Basement Impact Assessment

J1219, One Radlett Place, Primrose Hill

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Revision: X3

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GENERAL NOTES

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REVISION HISTORY

Revisions indicated with line in margin.

Revision status: P = Preliminary, T = Tender, C = Construction, X = For Information

Revision	Date	Author	Reviewer	Description
X1	19/09/12	EL	AY	Issued for Information
X2	19/10/12	EL	AY	Issued for Comment
X3	26/10/12	EL	AY	Issued for Planning

1 INTRODUCTION

This report contains the Basement Impact Assessment for the development at One Radlett Place.

Planning permission has been granted to construct a new residence with a basement on the site at One Radlett Place. The original building has been demolished and work has started on the new basement under current planning permission. However, the proposed superstructure does not conform to the requirements of the existing planning permission, so further planning permission must be sought to complete the superstructure.

Since planning was originally granted, the council has developed its Local Development Framework (LDF), which requires that significant subterranean developments undertake a Basement Impact Assessment (BIA). This BIA has been commissioned to form part of the revised planning application submission that will be required to permit the construction of the new superstructure. Nonetheless, the basement under construction does not deviate from the basement proposed in the original planning application in any substantial respect.

2 BASEMENT IMPACT ASSESSMENT BACKGROUND

The London Borough (LB) of Camden will only permit basement and other underground developments that do not cause harm to the built and natural environment and local amenity. LB of Camden defines the range of harms that are controlled by the planning authority through a series of development policies (DP) that contribute to the LDF strategy for managing growth. Several development policies (DP) are relevant to the proposed development:

- **DP22: Sustainability -** LB Camden will require development to be resilient to climate change by ensuring schemes include appropriate climate change adaptation measures
- **DP23: Water -** LB Camden will require developments to reduce the risk of surface water flooding by reducing the pressure placed on the combined storm water and sewer network from foul water and surface water run-off and ensuring developments in the areas identified as being at risk of surface water flooding are designed to cope with the potential flooding.
- **DP24 - Securing High Quality Design -** The Council will require all developments, including alterations and extensions to existing buildings, to be of the highest standard of design
- **DP25: Conserving Camden's Heritage -** require development outside of a conservation area to not cause harm to the character and appearance of that conservation area; Particularly, where basements are concerned, the ponds on Hampstead Heath and other water features that are sensitive to hydrogeological interventions.
- **DP26: Managing the impact of development on occupiers and neighbours** – Where basements are concerned, ensuring adjoining land or properties at a lower elevation are not subjected to an increased risk of surface water flooding.
- **DP27: Basements and Light-wells -** In determining proposals for basement and other underground development, LB Camden will require an assessment of the scheme's impact on drainage, flooding, groundwater conditions and structural stability, where appropriate.

To meet the requirements, a BIA is required by the LB Camden supplementary planning guidance to investigate the potential impact of the proposed basement development on the local surface water and groundwater environments and of potential impacts on slope stability which might affect the building and its neighbours. As recommended by Camden Planning Guidance for Basements and Lightwells (CPG4) the BIA methodology has been based around the following stages:

- **Stage 1 - Screening;** To identify any matters of concern which should be investigated further.
- **Stage 2 - Scoping;** To identify impacts shown by the screening process to need further investigation.
- **Stage 3 - Site investigation & study;** To develop an understanding of the site and its immediate surroundings.
- **Stage 4 - Impact assessment;** To evaluating the direct and indirect implications of the proposed project.

3 PROJECT INFORMATION

3.1 THE PROJECT

The project consists of the redesign of the structural scheme for a private residential house in Primrose Hill, London. The house consists of a double height basement housing a swimming pool, leisure facilities, a wine cellar and cinema. The above ground structure has 2 storeys of habitable space with a pitched roof on top.

3.2 THE SITE

The site is located to the West side of Primrose Hill in North London and is bounded by an existing boundary wall founded on a shallow concrete strip footings. An existing property, Radlett House, currently occupies the site. It is assumed that there is no basement to this building and that is it supported on shallow foundations. It is to be demolished as part of the enabling works. See Figure 1.

There are three London Plane trees in close proximity to the proposed building which have root protection zones. However the proposed basement construction respects these zones.

Initial investigation has shown up the possibility of an underground hidden river, a tributary of the Tyburn, running close to or underneath the site.

See Appendix A for Plan and section drawings of the proposed works and WYE report J1219-Doc-09 for Structural Engineering Report.

Figure 1 – The site

4 STAGE 1 - SCREENING

4.1 SCREENING CHECKLISTS

The first stage in assessing the impact of a proposed basement development is to recognise what issues are relevant to the proposed site. This is done by using the screening flowchart and checklists found in the Planning Guidance [Ref 4]. The checklists dealing with surface flow and flooding, subterranean groundwater flow and slope stability are presented in the sections below.

Where an impact has been identified or the answer to the screening question is unknown, the relevant screening question is presented in bold, with the issue carried forward to the scoping stage.

4.1.1 SURFACE FLOW AND FLOODING SCREENING CHECKLIST

While nowhere in the borough is identified by the Environment Agency as being flood prone from rivers or the sea, there are still parts that are identified as being subject to localised flooding from surface water due to surface water flooding, overwhelmed sewers and drainage systems and from inundation due to reservoir failure.

High precipitation events have been noted to cause deterioration in the water quality of the bathing ponds on Hampstead Heath with overland flows washing animal faeces and other organic matter into the ponds. For the bathing ponds changes in quality would be of concern and there other water features that dependant on stable inflows.

The surface water run-off will flow down-gradient away from the developed property and it is important to ensure that adjoining land or properties at a lower elevation are not subjected to an increased risk of surface water flooding.

The following screening questions identify the issues that may contribute to flooding from surface flow:

No.	Screening Question	Impact	Source/Comment
1.	Is the site within the catchment of the pond chains on Hampstead Heath?	No	Approximately 3.5km north of the site at its closest lies Hampstead Heath. The site is located outside of the Hampstead Heath surface water catchment. [Ref 2: Figure 14]
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?**	**Yes**	**The new construction will cause the volume of surface runoff to increase because the new construction will increase the impermeable plan surface area of the site by an additional 25% [See Appendix C/D]. Surface runoff from impermeable surfaces will be collected and transmitted to combined sewerage system via an attenuation tank, which will limit flow to 5L/s.**

3.	**Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?**	**Yes**	**The extent of impermeable surface area on the site will increase by 25% from 1368m^2 to 1697m^2. However, an area of 542m^2 of green roof will be incorporated into the scheme. [See Appendix C/D].**
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?**	**Yes**	**All water runoff from impermeable surfaces will be collected on site and discharged off site to the sewer and this will likely reduce the volume of surface water being received by adjacent properties.**
5.	**Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?**	**Yes**	**The site has concentrations of contaminants that exceed their respective thresholds for residential end use. However, much of the contaminated soil will be removed or covered during construction [See Appendix B].**
6.	Is the site in an area known to be at risk from surface water flooding, such as South Hampstead, West Hampstead, Gospel Oak and King's Cross, or is it at risk from flooding, for example because the proposed basement is below the static water level of a nearby surface water feature?	No	The site does not fall within the area known to be at flood risk and is it not located on one of the streets listed as being at risk of surface water flooding (Ref 2). Indicative online flood map shows the site to fall within Flood Zone 1 (Ref 6). Sites within Flood Zone 1 are considered to have less than a 1 in 1000 (0.1%) annual probability of flooding from rivers or the sea.

4.1.2 SUBTERRANEAN GROUNDWATER FLOW SCREENING CHECKLIST

Basement development may affect groundwater flows, and even though the displaced water will find a new course around the area of obstruction this may have other consequences for nearby properties, trees, etc. Basement development may have the potential to divert or displace groundwater which can cause a rise in groundwater, and cause flooding, upstream of the development, whilst immediately downstream the groundwater level may decline, which may affect wells, springs and ponds. The following screening questions identify the features that may cause significant changes to subterranean ground water flow:

No.	Screening Question	Impact	Source/Comment
1a.	Is the site located directly above an aquifer?	No	The site is underlain by unproductive strata comprising the London Clay (Appendix B)
1b.	Will the proposed basement extend beneath the water table surface?	No	The London Clay is up to 70m thick (Appendix B), with groundwater limited to pockets of perched water or localised lenses of water. The proposed basement is to extend to a maximum depth of 8.0m below ground level.
2.	**Is the site within 100m of a watercourse, well (open/disused) or potential spring line?**	**Yes**	**The site is also shown to be in close proximity to a tributary to the former River Tyburn [Ref 3]. There are no recorded wells within 100m of the site [Appendix B]. The hydrogeological environment is not conducive to a spring within 100m of the site [Appendix B].**
3.	Is the site within the catchment of the pond chains on Hampstead Heath?	No	The site is located approximately 3.5km south of Hampstead Heath and lies outside of the Hampstead Heath surface water catchment [Ref 2: Figure 14].
4.	**Will the proposed basement development result in a change in the proportion of hard-surfaced/paved areas?**	**Yes**	**The extent of impermeable surface area on the site will increase by 25% from 1368m^2 to 1697m^2. However, an area of 542m^2 of green roof will be incorporated into the scheme [Appendix C/D].**

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 soak-away and/or SUDS)?	No	The new construction will intercept a larger proportion of the precipitation which will be discharged into the sewerage system leaving less surface run-off to be discharged into the ground.
6.	Is the lowest point of the 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 pond is situated approximately 500m southwest of the site however due to the London Clay underlying the site; it is unlikely to be in hydraulic continuity. The largest ponds in the local area are within Regents Park. The site is situated at a height of approximately 22m above these ponds indicating that the depth of basement is unlikely to be close to or below the level of the ponds waters

4.1.3 SLOPE STABILITY SCREENING CHECKLIST

Basement development applications may put the structural stability of adjoining or neighbouring buildings at risk or lead to slope instabilities. The following screening questions identify the features that may cause significant changes to slope stability:

No.	Screening Question	Impact	Source/Comment
1.	Does the existing site include slopes, natural or manmade, greater than 7°? (approximately 1 in 8)	No	None [Ref 2: Figure 16].
2.	Will the proposed re-profiling of landscaping at the site change slopes at the property boundary to more than 7° degrees? (approximately 1 in 8)	No	None [Ref 2: Figure 16].
3.	Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7°? (approximately 1 in 8)	No	None [Ref 2: Figure 16].
4.	Is the site within a wider hillside setting in which the general slope is greater than 7°? (approximately 1 in 8)	No	The site is near to primrose Hill, which contains slopes in excess of 10° that are no closer than 200m from the site [Ref 2: Figure 16].
5.	**Is the London Clay the shallowest strata at the site?**	**Yes**	**There is 0.7m to 1.5m layer of made ground above the London Clay, but the London Clay is the effectively the shallowest strata on the site [Appendix B]**
6.	**Will any tree/s be felled as part of the proposed development and/or are any works proposed within any tree protection zones where trees are to be retained? (Note that consent is required from LB Camden to undertake work to any tree/s protected by a Tree Protection Order or to tree/s in a Conservation Area if the tree is over certain dimensions).**	**Yes**	**Refer to Arboriculturalist report.**

7.	Is there a history of seasonal shrink-swell subsidence in the local area (Claygate Beds), and/or evidence of such effects at the site?	No	No history of shrink-swell subsidence has been established. The effects of shrink swell subsidence are not evident at the site.
8.	**Is the site within 100m of a watercourse or a potential spring line?**	**Yes**	**The site is also shown to be in very close proximity to a tributary to the former River Tyburn [Ref 3]. There are no recorded wells within 100m of the site [Appendix B]. The hydrogeological environment is not conducive to a spring within 100m of the site [Appendix B].**
9.	**Is the site within an area of previously worked ground?**	**Yes**	**The site investigation shows that the site overlies an area of made ground up to 1.5m deep in places [Appendix B].**
10.	Is the site within an aquifer? If so, will the proposed basement extend beneath the water table such that dewatering may be required during construction?	No	The site lies within unproductive strata. There is a lower aquifer in the chalk stratum 70m below the london clay. The site lies within an inner source protection zone for this aquifer [Ref 2; Figure 8], but there is no linkage between the site and the aquifer.
11.	Is the site within 50m of the Hampstead Heath ponds?	No	[Ref 2; Figure 14],
12.	**Is the site within 5m of a highway or pedestrian right of way?**	**Yes**	**Both the boundary of the site and the new basement retaining wall are adjacent to a minor access road; 'Radlett place'.**
13.	**Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?**	**Yes**	**The foundation solutions for neighbouring properties are not known. The existing building is founded on a combination of piles and pad foundation. The new basement will have a piled retaining wall with toe depth 16m below ground level.**
14.	Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?	No	

5 STAGE 2 - SCOPING

A number of potential impacts have been identified in the screening process which must be evaluated and assessed according to the Camden Development Policies to see whether they are impacts of concern.

5.1 SURFACE FLOW AND FLOODING

5.1.1 SCREENING SUMMARY

Question 2: Will surface water flows be materially changed?

The new construction will intercept a larger proportion of the precipitation than the previous scheme. This water will be captured and drained into the sewerage system. Therefore, a smaller proportion of the precipitation falling on the site will be transmitted as surface water or otherwise, the risk of flooding due to surface water flow will be reduced. Therefore there is no problematic impact on the surface water flows and flooding.

Question 3: Will the proposed basement result in a change in the proportion of impermeable surfaces?

The proposed construction will result in an increased plan area of impermeable surfaces and this will cause more surface runoff. There is potential for this issue to impact surface water flows and flooding.

Question 4: Will the proposed basement result in changes to the profile of the inflows of surface water being received by adjacent properties or downstream watercourses?

Following on from the justification stated in response to question 2; the scheme reduces the amount of surface water being transmitted and neighbouring properties will receive less surface flows. Therefore there is no problematic impact on the surface water flows and flooding.

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

The site has concentrations of contaminants that exceed their respective thresholds for residential end use. It is possible that surface water will become contaminated. There is potential for this issue to impact the quality of surface water flows transmitted to adjacent properties.

5.1.2 IMPACTS ON SURFACE FLOW AND FLOODING

The increased plan area of impermeable surfaces increases the peak volume flow rate of surface runoff. Precipitation landing on surfaces that have little capacity to store or attenuate the flow will rapidly transmit the flow away from the buildings. The proposed scheme has green/brown roofs and is arranged to capture surface runoff and transmit it into a large concrete storage tank located below the sunken garden. From here the water is pumped into the combined sewerage system, which may not be able to accommodate the peak flow rate. This impact will be investigated in the site investigation and study to ensure that facilities are available to deliver the water in to the public sewer safely.

The site investigation has identified relatively high concentrations of contaminants for a residential site. Surface flow could become contaminated and impact the quality of surface flows transmitted to adjacent properties or downstream water courses.

5.2 SUBTERRANEAN GROUNDWATER FLOW

5.2.1 SCREENING SUMMARY

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

The site is in very close proximity to a tributary of the former River Tyburn. There is a risk that groundwater maybe diverted into or away from this watercourse, changing both the quantity and quality of water received by the River. The potential for the construction to impact these water courses must investigated further.

Question 4: Will the proposed basement result in a change in the proportion of impermeable surfaces?

The proposed construction will result in an increased plan area of impermeable surfaces and this will cause more surface runoff. There is potential for this issue to impact subterranean groundwater flow.

Notwithstanding the above, consideration has been additionally given to the potential presence of perched waters residing above the Made Ground/London Clay or Superficial Deposits/London Clay interface and to the potential presence of pockets for water bearing sand or claystone lenses that can occur in the London Clay. There is potential for this issue to impact subterranean groundwater flow.

5.2.2 IMPACTS ON SUBTERRANEAN GROUNDWATER FLOW

The increased plan area of impermeable surfaces in the new development means that surface water that would have in part contributed to the subterranean groundwater flow by infiltration, is now transmitted away from the site via the existing sewerage system. Reducing the subterranean base flow could undermine the vitality of surrounding water features or cause damage to structures through clay to shrink or swell.

Ground water could pass through the top stratum of made ground. If such a flow were blocked by the basement, it would be forced to find and alternative route. Research has shown [Ref 10] that when ground water flows around an obstruction, the volume flow rate is not significantly impacted, but the ground water level rises upstream of the obstruction and this could lead to local flooding or at least water logged ground, particularly as the made ground is 0.7m to 1.5m deep.

According to records [Ref 3] the site is in close proximity to a tributary of the former River Tyburn. The volume flow rate of subterranean groundwater flows from the site is likely to be reduced by the works and could impact the quantity or quality of water received by the River.

5.3 SCOPING SLOPE STABILITY

5.3.1 SCREENING SUMMARY

Question 5: Is the London Clay the shallowest strata at the site?

London Clay is the shallowest strata on the site; the potential to impact slope stability will be investigated further.

Question 6: Will any tree/s be felled as part of the proposed development and/or are any works proposed within any tree protection zones where trees are to be retained?

Refer to Arboriculturalist report. This issue will not be investigated any further in this report.

Question 8: Is the site within 100m of a watercourse or a potential spring line?

The site is in close to the former River Tyburn; the potential to impact slope stability will be investigated further.

Question 9: Is the site within an area of previously worked ground?

The site overlies up to 1.5m made ground; the potential to impact slope stability will be investigated further.

Question 12: Is the site within 5m of a highway or pedestrian right of way?

The site is adjacent to a minor access road; this issue will be investigated in the scoping stage.

Question 13: Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?

The new basement will have a piled retaining wall with toe depth 16m below ground level; The potential for this to impact the stability of neighbouring structures must be investigated further.

5.3.2 IMPACTS ON SLOPE STABILITY

The site is located upon 70m of London clay. Slope stability problems most often occur when slopes are built over soft soils such as low strength clays, silts, or peats. Changes to the subterranean hydrology will cause clay to shrink or swell and absorbed water is a major factor in the decrease in strength of cohesive soils [Ref 9]. When the surcharge is excavated from a body of consolidated clay the effective stress is reduced. Over time, the pores will absorbs water, expand/heaves and loose strength [Ref 8]. External forces, such as pile driving, disrupt the grain structure and undermine the attractive forces between the soil particles that may have prevented water absorption. [Ref 9]. These effects are amplified if the clay mineral happens to be expansive, such as London Clay.

Clay predominantly responds with plastic flow rather than deforming elastically in response to an applied force [Ref 9]. Time dependant creep is typical, pronounced and readily observed in clay. In comparison to sandy material, clayey soils usually display large creep deformations seen for instance in the form of prolonged settlements, tilts and horizontal shifts of structures, or slow slippage of the natural slopes and embankments [Ref 7]. This means that clays will creep until an equilibrium state is achieved or the cohesive forces are overcome in fracture. In short, the long term effect of building on clay must be carefully considered.

The site is in close to the former River Tyburn [Ref 3] and the potential effect of the works on the local hydrology is important factor in slope stability. Any changes to the hydrology could weaken the clay and impact vulnerable slopes.

By virtue of the uncertainty of its composition, compaction and consistency, made ground is an unpredictable stratum. Removing significant quantities of spoil from vulnerable slopes containing made ground could cause the made ground to slide over the underlying stratum or otherwise fail in unexpected ways.

The site is adjacent to a minor access road which serves a handful of residences. If unstable ground were to compromise the road, it would be costly and inconvenient, but not catastrophic, because the road serves low density, low speed traffic.

The installation of a basement will result in vertical and horizontal ground movement in the retained soil. The structural integrity of neighbouring properties should not be undermined by significant ground movements. The stiffness of the retaining wall must be checked to ensure that soil movements are within acceptable limits.

6 STAGE 3 – SITE INVESTIGATION AND STUDY

6.1 SITE INVESTIGATION

A site investigation was undertaken between 30th April and 2nd May 2008 by Chelmer Site Investigation with an interpretive report by G. L Martin produced 19th June 2008. The report is included in Appendix B. A summary of the findings is as follows:

The general ground build up consists of made ground to a depth of up to 1.3m, below which is a strata of stiff to very stiff brown silty clay (Upper weathered London clay) to 10.6-15.7m depth. This overlies a layer of very stiff grey silty clay to 14.2-20m bgl (London Clay). Claystone was encountered in two of the boreholes at 14.2m and 15.5m bgl and this should be taken into account when choosing the pile solution. Ground water inflows occurred in 2 of 3 boreholes at level of 1.3m and 2.4m bgl with final levels being measured at 1.7 and 1.2m bgl. Water seepage was noticed in 2 of the window sampler boreholes at 6.5m and 3.8m with final levels measured at 6.5m bgl. Standpipes installed on site measured the ground water level at between 3.4 and 3.7m bgl.

The results of soil sulphate tests indicate the natural subsoil/ made ground vary between Classes DS-1 and DS-3 and it is therefore recommended that the latter category be assumed for the purpose of the concrete mix design. The tests found concentrations of lead, zinc and benzoapyrene which exceeded their respective Generic Assessment Criteria threshold for residential end use scenarios and would therefore constitute a potential risk to human health in areas of sensitive end use. The concentration of pH, lead and mercury was found to exceed the respective guidance threshold and there would be a potential risk to plant health due to the elevated concentrations of zinc.

'In accordance with BRE (2004) Cover Systems for Land Regeneration: Thickness of Cover Systems for Contaminated Land, in areas of garden on average a minimum of 500mm of soils validated as being free from significant contamination should be placed above the in-situ site soils.' [Appendix B]

There are no areas of; outstanding beauty, environmental sensitivity, scientific interest, source protection, special conservation, special protection, nature reserves, forests or national parks within 500m of the site and;
'A review of the geological information and exploratory logs would appear to indicate that an SPL does not exist between the Site and controlled waters due to the presence of a significant thickness of clay and the distance to any waters. Therefore human health and building structures would appear to be the main sensitive receptors at the site...' [Appendix B].

6.2 SURFACE WATER RUNOFF

The London Borough of Camden requires details of sustainable design and construction measures showing how it is proposed that the development reduce energy, water and materials used in design and construction. The prescribed sustainability assessment for all new build residential developments is based on the Code for Sustainable Homes and requires surface water drainage which avoids, reduces and delays the discharge of rainfall run-off to watercourses and public sewers using SUDS techniques [Ref 5]. The surface water runoff calculations in Appendix D describe how these requirements are met.

6.3 RETAINING WALL ANALYSIS

The soil surrounding the basement at Radlett place will be retained by a contiguous piled wall. The basement will be constructed from the bottom-up. The retaining wall's structural interaction with the soil has been analysed using 'Frew Version 19.0', an iterative retaining wall design software package. Outputs from the analysis are included in Appendix F. The deflections taken from the Frew analysis have been turned into settlements and the settlement contours are presented in Appendix E. The typical maximum estimated settlement is around 20mm at a distance of around 5m from the basement. Virtually no settlement is predicted at a distance of 30m from the works.

7 STAGE 4 – IMPACT ASSESSMENT

7.1 SURFACE FLOW AND FLOODING IMPACT ASSESSMENT

The proposed drainage system incorporates some key characteristics of SUDS with respect to surface flows. 32% of the new development will be surfaced with green roof, providing additional storage and attenuation prior to the storm water attenuation tank. By storing rainfall and attenuating the discharge into the sewerage systems, natural drainage systems are replicated in a manner that smoothes peak flow of surface runoff that would otherwise contribute to the overloading of the existing sewerage and drainage systems following a high precipitation event.

As identified in screening process, the site is not located in a flood risk zone. In comparison to the previous scheme, a larger proportion of the precipitation is transmitted to the sewerage system and so the risk of flooding is diminished both to the property and the neighbouring properties. The storage tank will be sized to account for the current precipitation load plus an additional margin to account for climate change [Appendix D]. Therefore, it is unnecessary to investigate the surface water flood risk of the proposed construction to either the drainage system or the neighbouring properties.

The site has concentrations of contaminants that exceed their respective thresholds for residential end use. However, the bore holes from which the contaminated samples were retrieved are located within the perimeter of the new basement and therefore much contaminated soil will be excavated from the site. At the time of writing, it has been confirmed that the contaminated soils have already been excavated and removed and the remaining soils on the site classed as clean and inert. In addition, in accordance with BRE (2004) 'Cover Systems for Land Regeneration', a minimum of 500mm of contamination-free soils will be placed upon the existing soil. As discussed, the volume of surface water leaving the site will be reduced by the new scheme. Therefore, the quality and volume of surface water transmitted overland will reduce the risk of contamination to adjacent properties and this issue requires no further investigation.

The site is not within the catchment of the ponds. There are no areas of; outstanding beauty, environmental sensitivity, scientific interest, special conservation, special protection, nature reserves, forests or national parks within 500m of the site [Appendix B]. The nearest surface water feature or water abstraction is over 250m away [Appendix B]. Therefore, the site is located in an area of low ecological sensitivity, with no vulnerable local amenities. Given that the site is also located in impermeable unproductive ground, the works poses no significant threat to any heritage of Camden that might be vulnerable to a reduction in the volume of surface flow resulting from either the increased impermeable surfaces or adaptations to the transmission of the remaining surface flow.

7.2 SUBTERRANEAN GROUNDWATER FLOW IMPACT ASSESSMENT

Reducing the volume flow rate of subterranean base flow could undermine the vitality of surrounding water features. However, the site has concentrations of contaminants that exceed their respective thresholds for residential end use. As stated in the previous section the contaminated soil identified on the site has already been removed. There is now an extremely small risk that some will remain and could be transmitted to vulnerable locations. The site is located on relatively impermeable London Clay; therefore there are no significant natural drainage patterns to be maintained. The nearest surface water feature or water abstraction is over 250m away [Appendix B], so any reduction in subterranean flow will have a minor effect at such distance. Given the possibility, albeit extremely low, that the flow could be contaminated, this is beneficial.

Constructing such a large basement will remove ground that previously occupied the site footprint. This reduces the capacity of the ground to store rainfall, potentially leading to greater surface water run-off and greater risk of flooding. The scoping for the risk of flooding from surface run-off is discussed in section 6.1.2. However, the basement does not penetrate a permeable aquifer and so the impact of excavated storage greatly diminished.

Ground water could pass through the top stratum of made ground. If such a flow were blocked by the basement, it would be forced to find and alternative route. Research has shown [Ref 10] that when ground water flows around an obstruction, the volume flow rate is not significantly impacted, but the ground water level rises upstream of the obstruction and this could lead to local flooding or at least water logged ground, particularly as the made ground is 0.7m to 1.5m deep.

The made ground is composed of 'soft dark brown gravelly very silty clay with numerous concrete and brick fragments' [Appendix B]. Although it is likely that regions of permeable gravel are present within this stratum, it is unlikely that it is capable of transmitting large quantities of subterranean flow. Lenses of gravel may be porous, but even if these volumes are free from silt, they will be randomly arranged in an impermeable matrix of clay and rubble. Undulations in the thickness of the made ground will provide further bottlenecks to the transmission of water. In order to deliver a problematic flux of ground water flow to the basement obstruction, infiltrated ground water must be transmitted from a relatively large catchment of land. However, in this composition of made ground, the larger the catchment considered the smaller the chance that any continuously porous path exists. Given the negligible slope of the site, the potential for subterranean ground water flow is minor.

With such a made ground matrix of variable permeability sitting on top of a 70m thick stratum of impermeable London Clay, it is probable that pockets of perched water reside on the interface between strata. Excavation may open up pathways to drain pockets of water. As the site is nominally flat, it is likely that the volume of water will be manageable, but reasonable care should be taken to control ingress during construction. Once the basement is installed, perched water pockets will be recharged and the basement must be waterproofed to defend against water ingress. The possibility of local areas of water logged ground on the face of the retaining wall can be managed by drainage channels around the perimeter of the basement.

The made ground is not an aquifer and the geotechnical conditions are unlikely to enable significant flows of water, such as a hidden spring line or an underground linkage to the former River Tyburn. It is probable that the former River Tyburn has been collected into a man-made conduit, probably the sewerage system. The impact of building a subterranean basement barrier to this property will quickly become insignificant downstream of the site. It is unlikely that there will be significant ground flows to be blocked or diverted and the local environment does not contain sensitive areas of; outstanding beauty, environmental sensitivity, scientific interest, source protection, special conservation, special protection, nature reserves, forests or national parks within 500m of the site [Appendix B]. In short, the minor natural drainage patterns of the site will not be significantly upset by the development and there are no vulnerable assets to be concerned about.

7.3 SLOPE STABILITY IMPACT ASSESSMENT

A number of issues were identified in the slope stability screening exercise which could destabilise a slope. London clay is the shallowest strata on the site. Next to gravity, water is the most important factor in slope stability [Ref 9]. Driving, shearing and excavating are unavoidable means to constructing a basement and these processes have the potential to undermine the stability of clay. The surface and subterranean flow impact assessments bring together all hydrological considerations, including the impact of the river Tyburn. These assessments concluded that volume of surface flow and ground water flows will be reduced by the works. So while the works will upset the strength of the clay, the hydrological changes will not tend to contribute to any further loss of cohesive strength once hydrogeological equilibrium has been reached.

It is probable that the made ground will exhibit some of the characteristics of the underlying stratum, in this case London clay. Whatever the case, the maximum depth of made ground is around 1.5m, so the basement passes straight through the made ground and is supported on piles driven 16m into the London clay. Therefore, the made ground is only relevant to the geological stability as a surcharge to the underlying clay.

There is no reason to believe that once the works are complete the supporting clay will not creep into a configuration of stable equilibrium. The site is not situated in a hill side setting, nor does it contain any significant slopes existing or proposed, nor does the neighbouring land. There are some significant slopes on primrose hill, but they are beyond the influence zone of the works. The basement is big and supported on a long perimeter of deep piles. If the structure were to be unstable, it would require a slope on a similar scale to the basement and this kind of topography is clearly not present.

Potentially unstable slopes are too far away to be affected by minor soil movements and the proposed construction will not significantly alter the existing landscape gradients.

A soil structure analysis has been undertaken to ensure that the design of the retaining structure does not permit settlement of the retained soil behind the wall beyond acceptable limits chosen to protect and maintain the landscape and the structural integrity of neighbouring properties and roads. Refer to Appendix F for retaining wall analysis. Appendix E shows a worst case estimated settlement profile around the perimeter of the basement. The main risks to adjacent properties are ground settlements due to wall installation and lateral movements during excavation. The wall has been designed to limit these movements both in the temporary and permanent conditions by introducing two levels of temporary props and ensuring the piled wall itself is stiff enough. Due to the distance to the nearest neighbouring property and the estimated settlements there is an extremely low risk of any adverse impact to the neighbouring properties.

8 CONCLUSION

This Basement Impact Assessment has been carried out to justify that the basement construction at One Radlett Place, which is currently under construction under an approved planning application, meets the current planning rules related to basements in the Borough of Camden. This is in order to support a new planning application for a revised superstructure scheme on the site.

Following the stages of work set out, from screening through scoping, data collection and review to impact assessment it has shown that the basement construction has no adverse effect on the surface and subterranean water regimes and has no impact on slope stability.