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26 West Hill Park
London, N6 6ND

Basement Impact Assessment Audit

For

London Borough of Camden

Project Number: 12985-55
Revision: D2

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1.0 NON-TECHNICAL SUMMARY

1.1. CampbellReith was instructed by London Borough of Camden, (LBC) to carry out an audit on the Basement Impact Assessment submitted as part of the Planning Submission documentation for 26 West Hill Park, London, N6 6ND (planning reference 2019/1426/P). The basement is considered to fall within Category B as defined by the Terms of Reference.

1.2. The Audit reviewed the Basement Impact Assessment (BIA) for potential impact on land stability and local ground and surface water conditions arising from basement development in accordance with LBC's policies and technical procedures.

1.3. CampbellReith was able to access LBC's Planning Portal and gain access to the latest revision of submitted documentation and reviewed it against an agreed audit checklist.

1.4. The BIA has been carried out by individuals with suitable qualifications.

1.5. The site is rectangular shape and is occupied by a three storey detached dwelling. The proposed development involves extending the lower ground floor to the front and the rear. Maximum excavation depths of c.5.50m are anticipated.

1.6. The site is located within the Hampstead Ponds catchment area but at a higher elevation and at a distance of c.130m from the ponds.

1.7. It is accepted that the basement proposals will not result in a risk of instability provided there is good control of workmanship. Any steeper manmade cut slopes should be supported to avoid instability.

1.8. The BIA confirmed that the site is located above a 'Secondary A' aquifer, the Claygate Member of London Clay Formation. Monitoring indicated that groundwater may be encountered during construction and control of groundwater will be required.

1.9. It is accepted that the proposed development is not anticipated to impact the wider hydrogeological environment.

1.10. The ground movement assessment (GMA) should be revised in accordance with the comments of Section 4 of this audit. The GMA should consider any potential ground movement due to water ingress and proposed dewatering.

1.11. The outline movement monitoring strategy should be updated and finalised prior to construction to safeguard land stability.

1.12. It is accepted that there will be negligible impact to the hydrology of the site.

1.13. An outline construction programme is presented.

1.14. A number of queries have been raised as summarised in Appendix 2. It cannot currently be confirmed that the proposal adheres to the requirements of the CPG Basements.

2.0 INTRODUCTION

2.1. CampbellReith was instructed by London Borough of Camden (LBC) on 10 May 2019 to carry out a Category B Audit on the Basement Impact Assessment (BIA) submitted as part of the Planning Submission documentation for 26 West Hill Park, London, N6 6ND (planning reference 2019/1426/P).

2.2. The Audit was carried out in accordance with the Terms of Reference set by LBC. It reviewed the Basement Impact Assessment for potential impact on land stability and local ground and surface water conditions arising from basement development.

2.3. A BIA is required for all planning applications with basements in Camden in general accordance with policies and technical procedures contained within:

- Guidance for Subterranean Development (GSD). Issue 01. November 2010. Ove Arup & Partners;
- Camden Planning Guidance Basements (CPG Basements). March 2018;
- Camden Development Policy (DP) 27: Basements and Lightwells;
- Camden Development Policy (DP) 23: Water;
- Local Plan Policy A5 Basements.

2.4. The BIA should demonstrate 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 evaluate the impacts of the proposed basement considering the issues of hydrology, hydrogeology and land stability via the process described by the GSD and to make recommendations for the detailed design.

2.5. LBC's Audit Instruction described the planning proposal as "*Lower ground floor rear / front extension and associated alterations to single family dwelling*".

The Audit Instruction confirmed that 26 West Hill Park neither involves nor is neighbour to any listed building.

2.6. CampbellReith accessed LBC's Planning Portal on 4 June 2019 and gained access to the following relevant documents for audit purposes:

- "Basement Impact Assessment, Surface Water BIA & Engineering Design and Construction Proposals" (Structural BIA report), dated 15/2/2019, issued by Croft Structural Engineers;
- "Ground Investigation and Basement Impact Assessment Report" (Geotechnical BIA report), dated February 2019, v1.01, issued by Ground & Water Ltd;
- "Geo-environmental Interpretative Report" (GI report), dated May 2017, issued by Chelmer Consultancy Services;
- "Design and Access Statement", issued by London Development & Construction;
- "Arboricultural Impact Assessment & Method Statement (to BS5837:2012)", dated 20/2/2019, issued by Trevor Heaps Arboricultural Consultancy Ltd;
- "Topographic Survey", dated October 2016, issued by CD Surveys Ltd;
- Planning application drawings dated 25/2/2019, issued by London Development & Construction, consisting of:
  - 001 Location Plan and Block Plan;
  - 02-B Existing Lower Ground Floor Plan;
  - 03-B Existing Ground Floor Plan;
  - 04-B Existing First Floor Plan and Roof Plan;
  - 05-B Existing Section and Elevation;
  - 06-B Existing Front and Rear Elevation;
  - 07-B Existing Landscape Plan;
  - 08-B Proposed Lower Ground Floor Plan;
  - 09-B Proposed Side Section and Proposed Elevation;
  - 10-B Proposed Front and Rear Elevations;
  - 11-B Proposed Landscape Plan;
  - 10-1-B Visualisation. Existing Condition. View 1;
  - 10-2-B Visualisation. Existing Condition. View 2.
- Planning Comments.

2.7. CampbellReith issued a BIA audit report (rev. D1) on 20/06/2019 raising a number of queries on the above relevant documents.

2.8. The following revised reports and information were received from Croft Structural Engineers, via LBC, on 2 and 5 August 2019, in response to the queries raised in the BIA audit report (rev. D1):

- "Ground Investigation and Basement Impact Assessment Report" (referred to as 'revised Geotechnical BIA report' in this audit), dated August 2019, v1.01, issued by Ground & Water Ltd.

3.0 BASEMENT IMPACT ASSESSMENT AUDIT CHECK LIST

Item	Yes/No/NA	Comment
Are BIA Author(s) credentials satisfactory?	Yes	Refer to comment in audit paragraph 4.1.
Is data required by Cl.233 of the GSD presented?	Yes	However, reference to this audit should be made with regard to additional information required for the assessment of potential impact.
Does the description of the proposed development include all aspects of temporary and permanent works which might impact upon geology, hydrogeology and hydrology?	No	Some additional information is required as per the findings of this audit. Refer to comments in Section 4.
Are suitable plan/maps included?	Yes	
Do the plans/maps show the whole of the relevant area of study and do they show it in sufficient detail?	Yes	
Land Stability Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	Refer to Section 3.1.2 of the revised Geotechnical BIA report.
Hydrogeology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	Refer to Section 3.1.1 of the revised Geotechnical BIA report.
Hydrology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	Refer to Section 4.3 of the Structural BIA report.
Is a conceptual model presented?	Yes	Refer to Section 5 of the revised Geotechnical BIA report.
Land Stability Scoping Provided? Is scoping consistent with screening outcome?	Yes	Refer to Section 3.2 of the revised Geotechnical BIA report.

Item	Yes/No/NA	Comment
Hydrogeology Scoping Provided? Is scoping consistent with screening outcome?	Yes	As above.
Hydrology Scoping Provided? Is scoping consistent with screening outcome?	Yes	Refer to Section 5.3 of the Structural BIA report.
Is factual ground investigation data provided?	Yes	Refer to the GI report.
Is monitoring data presented?	Yes	As above.
Is the ground investigation informed by a desk study?	Yes	Refer to Section 2 of the revised Geotechnical BIA report and Section 3 of the Structural BIA report.
Has a site walkover been undertaken?	Yes	Refer to Section 3.2 of the Structural BIA report.
Is the presence/absence of adjacent or nearby basements confirmed?	Yes	Refer to Section 3.2.3 of the Structural BIA report.
Is a geotechnical interpretation presented?	Yes	Refer to Section 7 of the revised Geotechnical BIA report.
Does the geotechnical interpretation include information on retaining wall design?	Yes	Refer to Sections 7.2 and 7.4 of the revised Geotechnical BIA report.
Are reports on other investigations required by screening and scoping presented?	Yes	An arboricultural report is presented.
Are the baseline conditions described, based on the GSD?	Yes	
Do the base line conditions consider adjacent or nearby basements?	Yes	The absence of adjacent basements is confirmed in Section 3.2.3 of the Structural BIA report.
Is an Impact Assessment provided?	Yes	However, additional information is required as discussed in Section 4.

Item	Yes/No/NA	Comment
Are estimates of ground movement and structural impact presented?	Yes	A ground movement assessment (GMA) is presented in Section 7.6 of the revised Geotechnical BIA report. However, additional information is required as discussed in Section 4 of this audit.
Is the Impact Assessment appropriate to the matters identified by screening and scoping?	Yes	However, additional information is required as discussed in Section 4.
Has the need for mitigation been considered and are appropriate mitigation methods incorporated in the scheme?	Yes	However, additional information is required as discussed in Section 4.
Has the need for monitoring during construction been considered?	Yes	An outline monitoring strategy is presented in Section 7.4.3 of the Structural BIA report, however, additional information is requested as discussed in Section 4 of this audit.
Have the residual (after mitigation) impacts been clearly identified?	No	Additional information is required as discussed in Section 4 of this audit.
Has the scheme demonstrated that the structural stability of the building and neighbouring properties and infrastructure will be maintained?	No	As above.
Has the scheme avoided adversely affecting drainage and run-off or causing other damage to the water environment?	Yes	Refer to Section 5.3.1 of the Structural BIA report.
Has the scheme avoided cumulative impacts upon structural stability or the water environment in the local area?	No	Additional information with regard to structural stability and potential water ingress is required as discussed in Section 4.
Does report state that damage to surrounding buildings will be no worse than Burland Category 1?	Yes	However, additional information is required to be included in the GMA to confirm this outcome, as discussed in Section 4.
Are non-technical summaries provided?	Yes	

4.0 DISCUSSION

4.1. The Basement Impact Assessment (BIA) has been carried out by Ground & Water Ltd (Geotechnical BIA report) and by Croft Structural Engineers (Structural BIA report) by individuals with suitable qualifications.

4.2. The site has an approximately rectangular shape and comprises a three storey detached dwelling with a front and a rear garden, a detached garage and an adjoining driveway towards West Hill Park. According to the Structural BIA report the existing building is made of masonry and reinforced concrete. Due to the land within the property boundary sloping down from northeast to southwest, the lower ground floor is at street level at the front and extends below the garden level at the rear.

4.3. The proposed development involves extending the lower ground floor to the front and the rear, with the majority of the extension being below the existing building footprint and hardstanding areas. The front extension will be below a paved area beyond the front entrance of the building. The rear extension will include a swimming pool and will be partly located below a grassed area. Maximum excavation depths of c.5.50m are anticipated adopting a 'hit and miss' technique for the construction of the proposed lower ground floor reinforced concrete retaining walls and underpins as required. Outline construction sequence drawings and calculations are appended in the Structural BIA report indicating one and two phases of underpin construction for the proposed shallower (c.3.00m) and deeper (c.5.50m) sections of the lower ground floor respectively.

4.4. The BIA reports included screening and scoping sections for land stability, hydrogeology and hydrology, supported by a desk study and a site walkover as required by CPG Basements. The site is located within the Hampstead Ponds catchment area but at a higher elevation and at a distance of c.130m from the ponds. Based on GSD data, the site was indicated to be on the southwest edge of an area where a natural or manmade slope of between 7° and 10° is present. According to the revised Geotechnical BIA report, sectional drawings of 26 West Hill Park Road revealed that the adjacent street slopes between 5°-7° towards the southwest. As such, and given that no re-profiling is proposed, it is accepted that the basement proposals will not result in a risk of instability provided there is good control of workmanship. Any steeper manmade cut slopes should be supported to avoid instability. This should be taken into account in the final design of the proposed scheme.

4.5. A site walkover survey undertaken in the past (February 2017, Chelmer) recorded minor cracks at the neighbouring boundary retaining walls to the southwest.

4.6. Existing British Geological Survey (BGS) information indicates that the site is located above a 'Secondary A' aquifer, the Claygate Member of London Clay Formation. A site-specific intrusive

ground investigation comprised two cable percussion boreholes (BH1 and BH2) to a depth of 10.10m and two hand excavated foundation inspection pits to a maximum depth of 0.66m. The ground investigation confirmed the presence of Made Ground to depths between 0.45m and 0.90m, overlying the Claygate Member; the latter consisted of firm to very stiff, brown grey, sandy silty clay to the termination depth of the boreholes, thus confirming the BGS data. Based on topographic survey data, the boreholes were formed from approximately 89m AOD, although the exact elevation was not confirmed.

4.7. Groundwater strikes were recorded during drilling of the boreholes BH1 and BH2 at depths of 7.00m (c.82m AOD) and 6.80m (c.82.20m AOD) respectively. During three monitoring visits undertaken in March and April 2017, groundwater was recorded in BH1 at depths of c.3.40m (c.85.60m AOD) and in BH2 at depths of c.1.70m bgl (c.87.30m AOD). The proposed lower ground floor slab is proposed to be at c.86m AOD, hence groundwater may be encountered during construction. Monitoring and measures to control groundwater during construction are recommended in the revised Geotechnical BIA report (page 34), including the consideration of a contiguous or a sheet piled wall. The advice of a specialist contractor should be sought in that regard. Tanking of the basement is recommended in the long term.

4.8. Considering the scale and depth of the proposed excavations, the current lower ground floor on site, the neighbouring structural levels and the monitored groundwater level, the proposed development is not anticipated to impact the wider hydrogeological environment, provided that the recommendations of the revised Geotechnical BIA report are adhered to. However, as discussed in detail below, the GMA should consider any potential ground movement due to water ingress and proposed dewatering of the Claygate Member during construction. Additional information including calculations and drawings should be provided if a piled wall solution be utilised to deal with groundwater.

4.9. A geotechnical interpretation is provided. The methodology for deriving the values of bearing capacity was clarified in the revised Geotechnical BIA report (page 28).

4.10. A ground movement assessment (GMA) was undertaken and presented in the revised Geotechnical BIA report. The GMA assumed, in accordance with the architectural drawings, that underground excavations will be required to c.3.00m and c.5.50m below ground level, with the latter being in the area of the proposed swimming pool towards the rear of the site. The GMA adopted CIRIA C760 methodology which is intended for embedded retaining walls, however, it is accepted that this approach can predict ground movements within the range typically anticipated for the proposed ‘hit and miss’ retaining wall techniques when carried out with good control of workmanship.

4.11. Anticipated vertical ground movements were assessed using proprietary specialist software and horizontal ground movements were estimated according to CIRIA C760 report for ‘soft to firm

clay'. Existing and proposed loads were considered in the analysis, however, the detailed input and output of the software used was not provided with the revised GMA. Anticipated vertical and horizontal ground movements due to underpinning installation were not included in the revised GMA. As discussed in our D1 audit report, the anticipated vertical and horizontal ground movements due to underpinning installation may be c.5mm per underpinning stage. This should be taken into account in the calculations of the GMA as further discussed below.

4.12. The revised GMA assessed the potential impact and damage to the neighbouring buildings situated at 25 West Hill Park, 23 and 25 Merton Lane. Category 0 'Negligible' damage was predicted based on the calculations. Category 1 'very slight' damage or lower was predicted (page 39) assuming '...good construction underpinning practice be maintained...', however, it is considered that the predicted ground movements are an underestimate and the latter outcome was not supported by any calculation for the proposed one and two phase underpinning construction technique.

4.13. The GMA and the building damage assessment should include the calculation of ground movement due to the proposed underpin installation and any potential ground movement due to the proposed dewatering of the Claygate Member. The detailed calculations (input parameters and output) of the proprietary software used for the anticipated ground movement are also requested to be attached to the GMA to support the results and the damage assessment.

4.14. In this context above, any potential impact to nearby infrastructure (highways, pavements, underground services) should be re-assessed.

4.15. Further, if required, the GMA should reconsider and discuss appropriate mitigation measures to any unacceptable ground movements for all affected neighbouring structures and infrastructure.

4.16. According to the revised Geotechnical BIA report, excavations in the Made Ground and the Claygate Member are likely to be unstable. For this reason, the construction sequence presented by the Structural BIA report included temporary propping. It is understood that the floor slabs will act as permanent props in the long term.

4.17. According to the LBC website there is in place a planning permission for a side extension (2017/5176/P). It is understood that this side extension has been excluded from the current proposal and the revised Geotechnical BIA report has been updated accordingly.

4.18. An outline movement monitoring strategy was presented in the Structural BIA report (section 7.4.3) with movement trigger levels. This monitoring strategy should be further refined and finalised prior to construction based on the outcome of the revised GMA requested above.

4.19. The development is not within an area prone to flooding. According to the Structural BIA report there will be less than 2% increase in the hard surfaced areas across the site due to the proposed development. The requirement for any mitigation measures due to this minor increase in impermeable areas including the option of a green roof over the proposed extension suggested by the Structural BIA report, should be discussed with LBC. It is accepted that there will be negligible impact to the hydrology of the site due to the proposed development.

4.20. An outline construction programme was appended in the BIA documents.

4.21. Based on the above comments, a number of queries are still pending as summarised in Appendix 2. These queries should be addressed by a revised BIA taking into account the comments of this audit. It cannot currently be confirmed that the proposal adheres to the requirements of the CPG Basements.

5.0 CONCLUSIONS

5.1. The Basement Impact Assessment (BIA) has been carried out by individuals with suitable qualifications.

5.2. The proposed development involves extending the lower ground floor to the front and the rear. Maximum excavation depths of c.5.50m are anticipated adopting a 'hit and miss' technique for the proposed retaining walls.

5.3. The site is located within the Hampstead Ponds catchment area but at a higher elevation and at a distance of c.130m from the ponds.

5.4. it is accepted that the basement proposals will not result in a risk of slope instability provided there is good control of workmanship. Any steeper manmade cut slopes should be supported to avoid instability.

5.5. The BIA confirmed that the site is located above a 'Secondary A' aquifer, the Claygate Member of London Clay Formation. Monitoring indicated that groundwater may be encountered during construction and control of groundwater will be required.

5.6. It is accepted that the proposed development is not anticipated to impact the wider hydrogeological environment.

5.7. The GMA should be revised to allow for the proposed underpin construction sequence and assess any potential ground movements due to water ingress and the proposed dewatering. The detailed calculations of the proprietary software used are also requested. The potential impact and mitigation measures for all surrounding structures should be reconsidered and discussed.

5.8. The outline movement monitoring strategy should be updated and finalised prior to construction in accordance with the revised GMA.

5.9. It is accepted that there will be negligible impact to the hydrology of the site.

5.10. An outline construction programme was appended in the BIA documents.

5.11. A number of queries are still pending as summarised in Appendix 2. It cannot currently be confirmed that the proposal adheres to the requirements of the CPG Basements.

Appendix 1: Residents' Consultation Comments

Pertinent to the BIA

Residents' Consultation Comments

Surname	Address	Date	Issue raised	Response
Rose (Chair Highgate CAAC)	-	16/4/2019	Uncertainty with ground and groundwater conditions	A site-specific ground investigation has been undertaken thus reducing uncertainty. The potential need for dewatering is addressed in the BIA and is further queried in this audit (Section 4).
Newgas (West Hill Park Management Co Ltd)	-	21/4/2019	Recent planning permission has been granted to extend the house. Groundwater issues in the Claygate Member.	The side extension does not form part of the current proposal (Section 4 of audit). This issue is further queried in this audit (Section 4). However, in the long term the hydrogeology of the area is not anticipated to be affected.
Simon	-	21/4/2019	There is in place a planning permission for a side extension (2017/5176/P).	The side extension does not form part of the current proposal (Section 4 of audit).

Appendix 2: Audit Query Tracker

Audit Query Tracker

Query No	Subject	Query	Status	Date closed out
1	Stability	The methodologies for deriving bearing capacity and anticipated settlement and heave values should be clarified (Geotechnical BIA).	Closed	02/08/2019
2	Stability	The assumed distance to the closest structural element of 25 West Hill Park should be checked (GMA).	Closed	02/08/2019
3	Stability	The predicted ground movements in Appendix E (GMA) should be revised. They are not moderately conservative.	Open	
4	Stability	The GMA should be revised to consider existing and proposed loads, underpin construction, long-term ground movements, and potential ground movement due to water ingress and dewatering. Detailed input and output of the specialist software used should be provided[2]. Additional information including calculations and drawings should be provided if a piled wall solution be utilised to deal with groundwater[3].	Open[1]	
5	Stability	The GMA should consider the potential impacts and mitigation measures for all potentially affected surrounding structures and infrastructure.	Open	
6	Stability	The 'proposed side extension' shown in Figure 7 of the Geotechnical BIA report should be clarified.	Closed	02/08/2019
7	Stability	The outline movement monitoring strategy should be updated and finalised prior to construction in accordance with the revised GMA.	N/A	N/A
8	Stability	Consultation with utility owners should be undertaken should their utilities be affected by the proposed development.	N/A	N/A
9	Stability	Manmade cut slopes should be supported to avoid instability. This should be taken into account in the final design.	N/A	N/A

Notes to table

1. Text in bold indicates the pending matters.

2. Added as the revised Geotechnical BIA report included specialist software.

3. Added as the engineering solution intended for dealing with groundwater and the impact this may have to neighbouring properties, should be clarified, as part of the Geotechnical BIA report and the GMA assessment.

Appendix 3: Supplementary Supporting Documents

None

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