D BELOV AND G MCDOUGAL

58A REDINGTON ROAD

HYDROGEOLOGICAL IMPACT ASSESSMENT

REVISION 1

October 2018

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DISCLAIMER

REVISION HISTORY

Revision	Date	Prepared by	Reviewed by	Description
Draft	August 2018	Dr A. Gasparre Dott,Ing, PhD, DIC, CEng, MICE	Dr J.Skipper BSc PhD DIC CGeol	Issued for comments
Revision 0	October 18	Dr A. Gasparre Dott,Ing, PhD, DIC, CEng, MICE	Dr J.Skipper BSc PhD DIC CGeol	Typos amendments

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EXECUTIVE SUMMARY

The proposed redevelopment of 58a Redington Road comprises the demolition of the existing house and the construction of a new building with basement.

A hydrogeological study has been undertaken to assess the impact of the proposal on the local hydrogeology and on the adjacent structures.

The site is underlain by Claygate Member and it is close to the boundary where the Bagshot Bed Formation overlays the Claygate Member.

The site is on ground sloping southwards and eastwards with an approximate gradient of 1: 15.

Groundwater at the site has been measured throughout August and September 2018. It has been found to be approximately 4m below ground level and to flow following the topography of the area. There are lost rivers in the proximity of the site, which are likely to represent the preferential pathway for groundwater in the area.

The front of the proposed basement will intercept the groundwater level and extend approximately 1m below it. The rear of the new basement will remain above the measured groundwater level.

The new basement will therefore only create a local barrier to the groundwater flowing across the site and it is unlikely to cause adverse changes to the local hydrogeology.

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1 Introduction

The proposed redevelopment of 58 Redington Road comprises the demolition of the existing building and the construction of a new structure with a basement.

The Geotechnical Consulting Group (GCG) have been commissioned to estimate the impact of the proposed basement construction on the local hydrogeology.

This report discusses the issues related to groundwater and considers the land drainage design measures (if required) to minimise the potential risks of adverse effects of the project on groundwater and neighbouring properties.

Information on the proposal has been provided by Elite Designers, the structural consultants for the project.

This report has been prepared as part of the requirements set by the DP27/CPG4 and LB Camden's 'Guidance for Subterranean Development'. It addresses the issues of the subterranean (ground water) flow screening chart that is shown in full details in Appendix A.

2 The site and the proposed redevelopment

The site lies within the Belsize Camden Administrative Boundary and is located on the east side of Redington Road, at approximately 200m to the south of West Heath (Figure 1a).

It stretches approximately 75m along a north-west to south-east direction and it is approximately 7.5m wide. At its rear end it widens to approximately 22m over the width of the adjacent 58b Redington Road.

The site includes an 8m long paved driveway at the front, a semidetached mansion house with lower ground floor and a rear garden. Figure 1b shows a layout of the site.

The house is approximately 15m long and 6m wide, but it widens to 7.5m at the rear to extend to the eastern boundary of the site. This house is believed to be a late addition to the adjacent 58b Redington Road, with which it shares a party wall.

The house has a light well at the front and a patio at the rear that is 4.5m below the level of the front driveway.

The lower ground floor extends underneath the whole footprint of the house. At the front of it is approximately 2m below ground (i.e. finished floor level of +109.3mOD) and it steps down to +107mOD at the rear to reach the level of the patio. There is also a 3m deep basement underneath the driveway (i.e. finished floor level of +108mOD)

Figure 2 shows a plan of the existing lower ground floor and a north-west to south-east section through the house.

It is proposed to demolish the existing house and create a new basement underneath its original footprint and the existing rear patio . Figure 3 shows a plan of the proposed basement and a section through the site.

The finished floor level of the new basement will be approximately +104.1mOD and will require approximately 5m of excavation underneath the front of the original footprint of the house (assumed foundation level at +103.6mOD) and 2.5m excavation underneath the rear part of the original house and the patio.

It is understood that the basement will be formed by underpinning the party walls of the original house.

3 Topography and geology

The site is on ground sloping to the south at an approximate gradient of 1:15 (Figure 1a). The ground level at the front of the site is approximately +109.7mOD and about +105mOD at the rear.

The ground and groundwater conditions have been established on the basis of record information (British Geological Survey, BGS, maps and record boreholes) and a site-specific ground investigation carried out by Geotechnical & Environmental Associates, (GEA, 2018).

The 1:50,000 scale geological map (BGS, 1994, Sheet 256 – North London, Figure 4 shows that the site is on Bagshot Sand Formation at its boundary with the Claygate Member outcrop. The Bagshot Sand Formation includes horizontally bedded sands with occasional thin gravel beds and lenses of silt and clay, while Claygate Member is composed of interbedded layers of fine-grained sands, silts and clays.

It should be noted that the geological boundaries in the BGS maps are based on information combined from borehole logs, topography and features on the ground surface. The exact location of the geological boundaries provided in these maps is therefore only approximate.

There are no BGS record boreholes in the immediate vicinity of the site, but borehole logs in the GCG's database show that on Templewood Avenue, about 120m to the east of the site, Claygate Member is present from the ground surface, approximately 105mOD.

Below the Claygate Member the stratigraphy of the site includes London Clay, Lambeth Group, Thanet Sand and Chalk.

The London Clay outcrops at about 300m to the south of the site at levels that appear to be approximately +90mOD. The thickness of the London Clay in this area is expected to exceed 60m.

The site specific ground investigation included the sinking of a total of four boreholes and five trial pits. Three boreholes to 15m depth were sunk in the rear patio and in the garden, at the back of the main house, and one borehole to 10m was sunk in the light well at the front of the house. The location of the investigation holes is shown in Figure 5.

All borehole logs consistently identify the presence of a thin layer of Made Ground or Top Soil over a deposit of grey silty clay with bands of greenish silt and sand. This is identified as Claygate Member.

There is no evidence of Bagshot Formation being present at the site, although the construction of the existing house has required the excavation of approximately 3m of the original ground.

In all boreholes the upper part of the Claygate Member, down to a level of approximately +100 - +101mOD is described as *'firm brown and gsrey mottled silty sandy clay'*. Below this level, *'firm, grey silty Clay'* is identified. In the front borehole a 1.1m thick layer of sand is also recorded from +104.7mOD.

4 Hydrogeological conditions and hazards

A map of the Lost Rivers of London (Burton 1982, Figure 6) and the 1920 BGS map (Figure 4a) shows that numerous streams exist in the area of the site. These generally originate at the geological boundary between the Bagshot Bed Formation and the Claygate Member.

The closest stream to the site is immediately to the west and runs southwards parallel to the lower part of Redington Road to feed a tributary of the Westbourne River further to the south. There is another stream to the east of the site, along Templewood Avenue. Groundwater in the area of the site would be expected to flow towards these streams.

Other streams are further than 100m from the site and flow into various drainage channels to form tributaries of the four main rivers within the LB Camden. All these springs would be expected to be culverted or filled in.

The site is more than 100m away from the Hampstead Chain Catchment. The closest ponds appear to be at approximately 600m to the north of the site (Leg of Mutton), although smaller ponds are known to be present within West Heath.

4.1 Aquifers

Within the London area there are two recognised principle aquifers. The major aquifer is a deep aquifer below the London Clay, while the shallow aquifer lies predominantly within the deposits above the London Clay. The London Clay acts as a barrier between the two aquifers.

4.1.1 Deep Aquifer

The deep aquifer lies within the Chalk and Thanet Sand Formation that extends under the London Basin. Historically, extraction of water from this aquifer for drinking and industrial purposes has caused a significant drop in the aquifer level. Since the mid-1960s, extraction of water from the deep aquifer has declined greatly, and as a result the water level has been recovering. Due to the implications that this rising groundwater level has for the infrastructure of London, the aquifer level is now monitored and the rise in its level is controlled by pumping (as described by the Environment Agency, 2017).

Currently, the deep aquifer beneath the site lies at approximately -30mOD (Figure 7). The London Clay and clay sub-units of the Lambeth Group that overlie the Thanet Sand and Chalk are of very low permeability and of sufficient thickness that the proposed development will have no impact on the deep aquifer.

4.1.2 Shallow aquifer

The shallow aquifer lies within the superficial deposits above the London Clay. It is variable in both level and thickness, and is discontinuous. It has also been heavily modified by human activity throughout the history of London.

Groundwater in the shallow aquifer tends to flow above the underlying impermeable layers of clays following the underground topography of the area.

The presence of lost rivers or streams generally indicate the preferential ways of groundwater flow within the shallow aquifer.

4.2 Site conditions

There are two lost rivers in the vicinity of the site, which represent the preferential directions of groundwater flow in the area.

Due to the nature of the Claygate Member, some discontinuous and localised groundwater might also be present within the sandy bands above the more clayey layers.

Groundwater has been recorded during the investigation works and standpipes were installed to monitor groundwater at completion of the works.

Seepages and water strikes during the investigation works were recorded at various levels from approximately +101mOD in the rear part of the site and +105mOD at the front. The soil was found dry above this level.

The standpipes extended to 6m below ground level (bgl) in all boreholes and had a response zone to 1m bgl. Readings were taken on 3rd August 2018, 2 weeks after the completion of the investigation works and on 17th August 2018, after a few days of intense rainfall.

Groundwater was found at approximately +104.7mOD in the front borehole, +102.3mOD and 102.6mOD in the rear patio and +99mOD in the rear garden, further to the south-east of the house.

The levels of groundwater across the site are shown in Figure 8.

The measurements indicate that:

- groundwater across the site flows eastwards and southwards following the topography of the area.
- changes in groundwater levels before and after rain are negligible.

Groundwater levels reach their maximum at the end of winter, between February and April and therefore readings in Augusts might not be representative of a seasonal maximum. In order to verify how representative the readings are the annual rainfall rates and the rainfall rates of August have been analysed. These are shown in Figure 9.

Figure 9a shows that the total monthly rainfall for July and August 2018 are relatively high compared to annual values. Figure 9b confirms that the first set of readings in the standpipes at the site was taken during a long period of dry weather, while the second set of readings was taken after a few wet days. The fact that negligible differences were found in the measurements indicates that the permeability of the upper soil layers is relatively high and that groundwater drains rapidly so that the levels are not significantly affected by rainfall.

The combined data in Figure 9 indicate that the measured groundwater levels can be considered representative of an annual average for the site.

Groundwater levels measured at the site were consistent with those measured at a site in Templewood Avenue, 120m to the south-east of the site, at the end of September 2011.

It should also be noted that the presence of a lost river to the west and north of the site indicate that the groundwater catchment area of the site is limited.

4.3 Surface Flooding

The Environment Agency data indicates that the area of the site is at very low risk of flooding from surface water, rivers or sea and reservoirs (Figure 10a).

Redington Road is not in the list of roads of Camden affected by flooding in the last few years (Figure 10b), although Templewood Avenue, about 100m to the south of Redington Road, was flooded in 2002. Flooding occurred after intense rainfall and most likely it was due to poor drainage of superficial water and run off.

The site is not included in a Source Protection Zone and is also not in a sensitive land use or in a potentially contaminative industrial land use.

The proposal will slightly increase the current ratio of paved/green areas, but, given the extent of the rear garden, this is unlikely to have any adverse impact. Furthermore, it is understood that a SUDS system for the storage and attenuation of water run-off is to be provided in the rear garden. This will counterbalance the slight increase of paved areas of the proposed redevelopment and further mitigate any discharge of surface water.

5 Impact of the development and land drainage requirements

The excavation for the proposed basement will extend to an approximate level of +103.6mOD. Across the rear part of the house it will remain approximately 1.5m above the measured groundwater levels. At the front of the site it will be approximately 1m below the measured groundwater level.

The front part of the new basement box will create a minor, local barrier to the groundwater flowing across the site, but there will be space for groundwater flow underneath the rest of the site. Groundwater will therefore tend to deviate around the front of the basement box to continue its downhill course. A minor increase of groundwater head might occur on the uphill side (front) of the new basement. This will be confined within the boundary of the site, underneath the area of the driveway and it is unlikely to have any significant impact on the local hydrogeology or on any existing structure because the groundwater table is relatively deep below ground and there is space around the new basement.

It is possible that during wet winter periods groundwater could be higher than measured during the site investigation. However, given the nature of the ground, the limited size of the groundwater catchment area and the data in Figure 9, any potential increase of groundwater table is unlikely to be significant and alter significantly the scenario defined above.

The new basement walls should be designed accounting for groundwater and considering potential increase of levels.

Measures to deal with groundwater ingress will need to be adopted to form the underpinnings along the front edge of the new basement box. Perched water could also be present at higher levels above the clay strata of the Claygate Member, but this is likely to be localised and discontinuous.

In the permanent condition there will need to be a suitable internal construction to bring the structure to an acceptable standard with regard to moisture ingress.

6 Conclusions

The proposed redevelopment of 58a Redington Road comprises the demolition of the existing house and the construction of a new structure with basement.

The results of the site investigations carried out in August 2018 indicate that the site is underlain by Claygate Member, proved to 15m below ground level.

Groundwater has been found to be present from 4m blow ground level and flow southwards and eastwards following the topography of the ground.

Only the front part of the new basement would intercept the groundwater flow across the site. This might cause a local deviation of groundwater flow with, perhaps, a negligible increase of groundwater levels on the uphill side of the new basement. This will be localised within the boundaries of the site and is unlikely to have any significant impact on the local hydrogeology and on the surrounding properties.

Further to the rear of the site the groundwater flow would not be affected by the new basement construction.

There are two lost river in the vicinity of the site, but no other known ponds and wells. The site is outside the Hampstead pond chain catchment area.

The proposed basement will extend outside the footprint of the existing building, beneath the paved area leading to the garden at the rear. The proposed construction will only slightly increase the proportion of hard surfaced/paved areas.

Water ingress could occur during construction and provision should be made to excavate in the dry.

The proposal should have no impact on the deeper aquifer.

7 References

Barton N. (1992): The Lost Rivers of London. Historical Publications Ltd

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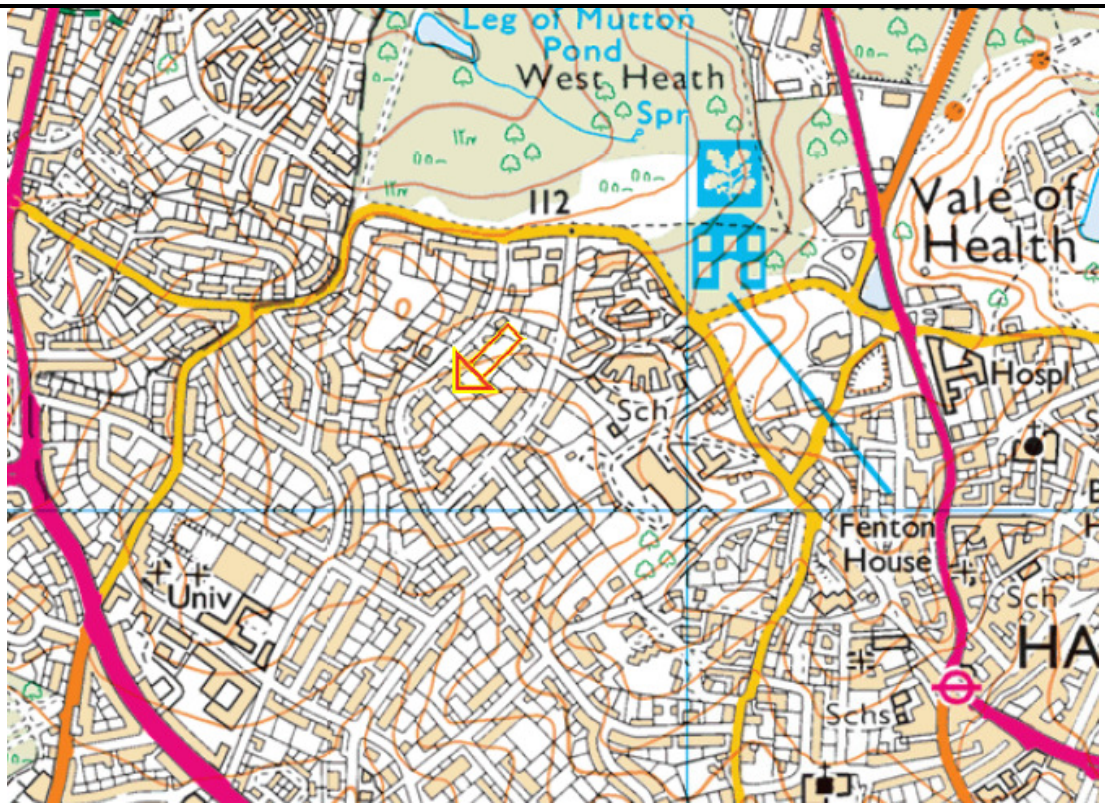
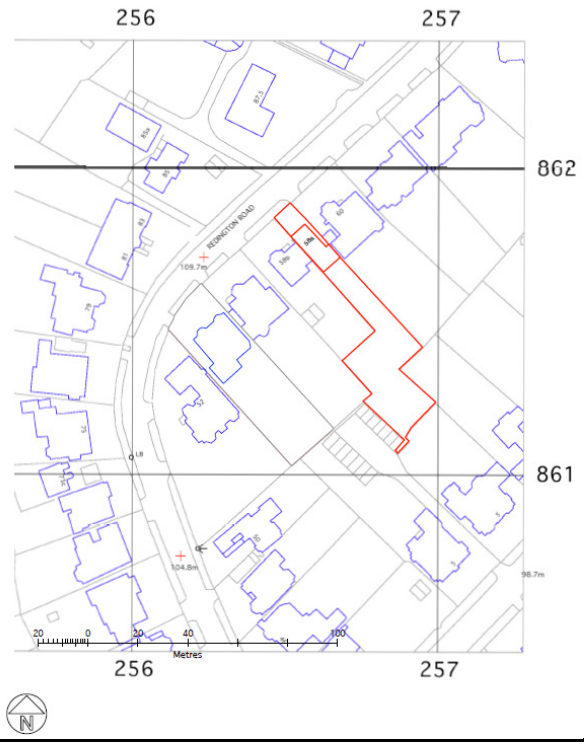
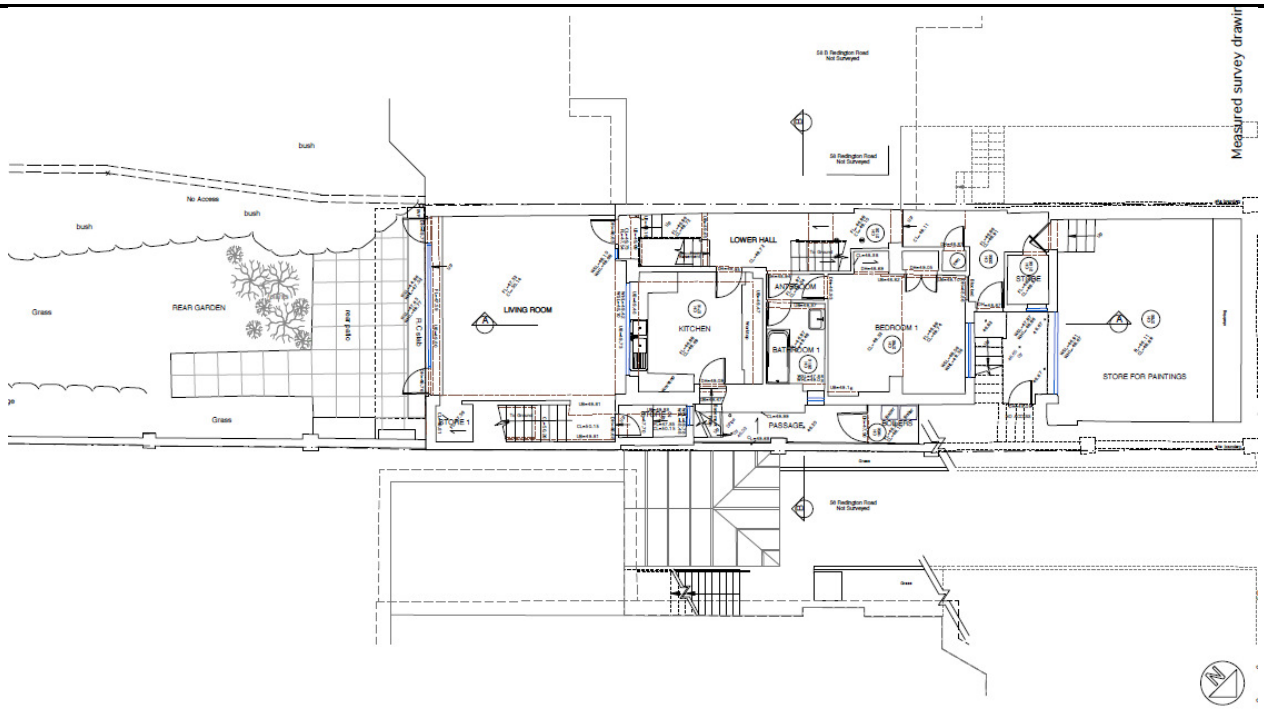
FIGURES





	D Belov and G McDougal 58a Redington Road	**Figure** **1**
	The site a) Location b) site layout	



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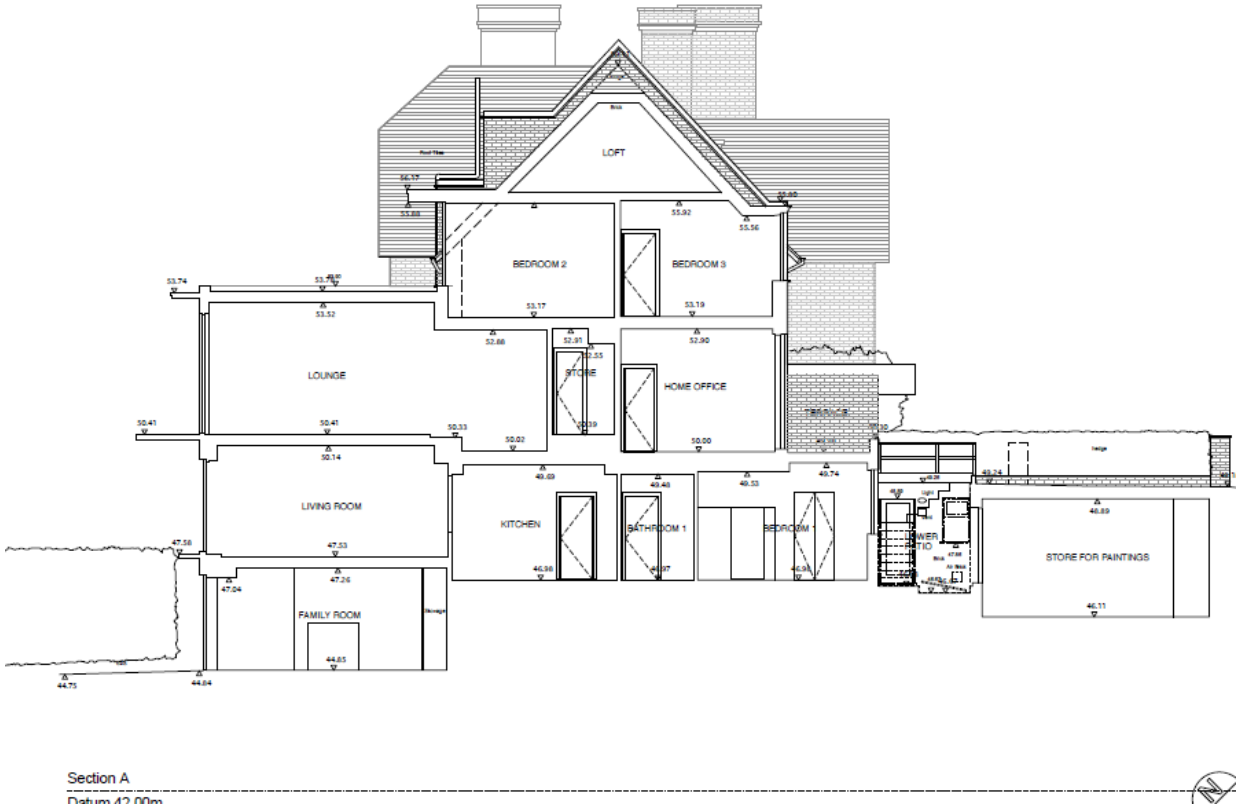
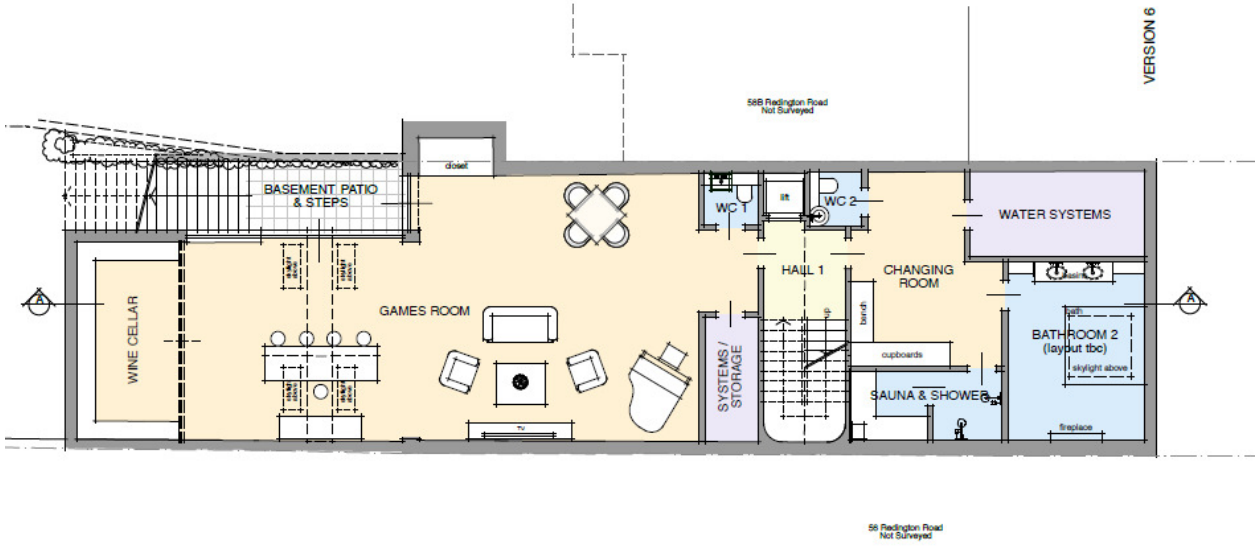


(b)

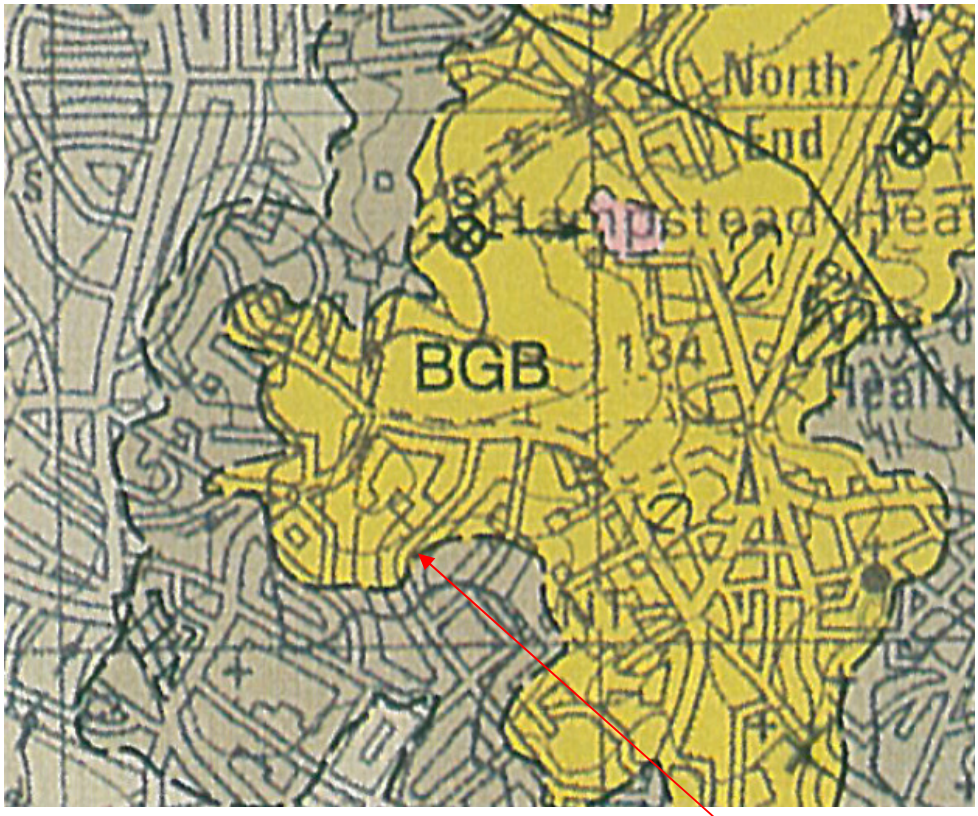
	D Belov and G McDougal 58a Redington Road	**Figure** **2**
	Existing lower ground floor (a) Plan and b) north-west to south-east section	



(a)

(b)

	D Belov and G McDougal 58a Redington Road	**Figure** **3**
	Proposed basement (a) Plan of lower ground floor and (b) north-south section	



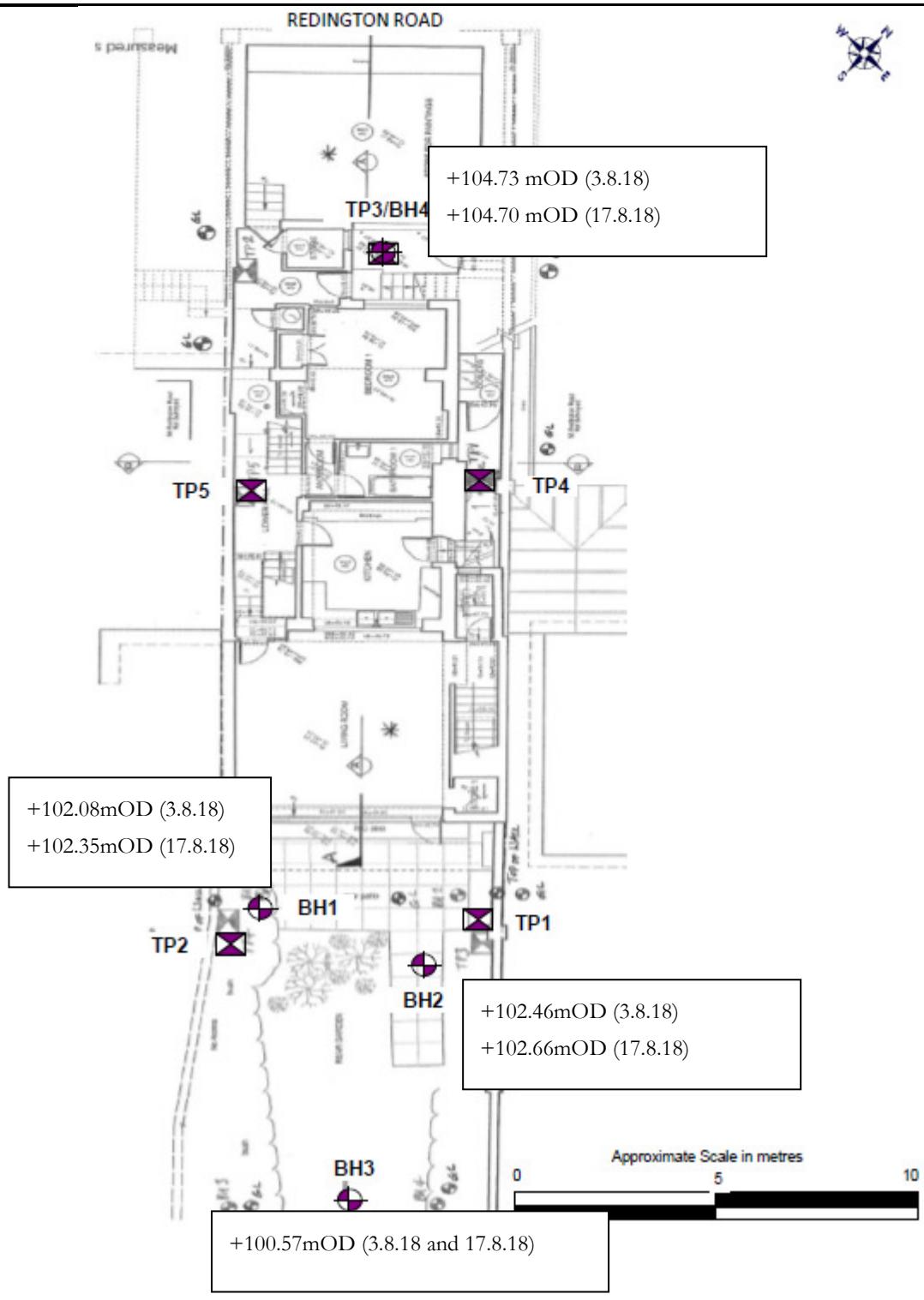
D Belov and G McDougal

58a Redington Road

BGS Geological map, 1992

Figure

4



	D Belov and G McDougal 58a Redington Road	**Figure** **5**
	Location of investigation points	

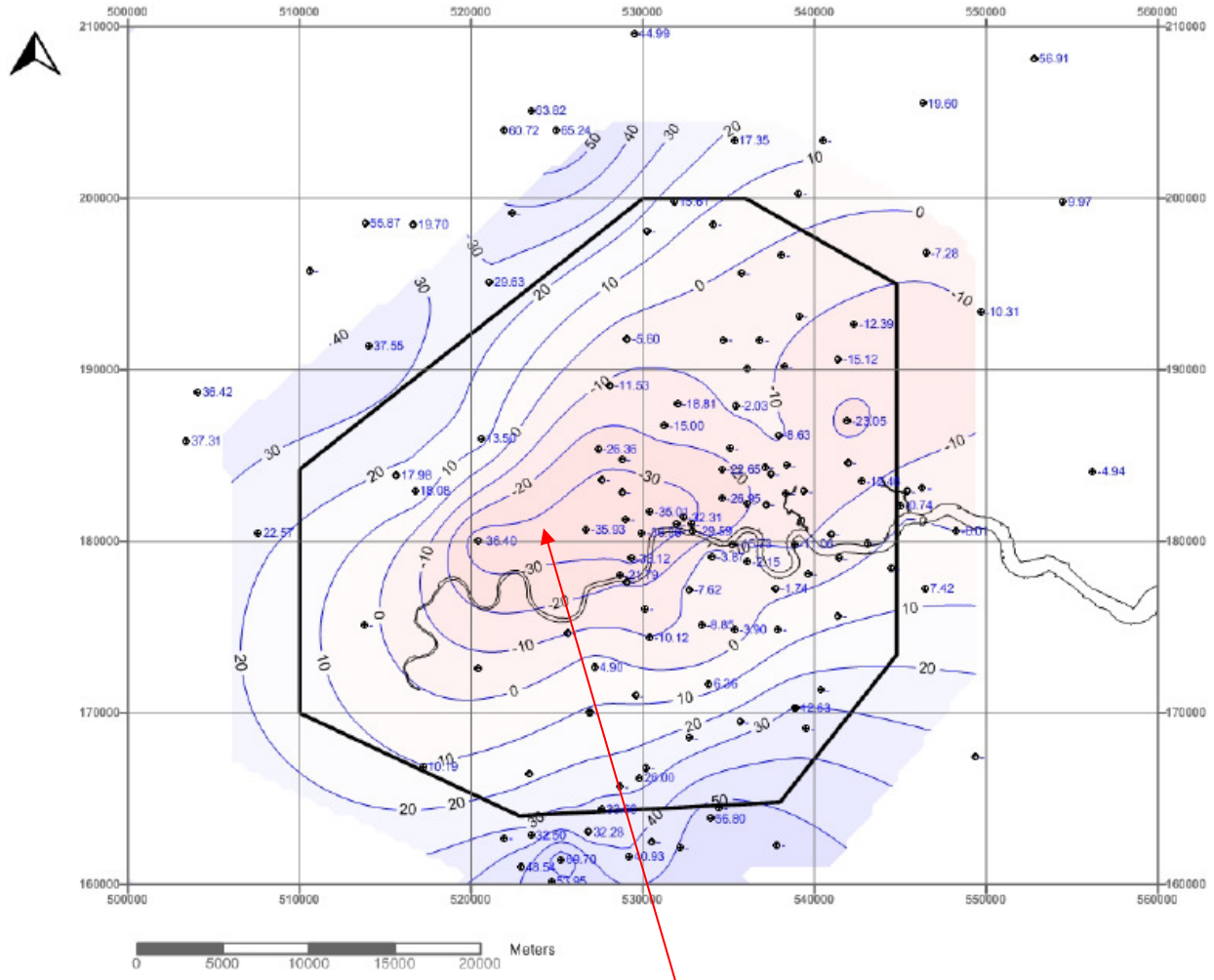
D Belov and G McDougal

58a Redington Road

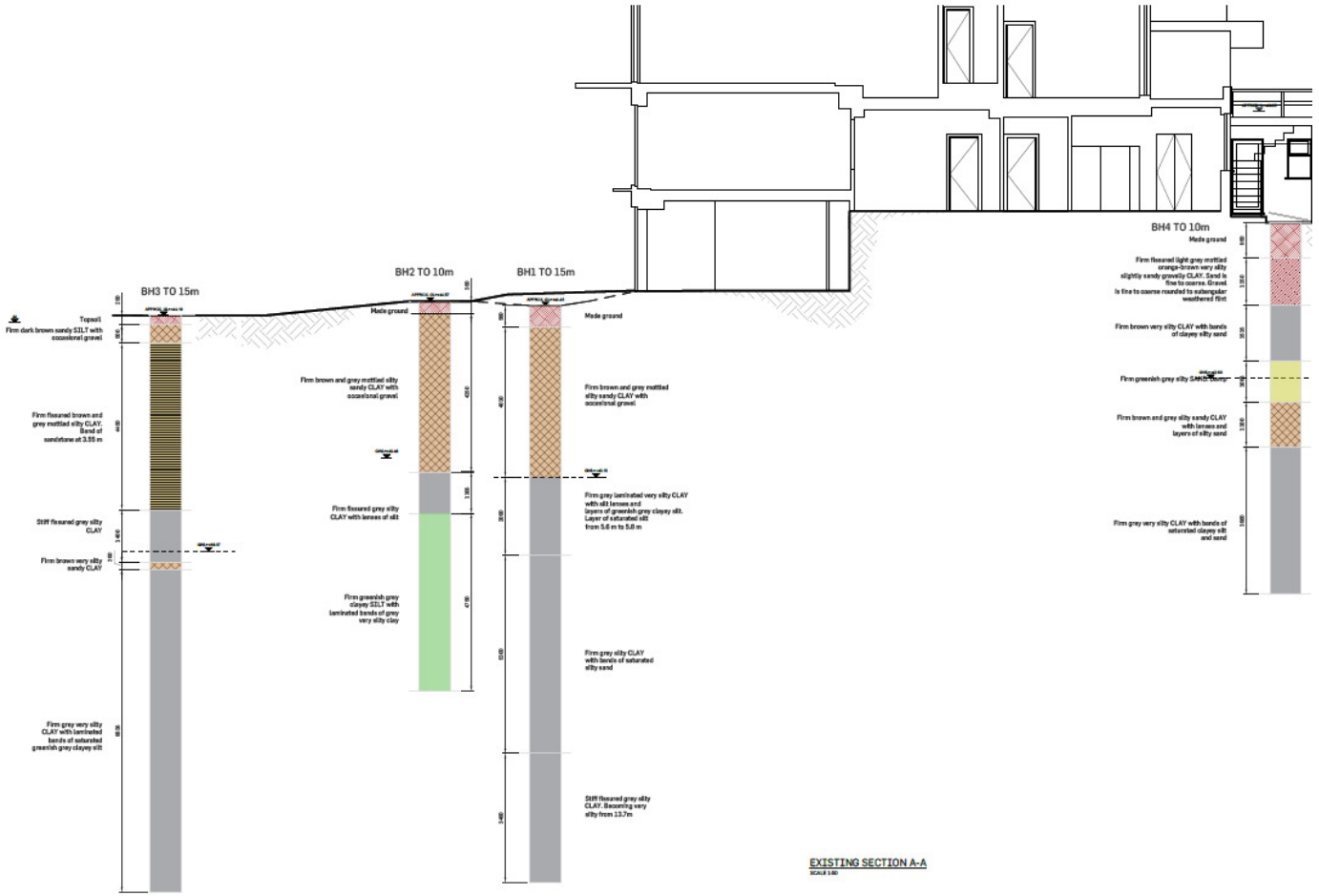
Extract from the Lost Rivers of London (Barton 1992)

Figure

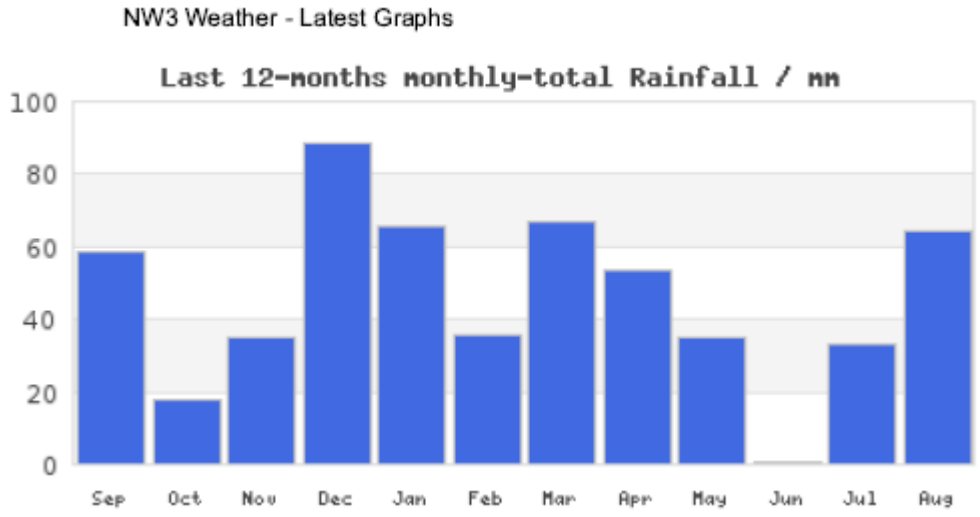
6



	D Belov and G McDougal 58a Redington Road	**Figure** **7**
	Level of deep aquifer Environment Agency 2016	



	D Belov and G McDougal 58a Redington Road **Groundwater levels across the site**	**Figure 8**



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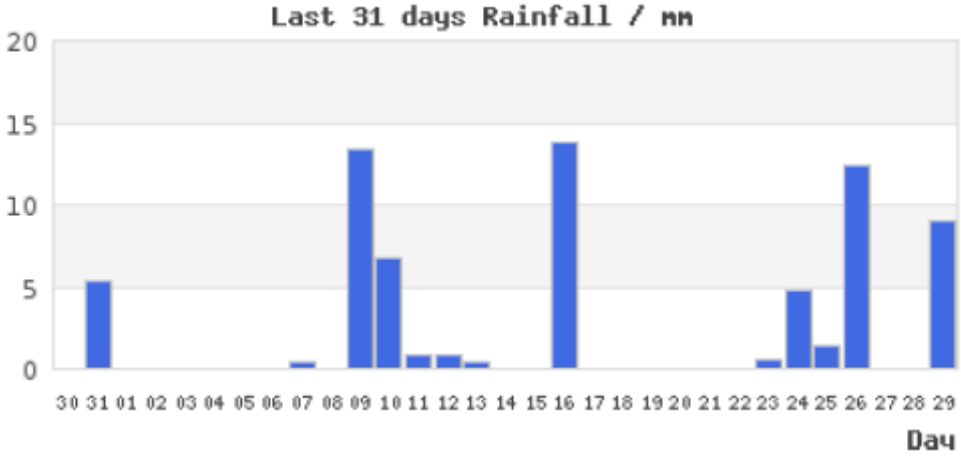
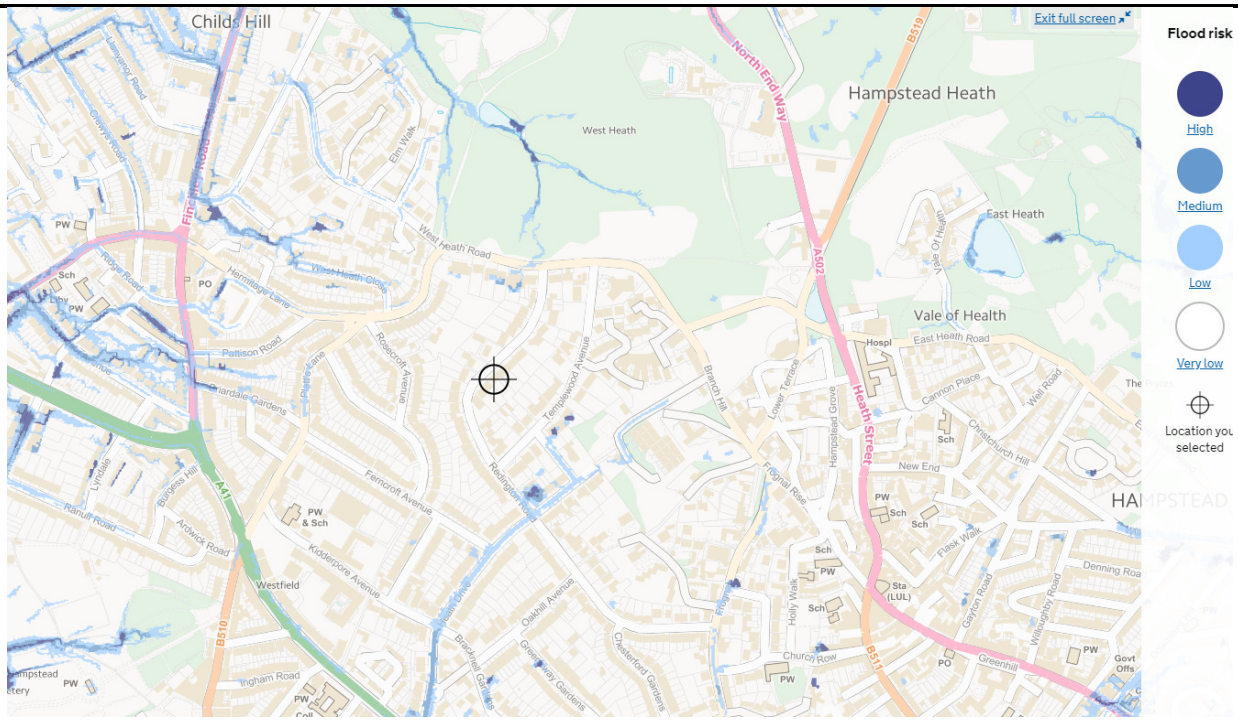
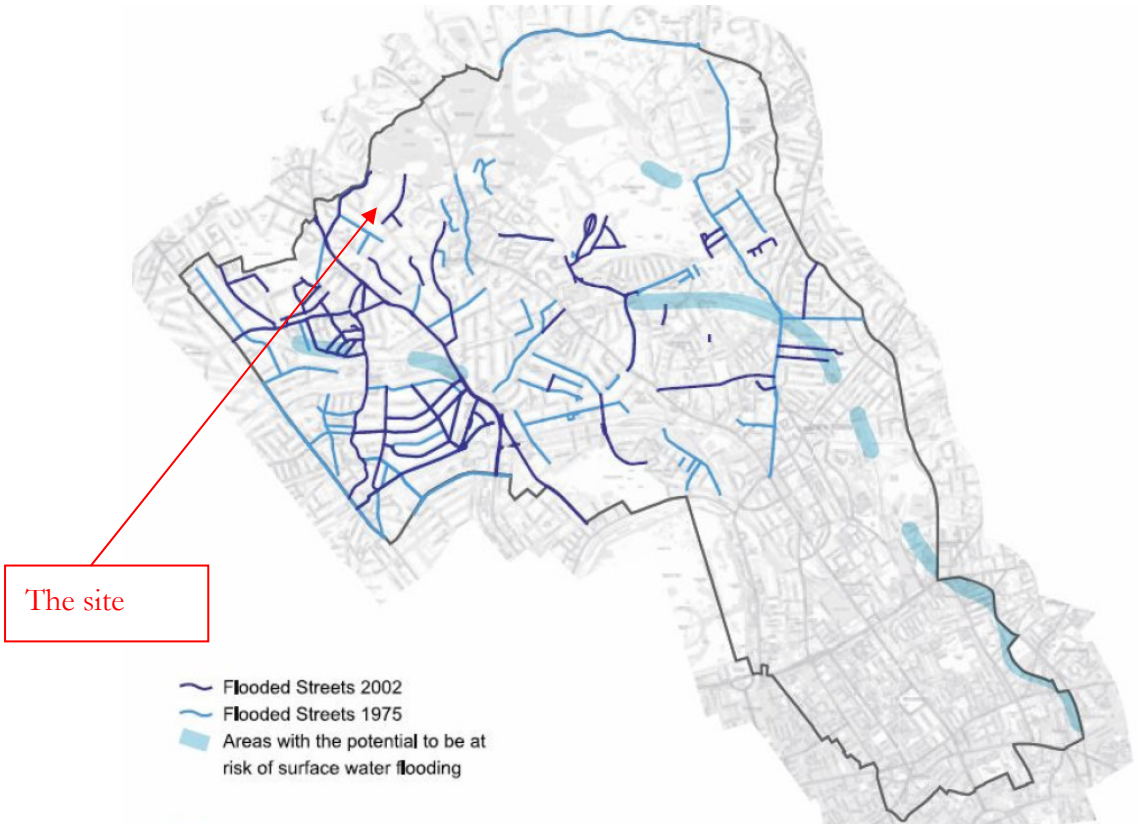


(b)

	D Belov and G McDougal 58a Redington Road	**Figure** **9**
	Rainfall levels a) Annual values, 2018 b) August 2018	





	D Belov and G McDougal 58a Redington Road	**Figure** **10**
	Surface flooding risk	

Appendix A

SUBTERRANEAN GROUND WATER FLOW SCREENING CHART

Question 1a: Is the site located directly above an aquifer?

The site is located above a secondary aquifer (Claygate Member). Given the nature of this soil, composed of interbedded layers of clay and silt and sand, free water could locally be found.

Question 1b: Will the proposed basement extend beneath the water table surface?

Only the front of the proposed basement will extend about 1m below he measured groundwater table at the site. The groundwater flows southwards and eastwards following the dip of the ground and the remaining area of the proposed basement will be approximately 1m above the measured groundwater level.

Question 2: Is the site within 100m of a watercourse, well (used/disused) or potential spring line?

Yes. The site seems to be close to a 'lost river', which originates on Redington Road, some 150m to the south of the site and runs southwards along a direction parallel to the road to form one of the tributaries of the Westbourne River. This is likely to be currently culverted or filled in.

Question 3: Is the site within the catchment of the pond chains on Hampstead Heath?

No. The site is more than 100m away from the Hampstead Chain Catchment.

Question 4: Will the proposed basement development result in a change in the proportion of hard surfaced/paved areas?

No. The proposed basement will extend below the footprint of the existing building and below the existing patio at the rear of the house.

Question 5: As part of the site drainage, will more surface water (e.g. rainfall and run-off) than at present be discharged to the ground (e.g. via soakaways and/or SUDS)?

No. A SUDS system will be provided that will reduce the current discharge of surface water.

Question 6: Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to, or lower than, the mean water level in any local pond (not just the pond chains on Hampstead Heath) or spring line?

Yes. The nearby stream is expected to originate at the junction between the Bagshot Beds and the Claygate Member to the north-west of the site and to run superficially within the Claygate Member deposits. As such the lowest point of the proposed excavation will probably be lower than the spring line.