CampbellReith
consulting engineers

25 and 26 Redington Gardens
London NW3 7RX

Basement Impact Assessment
Audit

For

London Borough of Camden

Project Number: 12066-16
Rev: F1

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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 25 and 26 Redington Gardens, London NW3 7RX (planning reference 2015/3200/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 review it against an agreed audit check list. Additional information was provided to CampbellReith on 10/08/15 and 03/09/15 that provided responses to queries raised in the original BIA audit.

1.4. It has been confirmed that the development site does not involve a listed building, nor is it in the neighbourhood of listed buildings.

1.5. The BIA has confirmed that the proposed basement will be located within the Claygate Beds and that the surrounding slopes are stable.

1.6. There is a shallow groundwater level which will require the use of a secant pile wall, or similar, to permit excavation of the basement.

1.7. The original BIA noted that the construction of the basement could alter the groundwater flow. It was not discussed in conjunction with a consideration of the presence of any other nearby basements, although there is a proposal to construct a granular trench around the proposed basement. Subsequent information provided by Chord Environmental Ltd confirmed the locations of nearby basements and that significant groundwater flow is not anticipated. It concluded that the development proposal will have no significant impact on groundwater/hydrogeological conditions.

1.8. The proposed basement will be excavated and constructed utilising established techniques.

1.9. It is accepted that the risk of surface water flooding the buildings is low, despite nearby streets having been flooded in 2002.

1.10. The initial BIA identified that part of the basement will be within alluvial soils which have the potential for groundwater flow within them. It included a proposal to provide a 1m deep granular trench around the basement to permit any such flow around the basement and our

initial audit recommended that confirmation be sought that there is no impact on the neighbouring basement. Subsequent information from Chord described how the alluvial soils are of a limited nature, annual recharge will be very low and other nearby basement developments will have reduced their water bearing potential further. It concluded that the proposed development would have no significant groundwater effects. Notwithstanding that, it is suggested that the concept for a trench to potentially cut off any groundwater be carried through to detailed design.

1.11. The BIA indicates that although the basement extends beneath the existing garden soft landscaping / SUDS will be provided above this part of the basement. It is accepted that will not significantly alter the existing surface water drainage conditions.

1.12. The ground movement assessment provided in the original BIA indicated that damage to the adjacent properties will be category 2 or less. However, our audit deemed it to be incomplete and be resubmitted. The revised submission used conservative assessments for soil parameters and wall stiffness. We suggest that these be reviewed at detailed design stage and detailed design can be modified e.g. prop details, wall stiffness in order to achieve the predicted settlements. The revised movement assessment confirms that damage should not exceed Burland category 2 and is acceptable for planning purposes.

2.0 INTRODUCTION

2.1. CampbellReith was instructed by London Borough of Camden (LBC) on 8th July 2015 to carry out a Category B Audit on the Basement Impact Assessment (BIA) submitted as part of the Planning Submission documentation for 25 and 26 Redington Gardens, Camden Reference 2015/3200/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 "The proposal is for the demolition of the existing two storey houses and replacement with two four storey semi-detached houses which includes the basement and habitable roof space."

The Audit Instruction also confirmed that the basement proposals did not involve a listed building nor the site neighboured listed buildings.

2.6. CampbellReith accessed LBC's Planning Portal on 8th July 2015 and gained access to the following relevant documents for audit purposes:

- Basement Impact Assessment
- Desk study and ground investigation report
- Construction management plan
- Drawings;
  - 1958-A101 basement plan
  - 1958-A110 lower ground floor plan
  - 1958-A151 elevation drawing
  - 1958-A152 elevation drawing
  - 1958-A153 elevation drawing
  - 1958-A170 section drawing
  - 1958-A171 section drawing
- Ground Movement Report (provided on 10th July)

2.7. Further to CampbellReith's original audit, additional information was submitted to us on 10/08/15 and 03/09/15 to address the queries raised. The additional information was:

- An updated Ground Movement Assessment Report – Byland Engineering Ltd, Project 1202 dated 13/08/15
- Letter report (PDisp analyses) – Byland Engineering Ltd dated 18/08/15
- Letter report by Chord Environmental Ltd - 1127/LJE020915

3.0 BASEMENT IMPACT ASSESSMENT AUDIT CHECK LIST

Item	Yes/No/NA	Comment
Are BIA Author(s) credentials satisfactory?	Yes	The authors of the BIA, the Ground Investigation report and the Ground Movement Assessment all have suitable credentials. Letter report by Chord Environmental also by individual with suitable credentials.
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	BIA Sections 3.02, 4.02 and 5.02.
Are suitable plan/maps included?	Yes	BIA and drawings.
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	BIA Section 4.01
Hydrogeology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	BIA Section 3.01
Hydrology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	BIA Section 5.01
Is a conceptual model presented?	Yes	Ground model in Ground investigation report Section 6.0

Item	Yes/No/NA	Comment
Land Stability Scoping Provided? Is scoping consistent with screening outcome?	Yes	BIA Section 4.02
Hydrogeology Scoping Provided? Is scoping consistent with screening outcome?	Yes	BIA Section 3.02
Hydrology Scoping Provided? Is scoping consistent with screening outcome?	Yes	BIA Section 5.02
Is factual ground investigation data provided?	Yes	Ground investigation report
Is monitoring data presented?	Yes	Groundwater monitoring in the Ground investigation report
Is the ground investigation informed by a desk study?	Yes	Desk study and ground investigation report
Has a site walkover been undertaken?	Yes	Ground investigation report Section 2.0
Is the presence/absence of adjacent or nearby basements confirmed?	Yes	Initial BIA had limited discussion on basements, documents refer to only one nearby basement being present. However, additional letter report by Chord Environmental covers this issue.
Is a geotechnical interpretation presented?	Yes	Ground investigation report Section 6.0
Does the geotechnical interpretation include information on retaining wall design?	Yes	Ground investigation report Section 7.1.2
Are reports on other investigations required by screening and scoping presented?	Yes	Thames Water asset search
Are baseline conditions described, based on the GSD?	Yes	

Item	Yes/No/NA	Comment
Do the base line conditions consider adjacent or nearby basements?	Yes	Only the nearest basement. Resident comment indicates other basements in the area. Further addressed in Chord Environmental letter report.
Is an Impact Assessment provided?	Yes	Ground Movement Assessment
Are estimates of ground movement and structural impact presented?	Yes	Ground Movement Assessment
Is the Impact Assessment appropriate to the matters identified by screen and scoping?	Yes	Initial BIA did not consider impact on subterranean flow in sufficient detail. Additional letter report by Chord Environmental covers this.
Has the need for mitigation been considered and are appropriate mitigation methods incorporated in the scheme?	Yes	Secant piled wall SUDS on top of basement under garden Granular trench around basement
Has the need for monitoring during construction been considered?	Yes	BIA
Have the residual (after mitigation) impacts been clearly identified?		Impacts on subterranean flow and adjacent highway to be further considered. Further addressed in Chord Environmental letter report.
Has the scheme demonstrated that the structural stability of the building and neighbouring properties and infrastructure been maintained?	Yes	Some of the assumptions within the ground movement assessment need to be confirmed during the detailed design.
Has the scheme avoided adversely affecting drainage and run-off or causing other damage to the water environment?	Yes	Not possible to confirm in original BIA. Additional letter report by Chord Environmental covers this.
Has the scheme avoided cumulative impacts upon structural stability or the water environment in the local area?	Yes	Not possible to confirm in original BIA. Additional Ground Movement Assessment and additional letter report by Chord Environmental covers this.

Item	Yes/No/NA	Comment
Does report state that damage to surrounding buildings will be no worse than Burland Category 2?	Yes	Estimated to be Burland Category 2 or less. The GMA in the original BIA was deemed to be incomplete. This has been re-submitted and is acceptable.
Are non-technical summaries provided?	No	But BIA is written so as to be understandable

4.0 DISCUSSION

4.1. The BIA and subsequent information has been carried out by an established firm of structural engineers, Michael Alexander, who have employed the services of GEA and Byland to supplement the work needed to form the BIA. The authors and reviewers from all of these organisations have suitable qualifications. Supporting information was also subsequently provided by Chord Environmental Ltd whose author has suitable qualifications.

4.2. The proposed basement will generally be excavated with the sides supported by a propped secant pile wall. This is an acceptable methodology using established techniques.

4.3. The original BIA mentioned only one nearby basement. An investigation of the presence of other nearby basements was requested and subsequently produced by Chord Environmental.

4.4. It is acknowledged that the basement is founded within the Claygate Beds, overlying the London Clay. The ground investigation report and original BIA refer to a water course that once traversed the site and a former tributary to the River Westbourne that ran along the south eastern boundary. The original BIA notes that the site may be located adjacent to a spring line. The basement extends through the alluvial soils and Claygate Beds. A full hydrogeological impact assessment was requested to confirm that the proposed 1m deep granular trench around the basement is sufficient to permit flow around the basement when other surrounding basements are considered.

4.5. Further information is provided in Chord Environmental Ltd letter 1127/LJE020915. The review of existing basements is based on a search of Camden's Planning Portal to establish which properties in the vicinity of 25-26 Redington Gardens have had basement developments. Numbers 4 and 6 Templewood Avenue both have double basements and lie immediately to the north and approximately 60m north east of the site. In addition, 38 Redington Avenue and 16-17 Redington Gardens also both have double level basements and are located immediately to the south west and across the road to the south east of the site respectively. The letter report concludes that neither the existing basements nor the current proposal will impact on the hydrogeological conditions.

4.6. The ground investigation report suggests that groundwater flow is to the south or south west and that the alignment of the basement has the potential to alter the flow of groundwater. Our initial audit suggested that the direction of flow should be confirmed by further monitoring.

4.7. Further information is provided in Chord Environmental Ltd letter 1127/LJE020915. The letter states that the proposed basement development would extend through alluvial deposits in the north of the site and then Claygate Member silty clays. It states that there is no significant

groundwater flow through the clays of the Claygate Member and therefore there is no potential groundwater impact from the basement development within these deposits.

4.8. As the Alluvium deposits would have a relatively narrow extent due to the size of the former tributary, any groundwater encountered by the proposed basement excavation would also be similarly limited. Annual recharge through these deposits would be very low. Recent basement developments across the former path of the tributary up gradient of the site will have reduced the water bearing potential of the Alluvium even further. The letter concludes that the proposed basement development would have no significant groundwater effects i.e. the direction of groundwater flow is not relevant.

4.9. The groundwater is shown to be at 1-1.5m depth and so the basement will be significantly below the groundwater level. The proposal to use a secant piled wall to form the sides of the basement should be adopted.

4.10. The BIA has shown that the surrounding slopes to the development are stable.

4.11. The BIA indicates that the new foundations will be deeper than any neighbouring foundations.

4.12. The BIA indicates that although the basement extends beneath the existing garden soft landscaping / SUDS will be provided above this part of the basement. It is accepted that will not significantly alter the existing surface water drainage conditions.

4.13. The BIA includes an assessment of whether the development is likely to be affected by surface water flooding, and even though nearby streets were flooded in 2002, the risk is accepted as being low.

4.14. The Ground Movement Assessment in the original BIA concludes that any damage to the neighbouring properties will be Burland Category 2 or less. However, it was not possible to validate these results because;

- The software program XDisp has been used to predict vertical and horizontal ground movements from wall installation and wall deflection during excavation only. This is clear from Table 1 in the Ground Movement Assessment report. It is standard practice to combine XDisp with another software program PDisp so as to also predict the additional vertical ground movements from excavation of the basement, and the subsequent reloading when the new houses are built. These additional movements may reduce or increase the building damage assessment; it is not possible to conclude without undertaking the additional analyses.
- On the basis of CIRIA C580, the Byland Ground Movement Assessment concludes that the secant pile wall will deflect less than 10-15mm, even though their calculations indicate that for a high groundwater table, higher deflections of 20 to 27mm might occur. The estimated deflections from CIRIA C580 assume the temporary propping is of a high

stiffness, and the basement is constructed in stiff clay. For the 6.2m deep basement this would give 10mm. It is likely that the combination of the propping system that will be provided with the high groundwater level and Claygate Beds would give a deflection somewhere in between these values of 10 and 27mm, say around 18mm. It would be prudent to base the ground movement and damage assessments on a more conservative value or a more accurate design method must be used to demonstrate that the wall deflections will be close to 10mm. If XDisp is used to assess the building damage category, the results of the more detailed ground movement analysis should be used.

4.15. The additional ground movement assessment has been covered in Byland Engineering Ltd report 1202 dated 13th August 2015. The report follows methodology advocated in CIRIA 580. Limited data was available for foundations to the adjacent properties and the analysis assumes stiff clay is to be retained. Since alluvial soils and softened Claygate soils are to be retained (i.e. not stiff clay as per the CIRIA methodology), modelling uses conservative assumptions i.e a medium stiffness wall. Average movements of 24mm (horizontal) and 19mm (vertical) were generated. Any reductions due to heave effects were ignored. These predictions were taken forward to the damage impact assessment.

4.16. It is believed that a review of wall stiffness and soil parameters should be undertaken at detailed design stage. However, modification of the detailed design e.g. propping details and wall stiffness would provide an opportunity to ensure the predicted settlements in the ground movement assessment are achieved. It is considered therefore that the movement assessment is acceptable as far as planning purposes are concerned.

4.17. A basic/outline movement monitoring regime is included in Byland Engineering's updated report. It states that, the plan should include a traffic light system which identifies safe (green), trigger (amber) and action (red) values of ground or wall deflection. Precise surveys of ground markers and targets fixed to building walls and the basement capping beam and pile deflection measurements using inclinometers cast into a few wall piles are recommended. The monitoring plan should identify specific measures to be implemented should specific thresholds be met in order to minimise any problems to neighbouring properties. A particular specification for piling based on the ICE specification for piling and embedded retaining walls 2nd edition (SPERW2) should be prepared. The specification should include the movement monitoring requirements. This is an acceptable approach.

5.0 CONCLUSIONS

5.1. The BIA and subsequent supporting information has been carried out by stablished organisations. The authors and reviewers from all of these organisations have suitable qualifications.

5.2. The proposed basement will generally be excavated with the sides supported by a propped secant pile wall. This is an acceptable methodology using established techniques.

5.3. The basement is founded within the Claygate Beds, overlying the London Clay and it is noted that the groundwater flow may be altered. A hydrogeological impact assessment was requested to confirm that the proposed 1m deep granular trench around the basement is adequate mitigation.

5.4. Further monitoring to confirm the direction of flow of the groundwater was requested based on the original BIA. Additional supporting information described how groundwater flow would be negligible. Notwithstanding, it is suggested that the concept for a trench to potentially cut off any groundwater be carried through to detailed design.

5.5. The groundwater is shown to be at 1-1.5m depth and so the basement will be significantly below the groundwater level. The proposal to use a secant piled wall to form the sides of the basement should be adopted.

5.6. The BIA indicates that although the basement extends beneath the existing garden soft landscaping / SUDS will be provided above this part of the basement.

5.7. The BIA includes an assessment of whether the development is likely to be affected by surface water flooding, and even though nearby streets were flooded in 2002, the risk is accepted as being low.

5.8. The original Ground Movement Assessment concludes that any damage to the neighbouring properties will be less than category 2. The assessment was deemed to be incomplete. A revised assessment was provided which used conservative assessments for soil parameters and wall stiffness. We suggest that these be reviewed at detailed design stage and the detailed design can be modified e.g. prop details, wall stiffness in order to achieve the predicted settlements. The revised movement assessment confirms that damage should not exceed BUrland category 2 and is acceptable for planning purposes.

5.9. A movement monitoring regime on the adjacent properties during construction is proposed and this should be provided.

Appendix 1: Residents' Consultation Comments

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Residents' Consultation Comments

Surname	Address	Date	Issue raised	Response
Yass	5A Templewood Avenue, London, NW3 7UY	27/06/15	Does BIA consider the cumulative effects of the other basements in the area	See Sections 4.5 and 4.8.
Heath and Hampstead Society		18/06/15	Questions the building damage assessment of level 2 Site is vulnerable to soil movement	This comment pre-dates the Ground Movement Assessment report provided for this audit. See Sections 4.11 to 4.17. The proposed secant pile wall should prevent this.

Appendix 2: Audit Query Tracker

Audit Query Tracker

Query No	Subject	Query	Status	Date closed out
1	Subterranean groundwater	Presence of surrounding basement to be confirmed and impact on hydrogeology.	Closed - Letter report provided by Chord Environmental Ltd	16/09/15
2	Subterranean groundwater	Direction of groundwater flow to be confirmed.	Closed – Letter report provided by Chord Environmental Ltd	16/09/15
3	Stability	Ground movement assessment to be revised.	Closed - Additional report provided by Byland Engineering Ltd	16/09/15
4	Stability	Outline movement monitoring regime to be provided.	Closed – Additional report provided by Byland Engineering Ltd	16/09/15

Appendix 3: Supplementary Supporting Documents

None

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