underlying scour hollow may have provided the water to feed the wetland (and possibly the so-called ‘river’, although this portion of the proposed route is more likely to have come from man-made drainage ditches in the area)	
Fragility	Seeds within the peat are well preserved and would be worthy of a complete auger through the 5.5 m of the deepest portion of the hollow if that were possible.	

Current Site Value		
Community	Peat obtained by the auger has already been used by Gail Dickerson in her artworks which were displayed locally in November 2018.	4
Education	The only geological site to be described in the LB of Southwark and is worth some acknowledgement locally (originally recommended as a site by LB Southwark)	3
Geodiversity value		
Recommended by Partnership as a LIGS: no exposure	Owing to rarity of inland peat even though there is	4
GLA 76 Rockingham Anomaly		

1. Dip down Meadows Road to the Rockingham Anomaly. Photo Diana Clements, 2017



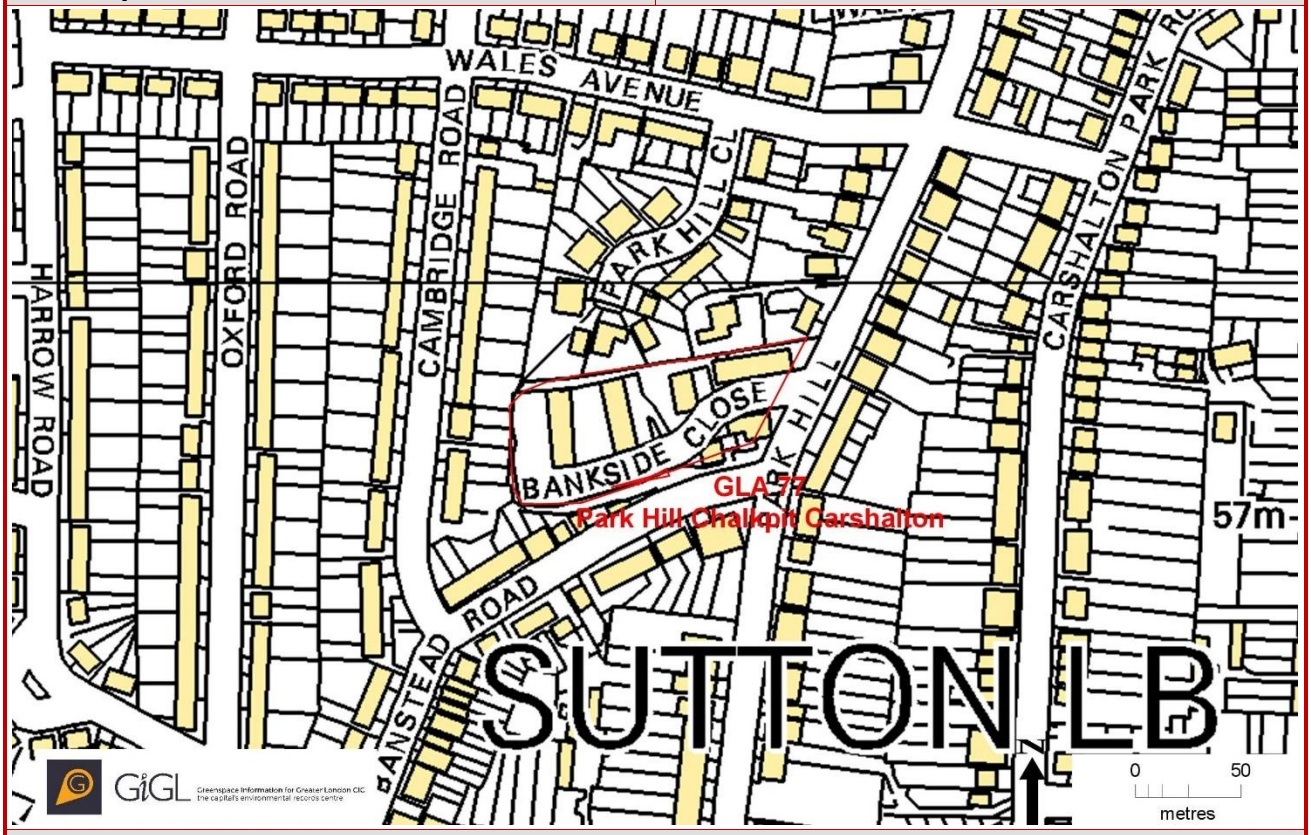
2. Section across the Rockingham Anomaly drawn by M. Hacker after P. Rainey

3. Rockingham Peat Artwork. Gail Dickerson 2017 www.ascstudios.co.uk/2018/02/core-sample

GLA 77 Park Hill Chalk Pit, Carshalton

Grid Reference: TQ 274 639	Site Type: Former Chalk Pit
Site Area (hectares): 0.66	Current use: Housing Estate
Site ownership: Bankside Close Freehold Company (BCFC), managed by HML Management of Croydon (HMLM).	Borough: London Borough of Sutton
Field surveyor: Diana Clements, Paul Rainey, Geoff West	Date: February 2018
Current geological designation: Recommended by Partnership as a LIGS	Other designation: none

Site Map



Stratigraphy and Rock Types

Time Unit: Late Cretaceous	Rock Unit: White Chalk Subgroup, probably Seaford Chalk Formation
Rock Type: Chalk	Details (Seaford Chalk): Firm white chalk with conspicuous semi-continuous nodular and tabular flint seams. Hardgrounds and thin marls are known from the lowest beds. Some flint nodules are large to very large.

Site Description

The south side of Carshalton is bounded by the chalk escarpment of the North Downs. The old Park Hill Chalk Pit has been chosen to represent the chalk in the area as the chalk face on the north side of the old quarry can still be seen at the back of the housing estate within Bankside Close. There were formally many chalk pits in the area working the chalk for lime to lay on the London Clay fields just to the north but most are filled in or completely overgrown. The chalk in this area is mapped on the London South map (1998) as 'Upper Chalk' and in more recent editions as 'Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation Undifferentiated, Chalk Group'. G.W Young 1905 in describing this pit states 'massive, well bedded chalk with many layers of nodular flints in regular courses, with one well-marked tabular flint. The Chalk is well weathered and fossils are scarce in the Zone of Micraster coranguinum'. This places it in the Seaford Chalk Formation as are most of the chalk exposures within Greater London. The prominent flint layers within the 22m cliff face are very apparent. Pit Cottage at the top and Pit House at the back are still standing – the house is constructed of knapped flint, presumably from the former pit.

Assessment of Site Value

Geodiversity topic: sedimentology;		
Access and Safety		
Aspect	**Description**	
Safety of access	There is public parking is on the road called Bankside Close (the same name as the estate) but not in the residents' parking areas; it leads down into the former pit from the B278, Parkhill Road. It is a Public Highway only as far as the turnaround. The chalk cliff face is best exposed on the north side of the old pit with access to the northern portion through the car park. Access to the southern face involves going through the private open space between the two rows of housing. There is a sign saying 'Cliff face keep away'	
Safety of exposure	There is a danger that the face could easily become vegetated (Ivy and buddleia are already beginning to take hold) – it will be up to the residents to keep it clear	
Permission to visit	In 2018, the spokesperson for the estate lived in No. 4, otherwise, this is private land so permission should be sought from BCFC (see above)	
Current condition	Good clean face but danger of quickly becoming vegetated.	
Current conflicting activities	Private residential estate	
Restricting conditions	Looking at the face by individuals should not be a problem but groups may not be welcome. Material must not be extracted as this is not allowed but there are fallen blocks.	
Nature of exposure	North face of former chalk pit	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	Old maps show 'Old Chalk Pit' from 1868. Sale documents in archives 1861	5
Aesthetic landscape	Interesting feature within the housing estate	5
History of Earth Sciences	unknown	
Economic geology	Presumably the chalk from the pit was used commercially, napped flint is still in evidence in the adjacent Pit House. London Bo. of Sutton Archives Ref: 48/4/37 show that the area including the houses was put up for auction in 1861. Presumably chalk extraction had ceased by then. The auction notices specify 'fine spring water'.	4
GeoScientific Merit		
Geomorphology	Adjacent to the prominent Dry Valley through Carshalton Beeches	3
Sedimentology	Seaford Chalk Formation	3
Palaeontology	None recorded	0
Igneous/mineral/ Metamorphic Geology	N/A	0
Structural Geology	Carshalton lies on the dip slope of the chalk close to the northern edge of the North Downs, partly on the Chalk, partly on the Thanet Sand. It is featured in the cross-section on 1:50,000 South London Map (270)	3
Lithostratigraphy	Upper Chalk exposure in old quarry face with prominent flints	4
Potential use	Should a trail down the dry valley be contemplated then the pit is just to the northeast of Carshalton Beeches and worth a diversion.	
Fragility	natural overgrowing but the residents were maintaining in 2018	
Current Site Value		
Community	Within housing estate	4
Education	Possible local use in terms of the whole area on the north face of the north downs. Class visits might be problematic	4
Geodiversity value		
Recommended by Partnership as a LIGS: The Chalk Pit is considered worthy of local importance (LIGS) as in 2018 the quarry side was clean and not overgrown. In order to		4

remain as a worthy site it would be necessary to get the assistance of the residents in maintaining the face

GLA 77 Park Hill Chalk Pit, Carshalton

February 2018

February 2018

December 2018

Photos: Geoff West

GLA 78 Wimbledon Common

Grid Reference: TQ 2301 7245 (for Windmill)	Site Type: Gravel plateau with bedrock geology exposed in places
Site Area (hectares): 206.82	Current use: Recreational
Site ownership: Wimbledon and Putney Commons Conservators	Borough: London Boroughs of Merton and Wandsworth
Field surveyors: Diana Clements, Allan Wheeler, Laurie Baker, Paul Rainey	Date: July 2019
Current geological designation: Recommended by Partnership as a LIGS	Other designation: Biological SSSI (part) ; SAC (UK0030301); Metropolitan SINC (Wimbledon Common and Putney Heath)

Site Map

Stratigraphy and Rock Types

Time Unit: Pleistocene	Rock unit: Black Park Gravel Member, Thames Valley Formation (oldest deposit assigned to post-Anglian diversion of River Thames).
Rock Type: Sand and gravel	Sand and gravel, mostly angular flint, some rounded with minor vein quartz and quartzite.
Time unit: Eocene	Rock unit: Bagshot Sand Formation, Bracklesham Group
Rock type: sand	Variable sands often iron-rich, deposited near shore (current bedding)
Time unit: Eocene	Rock unit: Claygate Member of London Clay Fm Thames Group
Rock type: sandy clay, clayey sand and silt	Details: Clay, silt and fine-grained sand deposited in shallow seas.
Time Unit: Eocene	Rock Unit: London Clay Formation Thames Group
Rock Type: Clay	Details: Grey clay that weathers brown, sandy at top. Five cycles of marine transgression

Site Description

The geology of Wimbledon Common is similar to that of adjoining Putney Heath, and nearby Richmond Park and Kingston Hill which are separated from the Common by the Beverley Brook, a south bank tributary of the Thames. There are four main lithologies. London Clay lies at the base, passing up into the sandier Claygate Member (both Thames Group). In a small area in the southern part of the common, the Claygate Member is

succeeded by the Bagshot Formation (Bracklesham Group). This is the only exposure known in South London. All are Paleogene (Eocene) in age. The highest ground, which forms a flat plateau, is covered by the Quaternary Black Park Gravel Member of the Thames Valley Formation. This Member is the oldest of the post-diversion Thames gravels, deposited as the Anglian ice sheet began to retreat (c.450,000 years ago). They are thus the oldest deposits of the Thames in its present course through Greater London. On the lower slopes towards the Beverley Brook are lobes of gravel mapped by BGS as 'undifferentiated' and several valleys descending to the Beverley Brook contain Head. Alluvium occurs in the Beverley Brook valley.

Drakeford A. & Sutcliffe U. (Eds) 2000. *Wimbledon Common & Putney Heath. A Natural History.* Wimbledon and Putney Commons Conservators.

Grist C.I., 1917. Excursion to Richmond Park, Kingston Hill and Wimbledon Common, May 19th, 1917. *Proc. Geol. Assoc. Vol. 28 Part 2*

Monckton, H.W., 1900. Excursion to Wimbledon and Kingston, Sat. April 28th, 1900. *Proc. Geol. Assoc. Vol 16: 443-445*

Assessment of Site Value

Geodiversity topic: lithostratigraphy, geomorphology

Access and Safety

Aspect	Description
Safety of access	From bus stops on Wimbledon Park Side (A219). Car park near the Windmill (access road from A219). Café, toilets. Network of paths, and bridleways which also carry cycle traffic. Golf course on part of common with need to watch out for players.
Safety of exposures	Exposures safe to access with some off-track but still reasonably accessible. Safety of exposures themselves is good; some slopes.
Permission to visit	Open access,
Current condition	Variable. Scattered small exposures of gravel. Pits degraded; one gravel pit flooded though more gravel is exposed after a dry spell. Bagshot Sand in horse training circuit.
Current conflicting activities	Golf course on part of common.
Restricting conditions	Lack of decent exposure except in horse training circuit.
Nature of exposures	Mainly gravel is visible on the ground and in banks; Clay/sandy clay exposures are degraded to varying degrees.

Culture, Heritage & Economic

Aspect	Description	Rating
Historic, archaeological & literary associations	Limited archaeological fieldwork; stray finds (*Archaeology of Greater London, MOLA 2000*). Iron Age fort. Wimbledon Society for literary associations.	8
Aesthetic landscape	Largest area of heathland in Greater London. High quality habitats associated with acidic soils include both wet and dry heath; one of London's very few valley bogs; extensive areas of acid grassland, woodland and scrub; several ponds and a section of the Beverley Brook. Views across the Beverley Brook valley to Kingston Hill and Richmond Park from western side.	8
History of Earth Sciences	Geologists' Association field trips in 1900 (*Whitaker, 1889*), 1917 (*Grist, 1917*) and 2017.	8
Economic geology	Former brickmaking and gravel extraction shown on OS maps	6
GeoScientific Merit		
Geomorphology	Relationship of geology to topography; comparisons with Putney Heath (GLA25) which adjoins at the Common's northern boundary, and with nearby Richmond Park (GLA 70) and Kingston Hill.	6
Sedimentology	Depositional environment of sediments.	5
Palaeontology	Fossils from the London Clay have been found in past temporary commercial excavations for building works (*Ellison, 2004, pp 47-50*).	4

	A number of flint fossils from the gravels have been deposited in the Wimbledon Museum.	
Igneous/mineral/ Metamorphic Geology	None except for mineral content of sediments.	2
Structural Geology	No known structures within the common but the NE-SW Wimbledon Fault cutting Paleogene strata lies beyond the southern boundary (*Drakeford & Sutcliffe, 2000*).	3
Lithostratigraphy	Encompasses four separate rock units. The Bagshot Sand has not been encountered in the adjoining areas and is the only exposure located in south London. Relationship of gravels with bedrock.	6
Potential use	Research; school and higher education, geotrail.	
Fragility	Overgrowth.	
Current Site Value		
Community	Valuable open space used daily	10
Education	Potential for Geotrail to include adjacent Putney Heath	7
Geodiversity value		
Recommended by Partnership as a LIGS: Black Park Gravel Member (oldest post-diversion Thames terrace) resting on London Clay Formation., Claygate Member & Bagshot Sand Formation. Springs, and ponds. It is the only southwest London location to include Bagshot Sand.		5
GLA 78 Wimbledon Common		

Wimbledon Common boundary stone and windmill

Former Bluegate Gravel Pit in the Black Park Gravel

Spring near Caesar's Well, flowing towards Beverley Brook

Bagshot Sand Formation in base of Horse Exercise Ring

Photos: Allan Wheeler, July 2019

GLA 79 Buckthorne Cutting

Grid Reference: TQ 362 746 (site access)	Site Type: Visible *in situ* septarian nodules in London Clay revealed whilst conserving
Site Area (hectares): 3.8	Current use: railway cutting; north section is an LNR
Site ownership: Network Rail (north half), property developer AA Homes and Housing (south half). Managed by Buckthorne Cutting Nature Reserve.	Borough: London Borough of Lewisham
Field surveyors: Diana Clements, Laurie Baker	Date: December 2020
Current geological designation: Recommended by Partnership as a LIGS	Other designation: LNR; Metropolitan SINC (Forest Hill to New Cross Cutting)

Site Map

OS Topography © Crown Copyright

Stratigraphy and Rock Types

Time Unit: Eocene	Rock Unit: London Clay Formation, Thames Group
Rock Type: Clay, silt, sand	Details: Fine, silty clay/ clayey silt, clay with occasional horizons of 'clay balls' known as septarian nodules or calcareous concretions.

Site Description

This section of the New Cross to Brighton line was opened in 1839 as the London and Croydon Railway. At Eddystone Road the railway is in a deep cutting into the London Clay. Further north at the New Cross Gate (Brockley) Nature Reserve there was a famous landslide in 1841, two years after the railway opened (SGI 17). At this point the railway follows the same route as the earlier Croydon Canal of which there is an 1805 description of a line of septarian nodules. Thes were rediscovered whilst cutting a path through the recently-designated Buckthorne Cutting Nature Reserve, and also observed in the cutting on the south side of Eddystone Road. Permanently exposed septaria in London are rare and the site provides opportunities for research and education both of the septaria and the London Clay itself.

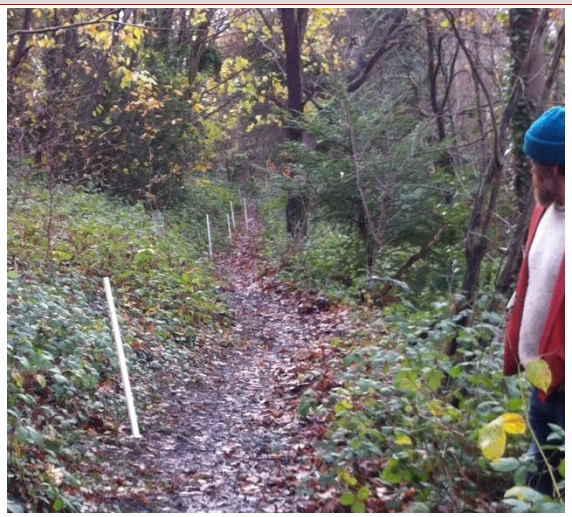
The ground elevation at the top of the cutting is c.40 m OD and was cut exactly beneath the old canal cutting for which we have a description. The canal cutting itself was 20 feet (6 m) below the top. The railway was dug down a further 50 feet (c.15 m) so that the cutting is 70 feet (c.21 m) at this point. We hope that more septaria can be exposed along at least one horizontal line. On the south side of the bridge fragments of septaria are evident along the horizontal path and were marked by white poles when visited. The *in situ*

septaria must be just above the path at those locations and excavation for them will be carried out. Reeds at the top of the embankment are rather enigmatic and do not seem to relate to a spring line, although small gullies in the hillside may prove to come from a line of septaria (see location map of septaria below).		
Assessment of Site Value		
Geodiversity topic: lithostratigraphy, mineralogy		
Access and Safety		
Aspect	**Description**	
Safety of access	The locked gate to the Nature Reserve is situated off Eddystone Road footbridge, Eddystone Road, Brockley, London SE4 2DB	
Safety of exposure	Slippage along a steep railway embankment; potential development on south half of the cutting; exposures become overgrown	
Permission to visit	Contact the Buckthorne Cutting Nature Reserve, www.fourthreserve.org.uk for access. Open days are held periodically.	
Current condition	Most occurrences are not *in situ* but some are and further excavation in their proximity will increase exposure, particularly adjacent to the path on the south side of the cutting.	
Current conflicting activities	Potential development on the south side	
Restricting conditions	Vegetation, slope stability, particularly if a section of London Clay was to be cut.	
Nature of exposure	Mostly uncovered fragments while creating a path and platform through the north half of the cutting; fallen fragments along the older path on the south side.	
Culture, Heritage & Economic		
Aspect	**Description**	**Rating**
Historic, archaeological & literary associations	Former site of Croydon Canal: description of the septaria in 1805 by David Hughson who wrote of the soil along the canal route, describing shells and clay nodules along the Buckthorne Cutting in Brockley Green (see text copied below)	9
Aesthetic landscape	Good view of frequent trains passing on the railway below. Apart from the noise of the trains, a quiet haven in an urban environment, well maintained.	5
History of Earth Sciences	Geological descriptions of the floor of the cutting closer to New Cross and of the former Croydon Canal cutting (see above)	9
Economic geology	Bricks were made locally from the London Clay dug from the cutting. There are descriptions and maps showing sites and over-burnt bricks are included in local garden walls	6
GeoScientific Merit		
Geomorphology		
Sedimentology	Septarian nodules within London Clay – a rare permanent exposure in London	3-4
Palaeontology	None found so far	0
Igneous/mineral/ Metamorphic Geology	NA	
Structural Geology		
Lithostratigraphy	Old descriptions along the canal/railway cutting	3-4
Potential use	Geological interest within existing Nature Reserve	
Fragility	Slippage along a steep railway embankment; potential development on south half of the cutting; exposures become overgrown	
Current Site Value		
Community	Nature reserve in urban environment	6
Education	Potential for leaflet explaining the geology and extending to north/south along the railway exposing older lithology	6

Geodiversity value	
Recommended by Partnership as a LIGS for the Septarian nodules (more excavation is required with photographs).	3-4

GLA 79 Buckthorne Cutting

People are standing at the entrance gate in Eddystone Road



The white poles mark the row of septaria fragments on the south side of the cutting

Exposure of *in situ* septaria beside the path

A loose septarian nodule

London Clay exposure: 'blue' (deep), beside pale (surface weathered)

1805 quotation re-septaria from "*London; being an accurate history and description of the British Metropolis and its Neighbourhood, to Thirty Miles Extent, from an actual perambulation*", David Hughson (pen name of Edward Pugh), LL.D. Vol 2 1805. Link to whole book: https://tinyurl.com/c4wb7mt8

On page 81-82: *The ground begins to rise up towards Brockley Green, and the first thing observable is the newly cut banks, is a very curious stratum, of a yard thick, or more, consisting entirely of small bivalve shells, and long slender screw shells:…In ascending the hill, it appears that a stratum of reddish coarse sand, of several feet thick, crops out above these shells; then a clay of considerable thickness is seen and then a slight spring of mineral water, very highly charged with iron, as appears by its ochre deposit*; *this was apprehended to proceed from a layer of* ***ludus helmantii****;...there is a thick stratum of yellow loamy clay, or brick earth. This thick stratum of yellow clay is succeeded by two layers, one about a yard above the other, of large and curious* ***ludus helmantii****, or clay ball, very compact, containing but few* ***septana****, and those mostly close filled with wax-coloured spar; but, on the sides of some of these sparry joints, but partly filled, pointed and small crystals were so thickly and uniformly set all over the surface, as to give the appearance of a rich piece of velvet.*

This 1805 description is along the old Croydon Canal cutting that pre-dated the railway cutting, which utilised the same cutting at this point, although at a higher level.

The description relates to Brockley Green, which would have been right here on Buckthorne Road SE4 2DG - grid reference TQ 36366 74424. A little further north, the Lambeth Group is shown on the BGS map at the base of the cutting and in the quote above, the Woolwich Shell bed (top Lambeth Group in this area) is described by its contained shells. Above that the 'stratum of reddish coarse sand' probably relates to the basal Thames Group, Harwich Formation, beneath the London Clay. 'Reddish coarse sand' is not typical of

the Blackheath beds but that does not rule it out.

We now call the ‘ludus helmantii’ septarian nodules and this is the main focus for this site.

Location map of finds either side of Eddystone Road.
Note that the Buckthorne Cutting Nature Reserve is restricted to the north side of Eddystone Road.

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Epping Forest Management Strategy and Business Plan for 2020-2023 can be seen at: https://www.cityoflondon.gov.uk/assets/Green-Spaces/epping-forest-management-plan.pdf

London Geodiversity Partnership Geotrails

Bus Pass Geology 1, *Round the southern limits of the Anglian Ice Sheet.* www.londongeopartnership.org.uk/geotrails/#buspass
Green Chain Walk audio www.londongeopartnership.org.uk/geotrails/#greenchain
Green Chain Walk Geotrail www.londongeopartnership.org.uk/geotrails/#greenchain
Greenwich Park Geotrail www.londongeopartnership.org.uk/geotrails/#greenwich
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