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56A King Henry's Road NW3 3RP

Basement Impact Assessment for Basement and Lightwell Construction

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1. Introduction

It is proposed to construct a single storey height space under the existing raised ground floor level which does not go below the more than 8m deep piled foundations of the modern terrace or below the recently created similar space adjacent on the west side, and a lightwell at the front of the property. To the east, under the suspended ground floor level slab, is the same predominantly granular and other fill from when the railway retaining wall, 7m high buttressed masonry, was constructed in excess of 100 years ago. The ground is clearly consolidated over that time scale and there is a covenant in place that restricts the load that may be put on the ground from any construction. It follows that any excavation behind the railway retaining wall improves the overturning and sliding stability of that old wall.

Ecos Maclean has been instructed to carry out a Basement Impact Assessment (BIA) to assess the potential impact on surrounding structures, hydrology and hydrogeology. We have been the engineers for the successful construction of three identical, partly below ground spaces in this modern terrace of 11 properties over the last 10 years.

This report follows the guidance set out in the Camden Borough Council policy guidance on assessment of basements.

The basement design and impact assessment has been undertaken by the Principal Engineer at Ecos Maclean – Nick Maclean BSc (Hons) 1970 who has nearly 50 years' experience as a practicing civil and structural engineer in the south of England with particularly extensive and continuous experience of basement construction in London both in new build, and under existing buildings, commencing with being the Assistant Resident Engineer explicitly dealing with the defects in the retaining structure to form the substantially underground Barbican Arts Centre in 1973/74. The report has also been reviewed by Mr R. Gulhane MEng, MICE, a civil and structural engineer also of 50 years' experience who has designed and over-seen the construction of basements in Camden. The summary of expertise is given at Appendix 1.

The report provides an assessment of geotechnical impacts on adjacent structures and the surrounding area based on available site data and experience of three other basements under this modern, concrete framed terrace of 11 houses on piles to significantly below the nearby railway. This includes design checks of proposed below ground structure and a damage assessment to predict the impact on adjacent properties.

2. Site Context

Summary

The site is on the west side of Camden Town. The building is a 1980's Town house on piles with parking at the front and a garden to the rear to the the railway cutting 7m below the terraced garden. The site and surrounding area is founded on weathered London Clay with no groundwater present. There are records of surface water flooding. The existing building and its curtilage is paved at the front. The site geology and ground conditions are well understood based on excavations pits and recent basements under the existing terrace building.

2.1. Site Location

The site is located at 56A King Henry's Road. The site location is shown in figure 1.

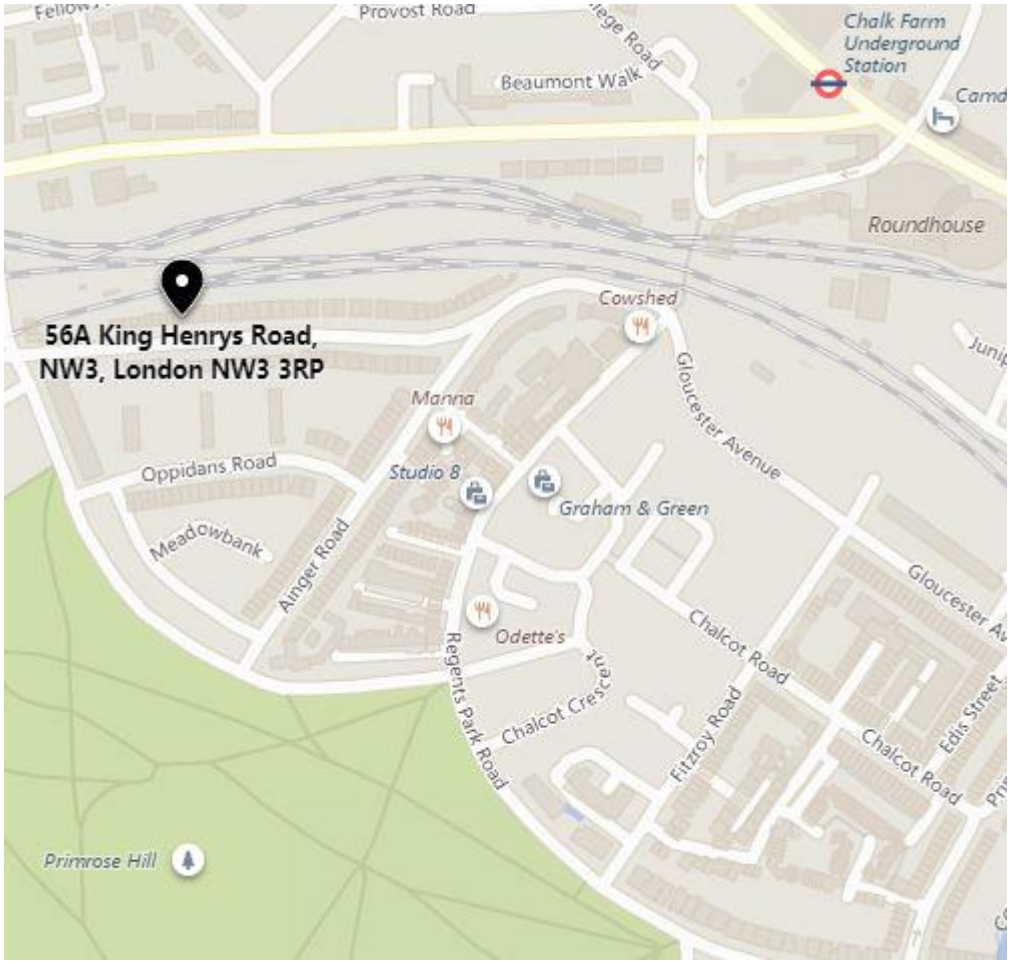

Figure 1: Site location plan

2.2. Site Layout

The property is one of a terrace of 11 modern town houses on King Henry's Road. It has the main access and a parking bay at the front of the property and garden to the back, which backs onto the railway. The property shares a party wall with no. 56 on the right and 56b on the left, with no.56b already having a semi-basement storey added.

The ground slopes approximately 10m below ground level from King Henry's Road to the railway lines at the back of the property. The existing ground floor is designed as a suspended slab, on a grid of concrete beams which transfer loads onto existing pile foundations under only the Party Walls. (The original engineer's design drawings for this structure and piled foundation is in our files from the first semi-basement which was designed by Nick Maclean).

2.3. Proposed Development

The structural details of the work have been developed as a result of the site investigation which confirmed the presence of significant depth piles for the existing foundations.

The proposal is for a semi-basement with the rear at garden level at the original greenfield site level, and a lightwell at the front of the property. The proposed semi-basement will built adjoining the boundary wall at 56b but approximately 500mm off the boundary behind the terrace to be clear of that existing extension and share the boundary wall with no. 56 on the opposite side. It will involve excavating beneath the existing ground floor level and built using 256 Stepoc retaining wall underneath the footprint of the existing ground floor on the east side only, (the wall to the west already in place from the adjoining basement) and extended hollow block wall and footing.

The lightwell will be approx 2.7 sq metres and 2.5m below the front pavement level, set back 2m from the footway and will be built using 256 Stepoc block retaining walls.

2.4. Topography

The site lies at an elevation of approximately 45 m. The street is slightly sloping up to the west at approximately 10 metres higher than the railway lines at the rear of the property. The proposed design takes into account the nature of existing topography.

2.5. Published Geology

The British Geological Survey (BGS) of the area indicates the site to be near the boundary between London Clay Formation and Claygate Member and 1km away from an area of worked ground beside the Finchley Road. See Figure 4 of ARUP CGHS

2.6. Site Investigation

There was 1 trial pit excavations dug within the property , adjacent to the basement and rear extension at 56b at lower ground level to establish: a) the underlying soil conditions and b) the depth and presence of piles on the Party Walls to verify the original foundation design drawings. This site investigation was undertaken in August 2018.

The excavations of the trial pit revealed stiff brown weathered clay under the granular backfill placed on the original ground slope when the terrace was constructed.

The trial pits were excavated to 2m depth and used to confirm the existing piled foundations which were shown on the engineering drawings.

The Trial Pits were left open for two months and remained dry with no perched, ground water or surface water observed entering the trial pits.

The underlying geology is therefore clearly brown London clay with a low permeability and a low to medium susceptibility to shrinkage and swelling movements due to changes in moisture content, but this will be in static moisture conditions because oif the depth and only relates to the free semi-basement construction.

The location and photo record of the excavations are shown at Appendix 2.

There property is served by gas, electrical and foul drainage infrastructure all of which are connected to the property from the front pavement. There is no underground infrastructure below the property within the zone of influence of the lightwell excavation.

2.8. Hydrogeology

The Environment Agency (EA) Aquifer Designation shown in Fig 8 of CGHHS indicates that the site location on the boundary of the Hampstead Heath secondary aquifer and the unproductive strata of the London Clay Formation. The Site investigation revealed no perched water or groundwater as would be expected for a site within London Clay.

2.9. Hydrology

There are no culverted rivers or other water bodies within 100m of the site as indicated in Fig 11 of CGHHS

2.10. Flood risk

With reference to the Environment Agency website King Henry's Road is within a flood risk zone 1 and so is classified as an area at low risk from Rivers or Surface Water Flooding.

2.11 Drainage Assessment and SUDS

The lightwell extends into front parking bay which is fully paved and so there is no increase in impermeable area as a result of the development and therefore no justification or scope for the introduction of flood attenuation features.

3. SCREENING

Summary

The results of the screening stage are presented. The screening process identified issues of slope stability – clay substrate and proximity to footpath; and surface water flooding.

3.1 Subterranean (ground water) flow screening - Fig 1

	Question	Response	Justification	Reference
1a	**Is the site located directly above an aquifer?**	No	The site is located in clay formation.	Fig. 8 CGHH Site Investigation
1b	**Will the proposed development extend beneath the water table surface?**	No	The water table is below the impermeable clay which is below the level of the basement excavations	
2	**Is the site within 100m of a watercourse, well (used/disused) or potential spring line?**	No	Evidence from maps and Reference to The lost of Rivers of London indicate that the site is distant from any culverted water bodies.	Fig. 11 CGHH
3	**Is this site within the catchment of the pond chains on Hampstead Heath**	No	Evidence from Map	Fig. 14 CGHH
4	**Will the proposed development change the proportion of hard surfaced/paved areas?**	Yes	The lightwell will be excavated at the front part of the Property which will take up part of the hard surfaced parking area, but will be under an original cantilever balcony on each property	
5	**As part of the site drainage, will more surface water than at present be discharged to the ground (e.g. via soakways and/or SUDS)?**	No	There is no increase in impermeable surfaces therefore no change to drainage arrangements	

6	**Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to, or lower than, the mean water level in any local pond (not just the pond chains on Hampstead Heath) or spring line.**	No	The site is one kilometer from ponds or any spring lines.	Fig. 11 and 12 CGHH

3.2 Slope stability screening - Fig 2

	Question	Response	Justification	Reference
1	**Does the existing site include slopes, natural or manmade, greater than 7°? (approximately 1 in 8)**	Yes	The slope of is less than 7°.	Fig 16 CGHH
2	**Will the proposed re-profiling of landscaping at site change slopes at the property boundary to more than 7°?**	No	The slopes at the property boundary will be unaffected by the development.	
3	**Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7°?**	No	Evidence from site location plan	
4	**Is the site within a wider hillside setting in which the general slope is greater than 7°?**	No	Evidence from site plan	Fig 16 CGHH
5	**Is the London Clay the shallowest strata at the site?**	Yes	Evidence from BGS geology map	Fig 4 CGHH
6	**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?**	No	Evidence from site plan. No trees exist on the site.	

7	**Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site?**	No	There is no evidence of shrink-swell subsidence	Site Investigation
8	**Is the site within 100m of a watercourse or a potential spring line?**	No	Evidence from maps and site walk over	Fig. 11 and 12 CGHH
9	**Is the site within an area of previously worked ground?**	No	Evidence from Site Investigation	Site Investigation
10	**Is the site within an aquifer? If so, will the proposed basement extend beneath the water table such that dewatering may be required during construction?**	No	The site is situated in unproductive strata	Site Investigation
11	**Is the site within 50m of the Hampstead Heath ponds?**	No	Evidence from map	Fig 12 GCHH
12	**Is the site within 5m of a highway or pedestrian right of way?**	Yes	The front lightwell will be is within 2m of the pavement	
13	**Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?**	No	The neighbour properties have existing basement	Site Investigation
14	**Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?**	No	Evidence from location map	Fig 18 CGHH

3.3 Surface flow and flooding screening - Fig 3 [1]

	Question	Response	Justification	Reference
1	**Is the site within the catchment of the pond chains on Hampstead Heath?**	No	Evidence from location map	Fig. 14 CGHH
2	**As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route?**	No	Site drainage will be channelled along the existing routes.	Proposed LGF plan
3	**Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?**	No	The lightwell is in an existing paved garden	Proposed LGF plan
4	**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	Evidence from plan of existing and proposed	Proposed LGF plan
5	**Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?**	No	Existing surface water drainage arrangements will be maintained	Proposed LGF plan
6	**Is the site in an area known to be at risk from surface water flooding, such as South Hampstead, West Hampstead, Gospel Oak and King's Cross, 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	King Henry's Road has not been identified with risk of flooding	Fig. 15 CGHH

4. SCOPING

4.1. Summary

This section of the report covers the scoping process of the BIA, which is used to identify potential impacts of the proposed scheme on the groundwater, slope stability and surface water flow identified as risks in the screening stage. The scoping stage also informs the scope of any necessary site investigations and is used to establish a Conceptual Site Model (CSM).

4.2. Groundwater

The screening questions identified no significant risks associated with ground water. There is no ground water present on site.

4.3. Slope Stability

The shallowest strata at the site is London Clay which is known to be a consolidated clay formation and is therefore subject to some changes in volume when excavating. The potential impact of excavating is the possibility of volume changes causing movement and cracking of existing structures. However, the site is not into the over-consolidated London Clay, merely the 'weathered' brown London Clay.

The proposal is to excavate an area of 80 sqm to a maximum of 3m in depth from the existing front garden.

This is a small amount of material to be removed that the volume change potential is so small as to be insignificant. The more significant issue for stability and ground movement is the impact of the excavation of the light-wells. The design of the lightwell structure and the sequence of the excavations have taken this into account to minimize the impact on the adjoining houses in the terrace and the pavement to the front.

The GSD guidance says soil investigation testing is necessary only if 'screening reveals concerns'. No concerns were identified. The trial pits have established the depth and structure of the adjoining property substantial foundations.

4.4. Surface Water Flow and Flooding

It was found in the screening stage that there is a risk of surface water flooding. The quantity or quality of surface water flows will be unaffected by this scheme and risks of flooding of the property can be reduced by taking the opportunity of introducing a low wall and step to protect the front garden, path and lightwell from surface water flooding.

4.5. Conceptual Site model

A conceptual site model before and after the proposed development has been formed based on a thorough investigation of the site and the surrounding area, in accordance with the recommendations of the Camden geological, hydrogeological, and hydrological study it is set out below.

The site is located in the London Borough of Camden to the west of Hampstead Heath on King Henry's Road. The lightwell excavation will be in weathered brown London clay overlain by made ground, the London Clay formation is an unproductive strata in terms of ground water flow. Groundwater is absent from the strata below and beside the building.

Hard surfacing is the predominant surface covering in the local area including the garden at the front of the property. The majority of rainfall falling on the surrounding area will run-off into local guttering and drainage system surrounding the site. Platts lane is know to have been location of surface water flooding in 2002.

The property and the neighboring properties are constructed on corbelled foundations to the north and the adjacent property has mass concrete underpinning. There are no sensitive or vulnerable buildings or infrastructure nearby to the proposed lightwell. The property and adjacent property to the south has an existing basement formed with mass concrete underpinning.

The risks, impacts and mitigation measures associated with the lightwell construction are identified in the table below.

Risk	Impact	Mitigation
Inadequate Restraint of front garden during construction	Leading to undermining of the front garden and pavement	Propping of face of excavation and face of excavation to be less than 1.5 M
Flooding of excavation during construction from surface water	Leading to swelling of clay below existing building	Covering all exposed excavation. Dewater sump pump on site during excavation
Flooding of light well and property from surface water when complete	Leading to damage to property	Construct low wall to protect property from flooding

4.6.1 Existing

1. The London Clay Formation below Made Ground to at least 20 m depth.

2. Rainwater is channeled as surface run-off into the main drainage system.

3. Front Garden paved impermeable surface.

4. No ground water flows below the existing building.

5. No sensitive infrastructure or structures within the vicinity

6. Existing basement room below building

7. Existing basement below adjacent building

4.6.2 Proposed

1. Excavation of approx. lightwell at front of property.

2. Rainwater from 5 sq. m. lightwell channeled as surface run-off into the main drainage system.

3. Light-well constructed as reinforced concrete with floor and side walls acting as restraint of the adjacent soil and pavement

5. Impact Assessment

5.1. Geotechnical Information

The review of the site conditions, hydrogeology and geotechnical information for this location show that there are no significant geotechnical risks.

5.2. Subterranean (Groundwater) Flow

The site is located above London Clay which presents an almost complete barrier to groundwater. The development will have a no impact on the groundwater flow as the site is identified as being unproductive strata.

5.3. Slope (Land Stability) Assessment

Adjacent Structures

The design has modelled the impact of the retaining wall design upon the adjacent buildings.

The basement floor slab and the new beams introduced at ground floor level combine to provide effective props at top and bottom of the party wall and reduces the risk of horizontal movement of the party wall. The engineering design and calculations show how the structure maintains continuing stability of the garden and pavement.

Damage Category Assessment

The risk of cracking of the adjoining party walls has been further assessed based on the review of the ground conditions and the revised detailed assessment of risks. The design and construction method if followed cracking will result in no more than Category 1 on the Burland Scale.

Monitoring of Movement

The primary method of monitoring any movement will be the recording of cracks in adjacent property plasterwork on the party wall and any occurrence of new cracks of more than 1 mm lead to a review of the working method.

5.4. Surface Flow and Flooding

The lightwell will be protected from water ingress by a low wall. All the surface water falling in to the light-wells will be transmitted to the existing drainage via a sump pump.

5.5. Sustainable Resource & impact on local environment

Steel reinforcement has been utilised only where it is necessary to achieve the structural performance needed to provide restraint of the light-well walls. The design thereby avoids the excessive or unnecessary us of high embodied energy materials

6. References

1. Camden Planning Guidance, CPG4, Basements and Lightwells, Sept 2013.

2. Environment Agency, Risk of Flooding from Rivers and Sea, February 2013.

3. Ove Arup and Partners, Camden geological, hydrogeological, and hydrological study. Guidance for subterranean development, November 2010.

4. Environment Agency, Drinking Water Protected Areas, February 2013.

5. Ordinance Survey Map – London Borough of Camden 1:2500

6. Burland, J.B., and Wroth, C.P. (1974). *Settlement of buildings and associated damage*, State of the art review. Conf on Settlement of Structures, Cambridge, Pentech Press, London, pp611-654

Appendix 1 - The Authors

Nick Maclean an engineer with over 40 years of experience has approved the basement impact assessment. He has above average experience of basements, commencing with being the Assistant Resident Engineer on the Barbican Arts Centre Site in 1973, (i.e. 43 years), specific duty there being investigating and overseeing remedial works to the many defects in retaining walls, walls to be prestressed as waling beams, and 1.5m thick jacked, cross-site, prop walls, which defects delayed the project for so long. This tiered basement was up to 28m below street level, below the piled foundations of the adjacent 140m high Tower Blocks and the adjacent Metropolitan & Circle line tunnels.

Additionally, he has in the last 28 years in Private Consultancy been involved in numerous basements in Camden and other Inner London Boroughs, with two under construction presently and three in the design phase. Additionally he is active acting as checking engineer for Party Wall Matters on two basements where his intervention to refine the design is resulting in less excavation and steel.

Roger Gulhane MICE – an engineer in private practice for four decades having previously been a chartered engineer in Ove Arup specialist structures division. His practice is based in Camden and has worked on several basement projects in North London in the last decade.

List of Appendices in support of the BIA

Appendix 2 – Site Investigation Report

Appendix 3 - Engineering design - plans and sections

Appendix 4a - Extracts from CGHH Figures 1-10 showing site location

Appendix 4b - Extracts from CGHH Figures 11-20 showing site location