Groundwater Impact Assessment

8 Lindfield Gardens
London
NW3 6PX

Site NGR: **TQ 2608 8528**

Prepared for:

David & Karin Gillerman

Updated

September 2014

18 Park Avenue, Bristol, BS3 5AH
+44 (0) 7595 023148 paul.thomson@onomatopia.net

Groundwater Impact Assessment

Site Address

8 Lindfield Gardens

London

NW3 6PX

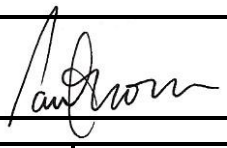
Site NGR: TQ 2608 8528

Document Control Sheet

This report has been prepared with all reasonable skill, care and diligence within the terms of the contract with David and Karin Gillerman incorporating Terms of Agreed work and taking account of the manpower and resources devoted to it by agreement with the client.

Whilst every effort has been made to ensure that the information presented in this document is accurate and that the opinions expressed are sound, Paul Thomson cannot be made liable for any errors or omissions or for any losses or consequential losses resulting from decisions based on its contents.

The report is confidential to David and Karin Gillerman. Paul Thomson accepts no responsibility of any nature to any third party to whom this report or any part thereof is made known.

Prepared by:	Paul Thomson BSc. MSc. DESS CGeol	

Report no:	R1	**Issue no:**	3	**Date:**	11th September 2014

Paul Thomson – Consultant Hydrogeologist
18 Park Avenue, Bristol. BS3 5AH
+44 (0) 7595 023 148 paul.thomson@onomatopia.net

Contents

1 Introduction

1.1 Background

David and Karin Gillerman are applying for Planning Consent to extend the existing part basement of 8 Lindfield Gardens (the Site). At the request of ~~Finkernagel Ross Architects Limited~~ Elliot Wood Partnership LLP, and working on behalf of David and Karin Gillerman, a groundwater impact assessment has been carried out in connection with the proposed development.

The groundwater impact assessment was originally completed in March 2013 (issued as revision 2 of this report). The assessment has been updated in this revision, and for ease of reading, amendments and additions are given in blue text. The update takes account of additional groundwater monitoring and considers any possible cumulative impacts.

Site investigation works have been undertaken by Site Analytical Services (SAS) Ltd. The work has included a detailed ground investigation[1]. This assessment should be read in conjunction with the ground investigation report.

The slope and ground stability component of the Basement Impact Assessment[2] was reported in April 2014 and includes additional information from a site investigation completed in March 2014. The investigation comprised the drilling of an additional borehole and collection of groundwater monitoring data.

1.2 Scope and Approach

The London Borough of Camden's "Guidance for Subterranean Development"[3] (the Guidance) requires that developers undertake a Basement Impact Assessment, or "BIA" for all basement developments within the Borough. The BIA follows the format of an Environmental Impact Assessment, and uses a risk based approach with regard to hydrology, hydrogeology and land stability.

The stages are as follows:

- Screening
- Scoping
- Site investigation and study
- Impact assessment
- Review and decision making

This report sets out the findings of the groundwater flow (hydrogeology) component of the BIA. Site investigations have been completed separately to inform the design process for the development. These investigations have been used to inform this groundwater assessment.

[1] "Report on a Ground Investigation" Site Analytical Services Ltd. Ref. 13/20316, March 2013.

[2] "Basement Impact Assessment (Slope and Ground Stability) Site Analytical Services Ltd. Ref. 13/20316-2, April 2014.

[3] "Camden Geological, Hydrogeological and Hydrological study - Guidance for Subterranean Development" Ove Arup & Partners Ltd., November 2010

The report will identify potential groundwater impacts the development may have. Appropriate mitigating measures can then be developed and adopted to avoid or minimise these affects.

The Author of this report is a qualified Hydrogeologist, Chartered Geologist and Fellow of the Geological Society of London, as required by the Guidance.

2 Proposed Development

Full details of the proposed development will be provided with the application. For the purpose of this groundwater impact assessment, the following brief description of the proposed development is given.

8 Lindfield Gardens is a large three-storey detached property with attic space which sits around 10 m back from the road. It has an existing part basement flat adjoining a basement level garage. The proposed development is to extend this basement level garage towards the rear of the property. Ground levels at the Site rise from the front of the property towards the rear (Northeast), and hence the deepest part of the basement will be at the rear where it will be up to 2.70 m below existing ground level.

It is proposed that the property's existing basement garage be extended towards the rear to accommodate the new basement area. Part of the basement will be excavated into area currently occupied by side and rear garden. The total area of additional basement will be approximately 90 m^2.

3 Site setting

3.1 Site location

The Site is situated on the east side of Lindfield Gardens in the Frognal are of Hampstead, London, NW 3 6PX within the Borough of Camden at National Grid Reference TQ 2608 8528. A site location plan is shown in Figure 1.

3.2 Topography

The Site lies at an elevation of approximately 85 mAOD on ground sloping at around 13% southeastwards.

Within the Site itself the ground slopes gently downward from the rear (northeast) to the front (southwest) of the property. The area to the immediate rear of the house where the basement is to be extended is at an elevation of approximately 5 m higher than the road.

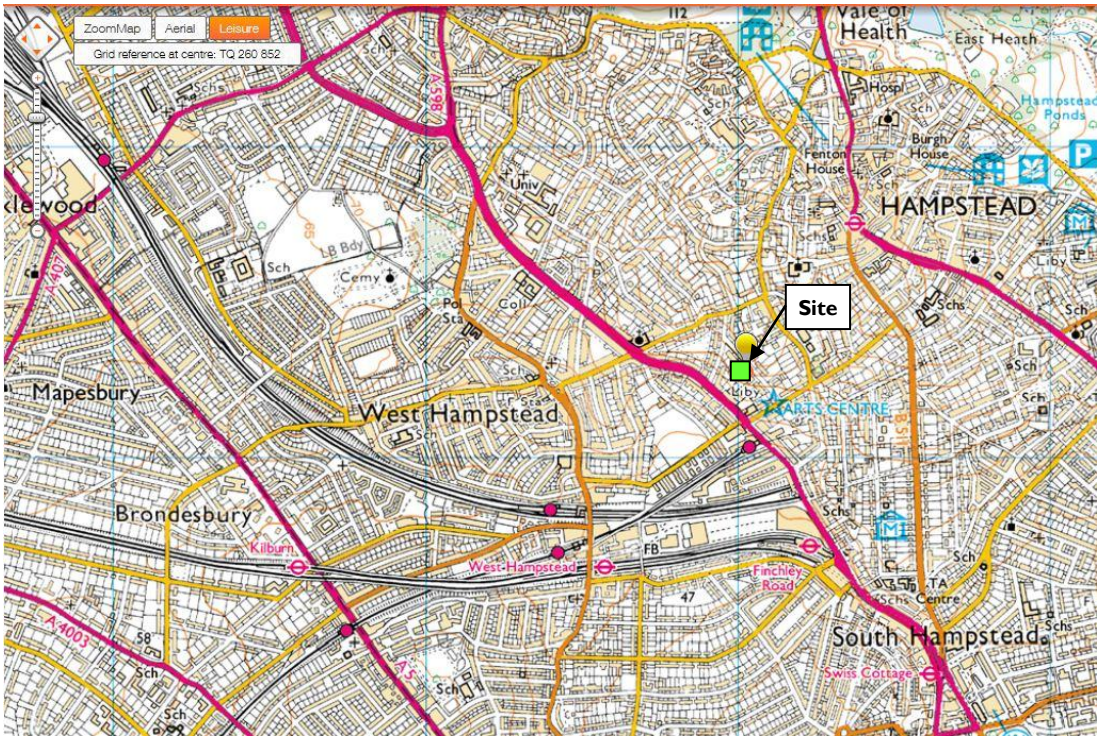


Figure 1 Site location

3.3 Hydrology and drainage

The Site lies within the surface water catchment of the lost Westbourne river. The river historically rose from springs on Hampstead Heath and has been culverted throughout its length. The site is more than 500 m to the East of the route of the culvert.

There are no other surface water features marked on Ordnance Survey mapping (1:25,000 scale) within 1km of the Site.

3.4 Geology

According to the British Geological Survey (BGS) 1:50,000 sheet for the area (Sheet 256, North London. 2006) and the associated geological memoir, The Geology of London (BGS 2004), the Site lies on the London Clay Formation. Approximately 300m north of the Site the sheet shows that Quaternary head deposits may be present. This is disturbed material which has moved downslope from higher ground in the area of Hampstead Heath.

The London Clay is underlain by the Cretaceous Chalk at a depth of over 150m beneath the Site.

The site investigation (March 2013)[1] established ground conditions to be generally consistent with the geological records and known history of the area and comprised between 0.25 m and 0.30 m thickness of made ground overlying materials typical of the London Clay Formation.

An additional site investigation (March 2014) found similar ground conditions with 0.30 m of made ground overlying Clay observed to a total depth of 10 m [(2)].

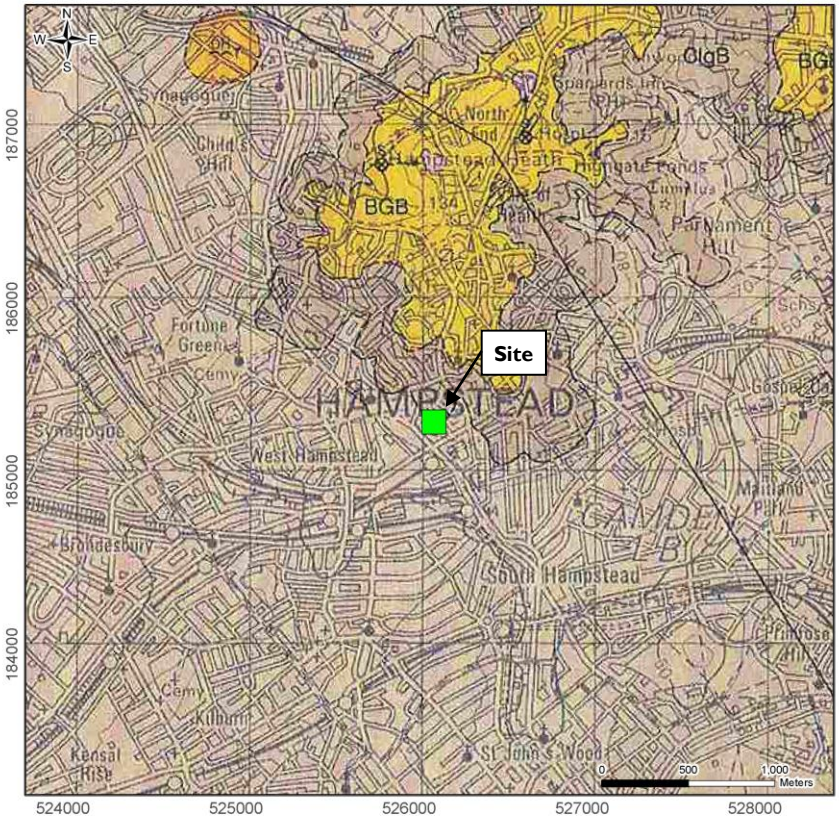


Figure 2 Geology

3.5 Hydrogeology

The Environment Agency classifies the London Clay as Unproductive Strata (formerly Non Aquifer), i.e. not capable of providing useable quantities of water; however this classification does not take into account local geological variations within the sandier upper London Clay Formation.

The Cretaceous Chalk is classified as a Primary (formerly Major) Aquifer however it is highly confined and not generally used for water supply in the central London area due to its poor water quality. Due to the thickness of London Clay at this location, the Chalk aquifer is not considered relevant to this assessment.

Groundwater vulnerability mapping for the area (Figure 3) shows the site to lie on the southern edge of secondary aquifer (previously known as "minor" aquifer). This aquifer is made up of the Bagshot Formation and Claygate Member which form the high ground of Hampstead Heath. However, the site investigation has demonstrated that the site lies on the London Clay, which is not part of the secondary aquifer.

The Site is not within any designated Source Protection Zones (Figure 3).

Any groundwater immediately beneath the Site will be within Unit D of the upper London Clay Formation. Due to the nature of the London Clay, any groundwater flow will be at very low rates and is likely to follow general topographic contours toward the southwest.

Groundwater was not encountered in any of the exploratory holes during boring and excavation and the material remained essentially dry throughout. ~~Groundwater was subsequently recorded at a depth of 7.16 m below ground level in the monitoring standpipe installed in Borehole 1 after a period of approximately four weeks. This is several meters below the proposed excavation level, and is considered to represent a high (winter) groundwater level.~~

Groundwater monitoring data is presented in Table 1 below [(2)].

Date	Borehole	Water level (m.bgl)	Depth to base of well (m.bgl)
5th March 2013	1	7.02	9.80
11th March 2013	1	7.16	9.81
25th April 2014	1	3.88	9.64
	A	5.24	9.77

Table 1 – groundwater monitoring data

All recorded water levels are below the base of the proposed excavation level. The water level in borehole 1 was found to be higher in April 2014 than previously recorded levels. The clay formation is known to be of extremely low permeability, and the construction of the standpipe is such that flooding of the well cannot be ruled out. It is likely that the well was flooded with rainwater during the visit, and it would be reasonable to expect a long delay before levels inside and outside the standpipe equilibriate.

Geological logs show only occasional partings of silty fine sand within the clay. Falling head tests have confirmed the very low permeability of the clay at around 2.2×10^{-7}m/s.

The combination of desk based assessment and site investigation results demonstrate that the proposed development is unlikely to encounter any significant groundwater.

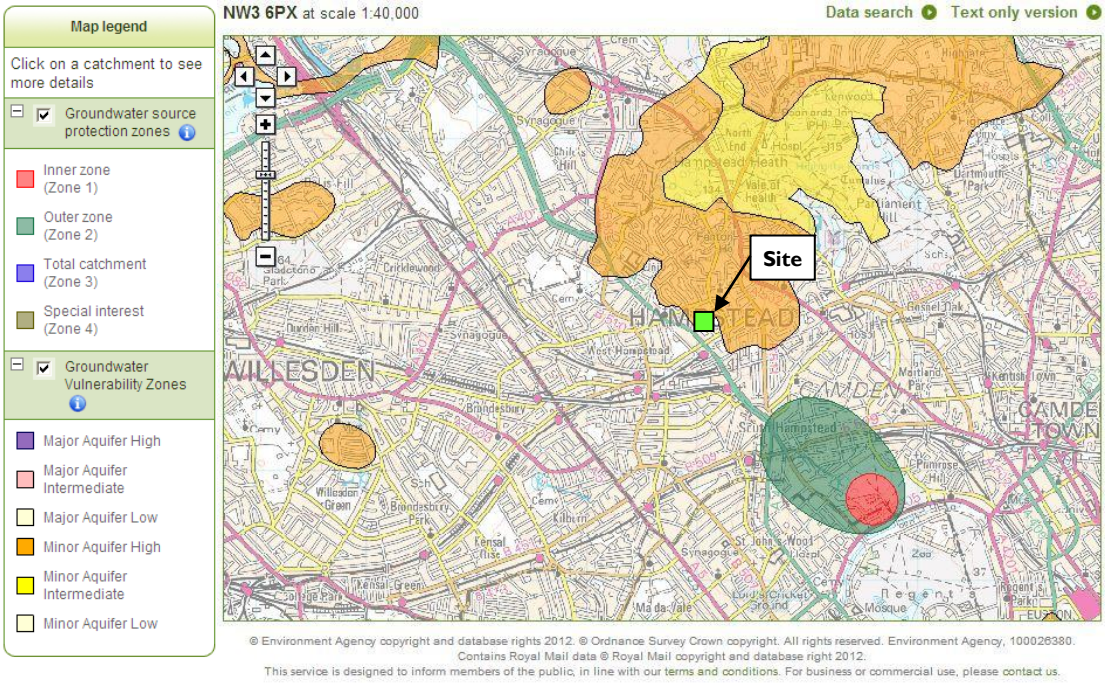


Figure 3 Groundwater vulnerability

4 Screening

The London Borough of Camden's "Guidance for subterranean development" suggests that any development proposal which includes a subterranean basement should be screened in order to determine whether there is a requirement for a BIA to be carried out. In this instance, the screening assessment is informed by results of the site investigation.

4.1 Screening discussion

Appendix E of the guidance document details the following six questions:

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

  No. London Clay is at outcrop, and this is not considered to be an aquifer. The Chalk aquifer is at great depth and is not considered relevant to this assessment.

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

  No. Groundwater seepage has been observed at a depth of 7.16 m below ground level, and this is considered to represent a high (winter) water table. Subsequent monitoring found higher water levels of 3.88 m below ground. It is questionable whether this value is a true representation of groundwater level, but even on the assumption that it is, the maximum proposed excavation depth is 2.70 m below ground level.

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

  No. Refer to Section 3.2.

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

  No. The Site is approximately 1km southeast and outside the catchment of Hampstead Heath ponds.

- **Question 4: Will the proposed development result in a change in the proportion of hard surfaced / paved area?**

  Yes. Additional roofing is proposed which represents a small area (approximately 110m^2). This will comprise green roof. The drainage from the Site will be directed to public sewer.

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

- No. The nature of the London Clay strata is unsuitable for receiving ground discharge.

- **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?**

- No. There are no local ponds or spring lines present.

4.2 Screening conclusions

Five of the six key screening questions required by the Guidance for assessment of subterranean (groundwater) flow can all be answered "no". The screening process has identified a single potential issue, in that the proposal will result in a change in the proportion of hard standing. This will be in the form of approximately 110 m^2 of green roof. This additional area will locally prevent recharge to the underlying ground.

5 Scoping and impact assessment

A single potential issue has been identified which is the change in proportion of hard standing. This could potentially result in decreased recharge to the underlying ground or changes to the degree of wetness which may in turn affect stability.

As discussed above, the site investigation has demonstrated that the Site is located on London Clay, which is a non-aquifer as defined by the Guidance. Recharge to the Formation is likely to be negligible and the proposal small in scale. As such, the proposal is unlikely to impact groundwater levels or flows.

Drainage from the green roof area will be directed to public sewer. The proposed basement is not expected to extend into saturated soils. Therefore, it is unlikely that the degree of wetness of local soils will be affected to any significant degree by the development. Issues related to ground stability are outside the scope of this report and will be dealt with by the slope and ground stability component of the BIA.

An additional question has been raised by LBH Wembley of the possibility of cumulative groundwater impacts. No impacts to groundwater levels or flows have been identified, so the possibility of cumulative impacts may be ruled out.

6 Review and decision making

A groundwater impact assessment of the proposed development has been undertaken. The assessment has been based on information and guidance published by the London Borough of Camden[3] and on site investigation information[1].

This assessment concludes that five of the six key screening questions required by the Guidance for assessment of subterranean (groundwater) flow can all be answered "no".

A single potential issue has been identified which is the change in proportion of hard standing. This issue has been assessed, and it is concluded that there will be no significant changes to the groundwater regime as a result of the proposal.

It is concluded that the proposed development is unlikely to result in significant changes to the groundwater regime beneath the Site.

Groundwater is by its nature, hidden from view and unforeseen ground conditions can occur. It is therefore recommended that the water levels in the monitoring boreholes be periodically measured immediately prior to, and during, the development. Borehole 2 is sited within the development footprint and will therefore be decommissioned prior to completion of the development. It is acknowledged that monitoring of this borehole will cease at this point. Should groundwater levels rise to within the excavation volume, or should significant groundwater inflow be observed during excavation, professional advice should be sought.