
European Centre for Medium-Range Weather Forecasts (ECMWF)

Planning Condition Report 18 - Drainage

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	Name	Position	Date
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Planning Condition 18 – Drainage

It is noted that the following planning condition is to be met before development can take place:

“No development shall take place until full details of the drainage system for the site have been submitted to and approved in writing by the Local Planning Authority. The details shall include:

- 1. Calculations indicating the Greenfield runoff rate from the site.*
- 2. BRE 365 test results demonstrating whether infiltration is achievable or not.*
- 3. Use of SuDS following the SuDS hierarchy, preferably infiltration.*
- 4. Full calculations demonstrating the capacity of attenuation features to cater for 1 in 100-year flood event with a 40% allowance for climate change and runoff controlled at Greenfield rates, or preferably better.*
- 5. As connection to an existing surface water sewer is proposed, we need to see confirmation from the utilities supplier that their system has got capacity, and the connection is acceptable.*
- 6. Separate drainage systems for any proposed adopted highways and residential dwellings.*
- 7. A drainage strategy plan indicating the location and sizing of SuDS features.*
- 8. Details demonstrating how any SuDS for this development would be managed throughout the lifespan of the development and who will be responsible for maintenance.*

The approved scheme shall be implemented prior to the first occupation of the development and shall be maintained in the approved form for as long as the development remains on the site.”

Response

We have met the condition as follows:

1. Calculations indicating the Greenfield runoff rate can be found in Appendix A. The table below summarises the results:

Greenfield Runoff Rates	
Qbar	6.62 l/sec
1 in 1 Year	5.62 l/sec
1 in 30 Years	15.22 l/sec
1 in 100 Years	21.1 l/sec

2. A Geotechnical report received from Mace, reference “ECMWF-CGL-XX-WS-RP-L-000002”, outlines that whilst infiltration is achievable, the groundwater level on site was found to be too high for infiltration to be a method for discharge, as there is less than 1m freeboard from the groundwater level to the base of the proposed tanks. A copy of the Geotechnical report can be found in Appendix B.
3. As per the previous point, infiltration was not deemed plausible for the site. However, many other SuDS features have been incorporated within the drainage system, such as lined open water features and permeable paving. Please refer to the Drainage Hierarchy table below for an outline of the surface water disposal routes and their suitability for the proposed site:

Drainage Hierarchy		Explanatory note
1	Rainwater use as resource	Rainwater harvesting (RWH) is proposed. Grey water reuse is proposed.
2	Rainwater infiltration to ground	Limited opportunities due to high groundwater table and poor infiltration rates. Green infrastructure components (wetlands, swales, and raingardens) are proposed across the site but these will be lined with an impermeable geomembrane and discharge into the surface water network.
3	Rainwater attenuation in green infrastructure features for gradual release	Wetlands, swales, raingardens, and below ground cellular storage will be utilised across the site for attenuation. The utilisation of tanked permeable paving is proposed within the car park.
4	Rainwater discharge direct to a watercourse	Surface water runoff is collected and discharged to new wetlands / swales, where appropriate. Surface water runoff is indirectly discharged to Whiteknights Lake.
5	Controlled rainwater discharge to a surface water sewer or drain	Separate surface water drainage networks are proposed for surface water runoff with restricted / controlled discharge rates, except for the access roads which will be drained as per the existing arrangement.
6	Controlled rainwater discharge to a combined sewer	Existing access road located north-west of the site is drains to an existing surface water sewer. This existing arrangement is to be retained.

4. Surface water drainage modelling calculations are found in Appendix C. These demonstrate that the below ground drainage system has been designed to cater for all storm events up to and including the 1 in 100 year + 40% climate change event. For the proposed drainage network for the building and eastern access road, refer to the MicroDrainage calculations in Appendix C. For the proposed drainage network for the car park and hardstanding area, refer to InfoDrainage calculations in Appendix C.
5. Surface water flows from the site will be collected via the proposed drainage network and discharge into the existing private University of Reading (UoR) owned drainage system. Total discharge from the proposed site will be limited to 7.2l/s for all rainfall events. For the 1 in 100 year + 40%CC event, this represents a betterment of 98.5% from the existing pre-development runoff rates for the same event. Therefore, flows entering the existing drainage system are reduced significantly from pre-development flowrates. There have also been no reported capacity issues within the existing system.

Foul water flows from the site will discharge indirectly to a Thames Water foul water sewer, via University of Reading private drainage. The CCTV drainage survey and/or dye testing will be used to gain Section 106 approval from Thames Water. A predevelopment enquiry has been submitted to Thames Water and Thames Water has confirmed capacity in the existing system to receive the additional foul flows from the proposed development. Refer to Appendix D for Thames Water correspondence.

6. As the site consists of only privately owned roads, a combined system has been selected for this development. Oil interceptors have also been incorporated in this development as it is a combined system.
7. The following SuDS features have been incorporated in the design:
 - Rainwater harvesting
 - Grey water reuse in buildings
 - Attenuation tanks
 - Permeable Paving
 - Open water features (swales and wetlands)

- Tree pits for attenuation

An updated Drainage Layout has been included in Appendix E visualising the above SuDS features including their respective sizes and locations.

- All SuDS components within the redline boundary of the ECMWF site will be privately owned by the University of Reading. The tenant/occupier will maintain drainage systems within the redline boundary of the ECMWF site and outside of the redline it will be the responsibility of the existing land owner UoR. The landlord has been involved in the development of the design and this strategy is aligned with a wider agreement for how the site is managed.

Refer to the following tables for the management and operation of SuDS components proposed for the development, based on the guidance from C753: The SuDS Manual:

Operation and Maintenance Requirements for Attenuation Storage Tanks		
Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface or filter for blockage by sediment, algae, or other matter; remove and replace surface infiltration medium as necessary.	Annually
	Remove sediment from pre- treatment structures and/or internal forebays	Annually, or as required
Remedial Actions	Repair/rehabilitate inlets, outlet, overflows, and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents, and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years as required

Operation and Maintenance Requirements for Rainwater Harvesting Systems		
Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspection of the tank for debris and sediment buildup, inlets/outlets/withdrawal devices, overflow areas, pumps, filters	Annually (and following poor performance)
	Cleaning of tank, inlets, outlets, gutters, withdrawal devices and roof drain filters of silts and other debris	Annually (and following poor performance)
Occasional Maintenance	Cleaning and/or replacement of any filters	Three monthly (or as required)
Remedial Actions	Repair of overflow erosion damage or damage to tank	As required
	Pump repairs	As required

Operation and Maintenance Requirements for Permeable Pavements

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional Maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Repair of overflow erosion damage or damage to tank	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48 h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Operation and Maintenance Requirements for Ponds and Wetlands		
Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove litter, debris and trash	Monthly (or as required)
	Cut grass – for landscape areas	Monthly (during growing season) or as required
	Cut grass – meadow grass	Half yearly: spring (before nesting season) and autumn
	Inspect marginal bankside vegetation and remove nuisance plants (for first 3 years)	Monthly (at start, then as required)
	Inspect inlets, outlets, banksides, structures, pipework, etc for evidence of blockages and/or physical damage	Monthly
	Inspect water body for signs of poor water quality	Monthly (May – October)
	Inspect silt accumulation rates in any forebay and in the main body of the pond and establish appropriate removal frequencies; undertake contamination testing once some build-up has occurred, to inform management and disposal options	Half yearly

	Check any mechanical devices i.e. penstocks	Half yearly
	Hand cut submerged and emergent aquatic plants 9at minimum of 0.1m above pond base; include max 25% of pond surface)	Annually
	Tidy all dead growth (scrub clearance) before start of growing season (Note: tree maintenance is usually part of overall landscape management contract)	Annually
	Remove sediment from any forebay	Every 1- 5 years, or as required
	Remove sediment and planting from one quadrant of the main body of ponds without sediment forebays	Every 5 years, or as required
Occasional Maintenance	Remove sediment and planting from one quadrant of the main body of big ponds when volume is reduced by 20%	With effective pre-treatment, this will only be required rarely, e.g. every 25-50 years
Remedial Actions	Repair of erosion or other damage	As required
	Replant, where necessary	As required
	Aerate pond when signs of eutrophication are detected	As required
	Realign rip-rap or repair other damage	As required
	Repair / rehabilitate inlets, outlets, and overflows.	As required

Operation and Maintenance Requirements for Swales		
Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove litter, debris and trash	Monthly (or as required)
	Cut grass – to retain height within specified design range	Monthly (during growing season) or as required
	Manage other vegetations and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets, and overflows for blockages and clear if required	Monthly
	Inspect infiltration surfaces for ponding, compaction, silt accumulation, record area where water is ponding for > 48 hours	Monthly, or when required
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half yearly

Occasional Maintenance	Reseed areas of poor vegetation growth, alter plant types to suit better conditions, if required	As required, or if bare soil is exposed over 10% or more of the swale treatment area
Remedial Actions	Repair erosion or other damage by returfing or reseed	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up soil deposits and prevent compaction of the soil surface	As required
	Remove build-up of sediment on upstream gravel trench, flow spreader, or at top of filter strip	As required
	Remove and dispose of oils or petrol residues using safe standard practices	

Operation and Maintenance Requirements for Drainage Pipes		
Maintenance Schedule	Maintenance Schedule	Maintenance Schedule
Regular Maintenance	Remove sediment and debris from inspection chambers and flow control chambers	Annually
	Cleaning of gutters and any filters on downpipes	Annually
	Remove any root ingress	As required
Occasional Maintenance	CCTV survey of drains to check alignment, cracking and joint displacement	10 year intervals

Appendix A – Greenfield Runoff Rate Estimate

Calculated by:	Jonathan Suenson-Taylor
Site name:	ECMWF
Site location:	Reading

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	51.43934° N
Longitude:	0.935° W
Reference:	1904718923
Date:	Jun 27 2024 12:16

Runoff estimation approach

FEH Statistical

Site characteristics

Total site area (ha):	1.8
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Methodology

Q _{MED} estimation method:	Calculate from BFI and SAAR
BFI and SPR method:	Calculate from dominant HOST
HOST class:	22
BFI / BFI _{HOST} :	0.374
Q _{MED} (l/s):	5.82
Q _{BAR} / Q _{MED} factor:	1.14

Hydrological characteristics

	Default	Edited
SAAR (mm):	642	642
Hydrological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

(1) Is $Q_{BAR} < 2.0$ l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is $SPR/SPR_{HOST} \leq 0.3$?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

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so Greenfield runoff rates

Default

Edited

Q_{BAR} (l/s):	6.62	6.62
1 in 1 year (l/s):	5.62	5.62
1 in 30 years (l/s):	15.22	15.22
1 in 100 year (l/s):	21.1	21.1
1 in 200 years (l/s):	24.74	24.74

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

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Appendix B – SI Results

Document Submittal Form

Mace Project:
Project Number:

ECMWF
39958

Document Ref: ECMWF-CGL-XX-WS-RP-L-000002

Revision: P01

Status: S2

Company Name: Card Geotechnics Limited - CGL

Title: Geotechnical Factual & Interpretive Report - Additional infiltration and site testing
(March 2024)

Classification: *(Select applicable classification)*

Revision History:

REV.	DATE	DESCRIPTION
P01	12/03/24	CGL Report

Template number:
Rev:





**GEOTECHNICAL &
GEOENVIRONMENTAL CONSULTANCY**

A PHENNA GROUP COMPANY

ECMWF-CGL-XX-WS-RP-L-000002 P01 S2

Official

Mace Construct Limited

ECMWF – New Headquarters, Reading

*Geotechnical Factual and
Interpretive Report*

Additional infiltration and site testing

Revision P01

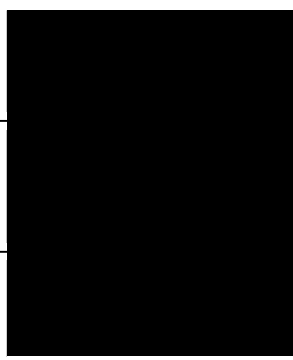
*Ref: ECMWF-CGL-XX-WS-RP-L-
000002*

March, 2024

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CONTENTS

1.	INTRODUCTION	3
2.	SITE LOCATION AND DESCRIPTION	4
2.1	Site Location	4
2.2	Site Description	4
2.3	Proposed Development	5
3.	DESK STUDY REVIEW	6
3.1	Site History	6
3.2	Anticipated Ground Conditions	6
4.	PREVIOUS GROUND INVESTIGATION	10
4.1	Atkins Investigation, dated October and November 2022	10
5.	SUPPLEMENTARY CGL GROUND INVESTIGATION	11
5.1	Site Investigation	11
5.2	Testing Rationale	11
5.3	Ground Conditions	12
5.4	Made Ground	13
5.5	Boyn Hill Member	13
5.6	Groundwater	13
6.	GEOTECHNICAL INTERPRETATION & RECOMMENDATIONS	15
6.1	General	15
6.2	Soakaway Testing	15
6.3	CBR Testing	16

APPENDICES

Appendix A	Exploratory Hole Records
Appendix B	Trial Pit logs
Appendix C	Infiltration testing results
Appendix D	CBR testing results

1. INTRODUCTION

Mace Construct Limited (“the Client”) has commissioned Card Geotechnics Limited (CGL) to undertake a geotechnical ground investigation at the European Centre for Medium Range Weather Forecasts (ECMWF), and to produce a Geotechnical Factual & Interpretative Report (GFIR) to provide recommendations for the proposed site redevelopment.

The following previous reports are completed for the site, copies of which have been made available to CGL:

- A Preliminary Sources Study Report, completed by Atkins in September 2019¹;
- A Ground Investigation Factual Report completed by Geotechnics Limited in February 2023², on behalf of Atkins; and,
- An interpretative Ground Investigation Report completed by Atkins in May 2023³.

Based on the above, CGL produced a Geotechnical and Geoenvironmental Factual and Interpretive Report⁴ for MACE dated September 2023.

The purpose of this report is to provide factual information and interpretation from the supplementary ground investigation undertaken to assess the permeability of the underlying geology and the feasibility of permeable paving and soakaways. The objectives of this report are to:

- Review the ground information based on the previous investigations;
- Present and review factual information from supplementary ground investigation undertaken in February 2024, including soakaway testing and California Bearing Ratio (CBR) testing results;
- Provide recommendation regarding in-situ testing CBR, pavement design and infiltration / permeability soil rates.

This report may be used to support a planning application and / or discharge of relevant conditions and inform detailed design aspects of the proposed development as required.

¹ Atkins (September 2019). ECMWF - New Headquarters Building; Preliminary Sources Study Report – Government Property Agency; Job Number: 5190142

² Geotechnics (February 2023). ECMWF New Headquarters Building – Factual Report. Ref. PC228496.

³ Atkins (May 2023). ECMWF - New Headquarters Building; Ground Investigation Report – Government Property Agency; ECW-ATK-XX-XX-RP-GE-81001

⁴ CGL (September 2023), ECMWF New Headquarters, Reading, GGFIR, Report reference: CGL/10078

2. SITE LOCATION AND DESCRIPTION

2.1 Site Location

The site is located within the Whiteknights Campus of the University of Reading, RG6 6BZ, roughly 4km to the northwest of junction 11 on the M4 motorway. The approximate National Grid Reference for the centre point of the site is 474015E, 171850N. The proposed site will be positioned between the School of Psychology and Wilderness Road.

A site location plan is presented in Plate 1 below.

Plate 1. Site Location Plan



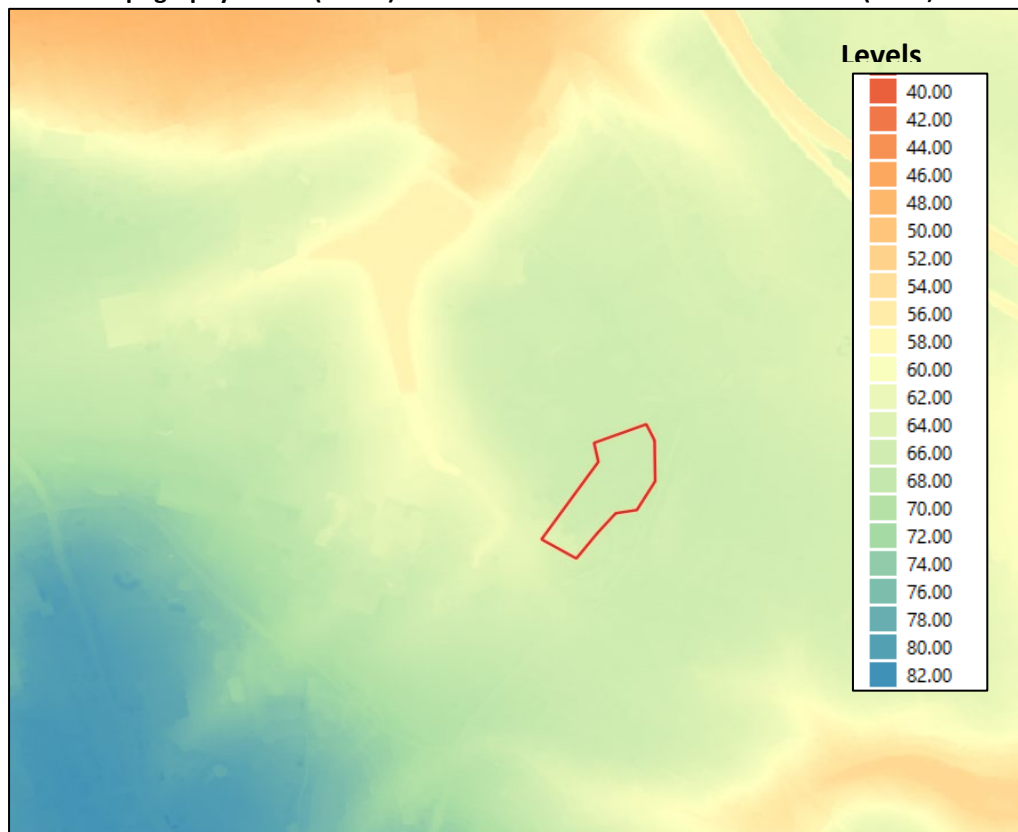
2.2 Site Description

The site is of irregular shape and occupies an estimated area of 1.8 hectares. The site currently comprises a collection of temporary prefabricated and masonry structures which are presently utilized as facilities for Reading University.

Directly to the east of the proposed site lies an area of woodland and ponds known as 'The Wilderness'. This natural area serves both recreational purposes and as a physical separation between the University property and nearby residential dwellings. The rest of the University Campus extends to the north and west of the proposed site. The surrounding land to the south and east primarily consists of suburban

residential properties, occasionally interspersed with schools and small businesses. The site is generally flat, although it has a gradual slope from the northeast (approximately +66.6mOD) to the south and southwest (approximately +66mOD). The topography of the site and the surrounding area is shown on Plate 2. This slope descends towards a lower-lying area which surrounds Whiteknights Lake and its associated streams. The closest of these streams is located roughly 170m southwest of the southern boundary of the site.

Plate 2. Topography of Site (LiDAR)⁵ levels in metres above Ordnance Datum (mOD)



2.3 Proposed Development

The new facility for ECMWF is designed to house a larger workforce ranging from 240 up to a maximum of 380 employees. According to preliminary assessments, around 1200m² of space will be needed to accommodate offices and conference rooms. Additionally, a parking area with approximately 290 spaces will be necessary to serve the office complex, conference centre, and data centre. The data centre itself will have the capacity for four data halls along with supporting facilities and equipment.

⁵ <https://environment.data.gov.uk/DefraDataDownload/?Mode=survey> (Accessed in March 2024)

3. DESK STUDY REVIEW

3.1 Site History

Historical maps obtained for the CGL desk study⁴ indicate that the office which dominates the site is mapped from 1948 onwards. The development of the wider campus is mapped from the 1970s onwards. It is also noted that a farm was present until 1948, prior to the existing build. A tank and depot in the southwest of the site is mapped in the 1980s.

3.2 Anticipated Ground Conditions

3.2.1 Anticipated Geology

With reference to the British Geological Survey (BGS) website⁶ and the 1:50,000 BGS bedrock and superficial map of Reading (sheet 268)⁷ obtained for the site, the site is shown to be directly underlain by superficial River Terrace Deposits of the Boyn Hill Gravel Member, underlain by the London Clay Formation, Lambeth Group, and Chalk Group in succession. A limited thickness of Made Ground is expected on site given the historical development of the area.

With reference to the BGS website⁶, these strata are typically described as:

- The Boyn Hill Gravel Member – poorly sorted sand and flint gravels, with possible lenses of silt, clay or peat. Anticipated to be approximately 4m in thickness in the Reading area.
- The London Clay Formation- mainly comprises 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. Anticipated to be 20-25m in thickness.
- Lambeth Group - Vertically and laterally variable sequences mainly of clay, some silty or sandy, with some sands and gravels, minor limestones and lignites and occasional sandstone and conglomerate. Anticipated to be 20-25m in thickness.
- Chalk Group - Chalk, with or without flint and discrete limestone, marl (calcareous mudstone), sponge, calcarenite, phosphatic, hardground and fossil-rich beds. Anticipated to be encountered at approximately 45-50m below ground level.

⁶ British Geological Survey (BGS), www.bgs.ac.uk [Accessed March 2024]

⁷ [British Geological Survey \(BGS\) | large image viewer | IIPMooViewer 2.0](#) [Accessed March 2024]