Basement Impact Assessment

in connection with proposed development at

No. 52 Eton Avenue
Camden
London
NW3 3HN

for

Natalie Matalon & Izzy Tepekoylu

LBH4564 Ver 1.0

January 2019

LBH WEMBLEY

ENGINEERING

Document Control				
Version	Date	Comment		Authorised
			Darcy Kitson-Boyce MEng (Hons) GMICE FGS FRGS	Seamus Lefroy-Brooks BSc(hons) MSc CEng MICE CGeol FGS CEnv MIEnvSc FRGS SiLC RoGEP UK Registered Ground Engineering Adviser NQMS SQP DoWCoP QP
1.0	10th Jan 2019			

LBH WEMBLEY ENGINEERING

12 Little Balmer

Buckingham Industrial Park

Buckingham

MK18 1TF

Tel: 01280 812310

email: enquiry@lbhgeo.co.uk

website: www.lbhgeo.co.uk

Contents

Foreword-Guidance Notes

GENERAL

This report has been prepared for a specific client and to meet a specific brief. The preparation of this report may have been affected by limitations of scope, resources or time scale required by the client. Should any part of this report be relied on by a third party, that party does so wholly at its own risk and LBH WEMBLEY disclaims any liability to such parties.

The observations and conclusions described in this report are based solely upon the agreed scope of work. LBH WEMBLEY has not performed any observations, investigations, studies or testing not specifically set out in the agreed scope of work and cannot accept any liability for the existence of any condition, the discovery of which would require performance of services beyond the agreed scope of work.

VALIDITY

Any use of or reliance upon the report in circumstances other than those for which it was commissioned shall be at the client's sole risk. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should therefore not be relied upon in such altered circumstances.

THIRD PARTY INFORMATION

The report may present an opinion based upon information received from third parties. However, no liability can be accepted for any inaccuracies or omissions in that information.

Non-Technical Summary

It is proposed to construct a basement beneath the entire footprint of an existing house at No. 52 Eton Avenue that will extend to approximately 3m depth. The basement will also laterally extend to the front and side of the existing building.

This report provides an assessment of the potential impacts that the basement development may have upon the surrounding area, neighbouring structures and the local environment.

The proposed basement will extend into the London Clay Formation.

Hydrogeological Impacts

The site is underlain by essentially impermeable London Clay and hence there is no shallow groundwater table and no scope for any adverse hydrogeological impacts to be caused by the proposed basement construction.

Hydrological Impacts

The proposed basement will extend outside the footprint of the existing building, which will lead to a net reduction in the amount of soft landscaping. However, it is considered that there will be no change to the flood risk at the site or neighbouring sites.

SuDS attenuation is to be included within the development.

Stability Impacts

Ground movement assessments have been undertaken to demonstrate the acceptability of the proposed construction methodology upon the neighbouring structures, resulting in a prediction of maximum Burland Category 1 (Very Slight) damage.

The depth of the new basement will obviate concerns regarding potential seasonal shrink/swell movements associated with London Clay soils and also potential stability effects due to nearby existing trees.

Conclusion

The assessment concludes that no adverse residual or cumulative stability, hydrological or hydrogeological impacts are expected to either neighbouring structures or the wider environment as a result of this development.

1. Introduction

1.1 Background

It is proposed to construct a basement beneath a three storey property at No. 52 Eton Avenue.

1.2 Brief

LBH WEMBLEY have been appointed by Natalie Matalon & Izzy Tepekoylu to complete a Basement Impact Assessment (BIA) in support of a forthcoming planning application to be submitted to the London Borough of Camden, in order to satisfy the specific requirements of the 2017 Camden Planning Policy and Supplementary Camden Planning Guidance (CPG) on Basements and Lightwells, and associated 2010 Camden Geological, Hydrogeological and Hydrological Study.

1.3 Planning Policy

The 2017 Camden Local Plan Policy A5 Basements reads as follows:

"The Council will only permit basement development where it is demonstrated to its satisfaction that the proposal would not cause harm to:

a) neighbouring properties;
b) the structural, ground, or water conditions of the area;
c) the character and amenity of the area;
d) the architectural character of the building; and
e) the significance of heritage assets.
In determining proposals for basements and other underground development, the Council will require an assessment of the scheme's impact on drainage, flooding, groundwater conditions and structural stability in the form of a Basement Impact Assessment and where appropriate, a Basement Construction Plan.

The siting, location, scale and design of basements must have minimal impact on, and be subordinate to, the host building and property. Basement development should:

f) not comprise of more than one storey;
g) not be built under an existing basement;
h) not exceed 50% of each garden within the property;
i) be less than 1.5 times the footprint of the host building in area;
j) extend into the garden no further than 50% of the depth of the host building measured from the principal rear elevation;
k) not extend into or underneath the garden further than 50% of the depth of the garden;
l) be set back from neighbouring property boundaries where it extends beyond the footprint of the host building; and
m) avoid the loss of garden space or trees of townscape or amenity value.

Exceptions to f. to k. above may be made on large comprehensively planned sites.

The Council will require applicants to demonstrate that proposals for basements:

n. do not harm neighbouring properties, including requiring the provision of a Basement Impact Assessment which shows that the scheme poses a risk of damage to neighbouring properties no higher than Burland Scale 1 'very slight';
o. avoid adversely affecting drainage and run-off or causing other damage to the water environment;
p. avoid cumulative impacts;
q. do not harm the amenity of neighbours;
r. provide satisfactory landscaping, including adequate soil depth;
s. do not harm the appearance or setting of the property or the established character of the surrounding area;
t. protect important archaeological remains; and
u. do not prejudice the ability of the garden to support trees where they are part of the character of the area.

The Council will not permit basement schemes which include habitable rooms and other sensitive uses in areas prone to flooding.

We will generally require a Construction Management Plan for basement developments.

Given the complex nature of basement development, the Council encourages developers to offer security for expenses for basement development to adjoining neighbours."

The following policies in the Local Plan are also relevant to basement development and will be taken into account when assessing basement schemes:

- "Policy A2 Open space";
- "Policy A3 Biodiversity";
- "Policy D1 Design";
- "Policy D2 Heritage"; and
- "Policy CC3 Water and flooding".

In addition to the Local Plan Policy Camden publishes Camden Planning Guidance on Basements and Lightwells. These CPG documents do not carry the same weight as the main Camden Development Plan documents (including the above Policy A5) but they are important supporting documents.

It is noted that the CPG4 Planning Guidance on Basements and Lightwells (formerly CPG4 2015) has been updated (March 2018) to reflect the Local Plan.

1.4 Report Structure

The report commences with a desk study and characterisation of the site, before progressing to BIA screening and scoping assessments, whereby consideration is given to identifying the potential hydrogeological, hydrological and stability impacts to be associated with the proposed development.

A ground model is then developed, which is followed by an outline construction methodology and an assessment of the potential ground movements affecting the neighbouring structures.

Finally, an assessment of the potential impacts of the proposed scheme is presented.

1.5 Supporting Documents

The following documents have been consulted during the preparation of this document:

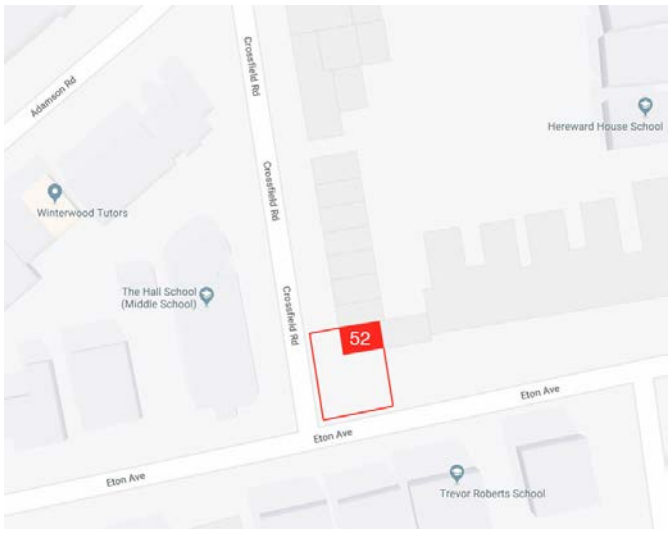
- Proposed Plans by Ambigram Architects, dated Dec 2018
- Design & Access Statement by Ambigram Architects, dated Jan 2019

2. The Site

2.1 Site Location

The site is situated on the corner of Eton Avenue and Crossfield Road, approximately 300m to the northeast of Swiss Cottage Underground Station.

The site may be located approximately by postcode NW3 3HN or by National Grid Reference 526940, 184460.



Location plan

2.2 Topographical Setting

The site lies on a relatively gentle slope falling to the south, towards the valley of the River Tyburn.

2.3 Site Description

The site is occupied by a 1960s three storey house with a ground floor level set at approximately +56m OD.

A shared driveway is present to the front of the house that serves both No. 52 and the adjoining No. 50 Eton Avenue. The house is also adjoined to the north by a three-storey house at No. 30 Crossfield Road.

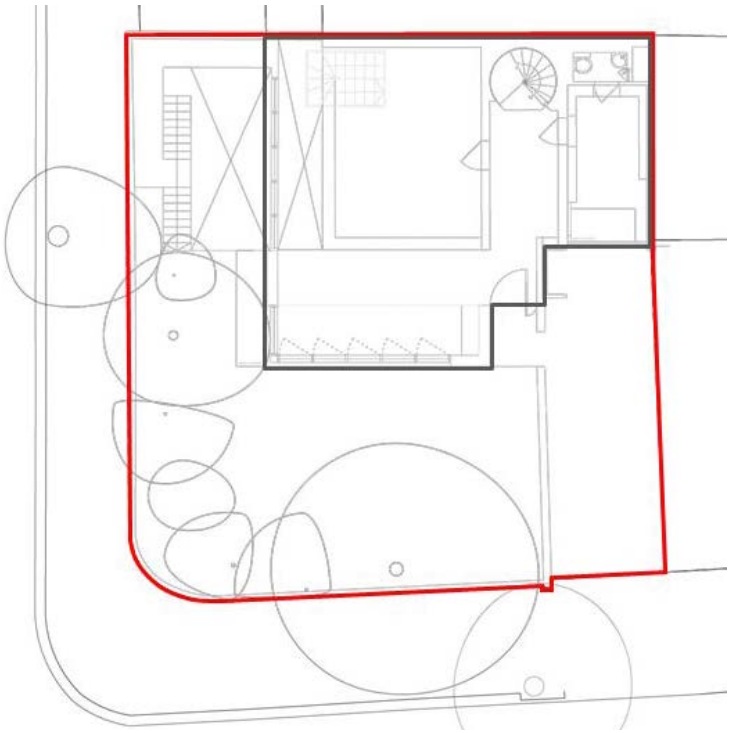
An L-shaped garden is present to the front and side of the building that contains several trees and is bordered by a hedge inside a brick wall.

A foul drain shared with the neighbouring No. 50 Eton Avenue, is present beneath the timber extension to the front of the property.

2.4 Proposed Development

It is proposed to construct an approximately 3m deep basement beneath the entire footprint of the existing building that will also extend laterally to the front and side beneath the existing garden areas.

A ground floor extension will be constructed above the basement to the front, while a basement level patio / garden area will be provided to the side.



Proposed Ground Floor Plan

Proposed Basement Plan

3. Desk Study

3.1 Site History

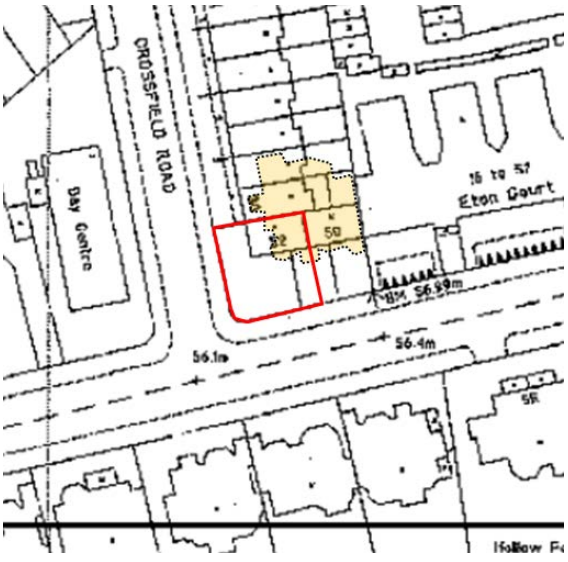
The site and surrounding area remained open fields north of Adelaide Road until the end of the 19th Century, at which time residential development began along Eton Avenue and Crossfield Road.

Development generally comprised large detached houses along Eton Avenue; one of which was No. 52 Eton Avenue, built on the land now occupied by both the site and the adjoining house. The area now occupied by Nos 24-30 Crossfield Road historically formed the rear garden of this former property.

Aerial View of the former No. 52 and No.54 Eton Avenue detached houses prior to demolition (1934)

The former No. 52 included a lower ground floor, set at approximately 2m below street level, and it appears that the areas surrounding the house to the front and side, as well as the rear garden area, are likely to have been set at this lower level.

A large block of flats known as Eton Court was built to the east of the site during the late 1920s / early 1930s. This was similarly built with a lower ground floor and front lightwells.



Plan showing location of the site with shaded area showing the approximate location of the demolished villa at No. 52 Eton Avenue

No. 54 Eton Avenue, a large detached house on the opposite side of Crossfield Road, is recorded to have been totally destroyed during the Second World War; however there was no recorded damage to any other surrounding properties, including No. 52.

No. 54 was subsequently demolished and replaced with the Hampstead Chest Clinic. By the 1960s, the detached house at No. 52 Eton Avenue was also demolished and replaced by the existing L-shaped terrace of three storey townhouses comprising Nos. 50-52 Eton Avenue and Nos. 24-30 Crossfield Road.

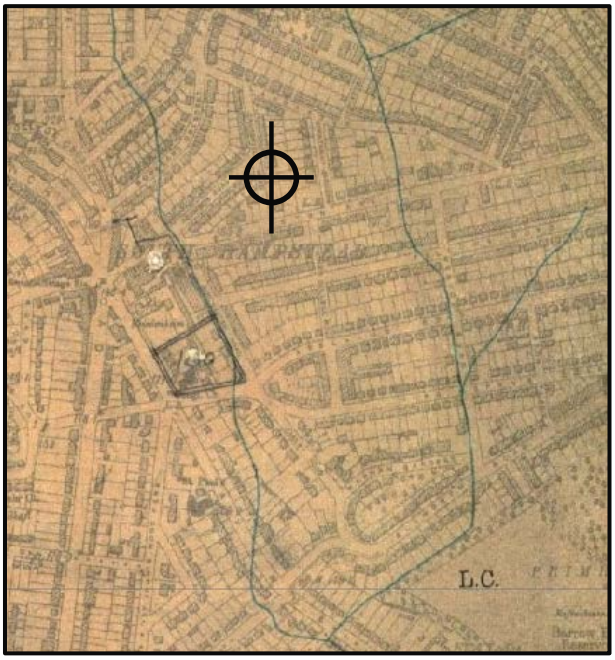
The basement to the former detached villa has evidently been backfilled, as have the lightwell areas to the front and side. The properties along Crossfield Road are set approximately 0.5m below street level, with rear gardens set approximately 1m below street level, therefore suggesting that the rear garden of the former villa was also set lower than street level.

A timber framed extension to the front of the ground floor of No.52 was constructed in 1984.

In recent years, small ground floor extensions to both No. 50 Eton Avenue and No. 30 Crossfield Road have been constructed.

3.2 Geological Information

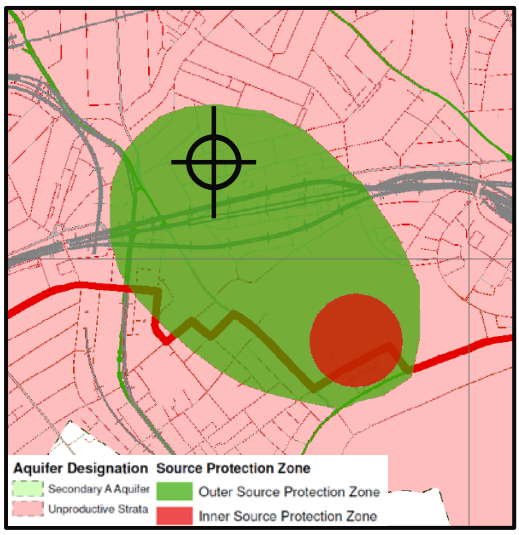
The British Geological Survey (BGS) records indicate that the site is directly underlain by the London Clay Formation.



Extract of Figure 2: Camden 1920 Geological Map (CGHHS, 2010)

3.3 Hydrogeological Information

The Environment Agency (EA) classifies the London Clay Formation as Unproductive Strata. Due to the impermeability of the clay, no significant groundwater flow is expected to occur beneath the site.



Extract of Figure 8: Camden Aquifer Map (CGHHS, 2010)

Figure 8 of the CGHHS indicates that the site lies within a Groundwater Outer Source Protection Zone 2, related to historical abstraction from the deep Chalk aquifer.

3.4 Hydrological, Drainage & Flood Risk Information

There are no surface water features in the vicinity of the site.

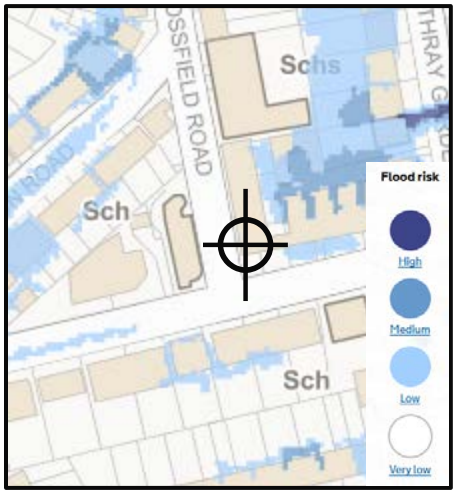
Figure 2 of the CGHHS (section 3.2) indicates that the River Tyburn lies approximately 150m to the southwest of the site.

The Environment Agency (EA) indicates that the site is at a very low risk of surface water flooding.

Figure 6 of the Camden SFRA indicates that the site lies within a Critical Drainage Area (Group3_005), but does not lie within a Local Flood Risk Zone.

The site currently comprises an approximately equal proportion of hard-surfacing and soft landscaping.

The new basement will be constructed within the footprint of the existing building, but will also extend outside of the building beneath the existing garden; hence there will be a net reduction in the area of soft landscaping.



Extract of EA surface water flood map showing the flood risk from surface water

4. Screening & Scoping Assessments

The Screening & Scoping Assessments have been undertaken with reference to Appendices E and F of the CGHSS, which is a process for determining whether or not a BIA is usually required. The relevant extracts from figures presented in the CGHHS are shown in the Desk Study section or the Appendix to this report.

4.1 Screening Assessment

The Screening Assessment consists of a series of checklists that identifies any matters of concern relating to the following:

- Subterranean (groundwater) flow
- Surface flow and flooding
- Slope stability

4.1.1 Screening Checklist for Subterranean (Groundwater) Flow

Question	Response	Justification
Is the site is located directly above an aquifer?	**No**	The Environment Agency (EA) maps indicate that the site is not underlain by an aquifer.
Will the proposed basement extend beneath the water table surface?	**No**	
Is the site within 100m of a watercourse, well (used/disused) or potential spring line?	**No**	The nearest watercourse is the River Tyburn, approximately 150m to the southwest of the site.
Is the site within the catchment of the pond chains on Hampstead Heath?	**No**	The site lies outside the boundary of figure 14 of the CGHHS which in turn indicates that the site lies outside the catchment of the pond chains on Hampstead Heath.
Will the proposed development result in a change in the area of hard-surfaced/paved areas?	**Yes**	The proposed basement will extend into the existing garden.
Will more surface water (e.g. rainfall and run-off) than at present will be discharged to the ground (e.g. via soakaways and/or SUDS)?	**No**	There is no drainage to the ground and the existing drainage arrangement will be maintained.
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?	**No**	There are no nearby surface water features.

4.1.2 Screening Checklist for Surface Flow and Flooding

Question	Response	Justification
Is the site within the catchment area of the pond chains on Hampstead Heath?	**No**	The site lies outside the boundary of figure 14 of the CGHHS which in turn indicates that the site lies outside the catchment of the pond chains on Hampstead Heath.
As part of the site drainage, will surface water flows (e.g. rainfall and run-off) be materially changed from the existing route?	**No**	The existing drainage arrangement will be maintained.
Will the proposed basement development result in a change in the proportion of hard-surfaced/paved areas?	**Yes**	The proposed basement will extend into the existing garden.
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?	**No**	The existing drainage arrangement will be maintained.
Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	**No**	Surface water drainage will be to the sewer.
Is the site in an area known to be at risk from surface water flooding, 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**	Environment Agency (EA) maps indicate that the site is at a very low risk of surface water flooding.

4.1.3 Screening Checklist for Stability

Question	Response	Justification
Does the existing site include slopes, natural or manmade, greater than 7 degrees?	**No**	There are no slopes greater than 7° within the site.
Does the proposed re-profiling of landscaping at the site change slopes at the property boundary to more than 7 degrees?	**No**	No re-profiling is planned at the site.
Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7 degrees?	**No**	There are no slopes greater than 7° adjacent to the site.
Is the site within a wider hillside setting in which the general slope is greater than 7 degrees?	**No**	Figure 16 of the CGHHS indicates that the general slope of the wider hillside is less than 7°. Extract is presented in the Appendix.
Is London Clay the shallowest strata at the site?	**Yes**	The British Geological Survey (BGS) records indicate

		that shallow stratum to be London Clay Formation
Will trees be felled as part of the proposed development and/or are works proposed within tree protection zones where trees are to be retained?	**Yes**	The proposed basement appears to lie within the anticipated zone of influence of trees present in the rear garden.
Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site?	**No**	Nearby BIAs do not indicate any evidence of shrink-swell subsidence in the local area.
Is the site within 100m of a watercourse of a potential spring line?	**No**	The nearest watercourse is the River Tyburn, approximately 150m to the southwest of the site.
Is the site within an area of previously worked ground?	**No**	Figure 3 of the CGHHS indicate that the site is not underlain by worked ground.
Is the site within an aquifer?	**No**	The Environment Agency (EA) maps indicate that the site is not underlain an aquifer.
Will the proposed basement extend beneath the water table such that dewatering may be required during construction?	**No**	
Is the site within 50m of the Hampstead Heath ponds?	**No**	Figure 12 of the CGHHS indicates that the site lies over 50m from the Hampstead Heath ponds.
Is the site within 5m of a highway or pedestrian right of way?	**Yes**	The proposed basement will lie adjacent to the pedestrian right of way on Crossfield Road.
Will the proposed basement significantly increase the differential depth of foundations relative to the neighbouring properties?	**Yes**	The proposed basement will increase the differential depth of foundations to No. 52 Eton Avenue and No. 30 Crossfield Road.
Is the site over (or within the exclusion zone of) tunnels, e.g. railway lines?	**No**	The site is not within any exclusion zones or over tunnels.

4.2 Scoping Assessment

Where the checklist is answered with a “yes” or “unknown” to any of the questions posed in the flowcharts, these matters are carried forward to the scoping stage of the BIA process. The other potential concerns considered within the screening process have been demonstrated to be not applicable or not significant when applied to the proposed development.

The scoping produces a statement which defines further the matters of concern identified in the screening stage. This defining should be in terms of ground processes, in order that a site specific BIA can be designed and executed (Section 6.3 of the CGHHS).

4.2.1 Scoping for Subterranean (Groundwater) Flow

- **Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?**

The guidance advises that the sealing off of the ground surface by pavements and buildings to rainfall will result in decreased recharge to the underlying ground. In areas underlain by an aquifer, this may impact upon the groundwater flow or levels. In areas of non-aquifer (i.e. on the London Clay), this may mean changes in the degree of wetness which in turn may affect stability.

4.2.2 Scoping for Surface Flow and Flooding

- **Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?**

The guidance advises that a change in the proportion of hard surfaced or paved areas of a property will affect the way in which rainfall and surface water are transmitted away from a property. This includes changes to the surface water received by the underlying aquifers, adjacent properties and nearby watercourses. Changes could result in decreased flow, which may affect ecosystems or reduce amenity, or increased flow which may additionally increase the risk of flooding.

4.2.3 Scoping for Stability

- **Is the London Clay the shallowest strata at the site?**

The guidance advises that of the at-surface soil strata present in LB Camden, the London Clay is the most prone to seasonal shrink-swell (subsidence and heave).

- **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?**

The soil moisture deficit associated with felled trees will gradually recover. In high plasticity clay soils (such as London Clay) this will lead to gradual swelling of the ground until it reaches a new value.

- **Is the site within 5m of a highway or pedestrian right of way?**

The guidance advises that excavation for a basement may result in damage to the road, pathway or any underground services buried in trenches beneath the road or pathway.

- **Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?**

The guidance advises that excavation for a basement may result in structural damage to neighbouring properties if there is a significant differential depth between adjacent foundations.

5. Ground Conditions

A ground model for this site has been developed on the basis of archive information.

A programme of trial pits will be undertaken in due course to confirm the ground conditions and to expose the configuration of the existing foundations supporting the perimeter walls.

5.1 Ground Conditions

A backfilled basement (and associated lightwells) is expected beneath the existing property and garden areas; which is likely to comprise demolition material from the former villa to a depth of approximately 2m.

Beneath the fill material, the London Clay Formation is expected to underlie the site, comprising typical firm to stiff silty clay.

Nearby data suggests that there may potentially be a thin capping of downwash deposits overlying the clay; however, this material was likely removed during the construction of the former villa at No. 52 Eton Avenue.

5.2 Groundwater

A shallow groundwater table is not expected to be present beneath the site.

However, some surface water seepage is likely to be present within the more permeable zones of the made ground over the surface of the impermeable clay soils.

6. Basement Construction

6.1 Excavation

The basement excavation will extend down into the London Clay Formation, albeit the bulk of the excavation will be demolition rubble used to backfill the former basement.

It is currently envisaged that the existing property is supported by strip foundations bearing upon the London Clay at a depth of at least 2m; hence an opening will need to be formed in the western perimeter wall, in order to provide access to the proposed basement patio area.

In the absence of any substantial groundwater inflows into the basement excavation, the basement perimeter walls will be formed by conventional underpinning and the construction of L-shaped reinforced cast in-situ concrete segments excavated and cast in a 'hit and miss' sequence of 1m wide sections.

The required depth of underpinning of the existing building is likely to be around 2m; however in order to model a worst case scenario, the existing party wall foundations are assumed to extend to 0.5m depth below existing ground floor level. Nevertheless, only one stage of underpinning will be required.

During the works, propping will be installed to ensure that lateral ground movements are minimised. As a precursor to the excavation, it is envisaged that the existing ground floor slab will be removed and replaced in part or wholly by a reinforced slab that will subsequently act as a prop to the newly underpinned walls during the main basement excavation.

As the main basement excavation proceeds, additional temporary propping will be installed at lower levels where necessary to ensure that lateral ground movements are minimised.

Where the proposed basement extends outside the footprint of the existing house, "hit & miss" techniques will be employed to construct the basement walls.

In the permanent situation the reinforced concrete underpins will connect to the basement slab to form a rigid concrete box to support the vertical structural loading of the overlying building. Both the basement raft slab and the ground floor slab will act as props.

6.1.1 Waterproofing

There is potential for water to collect around the basement in the long term. Hence, it is recommended that the basement should be fully waterproofed and designed to withstand hydrostatic pressures in accordance with Guidance provided in BS8102:2009, Code of Practice for the Protection of Below-Ground Structures against Water from the Ground. An assumed groundwater level at 1m depth below existing ground level would be prudent for the purposes of assessing hydrostatic pressures.

6.1.2 Basement Heave

Given the depth of excavation, it is evident that the self-weight of the new structure will not match the weight of soil removed and that there may as a result be some potential for residual net uplift.

An assessment of the likely extent of any long term uplift is made in Section 7 of this report.

6.2 Underpinning

Underpinning sections will be excavated in short widths not exceeding 1000mm.

The sequence of the underpinning will be in an extended 1, 3, 5, 2, 4 & 6 type numbering sequence, such that any given underpin will be completed, dry packed, and a minimum period of 48 hours lapsed before and adjacent excavation is commenced to form another underpin.

In the event that the existing foundations to the wall are found to be unstable, sacrificial steel jacks will be installed underneath the existing foundation to prop the bottom few courses of bricks. These steel jacks will be left in place and will be incorporated into the concrete.

Each pin excavation will be undertaken only under the direct supervision of a suitably experienced and competent person. In the event that the vertical soil face to an underpin is judged to be potentially unstable, face support and lateral propping will be provided as required, using perforated plywood shutter sheeting supported by temporary walings and adjustable steel trench “acrow” props.

6.3 Retaining Walls

The following parameters may be considered in the design of the retaining walls:-

Stratum	Bulk Unity Weight	Effective Cohesion	Effective Friction Angle
	(kg/m^3)	(c' - kN/m^2)	(ϕ'- degrees)
London Clay Formation	20	Zero	25

6.4 Effect of trees

The new basement excavation is to be constructed within the anticipated zone of influence of several existing trees.

Although the London Clay soils are of high volume change potential, the basement excavation is expected to remove any affected clay that may result in additional forces being exerted on the structure due to possible swelling of the clay.

An arboricultural survey has been undertaken, confirming that there are no mitigation measures required to preserve the trees.

6.5 Construction Sequence

1. Construct new reinforced partial ground floor slab
2. Underpin the existing foundations of the perimeter walls.
3. Where the proposed basement extends into the existing garden, the new basement perimeter walls are to be formed by excavation of a series of pins to approx. 3m depth, using “hit and miss” excavation methods.
4. Commence excavation and install additional lower level temporary propping to underpinning.
5. Undertake main excavation down to the basement slab formation level.
6. Install below-slab drainage for foul and ground water, sumps and pumps.
7. Place slab reinforcement and cast basement slab.

8. Remove temporary propping.

9. Construct basement liner walls, membranes, cavity drainage, insulation and screed

7. Ground Movements to Neighbouring Properties

Camden Council seeks to ensure that harm will not be caused to neighbouring properties by basement development.

Camden Local Plan (June 2017) states that the BIA must demonstrate that the proposed basement scheme has a risk of damage to the neighbouring properties no higher than Burland Scale 1 'Very Slight'.

7.1 Structures Assessed for Ground Movement

Although it is considered likely that the existing building is supported on trench-filled foundations extending to at least 2m depth in order to bypass the backfilled basement, a worst case scenario has been modelled whereby the party walls to No. 50 Eton Avenue and No. 30 Crossfield Road are assumed to be supported by shallow strip foundations extending to 0.5m depth below existing ground floor level.

Both of these properties, together with No. 52, were built as part of the same development of three storey 1960s townhouses formed in an L-shaped terrace. Both properties have since experienced minor ground floor extensions.

No. 50 adjoins the site to the east, while No. 30 Crossfield Road adjoins to the north. Neither property contains a basement, although the ground floor of No. 30 Crossfield Road sits approximately 0.5 lower than the site.

7.2 Modelled Ground Conditions

Excavation of the basement will result in unloading of the clay leading to theoretical heave movement of the underlying soil in both the short and long term. An analysis of the vertical movements has been carried out using the soil stiffness model detailed in the table below.

For design purposes a conservative undrained strength profile has been adopted, assuming an average Cu of 50kN/m^2 at the surface of the London Clay Formation, increase by 8kN/m^2 per m depth.

The Undrained Modulus of Elasticity (Eu) has been based upon an empirical relationship of Eu = 750 x undrained cohesion (Cu), and the Drained Modulus of Elasticity (E') has been based upon an empirical relationship of 350 x Cu.

Stratum:	**Undrained Elastic Modulus Eu (kN/m^2)**	**Drained Elastic Modulus E' (kN/m^2)**
London Clay Formation	37,500kN/m^2 at surface increasing linearly to 217,500kN/m^2 at 30m depth	17,500 kN/m^2 at surface increasing linearly to 101,500kN/m^2 at 30m depth

Poisson's Ratios of 0.5 and 0.1 have been used for short term (undrained) and long term (drained) conditions respectively.

The analysis uses the above parameters for stratified homogeneity and with the introduction of an assumed rigid boundary at approximately 30m depth.

7.3 Short Term Vertical Movements

There are two components of short term movement that will interact to affect the neighbouring structures.

These components are firstly progressive sagging movements of the underpinned party walls due to imperfections in the underpinning process itself and then secondly elastic heave of the ground within the new excavation as a direct response to the unloading of the weight of soil removed.

The basement excavation will extend to approximately 3m depth beneath the existing ground floor level. As a result, considering the worst case scenario, the potential effect of the excavation may be considered by a net unloading of -60kN/m^2 due to soil unloading.

7.3.1 Short Term Movement due to Underpinning

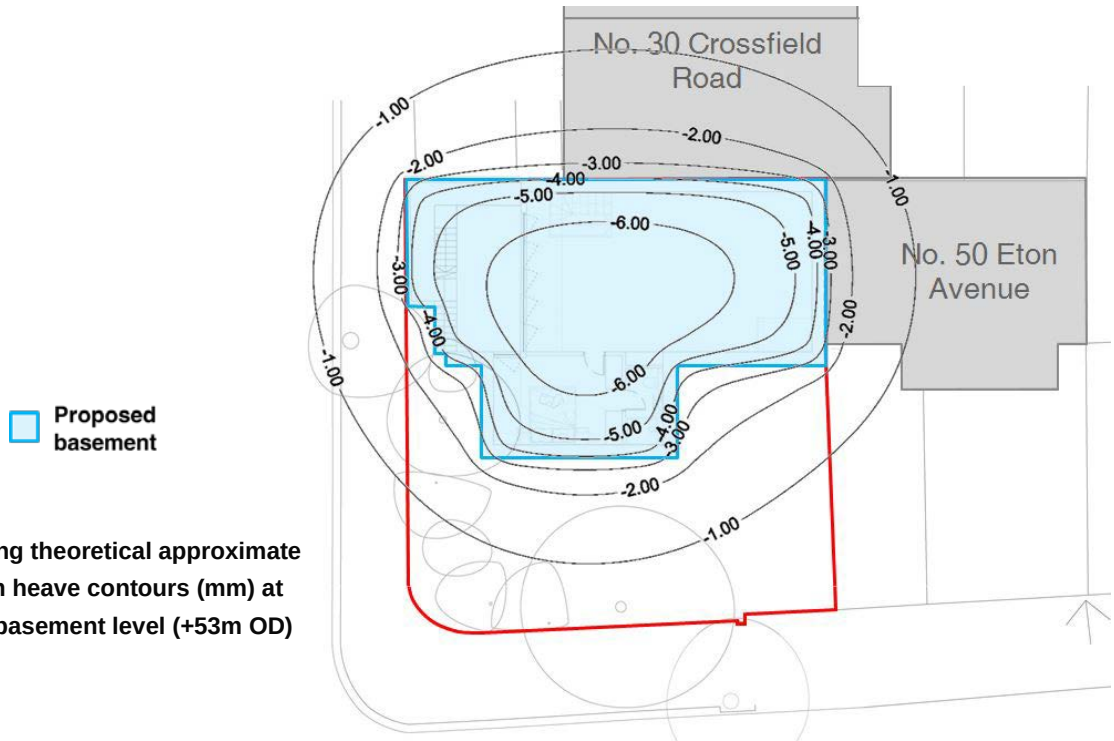
It is not possible to rigorously model the extent of party wall settlement arising from underpinning and experience indicates that amount of any movements are very much dependent on workmanship. However, it is suggested that given dry conditions and good workmanship, the amount of vertical movement of the party walls can reasonably be expected to be a maximum of 5mm per stage of underpinning.

For modelling purposes, the depth of underpinning is assumed to be 2.5m; hence one stage of underpinning will be utilised.

On the simplistic assumption of a 45° angle of support to any walls extending away in a direction perpendicular to the party walls, the scale of this vertical movement associated with the underpinning process itself is assumed to extend to a distance of 2.5m behind the wall.

7.3.2 Short Term Movements due to Excavation heave

Less than 10mm of short term soil heave is predicted at the centre of the basement excavation, reducing to less than 5mm beneath the party walls to both No. 50 Eton Avenue and No. 30 Crossfield Road.

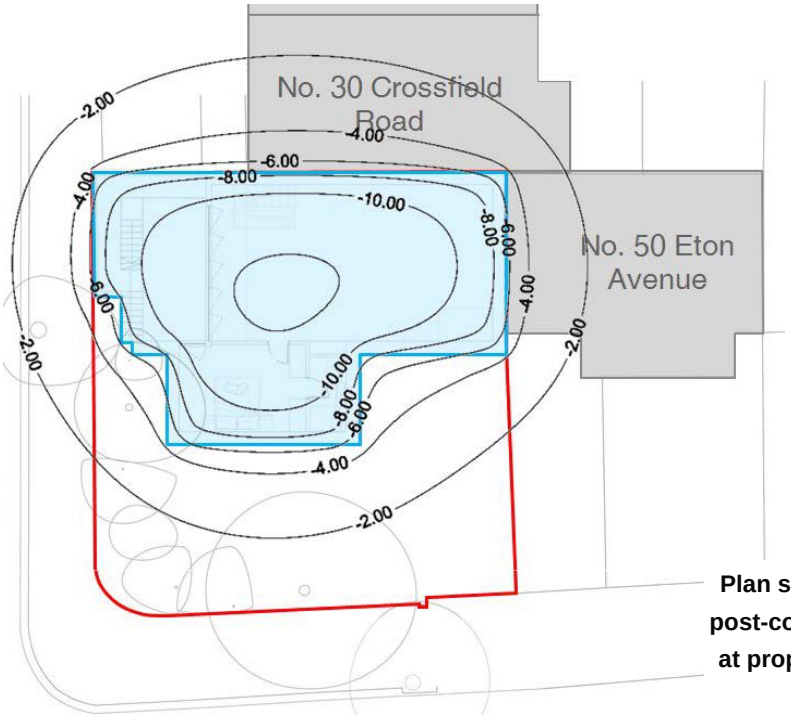


Plan showing theoretical approximate short term heave contours (mm) at proposed basement level (+53m OD)

7.4 Post Construction Vertical Movements

There will be a mismatch between the weight of soil that is removed and the weight of the new structure. In this situation, a component of long term heave that could proceed for decades is inevitable.

The results of heave analysis, as presented on the plan shown below, suggest that the scale of this additional long term heave will potentially amount to around 10mm within the basement, decreasing to around 8mm beneath the party walls to No. 50 Eton Avenue and No. 30 Crossfield Road.



Plan showing theoretical approximate post-construction heave contours (mm) at proposed basement level (+53m OD

7.5 Horizontal Movements

Horizontal soil movements are expected to occur due to yielding of the soil behind the underpinned wall during the basement excavation. For embedded retaining walls, this yielding has been found to extend to a distance approximately equivalent to four times the depth of excavation in front of the wall.

As a first approximation, the magnitude of the horizontal movement at the underpinned party wall is assumed to be 5mm, which is equal to the vertical movement at the wall.

This horizontal movement is assumed to reduce to zero at a maximum distance of 4 x 3m = 12m behind the wall.

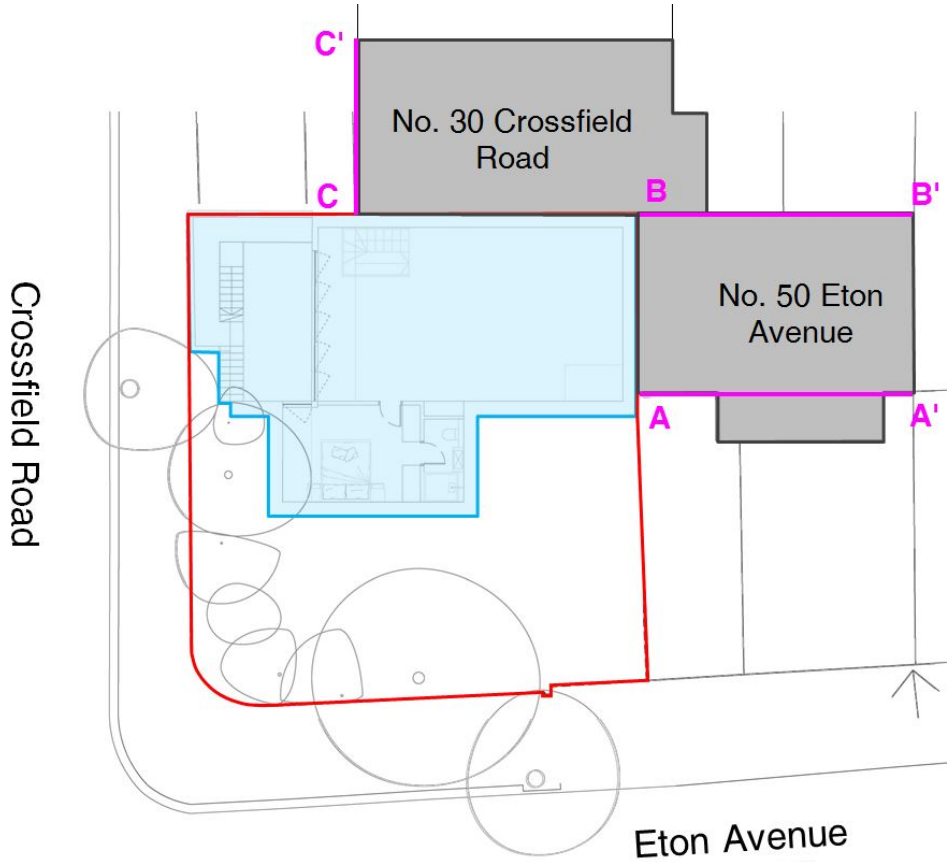
7.6 Impact on Neighbouring Structures

In practice, although the various movements described above will interact so that the soil basement heave effects will tend to counteract the underpinning wall settlement movements, it is considered prudent to consider the worst case situation. Thus, the analysis of potential damage to neighbouring structures is based upon movement predictions that ignore basement soil heave.

The effect of these predicted vertical and horizontal deflections have been assessed using the Burland damage category assessment process, which is based upon consideration of a theoretical masonry panel of a given length (L) and height (H).

The potential degree of the predicted ground movements on the assessed structures can be estimated by the correlation of maximum horizontal strain, □h, with the maximum deflection ratio, Δ/L, where Δ is the vertical distortion over a the wall length under assessment (where the wall length L is actually less than the distance to the point at which zero vertical movement is assumed, a minimum distortion of 1mm is assumed).

The potential degree of damage due to the proposed basement construction has been assessed for each neighbouring property using lines of sections and a summary for each property is shown below.



Plan showing line of sections used for damage category assessment

No. 50 Eton Avenue (Section A-A' and Section B-B')

The lengths of the sections (L) are taken as 9m and the wall heights (H) as 10m. Given the same wall construction and the similar expected ground movement, the damage category assessment has been combined for these sections.

The maximum horizontal strain, 0.12%, is assessed as the maximum deflection ratio Δ / L = -0.028, within a limiting tensile strain of 0.06%, for a Burland Category 1 "Very Slight" condition.

No. 30 Crossfield Road (Section C-C')

The length of section (L) is taken as 5m and the wall height (H) as 10m.

The maximum horizontal strain, 0.12%, is assessed as the maximum deflection ratio Δ / L = -0.03, within a limiting tensile strain of 0.055%, for a Burland Category 1 "Very Slight" condition.

7.6.1 Public Highway

The pavement to Crossfield Road lies adjacent to the western boundary of the proposed basement, where there is expected to be excavation of around 3m.

Given reasonable standards of workmanship during the underpinning works, negligible movement (<5mm settlement) is anticipated and this may be counteracted in practice by some small amounts of heave.

8. Impact Assessment

The screening and scoping stages have identified potential effects of the development on those attributes or features of the geological, hydrogeological and hydrological environment.

This stage is concerned with evaluating the direct and indirect implications of each of these potential impacts.

8.1 Hydrogeological Impact Assessment

This site is underlain by clay soils and there is consequently no shallow groundwater table at this site.

It is therefore considered that the development will not have any impact upon groundwater flow and there is additionally no scope for any cumulative impact.

8.2 Hydrological Impact Assessment

Although there will be a net reduction in the amount of soft landscaping, it is considered that there will be no change to the flood risk at the site or neighbouring sites.

Nevertheless, there will be a need to maintain the present water discharge regime and provide Sustainable Drainage Systems (SuDS) to meet the planning policy requirements.

An Outline SuDS Strategy is presented as a separate report (LBH4564suds).

8.3 Stability Impact Assessment

8.3.1 London Clay

The London Clay soils are of high volume change potential.

However, the depth of the proposed basement excavation will obviate concerns regarding potential seasonal shrink/swell movements.

8.3.2 Trees

Although the proposed basement is to be constructed within the anticipated zone of influence of trees, the depth of the proposed basement excavation will obviate any issues regarding potential stability effects associated with the existing trees.

8.3.3 Ground Movements

The Local Plan states that the proposed basement should pose a risk of damage to neighbouring properties no higher than Burland scale Category 1 ‘Very Slight’, and mitigation measures should be incorporated if the assessed damage is not acceptable.

The predicted building damage levels resulting from ground movements associated with the proposed development have been analysed and found to be acceptable.

In addition, negligible movement to the public highway due to the proposed basement development is predicted.

8.4 Residual Impacts

The proposed basement will have no residual unacceptable impacts upon the surrounding structures, infrastructure and environment. No cumulative impacts are envisaged.

9. Outline Structural Monitoring Plan

The ground movement assessment suggests up to Burland Scale Category 1 (very slight) damage may be expected to the neighbouring properties.

Nevertheless, structural monitoring should be undertaken to ensure the movements remain within acceptable limits and to enable mitigation to be effectively implemented in the event of agreed trigger values for movement being exceeded.

Monitoring positions should be located along the party walls to both No. 50 Eton Avenue and No. 30 Crossfield Road.

Before any excavation or construction works commence, monitoring is to be undertaken in order to establish a baseline situation.

During all underpinning works and basement excavation works, monitoring should be undertaken daily at the start and end of every work shift. At other times monitoring should be undertaken weekly to cover a period prior to commencement of any works and ceasing after completion of the works, by agreement of all interested parties.

Precise survey equipment should be used to record all vertical and horizontal components of movement (in three perpendicular directions) to a minimum accuracy of 1mm.

9.1 Criteria for assessment of Monitoring data and Comparison with Predicted Movements

The cumulative movements in any direction of any monitoring point are to be compared with the predicted movements at any stage and using the following decision table:

MONITORING CRITERIA		
Total movement less than 5mm in any direction		Green
Total movement in excess of 5mm in any direction or additional movement of 5mm in any direction	Notify Structural Engineer and Party Wall Surveyor	Red

9.2 Contingent Actions

Contingency actions should be undertaken using the following decision table:

CONTINGENT ACTIONS	
Green	None
Red	Cease work and Notify Structural Engineer and Party Wall Surveyor immediately. Commence backfilling / installation of additional propping. Undertake repeated monitoring as necessary to ensure that movement has ceased. Works to commence only once a revised construction methodology has been agreed with the Structural Engineer

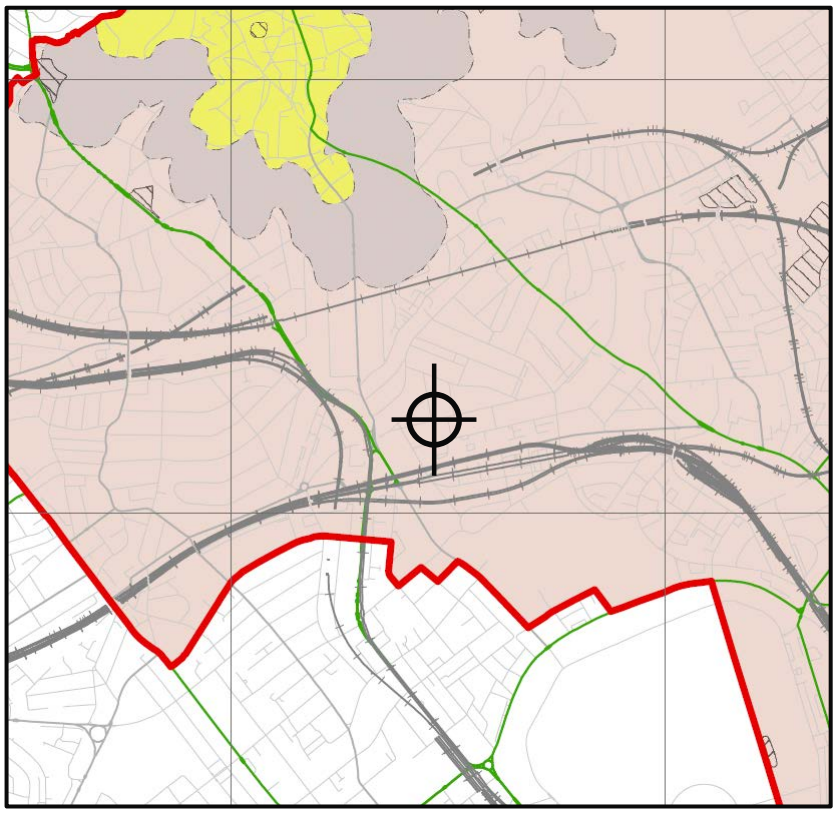
10. Conclusion

The assessment has demonstrated that no adverse residual or cumulative stability, hydrological or hydrogeological impacts are expected to either neighbouring structures or the wider environment as a result of this development.

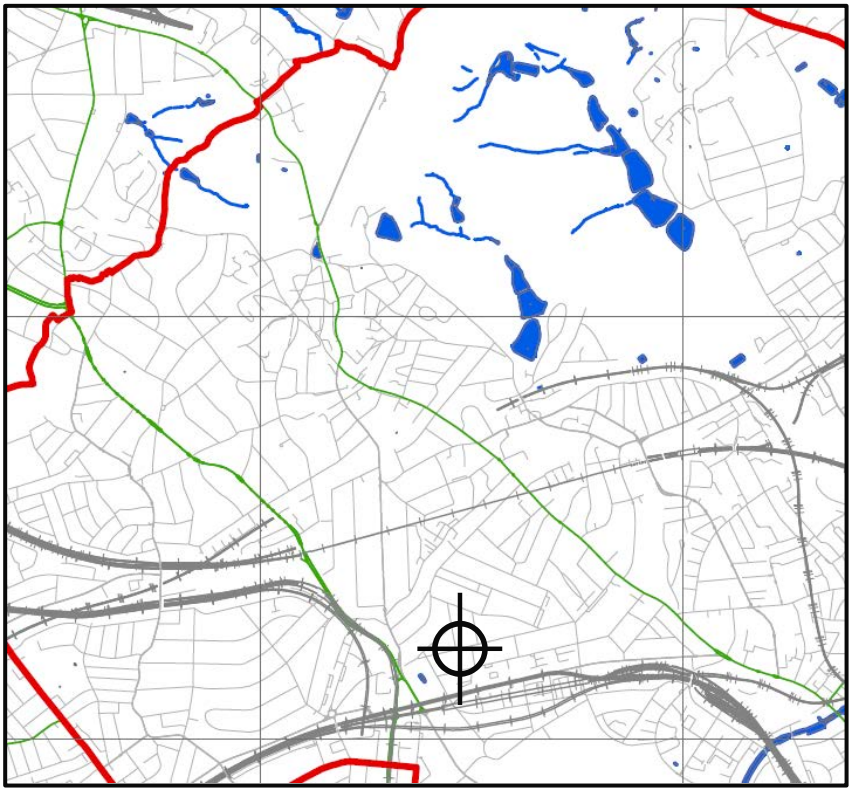
Appendix

Map Extracts from CGHHS

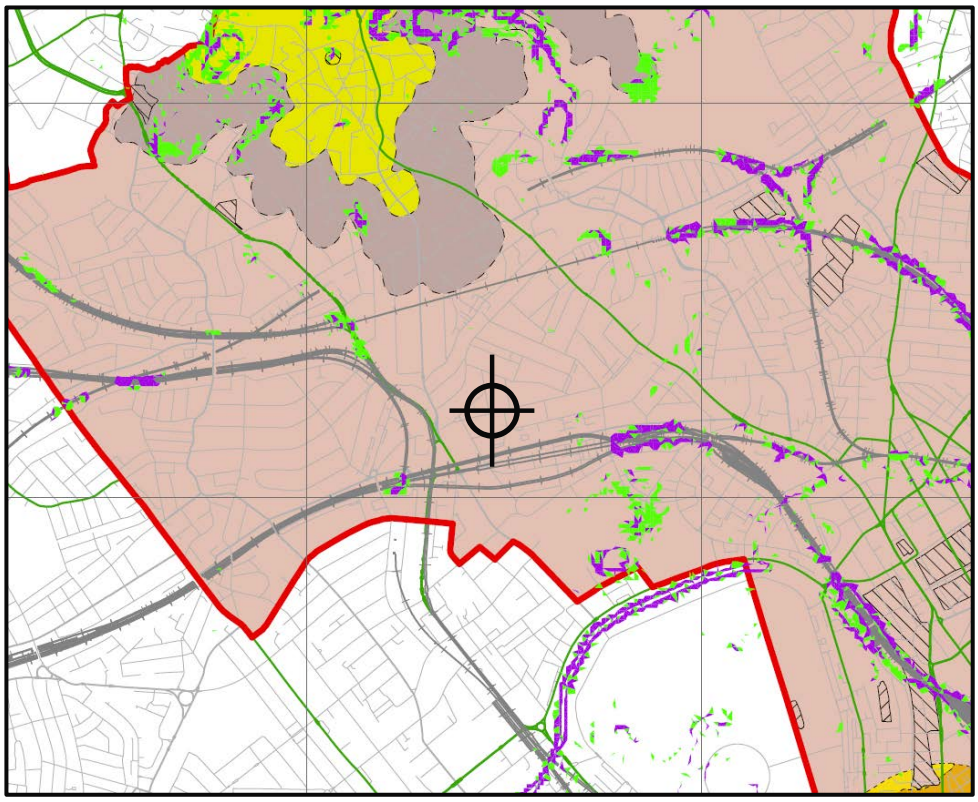
Map Extracts from Figures from CGHHS



Extract from Figure 3 of the CGHHS showing that the site is not underlain by worked ground



Extract from Figure 12 of the CGHHS showing that the site is located away from the Hampstead Heath Ponds



Extract from Figure 16 of the CGHHS showing no slope angles in excess of 7° are present on site