# Planning Application
# Basement Impact Assessment

University College London
New Student Centre

By Curtins Consulting Ltd
11th March 2015

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# Planning Application
# Basement Impact Assessment

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# Contents

# 1.0 Executive Summary

In accordance with London Borough of Camden Development Policy DP27 – Basements and Lightwells and the recent LB Camden guidance document entitled "Camden geological, hydrogeological and hydrological study – Guidance for subterranean development" (Issue 01 – November 2010), a risk-based impact assessment with regard to hydrology, hydrogeology and land stability is being undertaken for the basement development on this project.

DP27 states in paragraph 27.1, LB Camden "will only permit [basement and other underground development that] does not cause harm to the built environment and local amenity and does not result in flooding or ground instability". LB Camden "will require developers to demonstrate by methodologies appropriate to the site that schemes:

a) Maintain the structural stability of the building and neighbouring properties;

b) Avoid adversely affecting drainage and run-off or causing other damage to the water environment;

c) Avoid cumulative impacts upon structural stability or the water environment in the local area"

This report outlines, in Section 7, the approach adopted during the design to achieve point a). For points b) and c) the Basement Impact Assessment (or BIA) procedure outlined in the guidance document is being followed (Section 8 and 9). The BIA consists of stages as follows:

- Screening
- Scoping
- Site Investigation and study
- Impact assessment
- Review and decision making

At this stage of the design development the Screening and Scoping stages of the BIA are the most relevant and are covered in this document. It should be noted that further detailed assessments will be ongoing, as appropriate, as the design progresses.

In accordance with the Camden guidance document, these stages should be submitted to LB Camden for review, who may consult with relevant authorities/bodies and the public for their views on the proposed scope.

# 2.0 The Site

## 2.1 Site Location & Layout

The site is located on Gordon Street in the London Borough of Camden. The site is bounded by Gower Street to the northeast, the Bloomsbury Theatre bounds the site to the northwest, whilst other University College London (UCL) buildings are adjacent to the site to the south. The site is located at National Grid Reference (NGR) TQ 29660 82299.

For the location and layout of the site, please refer to Figure 1.


Figure 1: Site Location

# 2.0 The Site

## 2.2 Proposed Development

The site is currently partially occupied by a 4 storey temporary building with an access road to the side and back leading to a service yard behind the neighbouring terraces on Gordon Street. The site is bounded by buildings with single storey basements on three sides and disused coal stores on the street side, similar to the neighbouring terraced houses.

The current proposal is for a 6 storey high building to be used as a student centre, built as a reinforced concrete (RC) frame with 3000mm thick flat slabs. The building will have a two storey secant piled wall basement, up to a depth of approximate of 10m, around the perimeter of the new build footprint.

The foundations to the columns and walls supporting the superstructure will be supported on the capping beam over the secant pile wall, on the internal piled raft and on some pilecaps and ground beams adjacent to the basement, where required.

The stair to the back of the adjacent Bloomsbury Theatre is to be demolished and the building extended in its footprint with a new tunnel linking the plantroom in the new basement with the existing plantroom and network of tunnels at the back of the theatre.

It is likely that the below ground drainage will be required to be designed to meet the requirements of the London Plan. This will require approximately 50m$^3$ of storage to be provided on site. At this stage, it is expected to locate this volume of attenuation under the vehicular ramp.

## 2.3 Site History

The early maps indicate that the site is occupied by the All Saints Church. By 1896 the church has expanded and residential properties are also present on the site.

By 1940 the site has been cleared of buildings and remains this way until the early 1950's when a large undisclosed building (thought to be associated with the University College London) has been constructed.

All buildings on the site are demolished by the early 1990's and site remains unchanged until present day.

The early maps show that the majority of the site surrounding area is comprised of inner city terraced properties with some areas of public open space. University College is located adjacent to the sites western boundary. Euston, St Pancras and Kings Cross stations are located between 400 and 700m to the north. Industry in the area comprises of timber yards, saw mills, engineering works, gas works, printing works etc.

Over time and specifically post WW2 much of the residential properties have been demolished either due to bomb damage or through intended redevelopment. By the late 1900's much of the site surrounding area is comprised of commercial and office buildings. University College has expanded significantly and has a number of buildings located within the sites vicinity.

# 5.0 Hydrology

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3.1 Published Geological Data

A study of the Envirocheck records and British Geological Survey (BGS) 1:50000 mapping records (Bedrock and Superficial Editions) Sheet 256 North London indicates the following geological succession underlying the site.

- Lynch Hill Gravel Member (Sand and Gravel
- London Clay (Clay, Silt and Sand)

The Envirocheck report confirms that there is a low risk to no hazard from the following ground stability hazards on and around the site; collapsible, compressible, landslide, ground dissolution and running sand, with a moderate risk from shrinking or swelling clay.

3.2 Previous Ground Investigations

A Phase 2 Intrusive Ground Condition Investigation dated July 2013 by Curtins Consulting was produced for the site. The stratigraphy reported of the site is as noted in Table 1.

| Strata | Thickness (m) | Top of Stratum (m AOD) |
|---|---|---|
| Made Ground | 2.7-3 | +24.13 to +24.24 |
| River Terrace Deposits (Lynch Hill Gravel) | 2.7-4.3 | +21.19 to +21.43 |
| London Clay | 7.7-12.4 | +17.83 to +18.49 |
| Lambeth Group | 16.7-22.3 | +5.43 to +10.79 |
| Thanet Sand | 4-4.3 | -11.51 to -16.17 |

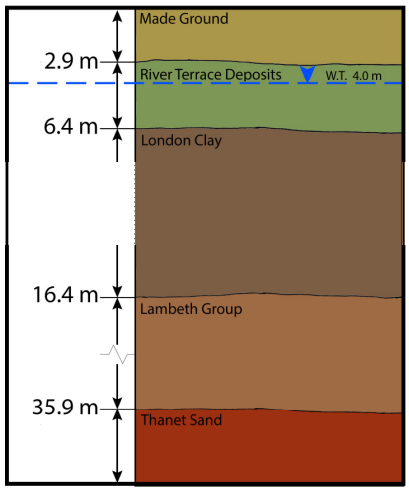



Table 1: Stratigraphy from previous investigations

4.1 Groundwater Vulnerability

A review of the Policy and Practice for the Protection of Groundwater Thames Regional Appendix (NRA, 1993) indicates that the Lynch Hill Gravel (part of the River Terrace Deposits) which underlies the site is classified as a minor aquifer in this area of London. The underlying London Clay Formation is classified as a non-aquifer.

# 5.0 Hydrology

The 1:100000 scale Groundwater Vulnerability Map Sheet 39 West London indicates that the site, corresponding with the underlying geology, is underlain by an Unproductive Aquifer. The superficial deposits are classed as a Secondary A Aquifer.

An Unproductive Strata is a rock layer or drift deposit with low permeability that have negligible significance for water supply or river base flow.

A Secondary A Aquifer is classed as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

The site soils are classed as having a high leaching potential.

The site is not within 1000m of a Source Protection Zone.

There are four groundwater abstractions within 1000m of the site of interest all for use in a heat pump. The nearest potable groundwater abstraction is 1036m to the south west of the site.

There are no significant surface water features within 1000m of the site of interest.

There are no discharge consents arising from the site of interest.

There are no pollution incidents to controlled waters arising from the site of interest.

4.2 Groundwater Flow Direction

Based on the previous Ground Investigations in Section 3.2, the groundwater levels data indicates that the flow direction is South to Southeast.

4.3 Source Protection Zones

The Environmental Agency (EA) has defined Source Protection Zones (SPZs) for valuable water resources such as wells, boreholes and springs used for public drinking water supply. According to the EA website the site is not within a SPZ.

4.4 Groundwater Abstractions

There are four groundwater abstractions within 1000m of the site of interest all for use in a heat pump. The nearest potable groundwater abstraction is 1036m to the south west of the site.

4.5 Discharge Consents

There are no discharge consents arising from the site of interest.

# 5.0 Hydrology

## 5.1 Surface Water Features

The closest surface water feature to the site is a boating lake present within Regent's Park, located approximately 1.5km to the northwest of the site.

The River Thames is located approximately 2km to the southeast of the site flowing in a north easterly direction.

## 5.2 Surface Water Abstractions

According to the Envirocheck Report (2009), there are four records of licensed surface water abstractions within a 2km radius of the site. The closest license is held by the British Waterways Board, 1800m to the north of the site and is used for top-up water.

# 6.0 Underground Structures

6.1 Basements

The majority of the buildings surrounding or adjacent to the site have at least a single level of basement. These basements may have modified the groundwater flow conditions in the shallow aquifer in the River Terrace Deposits.

6.2 Tunnels

There are existing tunnels to the back of the Bloomsbury theatre used for services distribution around the Campus.

6.2.1 London Underground Tunnels

Twin tunnels of the Circle Line pass under Euston Square, approximately 250m to the north of the site.

6.1.3 Crossrail Tunnels

The Crossrail 1 alignment follows High Holborn, which is located over 500m south of the site.

The Crossrail 2 tunnels will run between to connect Tottenham Court Road and King's Cross stations. The site is on the edge of the current 'safeguarded' zone.

Both tunnels will run at a depth of more than 30m from the ground level.

Owing to their depth, the tunnels are likely to have no impact on the shallow groundwater system.

# 7.0 Basement Impact on Structural Stability

The proposed development consists of two levels of basement. The design of the perimeter basement walls takes full account of lateral earth and groundwater pressures and the maintenance of structural stability. The design also considers potential impacts on adjacent buildings and infrastructure (including public highways and services), further assessments will be undertaken during detailed design to confirm that these will not be adversely affected.

The contractor will monitor the basement construction and adjacent structures to keep movements within acceptable limits.

The basement wall will be installed in advance of basement excavation works and will comprise alternating ‘hard’ and ‘firm’ secant piles.

# 8.0 Screening

8.1 Surface flow and flooding

Question 1: Is the site within the catchment of the pond chains on Hampstead Heath?

No. The site is more than 5km from Hampstead Heath. Any hydraulic links are unlikely to form. See Appendix A, Figure 8.

Question 2: As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route?

Yes, SW attenuation has been included with the design, reducing discharge to greenfield rates (in accordance with the London Plan. Any landscaping or inclusion of green roofing will also help reduce surface water flows and peak discharge/volumes.

The point of connection will not change.

Question 3: Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?

No. The new basement will not affect the proportion of hard surfaced/paved areas as the footprint of the proposed basement covers an area which is currently hard landscaping.

Question 4: Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface water being received by adjacent properties or downstream watercourses?

The attenuation tank and flow control systems will improve the sewage network downstream of the site. Flows from the site will no longer have free discharge, but will be held back on site within our attenuation tank to allow a more controlled outflow.

Question 5: Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?

No. The quality of the surface water should be improved as a more formalised and controlled network is being implemented. The proposed trapped gulleys will allow for oil separation further enhancing water quality. All surface water runs to Thames Water's sewer, not to a watercourse.

Question 6: Is the site in an area known to be at risk from surface water flooding, such as South Hampstead, West Hampstead, Gospel Oak and King's Cross, or is it at risk from flooding, for example because the proposed basement is below the static water level of a nearby surface water feature?

No. The site is not in areas known to be at risk of flooding. See Appendix A, Figure 9.

# 8.0 Screening

8.2 Groundwater flow

Question 1a: Is the site located directly above an aquifer?

Yes. The site is directly above the shallow aquifer which comprises River Terrace Deposits (RTD). See Appendix A, Figure 5.

Question 1b: Will the proposed basement extend beneath the water table surface?

Yes. The water table is within the RTD. Proposed secant walls around the basement cut into the underlying London Clay.

Question 2: Is the site within 100m of a watercourse, well (used/disused) or potential spring line?

No. See Appendix A, Figures 2 & 6.

Question 3: Is the site within the catchment of the pond chains on Hampstead Heath?

No. The site is more than 5km away from the pond chains on Hampstead Heath and downstream of them. See Appendix A, Figure 8.

Question 4: Will the proposed basement development result in a change in the proportion of hard surfaced /paved areas?

No. The new basement will not affect the proportion of hard surfaced/paved areas as the footprint of the proposed basement covers an area which is currently hard landscaping.

Question 5: As part of the site drainage, will more surface water (e.g. rainfall and run-off) than at present be discharged to the ground (e.g. via soakaways and/or SUDS)?

No, there will not be an increase in the amount of surface water discharged to the ground. All the collected surface water will discharge to the Thames Water Sewerage System Network. The existing site conditions are not suitable for the use of a soakaway system.

Question 6: Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to, or lower than, the mean water level in any local pond (not just the pond chains on Hampstead Heath) or spring line?

No. No local water features. See Appendix A, Figures 2, 6, & 7.

# 8.0 Screening

8.3 Slope Stability

Question 1: Does the existing site include slopes, natural or manmade, greater than 7 degrees? (approximately 1 in 8)

No. The site has no steep slopes within its boundary. The courtyard behind Northwest of the site is set at +24.80m OD, which is approximately 2.5m below the road level of the surrounding area. See also Appendix A, Figures 10, 11, & 12.

Question 2: Will the proposed re-profiling of landscaping at site change slopes at the property boundary to more than 7degs? (approximately 1 in 8)

No.

Question 3: Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7degs? (approximately 1 in 8)

No. The site is situated within a level area in Camden (no slopes in the vicinity). See also Appendix A, Figures 10, 11, & 12

Question 4: Is the site within a wider hillside setting in which the general slope is greater than 7 degrees? (approximately 1 in 8)

No. See also Appendix A, Figures 10 & 11.

Question 5: Is the London Clay the shallowest strata at the site?

No. London Clay is below the RTD and Made Ground. Refer Section 3 and Figure 4.

Question 6: Will any tree/s be felled as part of the proposed development and/or are any works proposed within any tree protection zones where trees are to be retained? (Note that consent is required from LB Camden to undertake work to any tree/s protected by a Tree Protection Order or to tree/s in a Conservation Area if the tree is over certain dimensions).

No.

Question 7: Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site?

No.

Question 8: Is the site within 100m of a watercourse or a potential spring line?

No. See Appendix A, Figures 2, 6 & 7.

Question 9: Is the site within an area of previously worked ground?

Yes. Historical mapping dating to the mid 1700s indicates the presence of several gravel abstraction pits within the general site vicinity. It is possible that one of these features could have been excavated at the site prior to the 1800s and subsequently used as a rubbish tip. See also Appendix A, Figure 4, which indicates worked ground in the area.

Question 10: Is the site within an aquifer? If so, will the proposed basement extend beneath the water table such that dewatering may be required during construction?

Yes. The site is within the shallow aquifer (see Appendix A, Figure 5). However, it is unlikely that dewatering will be required as the proposed secant piled wall forming the basement excavation will be expected to form a good groundwater cut-off. Minor seepage into the working area would be dealt with using sumps or other localised measures.

Question 11: Is the site within 50m of the Hampstead Heath ponds?

No. See Appendix A, Figure 7.

Question 12: Is the site within 5m of a highway or pedestrian right of way?

Yes.

Question 13: Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?

Yes. See Section 7.0

Question 14: Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?

Yes. See Section 6.0.

# 8.0 Screening

8.4 Conclusion from Screening

Based on the screening exercise, it is concluded that during detailed design there is a need for an assessment of the potential impact of the new basement on groundwater levels in the shallow aquifer. The new basement will extend into ground which is currently permeable and saturated. Potentially, therefore the basement will have a damming effect on groundwater flow. It is possible that the groundwater level will be raised up-gradient of the new basement and lowered down-gradient, compared with present situation. This is considered to be the only potential impact of any significance and the proposed approach to addressing this issue is set out in the following section.

# 9.0 Scope of Proposed Hydrogeological Assessment

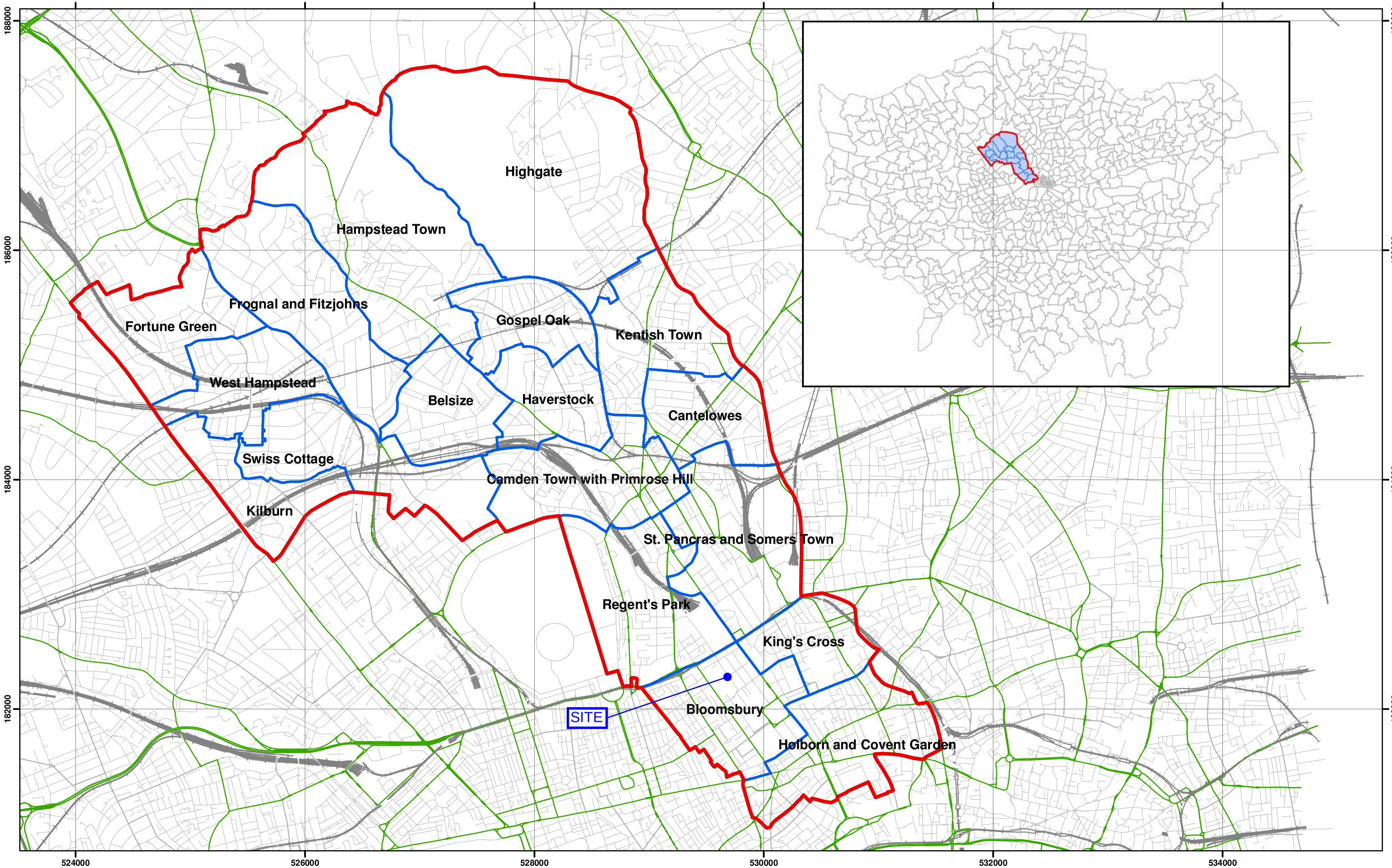
To address the hydrogeological issue identified in the screening, a calculation of the basement impact on groundwater flow will be carried out. The procedure will be as follows:

- Carry out a reconnaissance survey of basements along Gordon Street 250m each way from the proposed development
- Interrogate groundwater data collected from adjacent developments in the past
- Set up the conceptual model
- Calculate the damming effect
- Cross-check the results against the results obtained from a similar exercise carried out as part of the EIA for the Crossrail project as presented in a Crossrail report “Appendix E: Analysis of Impacts on Groundwater”

Detailed geotechnical and structural design of the basement and foundations is addressing the ground stability issues identified in the ‘slope stability’ screening questions to reduce to acceptable levels the risk of impact on adjacent structures. No further study is proposed.

# 10.0 Appendices

**Appendix A -** Camden geological, hydrogeological, hydrological study – Guidance for subterranean development figures




N

Scale at A3: 1:30,000

Coordinate System:
British National Grid
GCS_OSGB_1936

0 0.5 1 2 3
Kilometers

**Legend**

- London Borough of Camden
- Camden Wards
- Railway Lines
- A Roads

# Camden Geological, Hydrogeological and Hydrological Study

Camden Administrative Boundaries

213923 FIGURE 1

524000 526000 528000 530000 532000 534000

188000 186000 184000 182000

SITE

Data source - BGS Mapping - Scale 1:10,000

N

Scale at A3: 1:30,000

Coordinate System:
British National Grid
GCS_OSGB_1936

0 0.5 1 2 3
Kilometers

**Legend**

- London Borough of Camden
- Railway Lines
- A Roads

**BGS 1:10K Artificial Ground**

- MADE GROUND
- WORKED GROUND

**BGS 1:10K Drift Geology**

- ALLUVIUM
- HACKNEY GRAVEL FORMATION
- LANGLEY SILT FORMATION
- LYNCH HILL GRAVEL FORMATION
- STANMORE GRAVEL FORMATION

**BGS 1:10K Solid Geology**

- BAGSHOT FORMATION
- CLAYGATE MEMBER
- LAMBETH GROUP
- LONDON CLAY FORMATION

NB: Geological boundaries are largely indicative based on available geological mapping data

# Camden Geological, Hydrogeological and Hydrological Study

## Camden Geological Map

213923 FIGURE 3

526000 528000 530000

184000 182000

SITE

Data source: BGS Mapping - Scale 1:10,000

N

Scale at A3: 1:15,000

Coordinate System:
British National Grid
GCS_OSGB_1936

0 0.25 0.5 1 1.5
Kilometers

**Legend**

- London Borough of Camden
- Railway Lines
- A Roads

**BGS 1:10K Artificial Ground**

- MADE GROUND
- WORKED GROUND

**BGS 1:10K Drift Geology**

- ALLUVIUM
- HACKNEY GRAVEL FORMATION
- LANGLEY SILT FORMATION
- LYNCH HILL GRAVEL FORMATION
- STANMORE GRAVEL FORMATION

**BGS 1:10K Solid Geology**

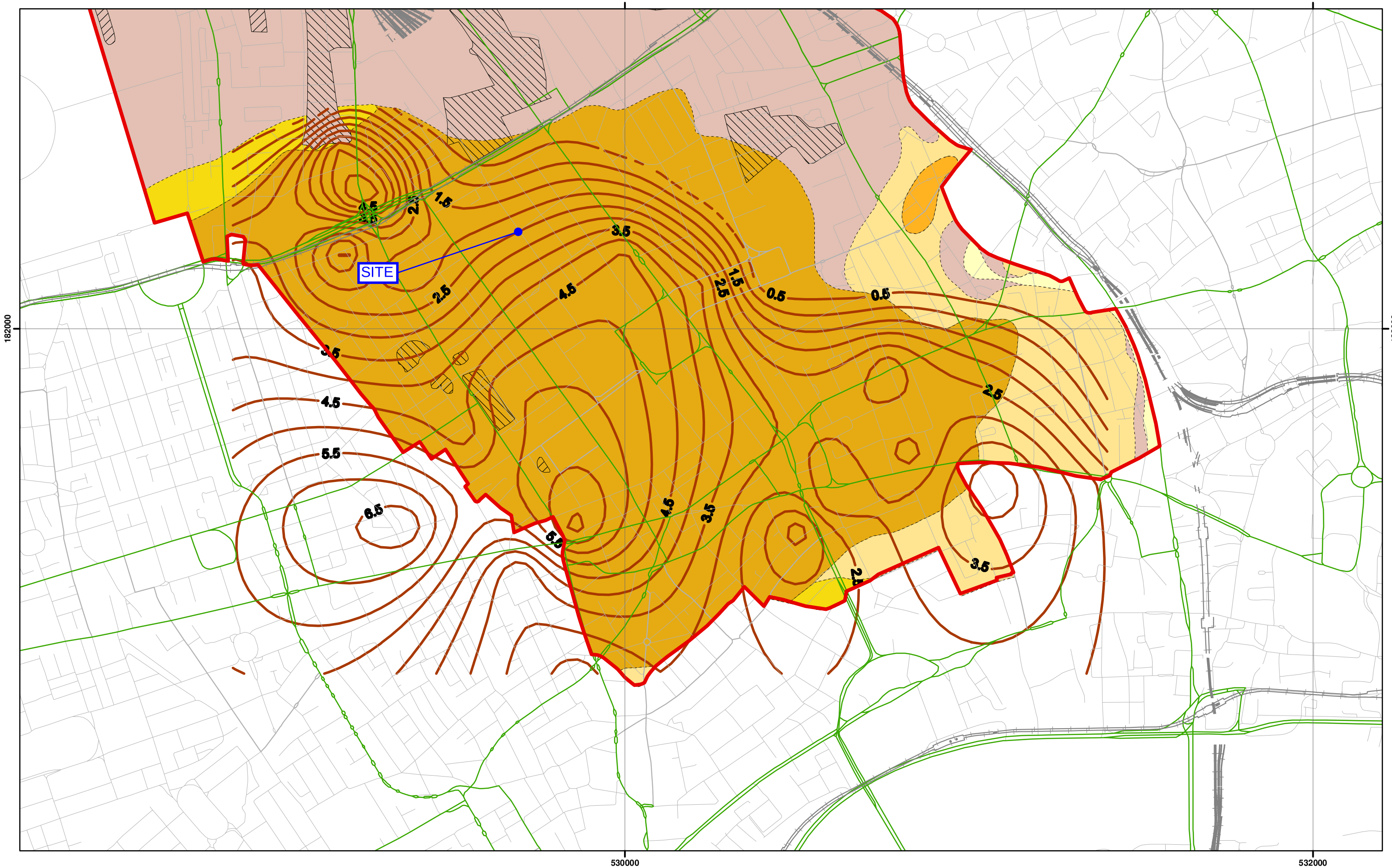
- BAGSHOT FORMATION
- CLAYGATE MEMBER
- LAMBETH GROUP
- LONDON CLAY FORMATION

NB. Geological boundaries are largely indicative based on available geological mapping data

# Camden Geological, Hydrogeological and Hydrological Study

## South Camden Geological Map

213923 FIGURE **5**




Data source: BGS Mapping - Scale 1:10,000

N

Scale at A3: 1:10,000

Coordinate System:
British National Grid
GCS_OSGB_1936

0 0.2 0.4 0.8 1.2
Kilometers

**Legend**

- London Borough of Camden
- Railway Lines
- A Roads
- RTD Thickness Contours
- BGS 1:10K Artificial Ground
  - MADE GROUND
  - WORKED GROUND
- BGS 1:10K Drift Geology
  - ALLUVIUM
  - HACKNEY GRAVEL FORMATION
  - LANGLEY SILT FORMATION
  - LYNCH HILL GRAVEL FORMATION
  - STANMORE GRAVEL FORMATION
- BGS 1:10K Solid Geology
  - BAGSHOT FORMATION
  - CLAYGATE MEMBER
  - LAMBETH GROUP
  - LONDON CLAY FORMATION

NB. Geological boundaries are largely indicative based on available geological mapping data

**Camden Geological, Hydrogeological and Hydrological Study**

River Terrace Deposit Thickness Contours

213923 FIGURE 6

524000 526000 528000 530000 532000 534000

188000 186000 184000 182000

SITE

Environment Agency Aquifer Designation based on BGS Mapping

N

Scale at A3: 1:30,000

Coordinate System:
British National Grid
GCS_OSGB_1936

0 0.5 1 2 3
Kilometers

**Legend**

- Borough of Camden
- Railway Lines
- A Roads

**Aquifer Designation**

- Secondary A Aquifer
- Unproductive Strata

**Source Protection Zone**

- Outer Source Protection Zone
- Inner Source Protection Zone

NB. Aquifer boundaries are indicative based on available geological mapping data

# Camden Geological, Hydrogeological and Hydrological Study

## Camden Aquifer Designation Map

213923

FIGURE 8

522000 524000 526000 528000 530000 532000

186000

184000

182000

SITE

522000 524000 526000 528000 530000 532000

Topographic map based on digital terrain model provided by Camden Borough Council

N

Scale at A3: 1:30,000

Coordinate System:
British National Grid
GCS_OSGB_1936

0 0.375 0.75 1.5 2.25 3 3.75

Kilometers

**Legend**

- London Borough of Camden
- Railway Lines
- A Roads

**DTM Terrain**

* Window Size: 20.000

**Elevation**

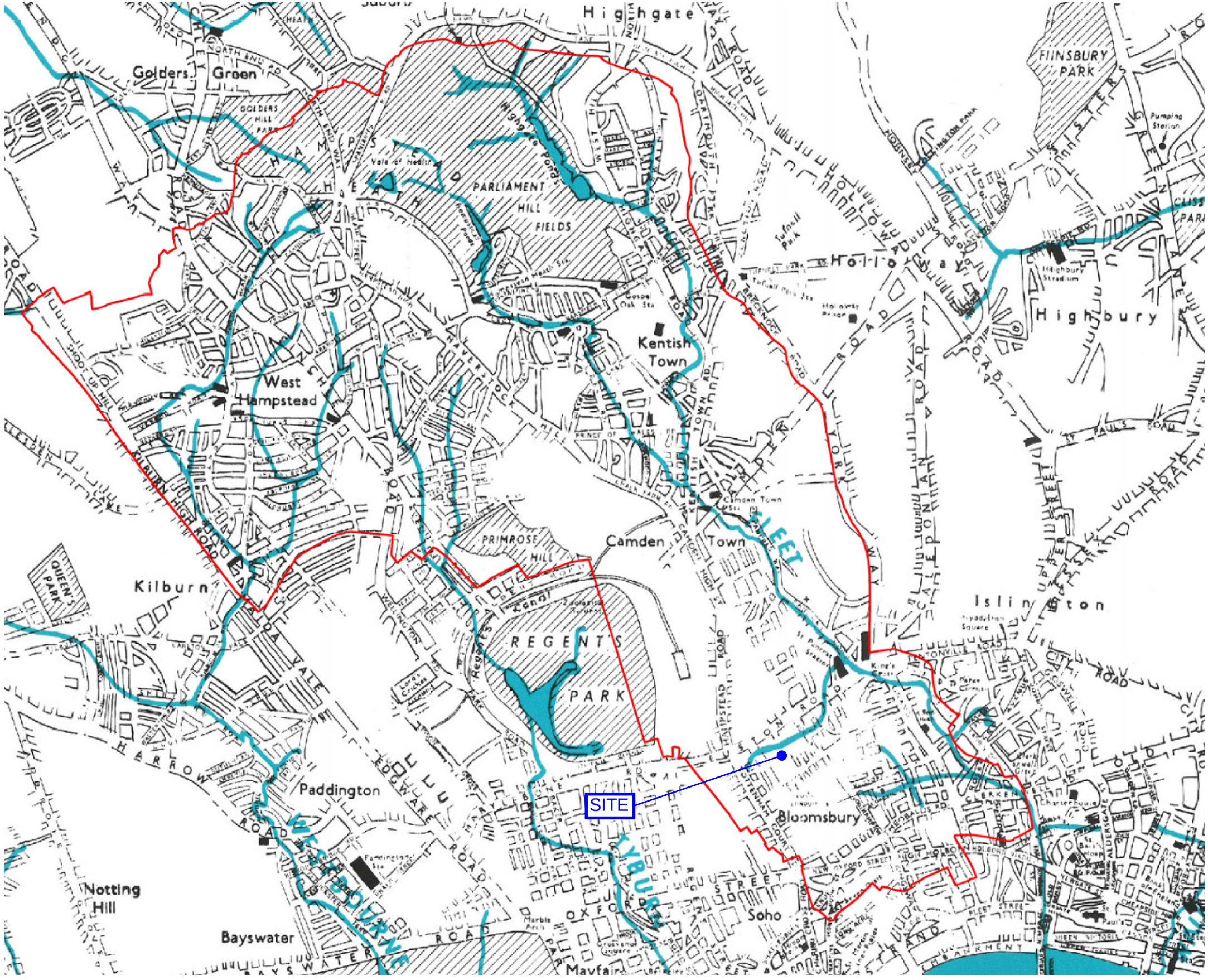
| | | | | | |
|---|---|---|---|---|---|
| 145 - 150 | 125 - 130 | 90 - 95 | 55 - 60 | 20 - 25 | |
| 140 - 145 | 120 - 125 | 85 - 90 | 50 - 55 | 15 - 20 | |
| 135 - 140 | 115 - 120 | 80 - 85 | 45 - 50 | 10 - 15 | |
| 130 - 135 | 110 - 115 | 75 - 80 | 40 - 45 | 5 - 10 | |
| | 105 - 110 | 70 - 75 | 35 - 40 | 0 - 5 | |
| | 100 - 105 | 65 - 70 | 30 - 35 | -5 - 0 | |
| | 95 - 100 | 60 - 65 | 25 - 30 | -7.4 - -5 | |

**Camden Geological, Hydrogeological and Hydrological Study**

Camden Topographic Map

213923

FIGURE **10**




Source – Barton, Lost Rivers of London

**Camden Geological, Hydrogeological and Hydrological Study**
Watercourses

213923

FIGURE **11**

522000 524000 526000 528000 530000 532000

186000 184000 182000

SITE

Data Source: London Borough of Camden, 2010

N

Scale at A3: 1:30,000

Coordinate System:
British National Grid
GCS_OSGB_1936

0 0.5 1 2 3
Kilometers

**Legend**

- London Borough of Camden
- Surface water
- Railway Lines
- A Roads

# Camden Geological, Hydrogeological and Hydrological Study

## Camden Surface Water Features

213923 FIGURE **12**

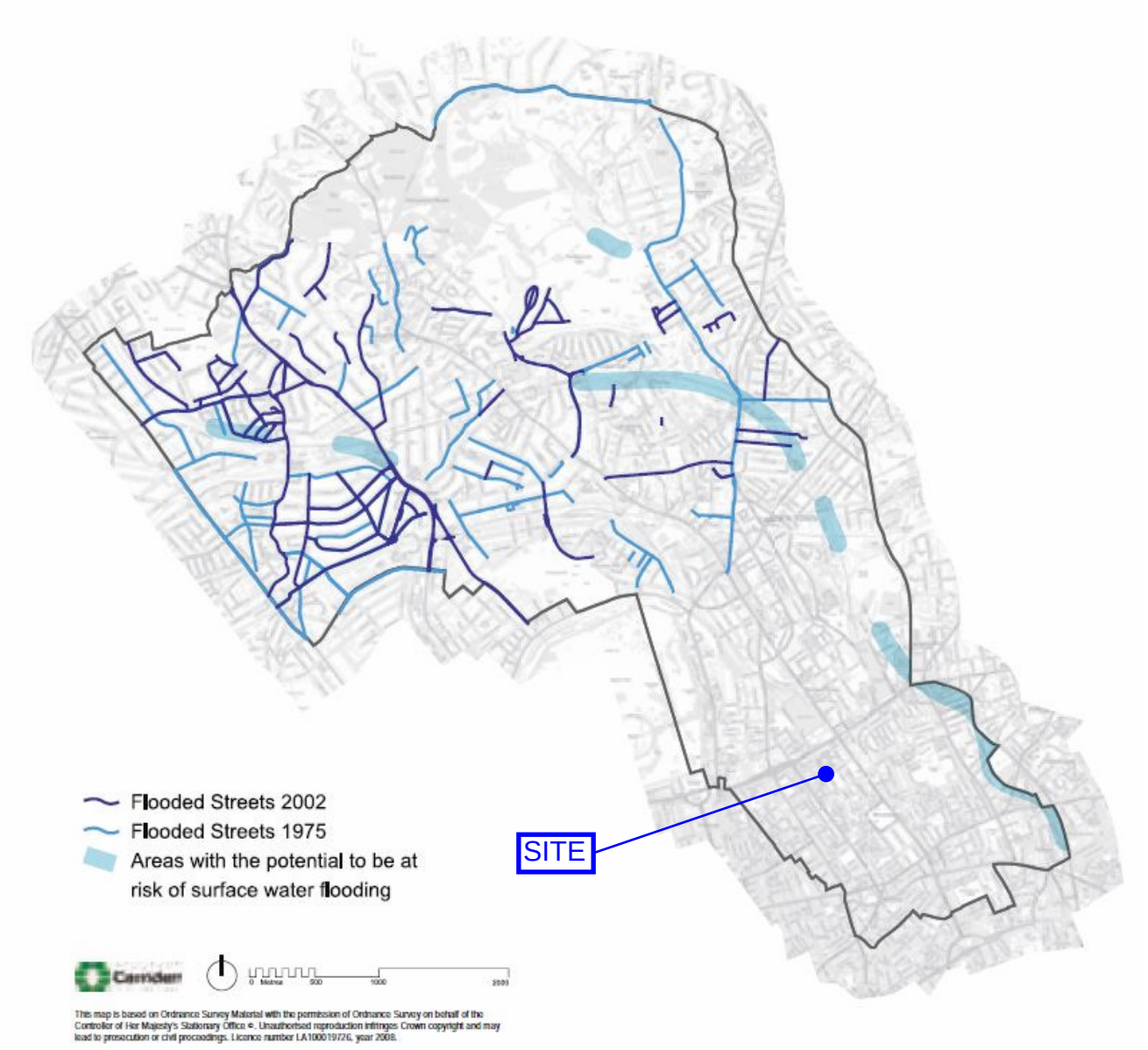



Figure 5 from Core Strategy, London Borough of Camden

**Camden Geological, Hydrogeological and Hydrological Study**
Flood Map

213923 FIGURE **15**

524000 526000 528000 530000 532000 534000

186000

184000

182000

SITE

Slope Angles calculated from Digital Terrain Model Provided By Camden Bourough Council

N

Scale at A3: 1:30,000

1:10,000 BGS Mapping
Coordinate System:
British National Grid
GCS_OSGB_1936

0 0.5 1 2 3
Kilometers

**Legend**

**Slope**
- 0° - 7°
- 7° - 10°
- > 10°

London Borough of Camden
Railway Lines
A Roads

**BGS 1:10K Artificial Ground**
- MADE GROUND
- WORKED GROUND

**BGS 1:10K Drift Geology**
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NB. Geological boundaries are largely indicative based on available geological mapping data

# Camden Geological, Hydrogeological and Hydrological Study

## Slope Angle Map

213923

FIGURE 16