CampbellReith
consulting engineers

Confidential

Basement Impact Assessment Audit

University College School Frognal, London NW3 6XH

For
London Borough of Camden

Project No.
14006-47

Date
May 2024

Campbell Reith Hill LLP
15 Bermondsey Square
London
SE1 3UN

T: +44 (0)20 7340 1700
E: london@campbellreith.com
W: www.campbellreith.com

DOCUMENT HISTORY AND STATUS

Revision	Date	Purpose/ Status	File Ref	Author	Check	Review
D1	08/02/2024	Preliminary	RAkb14006-47-040224-UCS Frognal-D1	RA	KB	KB
F1	09/05/2024	Final	RAkb14006-47-090524-UCS Frognal-F1	RA	KB	KB

Document Details

Last Saved	09/05/2024 14:15
Author	R Ashmore, MSci, MSc, FGS
Project Partner	E M Brown, BSc MSc CGeol FGS
Project Number	14006-47
Project Name	Basement Impact Assessment Audit
Revision	F1
Planning Reference	2023/5366/P
File Ref	RAkb14006-47-090524-UCS Frognal-F1.docx

CONTENTS

APPENDICES

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 University College School Frognal, London NW3 6XH (planning reference 2023/5366/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 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 Basement Impact Assessment (BIA) has been carried out by engineering consultants Price & Myers and A-squared Studio; the individuals concerned in its production have suitable experience and qualifications.

1.5 Full-size copies of the drawings have been provided within the updated BIA report.

1.6 The intrusive ground investigation identified that the site comprises a thin cover of Made Ground over soft to firm clays of the Claygate Member and London Clay Formation.

1.7 It is anticipated that the groundwater table is above the basement foundation level. The interpretive report suggests groundwater should be assumed to be a maximum of 1m bgl for structural design.

1.8 The screening questions have been updated to include justification for all 'no' responses.

1.9 It is accepted that the proposed development will not adversely affect the hydrogeology of the local or wider environment.

1.10 With the inclusion of the proposed mitigation measures it is accepted that the development will not impact the hydrology of the area.

1.11 It is accepted that the proposals will not impact the land stability of the area.

1.12 An addendum issued by the engineers confirms that the proposed foundations comprise newly cast raft foundations and have provided the anticipated loading.

1.13 The impact assessment has been updated and confirms that the maximum damage is Burland Category 1 (Very Slight).

1.14 It can be confirmed that the BIA complies with the requirements of CPG: Basements.

2.0 INTRODUCTION

2.1 CampbellReith was instructed by London Borough of Camden (LBC) on 02/01/2024 to carry out a Category B audit on the Basement Impact Assessment (BIA) submitted as part of the Planning Submission documentation for University College School Frognal London NW3 6XH and Planning Reference No. 2023/5366/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

- Camden Local Plan 2017 - Policy A5 Basements.
- Camden Planning Guidance (CPG): Basements. January 2021.
- Guidance for Subterranean Development (GSD). Issue 01. November 2010. Ove Arup & Partners.
- Redington and Frognal Neighbourhood Plan

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 "Partial demolition of Giles Slaughter Wing and full demolition of Fives Building, maintenance hut and outdoor stepped seating; erection of part 1 and part 2 storey school building consisting of classrooms, medical and wellbeing rooms, music recital room, music teaching rooms and stores, drama studios, and ancillary cafeteria and offices (Class F1(a)) with associated plant, sports area and court lighting posts and new retaining walls and landscaping; new hard and soft landscaping and drainage; new cycle parking and replacement car parking; and erection of 2no. part 1 and part 2 storey temporary accommodation buildings for the construction period only."

2.5.1 The Audit Instruction confirmed the University College School Frognal site contains and is neighbour to, Grade II listed buildings.

2.6 CampbellReith accessed LBC's Planning Portal on 05/01/2024 and gained access to the following relevant documents for audit purposes:

- Design and Access Statement issued Ed Toovey Architects in December 2023.
- Flood Risk Assessment issued by Price & Myers in December 2023, reference 30645, revision 1.
- Construction Management Plan issued by Blue Sky Buillding in December 2023.
- Drawings and cross sections by Ed Toovey Architects including:
  - Site Plan Existing (2037/GL/002) and Proposed (2037/GL/012)
  - Ground Floor Plan Existing (2037/GA/001) and Proposed (2037/GA/011)
  - West Elevation [south] existing (2037/GE/001) and proposed (2037/GE/012)
  - West Elevation [north] proposed (2037/GE/013)
  - West Elevation full proposed (2037/GE/011)
  - South Elevation Existing (2037/GE/004) and proposed with no boundary wall (2037/GE/020)
  - East Elevation/section Full proposed (2037/GE/015)
  - EW Section AA existing (2037/GS/001) and proposed (2037/GS/011)
  - EW Section BB existing (2037/GS/002) and proposed (2037/GS/012)
  - NS Section CC [south] existing (2037/GS/003) and proposed (2037/GS/013)
  - NS Section CC [north] existing (2037/GS/004)
  - NS Section C full proposed (2037/GS/018)
  - EW Section DD existing (2037/GS/005) and proposed (2037/GS/015)
  - EW Section EE existing (2037/GS/006) and proposed (2037/GS/016)
  - EW Section FF existing (2037/GS/007) and proposed (2037/GS/017)

2.7 Following the consultation period, ending on the 28th January 2024, CampbellReith accessed LBC's Planning Portal on 29/01/2024. A summary of the responses is included in Appendix 1.

2.8 Updated reports were made available to CampbellReith following initial comments, these reports include:

- Basement Impact Assessment Report issued by Price & Myers in November 2023, reference 30645, revision 3. Within the appendices of the report were the following reports:
  - Phase I Desk Study issued by A2 Site Investigation in July 2023, reference 32823-A2SI-XX-XX-RP-Y-0001-01, revision 01.

- Factual Report issued by A2 Site Investigation in August 2023, reference 32823-A2SI-XX-XX-RP-Y-0002-01, revision 01.
- Interpretive Report issued by A2 Site Investigation in August 2023, reference 32823-A2SI-XX-XX-RP-Y-0003-00, revision 00.

2.9 Additional information was provided to CampbellReith for review on the 2nd May 2024:

- Addendum to the BIA issued by A-squared Studio in May 2024, ref. 2891-A2S-XX-XX-MM-Y-0001-01
- Building Damage Ground Movement Assessment issued by A-squared Studio in May 2024, ref. 2891-A2S-XX-XX-RP-Y-0004-02, revision 02
- Structural Engineering Addendum to BIA issued by Price & Myers in May 2024, ref. P&M BIA Report Addendum
- Wallap Output calculations dated 30th April 2024

3.0 BASEMENT IMPACT ASSESSMENT AUDIT CHECK LIST

Item	Yes/No/NA	Comment
Are BIA Author(s) credentials satisfactory?	Yes	
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	
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	Section 4.0 of the BIA
Hydrogeology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	Section 4.0 of the updated BIA
Hydrology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	Section 4.0 of the BIA
Is a conceptual model presented?	Yes	Within the interpretive report provided in Appendix D of the BIA
Land Stability Scoping Provided? Is scoping consistent with screening outcome?	Yes	Additional information provided in the addendum issued by A2.

Item	Yes/No/NA	Comment
Hydrogeology Scoping Provided? Is scoping consistent with screening outcome?	Yes	Additional information provided in the addendum issued by A2.
Hydrology Scoping Provided? Is scoping consistent with screening outcome?	Yes	
Is factual ground investigation data provided?	Yes	Appendix D of the BIA
Is monitoring data presented?	Yes	Appendix D of the BIA
Is the ground investigation informed by a desk study?	Yes	Appendix C of the BIA
Has a site walkover been undertaken?	Yes	Appendix C of the BIA
Is the presence/absence of adjacent or nearby basements confirmed?	No	However, neighbouring structures assumed to be founded at ground level.
Is a geotechnical interpretation presented?	Yes	Appendix D of the BIA
Does the geotechnical interpretation include information on retaining wall design?	Yes	However, some clarification is requested.
Are reports on other investigations required by screening and scoping presented?	Yes	A Flood Risk Assessment is provided. Additional assessments, recommended in the scoping, regarding the hydrogeology and land stability provided in the addendum issued by A2.
Are the baseline conditions described, based on the GSD?	Yes	However, some clarification is requested as discussed in section 4.0.
Do the base line conditions consider adjacent or nearby basements?	Yes	Clarification provided in the updated BIA.
Is an Impact Assessment provided?	Yes	

Item	Yes/No/NA	Comment
Are estimates of ground movement and structural impact presented?	Yes	GMA provided in Appendix E of the BIA.
Is the Impact Assessment appropriate to the matters identified by screening and scoping?	Yes	Further assessment provided in updated BIA and addendum issued by A2.
Has the need for mitigation been considered and are appropriate mitigation methods incorporated in the scheme?	Yes	
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?	Yes	
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?	Yes	
Does the report state that damage to surrounding buildings will be no worse than Burland Category 1?	Yes	
Are non-technical summaries provided?	Yes	

4.0 DISCUSSION

4.1 The Basement Impact Assessment (BIA) has been carried out by engineering consultants Price & Myers and A-squared Studio (A2); the individuals concerned in its production have suitable qualifications.

4.2 The Design & Access Statement identifies that the main school building, situated just west of the proposed development, is a Grade II listed building.

4.3 The site currently comprises two raised tennis courts with a two-storey block (Giles Slaughter Wing) in the southeastern corner housing an existing basement partially bounded by a contiguous piled retaining wall. The proposed development is located on the eastern edge of the school site, situated within sloped ground that rises towards the east. The new development includes partial demolition of Giles Slaughter Wing and the existing retaining wall and the demolition of two small maintenance blocks in the southern edge of the site. A new two-storey block will replace the Giles Slaughter Wing, re-using the existing floor slab and parts of the existing retaining wall. A new single storey block will extend northwards along the eastern edge of the school site with a new retaining wall (sheet or secant pile) to be constructed along the eastern and northern edges. The new block will be set back into the slope with two basements within the southern and northern edges of the development.

4.4 Full-size copies of the drawings have been provided within the updated BIA report.

4.5 A desktop study and an intrusive ground investigation have been carried out by A2 Site Investigation and copies of the reports are provided in Appendix C and Appendix D of the BIA. The intrusive ground investigation included 3no. cable percussive boreholes to 22m below ground level (bgl), 4no. hand excavated trial pits to determine the extent and thickness of the existing foundations, 2no. California Bearing Ratio tests, 1no. infiltration test and, installation and monitoring of groundwater monitoring wells.

4.6 The intrusive ground investigation recorded a cover of Made Ground, up to 1.10m thick, across the site underlain by soft grey-brown mottled orange and dark grey, slightly sandy silty clay. Table 9.1 of the Factual Report (included in Appendix A of the Interpretive Report) suggests that the soft clays, interpreted as being within the Claygate Member, are present to depths of between 5.00m and 10.00m. These soils are underlain by soft, becoming firm, dark grey slightly sandy silty clays interpreted to be of the London Clay Formation. The ground model, summarised in Table 5.2 of the Interpretive Report (included in Appendix D of the BIA), indicates that the ground model for the site assumes soft clays to 79.00m OD over firm clays, becoming stiff with depth.

4.7 Water strikes were encountered in two boreholes at 4.20m and 6.00m bgl within the Claygate Member. Seepages of groundwater was also recorded in a trial pit at 0.90m bgl within the Made Ground. Subsequent monitoring recorded groundwater to be between 85.58m and 87.51m AOD. Based on these findings the interpretive report suggests groundwater should be assumed to be a maximum of 1m bgl for structural design.

4.8 The hand excavated trial pits confirmed the thickness of the raft foundation of the Giles Slaughter Wing is between 0.90m and 1.10m bgl and steps out between 0.20m and 0.90m from the external wall.

4.9 A parallel seismic test was carried out in one of the boreholes to establish the condition of the existing contiguous piled wall. The pile length was estimated to be approximately 12.30m (with the toe being at 75.70m AOD).

4.10 Proposed geotechnical parameters are provided in Table 5.2 of the Interpretive report.

4.11 The slope stability screening table highlights that the site and surrounding area contain slopes with gradients over 10 degrees. It also indicates the London Clay is overlain by c. 1m thick deposits of the Claygate Member and that existing trees will be removed as part of the development.

4.12 The site is within 5m of a pedestrian right of way and the screening responses indicate that the proposed basement may significantly increase the differential depth of foundations relative to neighbouring properties.

4.13 The scoping assessment for land stability identifies potential impacts to neighbouring properties, roads and buried services caused from excessive ground movements and/or slope instability. A Ground Movement Assessment, included in an addendum issued by A2, has been undertaken to determine the likely impacts to these assets due to ground movements. A slope stability assessment has also been carried out on the final proposed slope geometry. It is accepted that the proposals will not adversely impact slope stability in the area.

4.14 The hydrogeology screening identifies that the site is located directly over the Claygate Member, which is a Secondary A aquifer, and that the proposed basement will extend beneath the water table surface. A hydrogeological assessment has been included within the addendum provided by A2 and confirms that the groundwater encountered during the ground investigation is assumed to be perched and localised within sandy horizons present within the Claygate Member and no significant groundwater flow is anticipated to exist within these soils. The report also considers that in a 'worst case scenario' groundwater would be permitted to flow around the basement box, preventing damming affects.

4.15 The BIA states that the quantity of surface water being discharged to the ground will not increase and that the proposed development will result in a decrease of impermeable surface by a total of 20m^2. It also highlights that the proposed site drainage will alter the existing route of the surface water.

4.16 The Flood Risk Assessment (FRA) outlines that the drainage scheme has been designed to direct surface water runoff away from the buildings and sensitive areas. The FRA also includes proposals to mitigate surface water runoff through a combination of detention basins, permeable paving, and below ground attenuation tanks. The surface water will then be discharged off-site into an existing combined sewer situated in Arkwright Road.

4.17 The BIA report confirms that the proposed development construction sequence will include excavation of the basements with temporary props installed where required. Appendix B of the BIA includes a construction sequence for the new embedded piled wall to be installed behind the existing wall.

4.18 The addendum provided by Price & Myers in May 2024 confirms that the basement foundations will comprise newly cast raft foundations with loading up to 42kPa. It is noted that the interpretive report provides an indicative allowable bearing pressure of 200kPa for strip footings founded in the Thames Group however, Price & Myers have confirmed that no strip and pad foundations are proposed as part of the scheme.

4.19 The BIA indicates that the excavation of the proposed basement areas, to the north and southern boundaries, will extend below the groundwater table. As discussed above, this is anticipated to be perched water with localised lenses of granular material within the Claygate Member and, as such, the addendum provided by A2 confirms that no major dewatering scheme is anticipated to be required. Impacts from loss of fines is stated in the addendum to be low, however, monitoring is suggested to ensure any increase in fines wash out is identified and addressed if necessary. This approach is accepted to be adequate for the proposed development.

4.20 The BIA has been updated to confirm that no underpinning is proposed as part of the development scheme. Additionally, Wallap analysis of the contiguous retaining wall has been provided. The analysis has been based on a model that assumes groundwater is present from 87.50m AOD. The soil parameters presented in the BIA are consistent with those used in the Wallap analysis and appear suitable for the soils described.

4.21 A Ground Movement Assessment (GMA) has been updated and the addendum provided by A2 confirms that the normalised movement curves applied are as per those provided in CIRIA C760 guidance. The depth to the pile toe has been assumed based on a 2:1 ratio of embedment depth to retained height.

4.22 The updated GMA confirms that the maximum damage to the neighbouring buildings (including the Grade II listed structure) is Burland Category 1 (Very Slight).

4.23 The risk of surface water flooding has been addressed with a range of mitigation measures which are outlined in the FRA. It is accepted that the proposed development is not in an area prone to flooding and there will be no adverse effect on the local or wider hydrogeological environment.

4.24 The BIA writes that an appropriate movement monitoring strategy should be implemented and will consider the 'recommended limits provided in the BIA'. Price & Myers has provided confirmation these limits will be based on the findings of the GMA.

5.0 CONCLUSIONS

5.1 The Basement Impact Assessment (BIA) has been carried out by engineering consultants Price & Myers and A-squared Studio (A2); the individuals concerned in its production have suitable experience and qualifications.

5.2 The Design & Access Statement identifies that the main school building, situated just west of the proposed development, is a Grade II listed building.

5.3 The proposed development is located on the eastern edge of the school site, situated within sloped ground that rises towards the east. The proposed works includes partial demolition of the existing contiguous piled wall and the existing block, Giles Slaughter Wing, with the complete demolition of two maintenance blocks. The proposed development comprises the construction of a two-storey structure over the Giles Slaughter Wing, re-using the existing floor slab and parts of the retaining wall. A new single storey block will extend northwards along the eastern edge of the school site with a new retaining wall (sheet or secant piled) to be constructed along the eastern and northern edges. The new block will be set back into the slope with two basements within the southern and northern edges of the development.

5.4 Full-size copies of the drawings have been provided within the updated BIA report.

5.5 A desktop study and intrusive ground investigation have been carried out at the site. The factual report indicates that the site comprises a thin cover of Made Ground over soft clays of the Claygate Member. These are underlain by soft, becoming firm with depth, clays of the London Clay Formation.

5.6 The interpretive report suggests groundwater should be assumed to be a maximum of 1m bgl for structural design.

5.7 The screening questions have been updated to include justification for all 'no' responses.

5.8 It is accepted that the proposed development will not adversely affect the hydrogeology of the local or wider environment.

5.9 With the inclusion of the proposed mitigation measures it is accepted that the development will not impact the hydrology of the area.

5.10 It is accepted that the proposed development will not impact the land stability of the area.

5.11 An addendum issued by the engineers confirms that the proposed foundations will comprise newly cast raft foundations and have provided the anticipated loading.

5.12 Clarification that no underpinning is proposed for this scheme has been provided by Price & Myers.

5.13 The impact assessment has been updated and confirms that the maximum damage is Burland Category 1 (Very Slight).

5.14 Based on the additional information provided it can be confirmed that the BIA complies with the requirements of CPG: Basements.

CampbellReith
consulting engineers

Appendix 1

Consultation Responses

CampbellReith consulting engineers

Residents' Consultation Comments

Surname	Address	Date	Issue raised	Response
Redington Frognal Neighbourhood Forum	NA	24/01/2024	Excavation will likely impact the local hydrology. Existing issues with flooding of the area and downstream should be mitigated by significantly reducing the surface water run-off.	This has been raised in Section 4.0 above. The proposals have included mitigation measures to mitigate any impact to the surface water runoff and drainage regime of the area.
South Hampstead Flood Action Group	NA	26/01/2024	Existing issues with flooding of the area and downstream should be further mitigated by installing additional stormwater attenuation tanks. Recent flooding, from 2021, has not been considered within the assessment.	The proposals have included mitigation measures to mitigate any impact to the surface water runoff and drainage regime of the area.

CampbellReith
consulting engineers

Appendix 2

Audit Query Tracker

Audit Query Tracker

Query No.	Subject	Query	Status	Date closed out
1	Qualification	Provide evidence to show that the author(s) of the BIA have suitable experience and qualifications for the assessments as set out in the CPG.	Closed	25th March 2024
2	Drawings	Provide full size copies of the drawings presented in the BIA and appendices and provide the basement plan drawing. 2037/GA/011 shows an area of basement outside of the site boundary, provide clarification.	Closed	25th March 2024
3	Ground model and parameters	Provide clarification of the ground model and the assigned parameters.	Closed	25th March 2024
4	Screening responses	Several of the screening questions are missing justification for the response 'no'. These should be provided.	Closed	25th March 2024
5	Hydrogeology	Include reference to the lost river identified within the desktop study.	Closed	3rd May 2024
6	Land stability	Provide clarification for Q5 and Q13 of the land stability screening responses, including reference to the listed building. Ensure all items of the screening are brought through to scoping.	Closed	25th March 2024
7	Hydrogeology/ Land stability	The additional assessments identified within the scoping should be included within the BIA.	Closed	3rd May 2024
8	Construction Sequence	Confirm the construction methodology for the proposed basements.	Closed	3rd March 2024

Query No.	Subject	Query	Status	Date closed out
9	Construction Sequence	Provide the proposed foundation scheme for the basements including confirmation of the founding stratum, depth and/or level and, the proposed loads.	Closed	25th March 2024
10	Land stability	Provide further justification for the allowable bearing capacity.	Closed	3rd May 2024
11	Construction sequence	Confirm the details of the underpinning referenced in 1.1.7 of the BIA.	Closed	25th March 2024
12	Impact Assessment	Update the impact assessment following review of the above actions.	Closed	3rd May 2024
13	Impact Assessment	Confirm location of the recommended limits referenced in section 7.4 the BIA.	Closed	25th March 2024

CampbellReith
consulting engineers

Appendix 3

Supplementary Supporting Documents

None

London

15 Bermondsey Square
London
SE1 3UN

T: +44 (0)20 7340 1700
E: london@campbellreith.com

Birmingham

Chantry House
High Street, Coleshill
Birmingham B46 3BP

T: +44 (0)1675 467 484
E: birmingham@campbellreith.com

Bristol

Unit 5.03,
HERE,
470 Bath Road,
Bristol BS4 3AP

T: +44 (0)117 916 1066
E: bristol@campbellreith.com

Manchester

No. 1 Marsden Street
Manchester
M2 1HW

T: +44 (0)161 819 3060
E: manchester@campbellreith.com