Chelmer
Consultancy Services
'Groundbreaking Services'

Revised Independent Assessment of Re-revised Basement Excavation Justification for Planning Application 2014/7908/P

Site	140-146 Camden Street London NW1 9PF
Client	London Borough of Camden
Date	July 2015
Our Ref	BIAREV/5130

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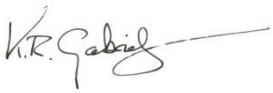
Lead author:	Keith Gabriel MSc DIC CGeol FGS UK Registered Ground Engineering Adviser	
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Foreword

This report has been prepared in accordance with the scope and terms agreed with the Client, and the resources available, using all reasonable professional skill and care. The report is for the exclusive use of the Client and shall not be relied upon by any third party without explicit written agreement from Chelmer Site Investigation Laboratories Ltd.

This report is specific to the proposed site use or development, as appropriate, and as described in the report; Chelmer Site Investigation Laboratories Ltd accept no liability for any use of the report or its contents for any purpose other than the development or proposed site use described herein.

This assessment has involved consideration, using normal professional skill and care, of the findings of ground investigation data obtained from the Client and other sources. Ground investigations involve sampling a very small proportion of the ground of interest as a result of which it is inevitable that variations in ground conditions, including groundwater, will remain unrecorded around and between the exploratory hole locations; groundwater levels/pressures will also vary seasonally and with other man-induced influences; no liability can be accepted for any adverse consequences of such variations.

This report must be read in its entirety in order to obtain a full understanding of our recommendations and conclusions.

CONTENTS

1.0 INTRODUCTION

1.1 This revised independent assessment was commissioned by the London Borough of Camden (LBC) and concerns the re-revised documents submitted with planning application 2014/7908/P for the demolition of the existing buildings at 140-146 Camden Street, London, NW1 9PF, and the erection of a 3-8 storey building with a single storey basement.

1.2 The application describes the proposed works as the: "*Demolition of existing buildings and erection of a part 3, 4, 5 & 8 storey building plus single storey basement level comprising 2000sqm of commercial floorspace and 51 residential units (20 x 1-bed, 20 x 2-bed and 11 x 3-bed) with associated landscaping.*".

1.3 The scope for this assessment, as set out in LBC's letter of enquiry dated 10th February 2015, is to provide:

1) "an audit of the submission documents for compliance with the Revised Basement Impact Assessment";
2) "a view on the technical sufficiency of the work carried out";
3) "assessment of the completeness of the submission";

all in relation primarily to compliance with Camden's LDF Development Policy DP27, and the Basement Impact Assessment requirements as set out in LBC's guidance document CPG4 'Basements and Lightwells' (2013) and the associated 'Camden, geological, hydrogeological and hydrological study – Guidance for subterranean development'' (Camden GHHS, Arup, November 2010).

1.4 Six specific requests were included within the scope; these are addressed in the Conclusions to this report. The final two (Nos 5 and 6) also included additions to the three aspects of the scope listed above; they were:

5. comment on whether the critiques submitted by the neighbours "raise any reasonable concerns about the technical content or considerations of the submission which should be addressed by the applicant by way of further submission, *prior* to planning permission being granted".
6. "Raise any relevant and reasonable considerations in respect of the structural integrity or condition of the road and the neighbouring properties which may be unknown or unaccounted for by the submission **or** which would benefit from particular construction measures or methodologies in respect of the development *following* a grant of permission for the development."

1.5 The over-riding aim of Camden's LDF Development Policy DP27 'Basements and Lightwells', as stated in its first paragraph, is: "The Council will only permit basement and other underground development that does not cause harm to the built and natural environment and local amenity, and does not result in flooding or instability". Detailed requirements are then presented for what developers must demonstrate and matters that the council will consider when assessing applications.

1.6 The professional organisations involved with the proposed basement are:

- Chassay + Last Architects
- Price & Myers Structural Engineers
- GEA Site investigation contractors and Geotechnical Consultants.

1.7 This assessment has been prepared by Keith Gabriel, a Chartered Geologist with a MSc degree in Engineering Geology and Mike Summersgill, a Chartered Civil Engineer and Chartered Water and Environmental Manager with a MSc degree in Soil Mechanics. Both authors have over 30 years experience in ground engineering and have previously undertaken assessments of basements in several London Boroughs.

1.8 Comments on the technical aspects of each of the main submission documents are presented in Section 2, together with technical issues raised by the consultees, followed in Section 3 by a comparison against LBC's specific requirements as identified in the scope for this assessment. No comment is expressed here on the Design & Access Statement, because a critique of the architectural aspects of the scheme is beyond the scope of this assessment. Similarly, this assessment does not provide a full technical review or check of the submitted documents.

1.9 Drawings of the existing property and the proposed scheme were prepared by Chassay + Last, Architects. The following drawings were obtained from the LBC Planning website (drawings for floors above 1st floor level have been ignored):

Existing Drawings

- Drg No D-CSC3-A100 Location Plan
- Drg No D-CSC3-A101 Site Plan
- Drg No D-CSC3-A102 Lower Ground Floor Plan (Canal level)
- Drg No D-CSC3-A103 Ground Floor Plan (Street level)
- Drg No D-CSC3-A104 First Floor Plan
- Drg No D-CSC3-A201 South & West Context Elevation
- Drg No D-CSC3-A202 North & East Context Elevation
- Drg No D-CSC3-A203 West Elevation
- Drg No D-CSC3-A204 South Elevation
- Drg No D-CSC3-A205 East Elevation
- Drg No D-CSC3-A206 North Elevation
- Drg No D-CSC3-A207 Section AA
- Drg No D-CSC3-A208 Section BB
- Drg No D-CSC3-A209 Section CC

Demolition Drawings

- Drg No D-CSC3-A.200 Site Plan
- Drg No D-CSC3-A.201 Lower Ground Floor Plan (Canal level)
- Drg No D-CSC3-A.202 Ground Floor Plan (Street level)
- Drg No D-CSC3-A.203 First Floor Plan
- Drg No D-CSC3-A.204 Section AA
- Drg No D-CSC3-A.205 Section BB
- Drg No D-CSC3-A.206 Section CC

Proposed Drawings

- Drg No D-CSC3-A110-Rev.A Location Plan
- Drg No D-CSC3-A111-Rev.A Site Plan
- Drg No D-CSC3-A112-Rev.A Lower Ground Floor Plan (Canal level)
- Drg No D-CSC3-A113-Rev.A Ground Floor Plan (Street level)
- Drg No D-CSC3-A114-Rev.A First Floor Plan
- Drg No D-CSC3-A211-Rev.A South & West Context Elevation
- Drg No D-CSC3-A212-Rev.A North & East Context Elevation
- Drg No D-CSC3-A213-Rev.A West Elevation
- Drg No D-CSC3-A214-Rev.A South Elevation
- Drg No D-CSC3-A215-Rev.A East Elevation
- Drg No D-CSC3-A216-Rev.A North Elevation
- Drg No D-CSC3-A311-Rev.A Section AA
- Drg No D-CSC3-A312-Rev.A Section BB
- Drg No D-CSC3-A313-Rev.A Section CC
- Drg No D-CSC3-A314-Rev.A Section CC

These drawings have been referred to primarily for factual information purposes.

1.10 Structural Drawings of the proposed scheme were prepared by Price & Myers (P&M). The following structural drawings were included in the re-revised Basement Impact Assessment report (Supporting Document 7):

- Drg No. SK10-Rev.D Lower Ground Floor & Foundations
- Drg No. SK11-Rev.B Ground Floor
- Drg No. SK12-Rev.B First Floor
- Drg No. Sk22-Rev.C Section A & Section B
- Drg No. SK25 Section D
- Drg No. SK26 Section C
- Drg No. SK28 Section through boundary with Pulse House
- Drg No. SK29 Analysis of Basement Levels
- Drg No. SK30 Section E and Section F.

And in Supporting Document 6 'Proposed Temporary Works':

- Drg No. SK23-Rev.B Temporary Works: Lower Ground Floor & Foundations
- Drg No. SK24-Rev.A Temporary Works (Sections)
- Drg No. SK27 Temporary Propping Scheme to Boundary with Canal Tow Path.

1.11 The re-revised Basement Impact Assessment (re-revised BIA) prepared by Price & Myers (report Ref: 20216, version 7, July 2015) includes 15 'Supporting Documents'. Some of these Supporting Documents are revised or reconfigured versions of the previous Appendices. There are also two completely new documents:

- Monitoring proposals by Price & Myers (Document 14)
- Further investigations in June 2015 by GEA (Document 15)

Our initial assessment (issued 12th March 2015) considered BIA version 4, and our up-dated assessment (issued 1st Mat 2015) considered BIA version 5.

1.12 Instructions to prepare this up-dated Independent Assessment were received by email on 24th June 2015 (covered by purchase order No. PO 4615).

2.0 CONSIDERATION OF DOCUMENTS SUBMITTED

2.1 Basement Design

2.1.1 From our review of the documents it is understood that construction of the proposed basement will require excavation of the entire footprint of the existing building, ground floor (northern part), lower ground floor (southern part) and removal of all the existing pile caps. The drawings in Supporting Document 5 of 'Revised Basement Impact Assessment' report by Price & Myers (P&M) indicate that the perimeter walls of the basement will require a combination of:

- Mass concrete underpinning and a reinforced concrete (RC) liner wall to the party wall with Pulse House (northern part of the east boundary).
- Construction of a new reinforced concrete (RC) retaining wall alongside the new Regent Canalside building (southern part of the east boundary).
- Construction of a new RC retaining wall along the canal frontage (new proposal in revised BIA).
- Retention of the existing (RC) retaining wall along the southern part of the (west-facing) frontage onto Camden Street, with RC underpinning in order to incorporate this wall into the new basement structure (new detail provided in revised BIA).
- A new contiguous bored pile wall along the north, Bonny Street frontage and the northern part of the frontage onto Camden Street.
- Mass concrete underpinning to the RC wall at the north end of the existing ramp structure (new proposal in revised BIA, in lieu of the easternmost part of the bored pile wall, in order to reduce the potential impact on the north wall of Pulse House).

2.1.2 The layout of the bearing piles shown on P&M's Drg No.20216/SK10 rev.D was revised in March (then revision C) following our previous concerns (the locations of some piles were not buildable). The revised layout has addressed that issue.

2.2 Construction Method Statement

2.2.1 A Construction Management Plan (sub-titled Method Statement for Planning Stage) was prepared by Chassay + Last, Architects (C+L). This document provides a very brief summary of the proposed basement works, titled 'Excavation and Basement Construction' (Section 3 in 'OUTLINE SPECIFICATION OF STRUCTURE & ENVELOPE'). It has not been up-dated to suit the revised BIAs, so is now assumed to be withdrawn.

2.2.2 Construction methods have been considered in the following documents:

1. The re-revised BIA report by Price & Myers includes a 'Construction Method Statement' (Supporting Document 1, which contains much of the original Appendix A). The drilling of a third borehole in June 2015 is now noted.
2. 'Temporary Works' (Document 6, originally Appendix E) now has an additional drawing showing a temporary propping scheme for the canal bank; this resolves our previous concerns about the adequacy of support to the canal bank.
3. 'Construction Management Plan' (Document 9). This comprises annotated diagrams with a tabulated 20-stage 'Outline Sequence of Works' summary for the basement construction phase, which was further revised on 30th April 2015. This is more detailed than the original version, and now includes both the RC liner wall (which will be essential to maintain the stability of the mass concrete underpins

along the boundary with Pulse House), and the new RC wall alongside the Regent Canalside development.

4. In various sections of the covering letter from P&M dated 25th March 2015.

2.2.3 The covering letter from P&M dated 25th March 2015 clarifies that construction of the retaining wall, which will span over the Fleet Sewer at the north-west corner of the site, "will be constructed in sections" and will be agreed with Thames Water.

2.2.4 As most of the consideration of construction methods has been presented in the supporting documents to the revised BIAs, the matters arising in relation to construction methods are presented in the following review of the BIAs.

2.3 Re-revised Basement Impact Assessment Reports

2.3.1 The structure of the re-revised (v7, July) Basement Impact Assessment (BIA) prepared by Price & Myers (report Ref: 20216) is essentially the same as the previous revised version (v5, March 2015). It now comprises a 'Non-technical Summary & Mitigation Measures' (page 2), the three Screening tables which form Stage 1 of the process required by CPG4, and 15 'Supporting Documents'. Supporting Document 3 is a 'Site investigation and Basement Impact Assessment Report' by Geotechnical & Environmental Associates (GEA, report Ref: J13304, 'Revised Final' status dated 27 March 2015), which covers ground stability and groundwater matters but not surface water/flooding.

2.3.2 These two BIAs have been assessed against the revised (September 2013) version of CPG4.

2.3.3 The authorship of Price & Myers' re-revised BIA, has reverted to Phil Hudson CEng MIStructE MICE, as sole lead author. The supporting authors (Dimitris Linardatos CEng MICE Steve Branch CGeol of GEA) are no longer listed on the front page, though Dimitris Linardatos has now signed the relevant hydrological and drainage-related documents (No's 4 & 7) and has checked, approved and signed Screening Table 3. Similarly, Steve Branch of GEA has checked, approved and signed Screening Tables 1 & 2.

2.3.4 The authors of GEA's BIA and site investigation report were Steve Branch (see above), Martin Cooper CEng MICE and John Evans CGeol (Hydrogeologist). Their qualifications cover all the professional qualifications required by CPG4 with the exception of hydrological expertise, which was excluded from their report.

2.3.5 GEA's BIA report covers the four Stages required by CPG4. Relevant desk study information about the site's history, geology, hydrology and hydrogeology is collated in Section 2, which is a sensible approach. The contamination risk assessment has not been reviewed as that falls outside the scope of CPG4. The GEA BIA report was originally prepared in November 2013; while some aspects have been up-dated in March 2015, it is not fully aligned with the current scheme. For instance, the report does not allow for the proposed deepening of the existing basement beneath the southern part of the site.

2.3.6 P&M's re-revised BIA emphasises several times the benefit of having archive drawings of the existing buildings. While certainly useful, it must be remembered that these do not appear to be as-built drawings, and it is not uncommon for the sub-structures actually built to differ from the design drawings.

Screening:

2.3.7 The Stage 1 Screening requires responses to the questions identified in CPG4 and the Camden GHHS (Arup 2010); these responses are presented in Section 3.0 of GEA's BIA report and Tables 1-3 of P&M's version. Several questions were answered 'No' by GEA without giving any justification, albeit these 'No' answers all

appeared to be appropriate, whereas P&M did provide justifications. Some of the issues in the Screening of previous concern also arise in other documents so, rather than considering separately each of the Screening issues and each of the supporting documents, paragraphs 2.3.19 to 2.3.31 below provide a review of each of those issues .

2.3.8 Questions for which we previously considered either the response or the justification by P&M to be inappropriate have all now been answered appropriately; however, some of the justifications given by P&M in a BIA version 6 were still not appropriate.

The Screening justifications for Q1B and Q6 in Table 1 have been revised in version 7 and now acknowledge that the design groundwater level will be "significantly higher" than the highest level recorded during the ground investigation, that a "comprehensive pumping and groundwater control strategy will need to be applied to the construction process for the new basement and its foundations", and that it is "reasonable to assume that the canal structure leaks".

2.3.9 The previous inappropriate justification in Screening Table 3 for Q6 has now been revised and is appropriate, identifying the risk of surface water flooding from both the topographic 'depression' in the Bonny Street highway and from Regents Canal.

Scoping:

2.3.10 Section 4 of GEA's BIA report presents the Scoping which forms Stage 2 of the BIA process. This considered all the Screening issues which had been identified with the exception of Groundwater Screening Q6 (excavation may extend below mean water level in canal). This omission appeared to have arisen because GEA's revised report did not allow for the proposed deepening of the southern part of the basement.

2.3.11 For each of the identified potential impacts, a brief note was provided on the possible consequences. These are generally appropriate.

2.3.12 Scoping for Surface Flow and Flooding has been added to Supporting Document 4, now called Basement Impact Assessment & Flood Risk Assessment. A Drainage Strategy (Document 7) have been provided in order to address surface water issues. Our concerns about the identified consequences of flooding from the canal towpath in P&M's BIA v6 have been resolved by a revised statement in version 7.

Ground Investigation (Stage 3):

2.3.13 Sections 5 and 6 of GEA's BIA report present the scope and findings from the site-specific ground investigation which forms Stage 3 of the BIA process. This site investigation was originally limited (by the client) to two boreholes drilled with window sampling equipment to depths of 5.50-6.00m below ground level. A third borehole was drilled in June 2015 to 8m below ground floor level, and a fourth borehole was attempted at four locations but all were abandoned on concrete obstructions (new Document 15). Standpipes were successfully installed in two of the three borehole positions, BH2 in 2013 and BH3 in 2015. As the site is underlain by London Clay (with only a limited thickness of Made Ground where the existing basement is present, and discontinuous remnants of alluvial sands and gravels), it is unlikely that a consistent groundwater flow direction could be determined, so three boreholes and two standpipes could be considered reasonable for planning purposes; however, the greater uncertainty regarding ground and groundwater conditions will need to be allowed for in interpreting the findings. P&M state that a further ground investigation will be undertaken during detailed design.

2.3.14 Despite the availability of some historic engineering drawings of the existing buildings, hand dug trial pits ought to have been excavated alongside the boundary walls to be underpinned (including Pulse House) in order to confirm the depths and nature of the existing foundations, and to enable further assessment of the ground and groundwater conditions. Such pits would have allowed a greater awareness of the relative levels and enabled more specific conclusions to be reached in the BIA; they will be required during the detailed design stage in order to assess the required heights of the underpins.

2.3.15 Fine rootlets were noted in BH1 in the uppermost 1.4m of the London Clay, which, at 4.10-5.50m below ground level (bgl), is unusually deep. BH1 was close to the largest of the three trees on the Bonny Street footway which is the only feasible source for these roots (assuming that they were live). This suggests that standard NHBC guidance on extent of influence of roots from this tree will not apply here.

Impact Assessment (Stage 4):

2.3.16 GEA's 'Design Basis Report' (Section 9) is effectively part of the impact assessment. Their advice and recommendations are broadly sound, though rather general, and all subject to the recommended further ground investigations, which is appropriate.

2.3.17 The depth of excavation for the new, northern section of basement is repeatedly given as 3.80m, whereas the basement's finished floor level will be 3.0-4.1m below the adjacent roads (as given on Chassay + Last's drawings) and when the thickness of the basement slab, insulation and floor finishes is taken into account the depths of excavation are likely to be in the order of 3.5-4.5m.

2.3.18 Section 10.0 of GEA's BIA report is identified as the impact assessment (as previously). Their, separate report on Ground Movement Analyses (Document 8) considers the potential impact of the proposed basement on the adjoining and adjacent structures. During the recent re-development of Pulse House (now Morgan House) the front wall was removed at ground floor level and replaced with a metal screen/gates, so our previous concerns regarding damage to the front wall of Pulse House caused by future growth of nearby trees no longer applies.

Groundwater:

2.3.19 Our previous concerns regarding groundwater centred on the apparently dismissive nature of the approach taken by the applicants to groundwater and the presence of the canal. It is also noted that GEA considered that groundwater is "*the main issue that requires careful consideration at this site*…" (Section 11.0). The new temporary works scheme for the canal bank (P&M Drg No.20216/SK27) includes use of interlocking trench sheets with clutch sealant, which represents a significant improvement on previous proposals. Points of note are:

1. It is now common ground that the groundwater encountered at 0.42m in BH2 (immediately beneath the concrete floor slab) was perched groundwater above the London Clay. However, this is not reflected by the groundwater level on P&M's new Drg No.20216/SK29 which is shown at a constant level of 22.050m. This is inappropriate because it is well below the level of the water strike recorded at 22.78m (0.42m bgl) in BH2. and the groundwater level in BH3 (22.03m), this indicates that recharge may be occurring from the canal into the surrounding ground
2. Similarly it is now common ground that the canal may be leaking (as acknowledged by GEA), and the Made Ground beneath the building has been shown to be permeable sands, which, together with the sand & gravel immediately overlying the London Clay, will permit flow through the site. When the

water level in the canal (23.14m) is considered in conjunction with the groundwater levels in BHs 2 & 3 (see above) it suggests, provisionally, that there is a northwards flow (recharge) from the canal.

3. The current geotechnical design codes (Eurocode EC7 and the superseded BS) require the use of worst credible groundwater levels. Given the water level in the canal and the high risk of flooding over the towpath (see below), P&M have now agreed that the design groundwater level should be "significantly higher" than the level recorded by the ground investigation. The actual design level has not been agreed, pending further ground investigation and monitoring. A hydrogeologist and/or a geotechnical engineer must therefore be appointed to determine the appropriate groundwater design level and must approve any subsequent changes to the detailed design.
4. The Flood Risk Assessment still states that "*As the site is not located within any aquifer catchment areas the proposed basement will not have an impact on any below ground flow paths and therefore will not increase the risk of flooding to the surrounding areas*" (Document 4, end of Section 4.2). This claim is not correct; groundwater flow can occur through granular Made Ground above the London Clay (where not prevented by obstructions), especially in areas of sloping ground, and where such flow does occur, creation of a major obstruction such as a large basement may have an impact. That impact would usually be limited to a small rise in groundwater levels on the upslope side of the basement which, in most cases, would not cause any problems though, where existing old cellars/basements without waterproofing are present just above groundwater level, then flooding may occur. Fine sand horizons do also occur within the London Clay and, where those are sufficiently interconnected, flow can occur through them. While it is understood that there is no cellar under Pulse House, the ground floor does step down progressively southwards. Thus, while it is considered unlikely that the proposed basement will have an adverse impact on groundwater flow and levels around the basement, further ground investigation and groundwater monitoring will be required to confirm that.

Adequacy of temporary support to Canal Tow Path:

2.3.20 The section across the proposed building's southern retaining wall, towpath and canal (SK25 in Document 5) indicates that the basement slab excavations will reach 0.7m below the existing floor slab, and the underside of the pile caps will require a further 0.65m depth of excavation to 1.55m below the tow path level. The pile caps are shown on the 'Lower Ground Floor and Foundations' plan to extend along almost the whole length (89%) of this retaining wall, so the total volume of excavation will be significant. P&M's new Drg No. SK27 'Temporary Propping Scheme to Boundary with Canal Tow Path' provides for the use of use of interlocking trench sheets with clutch sealant and a substantial temporary support framework. This represents a significant improvement on previous proposals and is considered appropriate subject to formal design analyses. Thus, our previous concerns that the stability of the tow path and canal bank had not been given adequate consideration have been resolved.

Surface Water flooding over the Canal Tow Path:

2.3.21 An extract from the EA's map of 'Risk of Flooding from Surface Water' (EA website, 2014) is presented in Figure 1 below, which shows that a 'High' risk of surface water flooding from the adjacent canal is predicted, including the towpath alongside the site of current interest. Appropriate flood resistance measures have now been recommended in the Flood Risk Assessment.

2.3.22 It is understood that the published Environment Agency map of surface water flood risk is less detailed than the full model, so the EA could be consulted for further details of the maximum predicted flood level of water from the canal.

Temporary Support:

2.3.23 The statement in Section 7.2 of Supporting Document 1 that "*existing retaining structures … will be examined and suitable temporary works devised if necessary*" gives no confidence that the essential temporary support will be installed. As the whole of the basement slab will be broken out and removed, and the existing walls to be retained will be underpinned, we cannot envisage a situation where temporary support would not be required. Submission of appropriate temporary support designs should be conditioned (see Section 3.3).

Ground Movement and Damage Category Assessment:

2.3.24 The ground movement analyses in GEA's Supporting Document 8 provide detailed modelling of predicted ground movements around the excavations, and the accompanying diagrams indicate that the increase in depth of the existing basement has been allowed for (unlike in GEA's BIA).

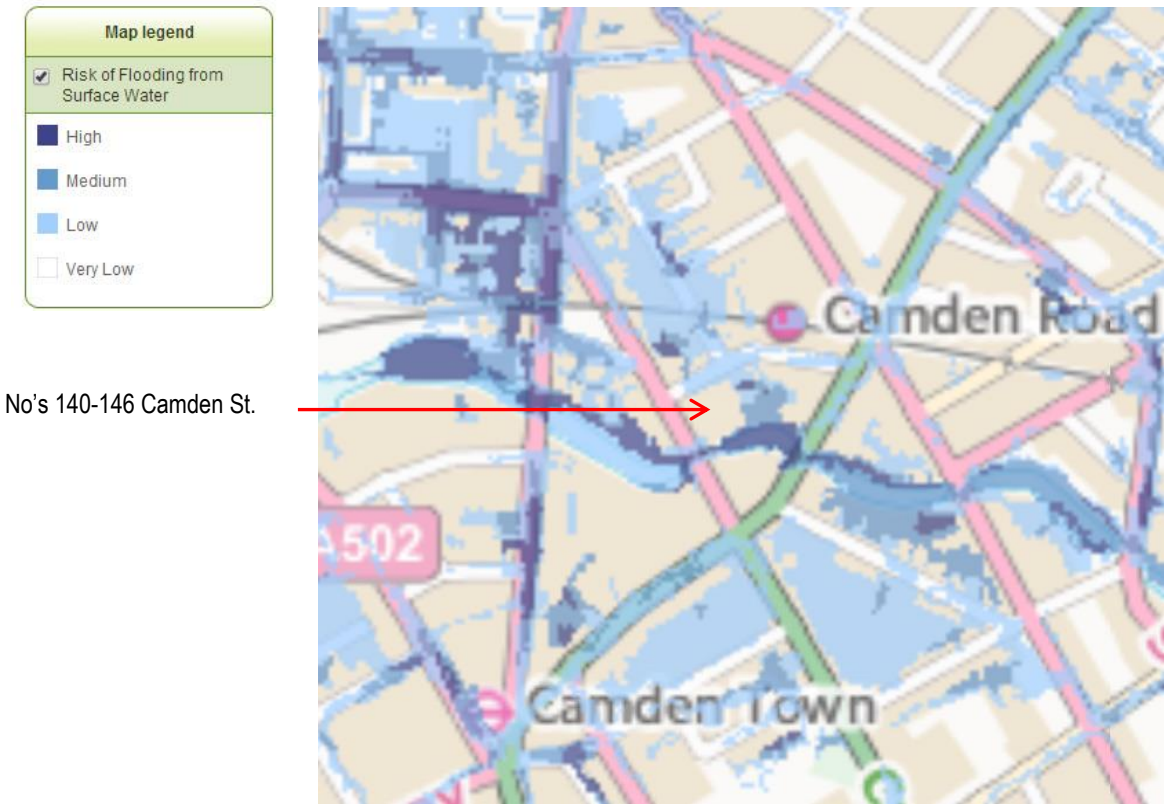

Figure 1: Extract from the Environment Agency's map of 'Risk of Flooding from Surface Water'.
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2.3.25 The acceptability of the predicted displacements on the Fleet river/sewer tunnel must be assessed by Thames Water.

2.3.26 For Pulse House, Section 7.2 in supporting Document 1 states that the ground movement analysis predicts "potential moderate to slight movement in this building". Moderate movement would exceed the acceptable limit of 'slight' movement given in CPG4. GEA's Ground Movement Assessment report concludes "*it is considered that this can be reduced by the proposed replacement of the bored pile wall with underpinning in that area, and / or by additional stiffening in that area*". P&M's scheme includes underpinning of the front wall of the existing ramp alongside Pulse House (as well as underpinning of the party wall with Pulse House). Ideally, GEA's analysis should have been re-run for the extent of underpinning now proposed; that should be undertaken as part of the detailed design.

Mitigation:

2.3.27 A brief summary of the proposed mitigation measures has been provided on page 2 of P&M's BIA report.

Monitoring:

2.3.28 Monitoring proposals were added as supporting Document 14 to version 6 of P&M's BIA, and were revised in version 7 in response to our feedback. These proposals include trigger levels and actions to be taken when recorded movements approach or exceed the given trigger values. The proposals are now considered appropriate.

Drainage:

2.3.29 Suitable calculations in relation to foul and surface water drainage (and the changes caused by this redevelopment) have been included in Document 7 (Drainage Strategy); these calculations incorporate current design standards and an allowance for climate change. A control mechanism to limit surface water outflows to sewer, including an on-site SuDS (storage tank), has been incorporated – the proposal appears to be sensible, although installation details are sketchy. The additional outflow of foul drainage (peaking at 11 lit/sec with all domestic outlets in operation) from the new housing is compared to the reduction in peak stormwater flows for the current development (down from 20 lit/sec in a 30-year rainfall event to a controlled 5 lit/sec); this will be a matter for Thames Water to find acceptable for adoption.

2.3.30 A Flood Risk Assessment (FRA) has been included as Document 4. The transposition errors in the initial version of Figure 2 have been corrected. Comments on potential flood risk from the Canal and across the towpath had been made previously by us (in Section 2.3.21 of our previous Review) and on Figure 1 above, and this aspect has now been addressed in the latest (July) revision of the FRA. Canals are frequently conduits for licensed/unlicensed surface water outfalls (and will have concomitant overflow weirs leading to watercourses/sewers), and hence normal water levels may rise in storm conditions; confirmation needs to be obtained from Canal & River Trust on this aspect (and/or the EA & Thames Water).

2.3.31 The FRA also acknowledges the risk from surface water ponding on Bonny Street, and proposes a bypass solution incorporating a siphoned pipe and outfall (to the Canal towpath). The details of this 'relief pipe' are preliminary, and will need further design evaluation and licensing of outfall, but the concept is not uncommon albeit the functionality of such submerged pipework requires regular maintenance.

2.4 Technical evidence from Consultees

2.4.1 Thames Water's consultation response states that the existing wastewater infrastructure cannot accommodate the needs of the proposed development. Their preferred solution is for all surface water to be disposed of on-site using SuDS. The new Drainage Strategy document recommends temporary interception storage in order to manage the rate of overall discharge(s) to the public sewers, which is considered a rational approach for a site which has no open land presently upon which permeable in-ground solutions could be proposed (the site also being underlain at depth by impermeable strata). As mentioned in 2.3.29 - 2.3.31 above, it would necessary to submit detail of the foul and surface water drainage proposals to the consultees for further comment and evaluation/approval of outfall(s)

3.0 COMPARISON AGAINST LONDON BOROUGH OF CAMDEN'S REQUIREMENTS

3.1 Compliance with requirements for Basement Impact Assessment

3.1.1 GEA's Basement Impact Assessment (BIA) report is structured appropriately so that it covers Stages 1 to 4 of the requirements in LBC's CPG4 'Basements and Lightwells' and the associated Camden GHHS (Arup 2010). The revised GEA version does not cover surface water and flooding, which is dealt with by Price & Myers in their FRA and Drainage Strategy (supporting Documents 4 and 7 respectively).

3.1.2 The initial ground investigation scope comprised two boreholes and laboratory testing; a third borehole was drilled in June 2015. Groundwater monitoring was only possible in two of these boreholes because the Made Ground in BH1 collapsed, preventing installation of a standpipe, and the monitoring undertaken has been minimal.

3.1.3 P&M's re-revised BIA acknowledges that further ground investigation will be required during the detailed design stage. This investigation should include trial pits (see paragraph 2.3.14), deeper boreholes, and groundwater monitoring in order to obtain an adequate understanding of groundwater distribution around the site, and of the degree of fluctuation of the water levels. This monitoring is considered essential in order to permit a proper evaluation of the impact of the basement on the groundwater.

3.1.4 A detailed commentary on matters arising from the BIA reports is presented in Section 2.3. Our previous concerns in relation to procedural aspects of CPG4 have generally been addressed, though we note:

i. The structure of the documents is un-necessarily complicated, with two partial BIAs within an overall 'BIA', with Screening sections having to be countersigned by those with the required qualifications, and 13 other supporting documents. This structure has not aided clarity and risks confusion regarding requirements for the detailed design stage.
ii. A single Non-technical Summary has been added at the front (page 2) of P&M's re-revised BIA. This does not strictly comply with the requirement in clause 2.10 of CPG4 for a non-technical summary "*against each stage of the BIA*", but has been indicated to be acceptable by LBC's case officer.

3.2 Technical sufficiency of the work carried out

3.2.1 Our previous concerns about the Basement Impact Assessments have generally been resolved, or undertakings have been given that outstanding issues will be dealt with during detailed design. Conditions

should be imposed on any planning consent granted to ensure that the undertakings given are implemented, as set out in Section 3.3 below.

3.2.3 The groundwater regime has not been adequately investigated and initially there appeared to have been a dismissive approach to its significance, despite groundwater being found immediately under the floor slab of the existing basement and the need to excavate at least 1.2m below the water level in the adjacent canal. Further monitoring and impact assessment will be required during the full design investigation.

3.3 Completeness of the Submission

3.3.1 The following matters could sensibly be made the subject of planning conditions to be imposed on any consent granted. Some aspects of these requirements are included in the mitigation measures listed by P&M on page 2 of the re-revised BIA.

i. Submission of factual and interpretive reports on the further ground investigation. This ground investigation should include trial pits alongside the perimeter walls which will be incorporated into the proposed building, in order to clarify the extent of underpinning required, and installation of additional groundwater monitoring standpipes/piezometers.

ii. Submission of a report by a suitably competent hydrogeologist or geotechnical engineer on the further groundwater monitoring, including a further assessment of the potential impact of this basement on the groundwater regime (both within, and perched above, the London Clay Formation) and recommended final design groundwater levels (which will vary around the perimeter of the basement). [We note that the groundwater level shown as 22.050m on P&M's new Drg No.20216/SK29 is inappropriate because it is well below the level of the water strike recorded at 22.78m (0.42m bgl) in BH2. When considered in conjunction with the water level in the canal (23.14m) and the groundwater level in BH3 (22.03m), this indicates that recharge may be occurring from the canal into the surrounding ground].

iii. Submission of the appointed contractor's method statements and temporary works designs, which must have been approved by the appointed structural engineer and, if separate, the temporary works engineer. These method statements and designs should include full details of all temporary work to support the excavations, the existing structures to be retained, and the new retaining walls prior to completion of the permanent works, in order to minimise movements in the adjacent ground. Particular attention will be required to:

   a. support for the Canal bank and the exclusion of groundwater;
   b. minimising noise and vibration during the works. Use of non-percussive techniques could be made mandatory for all demolition and breaking-out, although the use of hammer drills will be unavoidable.

iv. A requirement for an appropriately competent ground engineer, who complies with the relevant professional qualification requirements within CPG4 and/or is a member of the UK Register of Ground Engineering Professionals at Adviser grade, to be retained by the applicant for the duration of the groundworks. The ground engineer's brief should be to review all scheme drawings, specifications, method statements and other relevant documents, and to inspect the works and the ground exposed at appropriate stages, so that he/she is able to advise the applicant and his appointed structural engineer regarding the adequacy of all ground engineering aspects of the permanent and temporary works.

3.3.3 The planning conditions proposed above should require the applicant to submit the document(s) concerned to the Planning Authority for their review and approval in writing, prior to the start of basement construction works on site.

3.4 Requirement for further Submissions

3.4.1 Provided that the conditions proposed above are considered acceptable and are imposed on any consent granted, then we consider that no further revisions of the BIAs are required.

4.0 CONCLUSIONS

4.1 These conclusions consider only the six specific requests in the enquiry letter from London Borough of Camden (dated 10th February 2015). Each is considered in turn below. The whole report should be read to obtain a full understanding of the matters considered.

1. *The submission contains a Basement Impact Assessment, which has been prepared in accordance with the processes and procedures set out in CPG4.*
   The re-revised BIAs are now largely compliant with the required procedures, although the process of arriving at this stage has been un-necessarily tortuous.

2. *The methodologies have been appropriate to the scale of the proposals and the nature of the site.*
   The methodologies have broadly met the requirements in CPG4, though the unusual and fragmented structure of the re-revised documents submitted has not aided clarity.

3. *The conclusions have been arrived at based on all necessary and reasonable evidence and considerations, in a reliable, transparent manner, by suitably qualified professionals, with sufficient attention paid to risk assessment and use of conservative engineering values/estimates.*
   Further ground investigation evidence is still required, in part because the British Transport Police still occupy part of the building; an appropriate condition should therefore be applied to any consent granted (see 3.3.2 i & ii above).
   Suitably qualified professionals have now checked and countersigned relevant documents where they had been compiled by others.

4. *The conclusions are sufficiently robust and accurate and are accompanied by sufficiently detailed amelioration/mitigation measures to ensure that the grant of planning permission would accord with DP27, in respect of*
   a. *maintaining the structural stability of the building and any neighbouring properties*
   b. *avoiding adversely affecting drainage and run-off or causing other damage to the water environment and*
   c. *avoiding cumulative impacts on structural stability or the water environment in the local area*

   Once the items subject to the recommended conditions on any consent have been fully delivered, then we anticipate that the proposals would be sufficiently robust to ensure accordance with DP27.

5. *Raise any reasonable concerns about the technical content or considerations of the submission which should be addressed by the applicant by way of further submission, prior to planning permission being granted. In this case it would need to be apparent that the submission is so deficient in some respect that the three conclusions (points 4a-c above) cannot be guaranteed without the provision of further information at this stage. Please clearly denote the precise information (if any) that would be required to satisfy 4a-c*

   See Sections 3.2 to 3.4 above.

6. *Raise any relevant and reasonable considerations in respect of the structural integrity or condition of the road and the neighbouring properties which may be unknown or unaccounted for by the submission, or which would benefit from particular construction measures or methodologies in respect of the development following a grant of permission for the development. Please clearly denote what such conditions should entail.*

   The structural condition of the Fleet Sewer, which passes diagonally beneath this site, is not known and will need to be protected to the satisfaction of Thames Water.

   We are not aware of any abnormal conditions affecting the adjacent roads, though no site inspection was included in this review.

   If planning consent is granted, the detailed condition of the adjoining properties should be established by condition surveys under the Party Wall Act processes.

   Use of best practice methods of underpinning and temporary support will be essential to control adequately ground movements, and hence minimise structural damage in Pulse House (now called Morgan House) and its neighbouring properties, although control of temporary works through the planning system is known to be difficult.

   Items which could be made the subject of planning conditions, rather than being required prior to planning, are listed in paragraph 3.3.2.

References

Arup (November 2010) Camden geological, hydrogeological and hydrological study – Guidance for subterranean development. Issue 01. London.

BS EN 1997-1 (2004) Eurocode 7: Geotechnical Design – Part 1: General rules. British Standards Institution.

London Borough of Camden (2013) Camden Planning Guidance CPG4– Basements and lightwells.

NHBC (2013) NHBC Standards, Chapter 4.2, Building Near Trees.

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b) Save for the client no duty is undertaken or warranty or representation made to any party in respect of the opinions, advice, recommendations or conclusions herein set out.
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