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26-28 King's Mews, WC1N 2JB

BASEMENT IMPACT ASSESSMENT: SCREENING AND SCOPING REPORT

For

NJ Rae

Project No:

11066

June 2012

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Document History and Status

Revision	Date	Purpose/Status	Author	File Ref	Check	Review
D1	1 June 2012	Report	Alex Dent	JWCjwc11066-080612-D1	James Clay	James Clay

Document Details

Last saved	14/06/2012 12:46
Report version	LQS Proforma June 2010
Path	JWCjwc11066-080612-D1.doc
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Project Number	10660
Project Name	26-28 King's Mews, London

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EXECUTIVE SUMMARY

Author Credentials	This report has been prepared by: James Clay: MCIWEM C.WEM, CEnv, MSc, BSc Alex Dent: BSc, MSc, EurGeol, C.Geol, FGS Peter Butler: BSc CEng MICE
Data consulted	A site reconnaissance and desk study data has been obtained and reviewed based on the requirements of Section 7.2.1 of the Guidance for Subterranean Development (GSD) produced by the London Bough of Camden.
Development Proposal	The existing buildings are to be demolished and new buildings are to be constructed with a proposed basement formation level of 4m bgl. Plans illustrating the proposed development are given in Appendix A.
Ground Model	Made Ground up to 4.6m thick over River Terrace Gravel to around 6m bgl over London Clay. An equilibrium groundwater level of 3.6m bgl is anticipated. Party wall foundations are anticipated to extend to 0.70 to 1.12m bgl.
Screening	Screening concerning land stability, hydrogeology and hydrology was undertaken based on the flowcharts contained in 6.2.2 of the GSD. This identified potential impacts regarding groundwater, previously worked ground, the presence of an adjacent highway and associated services, party wall foundations and tunnels.
Scoping	Scoping was undertaken in relation to the above matters. Most of these were considered to be of negligible or minor significance, with the exception of waterproofing, worked ground, groundwater ingress, adjacent highways/services and party wall foundations. Residual impacts, which consider the proposed mitigation measures, are separately assessed below.
Investigations and Assessment Methodology	A site reconnaissance was completed and existing desk study data was reviewed as outlined above. The client has provided a copy of a ground investigation report which covers the site. It is recommended that he obtains a warranty of this or commissions his own investigation based on the requirements of the GSD. A number of additional recommendations are made in relation to consultations, excavation of trial pits and groundwater monitoring as given herein. Modelling and calculations will be required as the design of the basement is developed.
Mitigation measures	A number of options for mitigation measures are given in relation to temporary and permanent works, which should be considered as the design is developed. These include the aforementioned investigations, adopting suitable founding solutions, the securing of affected foundations, groundwater control measures, the provision of ground support and ensuring that the basement is designed to provide the required degree of protection from water ingress and resistance to hydrostatic pressures.
Monitoring.	The existing borehole should be used to facilitate additional groundwater monitoring. A pre and post works survey of the potentially affected surrounding buildings and ground is recommended as minimum. The need and extent of any additional monitoring to augment this should be considered as the design is developed.
Residual impacts	Based on the additional investigations and the design measures discussed herein it is anticipated that the matters identified in the screening exercise will be of **residual neutral or minor significance**.
Other	The client will be required to seek party wall awards for the proposed works which comply with current legislation.

1.0 INTRODUCTION

1.1 This report has been produced by Campbell Reith Hill LLP (CampbellReith) on behalf of the private individual freeholders: NJ Rae (26 King's Mews), Nico Warr (27 King's Mews) and Simon MacDonagh (28 King's Mews). It provides a Basement Impact Assessment (BIA) for 26-28 King's Mews, WC1N 2JB where it is intended to bring forward a planning application which includes new basements. The references and limitations associated with this report follow the main text.

1.2 The report has been produced in general accordance with the policies and technical procedures for BIA for the London Borough of Camden comprising:

- Guidance for Subterranean Development (GSD). Issue 01. November 2010. Ove Arup & Partners
- Camden Planning Guidance (CPG4) 4: Basements and Lightwells
- Camden Development Policy (DP)27: Basements and Lightwells

1.3 A BIA is required with all planning applications for basements in Camden in accord with DP 27 to demonstrate that schemes:

a) maintain the structural stability of the building and neighbouring properties;
b) avoid adversely affecting drainage and run off or causing other damage to the water environment; and,
c) avoid cumulative impacts upon structural stability or the water environment in the local area.

1.4 The purpose of this report is to evaluate the impacts of the proposed basement considering the issues of hydrology, hydrogeology and land stability via the process described by the GSD and make recommendation for the detailed design. This presents a staged methodology and tool kit which is illustrated by flow charts and checklists. This report has been structured to follow the guidance through the incremental stages of:

a) Screening (Section 4.0)
b) Scoping (Section 5.0)
c) Site Investigation and Study (Section 2.0/3.0)
d) Impact Assessment (Section 5.0/6.0)
e) Review and Decision Making (Section 6.0)

1.5 The report considers the full screening and scoping stages and available site investigation and desk study information, sufficient to appraise the potential impacts of the proposed basements and principle mitigation measures. This is intended to support the key deliberations during the agreement of planning permission. It is necessary that additional site investigation and study, review and decision making are made after granting of planning during design development.

1.6 It is proposed to develop 26-28 King's Mews as 3 individual properties but with basements beneath each which are likely to be most effectively constructed in a single operation. The 'Sketch Design' Proposals for the site (V4) are presented in Appendix A. As a result of a historic meeting with Camden Council it was requested that a joint BIA be considered for the properties.

1.7 The report is based on recent ground investigation information (dated 2007), desk study and Envirocheck reports which cover the site area provided by the Client. At the current time the freeholders have the benefit of only those reports for which an asterisk is noted (and therefore the remainder are not reproduced herein). These reports contain pertinent and relevant information in relation to the site. It is anticipated that the Client will obtain the benefit of the existing information.

1.8 The following site specific information was supplied by the Client and has been viewed in preparation of this report:

1.1: EXISTING SITE SPECIFIC INFORMATION

Report Title		Author	Type	Reference
Site Investigation Report 43 and 45 Greys Inn Road and 22 to 30 King's Mews, London WC1. Reference C10885.	March 2007.	Ground Engineering	Phase 1 Desk Study and Phase 2 Site Investigation Factual and Interpretative Report	[1]
43–45 AND 49 GRAY'S INN ROAD AND 22–30 KING'S MEWS London WC1 London Borough of Camden Archaeological desk-based assessment.	December 2006	MOLAS	Archaeological Desk Study	[2]

December 2006				
43-45, Gray's Inn Road, LONDON, WC1X 8PP. Reference SAS_34711535_1_1	May 2011	Landmark Information Group	SiteCheck Report	[3]
26, 27 and 28 King's Mews , London, WC1N 2JB, Sketch Design Proposals Heritage Statement , Land Use Assessment , Information Submitted in Support of Pre-Application Planning Advice . DRAFT V4	March 2012	FT Architects. Nico Warr	Draft Design	[4] *

1.9 Reference has also been made to ground investigation and desk study data contained within the CampbellReith GIS database, publicly available information and a site walkover.

1.10 This assessment has been carried out by persons with relevant qualifications listed under the guidance comprising:

James Clay:	MCIWEM C.WEM, CEnv, MSc, BSc
Alex Dent:	BSc, MSc, EurGeol, C.Geol, FGS
Peter Butler:	BSc CEng MICE

1.11 This commission from the client did not include for an appraisal of potential contamination issues or allied matters such as waste.

2.0 SITE DESCRIPTION

Site Location

2.1 The site location and boundaries are given on Figures 1 and 2 contained in Appendix A. The site is located on King's Mews, off Theobold's Road at London WC1 2JB. It is located in the London Borough of Camden: Holborn and Covent Garden Ward. The site is located at National Grid Reference of 530940 182010 and is at a level of around 20 to 21m AOD. The site is currently occupied by 3no. 1950's built industrial units previously addressed as 23-30 King's Mews.

Site Layout

2.2 A visit to the site was made during May 2012 by James Clay and Alex Dent of CampbellReith. The 3 properties were accessed from No. 28 doorway at street level. They incorporated an open layout with direct access into one another. A stairwell in No. 28 provided access to the rooms above. Photographs of the properties are presented in Appendix A. The buildings are two storey high and brick clad. It is believed that the current structure is of steel (concrete encased) frame construction with either brick cladding or brick work construction on at 1st floor level. The site is essentially flat. Concrete hardstanding was present throughout.

2.3 On the western elevation, some limited cracking (3mmm or less) was noted in brick work at 1st floor level and in the concrete frame on the western elevation where the site adjoins 25 Kings Mews. A construction joint separates the site from No 29/30.

2.4 A historic investigation within [Ref 9] indicates that the party wall foundations extend to depths in the region of 0.70m to 1.12m bgl. The construction of these variably comprised brickwork flush with the wall above, mass concrete projecting 0.65m from the wall and brickwork corbelling over mass concrete projecting 0.40m from the wall. All the footings were founded in Made Ground.

Surrounding Land-Use

2.5 The area in general is of a predominantly residential and commercial nature. There were no trees adjacent to the properties.

2.6 In this part of London a significant proportion of existing properties have basements, as evidenced by stair wells, access hatches, pavement lights and low level windows. Based on such

observations it would appear that, in the vicinity of the site, most of the properties along Grays Inn Road, with the possible exceptions of No 35, 49 and 55, possess basements. Likewise most of the properties along Theobalds Road (including at the junction with Kings Mews), John Street and Northington Street (possibly excluding those at the junction of Kings Mews) have basements.

2.7 With respect to Kings Mews itself, no such features were observed with the exception of the properties at the junction with Theobalds Road (as discussed above) and possible half height basement at a property opposite No 22 Kings Mews, which is set back by around 10m from the road.

2.8 It is known from the occupants of 29/30 Kings Mews that this adjoining property does not have a basement. Similarly it has been confirmed with discussion with the Client that 24 King's Mews also does not have a basement.

2.9 No signs of gross building distress were noted around the site, with the possible exception of No 39 and 45 Gray's Inn road, where the some reinforcement plates were noted at 1st and 2nd floor level (repair to war time damage). No 12 Theobalds Road has a notable eastward lean. Construction or major refurbishment works were on going No 12/13 Kings Mews and No 14 Kings Mews appears to be of recent construction.

2.10 At this stage consultation with the adjacent occupants of properties on Kings Mews has not been undertaken.

2.11 The nearest observable trees to the site were London Plane trees located approximately 40m east and 50m south of the site. Arial photography suggests some additional trees may be present in courtyards bounded by properties on John Street and Kings Mews.

2.12 A number of manholes and reinstatement scars were noted in the road pavement to Kings Mews, suggesting the possible presence of services.

2.13 The site is in an area with a gentle gradient down to the south. Ordnance survey maps suggest a gradient in the region of approximately 1:40 approx. (1.5°), which agrees well with Figure 10 of the GSD (referred to in section 1.2), which suggests that the site is an area where there is only very limited change to the relief and Figure 16 of the GSD which indicates that the site is remote from an area with a slope angle in excess of 7°.

2.14 No water courses or ponds were noted within 100m of the site.

Site After-Use Proposal

2.15 The proposed site redevelopment is shown in Appendix A. The development is for 3 no. new mews residential houses comprising basement, ground, first and a set-back second floor level across 26, 27 and 28 King's Mews with an additional part-storey to 28 King's Mews. The individual houses will be of bespoke design.

2.16 It is intended to construct a single storey basement to all of the properties. The current street level is approximately 20 to 21mAOD and an allowance has been made for the underside of the basement construction to be 4m below ground level (albeit foundations will extend beneath this depth).

3.0 ENVIRONMENTAL SETTING

Geology

3.1 The site geology is summarised in Table 3.1 and the associated references are listed in Table 1.1 and at the rear of the report.

3.2 The London Borough of Camden is divided into three distinct areas for the purposes of geology and, in this regard, the site falls into the area to the south of Euston Road (characterised by River Terrace Deposits overlying London Clay). An area of Alluvium exists around 160m to the north east of the site, associated with the historic route of the River Fleet, but such deposits are not likely to be present on site.

3.1: SUMMARY OF GEOLOGY

Type	Description	Anticipated Base of Stratum	Reference
Made Ground	Clayey, silty, sandy GRAVEL	1.00 to 4.60m bgl	[9]
Quaternary Drift Deposits	River Terrace Deposits: GRAVEL (Lynch Hill Gravel)	6.00 to 6.30m bgl	[9] [5] [6] [7] Figures 2, 3 and 5 of the GSD
Palaeogene Solid Deposits	London Clay Formation: CLAY	25m bgl	
	Lambeth Group (Woolwich and Reading Beds): CLAY with sand and pebble beds	35-40m bgl	
	Thanet Sands: Fine grained SAND	45-50m bgl	
Cretaceous Solid Deposits	Upper Chalk: CHALK	240m bgl	
Other			
Recorded Scour Hollows	None on site. Nearest located 270m North.		[6] & [8]
Dissolution Features	Not relevant given geological setting.		[9], [3] & [5]
Geotechnical Hazards	With respect to the site itself, 'no hazard' or low of very low potential is recorded in relation to: mining, brine, collapsible ground, compressible ground, landslides, and running sand. This is consistent with other information indicating the site geology and safety.		[3]
Tunnels*	The site is more than 100m from most recorded tunnels indicated on the CampbellReith GIS database. However, it is in the vicinity of the old mid level sewer and possibly also a government communications tunnel. The site is remote		[9]

	from the safe guarding zones associated with Crossrail 1 and Crossrail 2.	

*including indicative locations of London Underground, Network Rail, Crossrail 1, Crossrail 2, Rail Mail, Government Communications, Major Sewers, London Electricity Cable Tunnels, major sewers, and those operated by National Grid.

3.3 London Clay has been demonstrated to a depth of 25m on the site in two boreholes from previous investigations [ref 9].

3.4 The above is comparable with Figure 6 of the GSD which indicates the anticipated thickness of River Terrace Deposits at the site to be between 1.0-1.5m.

3.5 Ref 9 indicates that the Made Ground generally comprises loose, dark brown, slightly clayey, sandy GRAVEL with occasional cobbles of brick, concrete, flint, quartzite and ash with additional inclusions of ceramics, ash and shell fragments varying to loose gravelly sand and soft and very soft clay. The site is known to have been redeveloped (most recently during the 1950's) and to have been affected by bomb damage as described in Section 4.0 and this is likely to form the origin of the Made Ground material identified.

3.6 Ref 3 suggests a moderate potential for shrink-swell hazard. Bearing in mind generic nature of such reports and the additional, more detailed, data considered in this report, the risk can be considered to be low. This is justified on the basis that top of the London Clay is around 6m bgl and is overlain by water bearing River Terrace Deposits (see discussion below on groundwater levels) and that the site is remote from trees.

3.7 With reference to Figure 17 of the GSD, the site is not within an area of known significant landslide potential (and this concurs with the known site topography).

Hydrogeology

3.8 The site hydrogeology is summarised in Table 3.2 and the associated references listed at the rear of the report.

3.9 The River Terrace Deposits which are present at the site are designated as a Secondary A Aquifer by the Environment Agency and are the relevant water bearing strata for the consideration of a new basement in this area. London Clay is considered to be an unproductive stratum in this context. The Environment Agency definition of a Secondary A Aquifer is:

Secondary A - permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

3.10 It is also noted that the GSD indicates, in LB Camden, all areas where London Clay does not outcrop at surface are considered to be an aquifer.

3.11 A historic investigation contained with [Ref 9] indicates that a cable percussive borehole on the site encountered water at a depth of 4.10m bgl which thereafter rose to 4m bgl after 20minutes. During post site works monitoring programme of a nearby borehole this rose to 3.60m bgl. The River Terrace Gravel deposits form an aquifer and groundwater storage unit in the London Borough of Camden and it is noted that the water levels are often variable therein.

3.12 Groundwater is likely to flow towards the former River Fleet, offset by its direction of flow. Consequently, groundwater flow is likely to be towards either the northeast, east or southeast.

3.2: SUMMARY OF HYDROGEOLOGY

Type	Distance	EA Description	Reference
Upper Aquifer	On-site	Secondary A Aquifer associated with the River Terrace Deposits	EA Website
Lower Aquifer	On-site	Thanet Sands / Chalk Principle Aquifer	EA Website

3.13 The Environment Agency web site did not indicate any groundwater source protection zones or drinking water abstractions within 500m of the site.

3.14 The geological data consulted did not indicate any additional recorded wells within 100m of the site. Nor were such features recorded within 100m of the site on the GeoIndex provided by the British Geological Survey (BGS) (http://mapapps2.bgs.ac.uk/geoindex/home.html).

3.15 With respect to the potential for rising groundwater in the basal Chalk aquifer this site is not within a critical area for shallow foundations and basements [Ref 6]. It is close to a critical area for deep foundations and deep basements [Ref 6].

Hydrology

3.16 Figure 12 of the GSD, the ordnance survey plans [Ref 9], geological data consulted (as discussed above) and the site reconnaissance indicate that the site is more than 100m from surface water features, ponds and recorded spring lines. The nearest existing surface water course to the site is the River Thames, situated 1.2km to the south. Figure 11 of the GSD also indicates the historic tributary of the River Fleet and the River Fleet itself located to the north (approximately 130m

[Ref 2 and 10]). These rivers were artificially culverted along their route and enter the storm drainage network and, in turn, the River Thames.

Flooding

3.17 With reference to data held within the CampbellReith GIS database, the following is noted:

- the site is not within a Zone 1 or Zone 2 flood risk area associated with rivers or the sea;
- site is not in an area of recorded historical flooding;
- the site is not within the areas associated with floods with a return period of up to 1000 years, including pluvial flooding;
- the site is not located in an area of coincident with a BGS geological indicator of flooding;
- with reference to the National Flood Risk Assessment by the environment agency, this site is not in area with an identified flood risk;
- the site it is in an area where there is moderately high *susceptibility* to groundwater flooding.

3.18 Groundwater flooding occurs when groundwater rises to the surface. In this case it would be associated with rising ground waters within the River Terrace Deposits. Such flooding occurs away from river channels. It is noted that much of the area south of Euston Road has moderate to high susceptibility in this regard. *Susceptibility* is not the same as risk and it just indicates sensitivity to such matters: this issue is discussed on more detail in section 5.

3.19 Figure 15 of GSD (extracted from Figure 5 of the Camden Core Strategy) indicates that Kings Mews did not flood in either in 1975 or 2002 flood events.

Site History

3.20 Ref 1 and 2 and other data held within [Ref 9] indicate that the site was originally developed at some time between 1676 and 1720. A possible drainage ditch was noted on a plan dated 1720 at a location around 100m to the north. However this was backfilled by 1747.

3.21 More recent information relating to the site history has been obtained by reference to historic maps contained with [Ref 1], [Ref 3] and [Ref 9], including plans at 1:1000, 1:1250, 1:2500 and 1:10, 000 scale and dated 1875 through to 2006. In the context of this screening and scoping BIA this data is summarised for the site and a 100m buffer zone in Table 4.1.

4.1: SITE HISTORY

Date	Development
1875	The site is occupied by a series of buildings, considered likely to be of residential usage. The surrounding area is also indicated to be generally of residential nature. However, the grounds to Gray's Inn are located 50m to the south and a brewery is located 120m to the east.
1878-1896	No significant change
1916	The brewery had been removed and replaced by series buildings, presumably residential or possibly offices.
1920-1938	No significant change
1952-1954	No significant change, although some ruins are noted in the areas around the site – the nearest being approximately 45m to the southwest. An adjacent building on Gray's Inn Road is absent
1957	No 26 Kings Mews is also indicated to be absent.
1960-1968	No significant change
1974	Some alteration to the layout of buildings on Kings Mews, including the site, which indicates a replacement to the building a No 26.
1968 – 2006	No significant change

3.22 Bomb Damage Maps [Ref 11] indicate that the site is an area that received wartime damage, including 'damage beyond repair' being recorded in relation to an adjacent building to the east and in relation to buildings the opposite site of Kings Mews

3.23 Aside from the historic irrigation feature discussed above, the plans consulted did not indicate any historic water courses, ponds or wells within 100m of the site.

Liaison With Regulatory Authorities

3.24 At the current time liaison with the London Borough of Camden has not been implemented. It is a recommendation of this report that this report be submitted (pre-planning if possible) to form agreement on the matters discussed herein.

4.0 SCREENING

4.1 In accordance tithe the GSD, an initial screening exercise has been undertaken of Subterranean Flow (Table 4.1) Slope Stability (Table 4.2) and Surface Flow and Flooding (Table 4.3). These tables follow the form of the BIA Screening flowcharts are presented in Appendix E of the GSD.

TABLE 4.1: SUBTERRANEAN (GROUNDWATER) FLOW

No.	Question	Answer	Justification
1a	Is the site located directly above an aquifer?	Yes	Site is underlain by Made Ground over River Terrace Deposits. See section 3.
1b	Will the proposed basement extend beneath the water table surface?	Yes	Anticipated groundwater level of 3.60m bgl (see section 3) vs proposed level of 4m bgl.
2	Is the site within 100m of a watercourse, well (used/disused) or potential spring line.	No	No such features recorded within 100m of the site on Figures 2, 11, 12 of the GSD, aerial photography (Google Earth), ordnance survey maps (section 2 and 3), geological information (see section 3), Environment Agency website (see section 3) or Ref [10]. Nor were such features noted during the site reconnaissance (See section 2).
3	Is the site within the catchment of the pond chains on Hampstead Heath?	No	The site is not located within the areas indicated on Figure 14 of the GSD.
4	Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?	No	Site visit confirmed that the area of the proposed basement is already covered with hardstanding.
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	The extent of the basement in combination with its depth relative to groundwater level means that the development is not amenable to soakaway drainage. The existing site is covered with hardstanding as will the proposed development; volume and peak will not be materially changed.
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	No such features are within 100m of the site as discussed above.

TABLE 4.2: SLOPE STABILITY

No	Question	Answer	Justification
1	Does the existing site include slopes, natural or manmade, greater than 7°?	No	Site reconissence [Section 2] and ordnance survey maps [Section 4] confirm that the site is essentially flat. Figure 16 of the GSD indicates that the site is not in an area where the slope angle exceeds 7°.
2	Will the proposed re-profiling of the landscape at the site changes slopes at the property boundary to more than 7°?	No	The current plans detailed in Appendix A do not indicate landscape reprofiling.
3	Does the development neighbour land, including railway cuttings and the like, that slope greater than 7°?	No	Site reconissence [Section 2] and ordnance survey maps confirm that site does not neighbour such features. Figure 16 of the GSD indicates that the site is not adjacent to an area where the slope angle exceeds 7°.
4	Is the site in a wider hillside setting with a slope of more than 7°.	No	Site reconnaissance, ordnance survey data and Figure 10 of the GSD indicated the area around the site has a modest gradient of around 1.5°. Figure 16 of the GSD indicates that the site is not in an area where the slope angle exceeds 7°.
5	Is the London Clay the shallowest strata at the site?	No	Geological and ground investigation data as discussed in Section 3.
6	Will any tree(s) be felled as part of the proposed development and/or any works proposed within any tree protection zones where trees are to be retained?	No	Site visit confirmed no trees on or directly adjacent to site.
7	Is there a history of shrink-swell subsidence in the local area, and/or evidence of such effects at the site?	No	The London Clay is overlain by water bearing River Terrace Gravels and the site is remote from trees. Such a setting is not conducive to shrink-swell subsidence.
8	Is the site within 100m of a watercourse or potential spring line?	No	See answer to Q2 of Table 4.1
9	Is the site in an area of previously worked ground?	Yes	Given the site history (Section 4) and the geological data consulted (Section 3), Made Ground is anticipated to depths of 4-5m.
10	Is the site within an aquifer? If so, will the proposed basement extend beneath the water table such that dewatering may be	Possibly	See answers to Q1a and Q1b of Table 4.1. Therefore some form of groundwater control is required, possibly including

	required during construction?		dewatering.
11	Is the site within 50m of the Hempstead Ponds?	No	Figure 14 of the GSD indicates that site is considerable greater than 50m from the Hempstead Ponds.
12	Is the site within 5m of a highway or pedestrian right of way?	Yes	The site walkover (Section 2) and ordnance survey maps (Section 4) indicate that the site is adjacent to Kings Mews road.
13	Will the proposed basement significantly increase the differential depth of the foundations relative to neighbouring properties?	Yes	The existing party wall foundations are understood to be in the region of 0.70 to 1.12mbgl (see Section 2) whereas the proposed basement will extend to 4m bgl.
14	Is the site over (or within the exclusion zone of) any tunnels?	Possibly	As discussed in Table 3.1, the site is in the vicinity of the old mid level sewer and possibly also a government communications tunnel.

4.2 Whilst some cracking was noted to the western building elevation during the site walkover (as discussed in Section 2), this is considered likely to have arisen due to the foundations being supported in the Made Ground and/or due to the differing ages of construction (and an associated potential for differential settlement) pre and post WWII.

TABLE 4.3: SURFACE FLOW AND FLOODING

No	Question	Answer	Justification
1	Is the site within the catchment of the ponds on Hampstead Heath?	No	See answer to Q3 of Table 4.1
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?	No	The existing site is covered with hardstanding as will the proposed development; volume and peak will not be materially unchanged.
3	Will the proposed basement development result in a change in the proportion of hard surfaced/paved external areas?	No	See answer to Q4 of Table 4.1
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 water courses?	No	The status quo will be maintained: the existing site is covered with hardstanding as will the proposed development. The site is remote from watercourses
5	Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream water courses?	No	The status quo will be maintained: the existing site is covered with hardstanding as will the proposed development. The site is remote from watercourses.
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 features?	No	The site is not in an area of known surface water flood risk (see Section 3). The site is remote from water features : see response to Q2 in Table 4.1.

5.0 SCOPING

5.1 This scoping study incorporates a site walkover, desk study data and ground investigation data as discussed in sections 2 and 3 of this report. It considers the findings of the screening exercise presented in section 4 where either 'yes' or 'unknown' or 'possibly' responses have flagged a potential issue.

Ground Model

5.2 The anticipated ground conditions are presented in table 3.1. An equilibrium groundwater level of around 3.60m bgl is anticipated in the River Terrace Gravel aquifer. The basement formation level is anticipated to be 4m bgl. The surrounding party walls are founded at depths of around 0.70 to 1.12mbgl. The road pavement to Kings Mews is directly adjacent to the west of site. The site is in proximity the general vicinity of a sewer and possibly a government communications tunnel.

Potential Impacts and Possible Control Measures

5.3 With due consideration of the ground model, the potential impacts in relation to the matters requiring further consideration from the screening stage are discussed in Tables 5.2 and 5.3 below. For each matter discussed the potential impact is defined in terms significance based on EIA terminology as defined in Table 5.1 below. Tables 5.2 and 5.3 also consider the potential residual significance assuming the suggested mitigation measures are taken forward. For each potential impact a comment is presented on the pertinent matters and a concluding discussion is presented in Section 6.0.

TABLE 5.1: SIGNIFICANCE MATRIX USED WITHIN THE ASSESSMENT

MAGNITUDE OF EFFECT	SENSITIVITY OF RECEPTOR				
	Very high	**High**	**Medium**	**Low**	**Negligible**
Very large	Substantial Significance	Substantial Significance	Moderate Significance	Moderate Significance	[1]
Large	Substantial Significance	Moderate Significance	Moderate Significance	Minor Significance	[2]
Medium	Moderate Significance	Moderate Significant	Minor Significance	[2]	Neutral Significance
Small	Moderate Significance	Minor Significance	[2]	Neutral Significance	Neutral Significance
Negligible	[1]	[2]	Neutral Significance	Neutral Significance	Neutral Significance
[1] The choice between '*Moderate Significance'*, '*Minor Significance'* and *'Neutral Significance' will* depend on the specifics of the impact and will be down to professional judgement and reasoning.					
[2] The choice between '*Minor Significance'* and '*Neutral Significance'* will depend on the specifics of the impact and will be down to professional judgement and reasoning.					

TABLE 5.2: SUBTERRANEAN (GROUNDWATER) FLOW. POTENTIAL IMPACTS

No	Question	Potential Impact
1a	Is the site located directly above an aquifer?	The construction of the basement may affect the groundwater flow regime, although as discussed in section 5.4 below a negligible effect on the status quo is anticipated. The potential for this situation to occur will depend on the nature of the basement construction adopted (i.e. will it result in cut off of the water under the structure) the extent and depth of other basements in the area and the direction of groundwater flow. The potential effect of any such change is considered negligible as the site is remote from existing and historic wells, water courses and spring lines. Whilst the site is indicated to be in an area of 'moderate to high susceptibly' to groundwater flooding, the impact on the associated risk is considered to be limited, given that the basement is of limited plan area and that the exiting groundwater level is 3.60m bgl and a negligible effect is anticipated on the status quo conditions. **Given the above such matters are considered to be of minor significance.** The presence of groundwater will need to be considered in the design of the basement which will need to consider the associated hydrostatic up-lift pressures on the basement slab and the associated lateral pressures on the wall. However, these are likely to be modest. The basement design will also need to incorporate suitable water protection measures. Such matters are of high sensitivity for the client but are associated with a small effect (hydrostatic pressure) or large effect (water protection) and so are considered to be of minor significance and moderate significance respectively. Both of these would reduce to **minor or neutral significance through suitable engineering design.**
1b	Will the proposed basement extend beneath the water table surface?	

5.4 The basement floor slab should be designed to address hydrostatic pressures as required in BS8102 'Protection of Structures against Water from the Ground'.

5.5 In relation to the above it is noted that groundwater flow is anticipated to be towards the north east, east or possibly south east or south. Whilst current data suggests a paucity of existing basements on Kings Mews, there are already extensive existing basements along Gray's Inn Road to the east, (including the immediately adjacent properties), to the north (along Nothington Street) and south (along Theobald's Road). Consequently should basement construction result in damming of groundwater flow, this is likely to have already occurred. Consequently, given the limited size of the proposed basement and its location relative to the anticipated groundwater flow direction and the existing basements, the proposed basement is likely to only have a negligible impact on the status quo. Therefore, this matter is considered to be of **minor significance.**

TABLE 5.3: SLOPE STABILITY: POTENTIAL IMPACTS

No	Question	Potential Impact
9	Is the site in an area of previously worked ground?	Such ground has a relatively poor load bearing and settlement characteristics, which lead to a risk of structural failure or adverse differential movement. **This matter is of substantial significance**. This potential impact can be addressed by utilising the underlying River Terrace Deposits as a founding stratum or piled foundations. Subject to such operations this matters is reduced to **minor significance**. Such materials are likely to require temporary support during excavation.
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?	If River Terrace Deposits are to be used as a founding stratum for the proposed building and/or underpinning, then some form of dewatering or groundwater control may be required during construction. Such matters would need due consideration by the temporary works engineer. In relation to this, the depth of the London Clay may make it difficult to cut off groundwater using trench sheeting. Dewatering could result in ground movements that could affect nearby buildings and assets. However, only a limited effect is anticipated given the modest, temporary reduction in groundwater level required and so this matter is considered to be of moderate significance, provided that measures are adopted to prevent less of fines. For this risk to be better understood additional ground modelling will be required and monitoring of movements of the surrounding buildings and ground may be required to facilitate control. Subject to this or the adoption of a piled basement solution, this matter is likely to have a residual **minor significance.** It is noted that dewatering could result in a significant volume of water requiring storage and disposal (which would also have cost implications) and would require an abstraction license from the EA. Alternatively consideration could be given to cutting off the

		groundwater by the use of a piled wall followed by pumping. Another alternative would be to grout the permeable strata prior to excavation but this would also have associated impacts that would need to be considered.
12	Is the site within 5m of a highway or pedestrian right of way?	Basement construction could result in ground movements detrimental to the highway and any infrastructure contained therein. Statutory undertakers should be consulted so as establish if any buried utilities are present and the owners of these assets, along with the owner of highway, so as to determine any constraints to design, for example, easements, surcharge loadings on the basement wall casements and limiting values on ground movement. This matter is considered to be of substantial significance. Such matters will need to be modelled in the design of the basement. They are likely to result in a need for support to the excavation, through either bored piling or temporary sheet piling and may require the excavation to be propped. On such a basis the residual risk is considered to be of **minor significance.**
13	Will the proposed basement significantly increase the differential depth of the foundations relative to neighbouring properties?	The basement excavation will act to undermine the adjacent foundations leading to a risk of movement and damage. **This matter is considered to be of substantial significance.** Underpinning of these foundations is therefore recommended. The extent and nature of the underpinning would need to consider the potential for differential movement between the new, stiffer, foundations and the parts of the buildings on original foundations. Conventional underpinning would need to be undertaken in an appropriate and controlled 'hit and miss' sequence to minimise the risk of movement. As discussed in item 10, the temporary works engineer will need to consider the presence of groundwater above the bearing stratum, which may result in the conventional underpinning not being the preferred solution, possibly necessitating a piled underpinning solution. Alternatively, if a piled basement wall is taken forward,

		consideration could be given to ground modelling to determine if the adjacent foundations could be left as they are, but the with wall designed to accommodate the associated surcharge and to minimise ground movements. Assuming the proposed buildings are to be on foundations independent of the adjacent properties, construction joints should be placed between this building and the adjacent structures. In relation to the above matters it is recommended that a pre and post works survey is undertaken in relation to the surrounding buildings and that building movements are monitored. It is also recommended that some supplementary trial pits are undertaken in the northern part of the site so as to inspect uninvestigated party wall foundations. The design of the basement and the associated temporary works will need to give the above matters due consideration so as to ensure a minor residual significance.
14	Is the site over (or within the exclusion zone of) any tunnels.	The site is in the general vicinity of a sewer and possibly also a government communications tunnel. The proposed development could result in ground movements, such as ground heave associated with stress relief arising from the basement excavation or settlements arising from the new foundations. Similarly the new foundations could result in load being shed on to the tunnels. It is recommended that the utilities search discussed above is extended to include operators of underground tunnels. The asset owners should be consulted with regard to confirming the location, depth and nature of their tunnels and to establish any associated constraints to the proposed development. Typically such constraints comprise foundations exclusion zones and limitations on the magnitude of the load shed on to the asset and on the ground movements experienced by the asset. Initial data suggests that the site may be sufficiently remote from such features for such matters to be **of minor significance.**

5.6 The existing information indicates that the basement requires detailed engineering design, but subject to an appropriate design and construction, it should be possible to address the potential issues identified in Tables 5.2 and 5.3.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 The existing information and assessment suggests that, subject to supplementary investigations and detailed design, the proposed basement at 20-28 Kings Mews should not :

- cause harm to the built and natural environment and local amenity;
- result in flooding; or
- lead to ground instability.

6.2 For ease of auditing against section 8.1 of the Guidance for Subterranean Development (GSD) key aspects of this report are summarised in Table 6.1 below.

6.1: SUMMARY AUDITABLE MATTERS

Issue	Comment
Author credentials	Given Section 1.10
BIA Flowcharts	Used in Section 4.0
Temporary and Permanent Works that may impact geology, hydrogeology and hydrology	Discussed in Section 5 and in the remainder of Section 6.
Investigation of issues associated with impacts on land stability, hydrogeology and hydrology	This scoping and screening report is based on a site walkover and existing ground investigation and desk study data (Section 2 and 3). Potential impacts are identified in section 4 and discussed in Section 5. Recommendations for further work in relation to detailed design are given below.
Presentation of Maps	See Appendix A
Assessment Methodology	A desk study, based on the requirements of 7.2.1 of the GSD, is presented in Sections 2 and 3 and is considered in sections 4 and 5. Other matters relating to the assessment methodology are discussed in 6.3 below.
Has the need for mitigation been considered and included in the scheme	Mitigation measures are discussed in section 5 and in the remainder of Section 6. It is anticipated that these measures are taken forward as the design is developed.
Has the need for monitoring been addressed and is the proposed monitoring sufficient and adequate.	The need for monitoring is discussed in section 5 and below. Such matters will need to be given due consideration in design development to enable suitable schemes to be established.

Residual impacts	As discussed in Section 5residual impacts are likely to be of only negligible or minor significance.

6.3 This scoping and screening report is based on a site reconnaissance, desk study data ground investigation data held in the CampbellReith GIS database. The Client has access to a ground investigation report for the site, including cable tool boreholes, trial pits, geotechnical laboratory testing and post site groundwater level monitoring arising from this investigation. For such data to be used in design it is recommended that the client obtains a warranty for it. In addition some limited supplementary investigation work is recommended as discussed below. Alternatively the Client should commission an investigation that complies with section 7.2.2 and 7.2.3 of the GSD. The need and extent of any monitoring and the presentation of calculations are matters that can be addressed through design development.

6.4 The client will be required to seek party wall awards for the proposed works which comply with current legislation.

Further Site Investigation and Study:

6.5 To address the potential impacts discussed Section 5 the following further investigations are recommended in due course:

- The Client obtain warranties is for the data listed in Table 1.1 or commissions intrusive investigation works for this project. In the case of the former it should be noted that some supplementary foundation inspection pits would be required in the northern part of the site prior to construction;
- If still serviceable, it would be prudent to utilise the existing borehole installation to undertake additional groundwater level monitoring
- The Client undertakes consultation with local residents to establish local concerns;
- Through such consultation and through consultation with the local authority, enable a better understanding of the extent of neighbouring and nearby basements;
- Statutory undertakers, including utility operators and the owners of underground tunnels, are to be consulted to establish if any such assets could be affected by the works and associated constraints; and
- The owner of the adjacent road pavement (likely to be the London Borough of Camden) is consulted to establish associated constraints.

6.6 Depending on the outcome of the consultations discussed above there may be the need to better understand groundwater flow through additional ground investigation works, although on the basis of existing information this possibility is considered less likely.

Other Actions

6.7 In addition following actions should be considered:

- It would be useful to establish if the site's building frame extends into the adjacent properties.
- a pre and post works survey should be undertaken in relation to potentially affected surrounding properties.
- modelling of ground movements would be required if either dewatering or a piled wall are taken forward.
- modelling of ground movements and ground stresses may also be required in relation to buried tunnels, although on the basis of existing data, this is less likely.
- further consideration should be given to the potential need for monitoring of ground and building movements, depending on the form of basement construction, the foundation solution adopted and any underpinning; and
- as the extent and the depth of the basement relative to the groundwater level are such that the development is unlikely to be amenable to soakaway drainage, the client will need to consult with Thames Water with respect to disposal of such water through the mains network.

Design Guidance

6.8 As the design of the basement is taken forward the matters outlined in Tables 5.2 and 5.3 will need further consideration in terms of the Impact Assessment and Review and Decision Making stages of the BIA. Given below are some outline design guidance based on the existing data.

- a piled foundation and basement solution is likely to be the most practicable given the presence of a groundwater level that is shallower than the proposed basement level and also shallower than the founding stratum that would be adopted for strip or pad footings.
- a piled basement wall could be designed with sufficient propping to support the adjacent foundations and road pavement.
- it should be noted that a piled solution is likely to result in a reduction of usable space within the final basement when compared to that possibly achievable using conventional underpinning. It this is unacceptable to the client, then consideration could be given to a solution involving groundwater control measures and measures to support the associated excavations, founding the proposed building and the underpinning on the River Terrace

Deposits and temporary sheet piling of the western part of the excavation (to support the adjacent road).

- in relation to the above possible groundwater control options include dewatering and grouting. These carry a risk of ground movement, which would need to be modelled and other risks that would need to be considered.
- underpinning, piling and groundwater control measures are all specialist operations and so it is recommended that specialist contractors are consulted at an early stage so as to establish the viability of their proprietary techniques given the prevailing ground and groundwater conditions and the access constraints that will apply at the time of construction.
- it is also recommended that any piling operations are undertaken by firms that are members of the Federation of Piling Specialists and any underpinning is undertaken by firms that are members of the Association of Specialist Underpinning Contractors.
- given the setting of the site it is recommended that consideration should be given to the potential risks to any below ground works, including any further intrusive ground investigation works, posed by UXOs in accordance with CIRIA Report C681. In the first instance this should be informed by a Preliminary Risk Assessment undertaken in accordance with that document.
- the excavation of the basement will result in a volume of waste soil arising which should be classified and disposed of in accordance with good practice and legislation.

Appendix

TECHNICAL REFERENCES

No *	Reference Title	Type	Section
5	British Geological Survey. North London. England and Wales Sheet 256. Solid and Drift Edition.	Map	3
6	The Engineering Implications of Rising Groundwater Levels in the Deep Aquifer Beneath London. CIRIA Report SP69	Technical Report	3
7	Historic London Geological Map. London Sheet nV.S.W. dated 1920. 1:10560 scale	Geological Map	3
8	Late Quaternary Scour-Hollows and Related Features in Central London. F. G. Berry. Q. Jl Engng Geol. 1979 Vol 12 p9-29	Academic Paper	3
9	CampbellReith GIS Database	Database	3
10	Lost Rivers of London, NJ Barton	Reference Book	3
11	The London County Council Bomb Damage Maps 1939-1945 London Topographical Society 2005.	Reference Book	3

* Note numbering continues from Table 1.1

LIMITATIONS

Environmental & Geotechnical Interpretative Reports

1. This report provides available factual data for the site obtained only from the sources described in the text and related to the site on the basis of the location information provided by the client.
2. Where any data or information supplied by the client or other external source, including that from previous studies, has been used, it has been assumed that the information is correct. No responsibility can be accepted by CampbellReith for inaccuracies within this data or information. In relation to historic maps the accuracy of maps cannot be guaranteed and it should be recognized that different conditions on site may have existed between and subsequent to the various map surveys.
3. This report is limited to those aspects of historical land use and enquiries related to environmental matters reported on and no liability is accepted for any other aspects. The opinions expressed cannot be absolute due to the limit of time and resources implicit within the agreed brief and the possibility of unrecorded previous uses of the site and adjacent land.
4. The material encountered and samples obtained during on-site investigations represent only a small proportion of the materials present on the site. There may be other conditions prevailing at the site which have not been revealed and which have therefore not been taken into account in this report. These risks can be minimised and reduced by additional investigations. If significant variations become evident, additional specialist advice should be sought to assess the implications of these few findings.
5. The generalised soil conditions described in the text are intended to convey trends in subsurface conditions. The boundaries between strata are approximate and have been developed on interpretations of the exploration locations and samples collected.
6. Water level and gas readings have been taken at times and under conditions stated on the exploration logs. It must be noted that fluctuations in the level of groundwater or gas may occur due to a variety of factors which may differ from those prevailing at the time the measurements were taken.
7. Please note that CampbellReith cannot accept any liability for observations or opinions expressed regarding the absence or presence of asbestos or on any product or waste that may contain asbestos. We recommend that an asbestos specialist, with appropriate professional indemnity insurance, is employed directly by the client in every case where asbestos may be present on the site or within the buildings or installations. Any comments made in this report with respect to asbestos, or asbestos containing materials, are only included to assist the client with the initial appraisal of the project and should not be relied upon in any way.
8. The findings and opinions expressed are relevant to those dates of the reported site work and should not be relied upon to represent conditions at substantially later dates.
9. This report is produced solely for the benefit of the client, and no liability is accepted for any reliance placed upon it by any other party unless specifically agreed in writing.

APPENDIX A: SITE LOCATION AND DEVELOPMENT PROPOSALS

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