



**Residual differences of technical opinion on the BIA for Hall School
23 Crossfield Rd London NW3 4NT
Application 2016/6319/P
as of 1st November 2017**

Summary

S1. Although the BIA upon which is based the ground model used for predicting ground movement and damage to neighbouring properties considers the geological and topographical maps of the area, it does not use them to consider the likely geology beneath those properties but concentrates in its interpretation of them on the geology within the footprint of Hall School. This creates a BIA which is inadequate for protecting neighbouring properties.

S2. The flow of ground water is totally misunderstood to the point where it is considered not even to exist. No explanation of why or how that should be so on the side of a valley, not far from its local valley floor, where the valley side is fed by a spring line in an area that receives rainfall throughout the year, is provided. Water levels have not been measured for the better part of two years and thus no understanding of how groundwater at this site responds to seasonal rainfall has been gained. The assurances given that further basement works will have no perceptible hydrogeological effect are unfounded.

S3. The BIA presents an optimistic interpretation of the strength of materials below ground level, basing this on deliberately chosen values that are either less than or greater than those expected. That is adequate for design, but to predict ground response it is necessary to know as well as possible what the real strength of the ground may be and how it varies; particularly if changes occur abruptly. This aspect of the ground appears not to have been appreciated because it has been ignored.

S4. These aspects (S1, S2 and S3) all undermine the confidence with which the predictions of ground movement and damage to properties are based. Campbell Reith is asked to provide an opinion and according to GEA has already expressed an opinion of satisfaction, possibly without having seen the concerns from First Steps. This report sets out the reasons which justify why that opinion should now be reviewed.

Introduction

Two documents from First Steps have been submitted on the subject of the BIA supporting this application; the first, dated 26th January 2017 set out basic concerns and the second, dated 3rd August 2017 highlighted two issues of that report as it appeared the first report had just been ignored. It transpired much later that this was not necessarily the case, as Camden had been unusually late in putting the first report onto their website and Campbell Reith had not harvested it when they visited the web site to gather the documents

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for their review. The first report has now been reviewed by the applicant's technical team and their response to it is embedded in the report from Elliott Wood dated April 2017. The issues that remain unresolved as a result of those responses are now described in this report. The second report, highlighting issues described in the first report, may or may not have been considered by now. Since then, a Revised BIA has been submitted by GEA dated October 2017. It will be assumed that any items in the second report, dated August 2017, will have been dealt with if considered by GEA to be relevant. The issues that remain unresolved as a result of that revised GIA are now also described in this report. Thus this report is in two Parts; Part 1 responds to GEA of April 2017 and Part 2 responds to GEA of October 2017.

**Part 1; response to GEA comments of April 2017 to First Steps
observations of January 2017**

1 Basic Geology

1.1 The issue here is that GEA has to create a numerical model that incorporates the basic characters of the ground in order for it to make reasonably reliable predictions of ground movement. For this an understanding of the ground is required and First Steps has pointed out that the upper levels of the site, the levels on which neighbouring foundations may well be set and through which piles of adjacent properties may pass, has to be recognised as the hill wash that it is.

1.2 GEA in reply misquote the First Steps report where it is said the site "lies close to the centre of a valley", not "at the bottom" of the valley as viewed by GEA. GEA's use of ARUP's map should consider the scale of that map; the First Steps observation is based on the 1:25,000 scale Ordnance Survey sheet. GEA's comments on the likelihood of hill wash being present on site are thus unfounded; the fact that BGS does record these is because the BGS does record shallow near surface geology – however the BGS shows the likely presence of head to the north, west and south of the site and GEA might care to consider what that may mean for locations downslope, as is that of Hall School.

1.3 What it means is shown in the BH from near Winchester Rd which GEA dismiss not on the basis of lithology, which is why it was cited, but on its absence of mechanical properties. That does not make the observation of "dark brown sandy soil" that was present in the borehole invalid. How does GEA propose a sandy soil develops on Clay? They provide no explanation.

1.4 GEA thus reaffirm their belief that because their boreholes did not encounter soft deposits, they do not exist. This is in contrast to the conclusion that naturally come from the topographic setting seen at 1:25,000 scale, the geological map at 1: 50,000 scale and a nearby borehole off site.

1.5 The concerns raised by First Steps, associated with basic geology, remain.

2. Mechanical properties

2.1 First Steps presented in Fig.1 accompanying their report a clear plot of the data with depth, which shows beyond doubt the change that occurs in SPT values at around 7m bgl and the lack of comparison between the gradient of SPT with depth with that of undrained shear strength with depth. (For convenience that Fig.1 is attached) From this it was observed that these circumstances deserve to be explained particularly as they occur in the depth to be excavated, involve undrained parameters which would be those expected to dominate the temporary works, and if typical of conditions outside the intended retaining wall, could have implications for ground stiffness and hence ground movement.

2.2 This reading of the factual evidence has been dismissed by GEA but with no alternative explanation for the changes in gradient seen, or the mismatch of the gradients that is evident or the depths at which those changes occur.

2.3 Indeed GEA vouchsafe, almost in passing, a rather alarming piece of information viz *“As identified in our report, inspection of the failed samples indicated that failure occurred along pre-existing fissures, as can be expected, and therefore the results are not thought to be truly indicative of the insitu strength.”* The alarming information is the report of pre-existing fissures; these are not described and should be. If they are polished palaeo-shears then a major oversight has occurred that affects in-situ strength. If they were tensile fissures then something odd is happening as it is presumed that the confining pressures for the tests were akin to those insitu. For failure like that to occur some relaxation may well be present for the sample is not behaving as a continuum. That would affect stiffness. Either way that comment suggests GEA are not on top of the ground conditions here.

2.4 The concerns raised by First Steps, associated with the mechanical properties of the ground, remain and new ones have emerged.

3. Groundwater

3.1 Three straightforward questions of clarification were asked by First Steps and GEA have responded in a way that unfortunately demonstrates the author of the response does not understand groundwater.

3.2 GEA's response opens with the statement that because the London Clay is not an aquifer it does not support a groundwater table; this is totally wrong.

3.3 GEA's understanding of why groundwater does not enter standpipes in stiff clay fails to acknowledge the role played by negative pore pressures developed around the hole as a result of swelling on relaxation consequent to boring.

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3.3 As a consequence GEA fail to answer the three basic questions put in 10.1, 10.2 and 10.3 of the First Steps report and confuse the task of selecting values for design with that of selecting values to understand the nature of the ground and its likely response to the engineering work. Conservative values are fine for the former but disguise problems with the latter; this has not been appreciated (just as they were not appreciated with respect to strength in the original BIA, as pointed out in para 19 of the First Steps report).

3.4 The concerns raised by First Steps associated with ground water remain.

4. Made Ground

4.1 GEA refuse to accept that waterborne sediments exist in the area and are part of what is described as Made Ground yet refuse to explain where the sandy materials found just below ground level have come from.

4.2 GEA also fail to understand that First Steps is expressing the concerns of those who live outside the site. GEA's response implies they do not believe the conditions described may well exist beneath the foundations of the surrounding properties. They present no justification for that position.

4.3 As a consequence, concern remains about the validity of the predictions being made for vertical settlement and horizontal movement outside the site.

4.4 GEA's response on Made Ground concludes with the extraordinary statement that the wet ground in BH3 is clear evidence of standing (stagnant) water rather than flowing water, without explaining how flowing water would not also wet the ground. The prolonged flow of groundwater would surely wet the ground too. This statement seriously calls into question the picture GEA has of ground water on this site.

4.5 The concerns raised by First Steps associated with Made Ground remain.

5. BIA

5.1 A revised BIA has been submitted dated October 2017 and so comments arising from GEA's response dated April (the response to which this Part 1 of the present report refers) need not be considered.

5.2 There is however another statement referring to ground water which again betrays a misunderstanding by GEA of the groundwater system. GEA note that the site is 500m from the spring and thus not considered to have an impact on the spring line or vice versa. This misses the point that the site is below a spring line and its implication.

5.3 GEA point to the fact that this fact has been signed off by Campbell Reith so it need not be considered further, as if that somehow answers the technical case. *(As a point of information, the concern with groundwater was further*

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explained by First Steps in their letter of August 2017 where it is shown that in excess of 10 thousand cubic metres of infiltrated rainfall can be expected to be heading towards the site during a normal year and is going to have to go somewhere once the enlarged basement is in place.)

5.4. The concerns raised by First Steps, associated with aspects of the BIA, remain.

Part 2; response to GEA revised BIA of October 2017

6. It is not known whether GEA ever saw the second report from First Steps dated August 2017 however GEA did read the first as their responses noted in Part 1 demonstrates. It is therefore disquieting, professionally, to note that not a single issue raised by First Steps as unresolved, and left unresolved by GEA's response, has been addressed in this later report of October 2017, and that the same mistakes are repeated and the same shortcomings persist. These are highlighted below. It should be remembered that the numerical model for predicting damage outside the site uses the geology upon which it is based and if uncertainty exists then the predictions also carry that uncertainty. So each of the issues raised again here is an example of an uncertainty within the model whose predictions have been offered as proof of compliance with Camden's requirements.

7. GEA Section 2.5 Hydrology and Hydrogeology

7.1 *"The London Clay is not capable of supporting a continuous water table"*
This is wrong. A water table will exist and that on site has been undefined. That outside the site, beneath neighbouring foundations, has not even been considered.

7.2 GEA fail to consider what happens with rainfall. This is explained in the First Steps report of August 2017 and for convenience what has been said there is repeated here.

6. With regard to groundwater, the situation could be more serious because groundwater is largely dismissed as a potential problem by virtue of the use of secant piling toeing into London Clay at depth. Water encountered has been described as "perched" implying it sits as local ponds in the ground and that a groundwater table does not exist.

7. That opinion is contrary to two very basic facts;

7.1 the site is almost 20m lower than the spring line on Hampstead Hill, which itself is at the junction of the Claygate sediments with the London Clay only 500m away, uphill on the 75m contour: and

7.2 it rains, and that rain has to go somewhere.

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8. With regard to the second point (7.2). A trace of the topographic contours between the site and Hampstead Hill, up to the boundary between the London Clay and the Claygate sediments, allows lines at right angles to them to be drawn. These lines map the path of flow downhill. A corridor can thus be defined whose width is that of the ground between Crossfield Rd and Strathray Gdns (approximately 130m) and whose length extends from the site to the 75m contour (a distance of approximately 500m). The area of this corridor is 65000m²

9. Rainfall in this area was approximately 660mm for the 12 months of 2016. Assuming 75% of that was lost to evapo-transpiration and runoff from roofs and other hard surfaces discharging to drains, leaves 165mm to infiltrate which, occurring over 65000m², results in 10725m³ of infiltrated water per year; that is equivalent to 2,359,170 Imperial gallons, which would be flowing downhill towards Eton Avenue and thence to the course of the River Tyburn.

7.3 The BIA gives the impression this water will not be a problem, indeed does not exist, but offers no evidence to demonstrate that is so. The additional basement on site will add to the interception and diversion the existing basement already creates for groundwater and the implications of that for surrounding properties should have been considered.

8. GEA Section 3.1.1 Subterranean (groundwater) Screening Assessment

8.1 Q1b; Will the proposed basement extend beneath the water table surface?

A1b; No. The London Clay does not support a continuous ground water table due to the very low permeability. Localised perched groundwater inflows may be encountered from within the Made Ground however these would not be prolonged or of substantial volume.

First Steps comment; That answer is wrong; the London Clay can and does support a water table and there will be one here.

9. GEA Section 3.1.2 Stability Screening Assessment

9.1 Q5; Is the London Clay the shallowest strata at the site?

A5; Yes, the geological map indicates that the site is directly underlain by London Clay.

First Steps comment; That answer is correct for the site but not for the surrounding ground outside the site and it was to protect properties outside a site that these questions were originally posed. Outside the site other strata exist as discussed in Part 1 above, and to avoid them as has been done here is to misuse the purpose of these questions.

10. GEA Section 5.3 Groundwater

10.1 The water levels in 3 boreholes in stiff clay have been measured one month apart approximately 6 days after completion of the holes and one month later: that was in November and December 2015. The levels cannot be related both to themselves and to anything else, yet not a single reading has since been made and it is November 2017. Groundwater at this site has been misunderstood and little if any effort has been made by the applicant to understand it.

11. GEA Section 9.0 Basement impact assessment

11.1 GEA Section on *Cumulative impact*. GEA believe there will be no cumulative impact by the basement on the local hydrogeological setting or the stability of surrounding properties. Unfortunately the many residual issues raised in paragraphs above show that belief is in need of the support that closer attention to geology and groundwater can bring. It is at best optimistic and at worst it could be wrong. Little if any attention has been given to the geology that may exist outside the perimeter of the site and that is the geology on which the neighbours' properties are founded.

12. GEA Section 15.0 Outstanding risks and issues

12.1 GEA rightly say *"The ground is a heterogeneous natural material and variations will inevitably arise between the locations at which it is investigated. This report provides an assessment of the ground conditions based on the discrete points at which the ground was sampled, but the ground conditions should be subject to review as the work proceeds to ensure that any variations from the Ground Model are properly assessed by a suitably qualified person."* However, that caveat sits uncomfortably with the certainty expressed elsewhere. GEA cannot have it both ways.

Yours sincerely



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MH de Freitas PhD, DIC, C.Geol, C.WEM
Director First Steps Ltd, and
Emeritus Reader in Engineering Geology
Imperial College London.
Ground Engineering Adviser,
UK Register of Ground Engineering Professionals (RoGEP) (68302453)

Attached Fig.1 from the First Steps report of January 2017

