Independent Assessment
of
Basement Impact Assessment for planning application 2014/3625/P
(SECOND UPDATE)
at

Flat 1, 8 Lindfield Gardens
London
NW3 6PU

for
London Borough of Camden

LBH4260

December 2014

LBH WEMBLEY

Geotechnical & Environmental

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Foreword-Guidance Notes

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The report may present an opinion on the disposition, configuration and composition of soils, strata and any contamination within or near the site based upon information received from third parties. However, no liability can be accepted for any inaccuracies or omissions in that information.

1. Introduction

This property is a large three storey house set on a southwest facing hillside. The property is now divided into a number of separate apartments. An existing lower ground floor/basement is present beneath the front of the property and houses Flat A.

This development proposal is made by the occupier of the upper ground floor Flat 1, who owns a garage located adjacent to Flat A.

It is proposed to extend the existing basement / lower ground floor level rearwards from the garage into the hillside along the northwestern side of the property, adjacent to the boundary wall with no. 10 Lindfield Gardens, and across the back of the property to form an L-shape.

The formation level of the proposed works is approximately 3.5 metres below upper ground floor level.

1.1 Brief

LBH WEMBLEY Geotechnical & Environmental have been commissioned to provide an Independent assessment of information submitted against the requirements of LDF policy DP27 (but also including CS5, CS14, CS15, CS17, CS18, DP23, DP24, DP25 and DP26 – as stated at paragraphs 1.5 and 1.6 of CPG4) and with reference to the procedures, processes and recommendations of the Arup Report and CPG4 2013.

1.2 Report Structure

This report commences with a description of the LDF policy requirements, and then considers and comments on the submission made and details any concerns in regards to:

1. The level of information provided (including the completeness of the submission and the technical sufficiency of the work carried out)
2. The proposed methodologies in the context of the site and the development proposals
3. The soundness of the evidence presented and the reasonableness of the assessments made.
4. The robustness of the conclusions drawn and the mitigation measures proposed in regard to:
    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
5. Specific details of any further information that is required to enable an assessment to be satisfactorily concluded.
6. Any reasonable considerations in respect of the structural integrity or condition of the road and neighbouring properties which would benefit from particular conditions being placed upon a planning approval.

1.3 Information Provided

The information studied comprises the following Documents:

1. Structural Engineering Report and Subterranean Construction Method Statement by Elliot Wood, dated 20th October 2014, Ref: 212685 Rev: P5
2. Ten Existing Drawings referenced P13-100 D001, D002 and D003 dated 22.05.14 by Canaway Fleming Architects
3. Proposed Drawings 212685 S.090 P4 12.06.13, S.100 P4 06.05.14,S400 P4 25.03.13,S401 P3 25.03.13, S.402 P1 06.05.14, A1 P2 22.03.13 A2 P2 22.03.13 by Elliot Wood (Included as Appendix 1 of Document 1)
4. Eight Proposed Drawings referenced P13-100 D002 dated 22.05.14 by Canaway Fleming Architects
5. Ground Investigation by Site Analytical Services dated March 2013, Ref: 13/20316 (Included as Appendix 2 of Document 1)
6. Slope and Ground Stability Assessment by Site Analytical Services dated April 2014, Ref: 13/20316.2 (Included as Appendix 3 of Document 1)
7. Surface Water Assessment by Elliott Wood dated March 2103, Ref: 212685 (Included as Appendix 4 of Document 1)
8. Groundwater Assessment by Paul Thomson dated 11th September 2014, Ref: R1 Issue:3
9. Phase 1 Preliminary Risk Assessment by Site Analytical Services dated March 2013, Ref: 13/20316.1 (Included as Appendix 6 of Document 1)
10. Calculation of ground movement by Applied Geotechnical Engineering dated 13th May 2014, Ref: P2351 (Included as Appendix D of Document 6)
11. Freeholder's Objection Report by Stark & Associates dated 23rd June 2014
12. Structural Monitoring Proposals by Elliott Wood dated 10th October 2014, Ref: 212685 Rev P2

2. Policy DP27 – Basements and Lightwells

The CPG4 Planning Guidance on Basements and Lightwells refers primarily to Planning Policy DP27 on Basements and Lightwells.

The DP27 Policy reads as follows:

In determining proposals for basement and other underground development, the Council will require an assessment of the scheme's impact on drainage, flooding, groundwater conditions and structural stability, where appropriate. 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 ground instability. We will require developers to demonstrate by methodologies appropriate to the site 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 we will consider whether schemes:

d) harm the amenity of neighbours;
e) lead to the loss of open space or trees of townscape or amenity value;
f) provide satisfactory landscaping, including adequate soil depth;
g) harm the appearance or setting of the property or the established character of the surrounding area; and
h) protect important archaeological remains.

The Council will not permit basement schemes which include habitable rooms and other sensitive uses in areas prone to flooding. In determining applications for lightwells, the Council will consider whether:

i) the architectural character of the building is protected;
j) the character and appearance of the surrounding area is harmed; and
k) the development results in the loss of more than 50% of the front garden or amenity area.

In addition to DP27, the CPG4 Guidance on Basements and Lightwells also supports the following Local Development Framework policies:

Core Strategies:

- CS5 Managing the impact of growth and development
- CS14 Promoting high quality places and conserving our heritage
- CS15 Protecting and improving our parks and open spaces & encouraging biodiversity
- CS17 Making Camden a safer place
- CS18 Dealing with our waste and encouraging recycling

Development Policies:

- DP23 Water
- DP24 Securing high quality design
- DP25 Conserving Camden's heritage
- DP26 Managing the impact of development on occupiers and neighbours

This report makes some specific further reference to these policies but relies essentially upon the technical guidance provided by the Council in November 2010 to assist developers to ensure that they are meeting the requirements of DP27, which is known as the Camden Geological, Hydrogeological and Hydrological Study, Guidance for Subterranean Development (CGHHS), and was prepared by Arup.

3. Assessment of Adequacy of Information Provided

3.1 Basement Impact Assessment Stages

The methodology described for assessing the impact of a proposed basement with regard to the matters described in DP27 takes the form of a staged approach.

3.1.1 Stage 1: Screening

Screening uses checklists to identify whether there are matters of concern (with regard to hydrogeology, hydrology or ground stability) which should be investigated using a BIA (Section 6.2 and Appendix E of the CGHSS) and is the process for determining whether or not a BIA is required. There are three checklists as follows:

- subterranean (groundwater) flow
- slope stability
- surface flow and flooding

3.1.1.1 Subterranean (Groundwater) Flow

A screening checklist for the impact of the proposed basement on groundwater is included in Document 8 (Groundwater Impact Assessment by Paul Thomson dated September 2014).

This states that:

- **The site is NOT within 100m of a watercourse, well (used/disused) or potential spring line**
- **The proposed development WILL result in a change in the area of hard-surfaced/paved external areas.**

An earlier screening checklist for the impact of the proposed basement on groundwater was included in Document 6 (April 2014).

This stated that:

- **The site IS within 100m of a watercourse.**
- **The proposed development is NOT expected to result in a change in the area of hard-surfaced/paved external areas.**

3.1.1.2 Slope Stability

A screening checklist for the impact of the proposed basement on land stability was included in Document 6 (Slope and Ground Stability Assessment by Site Analytical Services dated April 2014).

This stated that:

- **The existing site includes slopes, natural or manmade, greater than 7 degrees (1 in 8).**
- **The development neighbours land with a slope greater than 7 degrees (1 in 8).**

- **The site is within a wider hillside setting in which the general slope is greater than 7 degrees (1 in 8).**
- **Trees will be felled as part of the proposed development and/or works are proposed within tree protection zones where trees are to be retained**
- **There is a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site.**
- **The site IS within 100m of a watercourse.**
- **The site is within an area of previously worked ground.**
- **The site is within 5m of a highway or pedestrian right of way.**
- **The proposed basement WILL significantly increase the differential depth of foundations relative to the neighbouring properties.**

3.1.1.3 Surface Flow and Flooding

A screening checklist for the impact of the proposed basement on surface water flow and flooding was included in Document 7 (Surface Water Assessment by Elliot Wood dated March 2013).

This stated that:

- **The proposed basement development will result in a change in the proportion of hard-surfaced/paved external areas.**

A more recent screening checklist for the impact of the proposed basement on surface water flow and flooding was included in Document 6 (April 2014).

This stated that:

- **The proposed development is NOT expected to result in a change in the area of hard-surfaced/paved external areas.**

3.1.2 Stage 2: Scoping

Where the checklist is answered with a “yes” or “unknown” to any of the questions posed in the flowcharts, these matters are carried forward to the scoping stage of the BIA process.

The scoping produces a statement which defines further the matters of concern identified in the screening stage. This defining should be in terms of ground processes, in order that a site specific BIA can be designed and executed (Section 6.3 of the CGHSS).

Checklists have been provided in the BIA and scoping stages are described in the submission (Documents 6, 7 and 8). On the face of it there are some obvious discrepancies between the various screenings that have been undertaken. Nevertheless, the issues identified from the checklists as being of potential concern have been assigned bold text in the previous sections and are as follows:

- **The site is within 100m of a watercourse.**
  The guidance advises that the flow from a watercourse may increase or decrease if the groundwater flow regime which supports that water feature is affected by a proposed basement and changes to groundwater regimes within slopes can affect slope stability.

- **The proposed development will result in a change in the area of hard-surfaced/paved areas.**
  The guidance advises that a change in the in proportion of hard surfaced or paved areas of a property will affect the way in which rainfall and surface water are transmitted away from a property. This includes changes to the surface water received by the underlying aquifers, adjacent properties and nearby watercourses. Changes could result in decreased flow, which may affect ecosystems or reduce amenity, or increased flow which may additionally increase the risk of flooding.

- **The existing site includes slopes, natural or manmade, greater than 7 degrees (1 in 8).**
  The guidance advises that there may be local slope instability within the site.

- **The development neighbours land with a slope greater than 7 degrees (1 in 8).**
  The guidance advises that there may be instability within the neighbouring site(s).

- **The site is within a wider hillside setting in which the general slope is greater than 7 degrees (1 in 8).**
  The guidance advises that there may be potential for a larger slope failure system including re-activation of a pre-existing slide.

- **Trees will be felled as part of the proposed development and/or works are proposed within tree protection zones where trees are to be retained**
  The guidance advises that the soil moisture deficit associated with felled tree will gradually recover. In high plasticity clay soils (such as London Clay) this will lead to gradual swelling of the ground until it reaches a new value. This may reduce the soil strength which could affect the slope stability. Additionally the binding effect of tree roots can have a beneficial effect on stability and the loss of a tree may cause loss of stability.

- **There is a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site.**
  The guidance advises that there are multiple potential impacts depending on the specific setting of the basement development.

- **The site is within an area of previously worked ground.**
  The guidance advises that previously worked ground may be less homogenous than natural strata, and may include relatively uncontrolled backfill zones.

- **The site is within 5m of a highway or pedestrian right of way.**
  The guidance advises that excavation for a basement may result in damage to the road, pathway or any underground services buried in trenches beneath the road or pathway.

- **The proposed basement will significantly increase the differential depth of foundations relative to the neighbouring properties.**
  The guidance advises that excavation for a basement may result in structural damage to neighbouring properties if there is a significant differential depth between adjacent foundations.

3.1.3 Stage 3: Site Investigation and Study

Site investigation and study is undertaken to establish the baseline conditions. This can be done by utilising existing information and/or by collecting new information (Section 6.4 of the CGHSS).

A ground investigation was undertaken by Site Analytical Services in February 2013 (apparently prior to both the screening and scoping stages) and is reported in Document 5.

This investigation comprised two cable percussion boreholes to depths of approximately 15m and four hand-dug trial pits to expose the existing foundations. A single groundwater monitoring standpipe was installed to a depth of 10m in one of the boreholes.

An additional borehole was sunk using a flight auger by Site Analytical Services in March 2014 and is reported in Document 6.

3.1.4 Stage 4: Impact Assessment

Impact assessment is undertaken to determine the impact of the proposed basement on the baseline conditions, taking into account any mitigation measures proposed (Section 6.5 of the CGHSS).

Impact assessments are described in the submission (Documents 6, 7 and 8), and the conclusions of these are summarised as follows:

- **The site is within 100m of a watercourse.**
  Document 6 states that the site lies within 100m and between two tributaries of the River Westbourne but that there are no present surface water features or fluvial or tidal floodplains located within 1km of the site and concludes that the proposed development will have minimal impact on any nearby watercourses.

- **The proposed development will result in a change in the area of hard-surfaced/paved areas.**
  Document 8 concludes that there will be no significant changes to the groundwater regime as a result of the proposal and that it is unlikely that the proposed development will result in significant changes to the groundwater regime beneath the site
  Document 7 states that new surface water drainage, including flow controls and attenuation devices will be provided to mitigate the increase in surface water flows from a 110 m^2 increase in hard surfaced area and concludes that, as a result of these mitigation measures to alleviate the potential impact on surface water flows generated on site as part of the new development, the scheme will not increase the risk of surface water flooding elsewhere.

- **The existing site includes slopes, natural or manmade, greater than 7 degrees (1 in 8)**
  Document 6 reports an existing ground level rise of 9m in 75m (less than 1 in 8) and states that the proposed development does not include any remodelling of slopes to angles greater than 7 degrees and concludes that slope stability can be maintained through the proper design of any necessary mitigation measures.

- **The development neighbours land with a slope greater than 7 degrees (1 in 8).**
  Document 6 reports a similar ground level rise of 9m across the length of the neighbouring land and that slopes in the vicinity may have been artificially altered and concludes that slope stability can be maintained through the proper design of any necessary mitigation measures.

- **The site is within a wider hillside setting in which the general slope is greater than 7 degrees (1 in 8).**
  Document 6 reports that the Arup guidance does not indicate slope angles greater than 7 degrees and that the British Geological Survey gives the hazard rating for landslides in the site area as "very low" and concludes that slope stability can be maintained through the proper design of any necessary mitigation measures.

- **Trees will be felled as part of the proposed development and/or works are proposed within tree protection zones where trees are to be retained**
  Document 6 states that trees will be removed and refers to the NHBC guidance.

- **There is a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site.**
  A high susceptibility of the natural soils to shrinkage and swelling movements has been recorded but Document 1 concludes that the new foundations to the basement will by their nature be such that they are below the zone of heave/shrinkage zone of the clay adjacent to the existing trees and consequently the trees will not impact on the proposed works.

- **The site is within an area of previously worked ground.**
  Document 6 states that foundations should be taken through any made ground and either into, or onto suitable underlying natural strata of adequate bearing characteristics.

- **The site is within 5m of a highway or pedestrian right of way.**
  Document 6 states that the proposed basement will not extend below Lindfield Gardens and therefore the impact is likely to be minimal.

- **The proposed basement will significantly increase the differential depth of foundations relative to the neighbouring properties.**
  Document 6 states that the excavation and construction of the basement has the potential to cause movements in the surrounding ground but concludes that ground movements and/or instability will be mitigated through the proper design and construction of mitigation measures and that the basement can be constructed without imposing more than a "very slight" level of damage on the adjoining properties at 6 and 10 Lindfield Gardens.
  Document 10 states that although damage to the host building (No.8) predicted by analytical techniques is "very slight" a greater degree of damage may accrue, the actual degree of damage being controlled to a large extent by the quality of workmanship.

3.2 The Audit Process

The audit process is based on reviewing the BIA against the criteria set out in Section 6 of the CGHSS and requires consideration of specific issues:

3.2.1 Qualifications / Credentials of authors

Check qualifications / credentials of author(s):

Qualifications required for assessments

Surface flow and flooding	A Hydrologist or a Civil Engineer specialising in flood risk management and surface water drainage, with either: • The "CEng" (Chartered Engineer) qualification from the Engineering Council; or a Member of the Institution of Civil Engineers ("MICE"); or • The "C.WEM" (Chartered Water and Environmental Manager) qualification from the Chartered Institution of Water and Environmental Management.
Subterranean (groundwater) flow	A Hydrogeologist with the "CGeol" (Chartered Geologist) qualification from the Geological Society of London.
Land stability	A Civil Engineer with the "CEng" (Chartered Engineer) qualification from the Engineering Council and specialising in ground engineering; or A Member of the Institution of Civil Engineers ("MICE") and a Geotechnical Specialist as defined by the Site Investigation Steering Group. With demonstrable evidence that the assessments have been made by them in conjunction with an Engineering Geologist with the "CGeol" (Chartered Geologist) qualification from the Geological Society of London.

Surface flow and flooding: The report does meet the requirements.

Subterranean (groundwater) flow: The report does meet the requirements.

Land stability: The report does meet the requirements.

3.2.2 BIA Scope

Check BIA scope against flowcharts (Section 6.2.2 of the CGHSS).

The scope of issues of concern has been checked against the flowcharts and it is considered that they have for the most part been identified in section 3.1.2 above.

However, given the reports of a water table within the soils, it is perhaps questionable whether the site lies over an aquifer, albeit that the borehole logs do not identify any substantial water bearing seams of silt or sand to be present.

An alternative explanation for the observed water would be that it has run into the monitoring installations from a high level, and represents a near-surface flow entering the site from an expected spring line at the emergence of the basal Claygate strata that have been assumed to be present beneath the higher ground to the rear of the property.

3.2.3 Description of Works

Does the description of the proposed development include all aspects of temporary and permanent works which might impact upon geology, hydrogeology and hydrology?

It would seem reasonable to expect at least some seepage entering the excavations. The revised construction method statement (October 2014) now requires the contractor to dig a relief trench to intercept any near surface flow of water and to prevent this from entering the underpin excavations, and also requires the contractor to "*Dig trial underpins for inspection by Elliott Wood Partnership to check how well the existing soil is cemented and in particular its ability to "stand up" whilst the individual underpin is completed*". This should provide an opportunity to conclude an assessment of whether or not there is groundwater ingress.

3.2.4 Investigation of Issues

Have the appropriate issues been investigated? This includes assessment of impacts with respect to DP27 including land stability, hydrology, hydrogeology.

The updated groundwater assessment (September 2014) takes into account the April 2014 groundwater monitoring data.

Little information has been provided in regards to the relationship between the proposed basement and the foundations/basements to the neighbouring buildings.

3.2.5 Mapping Detail

Is the scale of any included maps appropriate? That is, does the map show the whole of the relevant area of study and does it show sufficient detail?

The submission would benefit from a topographical survey or ground levels being ascribed to the exploratory boreholes in order to permit analysis of the absolute groundwater levels being measured.

3.2.6 Assessment Methodology

Have the issues been investigated using appropriate assessment methodology? (Section 7.2 of the CGHSS).

The submitted prediction of movements in Document 10 has relied upon Construction Information Research and Information Association (CIRIA) guidance contained in publication 580 *Embedded retaining walls – guidance for economic design* (2003). This guidance covers retaining walls that are supported by embedment and does not mention underpinning such as has been proposed at this site. The guidance may arguably be considered inapplicable to such construction where no embedment is contemplated and the wall will be formed by hand excavation with inevitably greater relaxation of lateral stresses.

It is considered that the movements associated with the use of conventional underpinning may therefore possibly be more significant than have been suggested by use of the CIRIA 580 data. However, it must be said that the amount of movement that will occur in this case cannot really be estimated through modelling and will depend very much upon the standard of workmanship. It is suggested that a "slight" damage category should perhaps at best be expected for the host building rather than a "very slight".

3.2.7 Mitigation

Has the need for mitigation been considered and are appropriate mitigation methods incorporated in the scheme? (Section 5 of the CGHSS)

Provision for additional mitigation may be required in terms of dealing with any water in the both the temporary and the permanent situations. Given the present uncertainty it is considered that an allowance should be made for the possibility that some water will enter the intended excavations and that at least a temporary diversion may be required. This provision in now included and the construction method statement requires the contractor to “Dig trial underpins for inspection by Elliott Wood Partnership to check how well the existing soil is cemented and in particular its ability to “stand up” whilst the individual underpin is completed”. This will provide an opportunity to conclude the assessment of whether or not any additional drainage mitigation measures will be required.

3.2.8 Monitoring

Has the need for monitoring been addressed and is the proposed monitoring sufficient and adequate? (Section 7.2.3 of the CGHSS)

Yes. Document 12 outlines structural monitoring proposals.

3.2.9 Residual Impacts after Mitigation

Have the residual (after mitigation) impacts been clearly identified?

No significant residual impacts have been identified.

4. Assessment of Acceptability of Residual Impacts

4.1 Proposed Construction Methodology

Conventional underpinning techniques are envisaged.

4.2 Soundness of Evidence Presented

There remains residual uncertainty in relation to the water conditions. However, there is now provision for intercepting any high level groundwater in addition to the excavation of initial trial underpins.

4.3 Reasonableness of Assessments

It would be appropriate for the assessments to have included consideration of potential cumulative effects, including the effects of any neighbouring basements.

The updated Document 8 states that *"No impacts to groundwater levels or flows have been identified, so the possibility of cumulative impacts may be ruled out".*

4.4 Robustness of Conclusions and Proposed Mitigation Measures

The inclusion of a groundwater interceptor trench should reduce the risk of groundwater ingress. This trench will collect any near-surface water flow and divert this in both the temporary and permanent situations

It will important to commence with an initial trial pin excavation to the rear of the existing property rather than beneath the rear wall itself in order to confirm that there is no groundwater ingress..

5. Conclusions

The initial submitted BIA reflected the processes and procedures set out in DP27 and CPG4, but it was considered that the original submission did not demonstrate sufficient detail and certainty to ensure accordance with DP27.

It was suggested that the concerns about the submission could be addressed by the applicant by way of further submission.

An updated groundwater impact assessment has been provided that takes account of current groundwater monitoring data and considers that there will not be any cumulative or other impacts.

The surface water impact assessment has not been updated but Document 1 has been updated to provide assurance that any additional surface water collected as a result of the proposed increase in impermeable area will be adequately accommodated.

The Construction Method Statement has now been updated (October 2014) to include specific drainage mitigation measures.

In addition, the structural monitoring proposals have been enhanced (October 2014)

As a consequence of these amendments, the submission is now considered sufficient to accord with DP27, in respect of

a. Maintaining the structural stability of the building and any neighbouring properties
b. Avoiding adverse impact on drainage and run-off or causing other damage to the water environment
c. Avoiding cumulative impacts on structural stability or the water environment.