

**Basement Impact
Assessment (BIA) –
Groundwater Flow
Statement**

Project Name: 5 Cleve Road

Location: 5 Cleve Road, London, NW6 3RN

Client: Blackcap Limited

Project ID: J13841

Report Date: 30th October 2018

Report Issue: 1

SUMMARY

The site comprises a detached house with a front courtyard and rear garden. There is an existing lower ground floor level. It is proposed to renovate the lower ground floor, construct new light wells at the front of the house, and to construct a new extension at the rear of the house. The rear extension will include a single level basement.

Geological records indicate the site to be underlain by London Clay Formation.

The site is location in the London Borough of Camden. This report is a groundwater flow statement, intended to augment the Client's existing Basement Impact Assessment (Stage 1 – Screening).

Stages 1 and 2 (Screening and Scoping) have been undertaken by others. Stage 3 (Ground Investigation) was undertaken by Southern Testing Laboratories (report ref. J13570, dated May 2018). Stage 4 (Ground Movement Analysis) will be issued in a separate report.

From the Ground Investigation Report, the soils underlying the site comprise Made Ground, overlying London Clay Formation. Groundwater was encountered and monitored during the Stage 3 investigation. The groundwater level appears to be at about 1.0 – 1.5m below street level.

The impact on the local and regional groundwater regime caused by the construction of the proposed basement is likely to be negligible. The cumulative effects of potential future basements of similar construction in the neighbouring properties would likely be negligible, although this would need assessing on a case-by-case basis.

The investigation was conducted and this report has been prepared for the sole internal use and reliance of Blackcap Limited and their appointed Engineers. This report shall not be relied upon or transferred to any other parties without the express written authorization of Southern Testing Laboratories Ltd. If an unauthorised third party comes into possession of this report they rely on it at their peril and the authors owe them no duty of care and skill.

The findings and opinions conveyed via this investigation report are based on information obtained from a variety of sources as detailed within this report, and which Southern Testing Laboratories Ltd believes are reliable. Nevertheless, Southern Testing Laboratories Ltd cannot and does not guarantee the authenticity or reliability of the information it has obtained from others.

Author	Thomas Lees MSci MSc CGeol FGS UK RoGEP Professional	
Checked / Approved	Jon Race BSc MSc CGeol	

For and on behalf of Southern Testing Laboratories Limited

Ref: STL J13841	Issue 1	Issue Date	30 October 2018
	Issue 2		
	Issue 3		

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A INTRODUCTION

1 Authority

Our authority for carrying out this work is contained in a Project Order form completed by B. Shaffer of Blackcap Limited, dated 15th October 2018. The order refers to our quotation ref. Q181997, dated 8th October 2018.

2 Location

The site is located on the southern side of Cleve Road, about 300m to the south of West Hampstead London Underground station. The approximate National Grid Reference of the site is TQ 25593 84342. The site location is indicated on Figure 1 within Appendix A.

3 Proposed Construction

It is proposed to construct new light wells at the front of the existing house, and a basement extension at the rear.

4 Object

The object of this study was to produce a Groundwater Flow Statement to augment the Client's Stage 1 (Screening) Report, as part of the wider Basement Impact Assessment for this development.

Basement Impact Assessment (BIA) to support the Client's planning application in accordance with the requirements of the London Borough of Camden. Reference has been made to the following documents:

- Ref [1] - Camden Planning Guidance CPG4 – Basements and Light Wells
- Ref [2] - Camden Development Policy DP 27 – Basements and Light Wells
- Ref [3] - Camden Geological, Hydrogeological and Hydrological Study. Guidance for Subterranean Development
- Ref [4] - London Borough of Camden SFRA Strategic Flood Risk Assessment

Base mapping and figures from the above documents are referenced throughout and have been reproduced within Appendix A of this report.

The purpose of the wider BIA is to enable London Borough of Camden to consider a scheme's potential impact on local drainage and flooding and on the structural stability of neighbouring properties through its effect on groundwater conditions and ground movement in accordance with both DP27 and CPG4.

5 Scope

This report presents our desk study findings and our interpretation of these data.

This report is not an engineering design and the figures and calculations contained in the report should be used by the Engineer, taking note that variations will apply, according to variations in design loading, in techniques used, and in site conditions. Our figures therefore should not supersede the Engineer's design.

The investigation has been completed with reference to BS 5930 Ref [5] and BS 10175 Ref [6].

Contamination issues are not considered in this report.

The findings and opinions conveyed via this investigation report are based on information obtained from a variety of sources as detailed within this report, and which Southern Testing Laboratories Ltd believes are reliable. Nevertheless, Southern Testing Laboratories Ltd cannot and does not guarantee the authenticity or reliability of the information it has obtained from others.

The investigation was conducted and this report has been prepared for the sole internal use and reliance of Blackcap Limited and their appointed Engineers. This report shall not be relied upon or transferred to any other parties without the express written authorization of Southern Testing Laboratories Ltd. If an unauthorised third party comes into possession of this report they rely on it at their peril and the authors owe them no duty of care and skill.

The recommendations contained in this report may not be appropriate to alternative development schemes.

Detailed information on the proposed, such as detailed final layout, loadings and serviceability limits was not provided. Accordingly, where geotechnical design advice is provided it is on the prescriptive basis allowed for by Eurocode 7: employing conventional and conservative design rules.

The contamination screening values used are valid at the time of writing but may be subject to change and any such changes will have implications for the assessments based on them. Their validity should be confirmed at the time of site development.

B DESK STUDY AND WALKOVER SURVEY

6 Ground Conditions

6.1 Geology

The British Geological Survey Map No 256 (North London) indicates that the site geology consists of London Clay Formation.

The site location is marked on the geological maps contained within the 'Camden Geological Hydrogeological and Hydrological Study (Ref [3]), which is contained within Appendix A (Figure 2). The map also show that the site is underlain by London Clay.

6.1.1 London Clay

London Clay is a well-known stiff blue grey, fissured clay, which weathers to a brown colour near the surface. It contains thin layers of nodular calcareous mudstone - "claystone" from place to place, and crystals of water clear calcium sulphate (selenite) are common. Although slopes will stand in the clay at steep angles in the short term, the long-term stable slope angle is about 7° for grassed, or cleared slopes, and a few degrees more for wooded slopes.

6.2 Historical Borehole Records

A search of previous exploratory hole records both from the online British Geological Survey database [7] and Southern Testing in-house records, recovered several records. The details are summarised in the table below.

BH Reference	Final Depth (mbgl)	Distance from site (m) / Direction	Remarks
TQ28SE2062 and TQ28SE2063	10.0	200 / South	Two boreholes drilled to 10mbgl at 65 Priory Road. Both boreholes recorded Made Ground overlying London Clay. Groundwater was not encountered in these boreholes.
TQ28SE514 and TQ28SE515	3.89	300 / North East	Shallow boreholes drilled at 973 Broadhurst Gardens. The recorded soils Made Ground overlying London Clay. Groundwater was not encountered.
TQ28SE635/A	12.2	450 / North West	Borehole drilled at Netherwood Street. The recorded soils comprised Made Ground, overlying London Clay. Groundwater was not encountered.

6.3 Hydrology and Hydrogeology

Data from Camden's records relating to controlled waters is summarised below.

Data Source		Remarks	Possible Hazard to/from Site (Y/ N)
Aquifer Designation	Superficial Deposits	None present	N
	Bedrock	London Clay – Unproductive Strata ⁽¹⁾ (see 'Camden Aquifer Designation Map' – Figure 3, Appendix A)	N
Groundwater Vulnerability		The site is located over a Non-Aquifer. Figure 3, Appendix A	N
Surface Water Features		The nearest surface water feature shown on the 'Camden Surface Water Features' map is about 400m to the west of the site. Figure 4, Appendix A	N
Surface Water Flood Risk		The site is not shown to be on a street which has flooded historically (Figure 5, Appendix A). This is also supported by the mapping contained within the Camden Strategic Flood Risk Assessment (REF)	N

(1) **Unproductive Strata:** Layers of rock or drift deposits with low permeability that have negligible significant for water supply or river base flow.

6.4 Shallow Groundwater

The site location is shown on the Camden 'Watercourses' map (Figure 6, Appendix A). The site is located between two of the tributaries of the former River Westbourne. The tributaries flowed north to south, about 500m to the east and west of the subject site.

Groundwater was recorded at about 1.0 – 1.5mbgl in the boreholes and trial pits undertaken as part of our Stage 3 investigation.

6.5 Flood Risk Statement

A separate Flood Risk Statement has not been undertaken.

7 Site Environment

7.1 Site Walkover Survey

A walkover survey was undertaken as part of our Stage 3 Ground Investigation, in May 2018. The walkover is replicated in the sections below. No additional walkover survey work has been undertaken.

7.1.1 General Site Description and Boundaries

The site comprises an approximately rectangular plot of land, containing a detached three storey house, which has a lower ground floor. The boundaries are as follows:

Boundary	Description
Northern	This boundary lies along Cleve Road. There is a low brick wall that forms a partition between the front courtyard of the site and the pavement along the southern edge of Cleve Road.
Western	A wooden fence forms a partition between the subject site and the neighbouring building. An alleyway runs between the subject house and this fence, providing access to the rear garden of the site.

Boundary	Description
Southern	A wooden fence separates the rear garden of the subject site and the rear garden of the adjacent house.
Eastern	The eastern elevation of the subject house runs along this boundary. In the front courtyard and rear garden a brick wall forms a partition between the site and the adjacent house. There is an alleyway along the other side of this boundary (the subject house is detached).

7.1.2 Topography and Drainage

The house had a lower ground floor level, which was about 1m lower than the street level of Cleve Road. The rear garden was at the same level as the lower ground floor. The topography of the surrounding area sloped down to the south east at 1 – 2 degrees.

Drainage appeared to be to mains sewers.

7.1.3 Vegetation

The front courtyard had several small bushes / shrubs.

The rear garden contained several mature trees, including a large Horse Chestnut (about 15 -20m in height, and about 6m from the existing rear elevation of the house). There were several other mature deciduous trees at the rear of the garden, including a Sycamore/Maple.

7.1.4 Buildings and Land Use on Site and Nearby

The existing house was three storeys in height, and of brick construction with a pitched roof. There was a two storey rear extension. The house had a lower ground floor level.

The building to the west of the site comprised a five storey block of flats. This building also had a lower ground floor.

The building to the east of the site comprised a three storey detached house, with a lower ground floor.

7.1.5 Inaccessible Site Areas

Access was restricted within part of the lower ground floor due to stored furniture.

8 Underground Structures

8.1 Existing Basements

The existing house had a lower ground floor level. The neighbouring buildings both had lower ground floors.

C STAGE 1 – SCREENING EXERCISE

9 Screening Framework

Guidance from Camden Borough Council through its Development and Planning documents require that any development proposal which includes a subterranean basement should be screened in order to determine whether there is a requirement for a full BIA to be carried out.

The existing building has a lower ground floor which covers the footprint of the building. The development proposals comprise an extension to the rear of the house, which will have a single level basement. The floor level of the proposed basement will be lower than the existing lower ground floor.

In this section, the screening flowchart questions for Subterranean Groundwater Flow contained within CPG4 Ref [1] are addressed in turn.

10 Subterranean Groundwater Flow

Question	
1a	Is the site located directly above an aquifer?
	No. The site is located above an area designated as unproductive strata, which comprises the London Clay Formation. See Figure 2 within Appendix A.
1b	Will the proposed basement extend beneath the water table surface?
	Yes. From the Stage 3 Ground Investigation the groundwater appears to be at about 1.0 -1.5m bgl. Long-term groundwater monitoring should be undertaken to confirm this.
2	Is the site within 100m of a watercourse, well (used/disused) or potential spring line?
	The site is not within 100m of any known existing watercourse, well or spring line.
3	Is the site within the catchment of the pond chains on Hampstead Heath?
	No. The site is outside the catchment of the pond chains on Hampstead Heath (Figure 7 within Appendix A).
4	Will the proposed basement development result in a change in the proportion of hard surfaced /paved areas?
	Yes. The proposed basement and rear extension is being constructed in the rear garden, which is currently grass. The development will, therefore, result in an increase in the proportion of hard surfaced / paved areas.
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.
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 surface water features have been identified within the immediate vicinity of the site and groundwater levels are currently unknown.

D GROUNDWATER FLOW STATEMENT

11 Groundwater Flow

The soils underlying the site comprise a thin layer of Made Ground, overlying London Clay Formation. The London Clay Formation soils will have very low permeability.

Groundwater flow within the London Clay Formation is likely to be via fissure flow. Published data for the permeability of the London Clay indicates that the horizontal permeability is likely to be in the range of 1×10^{-9} m/s to 1×10^{-14} m/s, with an even lower vertical permeability. The Made Ground will have higher, but probably very variable, permeability values.

Any groundwater flows that take place will likely follow the local topography, which in this instance is sloping down to the south east at about 1 – 2 degrees.

Given the information in this report, and the observations made in our Stage 3 report, it is unlikely that the proposed basement construction will result in any specific issues relating to the hydrogeology of the site and surrounding area.

Following construction of the basement, any resulting increases in groundwater levels within the area (locally, or regionally) will be negligible. Should similar basements be granted at the adjacent properties is it considered that potential cumulative effects on groundwater will also be negligible. The cumulative effects of all developments should be assessed on a case-by-case basis.

REFERENCES

- [1] London Borough of Camden, "Camden Planning Guidance CPG4 - Basements and Lightwells," 2015.
- [2] London Borough of Camden, "Camden Development Policy DP27 - Basements and Lightwells".
- [3] Ove Arup & Partners Ltd, "London Borough of Camden - Camden Geological, hydrogeological and hydrological study. Guidance for subterranean development.," 2010.
- [4] URS, "London Borough of Camden Strategic Flood Risk Assessment," 2014.
- [5] BSI Standards, "BS 5930 Code of practice for ground investigations," 2015.
- [6] BSI Standards, "BS10175 Investigation of potentially contaminated sites – Code of practice," 2013.
- [7] British Geological Survey (BGS), "Borehole Scans," [Online]. Available:
<http://www.bgs.ac.uk/data/boreholescans/home.html>.



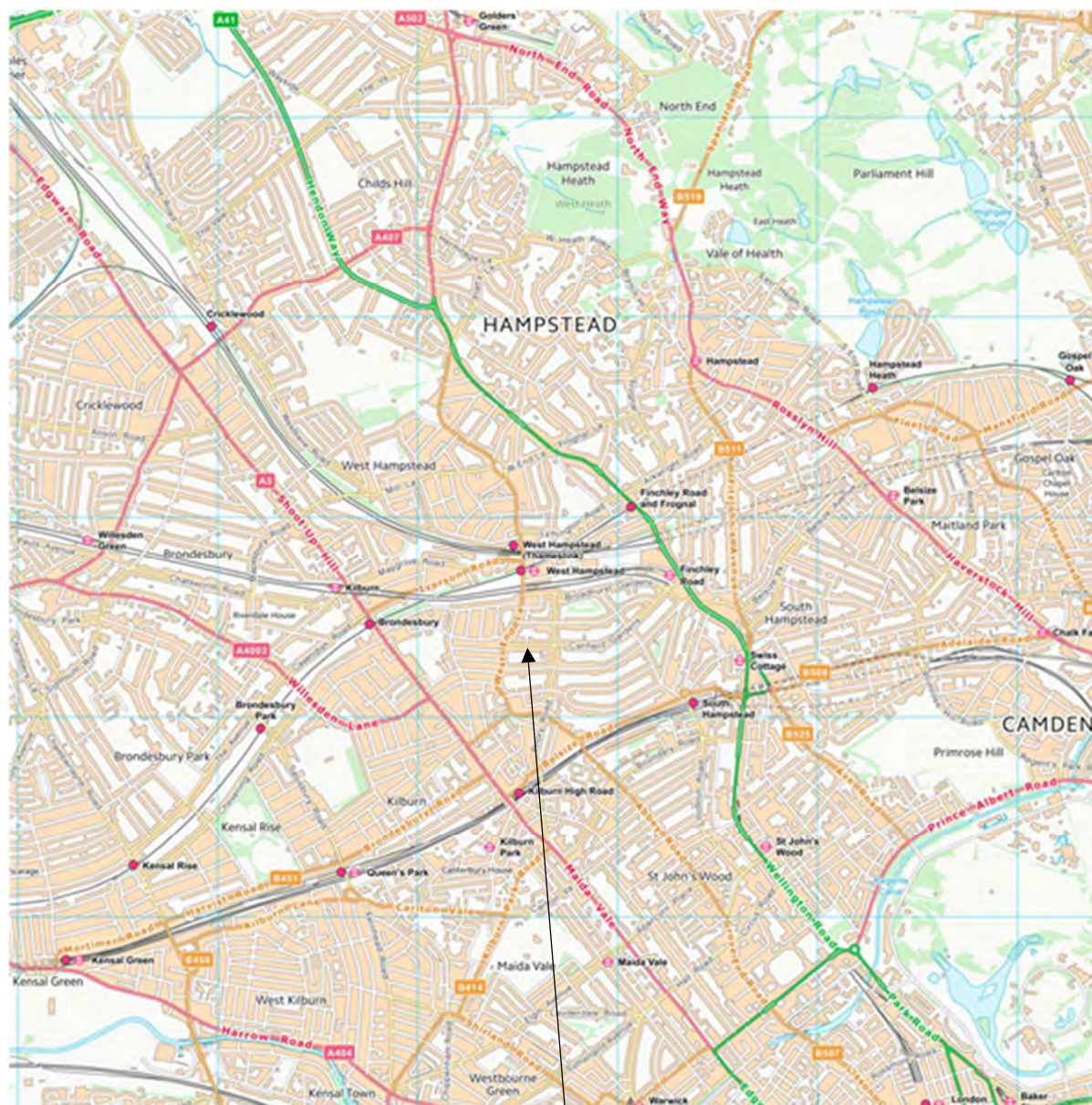
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APPENDIX A

Site Plans

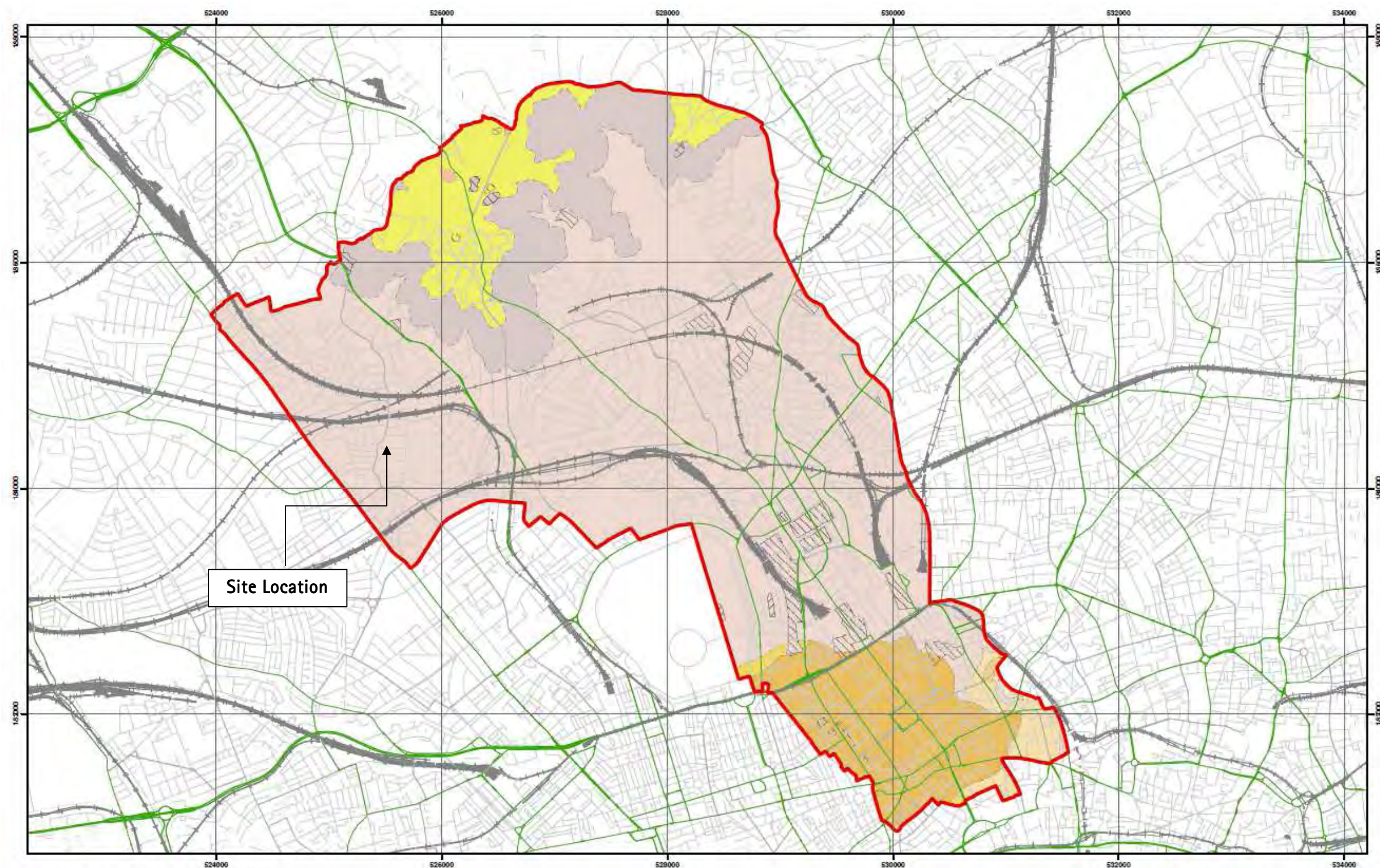




Site Location

Contains Ordnance Survey Data © Crown Copyright and Database Right 2018

Site:	5 Cleve Road, London, NW6 3RN	Project ID	J13841
Figure 1	Site Location Plan	Date:	29 th Oct 2018



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

Scale at A3: 1:30,000

Coordinate System:
British National Grid
GCS_OSGB_1936



Legend

- London Borough of Camden
- Railway Lines
- A Roads

- MADE GROUND
- WORKED GROUND

BGS 1:10K Artificial Ground

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

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

Site: 5 Cleve Road, London, NW6 3RN

Date: 30 October 2018

STL: J13841

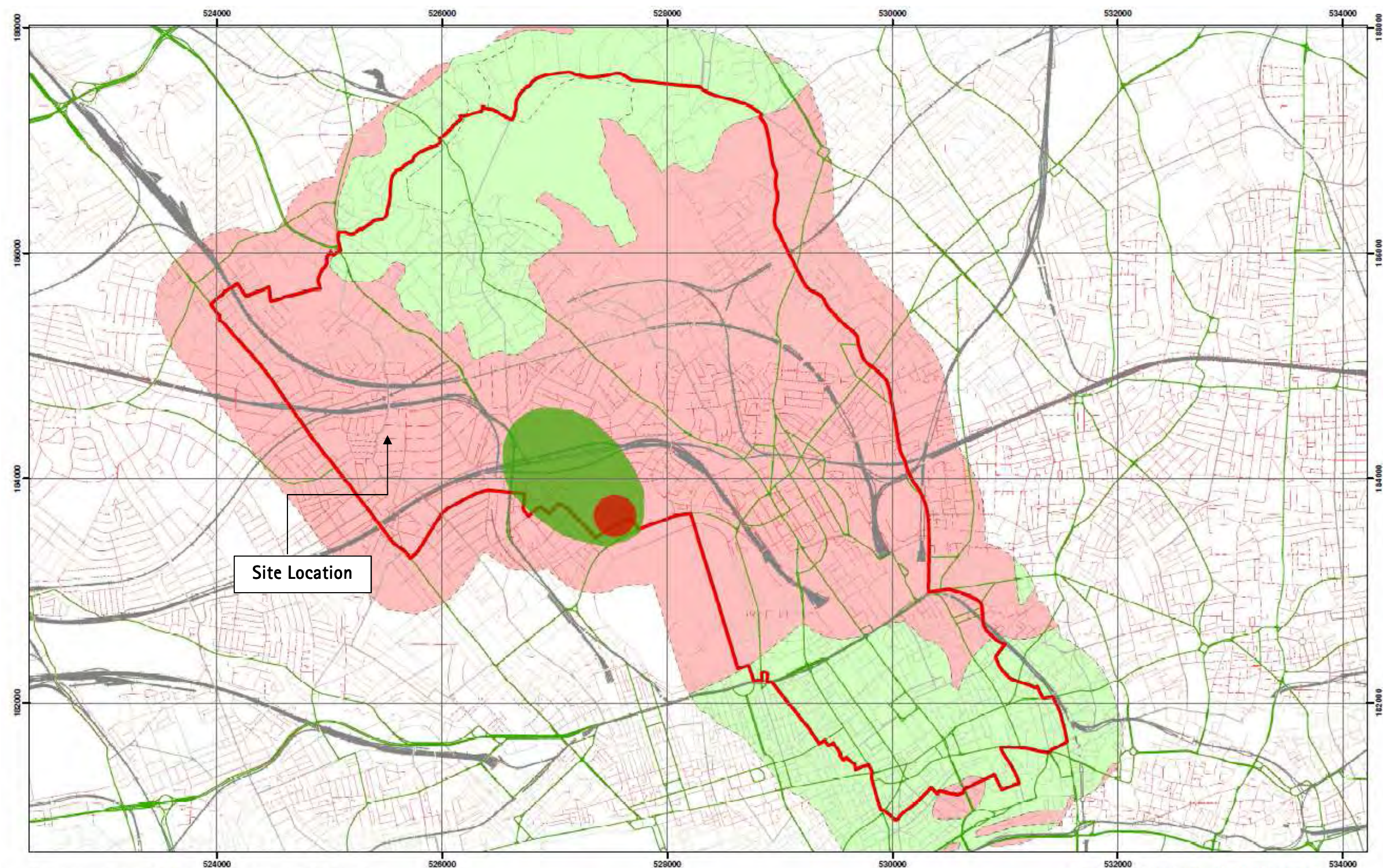
Fig No: 2

 Southern Testing

Southern Testing: Keeble House, Stuart Way, East Grinstead, West Sussex RH19 4QA
ST Consult: Twigden Barns, Brixworth Road, Creton, Northampton NN6 8NN

 ST Consult

Camden Geological Map



Environment Agency Aquifer Designation based on BGS Mapping



Scale at A3: 1:30,000

Coordinate System:
British National Grid
GCS_OSGB_1936



Legend

- | | | |
|---|--|---|
| Borough of Camden | Secondary AAquifer | Outer Source Protection Zone |
| — Railway Lines | Unproductive Strata | Inner Source Protection Zone |
| — A Roads | | |

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

Camden Geological, Hydrogeological
and Hydrological Study
Camden Aquifer Designation Map

213923

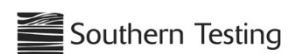
Site: 5 Cleve Road, London, NW6 3RN

STL: J13841

Fig No: 3

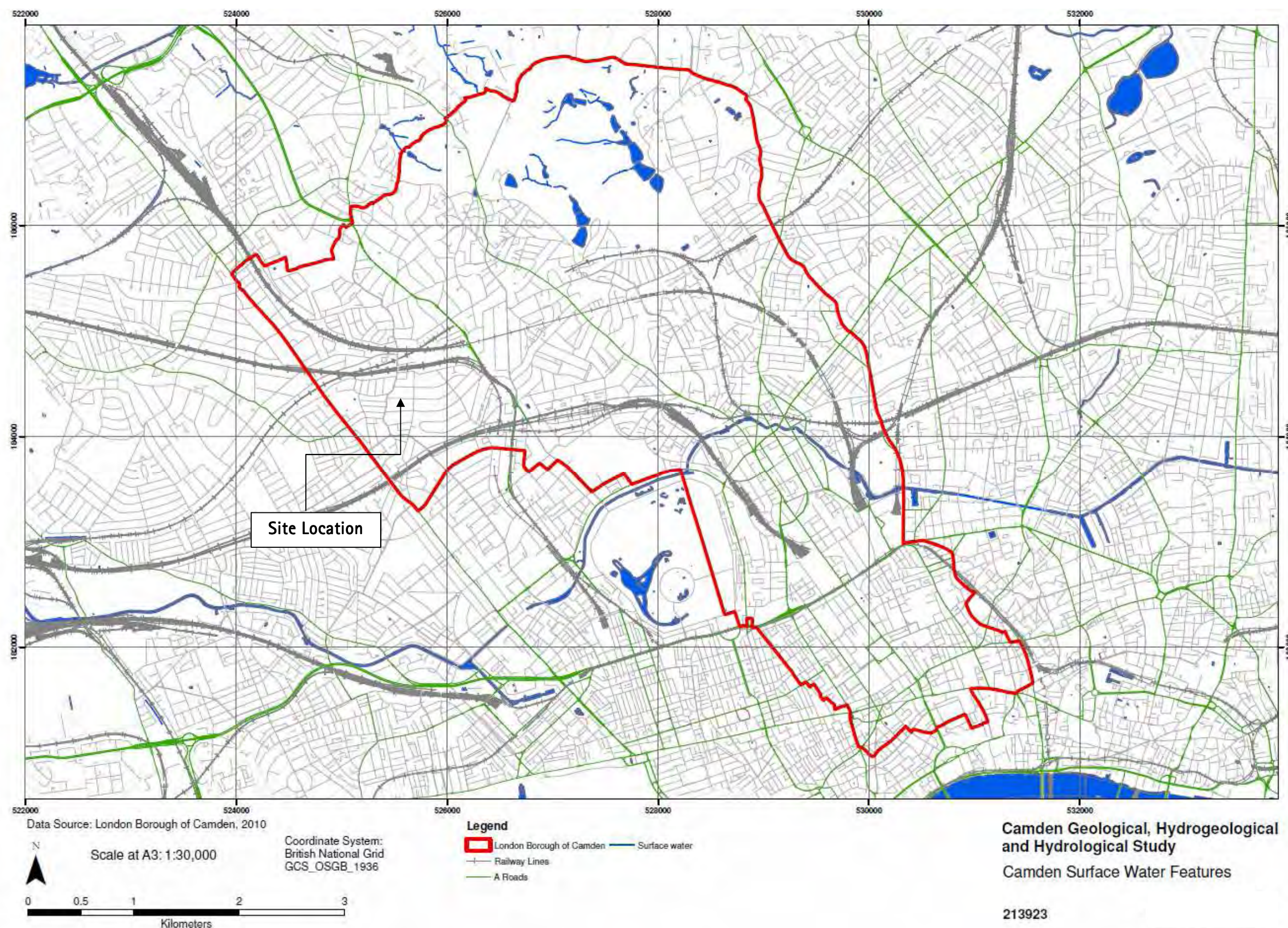
Date: 30 October 2018

Camden Aquifer Designation Map



Southern Testing: Keeble House, Stuart Way, East Grinstead, West Sussex RH19 4QA
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Site: 5 Cleve Road, London, NW6 3RN

STL: J13841

Fig No: 4

Date: 30 October 2018

Camden Surface Water Features



Southern Testing: Keeble House, Stuart Way, East Grinstead, West Sussex RH19 4QA
ST Consult: Twigden Barns, Brixworth Road, Creton, Northampton NN6 8NN



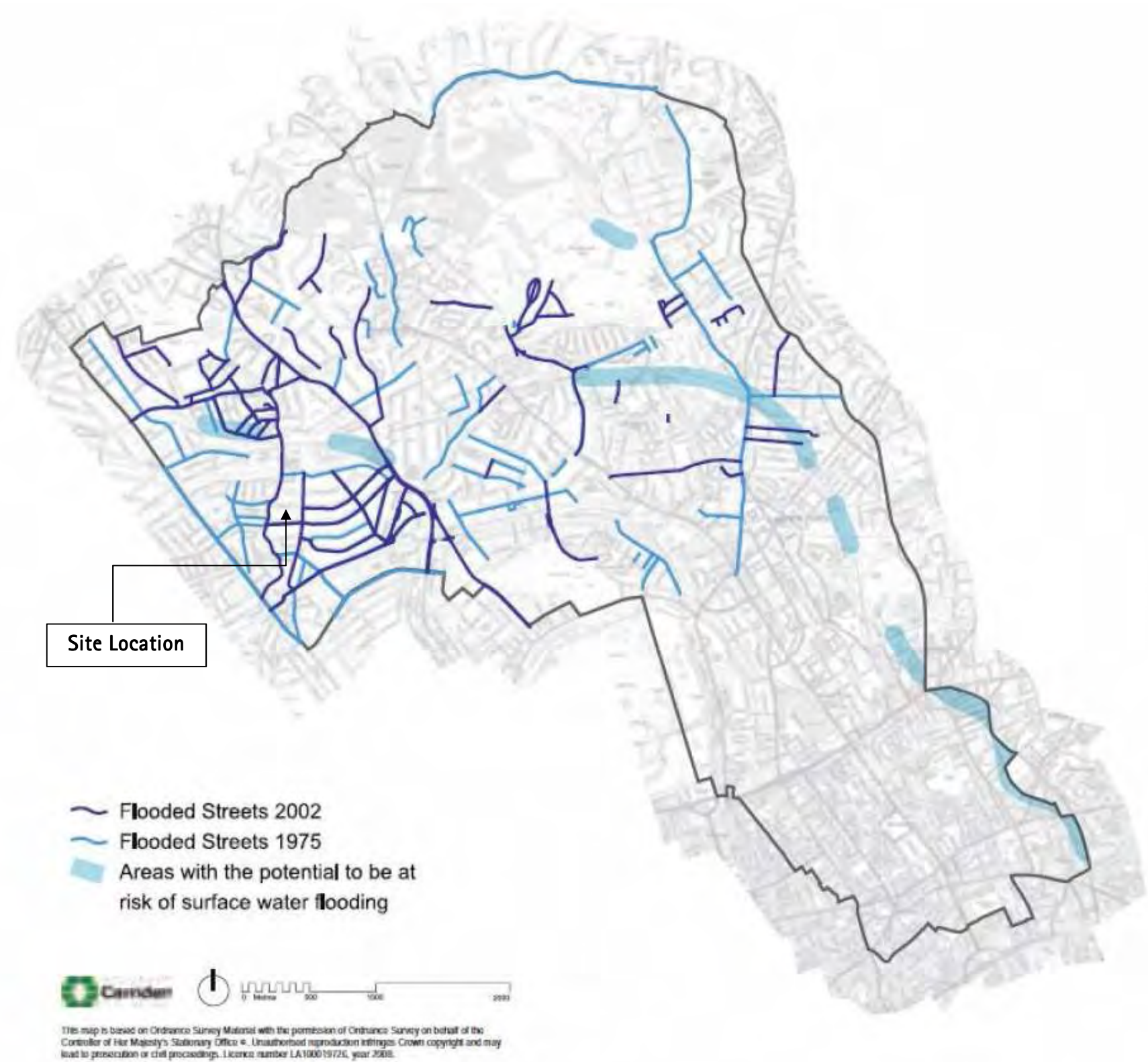


Figure 5 from Core Strategy, London Borough of Camden

Site: 5 Cleve Road, London, NW6 3RN

STL: J13841

Fig No: 5

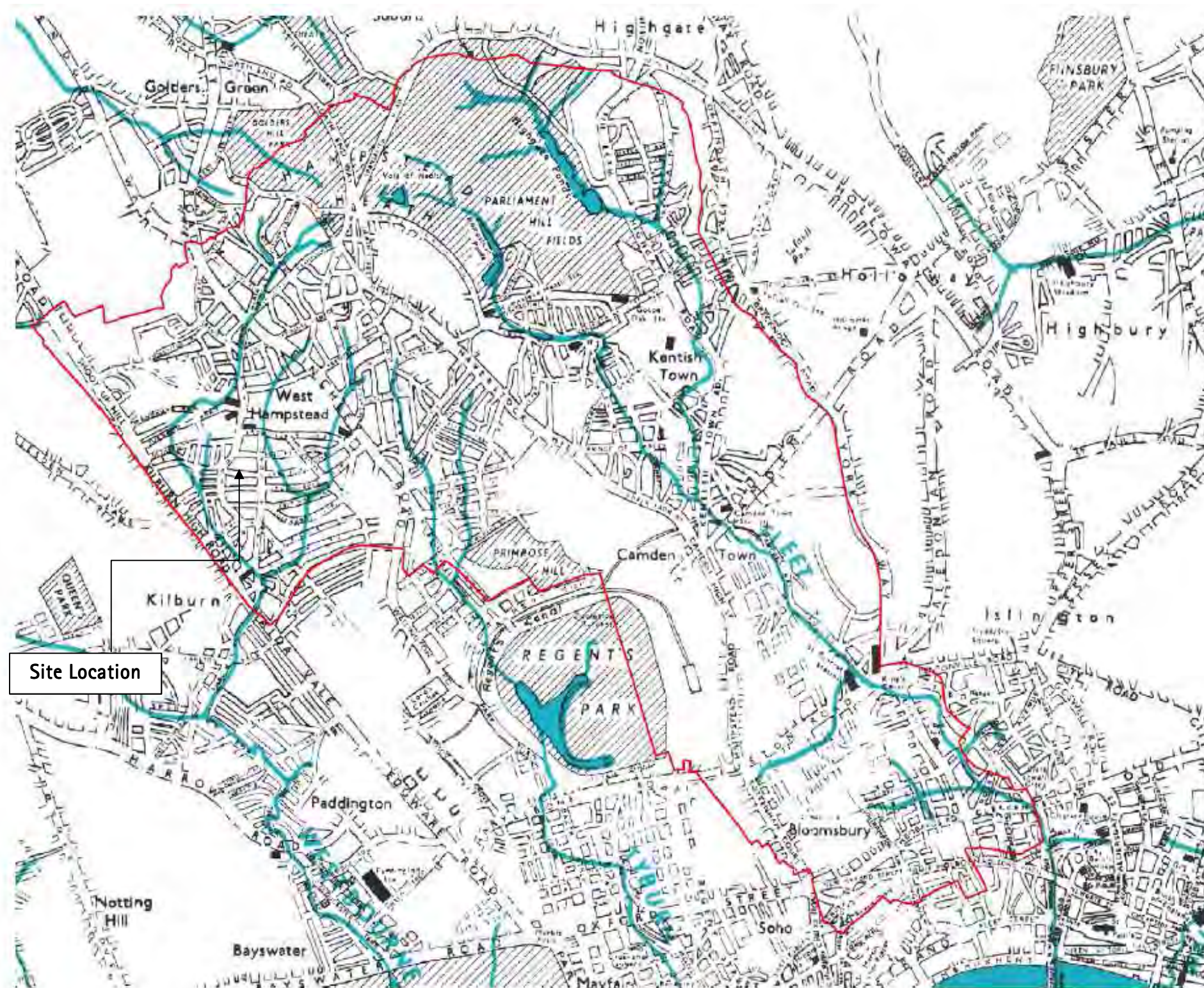
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Camden Flood Map

 Southern Testing

Southern Testing: Keeble House, Stuart Way, East Grinstead, West Sussex RH19 4QA
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 ST Consult



Source – Barton, Lost Rivers of London

Camden Geological, Hydrogeological
and Hydrological Study
Watercourses

Site: 5 Cleve Road, London, NW6 3RN

STL: J13841

Fig No: 6

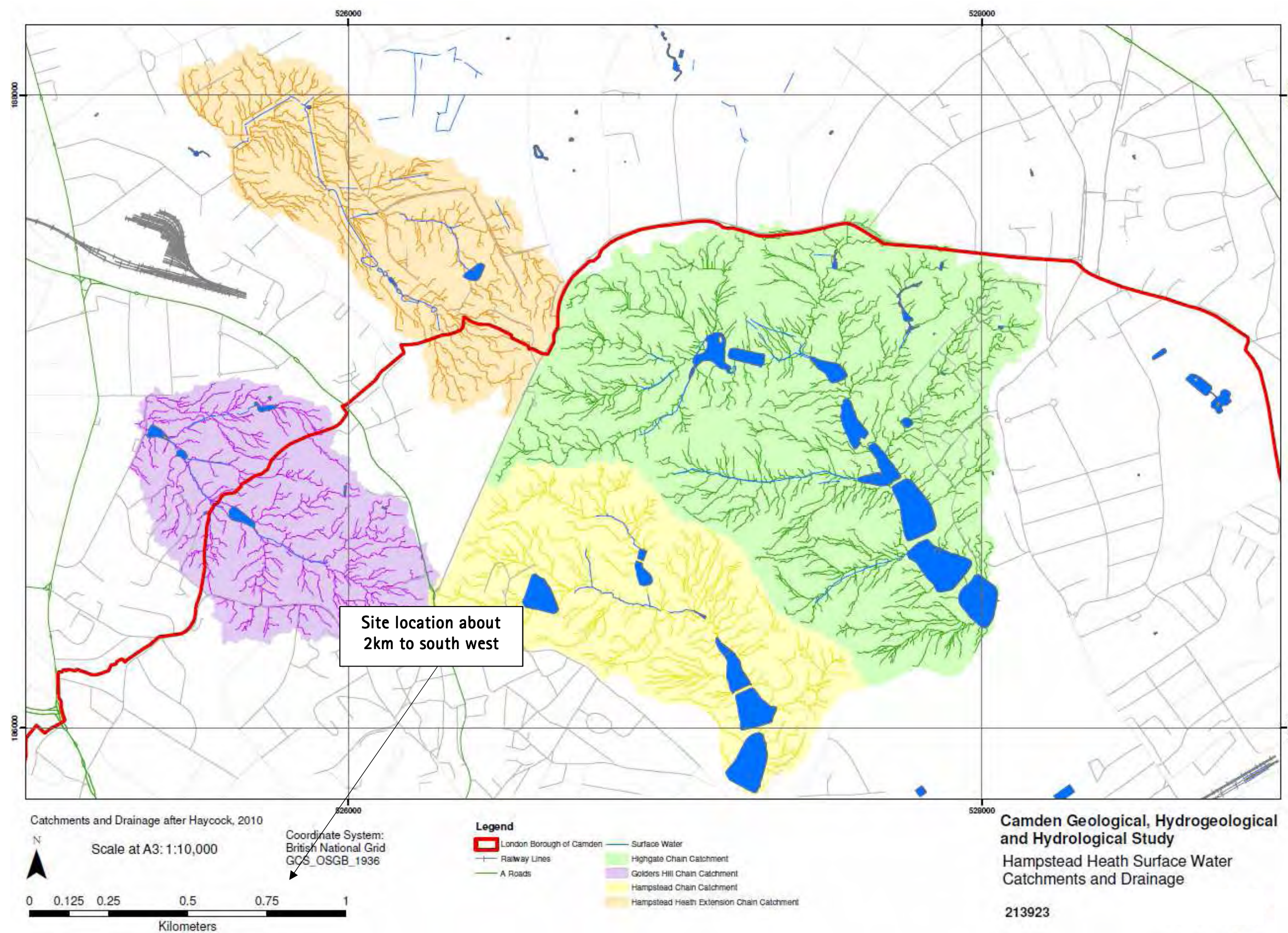
Date: 30 October 2018

Camden Watercourses

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Site: 5 Cleve Road, London, NW6 3RN

STL: J13841

Fig No: 7

Date: 30 October 2018

Camden Hampstead Heath Surface Water Catchments and Drainage

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ST Consult: Twigden Barns, Brixworth Road, Creton, Northampton NN6 8NN

 ST Consult



Southern Testing
Environmental & Geotechnical

ST Consult
Environmental & Geotechnical



Head Office
East Grinstead
Tel: 01342 333100
enquiries@southerntesting.co.uk

ST Consult Midlands
Northampton
Tel: 01604 500020
creaton@stconsult.co.uk

ST Consult Thames Valley
Hannington
Tel: 01635 800 950
hannington@stconsult.co.uk

ST Consult North West
Warrington
Tel: 01925 661 700
warrington@stconsult.co.uk



FS 29280 EMS 506775 OHS 506776

