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St Giles Circus
4 Flitcroft Street

BASEMENT IMPACT ASSESSMENT

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3rd December 2012

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CONTENTS

Revision History

Rev	Date	Purpose/Status	Document Ref.	Comments
00	03/12/12	Information	029-S-REP-007	For Planning

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1 INTRODUCTION

1.1 Objective

This Basement Impact Assessment (BIA) has been produced in response to the guidance for basement construction adopted by the London Borough of Camden (LBC) to support the Planning submission for St Giles Circus and deals with the proposed basement south of Denmark Street that extends between No. 4 Flitcroft Street and No. 1 Book Mews. A separate BIA (report number 029-S-REP-006) has been prepared for the proposed basement North of Denmark Street that is bounded by Charing Cross Road, Andrew Borde Street, St Giles High Street and Denmark Street, see figure 1.1.

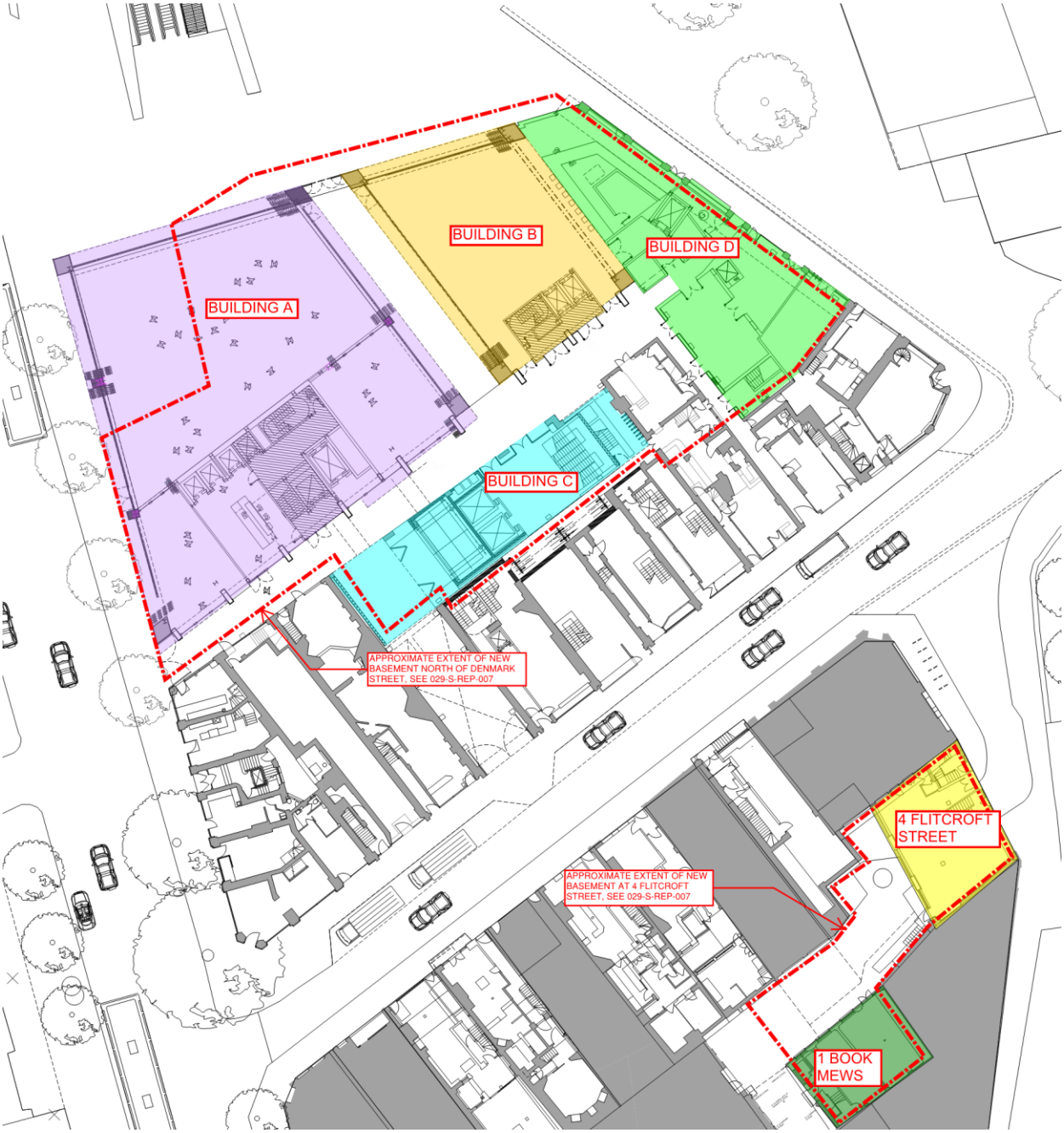

Figure 1.1 Site plan showing new basements.

The information contained within this BIA has been produced to cover the information required within a BIA as set out by Camden Planning Guidance - Basements and Lightwells (CPG4) including Camden Development Policies DP27 – Basements and Lightwells, in respect of the subterranean development proposal.

The purpose of this BIA document is to outline the key points for the method of safe excavation and construction of the proposed basement between No. 4 Flitcroft Street and No. 1 Book Mews on the south side of Denmark Street. It also sets out how the neighboring buildings will be protected as well as local environment and amenity.

The topics covered within the appendices are extracts from relevant maps, Camden CPG4 Appendix with notes and relevant drawings for the scheme. The successful main contractor will liaise with London Borough of Camden and the local residents to ensure that the principles outlined are established in detail prior to the commencement of construction.

For further information on the civil and structural design of the basement and how it fits into the whole development please refer to the Civil and Structural Engineering Concept Design Report (report number 029-S-REP-002).

1.2 Proposed Works – 4 Flitcroft Street

The client is proposing to construct a single level basement covering the footprint of the existing 4 Flitcroft Street building, the courtyard to the south west of 4 Flitcroft Street and the existing 1 Book Mews building. The works will involve increasing the depth of the existing 4 Flitcroft Street basement and forming a new basement in the rest of the site. The site lies just to the north of the planned westbound Crossrail running tunnel, as a result a separate Conceptual Design Statement (CDS) has been prepared for and reviewed by Crossrail which assess the impact of the proposed scheme on the planned Crossrail structure (see report number 029-S-REP-001). As a result this BIA does not repeat the detail on the interaction between the proposed scheme and the Crossrail structure.

The basement consists of an approximately 5m deep excavation below existing ground level, which reduces in depth as the existing ground level falls from east to west. The basement will be formed by means of traditional underpinning of existing foundations where the footprint of the basement aligns with existing walls and by piled retaining walls along the edge of the basement that crosses the yard.

2 SCREENING

The following screening stage was reviewed to see the effect of the basement on the surrounding area. The following Figures 1, 2 and 3 outline the results of the screening stage within this BIA report and reference them to supporting information in the Appendices.

Figure 1-Subterranean (ground water) screening chart

Q 1a: Is the site located directly above an aquifer?	Yes	The site sits on the Lynch Hill Gravel Formation, classified as Secondary A Aquifer. See Appendix A, B
Q 1b: Will the proposed basement extend beneath the water table surface?	Yes	Groundwater monitoring showed levels between 3.7m and 4.4m below ground level (20.4mAOD and 20.1mAOD respectively). See Appendix C, G
Q 2: Is the site within 100m of a watercourse, well (used/disused) or potential spring line?	No	See Appendix A, B
Q 3: Is the site within the catchment of the pond Chains on Hampstead Heath?	No	See Appendix B
Q 4: Will the proposed basement development result in a change in the proportion of hard surfaced/paved areas?	No	Refer to Flood Risk Assessment
Q 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	Refer to Flood Risk Assessment
Q6: 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 ponds chains on Hampstead Heath) or spring line.	No	See Appendix B

Figure 2 - Slope stability screening chart

Q 1: Does the existing site include slopes, natural or manmade, greater than 7°? (approximately 1 in 8)	No	See Appendix A
Q 2: Will the proposed re-profiling of landscaping at site change slopes at the property boundary to more than 7° ? (approximately 1 in 8)	No	See Appendix C
Q 3: Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7° ? (approximately 1 in 8)	No	See Appendix A
Q 4: Is the site within a wider hillside setting in which the general slope is greater than 7° ? (approximately 1 in 8)	No	See Appendix A, B
Q 5: Is the London Clay the shallowest strata at the site?	No	See Appendix A
Q 6: Will any tree/s be felled as part of the proposed development and/or are any works proposed within any	No	No tree will be felled as part of the proposed

tree zones where trees are to be retained?		basement development. See Appendix C
Q 7: Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site?	No	There is no evidence of heave related movement in the existing buildings See Appendix D, G
Q 8: Is the site within 100m of a watercourse or a potential spring line?	No	See Appendix A
Q 9: Is the site within an area of previously worked ground?	Yes	Due to historical developments in the area, made ground is present at the site and extends below existing foundation level. See Appendix G
Q 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?	Yes	See Appendix A, B, C, G
Q 11: Is the site within 50m of the Hampstead Heath ponds?	No	See Appendix A, B
Q 12: Is the site within 5m of a highway or pedestrian right of way?	Yes	See Appendix A, C
Q 13: Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	Yes	See Appendix C, E
Q 14: Is the site over (or within the exclusion zone of) any tunnels e.g. railway lines?	No	See Appendix A. Also refer to CDS.

Figure 3 - Surface flow and flooding screening chart

Q 1: Is the site within the catchment of the ponds on Hampstead Heath	No	See Appendix B
Q 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	See Appendix C and Flood Risk Assessment
Q 3: Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	No	The entire basement footprint is currently occupied by existing buildings and existing paved areas. See Appendix C
Q 4: Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface water being received by adjacent properties or downstream watercourses?	No	See Appendix C
Q 5: Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	No	See Appendix C
Q 6: Is the site in an area known to be at risk from Surface water flooding, such as South Hampstead, West	No	See Appendix B

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?		

3 INTERPRETATIVE REPORT

3.1 Site Investigation

A site investigation has been carried out at the site by GEA on behalf of Consolidated Developments Ltd (see figure 3.1). The works were carried out during the period between 5th October and 8th November 2012.

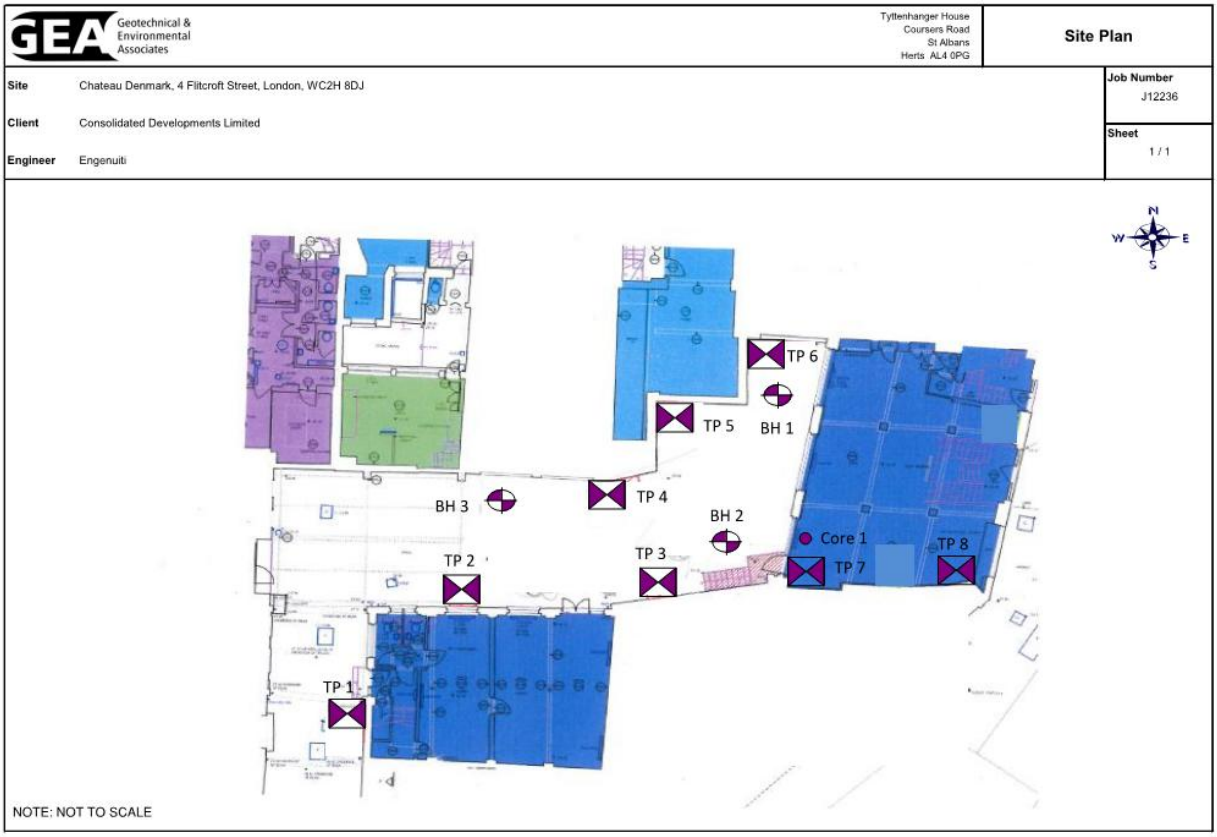

Fig 3.1 GEA Site Investigation Scope

The investigation included the sinking of three cable percussive boreholes (BH) to a depth of 6mbgl with standard penetration tests (SPT) undertaken at regular interval to assess the strength of the soils. Groundwater monitoring standpipes were installed in each borehole and monitored over the period of the investigation. Soil samples were taken from the boreholes and laboratory tested to confirm the classification of the soils.

Trial pits were hand dug in eight locations around the perimeter of the proposed basement to identify the existing foundations of the walls around the basement footprint.

Full details of the Ground Investigation are presented within the GEA Factual Ground Investigation Report, Chateau Denmark, 4 Flitcroft Street (GEA, November 2012), included in Appendix G.

3.2 Stratigraphy

The investigation revealed the following strata:

Table 3.1 Design Stratum Levels

Stratum	Top Of Stratum Level	Thickness (m)	Description
	mAOD		
Made Ground	+24.4 to +24.1	2.7 to 4.5	Greyish brown sandy clay, fragments of brick, clinker, ash, pottery, wood and chalk.
Lynch Hill Gravel Member	+21.7 to +19.6	0.3 to 3.1	Dense to very dense gravelly sand, sandy gravel and sand and gravel, occasional sandy silt.
London Clay	+19.3 to +18.6	Not proven	Variably soft to stiff, fissured silty clay.

3.3 Groundwater

Groundwater was encountered in all three boreholes with an initial strike at between 3.9m and 4.8m below ground in the Lynch Hill Gravel member, or in the case of BH3 in the Made Ground. Groundwater monitoring took place between October and November 2012 with a maximum recorded level of 20.4mAOD in borehole BH3 on the 8th November. The groundwater is perched above the London Clay.

Boreholes BH2 and BH1 recorded the groundwater in the Lynch Hill Gravels and indicate a slight fall in groundwater level from the site north of Denmark Street (groundwater +20.4mAOD) to the max level of +20.2mAOD recorded in the Lynch Hill Gravels. This is consistent with a slight groundwater flow from north to south.

The site investigation on nearby Denmark Place (see report number 029-S-REP-006) demonstrated with piezometric monitoring that the London Clay is under drained, it is likely that the London Clay at 4 Flitcroft Street is also under drained.

3.4 Geotechnical parameters

The recommended soil parameters used in the design are as follows:

Soil Parameter	Made Ground	Lynch Hill Gravel Member	London Clay
Undrained strength	NA	NA	s_u=100kPa
Drained strength	Φ'=28° c'=0	Φ'=36° c'=0	Φ'=24° c'=0
Stiffness (MPa)	E=10 Mpa	E=60 MPa	E_u=80MPa (total stress)
At rest earth pressure	k_o=0.53	k_o=0.41	k_o=1.5
Unit weight (kN/m^3)	γ=18.0	γ=20.0	γ=20.0
Poisson's Ratio	0.2	0.2	0.5 undrained 0.2 drained

These values are consistent with the nearby STATS geotechnical investigation (see report number 029-S-REP-006) and have been verified against the GEA investigation by reviewing the soil description and the SPT test results in the Factual Report.

3.5 Earthworks and drainage

The proposed basement involves significant excavation to a maximum depth of 4.5m over the footprint of 4 Flitcroft Street, 1 Book Mews and the existing yard that links the two. The formation level of the basement slab will be at approximately 19.9mAOD and will therefore be founded in the Lynch Hill Gravels, although in some areas the Made Ground may extend below this level.

The removal of this amount of overburden has the potential to cause heave as the London Clay swells over a period of time, however as the basement is founded in the Lynch Hill Gravels the basement slab is also required to resist water pressure which is taken at 1.0m below ground level to allow for the accidental discharge of a water main. As a result tension piles are required in the areas of basement where there is insufficient self weight of the structure above to resist the water pressure. These tension piles and the relatively small footprint of the basement will reduce the heave resulting from the basement excavation.

The excavation will generate a volume of material to be removed from the site. Access to and from the site will be predominantly from in front of 4 Flitcroft Street where the existing half basement provides access onto the street. A more detailed assessment of the construction traffic generated and routes to and from the site is included in the Construction Management Plan prepared by Mace.

In order to maintain slope stability during the excavation a system of underpinned retaining walls is proposed around the perimeter of the basement. In order to minimise ground movement the underpins will be constructed in a series of 'hit and miss' panels no more than 1.2m long. As the underpins will be largely in Made Ground or the Lynch Hill Gravels it is recommended that a bulk excavation to just above the existing foundations takes place prior to the underpinning. Temporary support and propping will have to be adopted during underpinning construction to insure ground stability and prevent excessive undermining of existing foundations. It is recommended that the underpinning operation is done in two stages to limit the maximum depth of the underpin to 1.5m. As the second stage of underpinning will be partly below the existing groundwater level permeation grouting will be undertaken prior to the second stage underpinning to form a cut off to the London Clay.

In order to maintain stability in the temporary case propping will be required to the underpinned retaining walls to resist the earth and water pressures behind the underpins. This will either be propped to the wall opposite or use raking props to the piled foundations in the centre of the basement.

Bulk excavations within the retaining wall will use battered slopes to maintain slope stability in the temporary case.

An assessment of the predicted ground movements as a result of the basement excavation is presented in Appendix F.

The perched groundwater on the site will be temporarily cut off from the surrounding aquifer by the permeation grouting required to construct the underpins below the water table. It is envisaged that the groundwater trapped within the excavation will be dewatered by local sump and pump just ahead of the excavation and removed via tanker to a controlled waste facility. In the permanent condition the retaining wall will be lined with an in situ reinforced concrete wall that is designed to resist the water pressure and will either be designed as a water resisting concrete structure with sufficient reinforcement to limit crack widths to less than 0.2mm, or will be provided with an additive to make the concrete water resisting. A drained and ventilated cavity will be provided inside this liner wall to deal with water vapour.

The new basement between 4 Flitcroft Street and 1 Book Mews will require the existing drainage from the rear of 4 Flitcroft Street and other downpipes that drain towards the basement footprint to be diverted above ground level. As it is possible that other properties that back onto the yard have below ground drainage that drains towards the yard it is recommended that a CCTV survey of the drainage in the yard is undertaken to identify any other existing connections that will require diversion as part of the works.

The surface water connections for the existing buildings on the site will be maintained wherever possible with all connections on Denmark Street and the connection to the front of 4 Flitcroft Street continuing in use. Where existing drainage into the yard is diverted as a result of the basement construction it will pass through an attenuation system prior to discharge. This attenuation system also serves the new roof and hard landscaping in the yard.

The total run off from the South of Denmark Street site(including retained buildings) in response to a rainfall event with an annual probability of 1% will be 13.5 litres per second. This compares with 15.4 litres per second pre-development.

The attenuation tank will be located in the yard to the west on the new basement and will have an outfall into the combined sewer in front of 10 to 12 Flitcroft Street. Given the invert levels of the existing sewer it is proposed to gravity drain from the attenuation tank to the combined sewer.

The foul water connections for the existing buildings that are retained on the site will be maintained wherever possible with all connections on Denmark Street and the connection at the front of 4 Flitcroft Street continuing in use.

Surveys will be required to confirm if any of the properties around the yard have foul water that drains into the yard which will require diversion before basement construction. The new basement incorporates kitchens and toilets at a level below the invert level of the existing combined sewer. A foul water sump and pumping chamber is provided in the basement plant room to provide in excess of 24 hours storage capacity. A rising main is provided from the foul water pumping chamber to a connection to the existing manhole in the alley between 10 and 12 Flitcroft Street which connects into the combined sewer on Flitcroft Street.

3.6 Retaining Wall Design

The retaining wall is required to resist surcharge loads, earth and water pressures generated by the basement excavation in both the temporary and permanent conditions. As noted above a system of temporary props is envisaged during the construction phase to reduce the vertical span of the retaining wall and therefore reduce the deflection of the retaining wall and associated horizontal and vertical movements of the surrounding ground.

As noted above, around the majority of the perimeter the retaining wall will consist of concrete underpinning to the existing party walls, however on the west side of the basement where the retaining wall crosses the yard a new embedded secant piled wall with interlocking piles and a capping beam will be constructed.

In the permanent condition the retaining walls will be propped by the basement slab and the ground floor which will transfer the horizontal pressures across the basement footprint to the balancing horizontal pressures opposite. The varying depth of retained ground around the basement footprint due to the existing basements on the other side of the retaining wall will result in some out of balance earth pressures, however these are relatively small compared to the passive resistance of the retained

soil below the existing footing levels. In order to ensure that water pressure is resisted and the existing masonry and concrete footings above the underpins are restrained an in situ concrete liner wall is provided to the basement.

The toe of the underpins is connected to the basement slab to provide a robust structure and spread the long term vertical loads over a larger footprint.

An analysis of the predicted movements and potential damage to the surrounding buildings is included in Appendix G.

In order to accommodate a rise in groundwater level or the accidental discharge of a large water main the retaining wall is designed to resist a water pressure 1.0m below existing ground level. The provision of the drained cavity inside the retaining wall will enable the basement to achieve grade 3 in accordance with BS8102:2009.

The 2:1 water/soil extract laboratory testing from the GEA investigation indicates that the soil samples have a sulfate level of up to 1.0g/l, which would normally require a design sulphate class of DS-1, however in order to maintain a consistency across the development a design sulphate class of DS-2 is proposed as this is required for the basement north of Denmark Street.

4 ISSUES BROUGHT FORWARD FOR SCREENING AND FURTHER STUDY

Subterranean (ground water) screening chart

Q1: The site is located on the Lynch Hill Gravel Formation which is designated by the Environment Agency as a 'secondary A' aquifer. The topography of the site is such that the land falls very slightly from North to South. The limited groundwater information from the Site Investigation appears to show a fall on the base of the aquifer from west towards east (0.7m difference between BH3 and BH2/1), however it would be reasonable to assume that the ground water within it would be draining southwards towards the River Thames.

Q1a
Possible Impact: The construction of a basement across the flow of ground water could modify/divert the ground water flow around the basement leading to increased ground water levels immediately upstream of the development and reduced ground water levels immediately downstream of the development.
Site Conditions: The level of the existing basement at 4 Flitcroft Street is 23.3mAOD. Street level is approximately 24.5mAOD. The proposed basement will extend to a level of approximately 20.6mAOD (top of basement slab level). Data from a recent Site Investigation at the nearby St Giles Circus site indicates perched water table level at 20.4mAOD. Ground water monitoring undertaken as part of the Site Investigation showed groundwater levels of 20.4mAOD to 20.1mAOD.
Impact Assessment: Immediately to the north of the proposed basement are a series of terraced buildings along the south side of Denmark Street. Some of these buildings have single level basements, extending to a minimum level of approximately 22mAOD. Due to the difference in level (at least 1.6m) between perched groundwater table and existing basement and considering the relatively limited extent of the proposed basement footprint in relation to the global groundwater seepage regime in the area, it is considered unlikely that a significant increase in perched water table level would occur to the north of the basement and therefore is unlikely to pose flooding problems to the existing basements.
A groundwater level increase in the Denmark Street area is also considered unlikely in view of the presence, at a minimum distance of approximately 50m to the north of the development (upstream), of the proposed St Giles Circus basement (considered in a separate Basement Impact Assessment, part of this same planning application), Centre Point and Tottenham Court Road tube station redevelopment (including enlargement of existing station and extensive Crossrail infrastructure construction). All these existing developments have subground structures which are most likely to extend into the Lynch Hill gravels (which are 3.5m to 6m below ground level) and would lower the groundwater level in the Denmark Street area.
In addition, it is worth noting that the perched groundwater table level is broadly consistent with the brick sewer invert level in proximity of the site. There is a possibility that the sewer may be acting as a drain and keeping the groundwater at its current level. If this is the case, the sewer would prevent any potential rise is groundwater table, providing an additional level of reassurance against the risk of existing basement flooding.

Q1b
Possible Impact: If the new basement extends below the water table surface, water seepage into the basement could cause flooding.
Site Conditions: The GEA Site Investigation proved the perched water table to be at 20.4mAOD to 20.1mAOD, demonstrating that the Lynch Hill Gravel Member contains a perched water table above the London Clay. The existing basement is dry and has no record of ground water flooding.
Impact Assessment: A water-resisting reinforced concrete basement slab and liner wall will be cast inside the underpinning/retaining wall system to prevent any significant water ingress into the basement. Finally a drained cavity system inside this concrete liner will drain to a sump to collect any residual ground water seepage. The sump will be provided with duty and standby pumps.

Slope stability screening chart

Q9: The site is within an area of previously worked ground. Made ground is present at the site, due historical developments in the area.
Possible Impact: Previously worked ground may be less homogeneous than natural strata, and may include relatively uncontrolled backfill zones. The presence of made ground increases the risk of slope

instability during excavation due to variable ground conditions. Previous uses of the site also increase the risk of contamination being present on the site and being disturbed by the excavation. The risk of potential contamination is dealt with separately in the EIA.
Site Conditions: The GEA Site Investigation found made ground reaching significant depths (between 2.2m and 4.5m below ground level), in areas extending below the level of the existing foundations.
Impact Assessment: Potential slope instability that could be triggered by basement excavation will be mitigated by means of staged construction and adoption of appropriate temporary earth support such as trench sheeting and props. An initial lowering of the ground level in the courtyard will be followed by localised excavation for underpinning construction (the first stage of underpinning will be above the water table). This will be carried out in phases, undermining a limited width of foundation (max 1.2m) at each time. In addition trench sheeting and props will be used to prevent the occurrence of local collapse mechanisms in the made ground and terrace gravel. A second and final stage of underpinning may extend to a level below the perched water table. Prior to this underpinning stage (reaching final formation level), permeation grouting will be carried out along the basement perimeter, in order to reduce the permeability of the made ground and river terrace gravel and therefore prevent groundwater ingress within the underpin zone and the development of potential instability mechanisms, allowing a safe excavation to take place. The appointed contractor shall submit a detailed method statement with an appropriate construction sequence to mitigate such risk for the engineer to review prior to any construction work taking place.

Q10: The site is founded on the Lynch Hill Gravel Formation which is designated by the Environment Agency (EA) as a 'secondary A' aquifer. The proposed basement may extend beneath the water table.
Possible Impact: The construction of any excavation in granular soil which extends below the water table would entail practical difficulties in terms of water inflowing into the excavation and potential washing of fines into the excavation from the surrounding strata, leading to potential instability of surrounding foundations. Dewatering can cause ground settlement, due to increase in effective stresses within the soil. The zone of settlement could extend beyond a site boundary and affect neighbouring structures.
Site Conditions: The highest monitored groundwater table measured as part of the GEA Site Investigation is 20.4mAOD. The underside of the proposed basement slab will be located at approximately 19.9mAOD and will therefore involve excavation below the water table.
Impact Assessment: Excavation for the construction of the proposed basement slab may require relatively minor dewatering (by means of a sump or equivalent system) which is unlikely to induce significant settlements of the neighbouring structures. In addition, low pressure permeation grouting will be carried out along the basement perimeter, following a first stage of underpinning, to prevent groundwater inflow into the excavation and allow a safe construction of the second and final stage of underpinning.

Q12: The site is within 5m of Flitcroft Street.
Possible Impact: Excavation for a basement may result in damage to the road, pathway or any underground services buried in trenches beneath the road or pathway.
Site Conditions: Excavation for the construction of the proposed basement will induce ground movements in its proximity. The magnitude and extent of ground movements is related to ground and groundwater conditions, means and methods, sequence and in general quality of the construction works.
Impact Assessment: Traditional underpinning will have to be constructed following a "hit and miss" sequence in order to minimize the induced foundation settlements. Temporary support and propping will have to be adopted during underpinning construction to insure ground stability and prevent excessive undermining of existing foundations. A preliminary building damage assessment exercise has been carried out on selected susceptible structures, please refer to Appendix F.

Q13: The proposed basement will increase the differential depth of foundations relative to neighbouring properties.
Possible Impact: Excavation for a basement may result in structural damage to neighbouring properties and services if there is a significant differential depth between adjacent foundations.
Site Conditions: Existing foundation levels of 1.2m to 2.5m below ground level have been found. The proposed works will involve increasing the existing foundation depth of approximately 2.0m to 2.7m (refer to table 1 below), as typical for basement extensions (refer to figure 16 of the Camden Geological, Hydrogeological and Hydrological Study authored by Arup).
Relatively large diameter brick sewers are present in proximity of the site, along Flitcroft Street and Denmark Street.

	ground level (mAOD)	underside of existing foundations (m bgl)	underside of proposed basement slab (mAOD)	foundation increased depth (m)
TP1	23.6	1.16	19.9	2.54
TP2	24	1.36	19.9	2.74
TP3	24.3	2.36	19.9	2.04
TP4	24.4	2.33	19.9	2.17
TP5	24.5	-	-	-
TP6	24.4	-	-	-
TP7	23.3	0.715	19.9	2.685
TP8	23.3	-	-	-

Table 1 – existing and proposed foundation levels

Impact Assessment: A preliminary building damage assessment exercise has been carried out in order to assess the likely impact of the proposed works on adjacent properties, as presented in Appendix F. "Moderate" damage (according to Burland 1995 damage classification) is predicted for a number of existing structures surrounding the proposed basement. "Severe" damage is predicted for a relatively minor structure in close proximity to the site northern boundary. The latter structure is owned by the client and will be subject to refurbishment as part of the construction works. Details of the building damage assessment carried out are presented in Appendix F.
Monitoring of existing façade displacements around the proposed basement perimeter will be implemented during the underpinning and basement construction works. Monitoring will be undertaken in a substantiated fashion by implementing an appropriate Action Plan for the project. The Action Plan will identify limiting criteria, trigger levels, data management and implementation of mitigation measures. Provision for underpin prestressing/jacking should be made between first and second stage of underpinning, to prevent excessive settlement and associated adverse impact on existing structures. A detailed action plan should be prepared, establishing prestressing procedures to be implemented as a function of measured deflections.
Sewer invert levels roughly coincide with the proposed basement formation level, therefore no significant impact of the basement construction on the sewers is envisaged.

5 SURVEYS

This report is based on site survey, search of current and historic ordnance survey maps and geological maps of the area and an intrusive site investigation, as presented in the Appendices.

6 SITE HOARDINGS AND SECURITY

It is intended that the perimeter of the site will be protected by hoardings with a vehicular and pedestrian gate which will be secured at night. All necessary permits will be obtained by the main contractor prior to start of relevant works.

The hoarding will be positioned wholly within the site boundary and will not adversely affect the highway, associated pavements or boundary walls and will act to reduce noise emanating from the site during the works.

Safety signage will be installed on the hoarding as necessary at points of access to the site and around the boundary. In additional the hoarding will also have Considerate Constructors Scheme Signs (which the contractor will be required to register with), details of the developer and consultants and contact numbers for the site manager.

7 HEALTH, SAFETY AND ENVIRONMENT

Health, Safety and Environment is an integral part of the planning process for each project. Implementation of a comprehensive Health, Safety and Environmental System and Procedures ensures every facet of the construction process is planned, managed and monitored. This also ensures compliance with statutory obligations.

Noisy working hours will be agreed with London Borough of Camden but typically will be between the hours of 8am and 6pm Monday to Friday and 8am to 1pm on Saturday.

8 CONSTRUCTION METHODOLOGY

8.1 Pre-Construction

During the preconstruction phase of the project the contractor will undertake a full review of the scheme and all background information.

The contractor will follow Camden's Considerate Contractors Manual this will involve incorporating the Guide for Contractors Works in Camden within the Construction Management Plan.

8.2 Logistics

As will all construction projects, the efficient and effective management of the site logistics is paramount to the success of the project. The logistical challenges posed by the construction of the structure call for a robust and carefully considered management plan to ensure the programme is met and that disruption to the neighbours and transport routes are kept to a minimum. Reference should be made to the Construction Management Plan prepared by Mace for further information on the proposed logistics and traffic management associated with the basement construction.

8.3 Neighbourhood Liaison

During the project the contractor will ensure that all works are carried out safely and in such a manner that it will not inconvenience pedestrians or other road users and with a positive consideration of the needs of the local residents, site personnel and visitors as well as the general public. If necessary airborne dust will be dealt with by dampening down areas with water prior to the works being undertaken.

Public footways and carriageways will be kept tidy, in safe condition and regularly inspected and washed down. Hoardings, safety barriers, lights and other features will be maintained in a safe and tidy condition. The site is to be kept clean and in good order at all times with surplus materials and rubbish controlled within the site and not allowed to spill over into the surroundings.

In addition to this, working times as stipulated within the contract particulars will be complied with and contractor would look to discuss with London Borough of Camden these times as a proactive approach to control of noise emissions from the site.

9 BASEMENT WORKS

An important consideration for any basement construction involving underpinning of existing foundations is the control of ground movement and ground water during excavation to ensure that any effect on adjacent buildings and infrastructure is minimal and within acceptable limits.

Relevant geological and hydrological maps and data have been reviewed with respect to the site at 4 Flitcroft Street (see Appendices). These studies confirm that the existing buildings (4 Flitcroft Street and 1 Brook Mews) are founded into the Lynch Hill Gravel Formation, which is classified as a 'secondary A' aquifer by the Environment Agency.

The proposed scheme comprises a new basement covering the 4 Flitcroft Street building footprint (increasing the depth of the existing basement), the courtyard area and the 1 Brook Mews building footprint. The basement retaining structures will be constructed by means of traditional underpinning of the existing building foundations.

The underside of the new basement slab (19.9mAOD) is located just below the groundwater table (20.4mAOD to 20.1mAOD), identified by the Ground Investigation undertaken as part of this BIA process. Minor temporary dewatering will be required during the basement construction activities, as a grout cut-off extending to the London Clay will be formed along the basement perimeter prior to excavation below the water table, in order to prevent groundwater ingress in the excavation.

A key risk associated with the construction of the proposed basement is related to the potential occurrence of ground movements (settlement and horizontal movements) during the underpinning construction process. The method involves localised undermining of existing strip foundations and construction of mass concrete piers to transfer the building load to a deeper zone. The adoption of a carefully planned construction sequence (involving a "hit and miss" pattern of construction) together with high quality workmanship will mitigate the risks related to ground movements.

Calculations have been undertaken to confirm that the removal of existing overburden adjacent to one side of the existing footing will not adversely affect the load bearing capacity of the foundation. In addition, preliminary sizing of the foundations has been carried out, as presented in Appendix F.

Preliminary calculations have been undertaken to assess the impact of the works on a number of existing structures located in proximity of the site. The tensile strains and associated crack widths induced by the proposed works on various sensitive elements (brittle masonry walls, subject to cracking induced by ground movements) have been evaluated and the potential damage assessed in line with the Burland (1995) damage classification procedure, widely adopted within the industry and recommended by the CPG4 document. The predicted levels of damage to the elements considered fall in the Moderate category, for existing buildings on the Denmark Street and Flitcroft Street sides of the proposed development. This is considered acceptable in line with the CPG4 recommendations.

No trees are to be removed as part of the development.

Prior to commencement a full schedule of condition will be carried out to all relevant buildings as defined within The Party Wall etc Act 1996.

10 CONCLUSIONS

A design analysis has been undertaken of the various aspects of construction and how these may affect the local amenity and neighbouring properties with regard temporary and permanent stability and the ground and surface water regime.

A review of maps, historic information and associated studies coupled with site inspections and intrusive site investigations have demonstrated that the development will not have an adverse effect on the local ground and surface water regime and will have an acceptable level of impact on neighbouring existing properties.

An assessment of movements caused by the basement excavation and underpinning construction has been undertaken for five typical existing structures located in proximity of the proposed basement. The study shows that all walls will experience moderate level of damage, with the exception of a relatively minor structure located in close proximity to the site northern boundary. The latter structure is owned by the client and will be subject to refurbishment as part of the construction works.

The risk of perched groundwater table rise in the area upstream on the north side of the basement (and associated potential issues related to existing basement flooding) is considered low in view of the following considerations:

- There is a relatively large difference in level between perched groundwater table and existing basements along Denmark Street.
- A number of significant substructures in the zone north of Denmark Street, including the proposed St Giles Circus basement, Centre Point and Tottenham Court Road tube station redevelopment (including enlargement of existing station and extensive Crossrail infrastructure construction) would lower the groundwater level in the Denmark Street area.
- Relatively large diameter brick sewers are present around the site, with invert levels roughly consistent with the perched groundwater table level, which may be acting as a drain would therefore prevent any potential rise is groundwater table.