

**GROVE LODGE ADMIRALS WALK NW3 6RS**

**A geotechnical and structural assessment of a basement planning application 2015/4485/P and its potential impact on Admirals House and Terrace Lodge NW3 6RS**

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## Summary of brief and conclusions

### The brief

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1. This report concerns planning application 2015/4485/P to Camden Council (Camden), which proposes a new basement below parts of the existing house and garden of Grove Lodge NW3 6RS. I am instructed to advise Mr & Mrs J Gardiner of Admirals House, Admirals Walk and Mr & Mrs Seaton of Terrace Lodge of whether or not the application provides sufficient information to satisfy the engineering aspects of Camden planning policy DP27. These are that planning applications should demonstrate by methods appropriate to the site that basement schemes:-
  - (a) Maintain the structural stability of the building and neighbouring properties.
  - (b) Avoid adversely affecting drainage and runoff or causing other damage to the water environment.
  - (c) Avoid cumulative impacts upon structural stability or the water environment in the local area.

### Conclusions

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2. I conclude that the scheme proposed by the application fails to satisfy the requirements of DP27 (a) or (b). I defer to Dr Michel de Freitas' report [1] with respect to part (c). A summary of matters leading to this conclusion follows.
3. Results of tests published within the two ground investigation reports provided may be interpreted to show that some strata have potential to suffer internal erosion and become unstable in the event that the proposed scheme changes the existing groundwater flow regime. Such erosion has been evidenced by the appearance of holes in Admiral's Walk. Dr. de Freitas has cited another case in Redington Road and Transport for London's and my own experience of similar situations in Greenwich and Blackheath are noted.
4. Dr de Freitas has also shown that neither the existing flow regime nor the existing ground water levels in the site have been defined by the application and that the investigations made do not permit such definition. Consequently the risk associated with groundwater changes associated with the proposal cannot be evaluated either.
5. The west wall of Admiral's House, which adjoins Grove Lodge was noted to be distorted in a 1986 Surveyor's report. It is close to a well in the basement of Admiral's House which has been receiving groundwater from high level sources in the ground for a great many years. Experience of ground conditions associated with deep soakaways leads to the belief that these water flows and consequent weakening of the ground were the original cause of the distortion. According to Mr & Mrs Gardiner, the condition of the wall has not deteriorated noticeably since 1986.

There is however the risk, which has not and cannot currently be evaluated, that groundwater changes caused by the proposed development would reactivate ground movement and, over a long period, cause further damage to the west wall.

6. Terrace Lodge is on a rise so that its foundations are at the same level as the lower ground surface in Grove Lodge. Ground slopes down into Grove Lodge from the north wall and steps down beyond a retaining wall to the east. The proposed basement is designed to be close to Terrace Lodge and preparatory work for a piled basement retaining wall is intended to expose the footing of the north wall and, although it is not shown, would leave the east wall perched at the edge of a shallow excavation. There, it would be at grave risk of major damage due to a combination of pressure from ground remaining at higher level within the building and collapse of the ground below the footing.
7. It is then intended to construct the piled retaining wall close to these exposed footings. That could not be done without disturbing ground below the footing and causing further damage.
8. Finally, a drawing depicting the finished construction leaves the Terrace Lodge footings exposed and resting on or very near the ground surface; a situation that invites settlement damage.
9. The previous application, 2015/0886/P, proposed underpinning Terrace Lodge. It should be noted that the situation described above could not be avoided simply by reinstating the previous underpinning. Whilst the applicant has an unavoidable duty to preserve the stability of Terrace Lodge and provide a scheme and construction that reduces the risk of damage to a specified level, it is not necessary for Mr & Mrs Seaton to permit the underpinning of their property to that end. Their decision on this point must have a major influence on both the application and form of the development.
10. It is also the case that until the groundwater regime has been clearly established, the groundwater and building damage risks associated with partial underpinning of Terrace Lodge could not be properly assessed.
11. A recent addition to the application was a substantial assessment of ground movement and building damage at Terrace Lodge. It deals in a routine manner with the ground movement situation routinely considered for basement schemes. It is meaningless because it bears no relation to the proposal. Faults in the engineering design and method statement, would have caused significant damage, possibly in Category 5, well before the situation considered by the assessors could exist.
12. The assessment also fails to consider the potentially weakening effect of groundwater erosion of the ground remaining between piles below the basement level, upon which the wall would rely for support and stability.

13. No information is provided about the proposed system for disposal of surface water from the sunken courtyard and adjacent area which is intended to be constructed close to Terrace Lodge. Surface water entering the courtyard thus presents an unconsidered flood risk for the basement.
14. It is intended to dispose of surface water to soakaways. Conditions already described make the design of such a system and assessment of its potential impact upon ground water movement and building stability an essential part of the basement impact assessment. No such design has been provided.

## 1 Introduction and purpose of report

15. Planning application 2015/4485/P to Camden Council (Camden) proposes a new basement below parts of the existing house and garden of Grove Lodge NW3 6RS; an existing cellar would be deepened to form part of the new accommodation. I am instructed to advise Mr & Mrs J Gardiner of Admirals House and Mr & Mrs Seaton of Terrace Lodge of whether or not the application provides sufficient information to satisfy the engineering aspects of planning policy DP27.
16. I am Michael Eldred MSc. CEng. FStructE MICE, Director of Eldred Geotechnics Ltd and a Consultant in the disciplines of Geotechnical, Geoenvironmental, Civil and Structural engineering (see appended biography). The assessment which follows is exclusively of matters falling within these disciplines. Dr Michael de Freitas has reported separately on hydrogeological aspects of the proposals [1] and comments in this report on such matters account for Dr de Freitas' advice.

## 2 Planning policy requirements

17. Policy DP27 states that 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. The Council will require developers to demonstrate by methods appropriate to the site that basement schemes:-
  - (a) Maintain the structural stability of the building and neighbouring properties.
  - (b) Avoid adversely affecting drainage and runoff or causing other damage to the water environment.
  - (c) Avoid cumulative impacts upon structural stability or the water environment in the local area.
18. The requirement to demonstrate compliance with these things is or should be of the utmost significance.
19. Camden policy guidance CPG4 [2] describes how applicants must undertake three stages of investigation, assess the results and use them in a 4th stage to show that the scheme satisfies DP27. In principle these four stages demand no more than the rational approach adopted by a reasonable human being who is desirous of undertaking any sort of project no matter how simple or complex. That is to say:-
  1. Decide upon the project and consider what is known of the circumstances capable of affecting its success. (Screening)
  - 2 Decide what other information is needed. (Scoping)

3. Enquire, investigate and consult with others having particular knowledge to fill gaps in the immediately available information; this sufficiently to engender a measure of confidence that the circumstances have been properly defined. (Site investigation and study)

4. Look carefully at what the results of 1 -3 mean for the plan, think about what might go wrong and do whatever is needed to offset the risk. (Impact assessment).

20. CPG4 and its charts constitute guidance, not a set of absolute rules; not a system of pass/fail charts that define the limits of investigation etc. needed. Those assisting applicants are expected to be competent in their fields and to extend and validate investigations as required by the circumstances.

### 3 Proposed development

21. It is intended to demolish much of Grove Lodge and construct a single storey basement having an area overall construction of about 280 square metres. A small existing cellar area within the basement footprint would be deepened. With the exception of a sunken courtyard and passageway at the south west corner, close to Terrace Lodge, the basement area would be covered variously by a courtyard, rear garden and new ground and upper floors. Beyond the basement, the garden rises to the west. The west wall of Admiral's House is intended to be about 3m from the new basement.

## 4 Ground and water

### 4.1 Water

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22. Dr de Freitas has clearly stated and carefully explained that the ground investigations provided by the application were badly designed and are inadequate for the purpose of DP27. In particular he points out that groundwater level, direction of flow and hydraulic gradient have not been defined and cannot be determined from the information available, and that seemingly confident statements on these matters in the application are unreliable being based upon supposition and unsuitable monitoring methods.
23. He points out that whereas the application repeatedly asserts that groundwater is unlikely to be as high as the basement excavation level (about 123.5m OD), groundwater has historically occurred at about 124.5m OD in the well and swimming pool excavation at Admiral's House. In case of the swimming pool it occurred in such quantity that Mr Gardiner was advised to avoid emptying the pool for fear of the pool structure being uplifted by flotation.

## 4.2 Ground

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24. Beyond distinguishing between cohesive and granular soils, and attributing them to geological formations, the application does little to consider the fabric of the materials encountered by the exploratory excavations. Results of grading tests defining the distribution of particle sizes in the granular soils vary considerably. Some have the grading characteristics of soils identified by Kenny & Lau [3] as capable of being destabilised by changes of groundwater flow. Two substantial shallow ground washouts that have occurred in Admirals Walk emphasise the possibility of such a hazard; Dr de Freitas refers to experience of similar occurrences at Redington Road.
25. Samples having potential for instability were recovered from materials found at:-
 

BH2	3.10 -4.00;
BH3	4.00 – 5.10;
WS1	4.5 – 6.00

Results for two samples from material between 2.30 and 6.30m in BH1 are at the boundary between stable and unstable conditions.
26. It is perhaps important to reiterate that it is the *potential* for instability that has been found. Whether they exist in original form or have been modified by groundwater flow over time, these natural soils are likely to be structurally stable and free from ongoing erosion in the conditions applied by the current groundwater regime. Changes in that regime caused by the basement development proposed would however introduce the risk of activating or reactivating the erosion and destabilising process. It is also important to remember that vulnerable or incipiently vulnerable conditions at each of the random borehole positions indicate not that the potential is limited to the points of investigation but rather that it may be widespread in the site area.
27. These matters will be considered further in the context of the proposed construction but first, a note concerning the basis for assessing instability potential.
28. The Kenny & Lau work, published in 1985, was a contribution to still ongoing research dealing with the internal stability of earth dam filters, and does not seem to be well known in the context of building construction. Essentially, the authors undertook experimental research and developed an empirical relationship between the shape of a particle size distribution curve for a granular material and its potential to suffer internal instability or erosion due to changes of its water environment. Importantly they considered a wide range of soil gradings and demonstrated both stable and unstable characteristics.
29. The susceptibility of sand and gravel to internal erosion due to water flow is well known but the cause of differing effects in seemingly similar circumstances is not always recognised. Reference [3] is far from the whole story but provides a starting



point for rational engineering judgement of what has happened in situations where damage has occurred and assessment of the risk of what might happen in others. It proved helpful in a number of cases in the Blackheath and Greenwich areas of S.E. London where the isolated occurrence of ground subsidence affecting buildings and land in or close to sloping ground could not be readily explained.

30. Geological characteristics in that area are extremely complex and internal erosion of granular material in the northern and western slopes from the high ground of Blackheath has caused locally loose and voided ground. The two year closure of the A2 trunk road following the sudden appearance of a 6m void on Blackheath Hill in 2002 is the extreme case in recent times. Other influences existed there but the event was reportedly triggered by internal erosion [4]. The geology of Hampstead is different but the same problems exist.

## **5 Admiral's House – potential impact**

31. In reporting a survey before purchase of the property by Mr & Mrs Gardiner in 1986, Adelaide Jones & Company noted that the west external wall had distorted but did not report any cracking or evidence of progressive damage. The lower section of the wall is party with Grove Lodge, and the upper part can be inspected only from within the grounds of that property. I have not made a structural inspection of Admiral's House but understand from Mr & Mrs Gardiner that they are not aware of the distortion having worsened
32. A well in the basement on the west side of the house had a standing water level of about 118.42m OD on 17/08/15. Dr de Freitas notes water entering from a higher level then and evidence of higher entry still at some prior time. The feature is a recharge well, attracting water passing through relatively near surface ground and transferring it to some lower groundwater body. Having regard for comments in Section 4 above, it is quite reasonable to suppose that flow of water towards the well could have given rise to some internal soil erosion and distortion of the west wall before the regime stabilised. Ground erosion near soakaways, (which are like wells that do not extend to water level) is common and the reason that they have to be sited a specified distance from buildings.
33. Neither the level nor flow direction of the groundwater is known. If they are such as to increase the flow of water to the well in consequence of the proposed development, there would be a long term risk of soil erosion and disturbance, and of consequent further distortion of the west wall of Admiral's House.
34. Neither the absence nor designed control of risk to neighbouring property have been demonstrated as required by DP27.

## 6 Terrace Lodge – potential impact

### 6.1 Work carried out to enable construction to proceed

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35. North and east walls of this property are founded approximately 1m below ground level immediately next to the walls. There is no topographical survey within the current application and I thus refer to that which was requested and provided in relation to the previous application 2015/0886/P. The drawing is difficult to read but it appears that ground slopes down by about 1m from the north wall of Terrace Lodge for about 3.5m into the garden of Grove Lodge. At the east wall, level ground extends for about 1.5m to a retaining wall, where it drops by 1.3m to a gravelled path. It is to be expected that the retaining wall footing will be about 1.8m below ground next to Terrace Lodge.
36. It is intended to construct a piled retaining wall 1.2m from the walls of Terrace Lodge and 0.9m from the projecting footing of the east wall. The piling rig would have to work on level ground from which all retaining wall construction and footings had previously been removed and upon which a safe and stable piling mat had been constructed. For that to happen ground would have to be removed from the north face of Terrace Lodge to at least the level of the underside of its footings and to 0.8m below the east wall footings.
37. Construction method drawings in the application show broadly this arrangement for the north wall but neglect to allow for the removal of retaining wall footings to allow piling to take place next to the east wall and the extra depth of enabling excavation required. That would leave the east wall at the unsupported edge of a 0.8m deep excavation. They also neglect to show that removing ground from the outer faces of the house walls would make it necessary for those walls to retain soil remaining below the house and to withstand the lateral forces it would impose upon them.
38. Neither underpinning nor any other means of protecting the stability of Terrace Lodge during this process has been provided by the proposed design. If the proposed construction method were to be followed, Terrace Lodge would become unstable even before piling work commenced. Consequently the ground movement and building damage assessment within the application, which concentrates entirely upon Terrace Lodge during the basement construction sequence, is meaningless. It models completely the wrong set of circumstances: Terrace Lodge would already be severely damaged before the modelled conditions could exist.
39. The previous application, 2015/0886/P, proposed underpinning Terrace Lodge. The reason for the omission of such work in this application is not clear but it should in any event be noted that the situation described above could not be avoided simply by reinstating the previous underpinning. Whilst the applicant has an unavoidable duty to preserve the stability of Terrace Lodge and provide a scheme and construction that

reduces the risk of damage to a specified level, it is not necessary for Mr & Mrs Seaton to permit the underpinning of their property to that end. Their decision on this point will have a fundamental effect upon both the validity of the application and the form of the scheme proposed.

40. It is also the case that until the groundwater regime has been clearly established, the groundwater and building damage risks associated with partial underpinning of Terrace Lodge could not be properly assessed.
41. Neither the absence nor designed control of risk to neighbouring property have been demonstrated as required by DP27.

## **6.2 Construction**

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42. Having exposed the footings of Terrace Lodge, the construction method drawings then assume that 0.45m diameter piles could be bored into the ground less than a metre away from footings that rest on the ground surface, all without disturbing the ground below and behind the footings and the building they support. This assumption becomes even more untenable when it is realised that the piles would be bored close together, leaving only about 150mm of ground between them, and that after they were filled with concrete other piles would be bored in these gaps so as to cut into the first set and create a solid wall.
43. The success of continuous flight auger (CFA) piling constructed through granular material can sometimes be marred by "overflighting". The term refers to situations in which the amount of material being excavated and transported upward is insufficient to fill the flight of the augers Archimedean screw and support the surrounding ground. Sand and gravel can then fall into the flight and cause loss of ground at depth and surface settlement.
44. To avoid such situations, piling contractors need good information about the ground and water conditions in order to select the right equipment and working methods. The situation at Redington Road described by Dr de Freitas might have been one where such information was lacking.
45. In the present case, water conditions are undefined, the possibility exists that water flow towards the pile bores could initiate instability and there is an unexplained apparent reduction of ground strength with depth in each of the boreholes, where penetration tests showed a distinct reduction of density and strength near the base of the granular material above the clay. Such reductions of apparent strength with depth are sometimes caused by drillers' failure to maintain a balance between water pressure within and beyond the borehole. But three holes made by two different drillers show the same characteristic. The matter is ignored by the application.

- 46. Also ignored is the final state of Terrace Lodge. The drawings depicting the intended construction method show that on completion, the footings of the property would remain exposed and supported on or very near the ground surface; a situation that invites settlement damage.
- 47. Neither the absence nor designed control of risk to neighbouring property have been demonstrated as required by DP27.

## **7 Flood risk**

- 48. Surface water entering the proposed sunken courtyard close to Terrace Lodge would present a flood risk for the intended basement that can only be assuaged by adequate design and construction of a competent surface water disposal system. Without better information it seems probable that such water would need to be pumped up to a chamber at surrounding ground level and drained thence to a soakaway.
- 49. As previously noted, without acceptable information concerning the soakaway location and depth DP27 could not be satisfied with respect to either groundwater issues or stability of Terrace Lodge. Concerning the latter, the extension of the basement below the garden surface and close to Terrace Lodge imposes greater restriction on the available solutions than might appear to be the case from the proposed site and ground floor plans.

## **8 Surface water and soakaways**

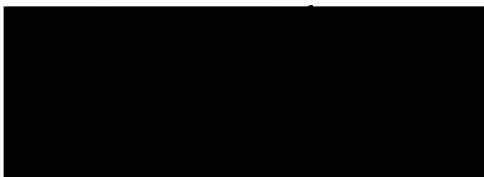
- 50. Soakaways constructed in sand and gravel deposits can be sources of ground instability capable of affecting the stability of buildings. Any shallow soakaway in such materials can both attract groundwater flows from rainfall and other precipitation entering the ground and generate new drainage paths for water draining from the soakaway. Whilst the normal provision of placing a soakaway 5m from the nearest structure is usually satisfactory this need not be so.
- 51. When soakaways have to be situated upslope from a structure, the gradient of the pipes discharging to the soakaways is opposite to that of the ground slope. If this makes the discharge point so deep that the soakaway chambers extend below a water table, the installations become discharge wells rather than soakaways. As such they are capable of altering flows in the groundwater body. In the present case, the potential for internal erosion of some of the ground has to be accounted for.
- 52. It is essential for the design of the surface water disposal system to be completed sufficiently to allow the depths and disposition of the soakaways to be recorded now rather than left to chance at some later time when the importance of these issues might be overlooked in favour of other design/construction matters.

53. Compliance with the requirements of DP27(b) has not been demonstrated.

## 9 Ground movement and building damage

54. Assessment of these matters with respect to Terrace Lodge has been made in part by Card Geotechnics Ltd (CGL) and in part also by R&E Geotechnical Ltd, who made calculations of piled retaining wall movement. CGL have used the R&E Geotechnical Ltd work to produce an overall opinion, which includes a calculation of the vertical ground heave and settlement deformation likely to arise from the basement excavation as well as ground movement arising from wall displacements.
55. Calculations made are of the standard form using industry standard software but, as previously stated, they are meaningless. Inadequacy of the design for enabling works and of the construction method mean that Terrace Lodge would be at grave risk of sustaining severe damage, probably of Category 5, before or shortly after the piling work commenced. As designed, the construction process would not reach the point of construction at which the calculations commence.
56. The calculations also fail to account for the possibility of ground disturbance caused by changes in the as yet undefined groundwater regime. It is intended that the retaining wall piles will extend 8m below ground level. Lateral support provided by the ground to the parts of the piles that would be embedded below the basement would be fundamental to both the stability and movement of the piled wall.
57. Currently, water flows in some stable way through ground below the proposed basement floor level. Once the piled wall was installed, however, the ground available for passage of water between piles below the basement would be reduced to one quarter of the present amount (see 6.2 above). The volume of water flowing would not change, so the water pressure upon the 150mm width of ground left between piles would increase, perhaps to a value capable of causing erosion and loss of critical support for the piled wall.

Compliance with the requirements of DP27(a) has not been demonstrated.



### References:

- [1] de Freitas M.H. Technical matters of concern within the Applications 2015/4485/P and 2015/4555/L for Grove Lodge, Admiral's Walk NW3 6RS. September 2015
- [2] Camden Planning Guidance 4, Basements and Lightwells, (CPG4)
- [3] Kenny T C Lau D (1985) Internal stability of granular filters. Canadian Geotechnical Journal Vol 22 pp 215-225
- [4] "New culprit found for A2 collapse" New Civil Engineer Special Report 1st August 2002

**Brief Professional Biography**  
**Michael Eldred MSc CEng FStructE MICE**  
**September 2015**



**Date of birth:** 26th December 1938

**Current Position:** Director of Eldred Geotechnics Ltd;  
Principal of Eldred Consultants

**General Education** King Edward VI Grammar School Chelmsford.  
**Higher Education** Westminster Technical College,  
Graduate membership of professional institutions.  
University of Surrey;  
MSc in Geotechnical Engineering.

**Professional Memberships**

Institution of Structural Engineers	Corporate Membership	1965
	Fellowship	1983
Institution of Civil Engineers	Corporate membership	1969
Association of Geotechnical and Geoenvironmental Specialists	Membership	1999

**Career Progression**

1957-1965	From draughtsman to project engineer; employed by British Rail, specialist civil engineering contractors and engineering consultants.
1965-1967	Associate Partner managing consulting engineers' subsidiary office.
1967-1969	Resident Engineer for the City of Lancaster central redevelopment.
1969-date	Independent practice.
1985-2007	Included ground investigation and laboratory testing facility within practice

**Principal Areas of both Theoretical and Practical Experience**

Ground investigation  
Laboratory testing  
Full scale testing of structures and motorway bridge beams  
Cofferdam and other types of excavation  
Ground dewatering  
Mine reinforcement  
Mining subsidence  
Clay subsidence and heave  
Groundwater erosion subsidence  
Temporary support of structures excavations and groundworks  
Underpinning  
Piling  
Roads and sewers  
Structures of all materials  
Restoration of historical structures  
Ground stability assessments and remedies  
Alteration and strengthening of subterranean structures  
Advice concerning basement development  
Contaminated land assessment and remediation  
Flood risk assessment

**Other related experience**

Lecturer in geotechnical engineering to the Royal Engineers MSc course, RMSE Chatham  
Informal lectures to Institution of Structural Engineers members on geotechnical/structural engineering interface for basements.  
Twelve years as Director, seven as Chairman, of a professional indemnity mutual insurer for engineers.