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17, 18 and 19 Park Square East, London SW

Basement Impact Assessment Audit

For

London Borough of Camden

Project Number: 13398-14
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Appendix

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 Assessments submitted as part of the Planning Submission documentation for 17, 18 and 19 Park Square East, London NW1 4LH (planning references 2020/0801/P, 2020/0802/P and 2020/0804/P). The basement for No.'s 17 and 19 are considered to fall within Category B, and No. 18 is considered to fall into Category C, as defined by the Terms of Reference. Due to the configuration of the properties, this BIA audit report will cover the applications for all three sites.

1.2. The Audit reviewed three Basement Impact Assessments (BIAs) 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 BIAs have been approved by individuals who possess suitable chartered engineer qualifications, however no evidence of suitable engineering geology expertise was provided.

1.5. The BIA has confirmed that the proposed basements will be founded within the Lynch Hill Gravel.

1.6. It is accepted that basement foundation excavation is unlikely to have a significant impact on the hydrogeology or the slope stability of the area.

1.7. Further assessment of the flood risk mitigation measures to the site is required. The BIAs for Nos. 17 and 19 should be updated to consider the flood risk assessment.

1.8. Further information is required to justify the pile length of the contiguous wall elements for No. 18.

1.9. Further clarification of the input geometry and loading/unloading combinations for the PDisp analysis, as well as the ground model and parameters used in the ground movement assessment is required.

1.10. The damage category assessment for all three properties should be updated to consider the maximum excavation depth, as opposed to the finished floor levels. The adjacent utilities and public highways should be considered in the damage category assessment.

1.11. Further information is required regarding what measures will be implemented to ensure the stability of the excavations in the Lynch Hill Gravels, and control ground movements affecting the Grade I Listed properties.

1.12. The BIAs recommend that pre-condition surveys of the neighbouring properties be undertaken and a system of monitoring of adjoining structures be established before the works start.

1.13. A number of queries have been raised and are 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 27 March 2020 to carry out an Audit on the Basement Impact Assessments (BIAs) submitted as part of the Planning Submission documentation for three properties; Nos. 17, 18 and 19 Park Square East, London NW1 4LH. Nos. 17 and 19 Park Square East are defined as Category B basements and No 18, Category C. It was agreed with LBC that a single audit report would be prepared.

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

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. 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 proposals as follows:

- No. 17 – *"Change of use from institutional use (sui generis) to residential (Class C3) to form a self-contained dwelling over basement, ground and upper storeys, excavation of existing vaults, extension at ground floor level to provide a single storey rear extension, internal refurbishment and associated works."*

- No. 18 – *"Change of use of building from institutional use (sui generis) to be used as Offices (Class B1), extension at roof level to provide new third floor, internal subdivision, infilling, refurbishment and associated works."*
- No. 19 – *"Change of use from institutional use (sui generis) to residential (Class C3) to form a self-contained dwelling over basement, ground and upper storeys, excavation of existing vaults, extension at ground floor level to provide a single storey rear extension, internal refurbishment and associated works."*

2.6. The Audit Instruction confirms all three properties are Grade 1 listed buildings, as are their immediate neighbours.

2.7. CampbellReith accessed LBC's Planning Portal on 02 April 2020 and gained access to the following relevant documents for audit purposes:

- Basement Impact Assessment (BIA) reports for each property by CET Infrastructure Ltd, comprising:
  - No. 17 (reference 1038915, v2, dated January 2020);
  - No. 18 (reference 1038915, v0, dated January 2020);
  - No. 19 (reference 1038915, v2, dated January 2020).
- Phase 1 Preliminary Risk Assessment report that covers all three properties in a single report by CET Infrastructure Ltd, reference 1038915, v2, dated November 2019.
- Geotechnical Report for each property by CET Structures Ltd, comprising:
  - No. 17 (reference 1038915, v0, dated January 2020);
  - No. 18 (reference 1038915, v0, dated January 2020);
  - No. 19 (reference 1038915, v0, dated January 2020).
- Planning Application Drawings for all three properties, by Marek Wojciechowski Architects Ltd, consisting of Location Plans, Existing Plans, Demolition Plans and Proposed Plans.
- Construction Method Statement (CMS) for each property by Form Structural Design, comprising:
  - No. 17 (reference 193206, revision P1, dated February 2020);
  - No. 18 (reference 193206, revision P1, dated February 2020);
  - No. 19 (reference 193206, revision P1, dated February 2020).
- Flood Risk Assessment (FRA) report that covers all three properties in a single report by Form Structural Design, document reference 193206/001, revision A, dated 24.10.19.
- Structural drawings for each property by Form Structural Design.
- Planning Statement for each property by Montagu Evans, all dated February 2020.

3.0 BASEMENT IMPACT ASSESSMENT AUDIT CHECK LIST

Item	Yes/No/NA	Comment
Are BIA Author(s) credentials satisfactory?	No	Input from CEng for land stability and hydrology but no input from CGeol for hydrogeology.
Is data required by Cl.233 of the GSD presented?	Yes	
Does the description of the proposed development include all aspects of temporary and permanent works which might impact upon geology, hydrogeology and hydrology?	Yes	Construction Method Statement also provided for all three properties.
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	
Hydrogeology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	
Hydrology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	
Is a conceptual model presented?	Yes	For all three properties this is presented textually in Section 3.6 and updated in Section 5.3 to account for site investigation findings.
Land Stability Scoping Provided? Is scoping consistent with screening outcome?	Yes	

Item	Yes/No/NA	Comment
Hydrogeology Scoping Provided? Is scoping consistent with screening outcome?	Yes	However, the maximum excavation depth given for No. 17 and 19 in Table 6-2 contradicts that given in the conceptual model.
Hydrology Scoping Provided? Is scoping consistent with screening outcome?	Yes	However impact from the increase in hard surfacing in No. 17 and 19 does not consider the need for mitigation measures presented in the FRA.
Is factual ground investigation data provided?	Yes	
Is monitoring data presented?	Yes	Two groundwater monitoring rounds carried out.
Is the ground investigation informed by a desk study?	Yes	
Has a site walkover been undertaken?	Yes	
Is the presence/absence of adjacent or nearby basements confirmed?	Yes	The sites form part of a terrace of similar properties with single basement/lower ground floor, and vaults to the front.
Is a geotechnical interpretation presented?	Yes	However, clarification is required as discussed in Section 4.
Does the geotechnical interpretation include information on retaining wall design?	Yes	
Are reports on other investigations required by screening and scoping presented?	Yes	A flood risk assessment is provided however the assessment is not consistent with the site layout.
Are the baseline conditions described, based on the GSD?	Yes	
Do the base line conditions consider adjacent or nearby basements?	Yes	
Is an Impact Assessment provided?	Yes	

Item	Yes/No/NA	Comment
Are estimates of ground movement and structural impact presented?	Yes	However, impact on adjacent road and utilities is absent.
Is the Impact Assessment appropriate to the matters identified by screen and scoping?	No	See comments in Section 4.
Has the need for mitigation been considered and are appropriate mitigation methods incorporated in the scheme?	No	Further consideration of flood mitigation is required.
Has the need for monitoring during construction been considered?	Yes	
Have the residual (after mitigation) impacts been clearly identified?	Yes	
Has the scheme demonstrated that the structural stability of the building and neighbouring properties and infrastructure will be maintained?	No	See comments in Section 4 regarding GMA.
Has the scheme avoided adversely affecting drainage and run-off or causing other damage to the water environment?	No	Further consideration of the flood risk is required.
Has the scheme avoided cumulative impacts upon structural stability or the water environment in the local area?	No	
Does report state that damage to surrounding buildings will be no worse than Burland Category 1?	Yes	GMA requires revision.
Are non-technical summaries provided?	Yes	

4.0 DISCUSSION

4.1. All three of the Basement Impact Assessments (BIAs) have been carried out by CET Infrastructure. The BIAs have been reviewed by an individual holding a CEng qualification but do not appear to have any input from a person with CGeol credentials.

4.2. The properties at Nos. 17, 18 and 19 form part of a terrace of properties. The LBC Instruction to proceed with the audit identified that all three properties are Grade I listed buildings, as are the adjoining properties to the north and south.

4.3. All three properties have four above-ground storeys with a single basement level. Nos. 17 and 19 have a similar profile to the adjoining properties in the terrace and the basements each occupy the same area as the above-ground levels. To the rear of both properties is a lightwell servicing the basement and a small open courtyard at ground level.

4.4. The footprint of No. 18 is considerably larger than that of Nos. 17 and 19. It comprises a similar size portion of the terrace with a large, approximately triangular area to the rear that opens to Peto Place. The basement of No. 18 is only located at the front of the property, and extends to the rear the same distance as the basements of the adjoining properties.

4.5. Each of the properties has two vault rooms that extend to the front of the properties, below the pavement of Park Square East.

4.6. It has been confirmed that the adjoining properties at Nos. 16 and 20 have basements similar to those at Nos. 17 to 19. The foundations of these basements have been assumed to be at 25.4m OD.

4.7. The proposed basement developments comprise the following:

- In all three properties the vault floors at the front of the properties will be lowered by 1.20m. The existing vault walls will be supported by underpins. For property Nos. 17 and 19 it is proposed to form openings between the two vault rooms and the nearest vault belonging to No. 18, to form three interlinked basement rooms per property.
- The basements of Nos. 17 and 19 will both be extended to the rear to occupy the full footprint below their respective courtyards. An extension at ground level, overlying approximately two thirds of the basement extension area, is also proposed in both properties.
- The existing basement in No. 18 will be extended towards the rear, below the large triangular area. The existing building walls will be supported with underpins and the rear of the new basement extension will be constructed using a contiguous pile wall.
- A new basement to the rear of No. 18 to house a new UKPN substation. This basement will be formed predominantly outside the footprint of the building, below an existing area

of hardstanding. The external walls will be formed by a contiguous pile wall and the areas adjoining No. 18 will be formed by underpinning.

4.8. A Phase I Desk Study has been undertaken covering all three properties in one report, and a site walkover visit was carried out.

4.9. A site investigation was carried out and comprised 3 no. deep boreholes. BH01 was carried out in the courtyard area of No. 18, BH02 was carried out within the basement of No. 19 and BH03 was carried out in the external courtyard of No. 17.

4.10. From the site investigation a ground model was compiled for all three properties, comprising Made Ground to a minimum level of 28.20m OD, over Langley Silt extending to a minimum level of 25.78m OD (2.42m thick). Below this, Lynch Hill Gravel was recorded to a minimum level of 20.60m OD (5.18m thick), with London Clay encountered below this to at least 7.65m OD.

4.11. In addition to the boreholes undertaken by CET, Appendix B of the Construction Method Statement (CMS) presents the records of 8 No. foundation inspection trial pits carried out at the site by Soil Consultants in 2015, and 2 No. trial pits undertaken by RSK in 2019, however these records are not referenced in any of the BIAs.

4.12. The site is described as generally level and ground level is identified in the BIA as 30m OD. It is accepted that no slope stability issues are presented by the development.

4.13. A risk of surface water flooding has been identified for the site. A flood risk assessment (FRA) has been carried out, which considers the three properties together. It concludes that the identified surface water flooding risk is low due to the elevated ground level entrances to the properties. However, the FRA does not take into account the presence of basement access steps and lightwells at the front of all three properties. The conclusion of a low flood risk requires further justification and/or mitigation.

4.14. The BIA identifies an increase in the area of hardstanding at Nos. 17 and 19, of 40m^2 per property (80m^2 in total). The BIA suggests that this increase is small enough to have minimal impact on the surface water drainage condition at the site. The FRA provides attenuation measures for surface water drainage, which include the use of attenuation tanks and a hydro brake to limit flows entering the sewer system. The BIAs for Nos. 17 and 19 should be updated to reference the attenuation identified in the FRA.

4.15. The BIAs identify the site to be underlain by a Secondary A Aquifer within the Lynch Hill Gravels. Two rounds of groundwater monitoring were carried out as part of the ground investigations. Water levels were recorded at between 23.00mOD and 21.65mOD. The deepest excavation from any of the properties is identified as 23.80m OD, for the underpins in the vault areas. This is above the highest recorded groundwater level and it is noted that the monitoring was carried

out in the winter months. Based on the groundwater monitoring data, it is accepted that the proposed development is unlikely to have a significant impact on the hydrogeology of the area.

4.16. Conflicting excavation levels are given in the groundwater flow scoping exercises for Nos. 17 and 19. The scoping response for Question 1 indicates a lowest proposed excavation level of 24.30m OD however the conceptual site model for the two properties give a level of 23.80m OD for the underpin blocks. Excavation levels should be presented consistently for all developments.

4.17. It has been confirmed that all underpinning will be seated on the Lynch Hill Gravel. Underpinning will be carried out using a 'hit and miss' sequence and excavated in bays not exceeding 1m width. The BIA for No. 18 indicates a founding level of 24.30m OD for the underpins, but in Section 7.2 a level of 23.80m OD is indicated, the latter being comparable with the underpin founding level for the adjacent vaults in Nos. 17 and 19. Clarification of the maximum level of excavation is required for the vault underpins in No. 18.

4.18. The development for No. 18 will use contiguous pile wall construction in addition to underpinning. Piles are indicated in the BIA to found at 22.10m OD, which, based on the ground model, is within the Lynch Hill Gravel. The maximum excavation in front of the pile wall is indicated in the Form structural drawings to be 25.00m OD for the central basement extension and 25.35m OD for the UKPN basement. Based on the top of pile levels given in the Form drawings (which are lower than the ground level given of 30.00m OD in the BIA), the pile wall in the centre of the site has a maximum excavation in front of the wall of 3.52m with a pile embedment of 2.90m. The UKPN retaining wall has maximum excavation in front of the wall of 3.70m with a pile embedment of 3.25m.

4.19. No calculations have been provided for the design of these contiguous pile walls. Based on the parameters described above, the proposed pile toe level of 22.10m OD is not considered realistic. Further information relating to the pile wall design is required, including consideration of piles punching through to the underlying London Clay, which was encountered at its shallowest at 21.3mOD in BH01 (located directly between the two areas where contiguous pile walls are proposed). It is noted that the pile walls are to be load bearing. If the length of the piles is amended, an associated revised GMA and DCA should be carried out for both installation and excavation of the contiguous pile walls.

4.20. A ground movement assessment (GMA) is presented in Section 7 of each BIA. Table 7-3 presents the soil parameters used in the PDisp analysis however the stratum depths are given as a range of values, therefore the exact ground model used for the ground movement analysis is unclear. Confirmation of the Poisson's Ratio used in the drained and undrained conditions is also required.

4.21. The PDisp analysis has been undertaken in four stages for Nos. 17 and 19, and in five stages for No. 18; the additional stage being the construction of pad foundations within the basement extension area. For each property, further clarification is required regarding the geometry used for the PDisp input model, and what combination of loading and unloading has been assumed in the analysis. PDisp input data should be provided for each property.

4.22. A damage category assessment (DCA) is presented in Section 8 of the BIAs. The calculated depths of excavation in Table 8-3, for all three BIAs, do not take into account the excavation required for construction of the underpins. The DCA should be updated to reflect the full amount of excavation to be undertaken for each wall assessed. This is particularly pertinent for the vault areas, where an additional 1m excavation is indicated for the underpins, as well as the assessment of the UKPN basement where underpinning is used.

4.23. Further justification for the ground floor levels used in Table 8-3 for all BIAs is required, as the depths given are considerably lower than the 30m OD ground level indicated in the conceptual site model, and the levels given on existing site plans.

4.24. In Table 8-3, in each of the BIAs, calculation of the vertical and horizontal displacements in accordance with CIRIA C760 are presented for excavation in front of the wall. Section 8.3 indicates this assessment equates to the ground movement due to the construction of the underpins. The predicted movements are considered insufficiently conservative for the basement extension underpinning. An appropriately conservative assumption of at least 5mm of horizontal movement should be adopted for construction of the underpins, especially given the granular nature of the soils through which the pins will be excavated and their potential for instability. Where PDisp has been used to calculate the vertical movements during the development as the underpins are loaded and excavation progresses, a comparable estimation of horizontal movement during construction should be included in the GMA.

4.25. In each BIA the DCA applies off-sets to some of the walls assessed. Further clarification is required regarding the reasoning behind the application of these off-sets. The associated graphs should be updated as necessary to show the displacement lines from the origin, with the Affected Length shown at the appropriate distance away from the origin.

4.26. Appendix E of the CMS presents the results of a Thames Water asset search, and indicates a 6 inch and a 3 inch water supply pipes in Peto Place. It should be confirmed with Thames Water that the impact of the UKPN basement construction on these utilities is acceptable. The impact to utilities and the public highway at the front of the properties (Park Square East) should be considered in the BIA.

4.27. The Proposed Cross-Section A-A of the Form structural drawings for No. 17 shows the underpins for the basement extension include a heel. This is considered unrealistic, particularly

considering the anticipated granular nature of the soils, therefore the drawing should be revised or further details regarding construction provided.

4.28. The structural drawings provided for the developments do not indicate the use of any temporary propping or sacrificial shoring in the construction of the underpins within the granular Lynch Hill Gravels. Further information is required regarding what measures will be implemented to ensure the stability of the excavations and control ground movements.

4.29. All three BIAs recommend that pre-condition surveys of the neighbouring properties be undertaken and that a system of monitoring of adjoining structures be established before the works start.

5.0 CONCLUSIONS

5.1. The BIAs have been approved by individuals who possess suitable chartered engineer qualifications, however no evidence of suitable engineering geology expertise was provided.

5.2. All three properties are Grade I Listed, as are the adjoining terrace of properties. The BIA confirms that the adjoining properties have basements

5.3. The BIA has confirmed that the proposed basement will be founded within the Lynch Hill Gravel, which is a Secondary A Aquifer.

5.4. Groundwater monitoring was undertaken on two occasions and the highest water level recorded was approximately 0.8m below the deepest excavation for the basements. It is accepted that basement foundation excavation is unlikely to have a significant impact on the hydrogeology of the area.

5.5. The site and surrounding area are generally level and it is accepted that the proposals will not impact the slope stability of the area.

5.6. Further assessment of the flood risk mitigation measures to the site is required. The BIAs for Nos. 17 and 19 should be updated to consider the flood risk assessment.

5.7. Further information is required to justify the pile length of the contiguous wall elements for No. 18.

5.8. Further clarification of the input geometry and loading/unloading combinations for the PDisp analysis, as well as the ground model and parameters used in the ground movement assessment is required.

5.9. The damage category assessment for all three properties should be updated to consider the maximum excavation depth, as opposed to the finished floor levels. Floor levels adopted should be consistent with the conceptual site model and existing site plans. The assessment should include appropriately conservative assumptions of horizontal displacements from installation of the underpins, and from loading as the development progresses.

5.10. Further information is required regarding what measures will be implemented to ensure the stability of the excavations in the Lynch Hill Gravels, and control ground movements affecting the Grade I Listed properties.

5.11. The adjacent utilities and public highways should be considered in the damage category assessment.

5.12. The BIAs recommend that pre-condition surveys of the neighbouring properties be undertaken and a system of monitoring of adjoining structures be established before the works start.

5.13. A number of queries have been raised and are 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

None

Appendix 2: Audit Query Tracker

Audit Query Tracker

Query No	Subject	Query	Status	Date closed out
	General	The Authors' qualifications do not fully comply with the requirements.	Open	
1	Hydrology	Further clarification is required regarding mitigation measures to prevent flooding of lightwells.	Open	
2	Stability	Clarification of the founding level for the underpins in the vaults of No. 18 is required and BIAs to present consistent levels throughout.	Open	
3	Stability	Further justification is required to the pile length chosen for the contiguous walls in No. 18.	Open	
4	Stability	Clarification of the geometries, loading/unloading combinations, ground model and parameters used in the PDisp analysis is required.	Open	
5	Stability	The Damage Category Assessment (DCA) should be updated to consider the maximum excavation depths. Ground movements due to construction are to be revised. Consideration of the impact of the UKPN basement construction to adjacent buildings to the rear of No. 18 should be included. Further information is required to support the off-sets applied to some of the DCAs and the associated displacement graphs should be updated as necessary. Further information is required regarding what measures will be implemented to ensure the stability of the excavations and control ground movements.	Open	
6	Stability	Consideration of the impact to public highways is required.	Open	
7	Stability	Structural drawings by Form require some clarifications as discussed in Section 4.	Open	

Appendix 3: Supplementary Supporting Documents

None

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