Stephen Buss Environmental Consulting

Neil McDonald
Principal Planner
London Borough of Camden

27 April 2018

Planning reference 2017/6973/P | 29 New End, London NW3 1JD

Dear Neil

I am writing in response to the draft basement impact assessment audit addendum recently completed by CampbellReith. In particular I refer to the point raised in paragraph 4.3, namely:

> 'A number of queries were raised in the initial audit on the hydrogeological assessments resulting in a number of mitigation measures (omission of shallow soakaways, introduction of a deep borehole soakaway, under slab drainage and piezometers through the basement walls). It should be confirmed that these measures are included in the new scheme. If they are included, the descriptions of the construction sequencing and ground movement assessment should be reviewed and updated for any impacts. If these measures are omitted, justification and a reassessment of likely impacts are required.'

Relevant Application History

For planning application reference 2016/2833/P we submitted the sub-surface component of the BIA (my report reference 2015-003-020-003) and the SUDS design in July 2016. Following the first audit by CampbellReith in August 2016 I responded by letter (my reference 2015-003-020-005) in the same month.

At the time of writing the BIA report I did not have information on the level of the cellar in the Duke of Hamilton pub, and I had to infer geology there from some (relatively) remote boreholes. Therefore, as a precaution against causing any rise in groundwater level I proposed a system to drain the upper aquifer (a passive drain, at pre-development water table level, using piezometer tips driven through the secant piles). I also did not have the benefit of being able to read the SUDS report, which was completed after mine (though they were submitted together in July 2016).

By the time of writing my letter in August 2016 my clients had obtained: the level of the pub cellar, geological and water level information from the immediate vicinity of the pub (borehole BH105), and longer groundwater level time series from the other boreholes. In addition, more groundwater monitoring points were identified and dipped. A constant head test was undertaken on BH102 to better understand the potential for using a soakaway in the deep aquifer.

Two further multi-level boreholes (BH106 and BH107) were drilled on the site in December 2016, and three shallow boreholes (BH108, BH109 and BH110) were drilled in March 2017. Logs will be provided to CampbellReith when they are finalised.

In December 2017 planning application refence 2017/6973/P was submitted, in which a change it was proposed to switch away from the previously approved bearing piled foundations to make use of a bearing raft below the basement slab. A BIA addendum report, prepared by Ross and Partners, was submitted in support of this. This addendum does not touch on hydrogeological aspects of the basement construction, just the ground movement analysis based on the new foundation design.

Water Table Drainage

In my August 2016 letter I reviewed the level of risk of water ingress in the Duke of Hamilton cellar as a response to audit point 4.10. The improved spatial coverage of groundwater level data and geological data led me to establish that there was no feasible risk of water ingress to the pub cellar, arising from basement construction. Appendix A to this letter reviews my findings in the light of more recent monitoring data and the new foundation design. My findings have not changed.

Hence the piezometer tip drainage system was deemed redundant and was dropped from the basement design. Clearly, there is no need to dispose of this water. In the BIA I suggested a French drain downstream of the building for this purpose. This is, obviously, no longer required. (This is not the same as the deep borehole soakaway to be used for rain water management.)

Discharge of rain water to deep soakaway

We propose to retain the proposed deep soakaway for rain water, as described in the SUDS strategy and in my August 2018 letter. The water is to be discharged into a sandy layer that (in BH102) lies between 105.5 m AOD and 103.0 m AOD. This is about 4.5 m below lower ground floor level, so several metres below the foundation slab.

Modelling of the impact on groundwater levels in this sand layer was undertaken in my August 2018 letter. This modelling made no assumptions about the basement construction and assumed an (effectively) infinite aquifer extent. Since the new foundation design is not going to penetrate the deep sandy layer, nothing has changed and the conclusions from August 2018 stand.

Under slab drainage

To my knowledge, under slab drainage of groundwater has not been proposed. I perceive no reason for this, for the same reason that there is no need for water table drainage. The only drainage below the slab is for domestic foul and surface water from the building.

Conclusion

To summarise, while the foundations have been redesigned, I consider that there has been no change in the likely hydrogeological impact of the proposed basement as a consequence. My previous assessments passed the final audit by CampbellReith in October 2016 and were the basis on which conditions 22 and 28 of application 2016/2833/P were discharged.

I trust that this letter provides enough detail for you to be able to move the application forward. Please do contact me if you need any further details.

Yours sincerely

Dr Stephen Buss

Hydrogeologist / Owner

THE GEOLOGICAL SOCIETY CGeol CHARTERED GEOLOGIST

Fellow No. 10004065

Appendix A: Groundwater level and hydrogeology review

Locations of all the boreholes that have been referred to in the risk assessments (relative to the former building) are shown below. Due to site works since August 2016 many of the boreholes have been lost but BH102 and BH105 have been retained. BH106 to BH110 were drilled in December 2016 and January 2017.

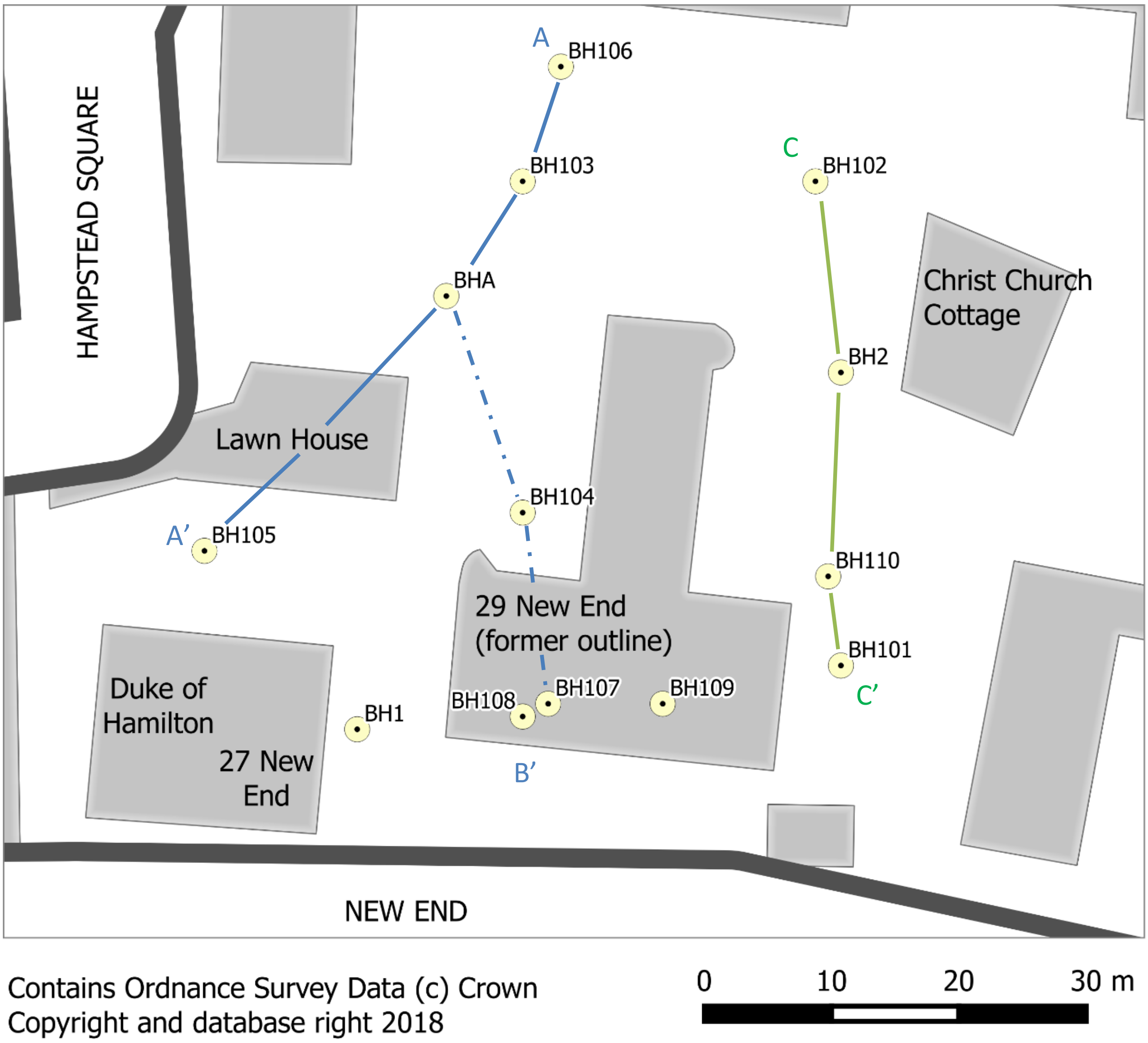

Figure 1 Borehole locations with cross sections A-A' (solid blue line), A-B' (dashed blue line) and C-C' (solid green line)

Water level measurements from all the boreholes are tabulated on the final page of this appendix. Time series for BH102 and BH105, the remaining boreholes used in previous interpretations, are plotted below. The levels are very similar from August 2016 to early 2017.

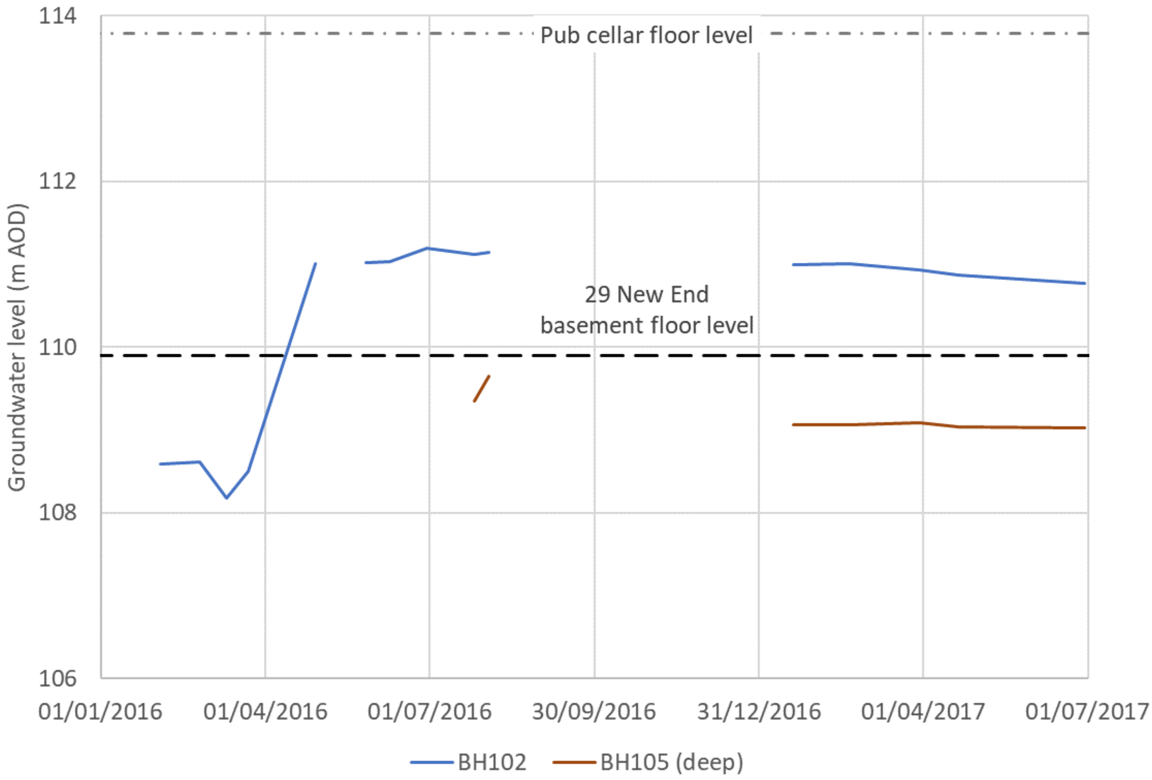

Figure 2 Long-term borehole levels

Of the newer boreholes, levels in BH106 (shallow), BH107 (shallow), BH108, BH109 and BH110 are all within the range of levels from previous monitoring. Levels in each borehole are consistent.

The level in BH106 (deep) is about 3 m deeper than the next deepest water level (BH101), possibly because BH106 is completed in a much deeper aquifer at around 90 m AOD, rather than BH101 which is completed at about 104 m AOD.

Water levels in BH107 (deep) have been irregular because it is completed in London Clay at depth (86 m AOD). The borehole was lost soon after due to site works.

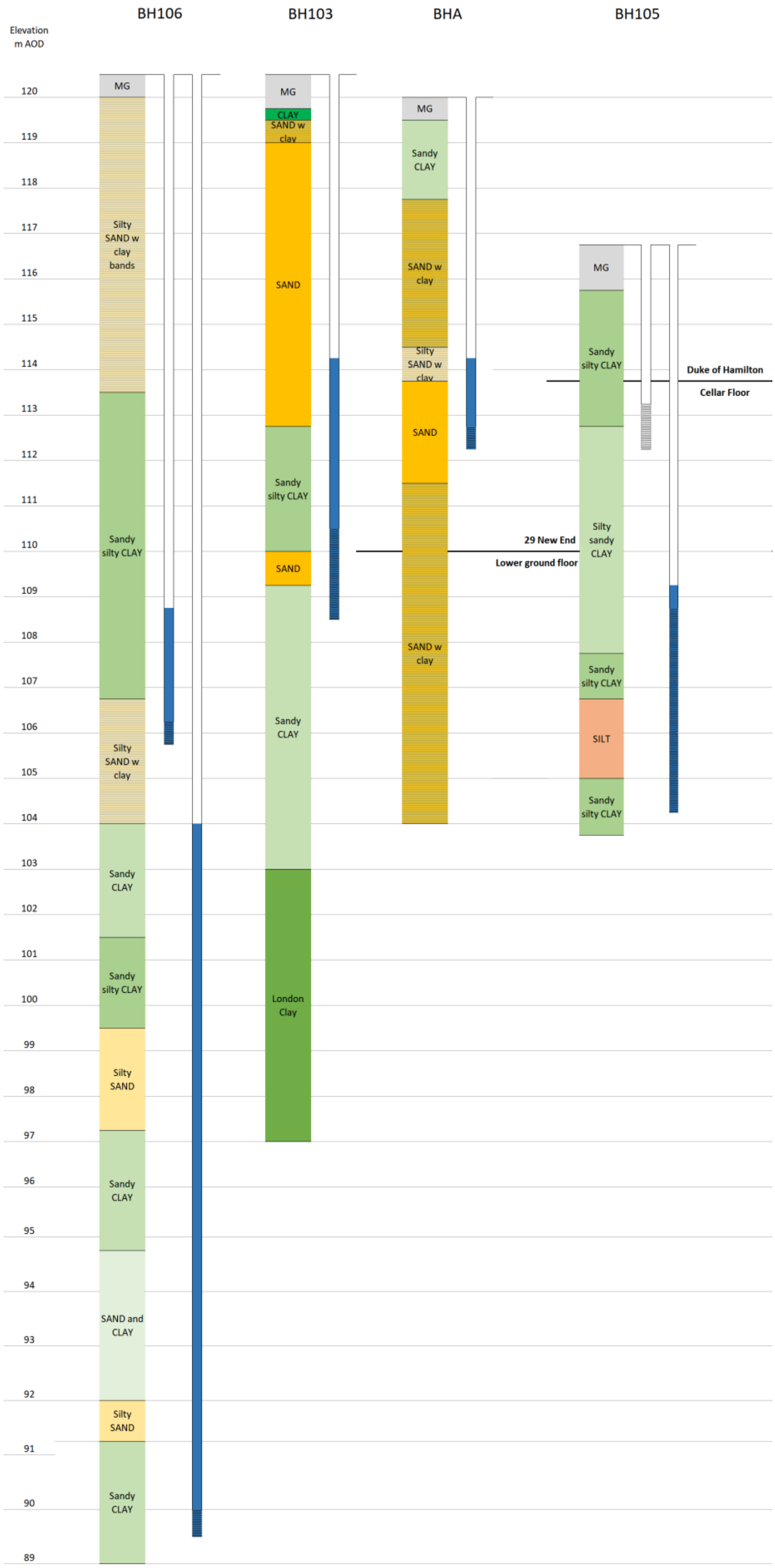

Figure 3 Cross section A-A’

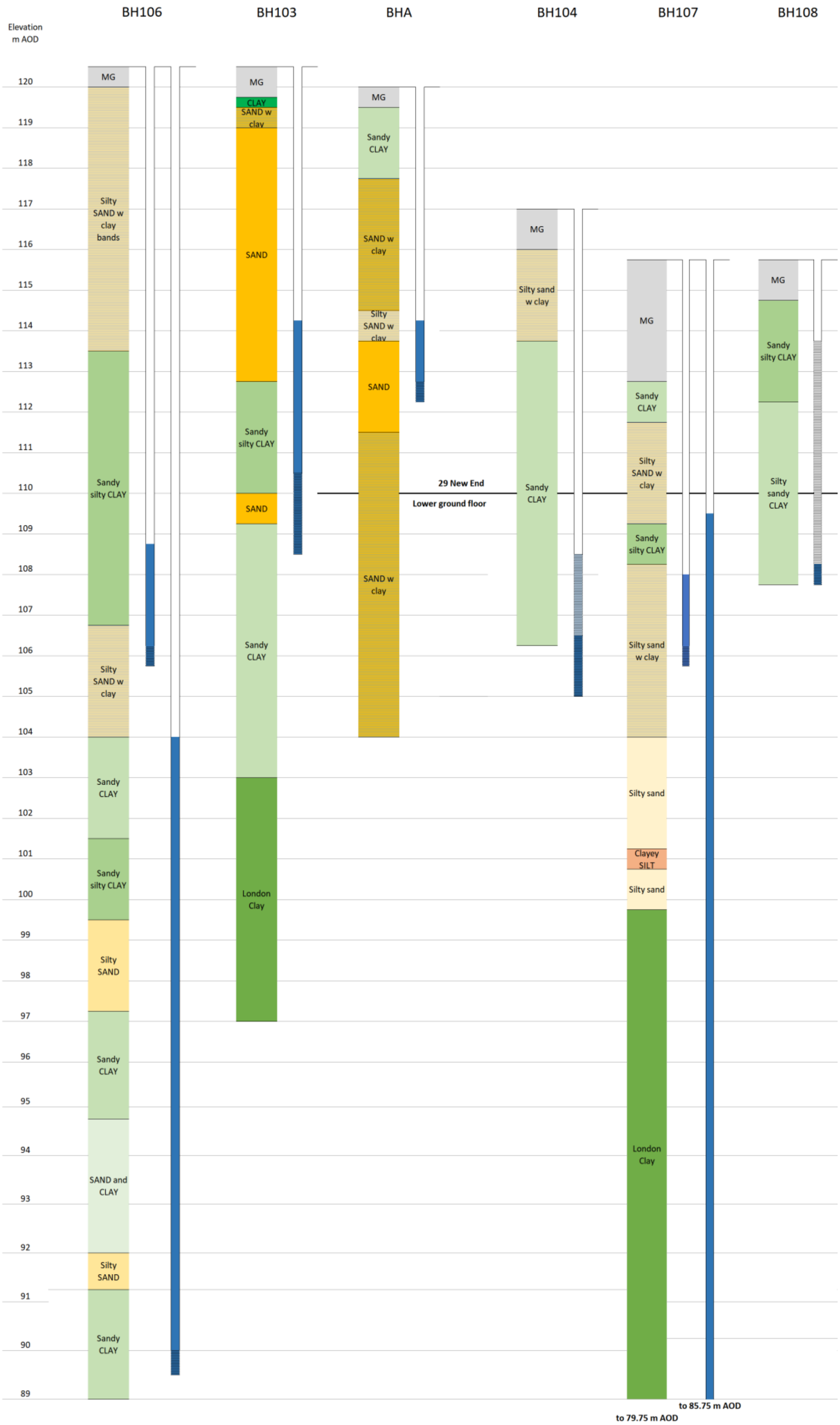

Figure 4 Cross section A-B'

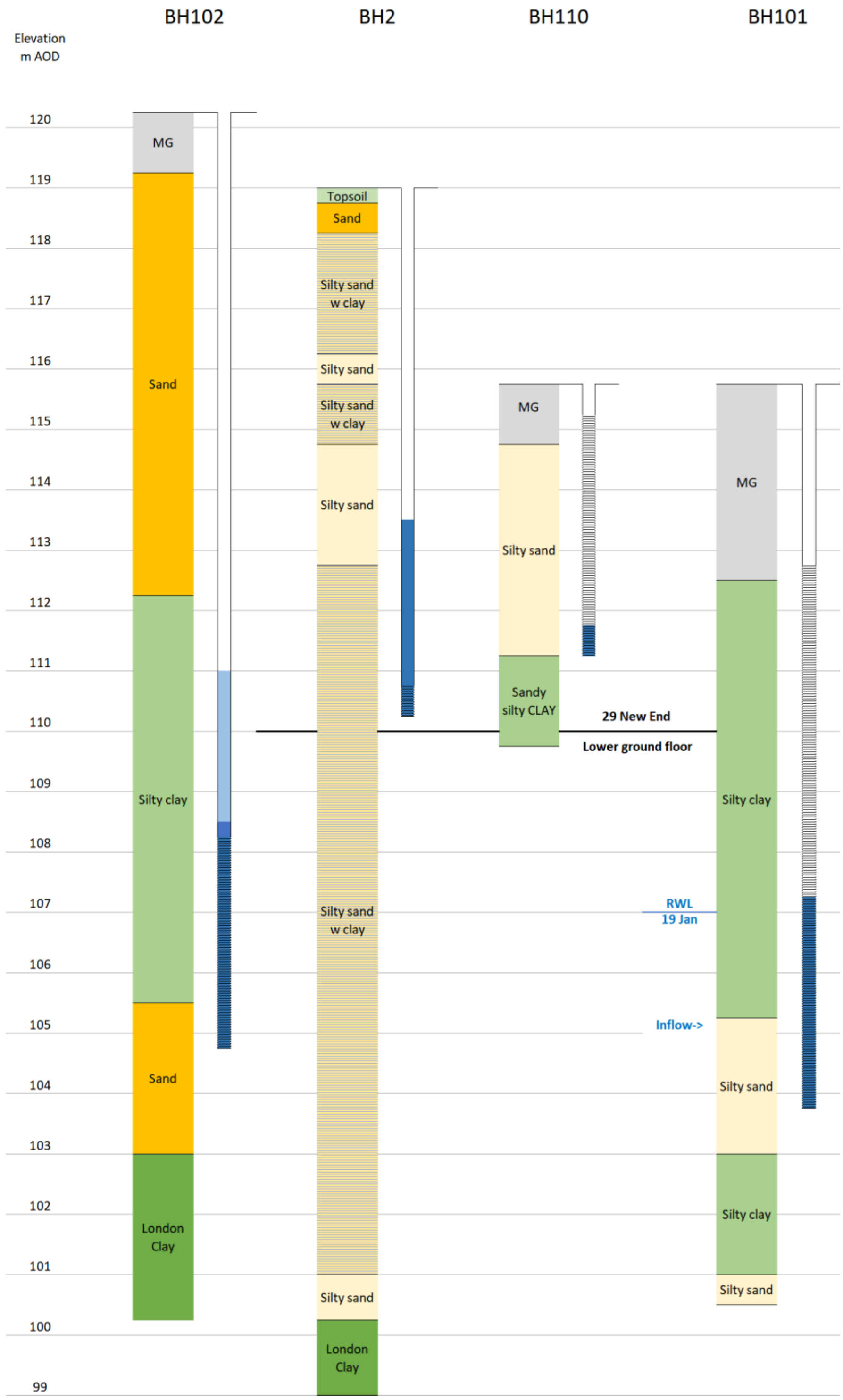

Figure 5 Cross section C-C'

Depth to water level in borehole (m)

	03/02/2016	25/02/2016	11/03/2016	23/03/2016	29/04/2016	13/05/2016	27/05/2016	09/06/2016	30/06/2016	26/07/2016	03/08/2016	19/01/2017	09/02/2017	30/03/2017	21/04/2017	30/06/2017
BHA								5.63	5.60	5.22	5.50					
BH1		7.40	7.40	7.41			7.40	7.30	7.30		7.33					
BH2									5.60	5.57	5.60					
BH101				8.57	8.37	8.46	8.70	8.50	8.30	8.30	8.40					
BH102	11.76	11.74	12.17	11.85	9.34		9.33	9.32	9.15	9.23	9.20	9.36	9.34	9.42	9.48	9.58
BH103	6.15	6.15	6.14	6.15	6.07	6.15	6.15	6.13	6.10	6.02	6.10					
BH104	8.65	8.66	8.65	8.67	8.55	8.65	8.60	8.63	8.50	8.60	8.63					
BH105 (deep)										7.40	7.10	7.69	4.56	7.66	7.71	7.73
BH105 (shallow)										dry	dry	dry	dry	dry	dry	dry
BH106 (deep)												17.50	16.85	16.20	16.48	16.45
BH106 (shallow)												10.85	11.66	11.67	11.72	11.79
BH107 (deep)												6.32	13.54			
BH107 (shallow)												7.73	7.53	7.63	7.64	7.72
BH108														7.42	7.48	7.52
BH109														2.34	2.34	2.55
BH110														3.57	3.59	3.70

Elevation of water level in borehole (m AOD)

	Datum	03/02/2016	25/02/2016	11/03/2016	23/03/2016	29/04/2016	13/05/2016	27/05/2016	09/06/2016	30/06/2016	26/07/2016	03/08/2016	19/01/2017	09/02/2017	30/03/2017	21/04/2017	30/06/2017
BHA	119.80								114.17	114.20	114.58	114.30					
BH1	115.80		108.40	108.40	108.39			108.40	108.50	108.50		108.47					
BH2	119.10									113.50	113.53	113.50					
BH101	115.70				107.13	107.33	107.24	107.00	107.20	107.40	107.40	107.30					
BH102	120.35	108.59	108.61	108.18	108.50	111.01		111.02	111.03	111.20	111.12	111.15	110.99	111.01	110.93	110.87	110.77
BH103	120.50	114.35	114.35	114.36	114.35	114.43	114.35	114.35	114.37	114.40	114.48	114.40					
BH104	117.10	108.45	108.44	108.45	108.43	108.55	108.45	108.50	108.47	108.60	108.50	108.47					
BH105 (deep)	116.75										109.35	109.65	109.06	112.19	109.09	109.04	109.02
BH105 (shallow)	116.75										dry	dry	dry	dry	dry	dry	dry
BH106 (deep)	120.56												103.06	103.71	104.36	104.08	104.11
BH106 (shallow)	120.56												109.71	108.90	108.89	108.84	108.77
BH107 (deep)	115.75												109.43	102.21			
BH107 (shallow)	115.75												108.02	108.22	108.12	108.11	108.03
BH108	115.69														108.27	108.21	108.17
BH109	115.69														113.35	113.35	113.14
BH110	115.73														112.16	112.14	112.03