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To Success

Observations on the Report of Dr Stephen Buss
Grove Lodge: Modelling impact of basement development on groundwater (20/01/2016).

Introduction

1. The report on modelling was commissioned by Campbell Reith in their capacity as the independent adviser to The London Borough of Camden's planning department and used to assist the Planning Committee with their decision on the application for the development of Grove Lodge (2015/4485/P & 2015/4555/L), taken on 21st January 2016.

2. Its findings were presented without warning at the planning meeting on the 21st January leaving the neighbours no opportunity to reply. A copy of the report has now been obtained and I have been commissioned by Mr & Mrs Gardiner of Admiral's House and Mr & Mrs Seaton of Terrace Lodge to review its contents.

3. I am a Chartered Geologist with specialisation in engineering geology and groundwater and listed as an Adviser on the UK Register of Ground Engineering Professionals retained by the Institution of Civil Engineers.

Summary

4. There are too many aspects of this report that require justification for the findings of the report to be acceptable. Indeed, they are misleading.

4.1 The basic model does not agree with larger evidence from topography and geology; it predicts east to west flow along the slope rather than north to south flow down the slope and an hydraulic gradient of 0.1 which even the author of the model finds unusual.

4.2 That hydraulic gradient is then changed to 0.04, which enables the model to agree in some respects with the data provided in the ground investigation reports.

4.3 The unreasonableness of all this is shown by a very simple analyses undertaken by First Steps based on ground investigation data, that predicts north to south flow (which would be expected here), with an hydraulic gradient that is identical to that chosen by the model (0.35) and further, predicts water levels encountered in the surrounding ground investigation holes.

4.4 The model is flawed.

4.5 This flawed model is then used to analyse what is described as the worst credible case, but it is not. Presumably neither HR Wallingford nor Campbell Reith explained to Dr. Buss what the problems were with this site. The worst credible case remains unchecked.

4.6 The report concludes with an ambiguous statement about erosion which says it should not be expected but may be “promoted” and is thoroughly confusing.

4.7 This is the document that was used to reassure the Planning Committee on January 21st that their concerns associated with the questions they were asking were unfounded. This study of the report shows the Planning Committee were seriously misinformed.

Details

5. The brief commissioning this work has not been provided and this raises questions on what the modelling was supposed to be achieving. This is of relevance because on p2 the last line of para 1 explains that the indented basement at Grove Lodge may change levels of the shallower water table.

6. That was not the issue of greatest concern to the neighbours; the concerns made repeatedly on behalf of the neighbours were;

6.1 that there was inadequate hydrological data for controlling groundwater during construction, should control be needed, and

6.2 no account taken of the potential incidence of internal erosion occurring during and after construction despite many neighbours witnessing the sudden appearance of two large holes in the Admiral’s Walk which could most readily be explained by local erosion.

7. These concerns have been described more than once in the reports from First Steps, of which there have been four; (25th March 2015 for a previous application that was withdrawn but the geological and hydrological concerns remained the same, 3rd September 2015, 19th November 2015 and 7th December 2015) yet reference to the reports used in this work cites only that of September even though Campbell Reith requested the report approximately one month after the last of the First Steps’ report. Had the others been referred to the differences between the modelling work done and the questions that needed to be answered would have been noticed.

8. Fig.2.2 of the report illustrates a cross section joining the 3 BH’s crossing the Grove Lodge. The water level shown in BH3 does not agree with that in the ground investigation being almost 2.5m lower than that reported.

9. Section 2.2 also explains that 60cm has been added to recorded heights to simulate worst conditions without addressing the fact that the water levels measured in the standpipes do not measure the highest levels, for reasons that have been explained fully in the First Steps’ reports. Neither HR Wallingford nor Dr Buss address this basic shortcoming in the input data to any analyses.

10. The addition of 60cm of water level is not explained, why not 15cm or 40cm? If that is supposed to reflect in some way the fluctuations in water level measured and presented in the HR Wallingford report then it would have been appropriate first to interrogate those records before basing a factor upon them, because the records show that two BH's within a few metres of each other respond quite differently to the same input (rainfall) – again a fact that was never explained by HR Wallingford. The adjustment seems arbitrary, as if to bolster a weak analytical case by giving the appearance of conservatism.

11. Fig. 2.4 of the report illustrates the water table contours for the area. They are very much governed by the choice of water levels used, and here the choice is between

i) the water levels encountered during drilling
ii) those subsequently measured in standpipes which corrupt the water levels measured and
iii) those in Admiral's well which can actually be seen.
iv) those for any particular date as water levels fluctuate with time as evidenced in the HR Wallingford report, and there are a range of dates to choose from varying from, July 2012 (Fleet House data) to August 2015 (well at Admiral's House).
v) the method of drilling used and the drillers involved (3 separate contractors have been involved).
It is unfortunate that the water level data is of such poor quality given the investigation has been in hand for so many years and clearly does not lack funding.

12. Given these variables a choice has to be made and Fig 2.4 illustrates the outcome of the choices made for this modelling. Fig. 2.4 contains a water level for BH3 which is not recorded; BH3 is allocate a level of 120.1m whereas the level in the standpipe is 123.19m. It should also be noted that BH2 is allocated a level of 122.4m which is the standpipe measurement but encountered water at 123.5m which is probably the more accurate value. Also that BH1 is allocated a level of 123.75m whereas during drilling a level of 124.1m was recorded. Finally, it should be noted that the well is allocated the highest water level recorded of 124.5m.

13. The result shown in Fig 2.4 is a flow that is predicted to travel from east to west along the slope rather than down it, with an hydraulic gradient of 0.1 (which is recognised in the report as being uncharacteristically high for such deposits as these) and predicts a water level that enters the clay at depth. Despite these warning signs the model is not adjusted but becomes the basis for the later analyses.

14. In an attempt to understand this further First Steps has completed a very simple analysis illustrated by two figures; Fig.1 (March 2016) shows the relative positions of the available data points and Fig. 1A a simple triangulation of water levels chosen as follows:

i) BH3 offers no choice, there is only one level, 123.19m
ii) The well has a range of levels which can be seen; a mid-level between the highest seen and the level measured in August 2015 has been chosen; 123.5m
iii) BH1 Fleet House intersected mild sub-artesian conditions and a level is taken as midway between the level where the water under pressure was struck and its piezometric level, as these two are not so far apart; 122.1m.

15. Despite the selection required for water levels the result of this simple analyses (Fig.1A) is a North – South flow (which would be expected from the topography and the geology) with an hydraulic gradient of 0.035 (which is an order of magnitude better for these materials than 0.1 generated from the modelling work) and a pattern of flow that remains in the superficial material above the clay (which is hydrogeologically reasonable).

16. Given that the selection of water levels could be criticised as arbitrary it is instructive to consider if this distribution of head can predict the heads in the other holes not used in the analysis, and the following if found;

For Grove Lodge BH 1 predicted = 122.72m: actual = 123.74m
For Grove Lodge BH 2 predicted = 123.1m: actual during drilling = 123.5m
For Grove Lodge WS1 predicted = 122.52m: actual (2nd reading) = 122.27m

17. Thus although the precise level of water to use in these analyses involves judgement it is reassuring to see the pattern of flow resulting from the levels used in Fig 1A reflects a judgement closer to reality than that shown by the modelling in Fig. 2.4.

18. It appears that the model shown in Fig.2.4 has been used as the basis for assessing the response of groundwater flow to the basement and if that is so it implies that the subsequent analyses are unlikely to be realistic; a conclusion not diminished by the uncertainties mentioned in the Conclusions of the report (Section 4).

19. Section 3.1 describes the difficulties of dealing with this model using the boundary conditions inherited from Fig. 2.4 and acknowledges important aspects of the model which either cannot be explained or as in the case of BH.3, are just wrong.

20. In Section 3.2 (Model Set-up) the boundary conditions used are said to be distant from the area of interest (the basement) but actually they are extensions of the data from the area of interest unless other data not declared has been used. If no other data has been used, then this is not as “far field” as implied.

21. In Section 3.2 (Geological layering) the model is described as being in two layers one of which is defined by the basement slab; there is no geological reason for dividing the ground at this level and none is given. A middle layer is

also mentioned but there is no middle layer in a two-layer model (presumably "lower" was intended).

There then follows a strange comment – that the swimming pool in Admiral's House does not extend below the water table. This is at odds with observed facts at the time of its construction and would have been better recorded as *not being included in the model because the water table chosen has been set at a lower level.*

22. The Heads and gradients used in the model are then described and here the basis for the model basically collapses. The hydraulic gradient generated from the initial model (0.1) when extended across the model conflicts with facts (too high to the east and too low to the west) so its value is just changed to 0.04 without further explanation. It is presumed that a certain amount of "parametric adjustment" using the model resulted in this change but interesting to note that the hydraulic gradient that "seems to work" agrees with that deduced for this material as calculated from the simple model shown in Fig.1A (0.35).

23. Aquifer properties are then considered and although idealisations have to be made for the purposes of modelling, no justification is given for the numbers chosen based on the stratigraphic profile recorded by the boreholes or the grading curves given, the implications of which are described in some detail in the First Steps report of 7th December 2015. Instead it is reported on p7 that a "guess" has been made.

24. From then on the report records how this model models the response of the groundwater to various situations, but there is now much evidence to claim that the basic model is unjustified and wrong; further the wrong situations have been modelled as described now.

25. Section 3.3 Worst case scenario. This is not the worst case scenario; water levels are of course a concern to neighbours as so many in Camden have been affected by rising water levels following basement construction, but this is not the worst case. The worst case scenario is a basement cutoff which has not been constructed as designed because of internal erosion in the piles below the water table (and here the perched water levels are relevant) and a basement excavation that is partially or perhaps almost completely excavated at a time of intense rainfall. This has not been analysed because it has not even been appreciated despite the hundreds of words written in exchanged reports. No means of managing ground water exists in the proposals to counter the effects of that possibility.

26. Thus the worst case scenario is not the worst case at all and it is alarming that neither HR Wallingford nor Campbell Reith have understood the worst case even at this late stage in the study.

27. There then follows an analyses of likely velocities associated with flow using hydraulic gradients that may be present – although the hydraulic

gradient used for that analyses is not defined (0.1 or 0.04 or something else?). However, the analyses fail to explain where the eroded fines are going; where is the free-face to which they will discharge? The problem has not been properly understood and the analyses is meaningless in terms of erosion potential. The key point here is that the worst scenario, as described above, would have the excavation floor as the free face, or between the piles if the pile wall was not water tight.

28. Section 4 Conclusions, summarises analyses which we would dispute as being of both an unreliable depiction of groundwater on site and an inappropriate analyses of situations for concern. Further the conclusions record that the model requires conditions which do seem to be highly questionable. It is also unclear what the conclusion on erosion is supposed to mean; it says *"Hence erosion should not be expected (though the hydraulic gradient is very steep and may promote erosion anyway).*

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Attached;
Fig. 1 March 2016
Fig. 1A March 2016

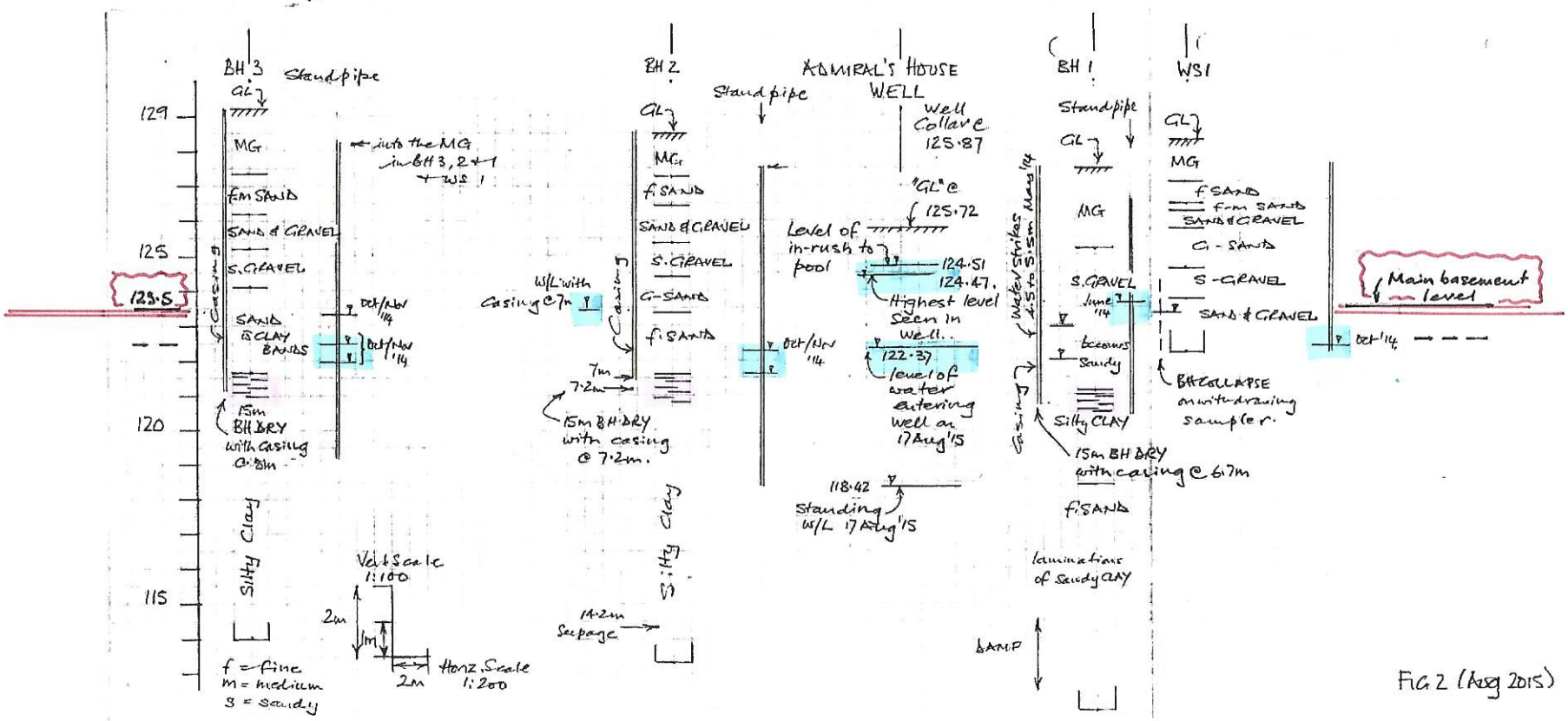


FIG 2 (Aug 2015)

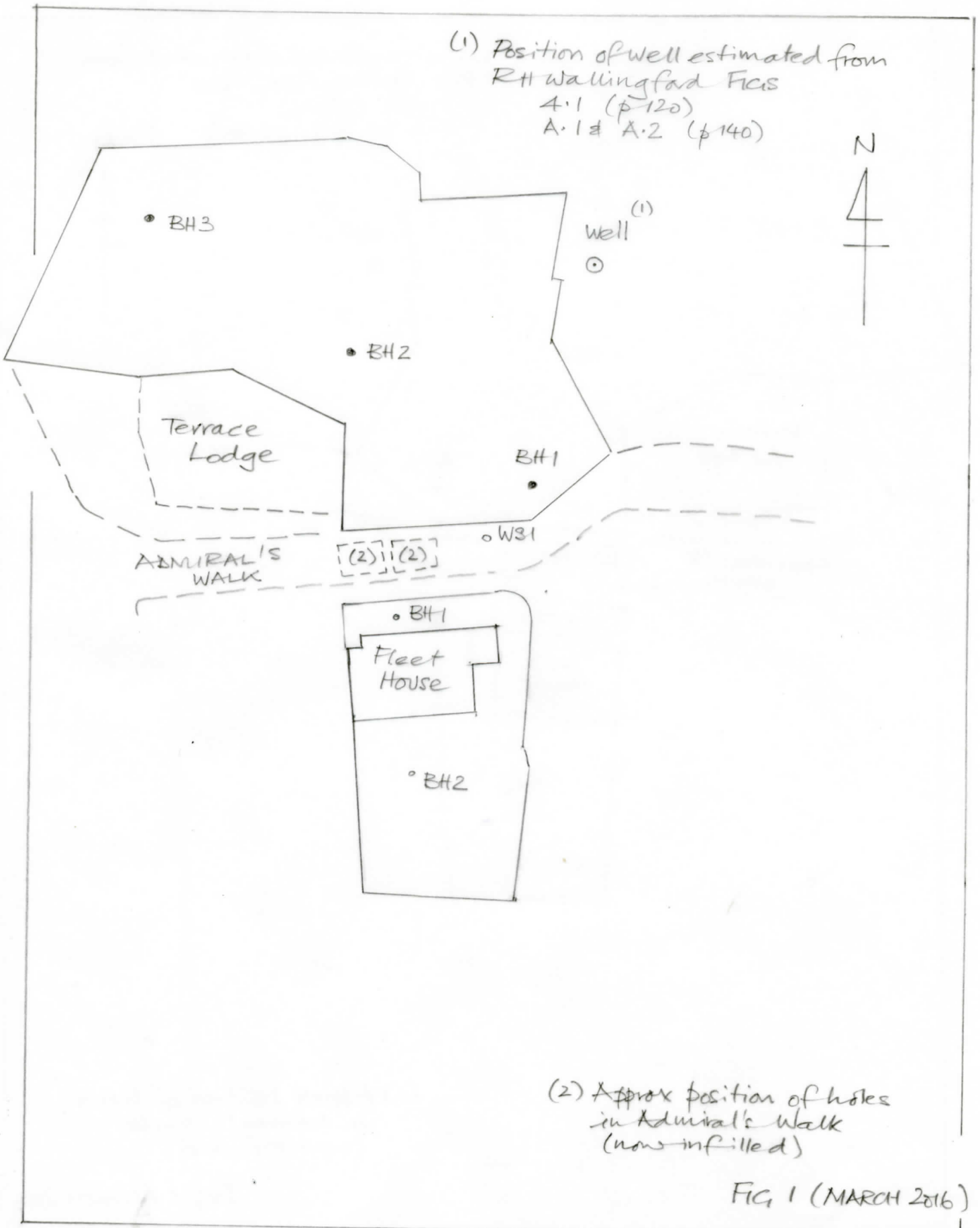


FIG 1 (MARCH 2016)

0 10 20 30 40 50m

1:500 SCALE

Traced from DRWG dNA GLR 00001
& Fleet House dimensioned from dNA GLR 00000

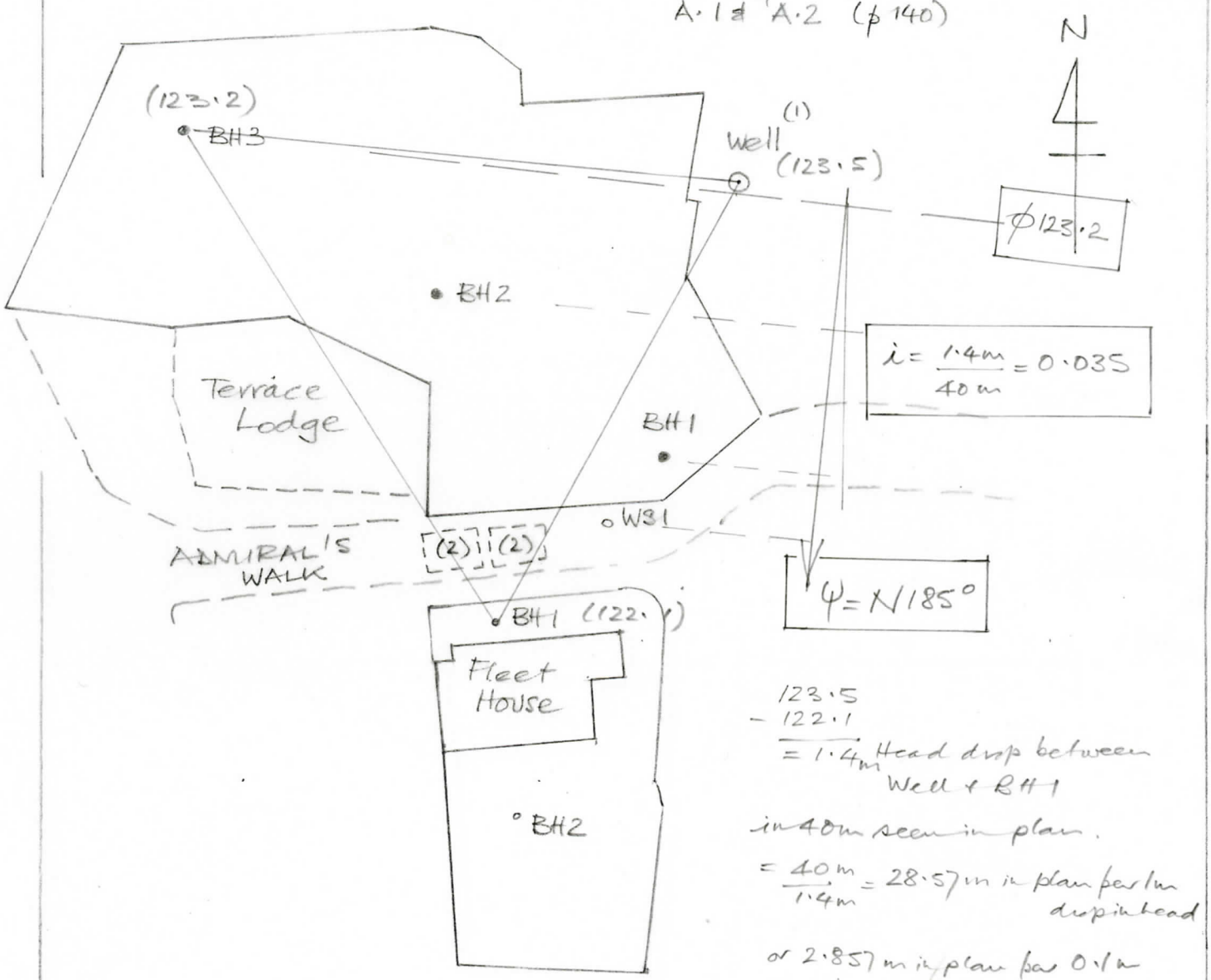
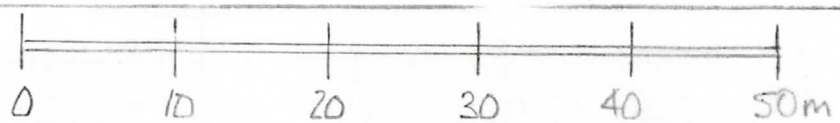


FIG 1 (MARCH 2016)



1:500 SCALE

FIG 1A.

Traced from DRWG dNA GLR 00001
& Fleet House dimensioned from dNA GLR 00 000