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# 8A Belmont Street
# Basement Impact Assessment: Groundwater

Prepared for: Ground and Water Limited
15 Bow Street
Alton
Hampshire
GU34 1NY

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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:

8A Belmont Street, NW1 8HH.

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 8A Belmont Street, NW1 8HH.

## 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. Table 2.1 presents relevant background information for the site. The site location is shown in Figure 2.1.

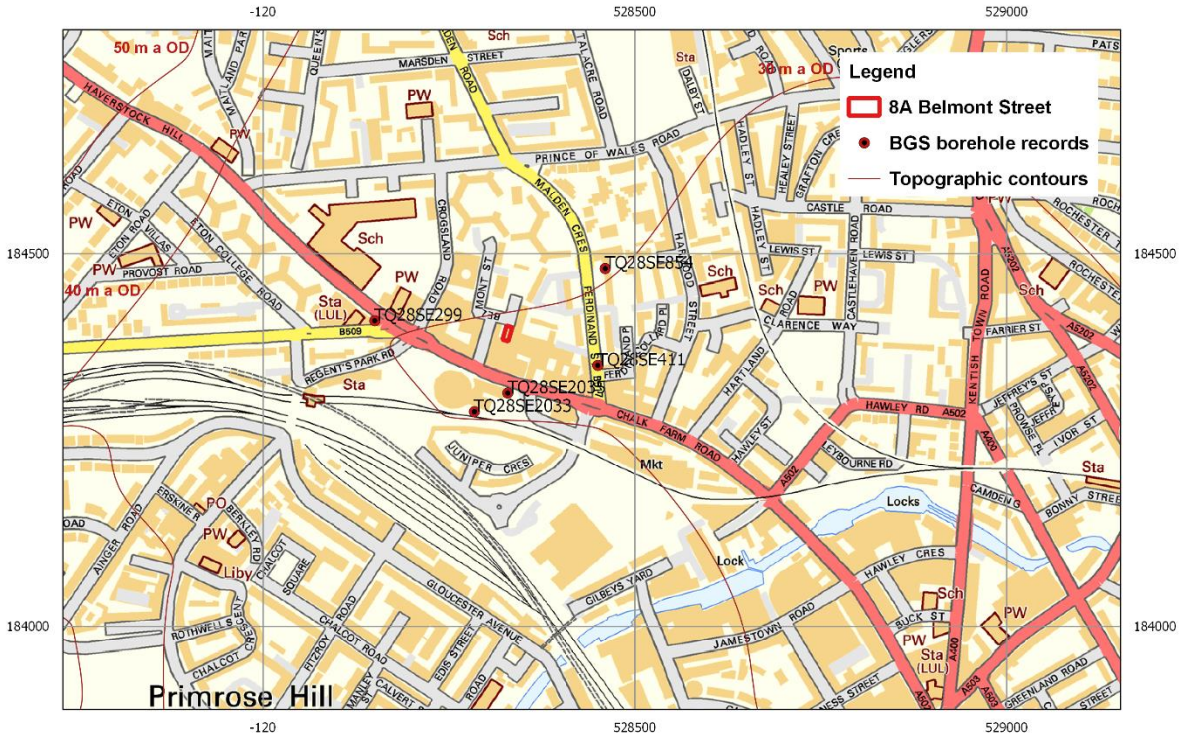


**Figure 2.1 Site location**

Contains Ordnance Survey data © Crown copyright and database right 2016

**Table 2.1 Background information**

| | |
|---|---|
| **Address** | 8A Belmont Street, NW1 8HH. |
| **NGR** | 528328,184393 |
| **Description** | The existing property comprises a one to two storey commercial/light industrial premises with a roller shutter door on the northern access. The northern, eastern and southern walls of the building are bounded by open ground, thought to be paved, and the western boundary is formed by the rear gardens of 4 – 8 Belmont Street, and the rear wall of 2 Belmont Street.<br><br>4 – 8 Belmont Street are accessed by stone stairs up to an upper ground floor level, with a lower ground floor level and lightwells evident from street photos. 2 Belmont Street is accessed at ground level, and it is not clear whether there is a basement at this property.[1] Plans for the development (e.g. BEL-PL-GA-03, Appendix B) show that the shared boundary between 2 Belmont Street and the proposal site predominantly comprises a walled yard, with a short section of the shared boundary being the rear wall of the house at 2 Belmont Street. |

[1] maps.google.co.uk

| | |
|---|---|
| | To the east of the property, separated by a narrow paved alley, is 10A Belmont Street. This is a large warehouse style building with at least 6 storeys and a basement.<br><br>Topography falls from Hampstead Heath in the northwest, towards the southeast. The site elevation is slightly less than 30 m OD; local topography is shown on Figure 2.1. |
| **Proposed development** | The proposal is to demolish the existing building and construct a basement with three storeys (including roof accommodation) above, on the footprint of the existing building. The new development will house two dwellings. Each will have an lightwell from basement level. The depth of the basement will be between 3.0 and 3.5 m bgl. Plans and sections for the proposed basement are presented in Appendix B. |
| **Planning history** | A search of the online planning records at www.camden.gov.uk shows that in 2013, planning permission was granted at 10A Belmont Street to create a new basement level beneath the footprint of the existing office building with associated front and rear lightwells, and installation of railings at ground floor level. In 2014, permission was granted at the same property for excavation of a basement level beneath the rear service yard. Photographic evidence shows there to be a basement at 10a Belmont Street. |
| **Geology** | Geological mapping[2] shows the area to be underlain by London Clay. The London Clay is extensive to the southeast; the overlying Claygate member and Bagshot Formation outcrop to form the elevated area of Hampstead Heath, with the closest outcrop of the Claygate member approximately 1.5 km northwest.<br><br>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]<br><br>There are no superficial deposits mapped at the site, the closest outcrop of superficial deposits is approximately 1.6 km m to the southeast.[4]<br><br>Table 2.2 presents geological data from selected BGS borehole records[5], and Figure 2.1 shows the location of the boreholes. The local borehole records confirm the presence of Made Ground underlain by London Clay.<br><br>A site investigation undertaken by Ground and Water Limited on 19th January 2016 and 2nd February 2016 comprised the excavation of a Window Sampler Borehole (WS1) to a depth of 4.00m bgl. A Heavy Dynamic Probe (HDP) (DP1) was undertaken adjacent to WS1 to a depth of 10.00m bgl. The investigation |

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

| | |
|---|---|
| | confirmed that the site is underlain by Made Ground and London Clay. Site investigation data are provided in Table 2.3. A groundwater monitoring well was installed within WS1 to 2.75 m bgl. |
| **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.<br><br>Three of the five BGS borehole logs summarised in Table 2.2 recorded groundwater, at 27.65 m a OD (TE28SE2033) and 28.2 m a OD (TQ28SE2035) and approximately 1 m a OD (TQ28SE411).<br><br>No groundwater was encountered within the trial holes on site. A return visit to dip the 2.75 m deep groundwater monitoring well, by a Ground and Water Limited Engineer on the 8th March 2016 revealed a standing water level of 2.10m bgl (Ground and Water, 2015). |
| **Watercourses** | The Regent's Canal lies approximately 400 m southeast of the site. There are two licenses to abstract surface water from the canal within 500 m of the site, these are 398 m and 402 m southeast of the site.[6]<br><br>The site does not lie within the catchment of the ponds on Hampstead Heath (Arup, 2012).<br><br>The site lies approximately 150 m southwest of the former route of the River Fleet. |
| **Spring lines** | There are no springs shown on OS mapping in the immediate vicinity of the property. |
| **Wells** | The closest groundwater abstraction is 554 m NE of the site, at Kentish Town sports centre. There is a potable water abstraction license 971 m southwest of the site at Primrose Hill. There are no source protection zones within 500 m of the site.[7] There are BGS records of 4 wells within 1 km of the site, all abstracting from the Chalk Aquifer underlying the London Clay[8]. |
| **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.[9] |

[6] Groundsure report GS-2757166
[7] Groundsure report GS-2757166
[8] http://mapapps2.bgs.ac.uk/geoindex/home.html
[9] Groundsure report GS-2757166

### Table 2.2 BGS borehole records

| Reference | Name | Length (m) | Easting | Northing | Description |
|---|---|---|---|---|---|
| TQ28SE299 | Chalk Farm Station Hampstead | 10.36 | 528150 | 184410 | Datum at 29.87 m a OD. Made Ground to 0.61 m, clay to 10.37 m. No record of groundwater. |
| TQ28SE2033 | The Roundhouse Development, Chalk Farm Road, London 2 | 12.49 | 528284 | 184288 | Datum at 32.84 m a OD. Clay and gravel to 0.15 m, brown sandy clay with stones, ash, brick, chalk nodules etc. to 4.42 m, grey organic clay to 5.49 m, brown clay to 5.8 m, brown/blue mottled fissured clay with crystals to 8.23 m, brown fissured clay with crystals to 12.5 m. Seepage at 3.66 m. Seepage at 5.49 m. Standing water level at 5.19 m (27.65 m a OD). |
| TQ28SE2035 | The Roundhouse Development, Chalk Farm Road, London 4 | 18.28 | 528329 | 184313 | Datum at 32.78 m a OD. Railway ballast to 0.61 m, clay with gravel to 1.22 m, brown clay with stones to 2.14 m, mottled brown clay with patches of organic matter to 3.51 m, grey/black organic clay with stones/bricks etc. to 5.34 m, brown/blue mottled fissured clay with crystals to 12.2 m, dark brown fissured clay to 18.29 m. Seepage at 4.58 m. Standing water level at 4.58 m (28.2 m a OD). |
| TQ28SE411 | Metropolitan Water Board 29 | 31.44 | 528450 | 184350 | Datum at 28.04 m a OD. Sett paving on a concrete base to 0.46 m, bricks, stones and clay fill to 0.76 m, grey-blue clay fill to 2.44 m, stiff brown fissured clay to 8.69 m, stiff grey-blue fissured clay to 31.45 m (traces of sand in fissures from to 16.77 m to 22.26 m, mudstone boulders from to 28.2 m to 28.5 m). Groundwater from 27.13 m to 27.28 m in seepage from pocket in clay. |
| TQ28SE854 | Camden, Harmood St. 10 | 15 | 528460 | 184480 | Datum at 28.85 m a OD. FILL (topsoil, gravel and brick fragments) to 0.3 m, firm to stiff fissured brown slightly sandy silty CLAY with grey staining in the fissures and pockets of orange-brown silty sand to 2.4 m, very stiff fissured grey brown silty CLAY with partings of silty fine sand and some selenite crystals to 15 m. Borehole dry. |

Geological data from site investigations in July 2015 are presented in Table 2.3 (after Ground & Water, 2016).

**Table 2.3 Site investigation data**

| Summary of Strata Encountered (WS1) | Strata Depth Encountered (m bgl) | Thickness (m) |
|---|---|---|
| MADE GROUND: Concrete overlying light brown clayey sand and gravel. Sand is fine to coarse grained. Gravel is occasional to abundant, fine to coarse, sub-angular to sub-rounded flint, brick and concrete. | GL | 1.70 |
| MADE GROUND: Grey/brown sandy gravelly silty clay. Sand is fine to coarse grained. Gravel is occasional, fine to coarse, sub-angular to sub-rounded carbonaceous material (coal/ash), brick and flint. Soft dark blue/grey lenses noted. | 1.70 | 0.50 |
| LONDON CLAY FORMATION: Brown, with occasional orange brown and grey mottling, silty CLAY. | 2.20 | >1.70 |

No groundwater was encountered within the trial holes during drilling. A return visit to dip the 2.75 m deep groundwater monitoring well, by a Ground and Water Limited Engineer on the 8th March 2016 revealed a standing water level of 2.10m bgl (Ground and Water, 2015).

# 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? | Yes | 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 proposal is to demolish the existing building and construct a basement with three storeys (including roof accommodation) above, on the footprint of the existing building. The new development will house two dwellings. Each will have an lightwell from basement level. The depth of the basement will be between 3.0 and 3.5 m bgl. The site elevation is estimated as c.30 m a OD, and the basement depth as approximately 26.7 m a OD.

The site is underlain by the London Clay. A borehole at the site showed there to be 1.7 m of Made Ground, comprising clayey sand and gravel, at the top of the soil profile. 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 southeast, although may be highly variable due to the presence of local underground structures.

Groundwater was not encountered during drilling at the site, however subsequent groundwater monitoring recorded a standing water level of 2.10m bgl, or approximately 28 m a OD. Local borehole records also indicate groundwater elevations of between 27.65 m a OD and 28.2 m a OD. On the basis of the available information, the basement will be partly below the water table.

The proportion of hardstanding at the site is not anticipated to change significantly. Currently there is no soft landscaping at the site; the proposals include for trees/shrubs at basement level in the lightwell spaces, which may include some permeable ground.

## 4.2 Matters of concern

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

1. Groundwater level –groundwater elevation has been recorded above the base of the proposed basement. This is carried forward for further assessment.
2. Range of seasonal fluctuation in groundwater levels – the range of seasonal fluctuation in groundwater levels is not known, and this is carried forward for further assessment.
3. Spring/stream hydrographs – there is no evidence that local streams or springs are likely to be affected and these are 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** – groundwater elevation is above the base of the proposed basement. | On the basis of the available information, the basement will be partly below the water table.<br><br>There may be some groundwater flows into the excavation during construction, however these are likely to be low to negligible due to the low permeability of the London Clay. Higher flows may derive from perched waters in the more permeable Made Ground deposits, particularly under wet conditions.<br><br>There may be some backing up of groundwater around the basement structure. Local groundwater flow directions are likely to be highly modified by the presence of existing basements and other underground infrastructure. The proposed structure is not thought to be contiguous with any other basement structures. In addition, the layer of permeable made ground at the top of the soil profile is likely to provide groundwater drainage around the structure, if it is continuous. On the basis of the available information, impacts to neighbouring properties due to groundwater are not anticipated to be significant.<br><br>The proportion of hardstanding at the site is not anticipated to change significantly, and recharge to groundwater is unlikely to be significantly affected. | Precautions should be taken to ensure that the excavation remains dry during construction.<br><br>The proposed basement structure should be adequately protected against ingress of groundwater.<br><br>Design of drainage systems should consider the requirements of sustainable urban drainage. |
| **2. Range of seasonal fluctuation in groundwater levels** – the range of seasonal fluctuation in groundwater levels is not known | The range of seasonal groundwater fluctuation is not known, and groundwater may rise to higher elevations than those recorded at the site. | The proposed basement structure should be adequately protected against ingress of groundwater. |
| **Soil moisture** – no site data are available for 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 proposal is to demolish the existing building and construct a basement with three storeys (including roof accommodation) above, on the footprint of the existing building. The new development will house two dwellings. Each will have an lightwell from basement level. The depth of the basement will be between 3.0 and 3.5 m bgl. The site elevation is estimated as c.30 m a OD, and the basement depth as approximately 26.7 m a OD.

The site is underlain by the London Clay. A borehole at the site showed there to be 1.7 m of Made Ground, comprising clayey sand and gravel, at the top of the soil profile. 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 southeast, although may be highly variable due to the presence of local underground structures.

Groundwater was not encountered during drilling at the site, however subsequent groundwater monitoring recorded a standing water level of 2.10m bgl, or approximately 28 m a OD. Local borehole records also indicate groundwater elevations of between 27.65 m a OD and 28.2 m a OD. On the basis of the available information, the basement will be partly below the water table.

There may be some groundwater flows into the excavation during construction, however these are likely to be low to negligible due to the low permeability of the London Clay. Higher flows may derive from perched waters in the more permeable Made Ground deposits, particularly under wet conditions. Precautions should be taken to ensure that the excavation remains dry during construction.

There may be some backing up of groundwater around the basement structure. The proposed basement structure should be adequately protected against ingress of groundwater and soil moisture.

Local groundwater flow directions are likely to be highly modified by the presence of existing basements and other underground infrastructure. The proposed structure is not thought to be contiguous with any other basement structures. In addition, the layer of permeable made ground at the top of the soil profile, if it is continuous, is likely to provide groundwater drainage around the structure. On the basis of the available information, impacts to neighbouring properties due to groundwater are not anticipated to be significant.

The proportion of hardstanding at the site is not anticipated to change significantly, and recharge to groundwater is unlikely to be significantly affected. 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 8a Belmont Street, Chalk Farm, London NW1 8HH. Ref: GWPR1534. March 2016

**London Borough of Camden** CPG4 'Basements and Lightwells'

# APPENDIX A

## Groundsure report

# APPENDIX B

## Site plans and elevations