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AND HYDROGEOLOGY

Basement Impact Assessment: Groundwater
43 Burghley Road, NW5 1UH

Prepared for: Ground and Water Limited
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Date: 15/03/2016
Status: Draft
Reference: 30130R1D1
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1 INTRODUCTION

Ground and Water Limited Ltd has instructed H Fraser Consulting Ltd (HFCL) to provide the hydrogeological aspects of a Basement Impact Assessment at the following property:

43 Burghley Road, NW5 1UH.

The site is in the London Borough of Camden.

1.1 Objective

The objective of this report is to provide the hydrogeological aspects of a Basement Impact Assessment to support a planning application for construction of a basement at 43 Burghley Road, NW5 1UH.

1.2 Scope of works

The following works have been undertaken:

- Desk study
- Screening assessment with regards to groundwater
- Scoping assessment to identify potential impacts
- Impact assessment with regard to groundwater attributes
- Reporting

The work has been undertaken in accordance with the requirements of London Borough of Camden's (LBC) Planning Guidance CPG4 'Basements and Lightwells' (referred to as CPG4) and Arup's 'Geological Hydrogeological and Hydrological Study, Guidance for Subterranean Development' (Arup, 2012, referred to throughout this report as the GHHS).

This assessment is limited to an assessment of the hydrogeological aspects of the proposed development and does not purport to make any comment on surface water flooding, hydrology, contamination or pollution, engineering, land stability, design or construction issues.

The work has been undertaken by Hannah Fraser, Director of HFCL, who is a Chartered Geologist with 19 years' experience as a hydrogeologist and consultant.

2 BACKGROUND INFORMATION

Background information has been derived from a Groundsure report for the site (Appendix A); geological information has been derived from on-line BGS sources (Geology of Britain Viewer, GeoIndex, Lexicon); on-line mapping and aerial photography have been derived from Streetmap and GoogleEarth. **Error! Reference source not found.** presents relevant background information for the site. The site location is shown in **Error! Reference source not found.**.

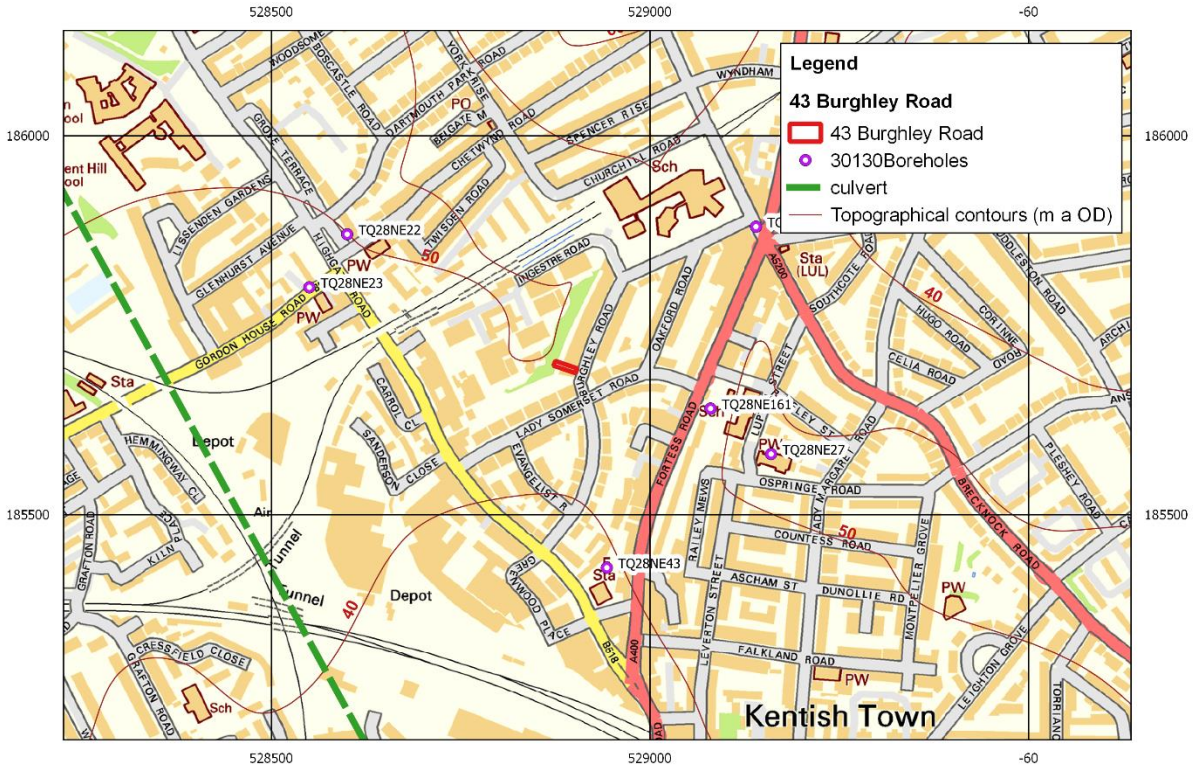

Figure 2.1 Site location

Contains Ordnance Survey data © Crown copyright and database right 2016

Table 2-1 Background information

Address	43 Burghley Road, NW5 1UH.
NGR	528892,185693
Description	The existing property comprises a terraced four storey brick built residential house, accessed via stairs to a raised ground floor level. It is understood that the property has no lower ground floor level. The site comprises an approximately rectangular shaped plot of land, totalling approximately 160 m^2 in area and orientated in a north-west to south-east direction, located on the north-western side of Burghley Road. The rear garden, which is accessible only through the house, is paved. The site is located approximately 30m north-west of Burghley Road's cross-road junction with Lady Somerset Road in Kentish Town in the London Borough of Camden.[1] Ground and Water Ltd (2014) report that the site's environs slope gently to moderately to the south-west. Site plans are shown in Appendix B.

[1] Ground and Water, 2014

	Ordnance survey topographic data show the site to lie in a 'saddle', just below the 50 m contour, as shown on **Error! Reference source not found.**. Ground elevations rise to the northwest and southeast, and fall to the southwest and northeast. Within the property, the ground slopes down from the back garden to the front, with a fall of approximately 1.5 m across the property.
Proposed development	Proposal plans show the development of a basement below the existing property, extending slightly beyond the existing footprint to the front and rear, to accommodate a lightwell at the front and a lightwell and roof light at the rear. A proposed section shows the basement level to be 3.2 m below the back garden level and 1.7 m below the road elevation at the front of the house. Site plans are shown in Appendix B.
Planning history	A search of the on-line planning records on www.camden.gov.uk for 'Burghley Road, and 'basement' indicates that several properties on Burghley Road have a basement, including nos. 10, 13, 19, 21, 30, 34, 48 52 and 91, and at 5 and 6 Lady Somerset Road.
Geology	Geological mapping[2] shows the area to be underlain by London Clay. The London Clay is extensive across the area, with the nearest superficial deposits mapped approximately 2 km southeast. To geological boundary with the Claygate Member, which overlies the London Clay, lies approximately 1.3 km northwest. The London Clay 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. It also includes a few thin beds of shells and fine sand partings or pockets of sand, which commonly increase towards the base and towards the top of the formation. At the base, and at some other levels, thin beds of black rounded flint gravel occur in places. Glauconite is present in some of the sands and in some clay beds, and white mica occurs at some levels[3] BGS Map 256 (1:50,000 series, North London) indicates that there are Quaternary Head Deposits at or close to the site. These are poorly sorted and poorly stratified deposits formed mostly by solifluction and/or hillwash and soil creep, and may comprise gravel, sand and clay depending on the upslope source and distance from source[4]. **Error! Reference source not found.** presents geological data from selected BGS borehole records[5], and **Error! Reference source not found.** shows the location of the boreholes. The local borehole records confirm the presence of London Clay, with Made Ground and/or gravel overlying the clay in 3 of the 6 boreholes. A site investigation undertaken by Ground and Water Limited on 29th August 2014 comprised the drilling of one window sampler borehole (WS1) to a depth of 5.00m bgl and the hand excavation of one trial pit foundation exposure

[2] http://mapapps.bgs.ac.uk/geologyofbritain/home.html
[3] http://www.bgs.ac.uk/lexicon/lexicon.cfm?pub=LC
[4] http://www.bgs.ac.uk/lexicon/lexicon.cfm?pub=HEAD
[5] http://mapapps2.bgs.ac.uk/geoindex/home.html

	(TP/FE1), both at the front of the property. In addition, a Heavy Dynamic Probe (HDP) was undertaken adjacent to WS1 (DP1) to 10.00m bgl. It was not possible to install a standpipe in WS1 due to a collapse of the borehole at 2.30m bgl upon completion of the borehole. The investigation confirmed that the site is underlain by Made Ground and London Clay. Site investigation data are provided in Table 2-3.
Aquifer status	The London Clay is classified by the Environment Agency as unproductive strata (rock layers with low permeability and negligible significance for water supply or river base flow). The site is not within a source protection zone of a public water supply. Two of the six BGS borehole logs summarised in **Error! Reference source not found.** recorded groundwater: at TQ28NE161, approximately 200 m southeast of the site, groundwater was recorded at 7.32 m below ground level, or 44.78 m a OD; at TQ28NE43, approximately 300 m south of the site, groundwater was recorded at 8.65 m bgl. A groundwater strike was encountered within the borehole on site during drilling at 3.3 m bgl.
Watercourses	A Groundsure report[6] for the site states that there is a culvert 455 m southwest of the site, as shown on Figure 2.1. Additionally, two water features are reported 134 m and 149 m north of the site, that are not represented on mapping. OS mapping shows two small line features approximately 260 m north of the site, associated with the railway. The former route of the River Fleet, now believed to be culverted, lay approximately 200 m southwest of the site. There are no surface water abstraction licences within 1700 m of the site. [7] The site does not lie within the catchment of the ponds on Hampstead Heath (Arup, 2012).
Spring lines	There are no springs shown on OS mapping in the immediate vicinity of the property, and no geological features mapped that might give rise to springs.
Wells	The closest groundwater abstraction licence is over 990 m from the site, at Kentish Town Sports Centre, which is a for a potable abstraction. There are no source protection zones within 500 m of the site.[8] There is one BGS record of a well within 750km of the site, at Highgate Road water works[9].
Groundwater flooding	British Geological Survey Groundwater flood risk mapping reports there to be no groundwater flooding susceptible areas within 50 m of the site, and the area is not considered prone to groundwater flooding, based on rock type.[10]

[6] Groundsure report GS-2806159
[7] Groundsure report GS-2806159
[8] Groundsure report GS-2806159
[9] http://mapapps2.bgs.ac.uk/geoindex/home.html
[10] Groundsure report GS-2806159

Table 2-2 BGS borehole records

Reference	Name	Easting	Northing	Description
TQ28NE24	Junction of Fortress Rd & Tufnall Rd	529140	185880	London Clay to 14.33 m.
TQ28NE27	St Benets Church Lupton St	529160	185580	Brown clay to 3.05 m, blue clay to 5.49 m.
TQ28NE161	Eleanor Palmer School 3	529080	185640	Datum is at 52.1 m a OD. Fill (tarmac) to 0.08 m, fill (brick rubble and ash) to 0.46 m, fill (mottled brown and grey silty clay, gravel, brick fragments) to 0.92 m, firm fissured brown with grey veining silty CLAY, with occasional partings of silty fine sand and some gypsum crystals to 5.64 m, stiff fissured brown silty CLAY with occasional partings of silty fine sand, and some gypsum crystals to 8.23 m. Groundwater level stood at a depth of 7.32 m below ground level, or 44.78 m a OD.
TQ28NE23	Gordon House Highgate Rd Kentish Town	528550	185800	Datum is at 45.72 m a OD. Stiff brown clay to 10.67 m, blue clay to 21.34 m. All dry.
TQ28NE22	Junction Chetwynd Rd Kentish Town	528600	185870	Datum is at 41.98 m a OD. Brown clay to 1.53 m, brown gravel to 1.83 m, blue clay to 9.15 m. All dry.
TQ28NE43	Kentish Town Fire Station	528943	185430	Made Ground to 0.92 m, brown and scattered gravel to 1.68 m, firm brown mottled clay to 6.71 m, firm brown fissured clay to 9.15 m. Water seepage at 2.44 m. Groundwater level at 8.54 m.

Geological data from site investigations in August 2014 are presented in Table 2-3 (after Ground & Water, 2014).

Table 2-3 Site investigation data

Strata	Depth (m bgl)	Thickness (m)
- Concrete	0.2	0.2
- Made Ground comprising orange brown silty clay with rare, fine, sub-angular gravel of brick and concrete.	2.3	2.1
- London Clay Formation comprising an orange brown silty clay, with blue grey mottling.	5	2.7

A groundwater strike was recorded at 3.3 m bgl. A piezometer was not installed due to the collapse of the borehole, and no further groundwater measurements were taken.

3 SCREENING

A screening assessment has been undertaken in accordance with the methodology set out in Section 6.2 and Appendix E2 of the GHHS (Arup, 2012). The results are presented in Table 3-1.

Table 3-1 Screening assessment

Ref	Question	Answer (yes/no/unknown)	Action
Q1a	Is the site located directly above an aquifer?	No	No further action
Q1b	Will the proposed basement extend beneath the water table surface?	Unlikely but data are sparse	Take forward to scoping stage
Q2	Is the site within 100m of a watercourse, well (used/ disused) or potential spring line?	No	No further action
Q3	Is the site within the catchment of the pond chains on Hampstead Heath?	No	No further action
Q4	Will the proposed basement development result in a change in the proportion of hard surface/paved areas?	Unknown	Take forward to scoping stage
Q5	As part of the 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)	Unknown	Take forward to scoping stage
Q6	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 or spring line?	No	No further action

4 SCOPING

This section of the report summarises the pertinent information as a Conceptual Model, and then describes the matters of concern that need to be considered in the Impact Assessment.

4.1 Conceptual model

The proposed development is for a basement below the existing property, extending slightly beyond the existing footprint to the front and rear, to accommodate a lightwell at the front and a lightwell and roof light at the rear. The topography falls to the southeast, and there is a 1.5 m fall across the site from the rear garden to the front, with the front door accessed via stone steps from the road level. Proposed sections show the basement level to be 3.2 m below the back garden level and 1.7 m below the road elevation at the front of the house.

The underlying geology comprises the London Clay. Site investigation data from the front of the property confirm the presence of London Clay below 2.3 m of Made Ground. The London Clay is classified as 'unproductive strata', and has low permeability. Groundwater flow within the London Clay is generally negligible, although some groundwater movement occurs on discrete sand partings or other discontinuities. Groundwater flow directions are likely to be in the direction of topography, to the south and southwest. Geological mapping indicates that there may be Head Deposits in the vicinity.

Groundwater was observed as a water strike during drilling at the front of the property, at 3.3 m bgl, which is 2.2 m below the basement level at the front of the property. Further groundwater monitoring was not possible due to the collapse of the borehole. If the site elevation is estimated as between 46 m a OD and 48 m a OD, the groundwater strike was at an elevation of between 42.7 m a OD and 44.7 m a OD. This is broadly consistent with a groundwater elevation measured at 44.78 m a OD at a BGS borehole 300 m south of the site.

Due to the very low permeability of the London Clay, it can take several days or weeks for a water table elevation to be established within a water monitoring boreholes. The groundwater strike recorded at 3.3 m bgl may not be representative of local groundwater elevations, but reflect the elevation of a particularly permeable feature such as a fissure or sandy patch. However, planning records indicate that there are several basements in the local vicinity, most of which are not recent, which provides additional evidence that groundwater is likely to be below the basement elevation. N.b. there are no records of basements at adjacent properties.

There is a reasonable thickness (2.3 m) of clayey Made Ground at the site, and Head Deposits are mapped locally. These may be more permeable than the London Clay and may transmit infiltrating rainfall and perched groundwater relatively quickly.

The existing ground cover in the area of the lightwell at the front of the property is not known, therefore it is not clear whether the development will increase or decrease the proportion of hardstanding at the site.

4.2 Matters of concern

Five attributes are considered as potential matters of concern, as discussed below.

1. Groundwater level – a groundwater strike was recorded below the base of the basement, however, groundwater monitoring was not possible due to the collapse of the borehole. This is taken forward for further assessment.
2. Range of seasonal fluctuation in groundwater levels – the range of fluctuation in groundwater levels is not known. This is taken forward for further assessment.

3. Spring/stream hydrographs – there is no evidence that local streams or springs are likely to be affected. This is not considered further.
4. Soil moisture – there is the potential for soil moisture content to affect the development, and this is carried forward for further assessment.
5. Water quality – there is no evidence that the development will affect water quality, provided good practice is followed with regard to pollution management. This is not considered further.

5 IMPACT ASSESSMENT

The impact assessment has been undertaken by considering groundwater attributes, how these are likely to change under the proposed development and the consequence of any predicted changes. The assessment is qualitative at this stage. The results are presented in Table 5-1.

Table 5-1 Impact assessment

Groundwater Attribute	Predicted Change	Consequence of change and mitigation
Groundwater levels	On the basis of the available data, groundwater levels are likely to be below the basement elevation. However, groundwater monitoring was not possible, and there is the possibility that groundwater elevations may be higher.	Precautions should be taken to ensure that the excavation remains dry during construction.
	Under higher water table or rainy conditions, there may be some groundwater flows into the excavation during construction, however these are likely to be low due to the low permeability of the clayey Made Ground and London Clay observed on site.	The proposed basement structure should be adequately protected against ingress of groundwater.
	Should groundwater elevations rise above the basement level, there is the potential for groundwater to 'back up' around the basement structure. There is no evidence that neighbouring properties have basements, and it is therefore unlikely that high groundwater levels will impact neighbouring properties.	Design of drainage systems should consider the requirements of sustainable urban drainage.
	The proportion of hardstanding at the site is unlikely to change significantly as a result of the development, due to the small areas of the proposed lightwells and roof light and the existing hard cover in the rear garden. In any case, it is unlikely that recharge to groundwater will be affected due to the low permeability of the London Clay.	
Range of seasonal fluctuation in groundwater levels	The range of groundwater fluctuation is not known.	The proposed basement structure should be adequately protected against ingress of groundwater, and structural design should include for groundwater elevations close to ground level.
Soil moisture	Soil moisture has the potential to permeate the basement structure.	The proposed basement structure should be adequately protected against permeation of soil moisture.

6 CONCLUSIONS

The proposed development is for a basement below the existing property, extending slightly beyond the existing footprint to the front and rear, to accommodate a lightwell at the front and a lightwell and roof light at the rear.

There is a 1.5 m fall across the site from the rear garden to the front, with the front door accessed via stone steps from the road level. Proposed sections show the basement level to be 3.2 m below the back garden level and 1.7 m below the road elevation at the front of the house.

The underlying geology comprises the London Clay. Site investigation data from the front of the property confirm the presence of London Clay below 2.3 m of clayey Made Ground. The London Clay is classified as 'unproductive strata', and has low permeability. Groundwater flow within the London Clay is generally negligible, although some groundwater movement occurs on discrete sand partings or other discontinuities.

Groundwater was observed as a water strike during drilling at the front of the property, at 3.3 m bgl, which is 1.6 m below the basement level at the front of the property. Further groundwater monitoring was not possible due to the collapse of the borehole.

Due to the very low permeability of the London Clay, it can take several days or weeks for a water table elevation to be established within a water monitoring boreholes. The groundwater strike recorded at 3.3 m bgl may not be representative of local groundwater elevations, but reflect the elevation of a particularly permeable feature such as a fissure or sandy patch. However, planning records indicate that there are several (not recent) basements in the local vicinity, which provides additional evidence that groundwater is likely to be below the basement elevation. N.b. there are no records of basements at adjacent properties.

On the basis of the available data, groundwater levels are likely to be below the basement elevation. However, groundwater monitoring was not possible, and there is the possibility that groundwater elevations may be higher.

Under higher water table or rainy conditions, there may be some groundwater flows into the excavation during construction, however these are likely to be low due to the low permeability of the clayey Made Ground and London Clay observed on site. Precautions should be taken to ensure that the excavation remains dry during construction.

Should groundwater elevations rise above the basement level, there is the potential for groundwater to 'back up' around the basement structure. There is no evidence that neighbouring properties have basements, and it is therefore unlikely that high groundwater levels will impact neighbouring properties. The proposed basement structure should be adequately protected against ingress of groundwater and soil moisture.

The proportion of hardstanding at the site is unlikely to change significantly as a result of the development, due to the small areas of the proposed lightwells and roof light and the existing hard cover in the rear garden.In any case, it is unlikely that recharge to groundwater will be affected due to the low permeability of the London Clay. Design of drainage systems should consider the requirements of sustainable urban drainage.

7 REFERENCES

Arup, 2012. Geological Hydrogeological and Hydrological Study, Guidance for subterranean development

Ground and Water, 2016. Ground Investigation Report for the site at 43 Burghley Road, Kentish Town, Camden, London NW5 1UH. File ref: GWPR1006. October 2014.

London Borough of Camden CPG4 'Basements and Lightwells'

APPENDIX A

Groundsure Report

APPENDIX B

Site Plans