

# Basement Impact Assessment

of proposed development at

**4 The Hexagon**

**Fitzroy Park**

**Camden**

**London**

**N6 6HR**

for

**Ms Lorraine Asbourne**

LBH4391b Ver 1.1

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**LBH**  
**WEMBLEY**



**Geotechnical &**  
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## 2. 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 Geotechnical & Environmental 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 Geotechnical & Environmental 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

Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances shall be at the client's sole and own 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 the future.

### THIRD PARTY INFORMATION

The report may present an opinion on the disposition, configuration and composition of soils, strata and any contamination within or near the site based upon information received from third parties. However, no liability can be accepted for any inaccuracies or omissions in that information.

### DRAWINGS

Any plans or drawings provided in this report are not meant to be an accurate base plan, but are used to present the general relative locations of features on, and surrounding, the site.

## 3. Introduction

### 3.1 Background

Following demolition of the existing building which has a partial lower ground floor, it is proposed to redevelop the site by construction of a three storey dwelling on approximately the same footprint with a lower ground floor area that will extend into the hillside beneath the full footprint.

### 3.2 Brief

LBH WEMBLEY Geotechnical & Environmental have been appointed to complete a Basement Impact Assessment (BIA) for subsequent submission to London Borough of Camden in order to satisfy the specific requirements of Camden Planning Policy DP27 on Basements and Lightwells and Supplementary Planning Guidance CPG4 on Basements and Lightwells.

### 3.3 Planning Policy

The CPG4 Planning Guidance on Basements and Lightwells refers primarily to Planning Policy DP27 on Basements and Lightwells.

The DP27 Policy reads as follows:

*In determining proposals for basement and other underground development, the Council will require an assessment of the scheme's impact on drainage, flooding, groundwater conditions and structural stability, where appropriate. The Council will only permit basement and other underground development that does not cause harm to the built and natural environment and local amenity and does not result in flooding or ground instability. We will require developers to demonstrate by methodologies appropriate to the site that schemes:*

- a) maintain the structural stability of the building and neighbouring properties;*
- b) avoid adversely affecting drainage and run-off or causing other damage to the water environment;*
- c) avoid cumulative impacts upon structural stability or the water environment in the local area;*

*and we will consider whether schemes:*

- d) harm the amenity of neighbours;*
- e) lead to the loss of open space or trees of townscape or amenity value;*
- f) provide satisfactory landscaping, including adequate soil depth;*
- g) harm the appearance or setting of the property or the established character of the surrounding area; and*
- h) protect important archaeological remains.*

*The Council will not permit basement schemes which include habitable rooms and other sensitive uses in areas prone to flooding. In determining applications for lightwells, the Council will consider whether:*

- i) the architectural character of the building is protected;*
- j) the character and appearance of the surrounding area is harmed; and*
- k) the development results in the loss of more than 50% of the front garden or amenity area.*

In addition to DP27, the CPG4 Guidance on Basements and Lightwells also supports the following Local Development Framework policies:

Core Strategies:

- CS5 Managing the impact of growth and development
- CS14 Promoting high quality places and conserving our heritage
- CS15 Protecting and improving our parks and open spaces & encouraging biodiversity
- CS17 Making Camden a safer place
- CS18 Dealing with our waste and encouraging recycling

Development Policies:

- DP23 Water
- DP24 Securing high quality design
- DP25 Conserving Camden's heritage
- DP26 Managing the impact of development on occupiers and neighbours

### 3.4 Documents Consulted

The following documents should be read in conjunction with this report:

- June 2016 – 4 The Hexagon, Hydrogeological, Geotechnical & Ground Movement Assessment LBH4391a ver 1.1 by LBH WEMBLEY Geotechnical & Environmental.
- May 2016 – Marked-up plan showing proposed foundations and load takedown. Drg No. S – 900 (job no: 2150655)
- April 2016 – Loading arrangement for existing foundations. Drg No. SK – L – 0900 Rev. 01 (job no: 2150655)

## 4. Stage 1 - Screening Assessment

### 4.1 Purpose and Methodology

Screening uses checklists to identify whether there are matters of concern (with regard to hydrogeology, hydrology or ground stability) which should be investigated using a BIA (Section 6.2 and Appendix E of the CGHSS) and is the process for determining whether or not a BIA is required. There are three checklists as follows:

- subterranean (groundwater) flow
- slope stability
- surface flow and flooding

### 4.2 Screening Checklist for Subterranean (Groundwater) Flow

Question	Response	Justification
Is the site is located directly above an aquifer?	<b>YES</b>	The BGS records that the site is underlain by the Claygate Member, which is classed as a Secondary A Aquifer.
Will the proposed basement extend beneath the water table surface?	<b>NO</b>	No significant sand seams have been encountered beneath the site and subsequent monitoring has not detected any groundwater presence.
Is the site within 100m of a watercourse, well (used/disused) or potential spring line?	<b>NO</b>	The nearest surface water feature is a pond located just over 100m downslope to the south of the site.
Will the proposed development result in a change in the area of hard-surfaced/paved areas?	<b>YES</b>	The basement will extend beyond the existing building footprint and result in an increase in impermeable area.
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)?	<b>UNKNOWN</b>	Carried forward to scoping.
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?	<b>NO</b>	There are no nearby surface water features.

### 4.3 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 degrees 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 of the site is planned.
Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7 degrees?	NO	The neighbouring land slopes at less than 7 degrees.
Is the site within a wider hillside setting in which the general slope is greater than 7 degrees?	YES	Figure 16 of the CGHHS shows the site to be within a wider area where the slope is locally greater than ten degrees.
Is London Clay the shallowest strata at the site?	NO	The Claygate Member is the shallowest strata at the site.
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	Carried forward to scoping
Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site?	NO	No evidence of cracks or building movements was evident upon visiting the site.
Is the site within 100m of a watercourse or a potential spring line?	NO	The nearest surface water feature is a pond located just over 100m downslope to the south of the site.
Is the site within an area of previously worked ground?	NO	No. Figure 3 of the CGHHS shows the site not to be in an area of worked ground.
Is the site within an aquifer?	YES	The BGS records the Claygate Member as a Secondary A Aquifer.
Will the proposed basement extend beneath the water table such that dewatering may be required during construction?	NO	No significant sand seams have been encountered beneath the site and subsequent monitoring has not detected any groundwater presence.
Is the site within 50m of the Hampstead Heath ponds?	NO	The Hampstead Heath ponds are approximately 350m to the southwest of the site.
Is the site within 5m of a highway or pedestrian right of way?	NO	The Hexagon access road is around 10m from the front wall of property on the site.
Will the proposed basement significantly increase the differential depth of foundations relative to the neighbouring properties?	YES	The proposed basement will be approximately 2m lower than the foundations to No. 3 The Hexagon.
Is the site over (or within the exclusion zone of) tunnels, e.g. railway lines?	NO	No tunnels have been identified beneath, or significantly near the site.



#### 4.4 Screening Checklist for Surface Flow and Flooding

Question	Response	Justification
Is the site within the catchment area of the pond chains on Hampstead Heath?	<b>YES</b>	The site is inside the catchment area of the Hampstead Heath ponds as shown in Figure 14 of the CGHHS
As part of the site drainage, will surface water flows (e.g. rainfall and run-off) be materially changed from the existing route?	<b>NO</b>	Surface water flows will be disposed of by the existing means.
Will the proposed basement development result in a change in the proportion of hard-surfaced/paved areas?	<b>YES</b>	The basement will extend beyond the existing building footprint and result in an increase in impermeable area.
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?	<b>NO</b>	SUDS storage techniques are suggested in order to maintain the flow profile.
Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	<b>NO</b>	The existing car park drainage is to be maintained.
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?	<b>NO</b>	The site is not at risk from surface water flooding.

## 5. Stage 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 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 CGHSS).

The issues identified from the checklists as being of potential concern in the previous sections are as follows:

- **The site is located directly above an aquifer**  
*The guidance advises that the basement may extend into the underlying aquifer and thus affect the groundwater flow regime.*
- **The proposed development may result in a change in the area 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. 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.*
- **More surface water (e.g. rainfall and run-off) than at present be discharged to the ground (e.g. via soakaways and/or SUDS)**  
*The guidance advises that 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.*
- **The site is within a wider hillside setting in which the general slope is greater than 7 degrees**  
*The guidance advises that there may be potential for a larger slope failure system including re-activation of a pre-existing slide.*
- **Trees will be felled as part of the proposed development and/or are works proposed within tree protection zones where trees are to be retained**  
*The guidance advises that the soil moisture deficit associated with felled tree 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. This may reduce the soil strength which could affect the slope stability. Additionally the binding effect of tree roots can have a beneficial effect on stability and the loss of a tree may cause loss of stability.*

- **The proposed basement will significantly increase the differential depth of foundations relative to the 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.*

- **The site is within the catchment area of the pond chains on Hampstead Heath.**

*The guidance advises that with regard to the pond chains on Hampstead Heath, any reduction in the spring inflow to the ponds would reduce the overall flow through the ponds, which in turn could allow an increased build-up of contaminants. This may potentially lead to the bathing ponds not attaining the required Bathing Water Directive water quality standards.*

*The guidance advises that any reduction in the surface water inflow to the ponds would reduce the overall flow through the ponds, which in turn could allow an increased build-up of contaminants. Any increase in surface water inflow to the ponds could result in an increase in contaminants (e.g. animal faeces and organic matter) being washed into the ponds. Any increase in surface water inflow to the ponds could also result in an increase in the "normal" volume of water in the ponds. With more water in the ponds on a day-to-day basis, the available spare capacity in the ponds for receiving storm rainfall would be reduced, thus increasing the risk of the ponds over-topping when, in the event of a storm, that spare capacity is needed. If overtopping were to occur, this could cause inundation of land and properties downstream.*

The assessment of potential impacts needs to be informed by the findings of intrusive ground investigation and all the above issues are to be carried forward to the impact assessment.

## 6. Stage 3 – Site Investigation

In February/March 2016 an intrusive ground investigation was undertaken including three boreholes constructed to depths of up to 8m in conjunction with dynamic probing.

Two standpipes were installed to allow for groundwater monitoring.

Three trial pits were also hand excavated along the boundary walls of the site as well as adjacent to the existing building to reveal the configuration of the existing foundations.

The investigation findings are presented and discussed within the accompanying geotechnical & hydrogeological assessment report (LBH4391a).

## **7. Stage 4 – Impact Assessment**

The screening and scoping stage has 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.

### **7.1 Aquifer**

The investigation has demonstrated that there are only impermeable clay soils present beneath the site and that there is no significant groundwater flow. Hence there is no potential issue of concern.

### **7.2 Surface water infiltration and drainage**

The exploratory investigation has indicated that, in addition to run-off, there may be some near-surface downhill water flow within the more permeable zones of made ground. There will be a need to maintain the present water discharge regime despite the proposed increase in hard surfacing.

Additionally, it will be necessary to maintain the status quo and in order to ensure that the new construction does not form an obstacle to this flow it is proposed that provision is made for a near-surface drainage bypass comprising collector drainage to intercept any high level seepage entering the site from above in conjunction with a downslope re-infiltration system to restore the groundwater regime at the southwestern boundary of the property.

The design of such a system must be sufficient to effectively maintain, as far as is possible, the present groundwater regime around the property boundaries. Hence a below-ground weir may be required within the system on the upslope northeastern site boundary to control the groundwater in front on the proposed basement cut-off wall. The re-infiltration system must be designed to safely deal with any peak flows without leading to the unacceptable flooding of the adjacent property downslope.

### **7.3 Hampstead Heath**

If the basement were to obstruct the natural near-surface groundwater flow regime this could potentially have some effect upon the Highgate ponds. However, it is anticipated that an effective drainage system incorporating the features described above can be designed and installed with the intention of maintaining the status quo.

### **7.4 Slope Instability**

There is no evidence of any current slope stability issues on or near the site. Nevertheless, care must be taken to maintain or improve the overall stability of the wider hillside. For this reason, unsupported battered excavations are not to be used and, although the neighbouring properties lie outside the zone of influence of the proposed excavation, full support will be maintained at all times to the slope by means of a contiguous bored pile retaining wall where the basement abuts land at a higher elevation.

### **7.5 Neighbouring Properties**

In line with policy DP27, Camden Council seeks to ensure that harm will not be caused to neighbouring properties by basement development.

A ground movement and damage category assessment has been undertaken based on the construction proposals outlined in the previous section. This assessment is reported within the accompanying geotechnical and hydrogeological assessment (LBH4391a).

CPG4 guidance recognises that residential properties are particularly sensitive to damage, as relatively minor internal damage to a person's home can incur cost and considerable inconvenience to repair and redecorate and the Council expect mitigation measures to be employed where a risk of damage to residential buildings is identified of Burland Category 1 'very slight' or higher.

On the basis of the construction proposals outlined in the previous section, the ground movement assessment indicates a predicted Burland Category 1 'very slight' for the nearest neighbouring property No. 3 The Hexagon.

The piled basement retaining wall should therefore be designed and maintained in as rigid state as is possible, through the installation of appropriate propping prior to any excavation and the installation of additional propping as necessary as the excavation proceeds, with the intention of allowing negligible deflection and yielding at any level.

The selection of larger diameter piles would allow increased reinforcement to be included and similarly increased rigidity to be achieved.

#### **7.6 Cumulative Effects**

It is proposed to install near-surface drainage measures comprising a collector system with a below-ground weir to above the property on the upslope northeastern side of the new retaining wall. The depth of this collector drain, which may comprise a trench backfilled with compacted free-draining material protected by a geofabric, may be limited to the depth of the made ground and is expected to be less than 1m. Such a system may be expected to successfully intercept the more permeable surface layers of soil and conduct the water flow through pipework to a downslope re-infiltration system along the southwestern boundary of the property.

From this discussion, it can be understood that given the design objective to maintain the status quo upstream and downstream of the property, the new construction will not lead to changes in groundwater levels in these areas and the artificial drainage linking the two areas will avoid any extra burden of flow upon the window that will remain between the planned basement and any neighbouring basements.

#### **7.7 Works close to existing trees**

A 10m tall fir tree located 3.5m away from the proposed building is to be removed as part of the proposals. The results of plasticity index testing have confirmed the Claygate Member beneath the site to be of high volume change potential. Although an arboricultural report should be commissioned no threat to slope stability is perceived as a result of the removal of this medium water demand tree.

#### **7.8 Monitoring and Contingency Plan**

Monitoring of the adjacent properties should be undertaken in order to confirm that no additional mitigation measures are warranted. The monitoring plan needs to be sufficiently robust to enable mitigation to be effectively implemented in the event of agreed trigger values for vertical and horizontal movement being exceeded at agreed monitoring positions. During the actual basement excavation stage both start of shift and end of shift measurements will be necessary in order for movements to be checked and, in the event of any adverse movement, for the contingency plan to be effected sufficiently quickly to prevent the excessive movement to neighbouring properties.

The plan will make it clear what emergency measures or mitigation may be required to be implemented in the event of an exceedance and will demonstrate the availability of the required resources. The plan will also identify exactly who will have the responsibility for implementing the plan.

## 8. CONCLUSION

This assessment has demonstrated that each of the potential impact issues can be satisfactorily addressed through the use of appropriate engineering design and construction measures, and that the proposed construction can be successfully completed without detriment to the environment, flooding or ground instability.

Given an adequate design and construction methodology it is envisaged that the basement construction will have no detrimental impact on the stability of the neighbouring structures and can be achieved without any cumulative impact.