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23 Ravenshaw Street
London, NW6 1NP

Basement Impact Assessment Audit

For

London Borough of Camden

Project Number: 12466-56

Revision: D1

April 2017

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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 23 Ravenshaw Street, London NW6 1NP (planning reference 2017/0911/P). The basement is considered to fall within Category C as defined by the Terms of Reference.

1.2. The Audit reviewed the Basement Impact Assessment 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 check list.

1.4. The proposed development involves the demolition of the existing building at 23 Ravenshaw Street followed by the construction of 8 flats over three storeys plus a basement level across the entire site to a depth of 3.5m below ground level.

1.5. The BIA has been prepared by Maund Geo-Consulting with supporting documents prepared by Croft Structural Engineers. The authors' qualifications are not all presented and consequently the requirements of CPG4 have not been demonstrated.

1.6. A desk study has been presented, broadly in accordance with aspects recommended by LBC guidance. However, utility companies have not been approached with regards to underground infrastructure and Network Rail should be consulted regarding the adjacent railway cutting to the southwest of the site.

1.7. The site investigation identifies the London Clay as the bearing formation for the proposed foundations, underlying Made Ground. The site investigation indicates that groundwater is likely to be encountered within the basement excavation. Further investigation should be undertaken in advance of the excavation to confirm the likely groundwater conditions.

1.8. With the exception of the basement walls to the rear, the structural scheme and temporary works proposals appear adequate. The rear basement walls' construction methodology has not been provided, and this should be presented for assessment. Similarly, the temporary and permanent propping arrangements of the proposed lightwells' retaining walls should be confirmed.

1.9. A damage impact assessment has been undertaken for the neighbouring property, 21 Ravenshaw Street. The assessment should be updated to consider the combined movements from both the heave and installation / excavation of retaining walls, and it should assess

damage to all structures within a defined zone of influence. The updated damage impact assessment should consider the construction methodology of the rear basement walls and the propping arrangements to the lightwells.

1.10. The BIA presents an outline structural monitoring methodology which is considered appropriate. This should be updated, as applicable, following any revisions to the ground movement and damage impact assessment.

1.11. Ravenshaw Street is within the designated 'Sumatra Road' Local Flood Risk Zone and within a Critical Drainage Area, although this was not identified within the BIA screening or scoping process. Further assessment and / or mitigation should be presented to confirm that the proposed development will be adequately protected.

1.12. An attenuation drainage scheme is proposed that will reduce the surface water run off rate by up to 70% of the existing condition. This should provide an improvement to the current site conditions and betterment to the wider hydrological environment.

1.13. The proposed development will not impact the wider hydrogeological environment.

1.14. Non-technical summaries should be provided within any revisions to the BIA submitted.

1.15. Queries and matters requiring further information or clarification are discussed in Section 4 and summarised in Appendix 2. Until the additional information requested is presented, the BIA does not meet the requirements of CPG4.

2.0 INTRODUCTION

2.1. CampbellReith was instructed by London Borough of Camden (LBC) on 7 March 2017 to carry out a Category C Audit on the Basement Impact Assessment (BIA) submitted as part of the Planning Submission documentation for 23 Ravenshaw Street, London NW6 1NP, Camden Reference 2017/0911/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 (CPG) 4: Basements and Lightwells.
- Camden Development Policy (DP) 27: Basements and Lightwells.
- Camden Development Policy (DP) 23: Water.

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; and,

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: "Erection of a three storey plus basement building comprising 8x flats (4 x 3-bed units and 4 x 2-bed units) following the demolition of the existing house".

2.6. CampbellReith accessed LBC's Planning Portal on 21 April 2017 and gained access to the following relevant documents for audit purposes:

- Basement Impact Assessment dated 7 July 2016 by Maund Geo-consulting.

- Basement Method Statement dated 12 March 2015 (ref 150122) by Croft Structural Engineers.
- Scheme Structural Calculations for Planning dated 6 July 2016 (ref 150122) by Croft Structural Engineers.
- Structural Monitoring Statement dated 10 March 2015 (ref 150122) by Croft Structural Engineers.
- Draft Construction Management Plan dated February 2017 by G2 Planning Solutions.
- Design and Access statement by Chris Taylor (the applicant).
- Planning Statement dated 7 February 2017 by Chris Taylor (the applicant).
- Existing plans and elevations, proposed elevations, proposed CGI views, proposed sections dated 11 February 2017 by Chris Taylor (the applicant).
- Proposed floor plans dated 15 February 2017 by Chris Taylor (the applicant).
- Tree Survey Report dated 4 February 2014 by Tree Reports Ltd.
- Comments and objections to the proposed development from local residents.

3.0 BASEMENT IMPACT ASSESSMENT AUDIT CHECK LIST

Item	Yes/No/NA	Comment
Are BIA Author(s) credentials satisfactory?	Not proven	The input of CEng MICE author / reviewer should be confirmed.
Is data required by Cl.233 of the GSD presented?	No	Information within the Desk study and BIA report is broadly in line with the information required by GSD Appendix G1. Utility companies have not been approached with regards to underground infrastructure and Network Rail have not been consulted with regards to the adjacent railway cutting.
Does the description of the proposed development include all aspects of temporary and permanent works which might impact upon geology, hydrogeology and hydrology?	No	Basement retaining wall construction methodology to be confirmed at rear of property.
Are suitable plans/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?	No	BIA report – Section 6.3. A railway cutting has been identified adjacent to the site boundary – consultation with NR should be undertaken.
Hydrogeology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	BIA, Section 6.1. The potential for perched water to be present above the London Clay formation level has been identified.
Hydrology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	No	BIA, Section 6.4. Ravenshaw Street has a low - medium risk of flooding from surface water and is within a designated Flood Risk Zone. Final site levels, threshold / lightwell levels, flood risk mitigation measures should be confirmed.

Item	Yes/No/NA	Comment
Is a conceptual model presented?	Yes	BIA, Figure 7.1 However, it does not identify potential impacts e.g. to adjacent railway cutting etc.
Land Stability Scoping Provided? Is scoping consistent with screening outcome?	No	Consultation with Network Rail should be undertaken re potential impacts to slope stability of the cutting / protection of asset. The basement is within 5m of the highway and presence of utilities should be confirmed, and impacts assessed if relevant. The new basement will significantly increase the differential depth of foundations relative to neighbouring properties – the ground movement assessment should include effects of heave, identify a zone of influence and assess structures within the zone.
Hydrogeology Scoping Provided? Is scoping consistent with screening outcome?	Yes	
Hydrology Scoping Provided? Is scoping consistent with screening outcome?	No	It is accepted that the development will adequately reduce run-off. The proposed development is located within the 'Sumatra Road' Local Flood Risk Zone - final site levels, threshold / lightwell levels, flood risk mitigation measures should be confirmed.
Is factual ground investigation data provided?	Yes	BIA report Section 3 and Appendix C.
Is monitoring data presented?	Yes	BIA report Section 4 and Appendix D.
Is the ground investigation informed by a desk study?	Yes	BIA report and Design and Access Statement.
Has a site walkover been undertaken?	Yes	
Is the presence/absence of adjacent or nearby basements confirmed?	No	Structural proposals indicate adjacent properties have shallow foundations with no basements. Not confirmed within BIA.

Item	Yes/No/NA	Comment
Is a geotechnical interpretation presented?	Yes	BIA report Section 5.
Does the geotechnical interpretation include information on retaining wall design?	Yes	Geotechnical design parameters presented. Retaining wall design outlined in Scheme Structural Calculations Report. However, rear basement wall construction methodology unclear.
Are reports on other investigations required by screening and scoping presented?	Yes	Ground movement assessment provided in Scheme Structural Calculations Report. However, should be updated to include effects of heave, identify a zone of influence and assess structures within the zone.
Are baseline conditions described, based on the GSD?	Yes	
Do the base line conditions consider adjacent or nearby basements?	No	However, stability assessments generally conservative. Hydrogeological impacts not applicable.
Is an Impact Assessment provided?	Yes	BIA report – Section 8
Are estimates of ground movement and structural impact presented?	Yes	Ground movement assessment provided for 21 Ravenshaw Street but not for all buildings within the zone of influence.
Is the Impact Assessment appropriate to the matters identified by screening and scoping?	Yes	However, should be updated to consider flood risk mitigation, structural impacts within the zone of influence, and consultation with Network Rail.
Has the need for mitigation been considered and are appropriate mitigation methods incorporated in the scheme?	No	To be updated, as required, for flood risk and stability following updated GMA.
Has the need for monitoring during construction been considered?	Yes	Basement Monitoring Statement report outlines the monitoring works to be undertaken at the site.
Have the residual (after mitigation) impacts been clearly identified?	No	To be further assessed, as applicable.

Item	Yes/No/NA	Comment
Has the scheme demonstrated that the structural stability of the building and neighbouring properties and infrastructure will be maintained?	No	Construction methodology to rear basement walls to be presented. GMA to be updated. NR to be consulted regarding cutting.
Has the scheme avoided adversely affecting drainage and run-off or causing other damage to the water environment?	Yes	
Has the scheme avoided cumulative impacts upon structural stability or the water environment in the local area?	No	Construction methodology to rear basement walls to be presented. GMA to be updated. NR to be consulted regarding cutting.
Does report state that damage to surrounding buildings will be no worse than Burland Category 2?	Yes	Construction methodology to rear basement walls to be presented. GMA to be updated to include effects of heave and assess all structures within the zone of influence.
Are non-technical summaries provided?	No	

4.0 DISCUSSION

4.1. The BIA has been prepared by Maund Geo-Consulting with supporting documents prepared by Croft Structural Engineers. The authors' qualifications are not all presented and consequently the requirements of CPG4 have not been demonstrated. Any re-submission should provide evidence of authorship or review by individuals with the qualifications detailed in CPG4, Section 3.

4.2. The BIA indicates that the proposed work involves the demolition of the existing building at 23 Ravenshaw Street followed by the construction of a development of 8 flats over three storeys plus a basement level across the entire site at a depth of 3.5m below ground level. Neither the site nor the surrounding structures are designated as listed buildings and the site does not lie within a conservation area. The rear site boundary is along the top of a Network Rail cutting.

4.3. The construction methodology indicates underpinning the neighbouring party walls to form the new basement level, and casting new retaining liner walls internally to the underpins. Sequencing and propping information is provided within the Basement Method Statement. Basement walls to the front of the property adjacent to the highway will be formed in a similar 'underpinning' sequence. Retaining wall design is provided in the Scheme Structural Calculations report. The construction methodology for the basement walls at the rear of the development has not been provided and should be presented.

4.4. The site investigation undertaken identifies the London Clay as the bearing formation for the proposed foundations, underlying Made Ground. Interpretative geotechnical information in accordance with the GSD Appendix G3 is presented. The site investigation and BIA have been informed by a desk study broadly in accordance with the GSD Appendix G1. However, utility companies have not been approached with regards to underground infrastructure and this should be presented, along with any assessment of impacts, if applicable.

4.5. The BIA presents discussion on the slope of the rail cutting and the stability of the London Clay. However, it does not consider the potential impact of the proposed development to the rail cutting and assets. Network Rail should be consulted and their requirements adopted within the proposed scheme.

4.6. Groundwater was encountered as seepages within the London Clay during the site investigation. Monitoring was undertaken indicating water above basement formation level. A leaking water main (reported as being subsequently repaired) has been identified as the cause of high water levels, within the Made Ground, during one period of monitoring. The basement has been designed adopting an assumed worse case water level of 0.5m below ground level (bgl). This is generally accepted as a reasonably conservative approach. It is recommended that further

groundwater monitoring is undertaken in advance of excavation to further inform temporary works contingency planning and control of construction.

4.7. Dewatering is likely to be required and this is briefly discussed in the BIA. Given the choice of underpinning as the construction methodology, and the granular nature of the Made Ground, this will need to be carefully considered and detailed by the contractor.

4.8. With the exception of the rear basement wall information (as discussed in 4.3), the structural scheme and temporary works proposals appear adequate. It is noted that the basement retaining walls have been designed to act as free cantilevers, although in the permanent case they will be propped by at ground floor and basement level by reinforced concrete slabs. The temporary works methodology also states that the walls will be propped at all times. Therefore, this audit considers that the retaining walls will be propped at all times, in both the temporary and permanent cases.

4.9. For the retaining walls at the rear, including both the walls to the accommodation and the lightwells, and for the lightwells at the front of the property, the temporary and permanent propping arrangements should be confirmed. It is noted that the lightwells are proposed to be to the full basement depth and run the whole width of the development.

4.10. A heave assessment is presented for the whole site, and a separate Ground Movement Assessment (GMA) is presented that considers the movements related to excavation and construction of the basement retaining walls, but only in relation to 21 Ravenshaw Street. The movements indicated in both the heave assessment and GMA are considered reasonable and in line with expectations for a basement development of this depth formed by underpinning.

4.11. The damage impact assessment indicates Category 1 damage (Very Slight) in regards to 21 Ravenshaw Street. However, this assessment has not considered the combined effects of both the heave and movements due to retaining wall installation / excavation, which is considered relevant for an underpinned methodology. Whilst the assessment has adopted parts of the CIRIA C580 methodology, it has not included a movement contour plot indicating structural walls of adjacent properties that are being assessed or an indicative zone of influence. For clarity, the assessment should present these and assess all structures within the zone of influence. The assessment should also consider the methodology for the formation of the rear basement walls and whether lightwells will be permanently stiffly propped. In line with CPG4, where Category 1 or a higher damage category is identified, the BIA should provide mitigation measures to address ground movement.

4.12. The BIA presents an outline structural monitoring methodology, including visual condition surveys, measured survey using total station and crack monitoring, if applicable. Frequency of

survey, trigger levels and contingency actions are considered appropriate. These should be reconsidered, as applicable, once the GMA and damage impact assessment have been updated.

4.13. Ravenshaw Street is within the designated 'Sumatra Road' Local Flood Risk Zone and within Critical Drainage Area (Group 3-010), although this was not identified within the BIA screening or scoping process. Developments within Local Flood Risk zones require a flood risk assessment. The BIA has identified that the site is at very low risk of surface water flooding, from referenced Environment Agency data. The adjacent highway is identified as low to medium risk. The risk from sewer surcharging has not been assessed. Further assessment and / or mitigation should be presented to confirm that the proposed development's topographic levels at potential surface water entry points (e.g. thresholds and lightwells) will be raised to a level that maintains a very low flood risk. Mitigation measures to protect against sewer surcharging should be presented.

4.14. The proposed scheme will slightly increase the proportion of permeable area. An attenuation scheme is proposed, with a rainwater collection tank that will reduce the surface water run off rate by up to 70% of the existing condition. This should provide an improvement on the current site conditions and betterment to the wider hydrological environment.

4.15. The proposed development will not impact the wider hydrogeological environment.

4.16. Non-technical summaries should be provided within any revisions to the BIA submitted.

4.17. Queries and matters requiring further information or clarification are summarised in Appendix 2.

5.0 CONCLUSIONS

5.1. The authors' qualifications should be demonstrated to be in accordance with the requirements of CPG4.

5.2. Underground infrastructure should be identified and any potential impacts assessed, if applicable. Network Rail should be consulted regarding the adjacent railway cutting to the southwest of the site.

5.3. The London Clay will be the bearing formation for the proposed foundations, underlying Made Ground. Groundwater is likely to be encountered within the basement excavation. The contractor should confirm groundwater conditions in advance of the construction works.

5.4. The construction methodology, structural scheme and temporary works proposed are generally accepted. The proposed construction methodology for the rear basement retaining walls should be presented. Temporary and permanent propping arrangements to the lightwells should be confirmed.

5.5. The damage impact assessment should consider the combined movements from both the heave and installation / excavation of retaining walls and assess damage to all structures within the zone of influence.

5.6. The BIA presents an outline structural monitoring methodology which is considered appropriate. This should be updated, as applicable, following any revisions to the GMA and damage impact assessment.

5.7. Ravenshaw Street is within the designated 'Sumatra Road' Local Flood Risk Zone and within Critical Drainage Area (Group 3-010). Additional assessment and mitigation should be presented.

5.8. An attenuation scheme is proposed that should provide an improvement on the current site conditions and betterment to the wider hydrological environment.

5.9. The proposed development will not impact the wider hydrogeological environment.

5.10. Queries and matters requiring further information or clarification are summarised in Appendix 2. Until the additional information requested is presented, the BIA does not meet the criteria of CPG4.

Appendix 1: Residents' Consultation Comments

Residents' Consultation Comments

Surname	Address	Date	Issue raised	Response
Eastwood	95 Ravenshaw Street	25th February 2017	Concerns about excavation of basement causing subsidence issues for surrounding houses and disturbance of underground streams.	5.5, 5.9
Sluys	33a Mill Lane NW6 1NZ	13th March 2017	Concerns about creating basements in a flood area. Both Mill Lane and Ravenshaw Street become 'veritable torrents of water in heavy rainfall'.	5.7
Earl	Fortune Green and West Hampstead Neighbourhood Development Forum	17th March 2017	Concerns about basement in a flood area and structural problems for neighbouring properties.	5.5, 5.7
Caines	29 Ravenshaw Street	17th March 2017	Concerns about structural integrity and impact on neighbouring houses.	5.5
McGill	47 Ravenshaw Street	Not provided	Basement excavation does not address the proximity of the high speed railway line.	5.2
Alfano	40 Ravenshaw Street	Not provided	Concerns about subsidence issues.	5.5
Bermudez	15 Dornfell Street	Not provided	Concerns about subsidence and structural impact issues relating to basement excavation in close proximity of the high speed railway line.	5.2, 5.5
Not provided	Not provided	Not provided	Houses on Ravenshaw Street have historically suffered from subsidence and ground movement. Excavation will cause movement.	5.5

Appendix 2: Audit Query Tracker

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Audit Query Tracker

Query No	Subject	Query	Status/Response	Date closed out
1	BIA Format	BIA authors' qualifications	Open – to be demonstrated as 4.1	
2	Desk Study	Identify underground infrastructure within proposed development's zone of influence	Open – to be provided as 4.4	
3	Desk Study	Proximity of railway cutting requires consultation with Network Rail.	Open – to be provided as 4.5	
4	Groundwater	Further groundwater monitoring should be undertaken.	Contractor to confirm groundwater levels in advance of construction as 4.6, 4.7	N/A
5	Surface Water Flow	Proposed development is located within a Local Flood Risk Zone – additional assessment / mitigation.	Open – to be provided as 4.13	
6	Stability	Construction methodology for rear basement walls and propping of lightwells	Open – to be provided as 4.3, 4.8, 4.9	
7	Stability	Ground Movement Assessment and Damage Assessment for all structures within the zone of influence. Monitoring proposals to be updated (if required).	Open – to be provided as 4.10, 4.11, 4.12	
8	BIA Format	Non-technical summaries	Open – to be provided as 4.16	

Appendix 3: Supplementary Supporting Documents

None

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