CampbellReith
consulting engineers

26 Netherhall Gardens
London NW3 5TL

Basement Impact Assessment
Audit

For

London Borough of Camden

Project Number: 12066-52
Rev: F1

March 2016

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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 (BIA) submitted as part of the Planning Submission documentation for 26 Netherhall Gardens (planning reference 2015/3314/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 basements 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 review it against an agreed audit check list.

1.4. Two separate BIAs have been carried out by established firms of consultants, Site Analytical Services (SAS) and Sinclair Johnson (SJ). Although SAS's BIA has been produced by authors who have suitable qualifications, the author of SJ's BIA has provided no proof of expertise in engineering geology as required by CPG4 although it is anticipated that, as a Technical Director and chartered structural engineer, sufficient experience has been accumulated.

1.5. The proposed development comprises the demolition of the existing building and its replacement by a new detached property which includes an enlarged lower ground floor and a new basement level below. The building cuts into an existing slope from its rear garden down to the front of the property and will be founded in strata of the London Clay formation which lies below Made Ground. Perched groundwater is likely to be encountered at less than 2 metres below ground level.

1.6. The proposed basement will be formed by the introduction of an embedded secant piled retaining wall, propped in the temporary excavation condition, and permanently lined with a reinforced concrete box construction to satisfy waterproofing and stability criteria. Rear garden L-shaped retaining walls are intended to facilitate new patio garden areas but no design calculations are provided.

1.7. A Ground Movement Assessment (GMA) has been undertaken by GEA using the Oasys software Xdisp and a damage Category 0 (Negligible) to Category 2 (Slight) has been predicted for the neighbouring properties.

1.8. It is accepted that there are no slope stability concerns, no hydrogeological concerns and no hydrological concerns with respect to the development proposals.

1.9. It is confirmed that:

- the BIA has been prepared in accordance with the processes and procedures set out in Camden Planning Guidance 4
- the methodologies and assumptions are clearly stated and are appropriate to the scale of the proposals and the nature of the site
- the conclusions of the various documents/details comprising the BIA are generally consistent with each other and are sufficiently robust and accurate and accompanied by sufficiently detailed amelioration/mitigation measures, such that further information required can be provided within a Basement Construction Plan.

1.10. Because a number of conclusions are based on necessary assumptions at present, it is recommended that a Basement Construction Plan is provided and approved prior to commencement on site and should include:

- trial pits to confirm assumptions regarding the depths of adjacent foundations or the greatest differential depth assumed between the basement and the neighbouring properties
- Justification for the approach used in the GMA
- design calculations for the rear garden L-shaped retaining walls
- assessment of the lateral movements of the front retaining walls to form lightwells and the effect of the construction activities on the adjacent highway
- an assessment of heave as a result of demolition and excavation
- measures to control heave arising from basement excavation
- mitigation measures to reduce potential movements down to a maximum of Burland Category 1 (very slight)
- results of condition surveys of potentially affected structures
- detailed monitoring scheme for potentially affected structures.

2.0 INTRODUCTION

2.1. CampbellReith was instructed by London Borough of Camden (LBC) on 04 September 2015 to carry out a Category C Audit on the Basement Impact Assessment (BIA) submitted as part of the Planning Submission documentation for 26 Netherhall Gardens, Camden Reference 2015/3314/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 the *"Erection of 4 storey plus basement detached building to provide 5 flats (4 x 2 bed and 1 x 3 bed) including front and rear roof terraces, hard and soft landscaping, boundary treatment and 3 car parking spaces, following demolition of the existing building."*

and confirmed that the basement proposals neither involved a listed building nor neighboured listed buildings.

2.6. CampbellReith accessed LBC's Planning Portal on 21 September 2015 and gained access to the following relevant documents for audit purposes:

- Basement Impact Assessment (BIA)
- Structural Design and Construction Statement (SDCS)
- Report on a Ground Investigation (RGI)
- Phase I Preliminary Risk Assessment (PRA)
- Architects Drawings
  - Proposed
  - Existing
  - Site Plan
- Location Plan

2.7. Further information was provided on 2 February 2016 in response to the initial finding of this audit. This comprises of:

- A letter dated 15 January 2016 from Sinclair Johnson (see Appendix 3)
- Basement Impact Assessment by Site Analytical Services, dated January 2016 (SAS BIA)
- Basement Impact Assessment by Sinclair Johnston & Partners Ltd, dated June 2014 (SJ BIA)
- Structural Design and Construction Statement by Sinclair Johnston & Partners Ltd, dated January 2016
- Ground Movement Analysis Report by GEA Ltd, dated December 2015 (GMA)
- Inventory of Below Ground Adjacent Structures by Sinclair Johnston & Partners Ltd, dated December 2016

3.0 BASEMENT IMPACT ASSESSMENT AUDIT CHECK LIST

Item	Yes/No/NA	Comment
Are BIA Author(s) credentials satisfactory?	Yes	BIA author credentials satisfactory.
Is data required by Cl.233 of the GSD presented?	Yes	BIA and SDCS.
Does the description of the proposed development include all aspects of temporary and permanent works which might impact upon geology, hydrogeology and hydrology?	Yes	BIA and SDCS.
Are suitable plan/maps included?	Yes	Contained in revised SDCS.
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 Yes	BIA Table 1. Contained in SJBIA and revised SDCS.
Hydrogeology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes Yes	BIA Table 1. Contained in revised SDCS.
Hydrology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes Yes	BIA Table 1.
Is a conceptual model presented?	Yes	Contained in SJBIA.
Land Stability Scoping Provided? Is scoping consistent with screening outcome?	Yes	BIA Section 5.0.

Item	Yes/No/NA	Comment
Hydrogeology Scoping Provided? Is scoping consistent with screening outcome?	Yes	BIA Section 4.0.
Hydrology Scoping Provided? Is scoping consistent with screening outcome?	Yes	BIA Section 6.0.
Is factual ground investigation data provided?	Yes	RGI
Is monitoring data presented?	Yes	Standpipes monitored once, see BIA Section 3.1.
Is the ground investigation informed by a desk study?	Yes	PRA Section 1.0.
Has a site walkover been undertaken?	Yes	PRA Section 2.0.
Is the presence/absence of adjacent or nearby basements confirmed?	Yes	Depths of adjacent foundations not investigated but depths of adjacent basements identified.
Is a geotechnical interpretation presented?	Yes	RGI Section 6.0.
Does the geotechnical interpretation include information on retaining wall design?	Yes	RGI Section 6.0.
Are reports on other investigations required by screening and scoping presented?	No	
Are baseline conditions described, based on the GSD?	Yes	
Do the base line conditions consider adjacent or nearby basements?	Yes	Inventory of Basements provided and GMA.
Is an Impact Assessment provided?	Yes	Contained in SJBIA Section 7.

Item	Yes/No/NA	Comment
Are estimates of ground movement and structural impact presented?	Yes	SDCS Section 5.3.
Is the Impact Assessment appropriate to the matters identified by screen and scoping?	Yes	
Has the need for mitigation been considered and are appropriate mitigation methods incorporated in the scheme?	Yes	Revised SDCS and Section 6 of the GMA although further mitigation with regards to limiting damage to neighbouring properties is required (see Audit paragraph 4.19)
Has the need for monitoring during construction been considered?	Yes	Contained in revised SDCS.
Have the residual (after mitigation) impacts been clearly identified?	Yes	Contained in SJBIA Section 8
Has the scheme demonstrated that the structural stability of the building and neighbouring properties maintained?	Yes	Demonstrated based on the assumptions made in the revised GMA, however, additional information required as part of a Basement Construction Plan (see Audit paragraphs 4.12 to 4.18)
Has the scheme avoided adversely affecting drainage and run-off or causing other damage to the water environment?	Yes	Contained in revised SDCS.
Has the scheme avoided cumulative impacts upon structural stability or the water environment in the local area?	Yes	Although additional information with regards to the ground movement assessment and assumptions made is required
Does report state that damage to surrounding buildings will be no worse than Burland Category 2?	Yes	Further mitigation with regards to limiting damage to neighbouring properties is required.
Are non-technical summaries provided?	Yes	BIA section 7.0 and SDCS section 8.0.

4.0 DISCUSSION

4.1. The BIA has been carried out by an established firm of consultants, Site Analytical Services (SAS), and the lead authors have suitable qualifications.

4.2. An additional BIA and a SDCS has been carried out by a well known firm of consulting engineers, Sinclair Johnson (SJ) and, although the author is a Technical Director and a chartered structural engineer, no proof of expertise in engineering geology is provided as required by CPG4.

4.3. The proposed development comprises the demolition of the existing building, which includes a lower ground floor, and its replacement by a new detached property, which includes an enlarged lower ground floor and a new basement level below.

4.4. The existing site slopes from rear garden down to the front of the property with the proposed lower ground floor and basement cutting into the sloping terrain. A soils investigation, carried out by SAS, found a varying depth of Made Ground of up to 1.50 metres underlain by weathered London Clay at depths of up to 9.20 metres below existing ground level, below which lies un-weathered London Clay to the full depth of investigation of 20 metres.

4.5. The presence of ground water was established by monitoring of boreholes at 1.14 metres and 1.88 metres below existing ground level and it is accepted that any seepages into the proposed excavation will be controllable by sump pumping as necessary.

4.6. Although suitable screening for land stability, hydrogeology and hydrology has been carried out in SAS's BIA report, no suitable plans or map extracts have been included, as required, using Camden GHHS data by Arup or the Environment Agency. Judging by responses within the BIA text, the scope of the SAS investigation appears to require widening to include the presence of below ground tunnels and the depth of foundations to adjacent properties as no details are provided.

Suitable extracts from the Camden GHHS and Environment Agency have now been provided within the revised SDCS document as requested.

4.7. Within the scoping section of the BIA, SAS state that basement floor level will be "*at a maximum depth of approximately 3.00 metres below ground level*" and go on to consider their analysis on this basis. Text and cross-sectional drawings contained in the SDCS clearly contradict this with a basement of at least 6.0 metres generally increased locally for a lift pit. The scoping exercise should be reconsidered and also take into account the overall retention of soils towards the rear garden boundary retaining wall shown on SJ's drawing no. 8240/SK015.

A refined scoping study has now been undertaken as requested. The original SAS BIA has been corrected to indicate the increased 7.50 metres depth of basement and the SJBIA takes the retained slope of soils towards the rear building into account.

4.8. A formal basement impact discussion stage has not been carried out, with some discussion of impacts carried out in the scoping stage and the conclusions sections of the report. A formal basement impact discussion should be provided following on from the scoping stage.

The SJBIA contains the formal basement impact discussion requested and goes on to consider potential mitigation measures to minimise effects on the local environment.

4.9. It is not possible to accept that the hydrogeology and the stability of the ground will not be affected by the development until the previous comments have been addressed.

With the additional information that has been provided within the SJBIA and revised SDCS, it is now accepted that there are no slope stability concerns regarding the proposed development. It is accepted that that no known ponds, springlines or wells are in close vicinity to the site and that the site is outside the Hampstead pond chain catchment area.

4.10. A theoretical discussion of potential sustainable urban drainage (SUDS) options is provided in the SDCS without any specific proposal to mitigate the increase in surface water run off generated by the proposed increase in the area of hard-standing on site, apparently because no designer has been appointed. It is not possible to accept that the hydrology of the area will be unaffected by the development until item 4.6 and the above comment have been addressed.

Specific surface water mitigation proposals have been included within the revised SDCS and it is now accepted that these proposals should mitigate the increase in surface water run off, generated by the proposed increase in the area of hard-standing on site, and, hence, the quantity of local rainfall entering the existing sewer system. It is further accepted that the site is not in a Flood Risk Zone based upon Camden Flood Risk Management Strategy maps and is not identified as a street that flooded in either 1975 or 2002.

4.11. A detailed proposal for the construction of the basement is presented within the SDCS, together with the specific requirements for temporary works propping of the basement excavation. A ground movements analysis has been carried out within the SDCS which indicated that potential damage is likely to be no worse than slight (Burland Category 2). However, there is no indication that the presence of adjacent basements have been established nor have the depth of existing foundations been established by trial pitting, rather an assumption has been made. Clarification of these issues is required as is confirmation that the CIRA C580 calculations in SDCS Appendix B are applicable to both the adjacent properties on Netherhall Gardens, the property to the rear on Maresfield Gardens, and a detailed assessment of movements potentially affecting the adjacent highway at the front of the property.

An inventory of Below Ground Adjacent Structures has been provided which has been annotated onto a site location plan and has informed a refined and more detailed Ground Movement Analysis. The depth of existing foundations has not been verified by trial pit investigation, however.

4.12. Drawing No SK015 indicates temporary sheeting where the garden level is being reduced to facilitate piling and a secant wall to support the basement excavation in the temporary and permanent case, however, the proposed section on SK01 appears to indicate a cantilever wall. Clarification should be provided in a Basement Construction Plan.

4.13. Clarification is requested on how the slope at the rear of the garden will be supported in the temporary case and that the proposed trench sheeting is adequate for the stability of the garden at the top of the slope and the rear building to No 47 Maresfield Gardens. Clarification is also requested on whether the retaining wall is propped or unpropped.

4.14. A revised ground movement assessment (GMA) has been carried out by GEA using the Oasys software Xdisp based upon structural drawings and construction methodology contained in the SDCS and its Appendix A. The analysis predicts minor damage varying between Burland Category 0 (Negligible) and Burland Category 2 (Slight) to the immediate neighbouring properties. However, a number of issues exist which should be resolved in a BCP.

4.15. The depth of the neighbouring property foundations used in the GMA are based on levels given on the associated drawing to the SJ 'Inventory of basements', however, these are assumed as the depth of the foundations have not been established. In the absence of such information, the maximum differential depth between the neighbouring property footings and the proposed basement should be assumed. Unless further information is forthcoming, it is recommended this is assumed for detailed design.

4.16. Justification is required for the statement on Section 4.1.1 of the GMA that the deeper and shallow sections of the basement will shield the buildings on the opposite side from the effects of each other and therefore their influences are considered separately or the combined effect of the two basements should be modelled and analysed.

4.17. The input data from the Xdisp programme for the pile installation has not been provided and should be included in a revised GMA once the construction methodology and sequence have been agreed.

4.18. It is stated on Section 4.1.2 of the GMA that heave effects should be negligible due to the reloading (construction) effectively balancing the unloading (assumed to be demolition and excavation). The magnitude of anticipated heave from the demolition and excavation should be provided to justify this statement.

4.19. Section 7 of the BIA states the form of basement is to be sufficiently stiff to ensure the stability of the adjacent highways and public right of way, however, the impact to these does not appear to have been analysed in the GMA.

4.20. It is stated on Section 6 of the GMA that the detailed retaining wall design will ensure ground movements are within acceptable limits. This together with the propping arrangements is described as a '*pre-emptive approach*' to mitigation, however, it should be noted that the proposed sequence already assumes high support stiffness with some degree of top-down construction which predicts a maximum damage of 'Category 2'. Further mitigation with regards to limiting damage to within Category 1 is requested.

4.21. The movement monitoring proposal contained within the SDCS should be enhanced to make specific proposals rather than a generic listing of options. Further specific information on the type of monitoring that is proposed to be undertaken has been added to the revised SDCS, as requested, and the location of targets has been shown on the Proposed Site Plan within Appendix A. These measures together with trigger values may be agreed as part of the Party Wall awards.

4.22. It is acknowledged that additional information has been provided that largely meets the necessary criteria for acceptance. The outstanding issues require further design to be undertaken and it is accepted that this can take place within a Basement Construction Plan.

5.0 CONCLUSIONS

5.1. Two separate BIAs have been carried out by established firms of consultants, Site Analytical Services (SAS) and Sinclair Johnson (SJ). Although SAS's BIA has been produced by authors who have suitable qualifications, the author of SJ's BIA has provided no proof of expertise in engineering geology as required by CPG4 although it is anticipated that, as a Technical Director and charted structural engineer, sufficient experience has been accumulated.

5.2. The proposed development comprises the demolition of the existing building and its replacement by a new detached property which includes enlarged lower ground floor and a new basement level below. The building cuts into an existing slope from its rear garden down to the front of the property and will be founded in strata of the London Clay formation which lies below Made Ground. Perched groundwater is likely to be encountered at less than 2 metres below ground level.

5.3. The proposed basement will be formed by the introduction of an embedded secant piled retaining wall, propped in the temporary excavation condition, and permanently lined with a reinforced concrete box construction to satisfy waterproofing and stability criteria. Rear garden L-shaped retaining walls are intended to facilitate new patio garden areas but no design calculations are provided.

5.4. It is accepted that there are no slope stability concerns, no hydrogeological concerns and no hydrological concerns with respect to development proposals.

5.5. It is confirmed that:

- the BIA has been prepared in accordance with the process and procedures set out in Camden Planning Guidance 4
- the methodologies and assumptions are clearly stated and are appropriate to the scale of the proposals and the nature of the site
- the conclusions of the various documents/details comprising the BIA are generally consistent with each other and are sufficiently robust and accurate and accompanied by sufficiently detailed amelioration/mitigation measures, such that further information required can be provided within a Basement Construction Plan.

5.6. Because a number of the conclusions are necessarily based on assumptions, it is recommended that a Basement Construction Plan is provided and approved prior to commencement on site and should include:

- trial pits to confirm assumptions regarding the depths of adjacent foundations or the greatest differential depth assumed between the basement and the neighbouring properties

- temporary works detail to support the ground at the rear of the site prior to and during the installation of trench sheeting
- detailed design of the basement wall using proprietary software such as FREW or WALLAP which will account for the surcharge from the neighbouring properties and soil behind the retaining walls hence demonstrating the adequacy of the walls to maintain the stability of the garden and the property beyond it. This should also account for ground movements associated with lowering the existing ground levels to the proposed piling level in the garden
- revision of the GMA to reflect the construction sequence and include the enabling works. The revised GMA should also justify the approach used as described in audit paragraph 4.15, or both sections of the basement should modelled together with their cumulative effects
- design calculations for the rear garden L-shaped retaining walls
- assessment of the lateral movements of the front retaining walls to form lightwells and the effect of the construction activities on the adjacent highway
- an assessment of heave as a result of demolition and excavation with the anticipated heave movements provided
- measures to control heave arising from basement excavation
- mitigation measures to reduce potential movements down to a maximum of Burland Category 1 (very slight)
- results of condition surveys of potentially affected structures
- detailed monitoring scheme for potentially affected structures.

Appendix 1: Residents' Consultation Comments

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Residents' Consultation Comments

Surname	Address	Date	Issue Raised	Response
Williams	Little House A, 16a Maresfield Gardens NW3 5SU	24/07/2015	No soils investigation	See Audit paragraph 4.4
Danish YWCA	43 Maresfield Gardens	24/07/2015	Depth of basement and subsidence	See Audit paragraphs 4.7, 4.9, 4.11 to 4.13
Roux	-	03/08/2015	Depth of basement and subsidence	See Audit paragraphs 4.7, 4.9, 4.11 to 4.13
Bacal	24a Netherhall Gardens	06/08/2015	Subsidence and structural damage	See Audit paragraphs 4.9 and 4.11 to 4.13
Bastian House Ltd	21 Netherhall Gardens	23/07/2015	Land slippage	See Audit paragraphs 4.9, 4.11 to 4.13
Formstone	21 Netherhall Gardens, NW3 5RL	23/07/2015	Land slippage	See Audit paragraphs 4.9, 4.11 to 4.13
Harris	24 Netherhall Gardens, NW3 5TH	23/07/2015	Ground stability Surface water runoff	See Audit paragraphs 4.9 and 4.11 to 4.20 See Audit paragraph 4.10
Church	23 Netherhall Gardens, NW3 5RL	27/07/2015	Damage to buildings No soils investigation	See Audit paragraphs 4.11 to 4.20 See 4.4
Schulman	23 Netherhall Gardens, NW3 5RL	27/07/2015	Land slippage	See Audit paragraphs 4.9, 4.11 to 4.13
Stevens	20 Netherhall Gardens, NW3 5TH	05/08/2015	Building Damage	See Audit paragraphs

			Below ground water movement Surface water runoff	4.11 to 4.20 See Audit paragraph 4.10
Amery	27 Netherhall Gardens	08/08/2015	Subsidence	See Audit paragraphs 4.9, 4.11 to 4.13
White	22 Netherhall Gardens	18/08/2015	Structural Damage	See Audit paragraphs 4.9 and 4.14 to 4.20
Hillman	7a Netherhall Gardens	10/08/2015	Slope stability	See Audit paragraphs 4.9 and 4.14 to 4.20

Appendix 2: Audit Query Tracker

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Audit Query Tracker

Query No	Subject	Query	Status	Date closed out
1	Camden GHHS and EA map extracts	Additional information required	Closed - Additional information provided.	02/02/16
2	Below ground adjacent structures	Additional investigation required	Closed - Additional information provided.	02/02/16
3	Stability	Further ground movement analysis as described on Audit paragraph 5.6 and justification for approach used required	Open - To be provided as part of a Basement Construction Plan (BCP).	N/A
4	Scoping	Refined analysis required	Open - Additional information provided.	02/02/16
5	Movement monitoring	Enhanced proposal required	Open - Refined information to be provided as part of a BCP. Details and trigger levels to be agreed as part of Party Wall awards	N/A
6	Surface water mitigation	Specific Proposal required	Closed - Additional information provided.	02/02/16
7	Stability/Groundwater	A formal impact section should be included in the BIA taking the points forward from the scoping stage	Closed - Additional information provided.	02/02/16
8	Stability	Trial pits to verify adjacent foundations or greatest differential depth assumed in GMA	Open - To be provided as part of BCP	N/A
9	Stability	Condition Surveys of adjacent structures	Open - To be provided as part of BCP	N/A
10	Stability	Mitigation proposals required to minimise potential damage to Burland Category 1	Open - To be provided as part of BCP	N/A
11	Stability	Magnitude of heave and measures to control heave	Open - To be provided as part of BCP	N/A
12	Stability	Lateral movement assessment of front lightwell retaining walls and effect on	Open - To be provided as part of BCP	N/A

		highway		
13	Stability	Design calculations for rear garden retaining walls.	Open - To be provided as part of BCP	N/A
14	Stability	Adequacy of the trench sheeting and how stability of the garden and rear building to 47 Maresfield Gardens is ensured	Open – To be provided as part of BCP	N/A

Appendix 3: Supplementary Supporting Documents

Letter from Sinclair Johnson dated June 2016

APPLICANT'S STRUCTURAL ENGINEERS RESPONSE TO BASEMENT IMPACT ASSESSMENT AUDIT BY CAMPBELL REITH

Project: 26 Netherhall Gardens, London NW3 5TL **Project No.** 8240

Application No. 2015/3314/P

Date: 15 January 2016

Reponse By: Ravi Azad MEng CEng MICE MIStructE

BACKGROUND

The following report has been prepared in response to the Basement Impact Assessment Audit carried out by Campbell Reith for London Borough of Camden, ref. 12066-52/D1, dated October 2015.

Responses to the queries raised have been incorporated the following updated reports (changes marked in red within the body of the report for clarity):

- Basement Impact Assessment by Site Analytical Services, dated January 2016
- Basement Impact Assessment by Sinclair Johnston & Partners Ltd, dated June 2014
- Structural Design and Construction Statement by Sinclair Johnston & Partners Ltd, dated January 2016
- Ground Movement Analysis Report by GEA Ltd, dated December 2015
- Inventory of Below Ground Adjacent Structures by Sinclair Johnston & Partners Ltd, dated December 2016

In addition, specific responses to queries raised by Campbell Reith as part of their audit (listed in the Campbell Reith Audit Tracker, attached for reference) have been outlined below for clarity.

RESPONSES

General

1.1 It was assumed that the BIA report prepared by Sinclair Johnston & Partners Ltd had been made available to Campbell Reith as part of the audit. The BIA report that was prepared provides answers to a number of the queries raised. The report (unchanged from June 2014) is enclosed for information.

1.2 All other information submitted as part of the original application remains unchanged and has not been enclosed or referenced, to avoid repetition.

Query 1 – Camden GHHS and EA Map Extracts

1.3 Extracts from The Camden GHHS and Environment Agency have been enclosed in the Structural Design and Construction Statement (SDCS) as requested.

Query 2 – Below Ground Adjacent Structures

1.4 An assessment of basements adjacent to the site has been made. Please see attached Inventory of Below Ground Adjacent Structures by Sinclair Johnston & Partners Ltd, dated December 2016. This has informed the Ground Movement Analysis (see Query 3).

1.5 The impact of the development on nearby below ground tunnels has been assessed in the SDCS - note: "*There are several Network Rail train tunnels, the Belsize Old and New tunnels some 100m to the north and 100m to the south of the site. These tunnels run approximately North-east to South-west. These tunnels are not significant in respect to the proposed development*."

1.6 For clarity, the approximate locations of these tunnels has been identified on a map in the SDCS. In summary, nearest tunnels to the development are for:

- the National Rail Thameslink line (approximately 100m to the South of the site, which is a shallow cut and cover tunnel);
- the London Overground line (approximately 100m to the North of the site, which is also a shallow cut and cover tunnel).
- the Northern line tunnel to the (approximately 500m away to the Northeast of the site).

1.7 All the above tunnels are outside the zone of influence of the proposed development.

Query 3 – Ground Movement Analysis

1.8 A refined, detailed ground movement analysis has been undertaken; please see attached report from GEA Ltd. The report summary states: "The analysis has concluded that the predicted damage to the neighbouring properties would, very between Category 0'negligible' and Category 2 'slight'. On this basis, the damage that would inevitably occur as a result of such an excavation would generally fall within the acceptable limits, with mitigation measures required for those walls predicted to be Category 1 or higher as set out in Section 3.3 of CPG4 (2015)."

Query 4 – Scoping

1.9 A refined scoping study has been undertaken. The scoping study within the SAS Ltd BIA has been updated to accommodate the deeper depth of basement (up to a 7.5m maximum depth of excavation). The Sinclair Johnston & Partners Ltd BIA report also relates to the proposed development, and takes the retained slope of soils towards the rear boundary into account. Please see enclosed reports for information.

Query 5 – Ground Movement Analysis

1.10 The scope of the movement monitoring to be undertaken has been outlined in the Structural Design and Construction Statement. Further specific information on the type of monitoring that is proposed to be undertaken has been added to the relevant section of the Structural Design and Construction Statement as requested.

Query 6 – Surface Water Mitigation

1.11 Specific surface water mitigation proposals have been included within the SUDs section of Sinclair Johnston & Partners Ltd's SDCS as requested.

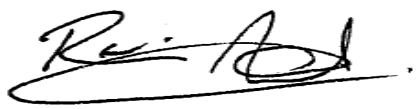
Query 7 – Stability / Groundwater

1.12 A formal impact section has been included within Sinclair Johnston & Partners Ltd's Basement Impact Assessment report, which takes into account the findings of the scoping study. Please find this enclosed.

CONCLUSION

1.12 It is considered that the updated reports referred to above provide clarification to the queries raised by Campbell Reith as part of the BIA audit, and that out all items on the Campbell Reith Audit Query Tracker have now been closed out.

For Sinclair Johnston & Partners Ltd



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Audit Query Tracker

Query No	Subject	Query	Status	Date closed out
1	Camden GHHS and EA map extracts	Additional information required	Open	
2	Below ground adjacent structures	Additional investigation required	Open	
3	Ground movement analysis	Refined analysis required	Open	
4	Scoping	Refined analysis required	Open	
5	Movement monitoring	Enhanced proposal required	Open	
6	Surface water mitigation	Specific Proposal required	Open	
7	Stability/Groundwater	A formal impact section should be included in the BIA taking the points forward from the scoping stage	Open	

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