ORIEL

Design File Note

PROJECT NAME
ORIEL

ORIGINATOR	ORIGINATOR LOGO
TERRELL LIMITED	TERRELL

TITLE

BASEMENT IMPACT ASSESSMENT

STAGE(s) (RIBA/BSRIA):	**RIBA 4**	SUITABILITY CODE:	S2 – Suitable for Information

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PROJECT	ORIGINATOR	FUNCTIONAL BREAKDOWN	SPATIAL BREAKDOWN	FORM	DISCIPLINE	SEQUENCE NUMBER	REVISION

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BASEMENT IMPACT ASSESSMENT

ORIEL HOSPITAL
ST PANCRAS WAY / GRANARY STREET
LONDON, NW1 0PE

Ref:	MES/2303/TER227
Rev:	01
Date:	March 2023
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1.0 Non-Technical Summary

At the request of Terrell Ltd, on behalf of Bouygues UK, a Basement Impact Assessment (BIA) has been carried out at Oriel Hospital, St Pancras Way / Granary Street, London, NW1 0PE (the site) in support of an amendment to a planning application for a proposed hospital development including a basement. A previous BIA (Basement Impact Assessment, October 2020, AECOM) has been submitted and accepted by the London Borough of Camden (LBC) and their BIA Auditor Campbell Reith (Basement Impact Assessment (ref CBemb13398-65-260521-St Pancras Hospital-F1), May 2021, Campbell Reith).

This updated BIA relies upon previously agreed assessments where relevant, with updated assessments presented where required to reflect the revised development proposals. The relevant amendment to the design from that assessed in the previous BIA is a slight increase in basement area (an additional 267m^2, from an enlargement to the eastern and southern boundary) and increase in depth (by 2m, resulting 94m^3 of additional excavation).

The assessments have been undertaken by appropriately qualified professionals, including a Chartered Hydrogeologist (CGeol FGS) and Chartered Civil Engineer (CEng MICE).

The site is underlain by the London Clay Formation and Lambeth Group, suitable bearing strata for the proposed development's foundations, confirmed by the site investigation.

The London Clay has potential to shrink and swell with moisture variation, which may cause movement and damage to structures bearing upon it. The risk of movement and damage to this development due to moisture variation is negligible, considering the proposed depth of the basement, the suspended slabs and piled foundations.

The London Clay is designated Unproductive Strata. There is a very low risk of groundwater flooding and there will be no impact to the wider hydrogeological environment.

The site and the adjacent properties have not been impacted by flooding. There is no change to the impermeable site area as a result of the development. The SuDS proposals are to attenuate surface water discharge flow off-site, in accordance with best practice. There is a very low risk of flooding to the proposed development and the development will not impact on the wider hydrological environment.

There will be no impact to slopes due to the proposed development. The site is not situated in a wider hillside environment of slopes of 7° or more.

Ground movements caused by the excavation and construction of the proposed development will be minimal. Damage impact to adjacent structures is assessed to be a maximum of Very Slight (Category 1 in accordance with the Burland Scale) with impact to the highway and underlying utilities assessed to be negligible. Asset protection criteria will be agreed with LB Camden (Highways) and relevant utility asset owners (e.g Thames Water). Structural movement monitoring is proposed and mitigation actions will be implemented if movement trends indicate structural tolerances could be exceeded.

The BIA demonstrates that the proposed development will not cause adverse impacts relating to land stability, groundwater and surface water flow, and is at very low risk of flooding.

A Basement Construction Plan (BCP) will be submitted to demonstrate that the strategies and assessment conclusions presented in the BIA will be implemented.

2.0 Introduction

At the request of Terrell Ltd, on behalf of Bouygues UK, a Basement Impact Assessment (BIA) has been carried out at Oriel Hospital, St Pancras Way / Granary Street, London, NW1 0PE (the site) in support of an amendment to a planning application for a proposed hospital development including a basement.

A previous BIA (Basement Impact Assessment, October 2020, AECOM) has been submitted and accepted by the London Borough of Camden (LBC) and their BIA Auditor Campbell Reith (Basement Impact Assessment (ref CBemb13398-65-260521-St Pancras Hospital-F1), May 2021, Campbell Reith). This updated BIA relies upon previously agreed assessments where relevant, with updated assessments presented where required to reflect the revised development proposals.

The updated BIA relies upon the Desk Study, Flood Risk Assessment and Site Investigation as previously submitted. The Site Investigation and interpretative geotechnical information has subsequently been validated by CampbellReith (as reference documents, section 2.3), which has been reviewed and considered within this BIA.

The updated BIA includes:

- Screening and Scoping – reviewed and updated as required;
- a Ground Movement Assessment (GMA);
- a Drainage Strategy;
- and a Basement Impact Assessment (BIA).

The majority of the proposed development will have a formation level of 19.00mOD, requiring minimal reprofiling of the site along the western boundary, and retaining walls along parts of the northern, southern and eastern boundaries of 1.50m to 4.00m retained height. A basement is proposed in the northeast corner, requiring retaining walls of up to 7.80m height.

2.1 Purpose and Methodology of Assessment

The purpose of this assessment is to consider the impacts of the proposed basement on the local hydrological, geological and hydrogeological environments, including potential impacts on neighbouring properties and the wider area.

The information contained within this BIA has been produced specifically to meet the requirements set out by Camden Planning Guidance - Basements (CPG, January 2021) and the Local Plan 2017: Policy A5 Basements. The development has been granted Planning Permission and this document is provided for reference in relation to the amendments from the original scheme, which (in regards to the proposed basement) are minimal.

The BIA approach follows current planning procedure for basements and lightwells adopted by LB Camden and comprises the following elements:

- Desk Study;
- Screening;
- Scoping;
- Site Investigation and additional assessments identified during Scoping;
- Impact Assessment.

2.2 Authors

The assessment has been reviewed and approved by Chartered Civil Engineer Corrado Candian, MEng CEng MICE and Chartered Hydrogeologist Philip Lewis, BSc CGeol FGS, who both have more than 20 years' relevant experience of design and assessment of residential and commercial developments including basements.

The Supervising Engineer for the scheme is Terrell Ltd, specifically Daniel Conroy CEng MIStructE, who has reviewed the relevant geo-structural information and provided confirmation of the suitability and buildability of the scheme, within the guidelines provided by LB Camden, and in conjunction with the Basement Construction Plan (BCP), which will be submitted to demonstrate that the strategies and assessment conclusions presented in the BIA will be implemented.

2.3 Sources of Information

The following baseline data have been referenced to complete the BIA in relation to the proposed development:

- Phase 1 & 2 Interpretative Geo-Environmental Assessments, October 2020, AECOM;
- Factual Report of Ground Investigation (ref 35862), July 2021, Geotechnical Engineering;
- 13932-CRH-XX-XX-RP-GE-0002, GGIR Validation Report, February 2023, CampbellReith;
- Basement Impact Assessment, October 2020, AECOM;
- Basement Impact Assessment (ref CBemb13398-65-260521-St Pancras Hospital-F1.doc), May 2021, Campbell Reith;
- Thames Water Asset Location Search, September 2022;
- Structural Engineering Drawings, February 2023, Terrell;
- Bearing Pile and Retaining Wall Calculations, 2023, Keltbray;
- Ground Movement Assessment (ref MES/2212/TER222 Rev03), March 2023, Milvum Engineering Services;
- Flood Risk Assessment and Drainage Strategy, October 2020, AECOM;
- Project Oriel – Drainage Design Notes, 6 December 2022, AECOM;
- orl-ter-zz-lg-dpl-c-209912 sw drainage layout rev p03, Terrell;
- Basement Construction Plan (ref MES/2302/TER232 Rev02), March 2023, Milvum Engineering Services;
- Ordnance Survey Mapping;
- British Geological Survey, Geology of Britain Viewer (online);
- LB Camden, Planning Guidance: Basements, January 2021;
- LB Camden, The Local Plan 2017: Policy A5 Basements;
- LB Camden, Strategic Flood Risk Assessment (produced by URS), 2014;
- Barton, The Lost Rivers of London, 1992;
- LB Camden, Camden Geological, Hydrogeological and Hydrological Study - Guidance for Subterranean Development (produced by Arup), 2010;
- CIRIA, C760 Embedded retaining walls - Guidance for Economic Design, 2017;
- Tomlinson, M.J. (2001) Foundation Design and Construction.

2.2 Existing and Proposed Development

The site location and recent aerial photograph are presented in Figures 1 and 2. Proposed development plans are presented in full within the BCP. It is proposed to redevelop the site, which will involve demolition of the four existing 2 storey and two existing 1 storey buildings to construct a new hospital building of 7 and 10 storeys. The relevant amendment to the design

from that assessed in the previous BIA is a slight increase in basement area (an additional 267m^2, from an enlargement to the eastern and southern boundary) and increase in depth (by 2m, resulting 94m^3 of additional excavation), as indicated in Appendix 1.

The ground level rises from approximately 19.80mOD in the southwest of the site to 23.90mOD in the northeast of the site. The majority of the proposed development will have a formation level of 19.00mOD, requiring minimal reprofiling of the site along the western boundary, and retaining walls along parts of the northern, southern and eastern boundaries of 1.50m to 4.00m retained height. A basement is proposed in the northeast corner, requiring retaining walls of up to 7.80m height. Development construction sequence drawings are presented in the BCP.

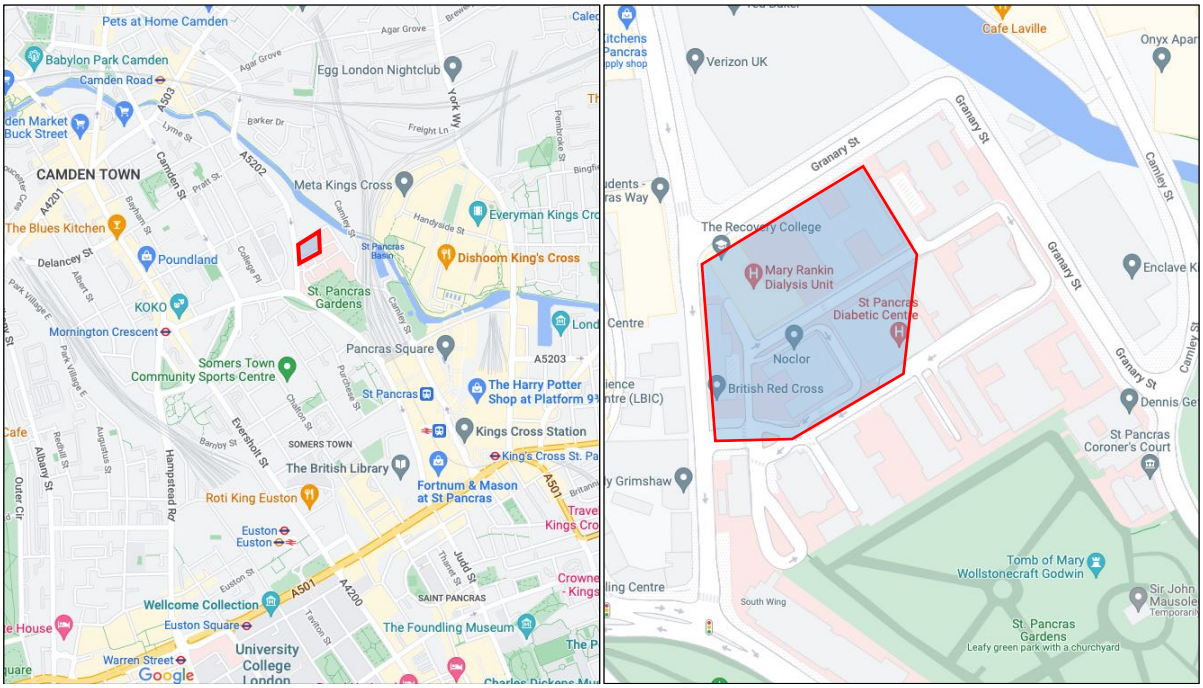


Figure 1: Site Location Plan


Figure 2: Aerial Photograph of the Application Site and Surrounding Area

3.0 Desk Study

The following sections summarise the findings of the BIA desk study undertaken by AECOM, with updated assessments presented where required to reflect the revised development proposals.

3.1 Site History

The historical mapping indicates the site was originally part of the St. Pancras Workhouse from at least 1875 with minor alterations to the building layout arising from 1895 through to 1920. Maps from the 1950s show that the site appears to have suffered bomb damage during the Second World War and was labelled as St. Pancras Hospital. Minor modifications continue from 1953, with the construction of tennis courts, new hospital buildings and an electricity substation. From 1987, no significant changes to the Site occur through to the present day with the exception of a few building alterations in 1999.

St Pancras Station, King's Cross Station and Euston Station have been present within 1km of the Site since the date of the earliest OS mapping, with minimal changes to track layouts compared to the present day situation, excluding the construction of the Channel Tunnel Rail Link within 500m of the Site as shown between 2006 and 2019 mapping. The surrounding land uses have been predominantly residential or industrial since the earliest OS mapping, due to the presence of the railways, including goods depots, warehouses, engine sheds and coal depots. On current mapping it is noted that significant parts of the historical industrial land use have become residential in use. Industrial land use appears to have declined on mapping since the 1960s. Other notable historical land uses include an ale store/granary adjacent north of the Site, a factory 170m northwest of the Site, a gas works 400m southeast of the Site, St Pancras Generating Station 300m northwest of the Site and a refuse treatment plant 400m northwest of the Site.

3.2 Geology

The British Geological Survey (BGS) map indicates that the site is underlain by the London Clay Formation (see Figure 3) which is underlain by the Harwich Formation (where present), Lambeth Group and the Thanet Formation. A general stratigraphy of the London Basin is presented in Table 1.

Made Ground would normally be expected above the naturally occurring strata related to the historic development on site. Where present, Made Ground is expected to exhibit a certain degree of heterogeneity and the nature of the material can be expected to vary substantially in both composition and thickness over short distances.

The London Clay Formation is typically a firm to stiff, high plasticity silty clay, becoming very stiff with depth. Where encountered near surface and in proximity to vegetation, consideration of desiccation and potential for shrink swell movements to impact shallow foundations is required.

Period	Series		Deposits	
Quaternary	Holocene		Made Ground	
			Alluvium	
	Pleistocene		Langley Silt (Brickearth)	
			River Terrace Deposits	
Palaeogene	Eocene	Thames Group	London Clay Formation	Sub-Divisions A - D
			Harwich Formation	Swanscombe Member
				Oldhaven Member
		Lambeth Group	Woolwich Formation	Upper Shelley Beds
			Reading Formation	Upper Mottled Beds
			Woolwich Formation	Laminated Beds
				Lower Shelley Beds
	Palaeocene		Reading Formation	Lower Mottled Beds
			Upnor Formation	
		Thanet Sand Formation	Thanet Sand	
			Bullhead Beds	
Cretaceous	White Chalk Sub-Group	Seaford Chalk Formation	Haven Brow Beds	
			Cuckmere Beds	
			Bell Tout Beds	

Table 1: General Stratigraphy of the London Basin

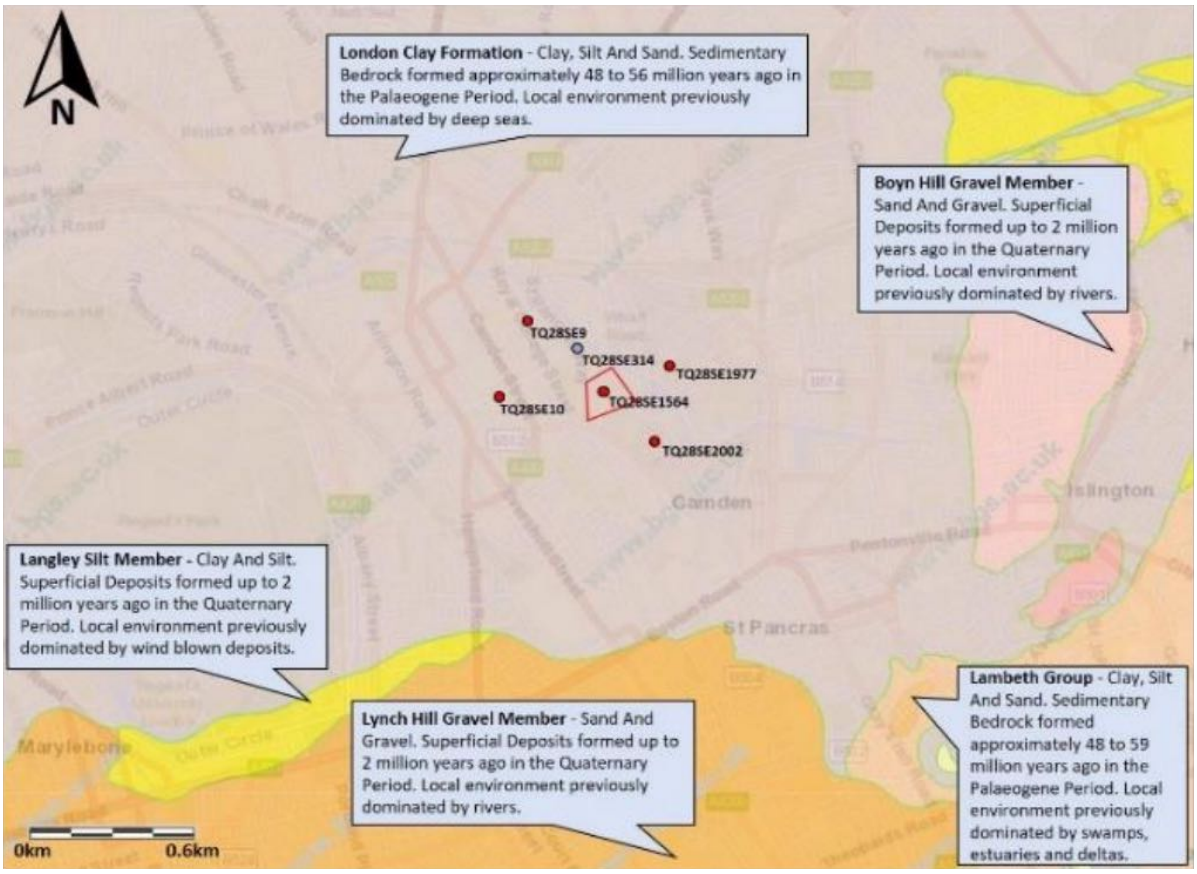


Figure 3: Geological Map of the Site Area (BGS Viewer)

3.3 Hydrogeology

The Environment Agency (EA) Groundwater Protection Policy uses aquifer designations that are consistent with the Water Framework Directive. These designations reflect the importance of aquifers in terms of groundwater as a resource (drinking water supply) and also their role in supporting surface water flows and wetland ecosystems:

- Principal Aquifers – layers that have a high permeability and are likely to support water supply and / or river base flow on a strategic scale.

- Secondary Aquifer (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.

- Unproductive Strata – predominantly impermeable or low permeability layers that have negligible significance for water supply or river base flow.

The aquifer designation beneath the site for the London Clay is Unproductive Strata. The London Clay is not considered likely to be vulnerable to pollutants or capable of supporting the migration of pollutants on or off site, due to its very low permeability.

The presence of a significant thickness of London Clay beneath the Site means that groundwater resources present in the deeper Principal Aquifer are perceived to be at no risk from activities carried out on the Site.

LB Camden data indicates the site is not within a groundwater source protection zone.

3.4 Hydrology

Barton's map of the 'lost' rivers of London indicates that the River Fleet is located in close proximity to the western boundary of the site. This is not considered to have an impact on the site or the adjacent properties as a result of constructing the proposed development.

The proposed building is approximately 95m west of Regent's Canal (man-made structure).

The site is not within the catchment of the Hampstead Heath Pond Chain. The nearest part of the catchment (Hampstead No. 1 Pond) is approximately 3.1km northwest of the site.

The Site is located in a heavily urbanised area and is currently occupied predominantly by existing buildings which form part of the St Pancras Hospital site, comprising the Bloomsbury Day Centre, Ash House, the Post Room, Jules Thorn Day Centre, The Camley Centre (Estates and Facilities Building) and the Kitchen Building. Surrounding the buildings are areas of hardstanding and roads, with small isolated landscaped areas.

The site is not within a Critical Drainage Area or within a Local Flood Risk Zone.

The site was not subject to surface water flooding in both the 1975 and 2002 flood events.

As stated in the Flood Risk Assessment and Drainage Strategy (October 2020, AECOM) the indicative flood maps for planning and the Envirocheck report flood risk maps show that the Site and the surrounding area are located in Flood Zone 1, indicative of a low probability of flooding.

The Site has also no potential for groundwater flooding to occur given the presence of a significant thickness of London Clay.

Parts of the Site, including the southwest area and the northern, western and southern Site boundaries are susceptible to a low to medium risk of flooding from surface water (pluvial flooding), within a 100 to 1,000-year return period. The remainder of the Site is not at risk of flooding from surface water.

There is no change in impermeable site area as a result of the proposed development. The site is considered to nearly 100% impermeable area (rooftops and hardstanding). Limited landscaped areas will be replaced on a like-for-like basis.

The Thames Region Catchment Flood Management Plan covers fluvial and non-tidal sections of the River Thames, i.e. the River Thames upstream of Teddington weir and tributaries of the River Thames (e.g. River Mole). The Proposed Development is within Sub-area 9, 'London catchments', here the preferred policy option is 'Policy option 4: Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change'. Climate change has been considered and accounted for within the FRA and Drainage Strategy.

3.5 Utilities and Underground Infrastructure

As reported in the previous BIA, there are no reported tunnels or utility infrastructure beneath the site. Future development should carefully consider the route of existing utility connections across the site.

3.6 Geotechnical Risk / Unexploded Ordnance Risk

As reported in the previous BIA, the potential risk from Unexploded Ordnance (UXO) should be considered as the piled foundations and basements are designed to be deeper than previous construction on the Site.

A detailed UXO Risk Assessment has been carried out by SafeLane Global. The current risk for UXO to be present on the Site is considered a medium risk which is typical for the central London area. Risk mitigation measures recommended in the risk assessment include:

- UXO awareness briefings for all groundworkers;
- Provision of unexploded ordnance site safety instructions;
- Explosive Ordnance Disposal (EOD) Engineer to be present on site during shallow intrusive works;
- Handheld intrusive magnetometer survey to be undertaken of all borehole locations down to the maximum bomb penetration depth; and
- Intrusive magnetometer survey of all borehole and pile locations.

It is understood that these standard procedures will be implemented prior to piling to mitigate the risk from UXO.

3.7 Preliminary Risk Assessment

The AECOM report (Phase 1 & 2 Interpretative Geo-Environmental Assessments, October 2020, AECOM) has made the following statements in regard to environmental sensitivity and risk:

- The site is considered to be of **low to moderate** environmental sensitivity.
- The potential **low** risks identified are associated with the use of the site as a hospital.
- The potential for the site to be designated as contaminated land (as defined in Part 2A of the Environmental Protection Act) is considered to be **low**. However, this is on the assumption that any planning conditions related to potential land contamination issues are dealt with to the satisfaction of the Local Authority as part of the development.

4.0 Screening

A screening process has been undertaken in accordance with the most recent guidance (CPG Basements, 2021) and the findings are described below.

4.1 Subterranean (Groundwater) Flow

Question	Response	Details
1a. Is the site located directly above an aquifer?	No	The site is located over the London Clay Formation, designated as Unproductive Strata.
1b. Will the proposed basement extend beneath the water table surface?	No	The London Clay Formation is classified as an Unproductive Strata. The presence of a significant thickness of London Clay beneath the Site means that groundwater resources present in the deeper Principal Aquifer are perceived to be at no risk from activities carried out on the Site.
2. Is the site within 100m of a watercourse, well (used / disused) or potential spring line?	Yes	The proposed building is approximately 95m west of Regent's Canal (man-made structure) and within 50m east of the historic River Fleet (which is culverted). There will be no impact to or from the culverted historic river, nor to the Regent's Canal.
3. Is the site within the catchment of the pond chains on Hampstead Heath?	No	Catchment of the pond chains are >3km to the northwest
4. Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?	No	
5. As part of site drainage, will more surface water (e.g. rainfall and run-off) than a present be discharged to the ground (e.g. via soakaways and/or SUDS)?	No	Attenuation SuDS proposed in accordance with best practice.
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 or spring line?	No	

4.2 Slope Stability

Question	Response	Details
1. Does the existing site include slopes, natural or man-made greater than 7° (approximately 1 in 8)?	No	
2. Will the proposed re-profiling of landscaping at the site change slopes at the property boundary to more than 7° (approximately 1 in 8)?	No	
3. Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7° (approximately 1 in 8)?	No	
4. Is the site within a wider hillside setting in which the general slope is greater than 7° (approximately1 in 8)?	No	
5. Is the London Clay the shallowest strata at the site?	Yes	The London Clay Formation is the shallowest natural strata. Made Ground is anticipated above the London Clay.
6. Will any trees be felled as part of the development and/or are any works proposed within any tree protection zones where trees are to be retained?	Yes	An Arboricultural Impact Assessment for the Proposed Development has been prepared by a suitably qualified arboriculturist and is submitted with the planning application.
7. Is there a history of seasonal shrink-swell subsidence in the local area and/or evidence of such effects at the site?	No	
8. Is the site within 100m of a watercourse or a potential spring line?	Yes	The proposed building is approximately 95m west of Regent's Canal (man-made structure) and within 50m east of the historic River Fleet (which is culverted). There will be no impact to or from the culverted historic river, nor to the Regent's Canal.
9. Is the site within an area of previously worked ground?	No	
10. Is the site within an aquifer? If so, will the proposed basement extend beneath the water table such that dewatering may be required during construction?	No	The London Clay Formation is classified as an Unproductive Strata. The presence of a significant thickness of London Clay beneath the Site means that groundwater resources present in the deeper Principal Aquifer are perceived to be at no risk from activities carried out on the Site.

11. Is the site within 5m of a highway or pedestrian right of way?	Yes	The Site is bordered by Granary Street to the north, St Pancras Way to the west and existing site access roads/paths to the east and south.
12. Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	Yes	As identified in the GMA.
13. Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?	No	

4.3 Surface Water and Flooding

Question	Response	Details
1. Is the site within the catchment of the pond chains on Hampstead Heath?	No	
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	However, attenuation SuDS will provide betterment in accordance with best practice.
3. Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	No	
4. Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface water being received by adjacent properties or downstream watercourses?	Yes	The surface water from the Proposed Development will be attenuated with flow restricted by 85% to limit the instantaneous surface water flows. The long-term inflows will remain unchanged.
5. Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	No	
6. Is the site in an area identified to have surface water flood risk according to either the Local Flood Risk Management Strategy or the Strategic Flood Risk Assessment or is it at risk from flooding, for example because the proposed basement is below the static water level of nearby surface water feature.	Yes	The Proposed Development is potentially at risk from local surface water flooding as the Site borders the King's Cross local Flood Risk Zone.

4.4 Non-Technical Summary of Screening Process

The screening process identifies the following issues to be carried forward to scoping for further assessment:

- The site is less than 100m from the historic River Fleet (now culverted) and Regent's Canal.
- The London Clay is the shallowest natural stratum at the site.
- Trees will be felled as part of the Proposed Development.
- The site is within 5m of both highways (Granary Street and St Pancras Way) and pedestrian rights of way.
- The basement of the proposed development will be deeper than some of the existing neighbouring properties' foundations.
- The proposed development will change the profile of instantaneous inflows being received (attenuated short term flows).
- The site borders an area known to be at risk from local surface water flooding.

The other potential concerns considered within the screening process have all been demonstrated to be not applicable or not significant when applied to the proposed development.

5.0 Scoping

The following issues have been brought forward from the screening process for further assessment:

5.1 Geology / Land Stability

Shrink Swell

The London Clay is typically firm to stiff and should provide sufficient bearing capacity for the proposed development. The volume change potential of the London Clay could result in shrink / swell movements impacting foundations. The risk of movement and damage to this development due to moisture variation is negligible, considering the proposed depth of the basement, the suspended slabs and piled foundations.

A site investigation is required with appropriate geotechnical assessment to ensure a suitable foundation design.

Removal of Trees

The risk of movement and damage to this development due to moisture variation caused by removal of trees is negligible, considering the proposed depth of the basement, the suspended slabs and piled foundations. None of the trees to be removed are close enough to neighbouring buildings such that their removal would impact them.

Differential Depth of Foundations

Excavation for a basement may result in structural damage to neighbouring properties if there is a significant differential depth between adjacent foundations. A ground movement assessment (GMA) is required to assess potential impacts.

Adjacent highways and pedestrian rights of way

The site is within 5m of both highways (Granary Street and St Pancras Way) and pedestrian rights of way and therefore a GMA is required to assess potential impacts.

5.2 Hydrogeology / Groundwater Flow

Considering the hydrogeological properties of the London Clay (i.e. a very low permeability formation, designated as Unproductive Strata) the presence of a continuous groundwater body is discounted. There will be no impacts to groundwater flow or the wider hydrogeological environment as a result of the proposed basement. However, there is potential for perched water to be present within the Made Ground or local seepage within the London Clay which may require groundwater control to be employed during construction to ensure stability is maintained.

A site investigation is required to determine the presence of perched water or groundwater.

5.3 Hydrology / Surface Water Flow

As the site borders an area known to be at risk from local surface water flooding, a Flood Risk Assessment is required.

As the proposed development will change the profile of instantaneous inflows being received, a Drainage Strategy is required.

6.0 Ground Conditions

6.1 Introduction

Site investigation has been undertaken to inform the final, detailed scheme design, validated by the CampbellReith Geotechnical Interpretative Report (GIR).

6.2 Ground Conditions

The typical ground conditions beneath the site adopted for these assessments comprise Made Ground of up to 3.60m thickness (ground level to 20.00mOD); approximately 17.00m of London Clay proven to approximately 3.00mOD; with Lambeth Group underlying.

The geotechnical parameters adopted by the piling contractor (Keltbray) for the retaining wall design are presented, as follows:

Stratum	Design level (mOD)	γ (kN/m^3)	K_0	α / K_s	c' (kPa)	φ' (°)	Cu (kPa)	E' (MPa)	E_u (MPa)
Made Ground	Retaining level	18	0.5	Ignored		30	-	10	-
London Clay	~20	20	1.0	0.5	5	24	35+7.17z	600Cu	800Cu
Lambeth Group (1) (Cohesive)	-3	20	1.0	0.5	0	27	225	600Cu	800Cu
Lambeth Group (1) (Granular)	-15.8	20	0.384	0.9	0	38	-	120	-

Table 2 Summary of geotechnical design parameters

(1) Not considered in retaining wall calculations as significantly below stability toe.

For the purposes of the GMA, the following amendments to the geotechnical parameters are made in order to be more conservative:

- Eu adopted as 400Cu and E' calculated as 0.8Eu.
- Groundwater at 0.5m bgl has been considered for sheet piles only, to represent worst case conditions (ie generate maximum deflection for assessment purposes).

6.3 Groundwater

Variable shallow levels of perched groundwater within the Made Ground have been monitored, overlying the London Clay. Whilst groundwater control methods will be required to be employed during the construction process the perched groundwater does not represent a continuous aquifer.

7.0 Flood Risk Assessment and Drainage Strategy

7.1 Flood Risk Assessment and Drainage Strategy

A FRA and Drainage Strategy has been submitted as part of the planning application and updated by Terrell (as provided in the BCP). It should be noted that there will be no change in impermeable site area due to the proposed development.

The conclusions of the FRA can be summarised as follows:

- The Proposed Development is categorised as “more vulnerable”.
- The Site is located in Flood Zone 1.
- There is no flood risk from tidal sources.
- The probability of fluvial flooding extending into the Site is considered to be low.
- Prior to the introduction of the mitigation measures the risk of flooding from pluvial sources is therefore considered to be Medium. However, the mitigation measures allow this flood risk to be reduced to low.
- The risk of flooding from sewers is therefore considered to be low.
- Based on published mapping the groundwater level at the Site demonstrates that the overall flood risk from groundwater on the Site is considered to be low.
- There is no risk of flooding from artificial sources to the Site.

The conclusions of the Drainage Strategy can be summarised as follows:

- A new separate foul water network will be provided to cater for the needs of the Proposed Development.
- An indirect Section 106 application will be made to TWUL for the new discharge regime.
- A new separate surface water network will be provided to cater for the needs of the Proposed Development.
- The design is based on the 1 in 100-year storm + 40% climate change allowance and a permitted discharge rate of 20.8L/S for the 1 in 100-year event.
- The attenuation facilities have been revised to consist of GRP tanks to the east of the new building and larger pipes to the west on St Pancras Way. It has also been necessary to introduce two hydro brake flow controls to be able to get the drainage network around the tower crane base LC1 at the entrance to the Lower Ground Floor.
- SuDS features will be employed where possible within the Proposed Development to reduce runoff rates and provide an element of water quality enhancement prior to offsite discharge.

All relevant reference documents are provided within the BCP.

7.2 FRA and Drainage Strategy, Non-Technical Summary

From a review of the sources of flooding that could influence the proposed works on site, it has been determined that there is a low risk of flooding to the development.

It is not considered that the proposals would result in an increased risk of flooding at the property location or surrounding area or that the effects of climate change will significantly change the current day regime. The surface water management measures to be adopted will provide betterment compared to the existing run-off drained from site.

8.0 Ground Movement Assessment

8.1 Ground Movement Assessment

A Ground Movement Assessment (GMA) is provided for reference within the BCP.

8.2 Summary

The predicted ground movements have been used to assess the resultant potential damage that may be experienced by neighbouring structures. The 'Burland Scale' damage categories are presented in Table 3.

Based on the ground movements calculated, and the existing basements and deep foundations to neighbouring buildings (where present), a maximum of Burland Category 1 damage (Very Slight) is predicted to occur to neighbouring buildings:

- Ted Baker, Category 0 to 1;
- 1 – 5 St Pancras Way, Category 0;
- 7 St Pancras Way, Category 0;
- 9 St Pancras Way, a Category 0;
- 11-13 St Pancras Way, Category 0;
- Remaining properties on Granary Street, Category 0 to 1.

Category of damage	Description of typical damage (ease of repair is underlined)	Approximate crack width (mm)	Limiting tensile strain, ε_{lim} (%)
0 Negligible	Hairline cracks of less than about 0.1 mm are classed as negligible	<0.1	0.0 to 0.05
1 Very slight	**Fine cracks that can easily be treated during normal decoration.** Perhaps isolated slight fracture in building. Cracks in external brickwork visible on inspection	<1	0.05 to 0.075
2 Slight	**Cracks easily filled. Redecoration probably required.** Several slight fractures showing inside of building. Cracks are visible externally and **some repointing may be required externally** to ensure weathertightness. Doors and windows may stick slightly.	<5	0.075 to 0.15
3 Moderate	**The cracks require some opening up and can be patched by a mason. Recurrent cracks can be masked by suitable lining. Repointing of external brickwork and possibly a small amount of brickwork to be replaced.** Doors and windows sticking. Service pipes may fracture. Weathertightness often impaired.	5 to 15 or a number of cracks >3	0.15 to 0.3
4 Severe	**Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows.** Windows and frames distorted, floor sloping noticeably. Walls leaning or bulging noticeably, some loss of bearing in beams. Services pipes disrupted.	15 to 25, but also depends on number of cracks	>0.3
5 Very severe	**This requires a major repair, involving partial or complete rebuilding.** Beams lose bearings, walls lean badly and require shoring. Windows broken with distortion. Danger of instability.	Usually >25, but depends on numbers of cracks	

Table 3: Damage Categories on the Burland Scale

Movements to the highway / utilities are considered to be very small, such that they would cause negligible impact. Approval in Principle (AIP) will be agreed with LB Camden (Highways) in advance of construction.

Consultation with relevant asset owners (e.g Thames Water) will be undertaken to ensure that appropriate design and mitigation measures can be provided for the development such that impacts to utilities are maintained within the agreed limits.

9.0 Basement Impact Assessment

The purpose of this assessment is to consider the potential impacts from basement development on the local hydrology, geology and hydrogeology and any resulting impacts to stability of adjacent structures. The assessments have been undertaken by appropriately qualified professionals in accordance with the guidance.

This updated BIA relies upon previously agreed assessments where relevant, updated where required to reflect the revised development proposals. A Basement Construction Plan (BCP) will be submitted to demonstrate that the strategies and assessment conclusions presented in this BIA will be implemented.

9.1 Geology and Land Stability

The site is underlain by the London Clay Formation and Lambeth Group, suitable bearing strata for the proposed development's foundations, confirmed by the site investigation.

The risk of movement and damage to this development due to moisture variation is negligible, considering the proposed depth of the basement, the suspended slabs and piled foundations.

Ground movements caused by the excavation and construction of the proposed development have been demonstrated by assessment to be minimal, assuming the adoption of best practice construction methodologies. Damage Impact to adjacent structures will be limited to a maximum of Very Slight (Category 1 in accordance with the Burland Scale).

Structural movement monitoring is proposed and mitigation actions will be implemented if movement trends indicate structural tolerances could be exceeded.

Movements to the highway / utilities are considered to be very small, such that they would cause negligible impact. Asset protection criteria will be agreed with relevant parties.

9.2 Hydrogeology and Groundwater Flow

The London Clay is designated as Unproductive Strata. There is a very low risk of groundwater flooding and there will be no impact to the wider hydrogeological environment.

9.3 Hydrology and Surface Water Flow

The site and the adjacent properties have not been impacted by flooding. There is a very low risk of flooding to the proposed development and the proposed development will not impact the wider hydrological environment. The proposed drainage strategy should provide betterment and reduce the risk of surface water flooding or sewer surcharging on site and in the immediate vicinity.

The SuDS proposals allow for a suitable attenuated drainage scheme with off-site discharge flow rates limited to the minimum practicable in accordance with best practice.

9.4 Residual Risks and Mitigation

Structural movement monitoring, include precise levelling, reflective survey targets or other appropriate instrumentation as determined by the Engineer (as Monitoring Plan provided in the BCP), will be installed on adjacent structures and the highway. This will be agreed under the Party Wall Act and as part of any asset protection agreements required.

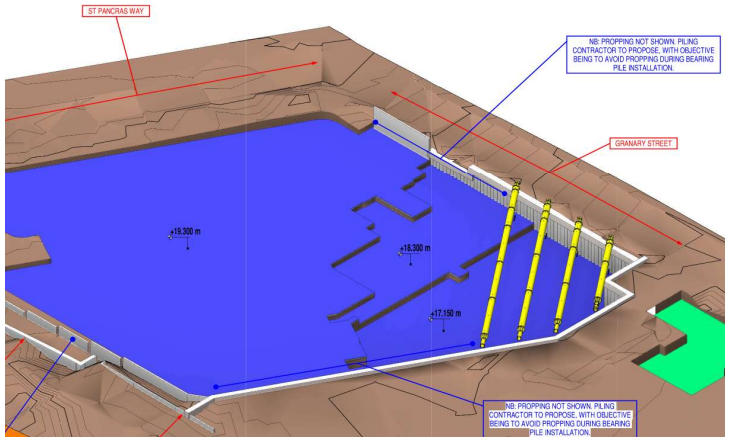
Appendix 1 Changes in Proposed Basement Layout

TERRELL

ORIEL
VOLUME AND AREA COMPARISION
05.12.2022

AECOM LGF

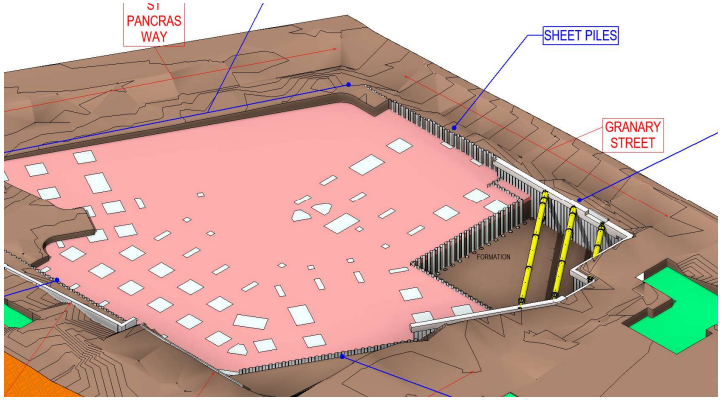
SSL LEVEL	AREA (M2)	VOLUME (M3) BELOW 19.3 (TO SSL)
19.3	3821	0
18.3	588	588
17.1	1116	2455
Mezzanine	365	0
	5890	3043



NEW BASEMENT LAYOUT

SSL LEVEL	AREA (M2)	VOLUME (M3) BELOW 19.3 (TO SSL)
19.3	5410	0
15.1	747	3137
	6157	3137

CHANGES	AREA (M2)	VOLUME (M3)
	267	**94**
	INCREASE	**INCREASE**



NB:
Area figures are straight comparision taken from the AECOM Revit model
Volume figures consider that the excavation below the lowest level SSL is the same for both layouts
Volume figures consider the excavation above +19.3 is the same for both layouts

Appendix 2 Risk Classification Matrix

Risk Classification Matrix (C552 CIRIA, 2001)

Classification of Consequence

Classification	Definition
Severe	Short term (acute) risk to human health likely to result in 'significant harm' as defined by the Environment Protection Act 1990, Part IIA. Short term risk of pollution (note; Water Resources Act contains no scope for considering significant pollution) of sensitive water resource. Catastrophic damage to building/property. A short term risk to a particular ecosystem, or organism forming part of such ecosystem. (Note the definitions of ecological systems within the Draft Circular on Contaminated Land DETR, 2000).
Medium	Chronic damage to human health ('significant harm', as defined in DETR, 2000). Pollution of sensitive water resources (note; Water Resources Act contains no scope for considering significant pollution). A significant change in a particular ecosystem, or an organism forming part of such an ecosystem. (Note the definitions of ecological systems within the Draft Circular on Contaminated Land DETR, 2000).
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services ('significant harm', as defined in DETR, 2000). Damage to sensitive buildings/structures/services or the environment.
Minor	Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as persona protective clothing etc). Easily repairable effects of damage to buildings, structures and services.

Classification of Probability

Classification	Definition
High likelihood	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution.
Likely	There is a pollutant linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low Likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period that such an event would take place, and is even less likely in the shorter term.
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

Classification of Probability

		Consequence			
		Severe	**Medium**	**Mild**	**Minor**
Probability	**High Likelihood**	Very High Risk	High Risk	Moderate Risk	Moderate / Low Risk
	Likely	High Risk	Moderate Risk	Moderate / Low Risk	Low Risk
	Low Likelihood	Moderate Risk	Moderate / Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate / Low Risk	Low Risk	Very Low Risk	Very Low Risk

Appendix 3 References and Guidance

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25. Environment Agency (2012). Groundwater Protection: Principles and Practice (GP3)
26. Water Framework Directive (2000/60/EC)
27. Groundwater Regulations (2009)
28. Drinking Water Quality Standards England & Wales 2000 (Amended 2004, DWS)
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33. DEFRA (2012). Guidance on the Legal Definition of Waste and its Application

[1] This document has been withdrawn but is considered to remain useful in proving technical background for designing ground investigation works.

[2] This document has been withdrawn but is considered to remain useful in proving technical background for designing ground investigation works.

Appendix 4 Disclaimer

This report has been prepared by Milvum Engineer Services in its professional capacity as soil and groundwater specialists, with reasonable skill, care and diligence within the agreed scope and terms of contract and taking account of the manpower and resources devoted to it by agreement with its client, and is provided by Milvum Engineering Services solely for the use of its client (Terrell Ltd / Bouygues UK) and for reference by the London Borough of Camden.

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