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Technical objections to Planning application 2015/0851/P for No. 2 Akenside Rd, and 2015/1207/P for No. 3 Akenside Road, NW3 5BS

Conclusions

1. This area of Akenside Road is just below the spring line that supported Shepherd's Well and the headwaters of the Tyburn, and is already blighted by the effect groundwater has on surface water; effects which are now made worse from groundwater diverted around basements that were developed immediately uphill in Lyndhurst Road.

2. Not surprisingly the area features on the Flood risk maps of Camden and the Environment Agency.

3. The BIA submitted in support of the application contains contradictory statements and factual errors, and is itself supported by a ground investigation that contains unacceptable differences of fact with respect the strength of the ground, and as strength is incorporated into the calculations of ground movement and stability resulting from excavation, those calculations and assessments have to be suspect also.

4. Nor does the ground investigation throw light on the overall condition of wetness of the ground, which has not been appreciated within the BIA itself.

5. Contrary to the spirit of CPG4 the BIA has been divided up into sections each written by an appropriately qualified author – each having to assume the other parts on which they relied were satisfactory. That is something CPG4 was designed to stop; the BIA has not been signed off by all authors but by geologists who are not Chartered.

6. The proposed excavation will expose the ground to serious risk of settlement and ground movement, affecting the properties on its either side, and when complete, divert even more groundwater into neighbouring properties.

7. The risk of ground movement can be substantially reduced by surrounding the excavation with a cut-off, however there is insufficient space for this cut-off to be created around the complete excavation using conventional equipment. A cut-off, once created, will divert even more water to neighbouring properties.

8. The application therefore contains proposals that are based on inappropriate ground strengths and suspect water levels, and proposes construction methods that are dangerous in the special circumstances of this site. That is because the natural conditions on site and their implications for both ground stability and ground water have not been fully appreciated. The design for achieving the excavation is wrong, as is the design for the excavation itself, and wrong design cannot be

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corrected by conditional clauses. The proposal clearly contravenes DP23 and DP27, fails to follow CPG4; it should be rejected.

Background

9. It is important to see a Basement Impact Assessment (BIA) in context and the context that is most relevant is that which comes from the geological and hydrological facts of the location and the long term experience of those who have lived at the location, and seen how it responds to changing conditions, both natural and man-made. That is what this Background describes; it leads on to a review of the BIA submitted.

10. Akenside Road is on the side of a hill that stretches from Hampstead down to Swiss Cottage. The top of the hill, around Hampstead, is capped with the sands, silts and gravels of the Bagshot Beds; these soak up the local rainfall, store it within its porous matrix and have been the traditional source of water for such rivers as the Tyburn whose headwaters rose in just north of Akenside Road and flowed down this hill.

11. The boundary of the Bagshot Beds is crossed about 400 metres uphill of Akenside Road where the hillside exposes the silt and clay rich deposits of the Claygate beds which lie beneath them.

12. Nos. 2 and 3 Akenside Road (a semidetached pair) are located on the Claygate beds (now classified as the Claygate Member of the London Clay), but are separated from them by a thickness of stratified and inter-bedded mixtures of gravels, sands, silts and clays derived from the Bagshot Beds uphill. The shallow foundations for these properties could in part be within these deposits rather than in the Claygate beds themselves.

13. This mixture of gravel, sand, silt and clay, slid and flowed down hill as a sludge towards the end of the ice age, since when it has drained and stopped moving. It now provides a mantle of permeable material that forms an apron covering the upper parts of the topography around Hampstead and is often logged (incorrectly) as Made Ground (i.e. artificially placed by man).

14. This apron acts as a natural shallow aquifer when compared with the Claygate deposits below and because it is linked uphill to the Bagshot Beds, from which it is derived, it is provided with a constant supply of groundwater. Indeed it is the route through which the Bagshot Beds naturally drain their stored groundwater and is the reason why rivers, such as the Tyburn, have their headwaters at this location on the hill.

15. The down-hill fringes of this apron normally dictate the position of the emergence of groundwater as a seepage surface and it is the undulations of topography with this seepage surface that create local concentrations of flow that are recognised as “springs”. A spring line is thus a contour joining springs scattered along the seepage surface. Most natural topographic undulations that have springs at their head are the headwaters of valleys.

16. The headwater for the River Tyburn rose just north of Akenside Road in the general area of one such spring, known as the Shepherd's Well; drawings of the time show this was not a well as such to begin with but may at some stage have been deepened to provide water when seasonal water level were lower. Spring Path and Shepherds Path, just uphill from Akenside Road, bear witness to these times. This water still flows although no longer as a surface stream in normal weather, however it is not far below the surface and that accounts for two aspects of the ground here which are of direct relevance to this Planning Application.

1. Because the ground is carrying so much water there is little space left within it to absorb further water, such as occurs in heavy rainfall. Not surprisingly the area around Akenside Road features in the Flood Risk maps of Camden (Strategic Flood Risk Assessment prepared for the London Borough of Camden by URS, in July 2014). Appendix figure 3 iii shows the proximity of the site to the flood risk area (dark blue colour indicating a high risk (1 in 30 years) of flooding from surface water. Figure 3 viii shows the site adjacent to a "significant flood hazard zone" with a danger of 1.25 to 2.5 meter of water.) Such evidence is not "co-incidental"; it is a natural consequence of the geology of the area and as such the maps of flooding should not be interpreted as having hard and fast boundaries *("I am just outside the area so I am not affected")*. The whole area around this elevation where ground water is emerging is liable to behave in this way; its actual behaviour at any one flood will be determined by the circumstances of the time, in particular the man-made alterations to the ground in the form of basements that divert water, the volume of water already in the sewers, volumes of water from basements that discharge water to sewers and existing soak-aways. **The conclusion from this is obvious;**

the consequences of adding further underground obstructions to this most complex set of interactions can only make conditions at this location worse than they are already; thus permission should only be granted once their impact has been shown to be of no concern.

2. The water laden condition of the ground lowers its mechanical properties making it a weak and difficult material in which to engineer. The Party Wall separating the outdoor passages between the sides of Nos. 3 and 4 had for years been tilting, and eventually had to be demolished and rebuilt. The owners of No.4 were also obliged to arrest subsidence of their flank wall nearest the Party Wall with No.3, by underpinning. Excavations for this work exposed the wetness and weakness in the ground and most particularly the speed with which the shallow trenches required for the work filled with water; constant pumping was required to enable work within them to continue. No. 4 has a history of slow and gentle settlement with floors being re-levelled, the frames of doors and windows being adjusted and brickwork being repaired. In all these instances a perfectly stable structure at the time of construction (a side wall and a flank wall, and other walls as well) gradually failed to function as intended and eventually had to be either rebuilt or adjusted to level. The ground beneath these walls did not

change with time nor did the load upon their foundations change by any significant amount, so the greatest variable in this case has to be ground water, in particular, changing levels of saturation with time. Such experience agrees with the geology and ground water of the location. **The conclusion from them is as follows**;

the mechanical properties of the ground at this location, i.e. its strength and stiffness, are affected by groundwater and the level of saturation it governs; thus before permissions are granted to any proposal that changes the saturation of this ground, the proposer should demonstrate that such changes are of no consequence. The necessity for this is demonstrated by the flooding following approved development at Lyndhurst Road

The effect of development at Lyndhurst Road

17. Lyndhurst Road forms three sides of a rectangle of which Akenside Road forms the fourth. Nos. 2, 3 and 4 Akenside Road and Nos. 29 and 30 Lyndurst Gardens are located in the region where the two meet, at the western corner of the rectangle, and just below the spring line on which Shepherd's Well was developed.

18. Permission was granted for Nos. 29 and 30 to develop very extensive basements down stream of this spring line and from then on the garden of No. 31 Lyndhurst Road, together with that of No.4 Akenside Rd and that of their neighbours in Wedderburn Road became so wet and boggy that surface flooding occurs in wet weather. Not only that, but a free standing sculpture in the garden of No.4 Akenside Road began tilting on its base and had to be removed before it toppled; in mechanical terms it suffered a bearing capacity failure – just as the party wall between Nos. 4 and 3 had done before. Once again, the only thing that had changed was the saturation of the ground.

19. The development Camden permitted has clearly changed the pattern of groundwater flow that existed to the detriment of those living next door and downstream. It blocked natural flow paths carrying ground water downhill from the spring line, and diverted the water to the west and east of the development. Water diverted to the west now streams through the ground of No. 31 and No. 4 so filling its pores with more water than would normally have been the case. The garden in No.31 has been blighted by excess water, the grass in No.4, garden died from lack air at its roots and the ground became soft and spongy, unable to support a free standing garden ornament. **From this evidence the only conclusion to be drawn is**

20. that the present proposal to build a water tight basement across this stream of water will increase further the saturation of the ground elsewhere, decrease further its ability to absorb rainfall and jeopardise further the long term stability of existing foundations. A limit has been reached with development in this area – indeed it has been exceeded. No further development can be done without making matters worse.

21. The BIA submitted for this proposal is now considered against this background of geology, hydrology and personal experience of the neighbours.

The Basement Impact Assessment

Ground investigation

22. A walk-over survey has been completed and 2 boreholes drilled, one at the front of the property and one at the rear; water levels have been measured in both. The depths below ground level at which strata change do not agree and there are 3 obvious reasons for that; viz;

1. Ground levels were not measured so ground levels may not be the same,
2. BH2 was a drilled using a fight auger which corrupts the depths from which strata boundaries come, and
3. There could be a change in the geology over the ~25m separating the two BH's due to shallow landsliding in the glacial past.

All three explanations may be present but of them, the last is the most dangerous of and it is supported by data from elsewhere in the investigation.

23. Insitu measurements of strength were made in BH1 (window sampler) using the Standard Penetration Test and when these data are plotted with depth a change in gradient occurs at the boundary of the Claygate beds of the London Clay Formation and the London Clay (between 4m and 5m below ground level and close to if not just below the founding level proposed for underpinning); that is exactly the place where solifluxion might have occurred in the glacial past, creating palaeo-shear surfaces. If that has happened this area will be the place where shear strength will be at a residual value; this has significant implications for the magnitude of lateral loads to be resisted and for he values of small strain stiffness, which could be very different from what was encountered at Bond Street, from where the values for stiffness used in the calculations presented are derived.

24. Doubts about the presence of palaeo-shear surfaces are reinforced by the response of water level in the rising head permeability test conducted in BH2; these rose from 4.4m below ground level to 2.6m. When the water level data with time is plotted against the square-root of time it is seen to rise in three steps and it is possible that these steps are reflecting the presence of shear surfaces at these levels. Water was noted to be seeping into BH2 at 4m below ground level, in precisely this region.

25. Unfortunately great uncertainty can be attached to the assessments and measurements of strength in this investigation. Samples were taken from each BH for laboratory investigation as follows.

- The two from BH1 were from strata at 3m and 3.5m below ground level (i.e. just above the base f the intended excavation) and describe in the log as "*Very Stiff* "– that means when it was described the material is in a condition that *"cannot be moulded but crumbles"*. The laboratory test shows the water content in the samples was on the wet side of their

Plastic Limit, in fact half way towards their Liquid Limit – such a sample would be so wet and soft it would not roll to a thread as it should at its Plastic Limit, or crumble as it would on the dry side of the Plastic Limit, but stick to the fingers.

- The two samples from BH2 were from material at 3.5m described as *"Stiff"* i.e *"crumbles in rolling threads but remoulds"* and from 4.0m described as *"Very Stiff"*, as described above. Both had water contents well on the wet side of their Plastic Limit, with that from 4.0m being 70% of that required for the sample to be at its Liquid Limit, i.e. to have the consistency of soft butter of thick yoghurt.

26. The trouble with this information is the uncertainty created by the presence of silt. If silt was present at laminations, as could be expected, it is possible for the clay adjacent to it to become wetted with time as it draws water out of the silt. The problem is the logs do not describe the presence of laminations. The logs are unsigned and may not have been logged by a Chartered geologist, or indeed by a geologist but possibly by the driller.

27. Water levels were measured from this ground investigation using piezometers that acted as stand pipes. No free standing water was encountered in BH1 during drilling but that is not unusual in clay as it tends to expand into the cavity created by the BH so locally reducing pore water pressures around the hole and "sucking" water into its pores. However despite this effect water did enter BH2 as mentioned in paragraph 24 above. Water levels in both holes rose over a period of about one month to within 1.75m and 2.5m below ground level.

28. However the effective section of the instrumentation for measuring water levels excluded the superficial sandy layer and Made Ground, both of which are suspected of carrying water discharging from the spring line up hill (as explained in paragraphs 11 to 16 above). In other words, a near surface source of water (something experienced by the neighbours as described in paragraphs 16 to 20) and its water level, which could seriously influence an excavation during construction, may have been ignored.

29. **The unresolved problems that arise from the ground investigation can therefore be summarised as follows;**

the ground investigation provides positive proof that neither the geology of the site, nor the mechanical properties of the ground, nor the water levels on site are known properly; it thus fails to justify the input to calculations made of stability and ground movement resulting from excavation of the basements at Nos. 2 and 3, nor the effect of the basement on surrounding water levels. It also provided the wrong picture for selecting appropriate methods for construction.

Basement excavation

30. The basement for Nos. 2 and 3 will extend approximately 3.950m below ground floor level (Halsteads Report) and require excavation to just over 4.3m

(Site Analytical Services). Two designs are proposed for excavating the basement.

1. To support the ground at the front and rear of the excavation piles are proposed forming a contiguous wall; i.e.one where each pile is separated from its neighbour by a number of centimetres. The ground will be excavated in front of these and in-situ concrete panels cast against them. Ground water is expected and will be controlled by pumping.

Such a piled wall is leaky – it will allow water to travel easily through it and with it any fine particles of soil it can carry. **It is exactly not what is wanted for this ground** which contains silts and fine sands that are easily eroded in such circumstances, and levels of water and degrees of saturation both increased by development of Nos. 29 and 30 Lyndhurst Road.

2. To support the ground on the either Party Wall side of the joint properties it is proposed to excavate 1m wide panels where the first metre of ground is excavated to its full depth and its panel completed and the next metre left untouched, and the third metre excavated to its full depth and completed, as was the first, and so-on; called “hit-and-miss”.

This is even worse than having the support of a leaky piled wall in as much as the excavators will be facing a wall of wet silty clay with running water in its more permeable seams of sand and silt, with the prospect of being able to do nothing about this other than pump until the full depth of excavation is complete and concrete is cast against the ground. **This is a recipe for serious damage to neighbouring property.**

31. The BIA should reflect the issues that are raised by the Background and by the proposed method of construction and will be reviewed with these in mind.

As can be seen groundwater and ground strength are intimately related and this is why BIA’s are supposed to bring all that together. This BIA fails to do that; it has been divided up into sections and appropriately qualified authors have been commissioned to write their particular part on the basis that the other parts are both correct and adequate, but without being able to assess whether that is so. This completely usurps the purpose of the BIA which was designed to stop produce an holistic approach. **The BIA should be signed by all authors who in signing carry the responsibility of the whole document.** The BIA has been signed off by two geologists neither of whom is a Chartered and for this reason alone should be rejected; the BIA fails to reflect the intention of CPG4 and as a consequence it is not surprising that (as will be demonstrated below) the whole document fails to satisfy DP27.

BIA details

32. With reference to BIA Table 1: Section on Sub-terranean ground water flow

Q1a. Is the site directly located above an aquifer?
"*Yes"* Comment *"The site lies above the Bagshot Formation.."*

- It does not! The site has been wrongly located on the geological map.

Q2. Is the site within 100m of a watercourse, well (used/disused) or potential spring line?
"Yes" Comment *"…the site is extremely close to the one of the tributaries of the former River Tyburn"*

- But no mention is made of the spring line that continues to exist and cause so much trouble in Lyndhurst Road and downstream. The ground has not been understood.

Q6. Is the lowest point of the proposed excavation….lower than….any local pod or spring line?
"No" Comment makes no mention of a spring line but talks about the Hampstead ponds.

- The answer is Yes, as described in the Background earlier.

33. With reference to BIA Table 1: Section on Slope stability

Q5. Is London Clay the shallowest strata on site?
"No" Comment *"The investigation found that the site is underlain by Made Ground overlying the Claygate Member"*

- This is correct in as much as that is what the borehole logs record BUT does not agree with the answer to Q1a above! That is why the BIA should not be divided up into separate parts with separate authors for each, or if done so, why it should be signed by all authors.

Q8. Is the site within 100m of a watercourse, well (used/disused) or potential spring line?
"Yes" Comment *"…the site is extremely close to the one of the tributaries of the former River Tyburn"*

- But no mention is made of the spring line that continues to exist and cause so much trouble in Lyndhurst Road and downstream. The ground has not been understood.

Q10. Is the site within an aquifer? If so …..may dewatering be needed?
"Yes" Comment *"…the site lies above a secondary aquifer (Claygate Member)"*

- The role of the superficial drift (called Made Ground here) in transmitting water and the effect this transmission can have as seen on

neighbouring properties, is not mentioned because it is either not known or not appreciated, or both.

34. With reference to BIA Table 1: Section on Surface Water Flooding

Q4. Will the proposed basement result in changes to the profile of the inflows (instantaneous and long term) of surface water being received by adjacent properties or downstream watercourses?
"No" Comment *"As no changes are occurring above ground surface water will not be impacted by the development"*

- This reflects a lack of understanding of the balance between rainfall and groundwater near spring lines and how restrictions of groundwater paths, as created by basements, can drive groundwater towards the surface. The effect of basements at Lyndhurst Road, mentioned above, illustrates the error of this answer.

Q6. Is the site in an area known to be at risk from surface water flooding?
"*No"* Comment Precis … Envirocheck does not list the location as being at risk and CPG4 does not list Akenside Road as a street at risk, however he Enviroment Agency latest map shows a "low" risk of flooding from surface water for the adjacent part of Akenside Road"

- So the answer should be "Yes"; that would agree with Camden's own Flood Risk maps mentioned in the Background above, and with the experience of neighbours.

Scoping of issues highlighted in the screening process (Groundwater)

35. A number of issues where identified as needing scoping including those related to groundwater of which one in particular is considered here (54.4 Groundwater flow and Depth to Groundwater) as it is clearly a major issue at this site.

36. A ground investigation was commissioned as reported in paragraphs 22 to 29 above but leaves many questions unresolved and more dangerously, misses aspects of the ground that could have a serious impact on both the stability and eventual functionality of the work proposed. The conclusions in paragraph 29 are that;-

the ground investigation provides positive proof that neither the geology of the site, nor the mechanical properties of the ground, nor the water levels on site are known properly; it thus fails to justify the input to calculations made of stability and ground movement resulting from excavation of the basements at Nos. 2 and 3, nor the effect of the basement on surrounding water levels. It also provided the wrong picture for selecting appropriate methods for construction.

37. With regard to water levels resulting from the creation of the basement, calculations have been presented to show that water impounded behind a basement or drawn down around a basement will extend for no more than 4m

from the basement. This calculation cannot be trusted because it relies on assumptions that are not met; prime amongst these are

- that the relevant water levels have been used in this calculation; i.e. that there are no higher water levels than those measured in the ground investigation especially from water in the permeable ground above the Claygate beds,
- that the calculation relies on there being radial flow – and there is not,
- that the permeability of the ground is the same in all directions – which is most unlikely, and that
- water levels used as the basis for the calculation do not change with time – which they do.

38. However, the rise in water level resulting from an obstruction and the fall in water level towards a basement causing drainage are not the main issue. The change that has caused problems in the past (see paragraphs 17 to 20 above) and will cause problems again is the diversion of flow – as seen from the Lyndhurst Road experience – and because this is not appreciated it has not been addressed.

39. The BIA correctly notes here that dewatering can cause problems for neighbouring properties through the removal of fines and the lowering of pore water pressures. It recommends the contractor provides details of groundwater is to be controlled – and the answer to that is in the report from Halsteads; it will be by pumping within the excavation. That is not the way to manage water in this ground and this, with other issues are considered further under Ground Stability, below.

Scoping of issues highlighted in the screening process (Ground stability)

40. The BIA recognises that excavations below the water table within the sediments of the Claygate Formation are vulnerable to the loss of clay, silt and fine sand carried by water flowing from the ground into the excavation, and suggest support is provided by sheet piles. The proposal submitted by Halstead is for a leaky contiguous piled wall at the back and front of the excavation and nothing other than shoring on the other two sides of the excavation adjacent to the Party Walls.

41. Once water starts draining to an excavation the water pressures in the surrounding ground are reduced and this initiates consolidation of the ground and settlement at ground level. This settlement will be greatest nearest the excavation and decrease with distance from it; i.e. it will not be uniform and any structure above it will deform differentially.

42. **There is nothing in the BIA that will prevent either of these foreseeable consequences with ground stability from materialising.**

43. In addition to these concerns there is the possibility that palaeo-shear surfaces exist in the ground between 3m and 4m below ground level, as explained in paragraphs 23 and 24. These would be directed down-hill in the general direction of Wedderburn Road and their greatest influence would be

on the north side of the excavation, on one of the excavation walls that is going to be supported by props as explained in paragraph 30 above.

44. It is therefore possible that a contractor unaware of the ground conditions that could develop with time would face an excavated panel of ground that is leaking water in the top 1m, seeping water over the lower 3m with silt horizons eroding into the excavation whilst the greater part of the exposed face begins to slide into the excavation on palaeo-shear surfaces nested between 3m and 4m below ground level, at about the depth where the underpinning is to be founded.

45. **The overall conclusions from this BIA are that it is**

- **factually wrong in important places**
- **misleading in its calculations and**
- **inadequate for what is proposed to be built.**

Conclusion

46. The area of 4 Akenside Road lies just below the spring line that supported such supplies as Shepherd's Well and the headwaters of the Tyburn, and is now bedevilled with groundwater that has been added to its location by the diversion of waters around 29 and 30 Lyndhurst Road. The area now features on the Flood Risk maps for Camden and the Environment Agency.

47. The construction methods proposed will do nothing to alleviate these conditions and much to aggravate them.

48. The BIA is seriously flawed with respect to groundwater, settllement of neighbouring ground and ground stability.

49. The proposal seen overall, together with its BIA, is disjointed, contradictory and erroneous. In this it fails to satisfy the requirements of DP23 (Water) and DP27 (Basements and lightwells) and CPG4.

50. Further, because so many of the errors are within the design they cannot be remedied by Conditional clauses. The work proposed will increase the wetness at ground level and initiate long term settlement beneath neighbouring properties no matter how it is done.

51. **The proposal should be rejected.**

30th March 2015

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