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13a Crossfield Road: Basement Impact Assessment

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1. Introduction

1.1 Background

This report presents the basement impact assessment, to be submitted in support of a planning application for the basement development at 13a Crossfield Road, London NW3 4NS (Figure 1.1, national grid reference TQ 2688 8455). The local planning authority is Camden Borough Council.

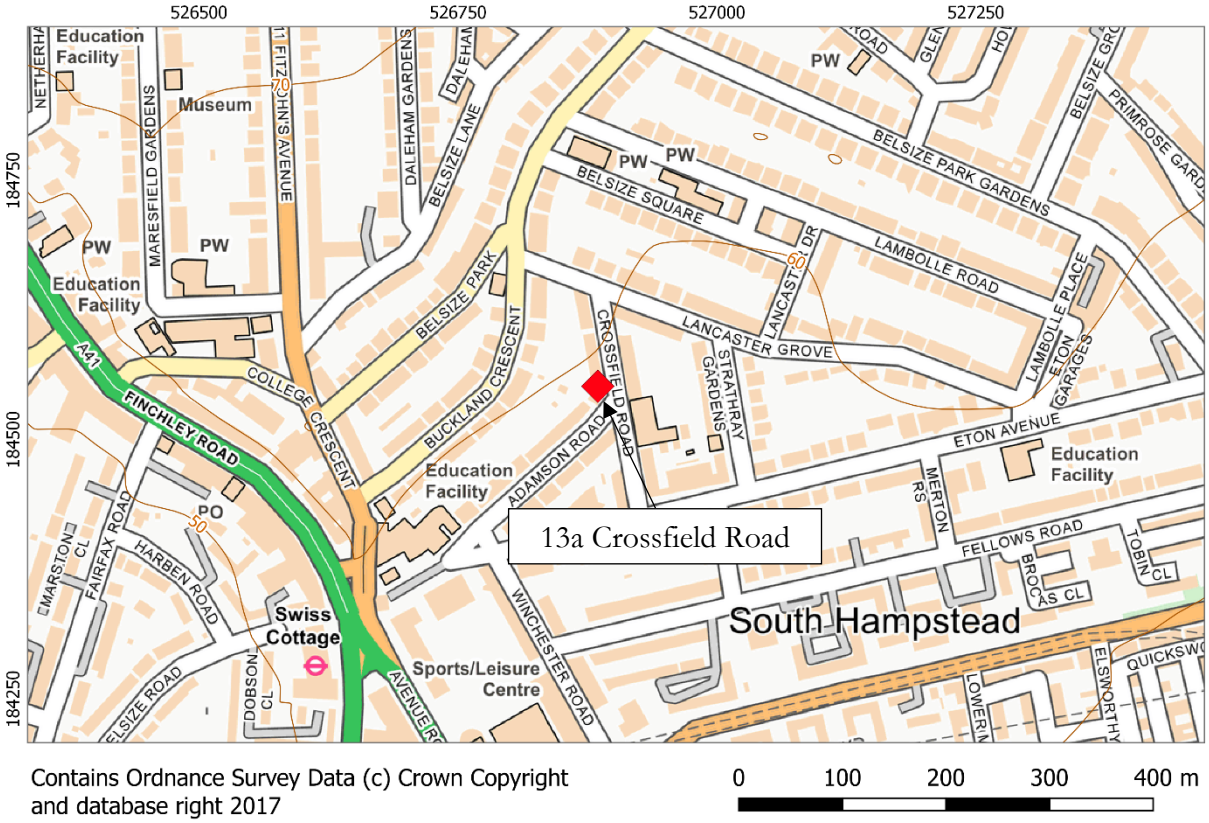

Figure 1.1 Location of 13a Crossfield Road

1.2 Basement Works

The site comprises 13a Crossfield Road which is the lower ground floor flat of a four-storey end-terrace house, on the west side of the road, at the junction with Adamson Road. To the east, south, west and north of the site are neighbouring residential properties. Hall School lies across Crossfield Road, to the south east of number 13. Number 12 Crossfield Road adjoins the property to the north and number 37 Adamson Road is just to the south west.

Plans for the new basement development involve constructing a single floor basement beneath the footprint of the building and a small part of the rear garden, which is currently patio paving (Figure 1.2). The elevation of Crossfield Road outside the property is estimated at 58 m AOD from Environment Agency LIDAR data, and formation level of the basement is expected to be around 54 m AOD.

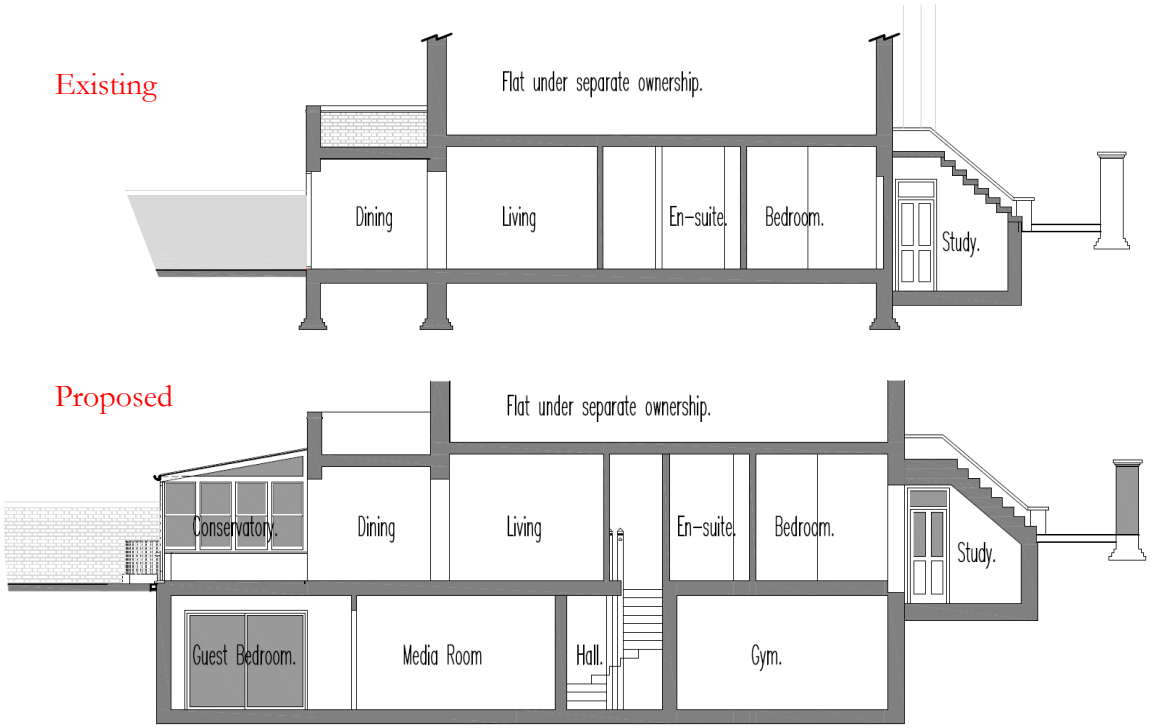

Figure 1.2 Existing and proposed basement sections (looking north)

1.3 Scope of Report

Stephen Buss Environmental Consulting Ltd was instructed in December 2016 to complete this report. This report presents the basement impact assessment for a basement development that complies with CPG4 screening, scoping and site investigation stages, and makes reference to the basement impact assessment guidance of ARUP (2010)[1]. The main report covers the subsurface flow (groundwater) and surface water components of the BIA, and appendices include the slope stability component, plus ground investigation results.

[1] ARUP, 2010. Camden geological, hydrogeological and hydrological study. Guidance for subterranean development.

1.4 Authorship of Report

This report has been prepared by Dr Stephen Buss MA MSc CGeol. Dr Buss is a UK-based independent hydrogeologist with more than 16 years' consulting experience in solving groundwater issues for regulators, water companies and other private sector organisations. **Dr Buss is a Chartered Geologist with the Geological Society of London.** Dr Buss's CV and publications list is available at www.hydro-geology.co.uk.

Rupert Evans MSc CEnv C.WEM MCIWEM AIEMA is a UK-based independent hydrologist with more than 12 years' consultancy experience in flood risk assessment, surface water drainage schemes and hydrology/hydraulic modelling. **Mr Evans is a Chartered Water and Environmental Manager (C.WEM) and a Member of the Chartered Institution of Water and Environmental Management.**

Alan Watson BSc [Eng] CEnv CEng MICE is a UK-based geotechnical engineer with 30 years' experience of ground investigations, geotechnical interpretation and contamination assessments. **Mr Watson is a civil engineer with the "CEng" (Chartered Engineer) qualification from the Engineering Council and specialises in ground engineering.**

2. Conceptual Site Model

2.1 Drainage and Topography

Elevation of Crossfield Road outside number 13a is about 58 m above Ordnance Datum (m AOD) according to Ordnance Survey Terrain 5 data. Ground surface around the site slopes south-eastwards; the gradient calculated from Ordnance Survey 10 m contours is about 0.02.

The property lies close to one of the former tributaries of the River Tyburn[2], which has been culverted beneath the city (Figure 2.1). Ground elevation data from Environment Agency LIDAR (Figure 2.2) and Ordnance Survey contours indicate that the nearest tributary (to the west) probably flowed closer than the map in Barton (1993) indicates: perhaps about 100 m to the west of Crossfield Road. Likewise the eastward tributary may have been closer than suggested, but still about 150 m to the east.

The nearest current surface water feature is the Hampstead Ponds chain, the nearest of which is Hampstead No. 1 Pond about 1300 m to the north east of the site. Whilst the elevation of the pond is a little higher than Crossfield Road there is a topographic ridge feature between them that rises to nearly 80 m AOD. Regents Canal is about 1300 m to the south of the site.

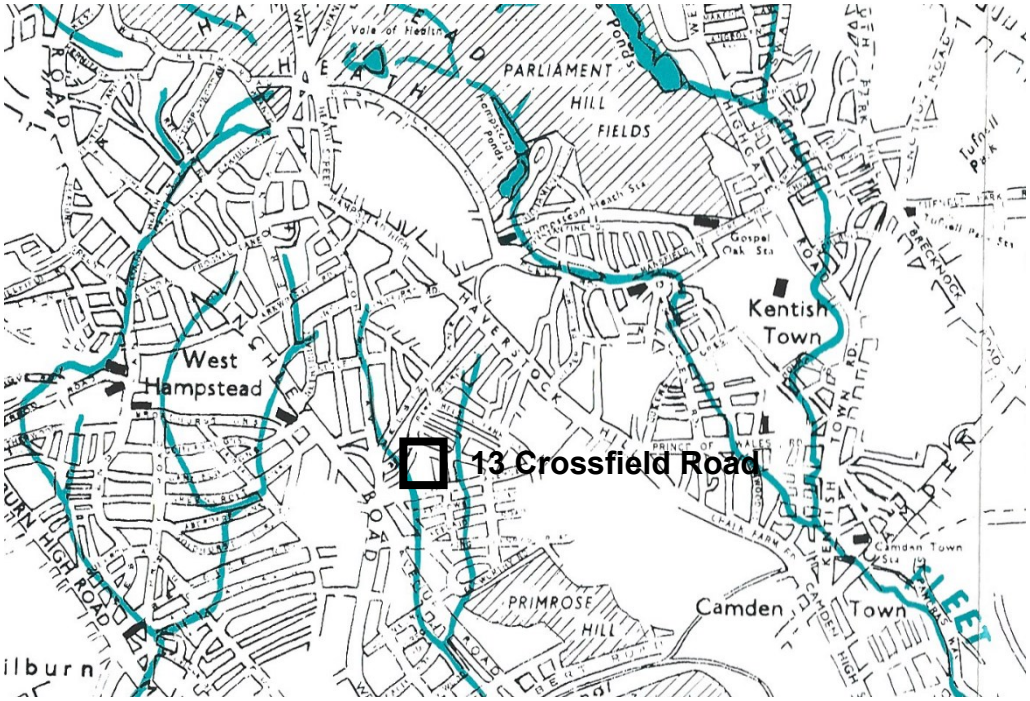

Figure 2.1 Location of lost rivers

[2] Barton, N.J., 1993. The Lost Rivers of London 3rd edition.

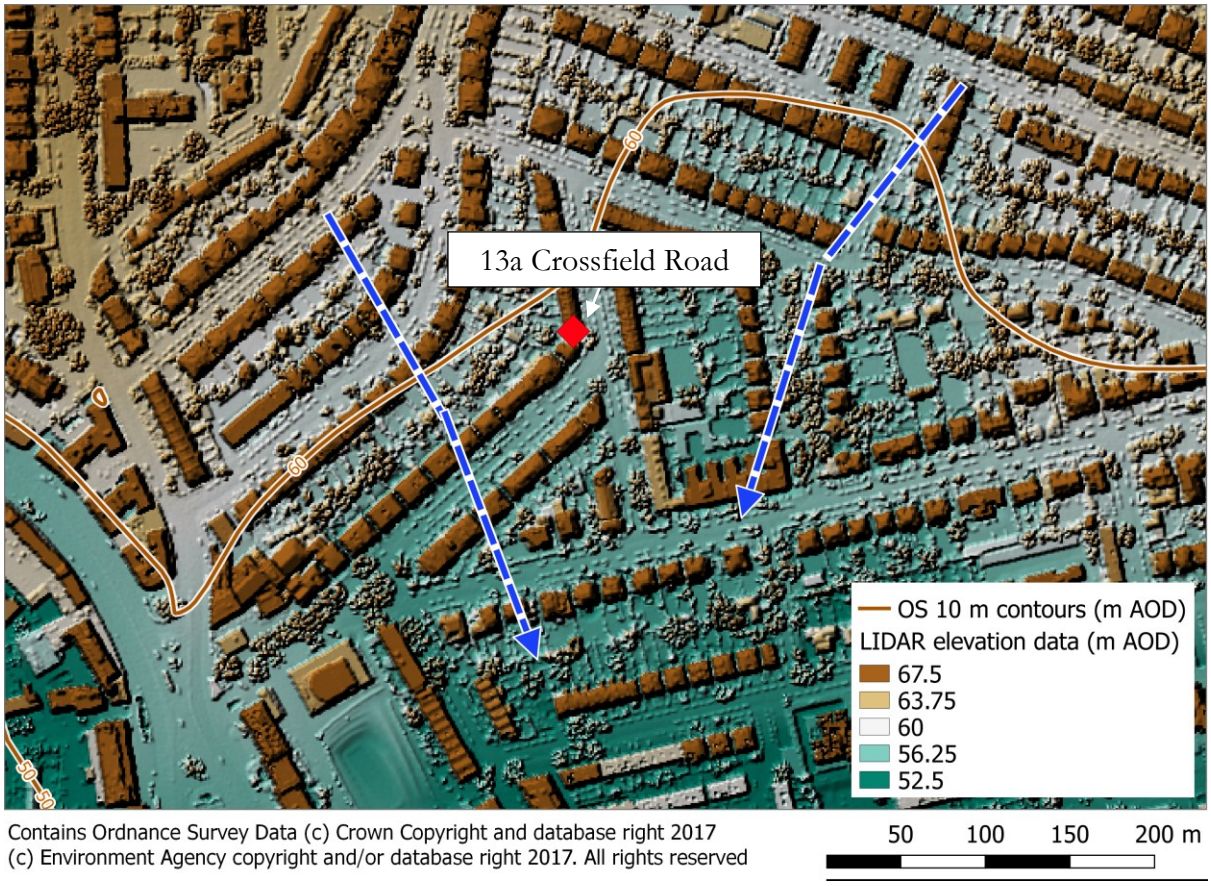

Figure 2.2 Suggested locations of lost rivers near Crossfield Road

2.2 Geology and Hydrogeology

Bedrock at the site comprises London Clay. This is about 83 m thick at the Swiss Cottage open space borehole[3] (about 300 m to the south west of the site) and isolates the main aquifer of the London Basin from the surface.

No superficial deposits are mapped at the surface. Nearby borehole records available from the British Geological Survey also show no superficial deposits, just thin Made Ground over London Clay. (Borehole TQ28SE2337[4] is the closest from a site investigation centred around 3, 5 and 7 Fitzjohn`s Avenue 350 m north west of the site; and the Swiss Cottage open space borehole also shows no superficial deposits.) All of the boreholes were dry on excavation.

Outcrop of the Claygate Beds (which is highlighted in the ARUP 2010 report as prone to groundwater issues) is about 500 m to the north of the property and at an elevation of about 78 m AOD.

2.3 Site Investigation Results

Two boreholes were constructed at 13a Crossfield Road in December 2016 (Appendix A). Borehole WS1 was constructed in the rear garden and WS2 was constructed in the front garden. Standpipes were installed to 8 m in WS1 and to 5 m in WS2.

Based on observations by Soil Consultants the rear garden is expected to be about 1.4 m lower than the front garden. Schematic logs are presented in Figure 2.3. Levels from the logs have been reduced to Ordnance Datum by assuming ground level in the front garden (WS2) is 58 m AOD, and that the rear garden is 1.4 m lower at 56.6 m AOD (WS1).

Whilst both boreholes were dry on completion, both have seen a rise in groundwater levels to an elevation of around 55.9 m AOD, or about 1.9 m above formation level. Whilst the level in WS1 seems to have risen very quickly (and may not have been at equilibrium on 19 January 2017), it has risen to about the same level as WS2 so it seems likely that 55.9 m AOD is quite close to the equilibrium level.

Table 2.1 Groundwater observations

	WS1		WS2	
	Dip (m)	Level (m AOD)	Dip (m)	Level (m AOD)
19 December 2016	dry	-	dry	-
5 January 2017	7.35	49.25	2.42	55.58
19 January 2017	0.68	55.92	2.13	55.87

[3] http://scans.bgs.ac.uk/sobi_scans/boreholes/15020820
[4] http://scans.bgs.ac.uk/sobi_scans/boreholes/18393270

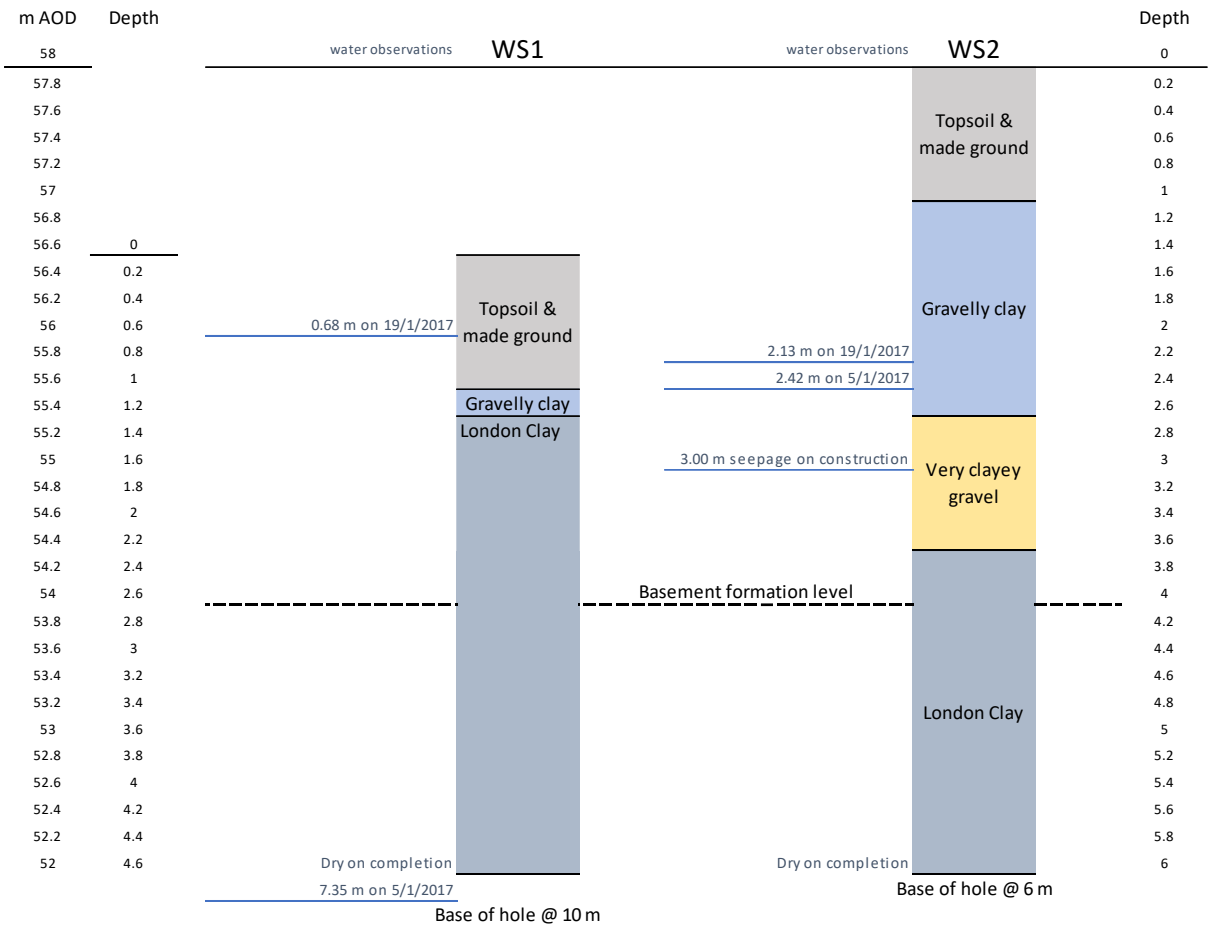

Figure 2.3 Schematic borehole logs

2.4 Local basements

Other nearby properties on Crossfield Road have lower ground floors. The attached terrace property to the north, number 12, has a lower ground floor but not a basement. Based on the difference in elevation between the gardens in the Environment Agency LIDAR data, the level of the lower ground floor at number 12 is expected to be 0.3 m higher than at 13a, and the next property along to the north – number 11 – is expected to have a lower ground floor 0.5 m higher than 13a. 37 Adamson Road, south of the property, appears to have a lower ground floor flat at about the same level as number 13a.

Details of any recent basement developments in adjacent properties have been searched for via the Camden Planning Portal but none have been identified.

3. Screening Assessment: Groundwater

Subterranean (groundwater) screening follows the procedure outlined in Figure 1: Subterranean (ground water) flow screening chart of the Camden Planning Guidance 4 (CPG4) entitled Basements and Lightwells dated 2013.

1a) Is the site located directly above an aquifer?

NO. The geological map and the nearest off-site boreholes indicate that a layer of permeable superficial deposits is not present beneath the site. Local boreholes and the site borehole show clayey gravel and gravelly clay, over London Clay (Section 2.2). None of these can be considered an aquifer. Beneath the superficial deposits a considerable thickness of London Clay isolates the deeper aquifer units of the London Basin aquifer from the surface.

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

YES. Both boreholes constructed at 13a Crossfield Road encountered water seepage from the near-surface superficial deposits. Groundwater level is likely to be within 0.7 m of the existing lower ground floor, and is therefore likely to be above the formation level of the new basement.

This is discussed further in Section 5.

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

NO. There are no surface water bodies within 100 m of the site. The site lies about 100 m east of a former tributary of the former River Tyburn. There are no known water wells within 100 m of the site.

Geological conditions indicate that there is no potential for development of a spring line near the property, as the 1:50 000 geology map indicates that it is located on London Clay outcrop (Claygate Beds crop out about 500 m to the north, and 10 m higher in elevation), and there are no superficial deposits nearby.

3) Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?

NO. The basement will mostly be beneath the current footprint of the property. It will extend to beneath the rear garden, beneath an area that is currently under impermeable paving which will be covered by a conservatory. Any new paving areas will be laid with porous paving. Therefore surface water flows will be unchanged or slightly reduced.

4) As part of the site drainage, will more surface water (e.g. rainfall and runoff) than at present be discharged to the ground (e.g. via soakaways and/or SUDS)?

NO. Discharge to the ground is not proposed.

5) 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 or spring line?

NO. The nearest surface water body is the Hampstead No. 1 Pond, about 970 m to the north east of the site. Whilst the elevation of the pond is slightly higher than 13a Crossfield Road there is a ridge feature between them that rises to about 80 m AOD.

4. Screening Assessment: Surface water

Surface flow and flooding screening follows the procedure outlined in Figure 3 (surface flow and flooding screening flowchart) of the Camden Planning Guidance 4 (CPG4) entitled Basements and Lightwells dated 2013.

1) *Is the site within the catchment of the pond chains on Hampstead Heath?*

   NO. Figure 14 of the Camden geological, hydrogeological and hydrological study – Guidance for subterranean development dated 2010, confirms that the site is not located within this catchment area.

2) *As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route?*

   There will not be an increase in impermeable area across the ground surface above the basement, so the surface water flow regime will be unchanged.

   There will be no surface expression of the basement development, so the surface water flow regime will be unchanged.

   The basement will entirely be beneath the footprint of the existing building/hardstanding, therefore the 1m distance between the roof of the basement and ground surface as recommended by the Arup report and para 2.16 of the CPG4 does not apply.

   The extension will occur across existing impermeable areas. Additional proposed paved areas will be made permeable.

3) *Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?*

   NO. There will not be an increase in impermeable area across the ground surface above the basement. There will be no surface expression of the basement development.

4) *Will the proposed basement result in changes to the profile of the inflows (instantaneous and long term) of surface water being received by adjacent properties or downstream watercourses?*

   NO. There will not be an increase in impermeable area across the ground surface above the basement, so the surface water flow regime will be unchanged.

   There will be no surface expression of the basement development, so the surface water flow regime will be unchanged.

   The extension will occur across existing impermeable areas. Additional proposed paved areas will be made permeable.

5) *Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?*

   NO. The proposed basement is very unlikely to result in any changes to the quality of surface water being received by adjacent properties or downstream watercourses as the surface water drainage regime will be unchanged and the land uses will remain the same.

6) *Is the site in an area identified to have surface water flood risk according to either the Local Flood Risk Management Strategy or the Strategic Flood Risk Assessment or is it at risk from flooding, for example because the proposed basement is below the static water level of nearby surface water feature?*

NO. The findings of this BIA together with the Camden Flood Risk Management Strategy dated 2013, and Figures 3v, 4e, 5a and 5b of the SFRA dated 2014, and Environment Agency online flood maps show that the site has a low flooding risk from surface water, sewers, reservoirs (and other artificial sources), groundwater and fluvial/tidal watercourses.

In accordance with paragraph 5.11 of the CPG a positive pumped device will be installed in the basement in order to further protect the site from sewer flooding.

5. Impact Assessment: Groundwater

Both boreholes constructed at 13a Crossfield Road encountered water seepage from the near-surface superficial deposits. Groundwater level is likely to be within 0.7 m of the existing lower ground floor, and is therefore likely to be above the formation level of the new basement. This section assesses the risk to neighbouring properties from construction of the basement.

The schematic cross-section in Figure 5.1shows the expected levels of current basements (in grey), the street level (in green), the expected depth of the new basement at 13a Crossfield Road, and the expected water table (in blue, sloping parallel with the road).

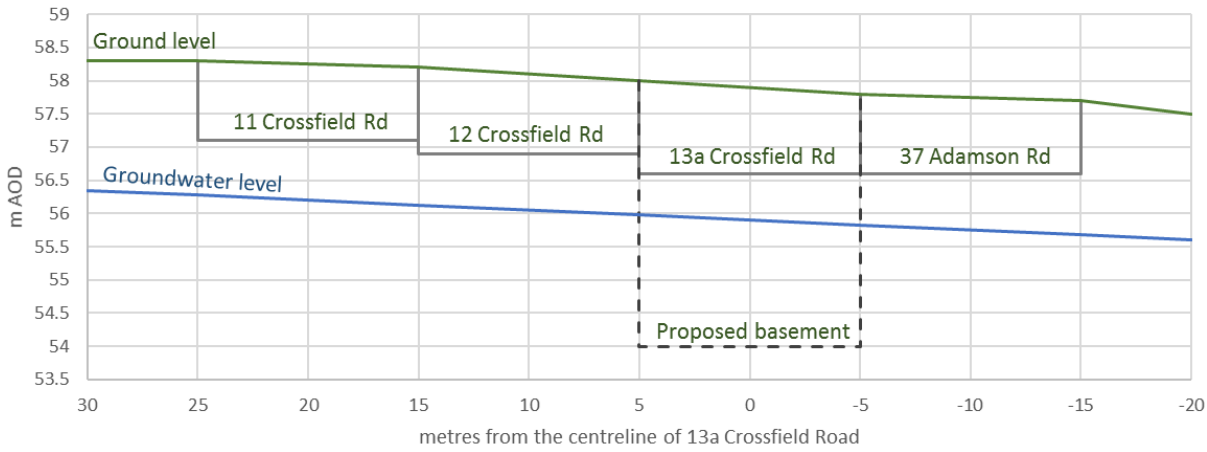

Figure 5.1 Schematic north-south cross section

Typical behaviour of the water table when intercepted by an impermeable basement (such as this) is to rise up-gradient of the basement, and to lower down-gradient of the basement. ARUP (2010, paragraph 160) states that: 'A solitary, isolated basement which intersects the groundwater table is unlikely to affect the groundwater flows in the wider area: the water will simply flow around the obstruction. The effects on water level are likely to be small and less significant than seasonal or other existing variations in the groundwater table'.

Typically, when modelling the impacts of domestic basements, SBEC finds that the maximum expected rise in the water table at adjacent properties is 0.15 to 0.20 m. The change in level tends not to be sensitive to hydraulic conductivity of the formation.

Hence at the southernmost edge of number 12 Crossfield Road, the expected maximum water level post-construction is 56.1 m AOD (assuming a baseline level of 55.9 m AOD from monitoring and a rise of 0.2 m). This is 0.8 m beneath the lower ground floor at number 12 (which is assumed to be at 56.9 m AOD).

In river terrace gravels, closer to the River Thames, seasonal variation is usually 0.2 to 0.3 m (CIRIA[5], 1993). But with this basement being in a clay-dominated subsurface environment, the seasonal range of water levels is expected to be smaller.

ARUP (2010) also mentions the cumulative impacts of basement development in a block. As this is the first basement, cumulative impacts are not an issue.

[5] CIRIA, 1993. A Study of the Impact of Urbanisation on the Thames Gravels Aquifer. CIRIA report 129

6. Conclusions

Potential environmental impacts of the basement development at 13a Crossfield Road have been considered. The following summary conclusions are made:

- There will be no increase in man-made impermeable area so the amount, timing and quality of surface water runoff will not be affected by the development. No water will go to ground as a result of the basement development.
- There are no local surface water bodies.
- Available geological and hydrogeological information indicates that there is no permeable aquifer beneath the site that is capable of maintaining a significant groundwater body. Gravelly clay and very clayey gravel does host a local groundwater body.
- Both boreholes constructed at 13a Crossfield Road encountered water seepage from the near-surface superficial deposits. Groundwater level is likely to be within 0.7 m of the existing lower ground floor, and is therefore likely to be above the formation level of the new basement.
- The likely rise in groundwater level arising from basement construction has been considered and no risk to the neighbouring basements is anticipated.
- Waterproofing of the basement and a small amount of dewatering during construction is likely to be required.

These conclusions are considered to be robust and no further investigations are needed.

Appendix A

Desk Study,
Ground Investigation Results, and
Slope Stability BIA