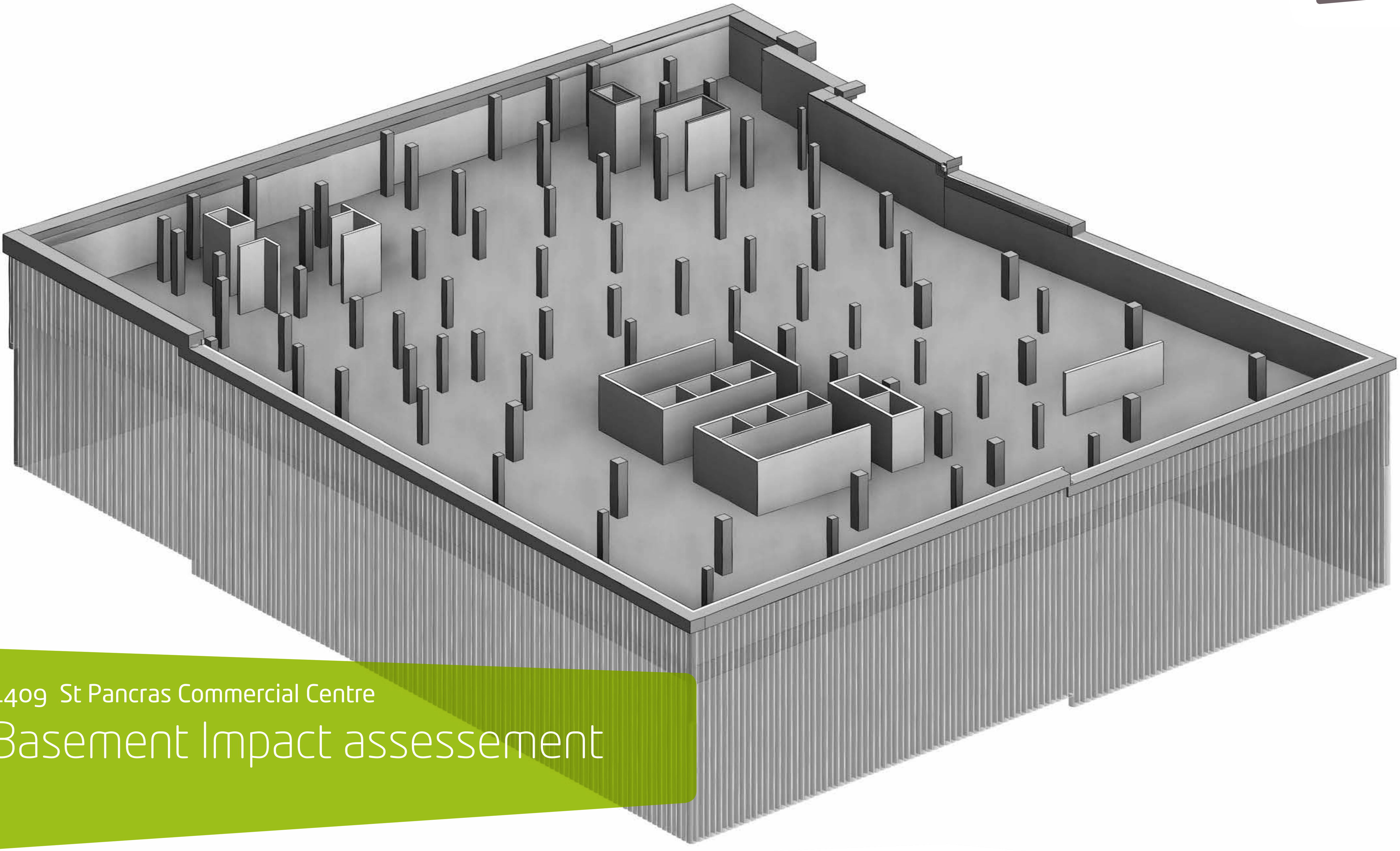
AKT II

St Pancras Commercial Centre
Basement Impact Assessment   August 2019



4409 St Pancras Commercial Centre

Basement Impact assessement

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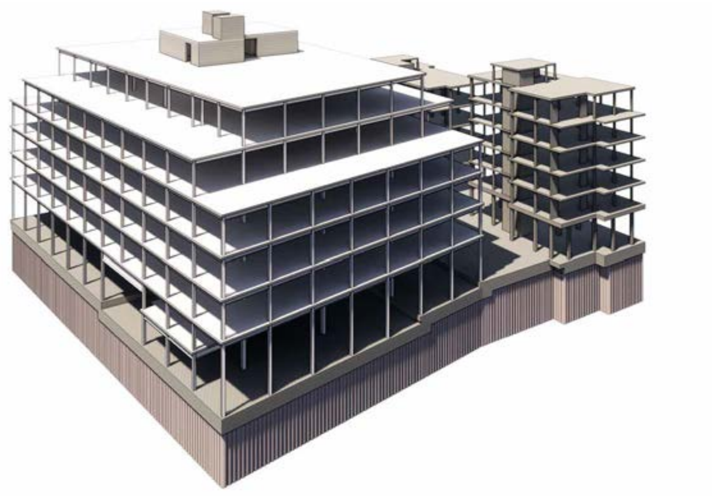

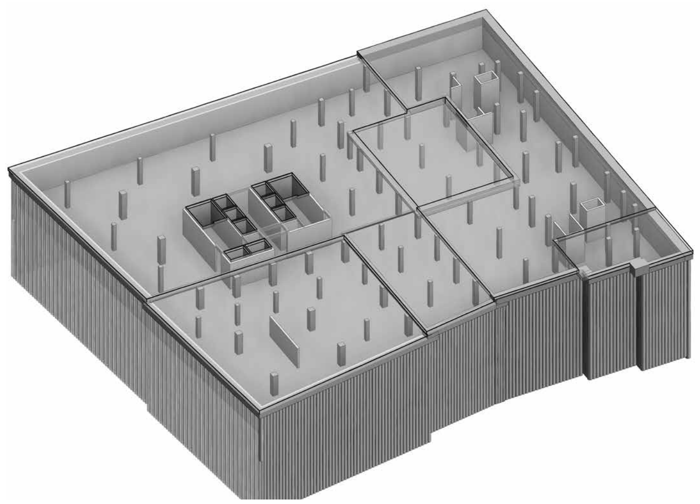

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Checked by:		Rob Bennett
Approved by:		David Illingworth

1 Introduction

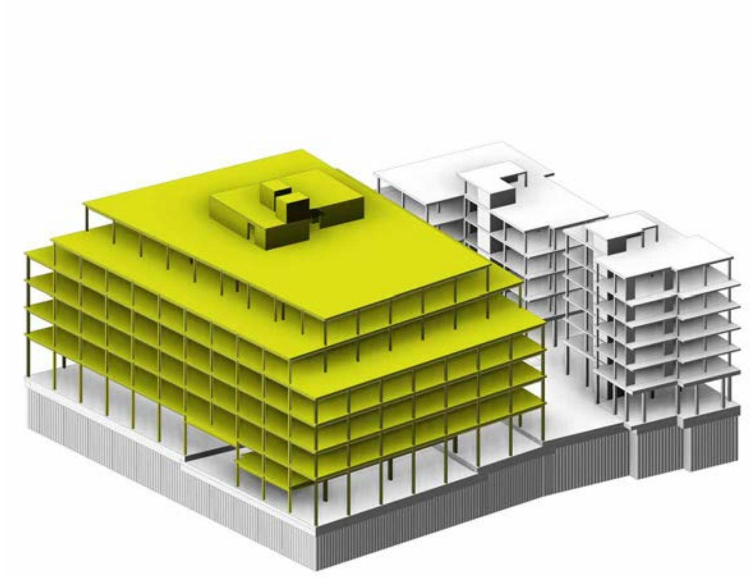
This report provides a summary of the work undertaken to date in assessing the impact of the proposed basement as part of the overall redevelopment of the St Pancras Commercial Centre scheme. The report also outlines the work that is required in order to achieve the necessary third party approvals and the design philosophy to be applied in completing this work.

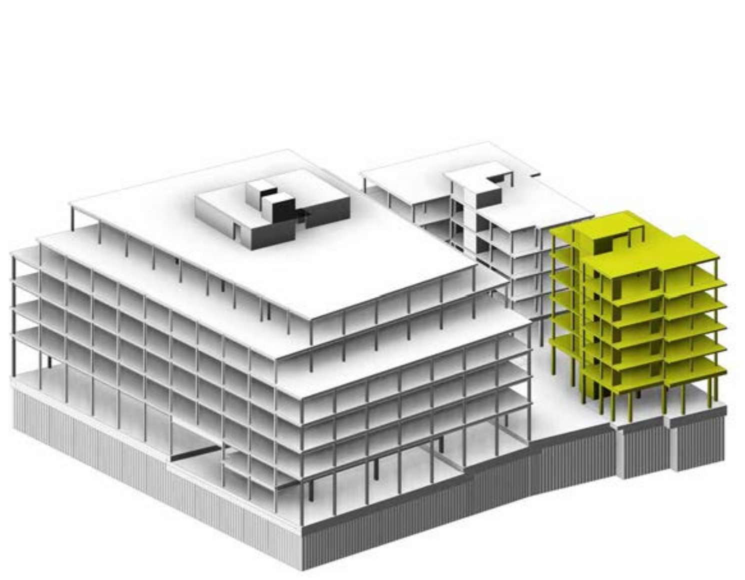
The report provides reference summary of the findings together with an overview of the current site constraints which is included for information. A geotechnical and geo-environmental investigation specific to the current scheme has been undertaken in part which will facilitate the processes and framework set out in this report. A summary of the assumed ground model is included together with a description of the proposed super and sub-structure works. Commentary on assumed construction methodologies is provided with final method statements for excavation, construction sequence, and temporary works to be determined by the Contractor at the appropriate stage. Current site conditions and information on surrounding structures is described in brief based on available record information and initial desk study work.

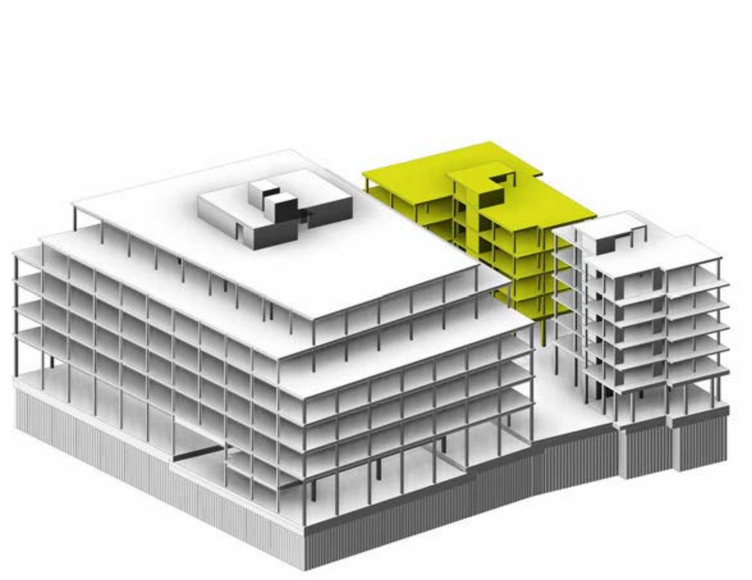
Comprehensive detailed structural and geotechnical assessment of the basement impact has not yet been completed given the current stage of the overall design. Where further work is to be completed, a description of the appraisals to be undertaken together with the underlying design philosophy is included with reference to well established methods of assessment for this type of construction as well as bespoke methods of analysis as appropriate. The principal third party approvals and consultations to be sought in the next stage of design are as noted below:

- Thames Water approval.
- Highways approval.
- UKPN & telecommunications approvals
- No party walls are known however consultations to be undertaken with regards to the structures in the immediate vicinity of the development.

This report has been prepared in response to the requirements outlined by the London Borough of Camden in relation to basements and flooding. Reference should be made to the independent flood risk assessment report for detailed appraisals of the impact on surface water and groundwater flows.







2 The Project: structural summary

The project involves the redevelopment of what is currently referred to as St Pancras Commercial Centre site in Camden, consisting of demolishing the existing light industrial concrete framed structures and the construction of one Office building to the South and two Residential buildings to the North of the site. All three buildings will be joined with a shared basement proposed to occupy the majority of the site boundary.

2.1 Office

The office block rises to 6 stories and a Roof level which includes two set-backs in the massing to create terraces. The following uses are expected to be incorporated in the building:

- Mixed uses at basement which includes plant and Industrial floorspace;
- Mixed uses at ground floor which includes industrial and retail floorspace.
- Loading bay/internal street at ground floor to service the industrial units.
- Offices and landscaped areas on the Terraces
- Plant on the roof

The structural design for the Office building has been developed to respond to that above, together with the Architectural aspirations. Some principle objectives in achieving this have been the following:

- Maximizing Plan Areas for the Office building to accommodate large 'column free' spaces which generated a 12x12m internal gird.
- Achieving an open concrete soffit for the Office building as per Architectural aspirations which generated the use of precast planks as flooring structural option for the steel frame.
- Mindfulness of potential build sequences speed and overall buildability on site.
- Varied options undertaken for cost analysis and review comparing concrete and steel for various grids.

2.2 Residential

The two residential blocks, added later into the scheme following conversations with local Planning Authority are proposed as reinforced concrete (RC) buildings accross 6 and 5 storeys respectively. These are intended for both Market and Affordable housing uses with retail and light industrial at ground f loor.

The two buildings will be inter-connected together (as well as with the Office building) at Ground Floor through a common landscaped public open space.

2.3 Foundations

A conventional reinforced concrete raft foundation has been adopted. This foundation solution is considered favourable given overall project massing and has already been confirmed in principal by the geotechnical site investigation. Considering the previous site usages and expected risk of site contamination a raft foundation would minimise the volume of dig required relative to a piled foundation solution.

As the Site investigation works have been completed in part and towards the end of Stage 2, it seems the proposed solutions are deemed as well suited given reported ground conditions.

Basement retaining wall on the perimeter of the site to be formed of a secant pile wall system.

2.4 3rd parties / Investigations/ Testing

Discussions and approvals will likely be required with regards to the following:

- Thames water - Underground utilities adjacent to the site

Future investigations to be undertaken ahead of any construction works:

- Thames water sewer CCTV conditions survey.

Investigations that have been undertaken:

- A project specific site investigation has been completed in part towards the end of stage 2 and are further discussed in Chapter 3.7.

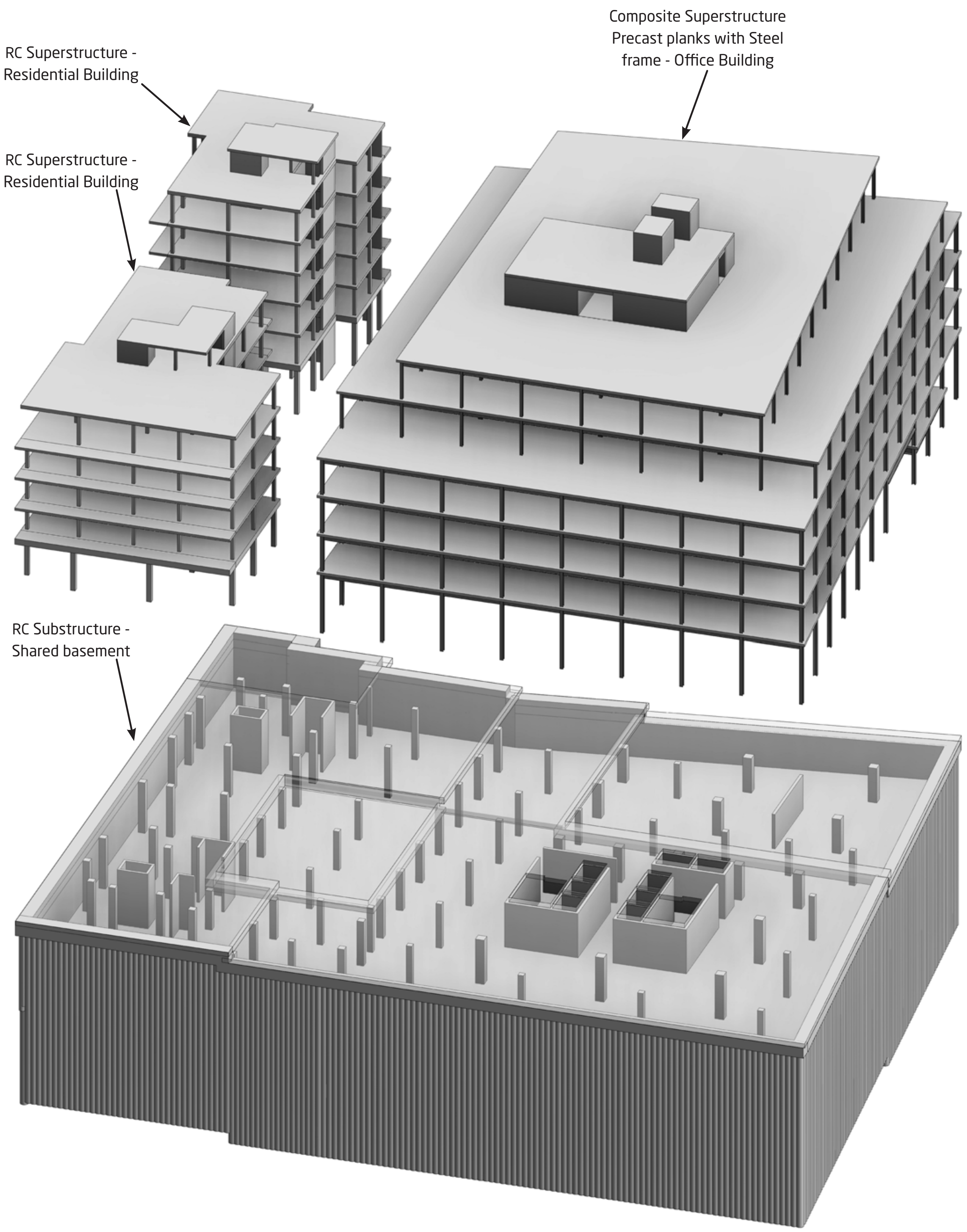


Figure 2.1 St Pancras Campus (Exploded Isometric 3D view)

3 The site

3.1 Site location

The site is located in The London Borough of Camden approximately 1.2 km north-west of London King Cross station. The site is bordered by Royal College Street along West, St Pancras Way to the East, Pratt St to the South, and Georgiana Street along the North. Regent's Canal runs in the vicinity to the East. The North-east corner of the site face directly on to Gray's Inn Bridge which spans over the canal.

The national Grid reference is 529370, 183960. The site postcode is NW1 0SE.

Camden Road Overground and Camden Town Underground stations are located in close proximity to the site - less than 500m to the North and East respectively.

The site datum is approximately 24.50m AOD (ranging from 22.75m to 24.80m AOD South-East to North-West).

3.2 Site History

This chapter of the report is intended to provide a brief overview of the site's history which has been interpreted from various archive and statutory searches.

Historic maps dating back to the early 1870s show that the site was predominantly occupied by residential properties, with a number of commercial buildings and stables, which are likely to be terraces from the Victorian or Georgian eras.

Towards the end of the 1800s, the site passed into the ownership of the St Pancras Borough Council and was redeveloped as an electric power station. By the late 1890s, a combined coal fuelled power station and refuse destructor had opened on site.

The generating station remained on site approximately until the mid 1900s when it was redeveloped into the St Pancras Commercial Centre broadly in the configuration seen today.

It is known that the site suffered bomb damage during WWII. Historic bomb maps indicate that much of this was considered as 'general blast damage'.

Regent's Canal stretches in close proximity along the East of the site towards the North and beyond. It was built in the early 1800s stretching from the national Grand Union Canal (Paddington Branch) to Limehouse on the river Thames connecting London's waterways to the British Midlands.

The canal served as a major transportation route for various products including large quantities of coal to fuel the various power stations along its route. it is reported that by 1876 it was carrying 1.4 million tonnes of goods a per annum.

The canal was originally built with earth banks but these were subsequently replaced with ragstone walls. Some of the stone revetments are still present to this day with the addition of concrete copings. In many other areas the banks were replaced by steel sheeting. The surface width of the canal broadly varies between 14 -17m along its route.

Broadly speaking, the surrounding area remained predominantly residentiai in nature with a number of interspersed commercial/industrial developments.

Bangor Wharf, immediately North on the other side of Georgiana Street, became part of the electricity board providing office and ancillary buildings.

A portion of the site immediately to the East also became part of the St Pancras generating station. The remainder of this block featured terraced houses, a church, and later a Primary school.

On the other side of Pratt Street to the South the site was industrialised and was occupied by mineral water manufacturing works, garages, workshops, and factories.

Star Wharf and Knowles Wharf on St Pancras Way were redeveloped and now feature residential apartments facing on to Regent's Canal.

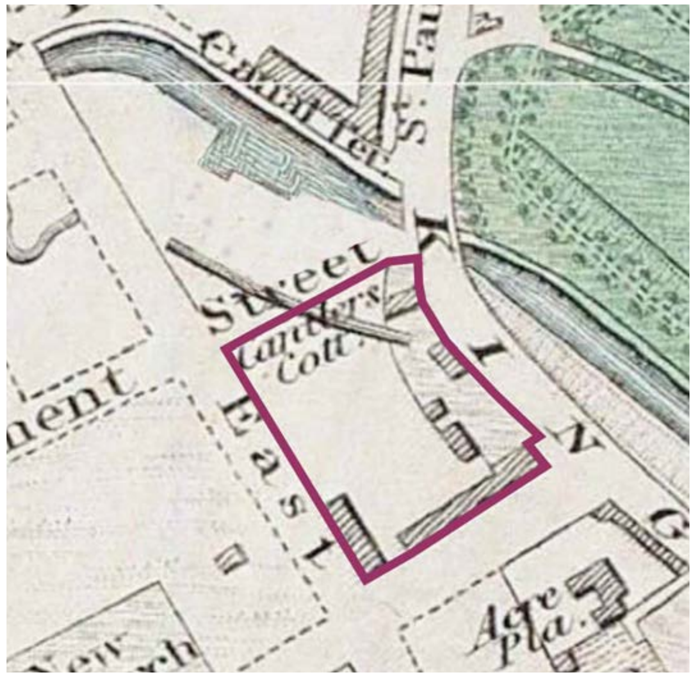


Figure 2.2 Historic Map dated 1830

Figure 2.3 Historic Map dated 1895

Figure 2.4 Historic Map dated 1967

Figure 2.5 Historic Map dated 1994

3.3 Existing Structure

The site can generally be described as approximately 75sqm in rectangular shape and is currently occupied by a series of industrial buildings which comprises the St Pancras Commercial Centre. The Eastern edge of the site features a narrow strip of lawn.

The site is currently occupied by industrial units which are low rise accross 1 to 2 storeys in height. As per the building survey report, it is assumed that these are concrete framed and feature combination of brickwork and profiled steel cladding. The central portion is covered by hardstanding to accommodate vehicular access and parking.

It is assumed there are no existing basements however, buried obstruction may exist owing to vaults below the pavements along Georgiana Street and St Pancras Way (formerly King's Road).

3.4 Thames Water assets

A number of Thames Water assets are present in the immediate vicinity of the site. These include combined trunk sewers beneath the public highways Georgiana Street, Royal College Street, and Pratt Street which border the site.

The Fleet Sewer, historically part of the Fleet River, also connects to the trunk network along the North-East corner of the site.

Some of these assets, the Fleet Sewer in particular, are likely to be of Victorian masonry construction. The condition of the sewers is currently unknown and it is recommended that surveys are undertaken in the subsequent stages of design before any work is carried out on site.

Although Thames Water assetss have currently been highlighted as not afected (based on utility searches on the site vicinity), at the time the present report has been written, further advice has been sought from Thames Water with regards to the above Fleet Sewer in relation to the proposed one level basement of the development. This is to be looked at in the following stages.

3.5 UKPN, Cadent Gas, & other utilities

Initial utility searches indicate that there are a number of services located in the area,

Services include UKPN, Cadent Gas, BT Telecommunications, and Virgin Media Assets. These are generally located beneath the pavements around the site and connect into the properties at various points.

It is of note the presence of an extra high voltage underground cable in the vicinity of the site.

The above will require further conversations and potentially third party approvals are to be sought in the subsequent stages of design.

3.6 Unexploded Ordnance

Historic Bomb damage maps recorded by The Ministry of Defence indicate that the site sustained bomb damage during the German bombing of Britain in WWII.

Generally speaking, approximately half of the site experienced damage classed as 'General blast damage'. A portion of the site in the centre suffered more serious damage.

Given the redevelopment of the site after the war, it couid be inferred that the risk of unexploded ordnance is reduced however an inherent residual risk remains.

Advice should be sought from a specialist UXO consultant as appriopriate.

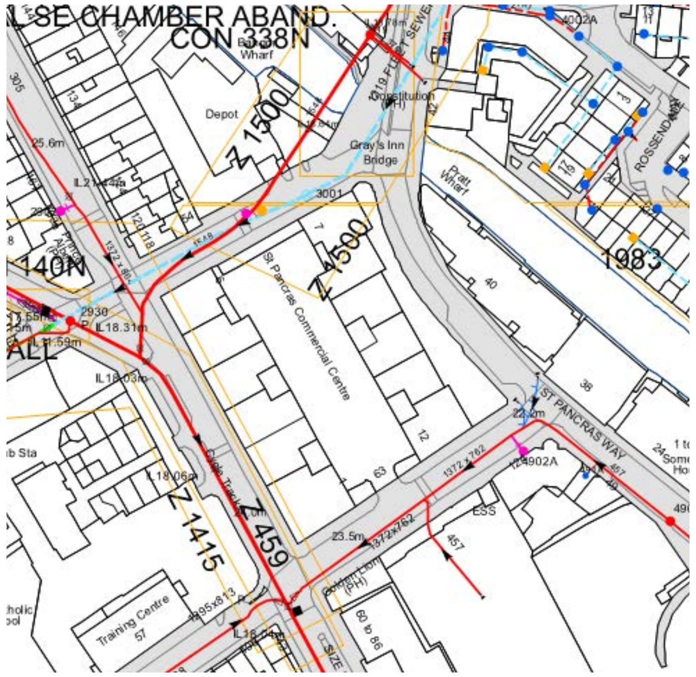


Figure 3.2 Sewer system around site

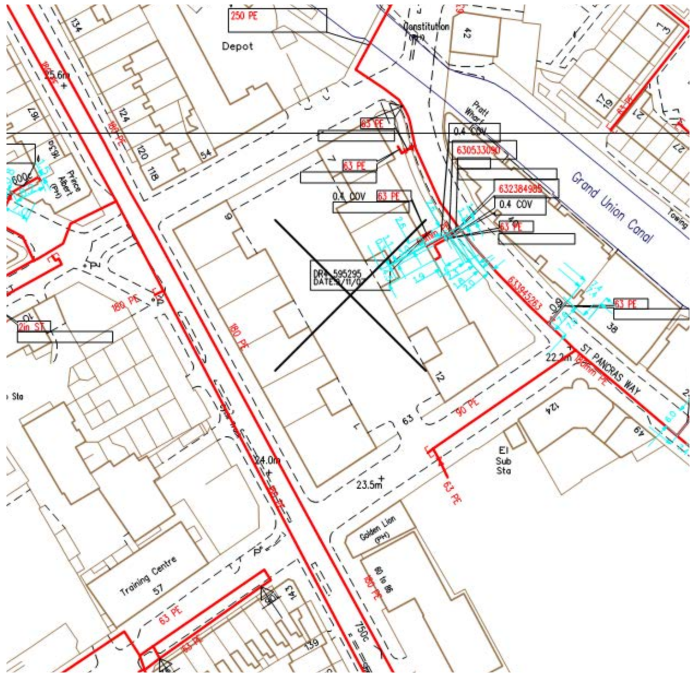


Figure 3.1 Cadent gas lines around site

Figure 3.4 Bomb Damage Map

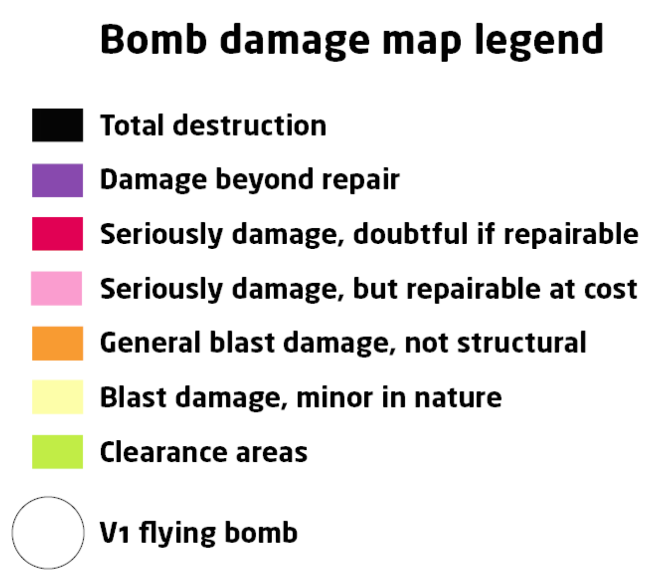


Figure 3.3 Bomb Damage key

3.7 Geotechnical Information

The following section aims to provide an overview of the anticipated ground conditions on site. This information has been taken from a variety of publicly available sources and has been verified as part of the completed Site Investigation works.

3.7.1 Published geology & historical boreholes

London is part of the Thames Basin which is a large geographical river basin characterised by its Chalk stratigraphy together with clays and sands towards the centre.

The following maps related to the site's geology were received by Envirocheck.

- Superficial Geology Map.
- Bedrock and Faults Map.
- Artificial Ground and Landslip.

These maps show that the soil underlying the site is London Clay and that there are no drift deposits. An area of worked ground, is indicated immediately to the south-west of the site.

The following Figures show the Artificial Ground and Landslip Map and the Bedrock&Faults Map.

Reference to the British Geological Survey 1:50,000 scale Geology Sheet No 256 (North London) shows the site to be underlain by London Clay strata.

3.7.2 Groundwater & perched water tables

A large portion of large water supplies in the Thames Basin come from the groundwater present within the Chalk aquifer. It is therefore expected that an aquifer, regional/strategic in scale, this will be present within the Chalk stratum at depth. Based on the preliminary information received to date (following the completion of site specific ground investigation works), it seems that the water level has been struck in the Made Ground deposite at range of 4.13m and 5.48m (assumed perched water) below ground level. The nearest water course is the Regent Water Canal located 10m to the North.

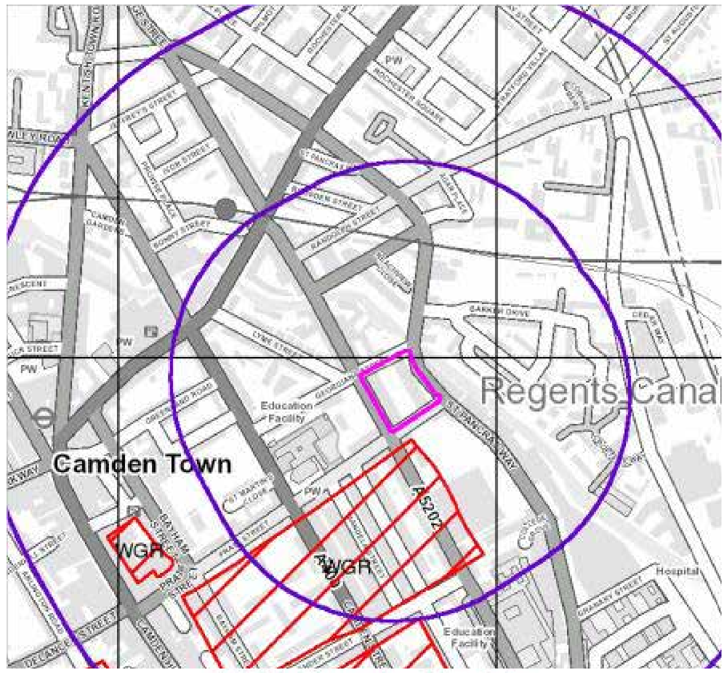
3.7.3 Anticipated Ground Conditions

Preliminary information has already been received following the completion of site specific ground investigation and this was corroborated with boreholes located in close proximity to the site which were obtained from the British Geological Survey (BGS) archives.

Based on this information ground conditions at the site are expected to comprise of a Made Ground over Clay strata as illustrated in the 'Borehole profile based on reported Site Investigation works.

Furthermore, it is noted that based on information received to date, the thickness of made ground strata varies from 5.7m to 5.1m.

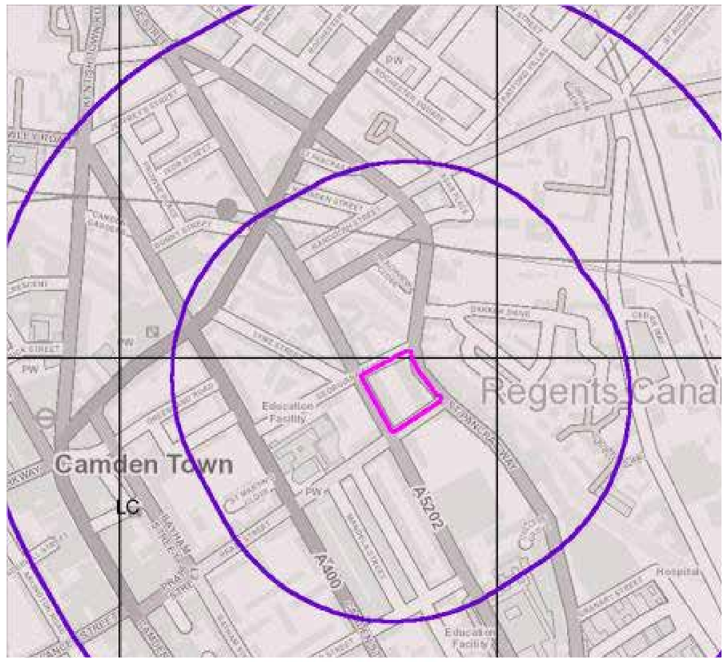
This information is supported by borehole information obtained just outside the site which indicate London Clay strata overlaid with Made Ground (Fire Brigade Station borehole on the site of the existing Pan African Refugee Housing building).



Artificial Ground and Landslip

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	WGR	Worked Ground (Undivided)	Unknown/Unclassified Entry	Holocene - Holocene
	WGR	Worked Ground (Undivided)	Artificial Deposit	Holocene - Holocene
	MGR	Made Ground (Undivided)	Artificial Deposit	Holocene - Holocene
	MGR	Made Ground (Undivided)	Unknown/Unclassified Entry	Holocene - Holocene

Figure 3.2 Artificial ground and landslip



Bedrock and Faults

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	LC	London Clay Formation	Clay	Eocene - Eocene

Figure 3.3 Bedrock and faults

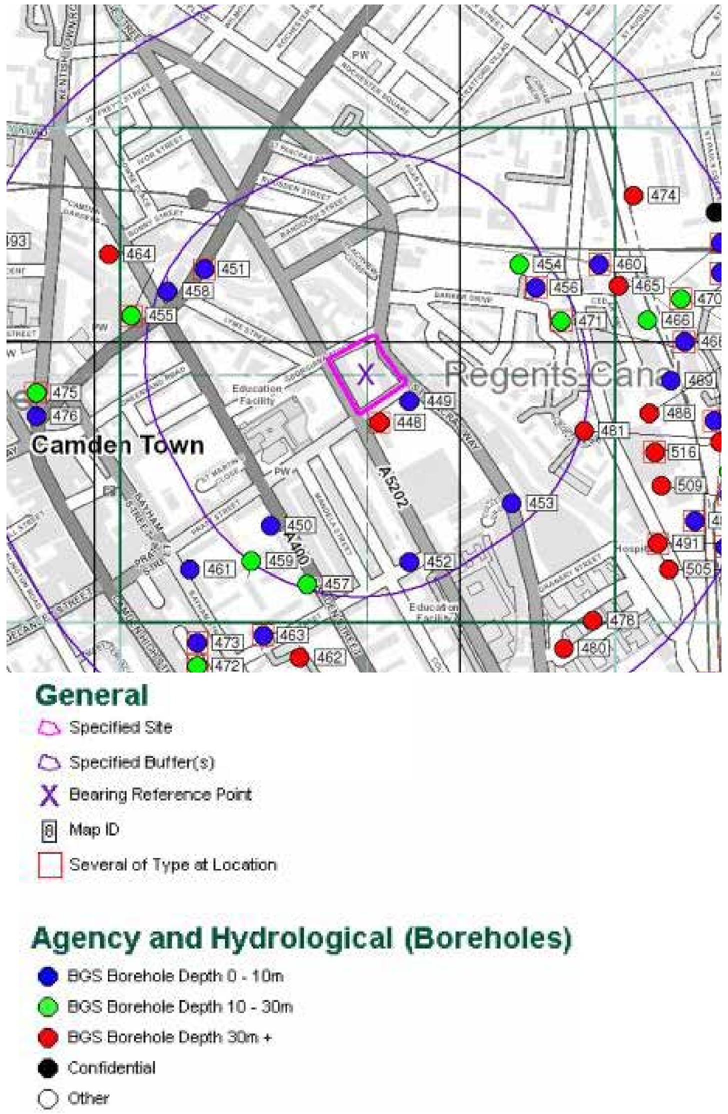


Figure 3.4 Borehole Map

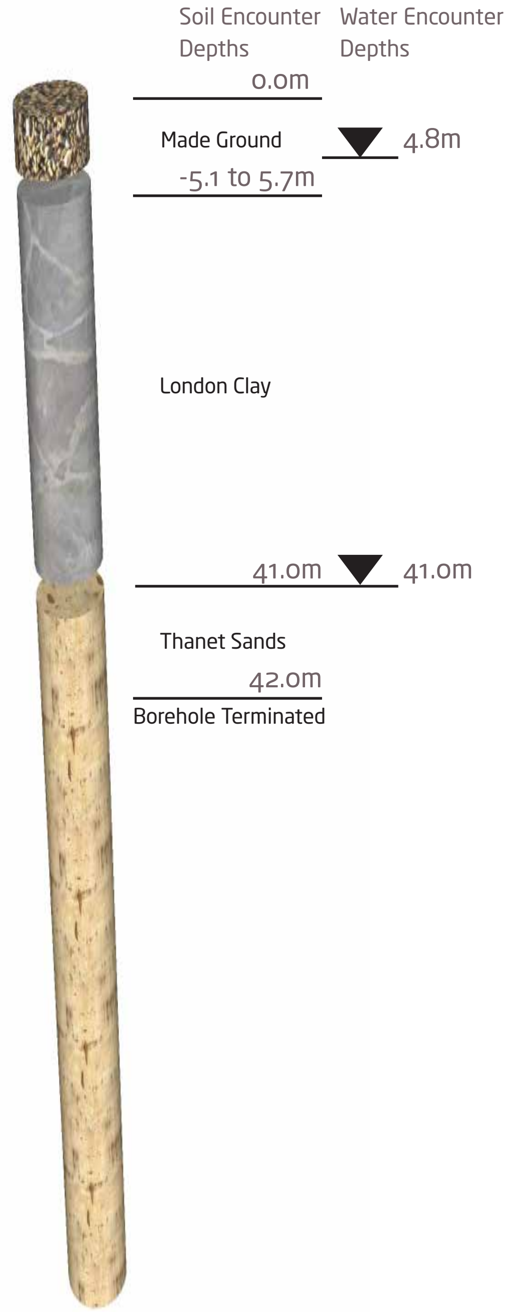


Figure 3.1 Borehole profile based on Site Investigation works

3.8 Below Ground Features

The site does not lie within a London Borough of Camden Conservation Area (although some of the areas in the vicinity fall within the Regent's Canal Conservation Area). Guidance from Historic England suggests that the Borough of Camden, among others, is currently under review in accordance with their APA guidelines at the time of writing. The status and outcome of this should be monitored.

An archaeological desk based study was performed by the Archaeology Collective, it was concluded that no world heritage sites or monuments would be contained in the site. Although it was determined there may be a medium to high potential of remains from St Pancras Vestry Refuse Destructor and the St Pancras Generating Station.

3.8.1 Hydrology & flood risk

The nearest significant water feature is Regent's Canal which is immediately to the East of the site.

The site is located within a floodplain designated by the Environment Agency (EA) as Zone 1. This translates to land assessed as having a less than 1 in 1000 annual probability of river or sea flooding (<0.1%).

Please refer to AKTII Flood Risk Assessment Report for more information.

3.8.2 Ground contamination

Based on the site history, there is the potential for heavy metals, petroleum hydrocarbons, semi-volatile organic compounds (SVOCs) and volatile organic compounds (VOCs) to be present within the shallow soils beneath the site.

There are no recorded current landfills indicated within the vicinity of the site and precautions against the ingress of radon gas are not required for this development. On site, historical reviews confirmed miscellaneous power facilities from 1953 to 1968. A chimney was present within the southern section of the site and ashy materials would have been produced at this site. If these materials, or other ashy Made Ground, exist locally beneath the site metal compounds may be present.

Historical or current potential contaminative uses were found offsite within a 100m radius of the site, including a coal depot, a freight terminal and factories. Although not considered as a potential on-site risk, radioactive substances were detected to the West within six metres of the site on Royal College Street the nature of which is to be investigated in the following stages.

The site has had a number of historic structures that have since been demolished, made ground on the site can include remnants of existing foundations, brick, ash and clinker. There may also be existing historic basements that have since been backfilled with reworked soil that could also contain various historic contaminants.

As previously mentioned, at the time the current information is being reported the SI works have been completed and based on reported information it seems that potential samples of asbestos have been found in some of the trial pits. This is to be further investigated in the following stages to estimate the extent of contamination present.

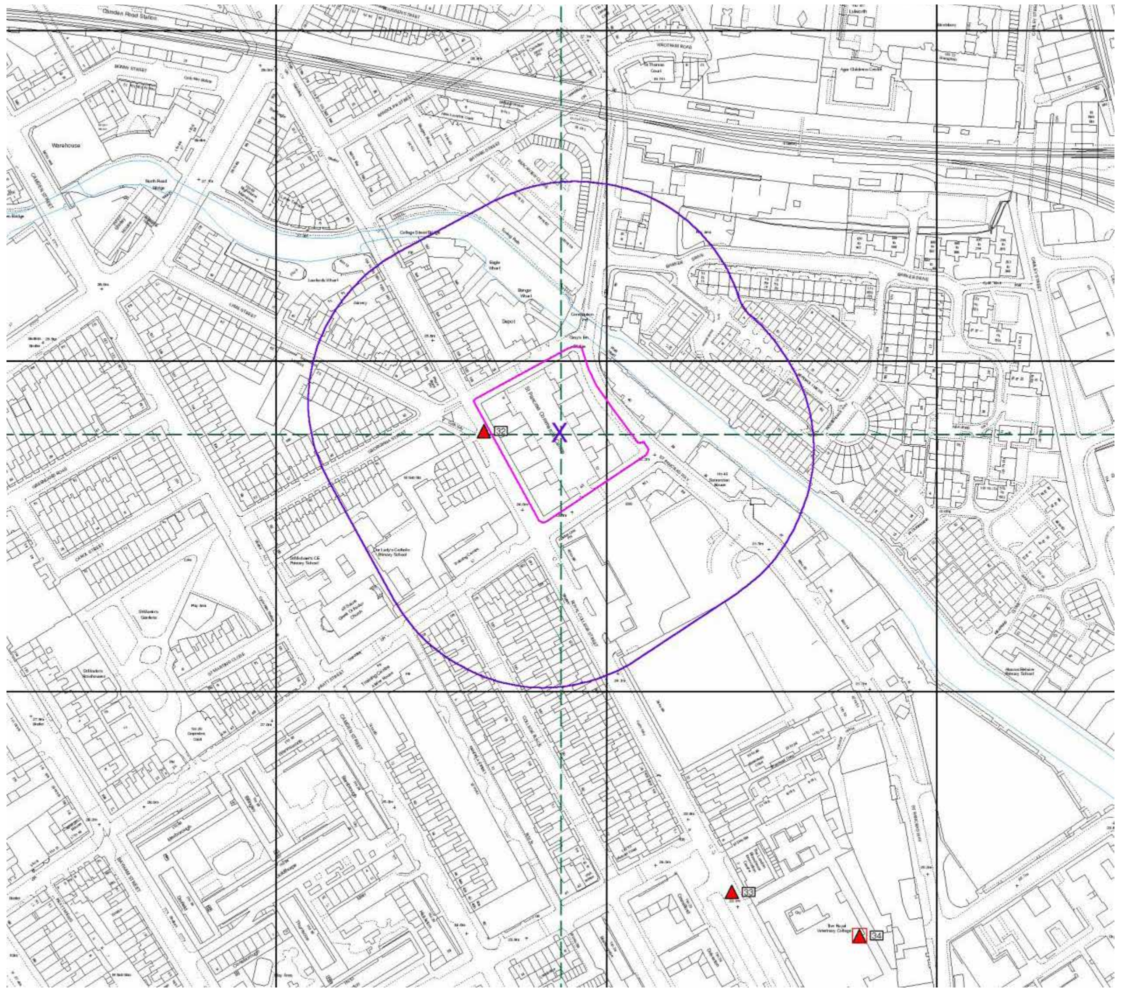


Figure 3.6 Site Sensitivity Map

Figure 3.5 On a location next to the site there is a n electrical substation; potential source of radioactivity (highlighted red)

3.9 Site constraints

The following chapter is intended to provide a general summary of potential project constraints that have so far been identified in relation to the current proposals. These are not exhaustive and should be considered in conjunction with information from the wider design team.

These issues should be considered in more detail as the project moves into the next stages of design and recognised accordingly in the project risk register. Where appropriate a specialist consultant should be engaged to advise on any specific items.

Consideration should be given to the potential Vaults under the pavement and underground Tunnel on Georgiana Street to the North, both of which are mentioned on the historic maps. Proposed trial pits in the area have not uncovered the presence of these above although it is still expected they might be present at a different location/depth.

Given previous uses of the site, there is a risk of large obstructions which might potentially impede demolition works such as the foundation of the old chimney located relatively central on the site. Moreover, one such obstruction has been found while performing the ground investigation works in one of the boreholes - the full extent of which is further to be evaluated.

Please refer to AKTII Site Constraints drawings for further information.

3.9.1 Statutory searches

Searches have been undertaken to locate potential underground obstructions and services that may clash or influence the proposed substructure. The Information provided has been used to generate a site constraints drawing shown in the figure below. It is noted that the information provided by the relevant statutory bodies is approximate.

3.9.2 Utilities

The following utilities can be identified to run in the proximity of the site:

- Telecommunications - likely to be located beneath the surrounding pavements and will potentially require third party approvals.
- Gas - Existing gas mains are running along site boundaries. Depending on the proximity of these gas mains to the proposed structures, a detailed ground movement analyses and load assessments might be required in the later design stage.
- Sewer - The old River Fleet Sewer runs on the east side of the site on Royal College Street and although Thames Water assetss have currently been highlighted as not afected (based on utility searches on the site vicinity), at the time the present report has been written, further advice has been sought from Thames Water on this matter.
- Electric and power distribution- Extra High Voltage equipment potentially present on/around sitea alongside several UKPN sub-stations in the vicinity. This is to be further investigated in the later stages to assess impact.

3.9.3 Party walls

The site is located alone surrounded by four roads at each edge. It is assumed that there are no party wall restrictions but this should be confirmed by the client body.

3.9.4 Site Access

It is not thought that the site locations will impose any onerous restrictions on the accessibility of vehicles to the site, specifically construction traffic except from one way routes, cycle paths and bus routes. This however needs to be assessed and determined by the future contractor.

No weight restrictions currently applies on the adjacent bridge on St Pancras Way across the Regent Canal but this should be confirmed.

Proposed Investigations

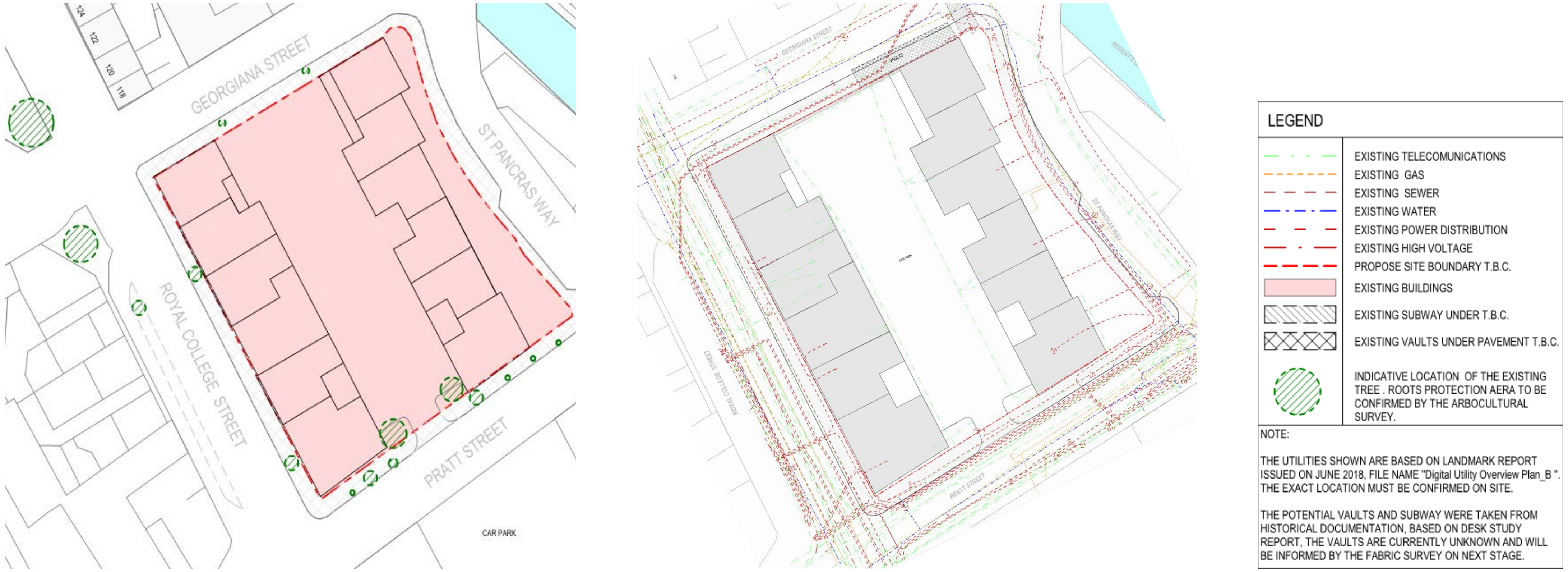
The following section outlines AKTII recommendations for specialist investigations to be undertaken at the earliest available opportunity. These investigations are intended to provide further information on parameters required for more detailed structural design and to reduce/mitigate associated risks. These investigations include:

- Project specific site investigation - SI works completed, awaiting final report
- CCTV drainage surveys
- Condition surveys of the Thames Water sewers below the surrounding highways

3.9.5 Geotechnical and Geo-environmental Investigation

An initial summary of the anticipated ground conditions has been discussed in this report. Much of this information has been confirmed through a detailed site specific investigation with the purpose of covering the following:

- Independent specialist desk study
- Establish the soil profile throughout the site.
- Testing of soils, through intrusive investigations, to establish their geotechnical parameters and subsequently facilitate the design of various structural and civil items.
- Recommendations of foundation solutions.
- Indication/example of raft foundations for the current proposals.
- Establish groundwater conditions.
- Environmental and contamination testing of soils and groundwater.
- Facilitate archaeological watching brief.



4 Superstructure

4.1 Overview of the Superstructure - Office

The following section records the structural option studies undertaken in the development of the outline design and identifies those options and proposals to be taken forward into the scheme design stage. The outline design proposals discussed below are based upon the Stage 02 architectural coordination drawing set issued on April 10th 2019.

The majority of the building will feature office suites while the ground floor will accomodate a mix of industustrial units, retail areas, office and office lobby spaces.

The office building, located on the south side of the site, is proposed as a six-storey high building with roof levels approximately 65m wide x 46m long. Two sets of set backs are incorporated at the fifth and sixth floor.

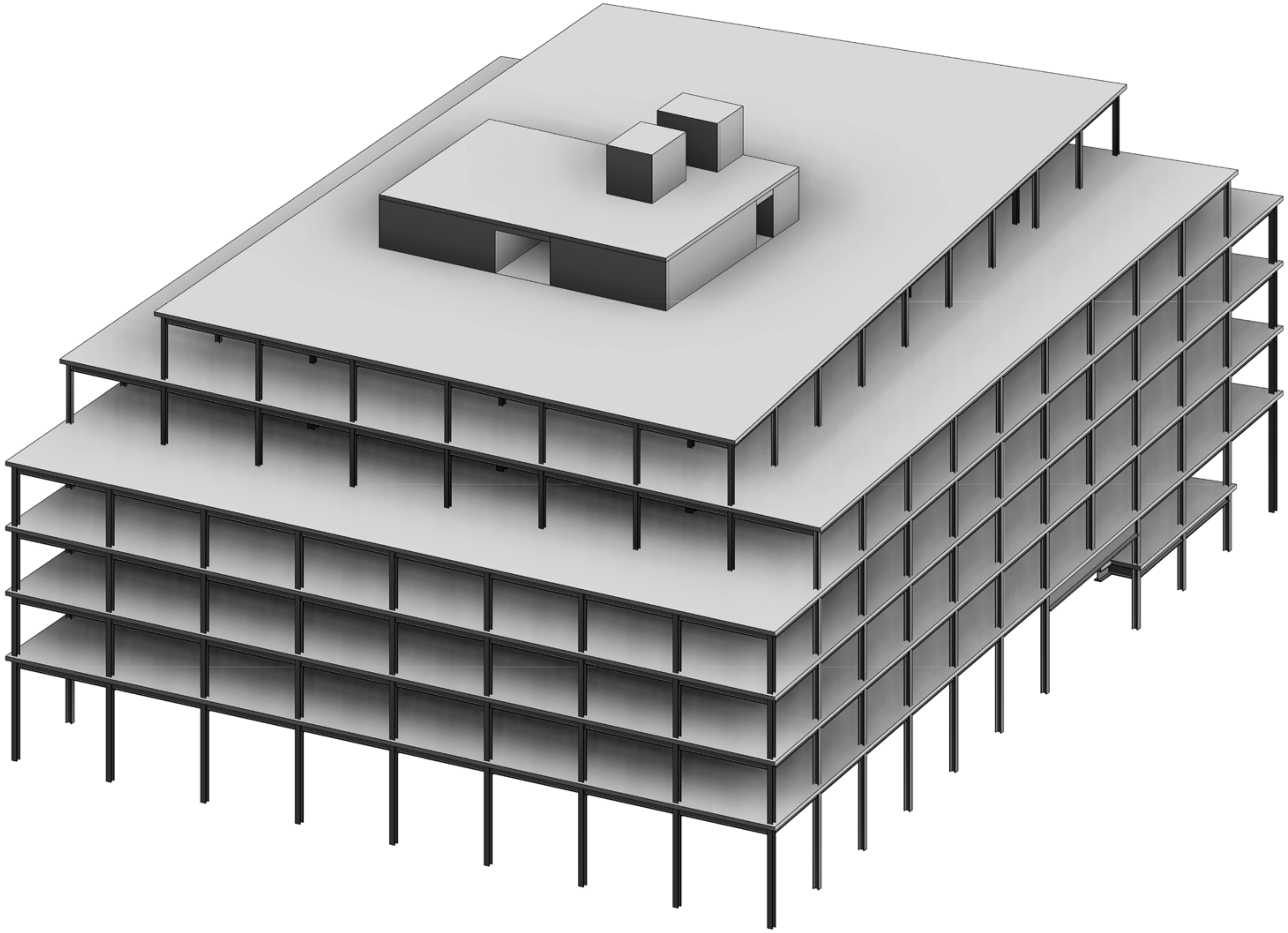


Figure 4.1 Office building superstructure (3D Isometric View)

4.2 Overview of the Superstructure - Residential

The two residential blocks situated North of the Office block have been incorporated into the development following conversations with the Camden Council which stipulated the introduction of housing.

Although joint with the Office and industrial and retail building through the shared basement, the residential structures are proposed as two distinct units scheduled to house seperate affordable and market apartments with retail/light industrial ground floor usages.

The residential superstructure consists of one six storey affordable block and another five storey market block.

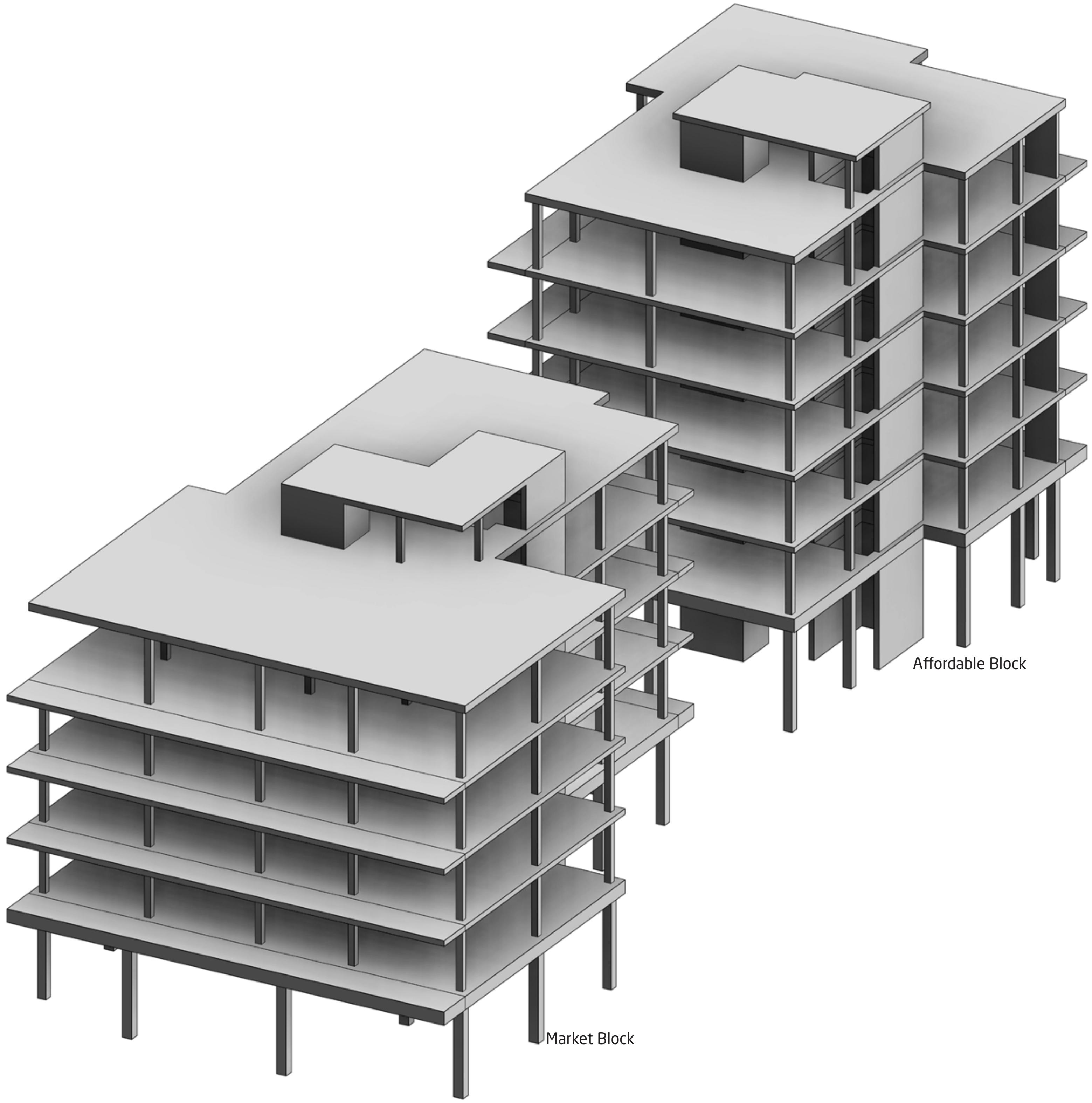


Figure 4.2 Residential building superstructure

5 Substructure

5.1 Overview

This chapter outlines the main aspects of the below ground structure with a narrative on foundation options for the current proposals. It should be borne in mind that the information contained in this section and the solutions presented are indicative only pending the receival of the final geotechnical site investigation report. At the time the current report is being produced, the site investigation works have been completed and a final issue of the reported findings is yet to be received. Based on the preliminary information available it seems that the proposed foundation system is suitable for the ground conditions on site. Attention is drawn to the potential excessive depth of Made Ground and potential large obstructions and contaminants.

The current proposals include a single basement level, approximately 4m deep from ground floor level at its maximum height with reducing heights due to steps at ground floor, which will primarily house plant areas,industrial units and retail units and cycle storage. The basement will be boxed out using perimeter retaining walls which will take the form of secant pile construction together with an internal liner wall and a capping beam. The columns and cores will be supported on the 1100mm deep raft foundation. An attenuation tank is proposed below raft level to reduce the collected rainwater peak discharge rate. The ground foor levels over the basement will be supported by the columns and cores extending down to the ground bearing raft.

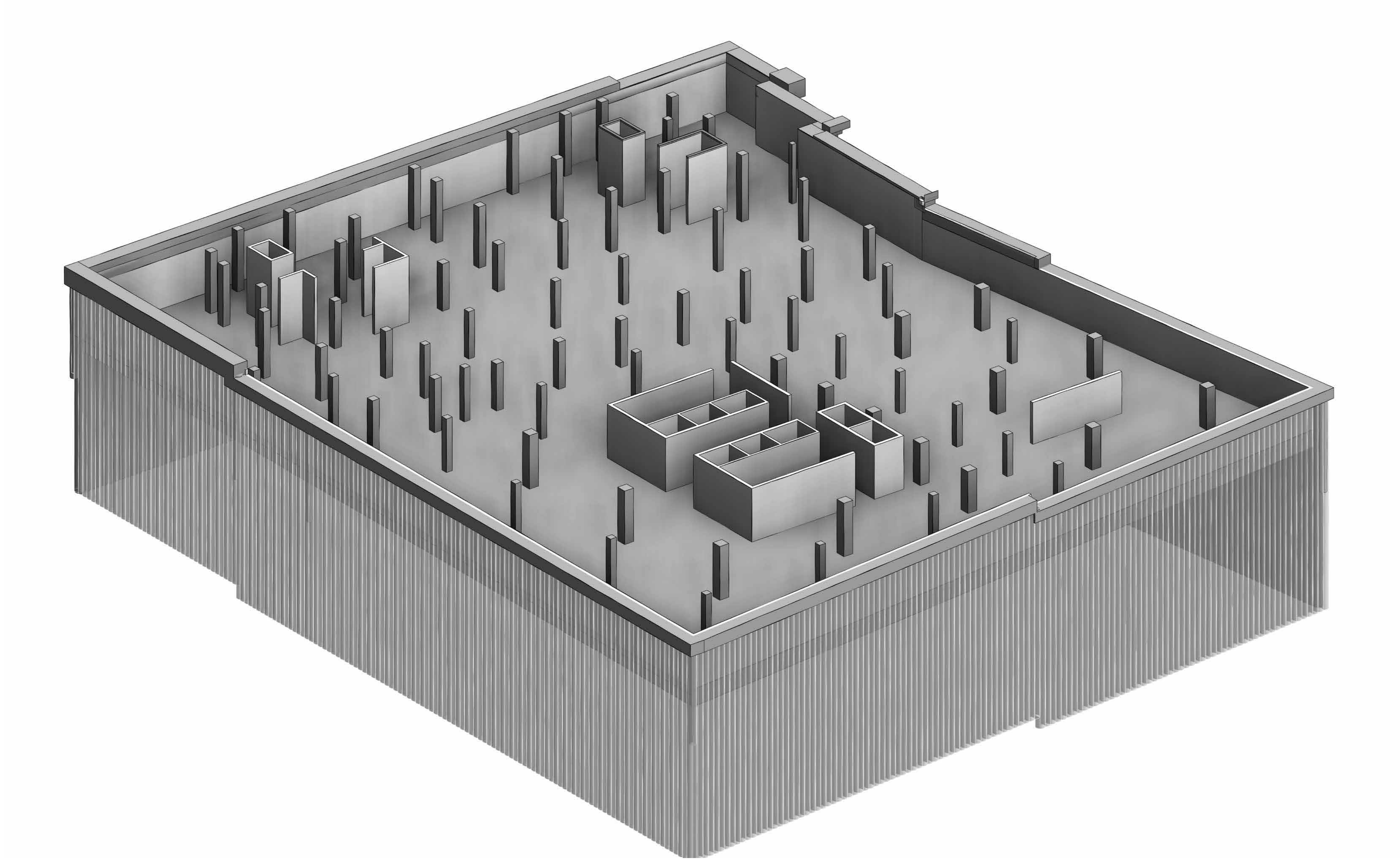
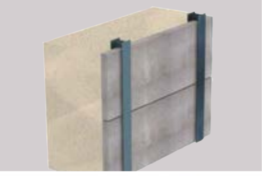
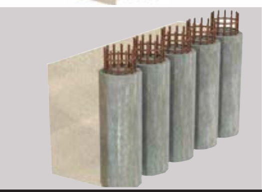
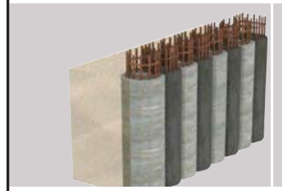
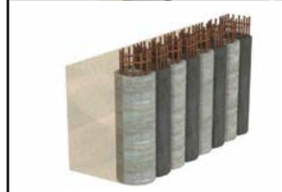
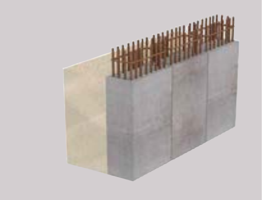


Figure 5.1 Substructure Isometric 3D View

5.2 Basement & Wall Options

Options for the basement retaining wall construction are summarised in this section providing a general overview on typical characteristics, advantages/disadvantages, and additional comments. The solutions will be narrowed down as more detailed design is undertaken however, an initial zone has been coordinated to allow the fexibility of available options. At the present stage, it is thought that secant piled wall construction would provide an adequate solution. This will need to be confirmed in the next stage of design.

	WALL CONSTRUCTION	TEMPORARY / PERMANENT SUPPORT	TYPICAL WALL DEPTH	TYPICAL RETAINED HEIGHT	USUAL INSTALLATION TOLERANCE: VERTICALITY	ADVANTAGES / DISADVANTAGES	REMARKS	Suitability
	**King Post Wall: Steel UC soldiers and timber or R.C. (or R.C./P-S.C. + grouting) skin wall/lagging**	Usually only temporary support	King posts typically 6 to 20m	3.5m as cantilever 12 to 15m anchored	1:100	Where good construction tolerances apply, the wall surface may be used as a permanent back shutter to an R. C. wall	Generally only used where groundwater is below formation level. Not feasible in soft and loose soils.	
	**Steel Sheet Piling**	Temporary or permanent support (e.g. in car park basements)	Typically 10 to 15m. Max pile length: ~30m	8 to 12m as single propped wall	1:75	Significant noise and vibration from installation. Vibration and noise can be overcome in some soils by use of hydraulic press equipment.	Re-use of sheet piles will often determine cost viability of temporary sheet piling. Difficulties installing through dense gravels and buried obstructions pose the risk of declutching.	
	**R.C. Piles** **Contiguous Piles**	Temporary and permanent support (where R.C. facing wall is used)	12 to 20m	6 to 15m propped or anchored	1:100	Cheapest form of R.C. piles when installed by cfa equipment. Not a water resistant wall	Non-interlocking of piles means little or no water resistance. Can be used with jet grouting to provide permanent water and soil exclusion	
	**R.C. Piles** **Hard/Soft Secant**	Temporary and permanent support, see note regarding durability	12 to 20m propped or anchored	6 to 15m	1:125	The use of a weak concrete mix to allow economical excavation of secant by male piles may also have durability disadvantages long term	May only be considered water resistant in the short term	
	**R.C. Piles** **Hard/Firm Secant**	Temporary and permanent support, see note regarding durability	12 to 20m propped or anchored	6 to 15m	1:125	The use of a stronger mix for female piles than that used for hard/soft secants may improve water resistance and durability long term	Possible suitable solution for current proposals, extent of basement, and likely ground conditions to be encountered	
	**R.C. Piles** **Hard/Hard Secant**	Temporary and permanent support, usually permanent	15 to 30m	10 to 20m propped or anchored	1:125 to 1:200	Depth limited by vertical tolerances which influence depth of cut secant joint, and their water resistance. Avoids the use of slurry	Female pile may be reinforced with UB section, male by UB or circular rebar cage. Shear plates may be welded to UBs before insertion for floor connections	
	**Diaphragm Walls installed by Grab**	Permanent (if temporary, then left in place)	15 to 30m	12 to 25m propped or anchored	1:125	Heavy installation plant and increasing difficulties in disposal of slurry pose disadvantages	Solution to deep walls in variable soil conditions with water retention. Difficulties may arise with excavation of obstructions, natural or otherwise. The wall surface may serve as the final finished surface for some applications	
	**Diaphragm Walls installed by Cutter**	Permanent (if temporary, then left in place)	15 to 50 m	12 to 35m propped or anchored	1:400	Improved installation tolerances but minimum job size influenced by large mobilisation and demobilisation costs	Solution to deep walls in variable soil conditions with water retention. Difficulties may arise with excavation of obstructions, natural or otherwise. The wall surface may serve as the final finished surface in some applications	

5.3 Foundations

Broadly speaking, there are two types of foundation solution: shallow foundations and deep foundations. The choice of foundations is very much dependent on the extent of the development; greater massing generally leads to greater foundations loads. The design of foundations is predicated on the exact ground conditions which will need to be confrmed in the next stage.

For smaller structures shallow foundations such as pad and strip footings are often a suitable solution. These spread the loads on to the founding soil strata. However with large structures, the magnitude of the loads are such that they exceed what is feasible or efcient at shallow depths.

In such cases the loads need to be transmitted to deeper strata where the soil or bedrock can be significantly stronger. Deep foundations generally come in the form of piles which can simply be considered as columns embedded in the ground.

5.3.1 Shallow foundations

Foundations, such as pad and strip footings, formed in relatively shallow strata are some of the most established methods of foundations in building construction.

For a large number of applications where massing is moderate in height, therefore loads are less onerous, and the ground strata is suitable, shallow foundations present the most efficient and economical approach.

Pad foundations are essentially designed to spread concentrated loads on to the founding strata so as not to exceed the soil's bearing capacity. Construction is relatively straightforward with excavations taken to formation level, blinding and reinforcement is placed before the concrete is poured to cast the element.

Strip foundations are similar to pad footings and their construction is typically similar. They are commonly used where the loads appear in a linear fashion, where geometry between pads overlaps or is very close, or for tighter control of settlementsbetween discrete foundations.

Raft foundations are typically designed to behave as a monolithic part of the structure and commonly encompass entire parts of a building. Depending on the scale of a given development, it is common for the lowest basement level to be formed by a concrete raft.

5.3.2 Pile Foundations

Pile foundations come in diferent types and form of construction, three of the most common techniques are summarised below:

- **Bored and cast in-situ piles:** These systems are well developed and comparatively cost effective for large applications. However, loose soils and high water tables often require bentonite slurry (which commands considerable site storage) or additional steel casing to support the borehole. The casing can be extracted and re-used or left in place where it is more economical for programme.
- **Continuous fight auger (CFA) piles**: Can be economical and often pose the least noise and vibration issues of all piling techniques. This technique is often used in situations where temporary casings would otherwise be required however, CFA rigs in the UK are not generally capable of achieving piles greater than 600mm in diameter or 35m in depth therefore the capacities are limited accordingly.
- **Driven Piles:** Can take the form of steel or precast concrete sections driven into the ground (at the head or the base) by a drop hammer or diesel hammer. The percussive nature of the installation means that considerable noise and vibrations are produced. Signifcant difculties are encountered when attempting to drive piles greater than circa 600mm wide or through very stif soils. Buried obstructions can also pose restrictions. In some cases a borehole can be pre-drilled.

Figure 5.2 Steel encased rotary boring (One Nine Elms, London)

Figure 5.3 Installation of pile cage reinforcement (One Nine Elms, London)

Figure 5.4 Pile cage reinforcement (One Nine Elms, London)

5.3.3 Foundation solution

A conventional reinforced concrete raft foundation has been adopted. This type and method of construction is believed to go hand in hand with the development of the overall project and with the findings of the geotechnical site investigation. However, at this stage a number of observations can be made from the design and investigation undertaken thus far. These will be considered in further detail in the next stage of design.

Considering as well the previous site usages and expected risk of soil contamination a raft foundation would relatively minimse the actual volume of dig required which would be higher in the case of a piled foundations.

Although not a significant problem given height of proposed developement, consideration should be given to potential diferential settlements to ensure the superstructure can routinely tolerate. It is noted that it is expected that a large proportion of settlement tends to occur during construction.

Where constraints pose a project risk or unknown, appropriate record should be made in the risk register with more clarity being provided as the project moves through the next stages of design.

The key engineering challenge is in accurately modelling the relative stiffness's of diferent parts of the site. The stifness is effected by several factors:

- 1) Ground conditions (depth of London Clay)
- 2) Existing state of stress in ground
  - Historic loading - (Unloading)
  - Future Loading - (Reloading)
- 3) Obstructions such as the foundations of the previous chimney located in the central portion of the site.

Items 1 & 2 above typically result in different degrees of heave or settlement at a point on the site. Item 3 can affect the amount of heave or settlement that will occur and the raft has to be designed to accommodate it.

5.4 Waterproofing

This section covers the structural aspects of providing water tightness to the basement areas of the development with respect to protection against groundwater. This generally covers the basement foors and walls only.

Guidance is provided by BS 8102 (2009) 'Code of practice for protection of below ground structures against water from the ground.

A clear understanding of the degree of water tightness is required by the Client before detailed design commences from the design team. This should be clarifed in the next stage of design. A number of parameters are key to the design of a coordinated water-resisting system:

- Required grade of environment: This is the most important parameter which needs to be agreed. Grades of basement environment are related to the proposed usage of the basement and their associated functional requirements. The table below provides useful guidance in this regard.
- Forms of construction: BS 8102 identifes three specifc methods of water-resisting construction as below.. The choice of method (or combination of methods) should be undertaken bearing in mind the required grade of environment as well as advantages/disadvantages and the types of warranties provided.
  - Tanked protection
  - Structurally integral protection
  - Drained protection
- Risk assessment: The level of risk of water, moisture, and water vapour penetration associated with each form of construction should be taken into account.

	Grade of Basement	Basement Usage (BS 8102)	Relative Humidity	Termperature	Performance Level Dampness	Wetness	Form of Construction (BS 8102)
	**Grade 1** **(Basic Utility)**	Car parking, plant rooms (excluding electrical equipment) workshops	>65% normal UK external range	Car parks: atmospheric Workshops: 15-19°C Mechanical plantrooms: 32°C max at ceiling level	Visible damp patches may be acceptable	Minor seepage may be acceptable	Temporary wall (concrete piles, steel sheet piles or kingpost) or battered excavation with reinforced concrete box design (Type B) in accordance with BS EN 1992-1. Permanent steel walls - welded-clutches (or adequately sealed with interlocked-clutches) steel pile walls to BS EN 1993-5.
	**Grade 2** **(Better Utility)**	Workshops and plant rooms requiring drier environment retail storage areas	35-50%	Retail storage: 15°C max Electrical plantrooms: 42°C max	No visible damp patches, construction materials to contain less than the air dry moisture content	None acceptable	Temporary wall (concrete piles, steel sheet piles or kingpost) or battered excavation with tanked protection (Type A) applied to a structure constructed from concrete or masonry offering no protection against the ingress of water and water vapour by the nature of its design. Protection is therefore totally dependant on a continuous barrier system applied to the structure. Temporary wall (concrete piles, steel sheet piles or kingpost) or battered excavation with reinforced concrete box design (Type B) in accordance with BS EN 1992-3/EN 1993.
	**Grade 3** **(Habitable)**	Ventilated, residential and working areas, including offices, restaurants, leisure centres	40-60%	Offices: 21-25°C Residential: 18-22°C Leisure Centres: 18°C for spectators 10°C for squash courts 22°C for changing rooms 24-29°C for swimming pools Restaurant: 18-25°C Kitchens: 29°C max	None acceptable Active measures to control internal humidity may be necessary	None acceptable	Temporary wall (concrete piles, steel sheet piles or kingpost) or battered excavation with tanked protection (Type A) applied to a structure constructed from concrete or masonry offering no protection against the ingress of water and water vapour by the nature of its design. Protection is therefore totally dependant on a continuous barrier system applied to the structure. Temporary wall (concrete piles, steel sheet piles or kingpost) or battered excavation with reinforced concrete box design (Type B) in accordance with BS EN 1992-3/EN 1993. Temporary wall (concrete piles, steel sheet piles or kingpost) or battered excavation with structure to minimize the ingress of water. Any moisture which does find its way into the basement is channeled, collected and discharged (Type C) within the wall and floor cavity with a DPM.
	**Grade 3** **with enhanced active ventilation/de-humidification (previously grade 4 under BS8102-1990)**	Archives and stores computers Requiring controlled environment	50% for art storage >40% for microfilms and tapes 35% for books	Art storage: 18-22°C Book archives: 13-18°C	Active measures to control internal humidity probably essential	None acceptable	Temporary wall (concrete piles, steel sheet piles or kingpost) or battered excavation with tanked protection (Type A) applied to a structure constructed from concrete or masonry offering no protection against the ingress of water and water vapour by the nature of its design. Protection is therefore totally dependant on a continuous barrier system applied to the structure. Temporary wall (concrete piles, steel sheet piles or kingpost) or battered excavation with reinforced concrete box design (Type B) in accordance with BS EN 1992-3/EN 1993 plus a vapour proof membrane. Temporary wall (concrete piles, steel sheet piles or kingpost) or battered excavation with structure to minimize the ingress of water. Any moisture which does find its way into the basement is channeled, collected and discharged (Type C) within the ventilated wall cavity with vapour barrier to the inner skin and floor cavity with DPM.

5.5 Basement Structural Layout

Due to different column grids at floor above the basement from the office and residential building an approximate 9mx9m grid was generated in the basement. Additional columns were added to produce the grid (shown in blue on Figure 8.4). Facade columns from the levels above will be transferred to the retaining walls except for the internal facade line between the buildings which will be transferred to columns below (shown in pink on Figure 8.4).

A 450mm slab at the GF level with higher loaded areas being a 600mm slab to accomodate a 30kPa loading (this will need to be further investigated in the future to due to the onerous loading).

Several steps are proposed in the Ground Floor RC slab to accommodate the existing ground sloping gradient which generates a difference of approximately 2m from North to South. All steps are proposed to occur on column lines in the basement. The steps are to be further rationalised in the following stages (where required) through consideration of adding additional void formers to achieve intended FFL levels.

Different thickness are proposed for the GF slab in relation to the steps described above and intended usages (Loading bay/internal street, light industrial, retail, landscape etc.).

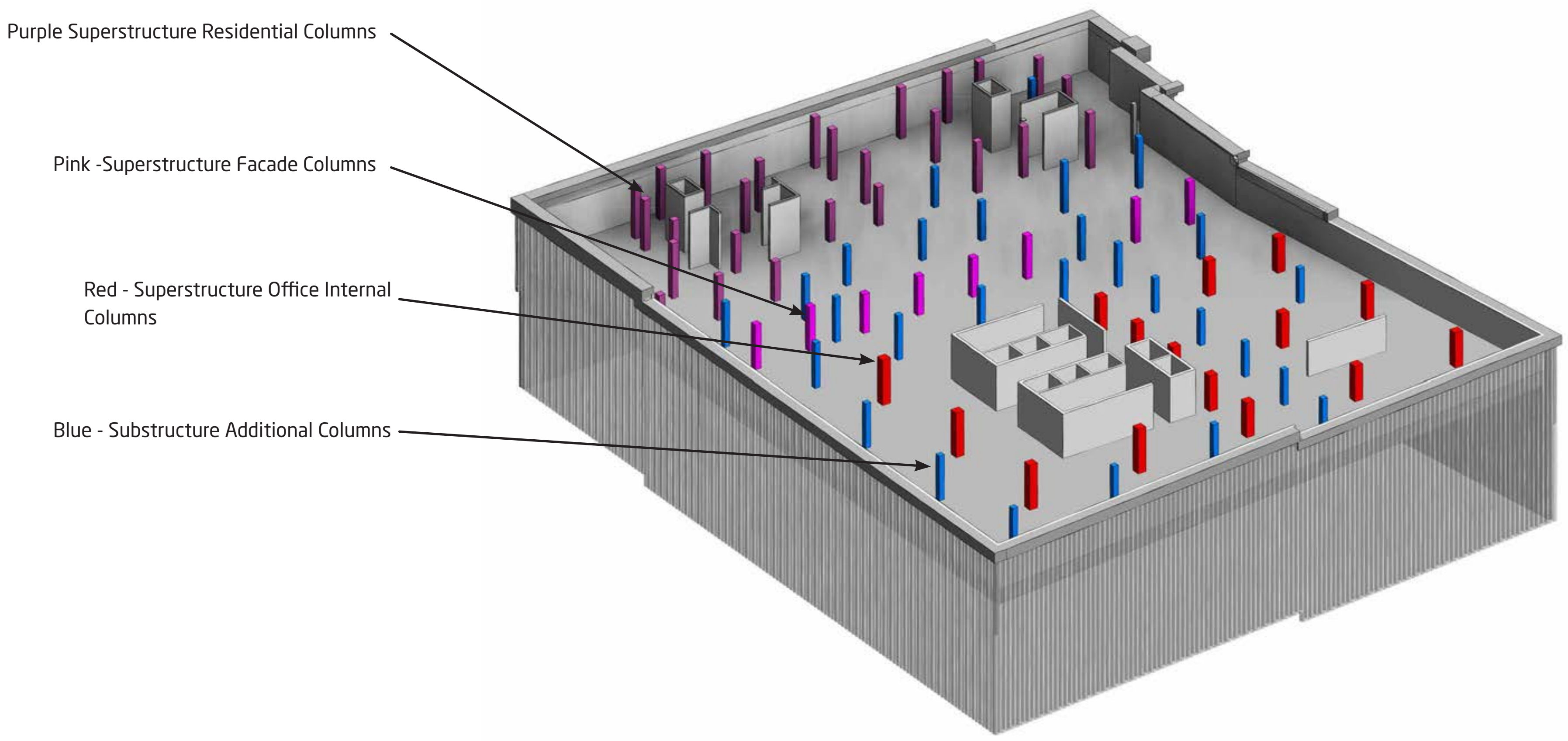


Figure 5.5 Basement columns

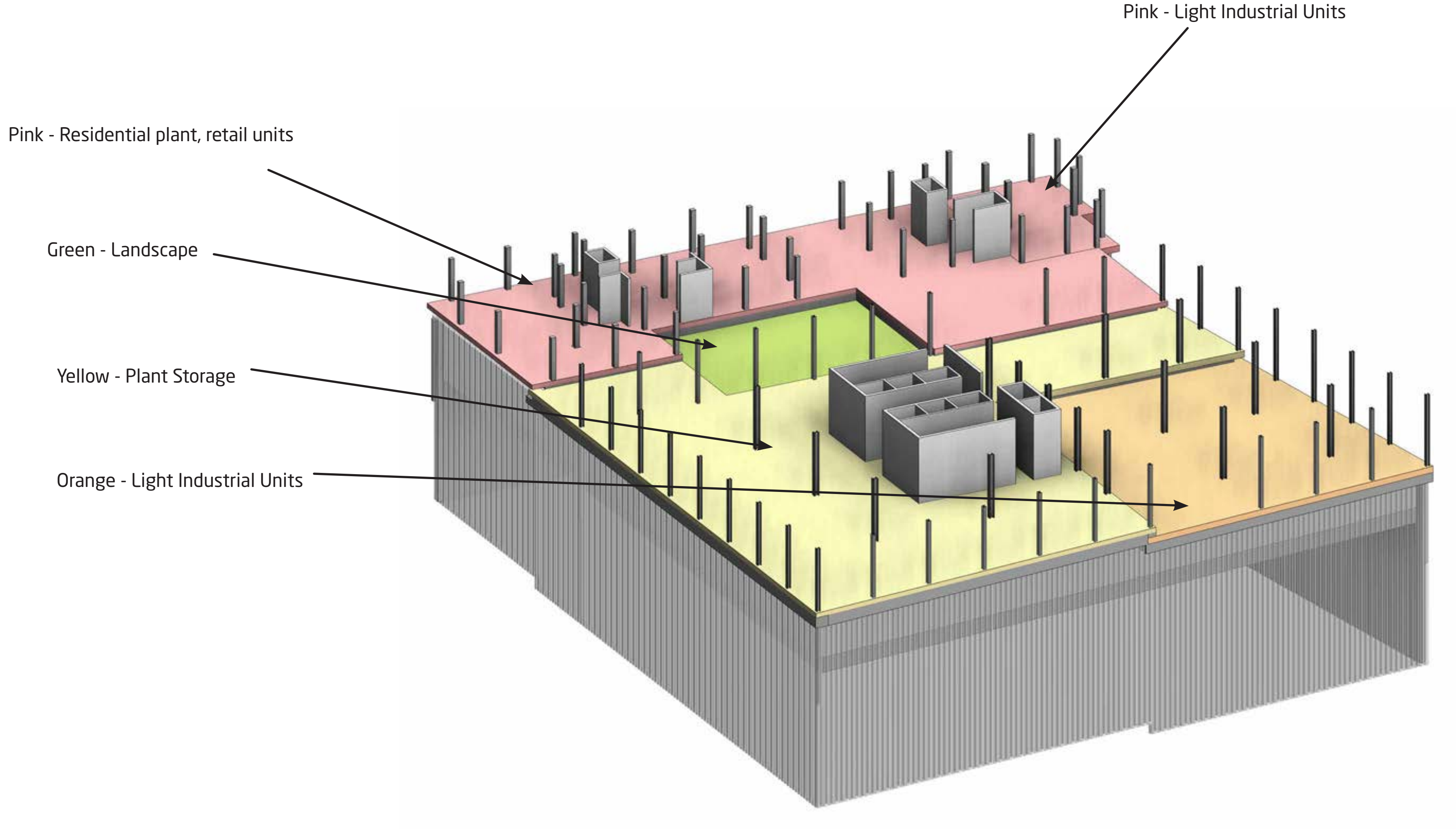


Figure 5.6 Ground floor step levels

6 Construction Methodology / Buildability

6.1 Preface

Consideration of the sequence of construction activities for any building project is an important part of the design process.

This section aims to summarise the assumed construction method for the current proposals which should be taken as indicative only. At the next stage of design an outline construction programme will be required in order to expand on the costruction design and verify assumptions. It is recommended that contractor input is sought to advise on construction programme items which for the current stage has been assumed to take the form of a bottom up sequence.

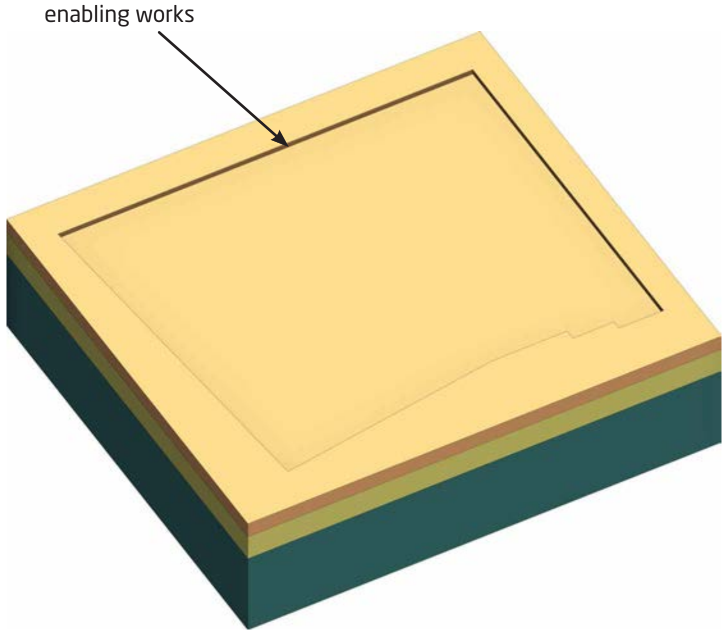
6.2 Bottom up sequence

Arguably the most common method of basement construction is the bottom up sequence. This method generally offers a simpler methodology and involves constructing the substructure followed by the superstructure sequentially.

A potential bottom up sequence is illustrated below which for the purposes of this report this has been simplifed. Further details on the sequence and any unique items should be sought in the next stage of design.

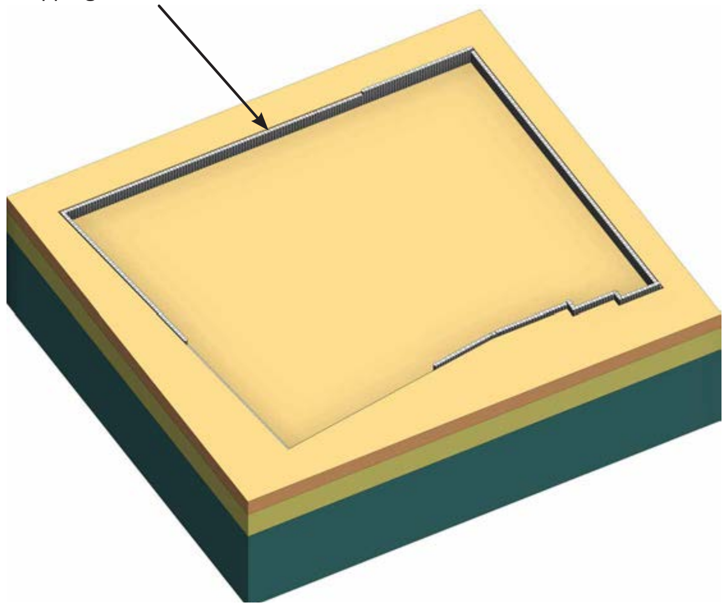
1.

- Site post demolition, clearance and enabling works



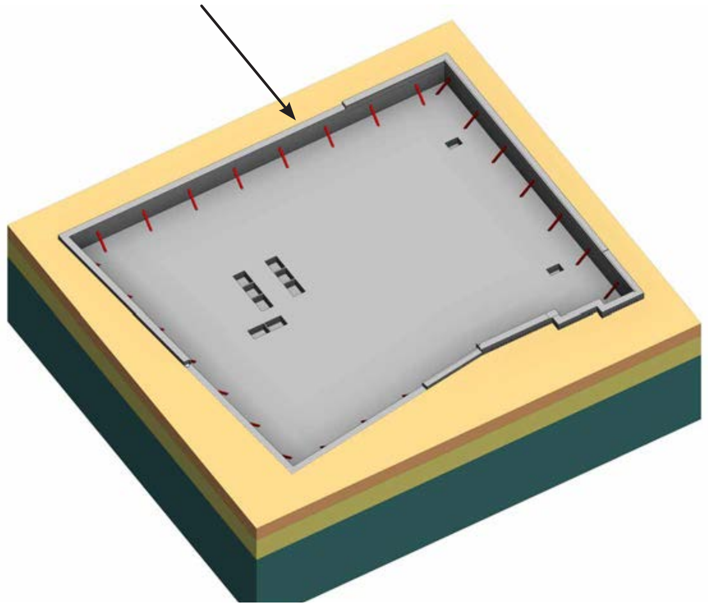
2.

- Perimeter retaining secant pile wall and capping beam installed



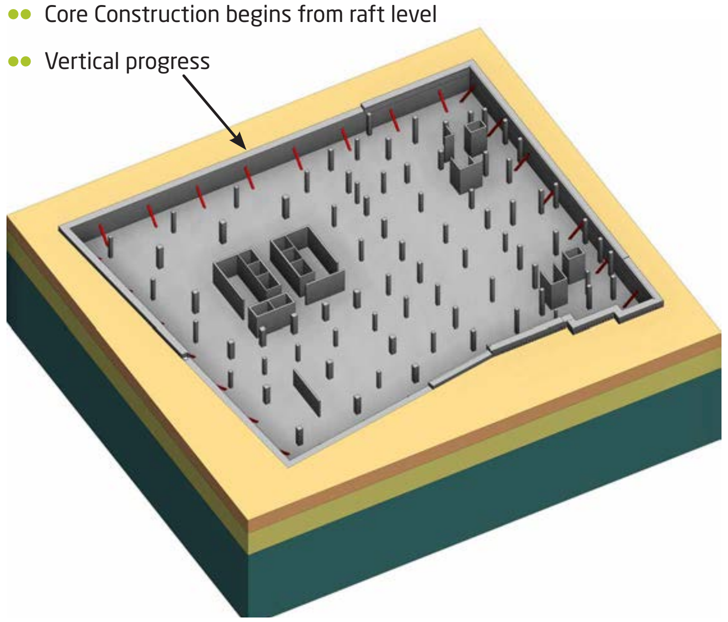
3.

- Temporary props installed
- RC Raft cast



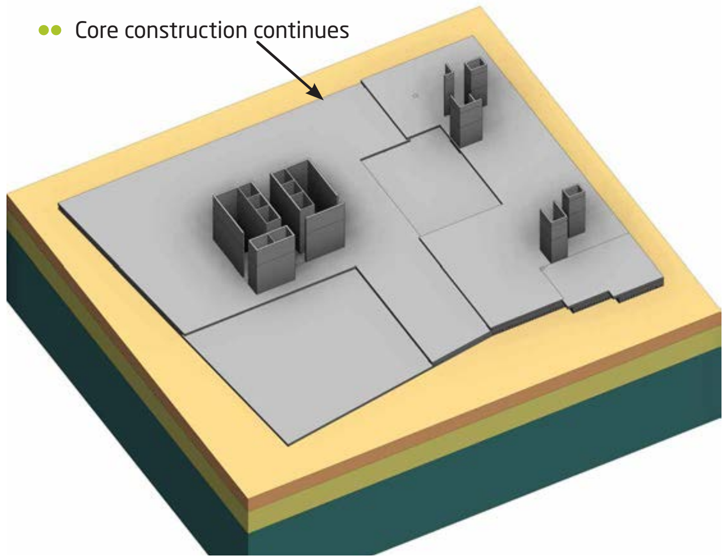
4.

- Core Construction begins from raft level
- Vertical progress



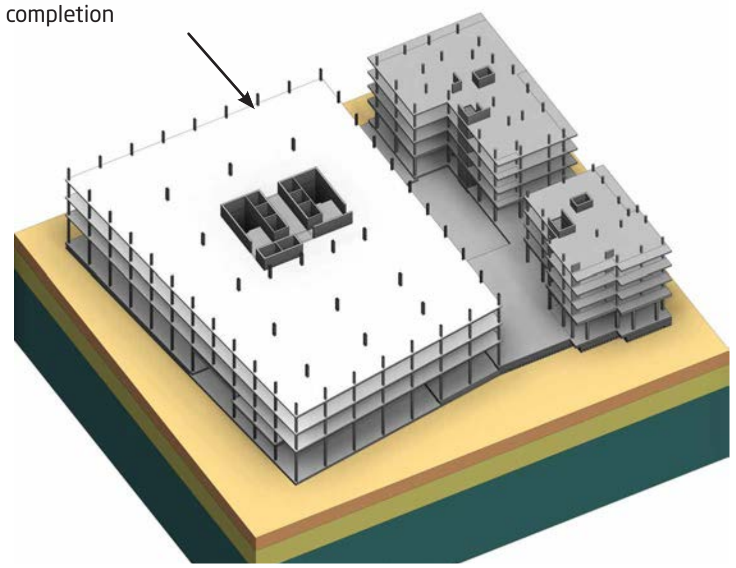
5.

- Ground floor slab cast, all temporary props removed
- Core construction continues



6.

- Superstructure constructed to completion



7 Design Standards

7.1 Design standards and guides

The building will be designed in accordance with the following standards. For the sake of brevity. National annexes are not listed.

- BS EN 1990 - Basis of structural design
- BS EN 1991 - Action on structures
- BS EN 1992 - Design of concrete structure
- BS EN 1993 - Design of steel structures
- BS EN 1994 - Design of composite steel and concrete structure
- BS EN 1997 - Geotechnical design

Additional guidance on geotechnical aspects and issues relating to the basement impact has been taken from the following:

- CIRIA C760 - Guidance on embedded retaining wall design, Gaba et al, CIRIA
- Concrete Basements - Guidance on the design and construction of in-situ concrete basement structures, Narayan & Goodchild, Concrete Centre.

8 Impact Assessment

8.1 Analysis and Process

The impact assessment will be carried out in stages appropriate to the level of design. At the time of writing, the design is at the concept stage, and there are a number of assumptions that need to be validated before the impact assessment can be concluded.

The following section gives and outline of these assumptions, and the process which will be followed in order to gain the necessary third party approvals

8.1.1 Data and assumptions

The key information required to fnalise the design can be broken into the following sub-categories. The current assumptions within each category are defned below.

Form and Loads

As the design develops, the massing of the building could be subject to change and this can afect the outcome of any analysis carried out. It is therefore essential that the form of the building is fixed prior to commencement of the approvals processes. Similarly as the use of the building changes, the applied loads will follow accordingly.

Construction Sequence

The construction phasing shall be considered in the assessment of time dependant effects. At this stage, a traditional bottom up sequence is being assumed, however as discussed in previous sections of this report, this is subject to a number of infuencing factors, and while unlikely, it is possible that this may change.

Ground Conditions

Site investigation has been completed and is being reviewed in order to establish the soil parameters necessary to complete a detailed assessment of the ground movements for comparison against relevant acceptance criteria.

Third Party Assets

As dialogue continues with third parties, assumptions relating to location, fabric and condition of adjacent / underground structures may change.

8.1.2 Initial modelling

Based on the structural solution at planning, initial models will be developed once the form, construction and ground conditions have been finalised post planning. These will be used to assess the potential impact on adjacent structures.

Based on the findings of the project specific site investigation, the aim of these analysis models will be to establish the likely magnitude of the impact on any surrounding assets, and provide values which can be used as a basis for initial discussions with third parties as necessary.

The assessment of ground movements will typically comprise of the following analysis types, addressing both vertical and horizontal movements:

- Analysis of the proposed retaining wall considering short and long term conditions, accounting for the consolidation of the clay which is linked to variation in pore water pressures and soil properties. The method and software used shall assess the horizontal movements, forces and moments of the retaining wall during excavation and construction of the proposed development.
- Review of predicted ground movements against empirical derivations and case study data (eg CIRIA C760 data). The results will be assessed against relevant acceptance criteria in order to secure the relevant formal approvals for the works to be undertaken. Any resulting requirements with regard to the Contractors' methodology will be detailed and enforced through the project specifcations and preliminaries. From these initial calculations and discussions, it may be concluded that the results of the initial modelling are sufficient to gain approvals, or as agreed with third parties whether more detailed modelling is necessary.

8.1.3 Detailed modelling

Where detailed analysis is considered necessary, the initial calculations will be expanded upon through more rigorous analytical processes.

The key elements of this stage will consist of Elastic plane-strain 2D section cut analyses for assessment of lateral and vertical ground movements in regions adjacent to the excavation. A full 3D analysis of the ground may be required in some cases. The requirements of the analysis are varied depending on the approvals process of the asset in consideration, and the scope will be discussed and agreed with the relevant parties as necessary.

Following the outcome of the analysis described in the previous section, and appropriate consultation with third parties, the following aspects will be addressed.

8.2 Impact on adjacent buildings / Assets

The impact of the proposed development on the adjacent buildings will be assessed and approvals secured via party wall awards where required.

A package of relevant drawings, calculations and reports shall be prepared for review by the adjacent owners appointed structural engineer and relevant third parties. Assumed temporary works designs shall be prepared prior to the Contractor completing the final design.

A summary of the existing structures in the immediate vicinity of the site (as shown in fgure 8.2):

- EDF Energy Building / Kelley House Garden: is immediately North of St Pancras commercial centre site, The existing properties are approximately 2 and 3 storeys in height. Both structures are likely of RC frame construction with shallow foundations. It is unknown of any current basement levels. There is also a car park on the East side of the site.
- St Pancras Way Bridge: to the North East of the site and will potensially have shallow foundations and may potentially be affected by vibrations on the bridge.
- Regents Canal: Flowing East of the site.
- Star Wharf Apartments: East of the site and appears to be of similar construction. It stands at approximately 6 storeys with possible deep and/or shallow foundations. it is not known if there are any current basement levels.
- Fleet Sewer: The sewer under Georgiana Street is in immediate proximity of the site.

8.2.1 Damage criteria assessment

The lateral ground movements will be predicted from both short term and long term retaining wall analyses; this is combined with vertical settlement predictions in accordance with CIRIA C760 to develop a ground model. This model shall be used to assess the impact upon adjacent buildings. It is proposed to use the classifcation of visible damage to walls scheme as outlined in CIRIA C760 with reference to Burland et al,1977, Boscardin and Cording,1989; and Burland,2001. Subject to the approval of adjacent owners' party wall surveyor and relevant LBC, Damage Category (very slight) shall be assumed to be acceptable. This will be subject to party wall and 3rd party agreements determined in the next stage of design.

8.2.2 Survey and monitoring

A regime of surveys and monitoring of the surrounding building, third party assets, proposed/existing retaining walls and adjacent pavements may need to be implemented depending on the results of the movement analysis and the condition of assets.

Appropriate green, amber and red trigger levels shall be set with reference to relevant CIRIA guidance documents on the observational methodology. The scope of monitoring may include the following:

- Movement monitoring of structures in the immediate vicinity via targets surveyed using electronic levels.
- Vibration monitoring using transducers placed on the foundations of the adjacent buildings.
- Crack monitoring via the use of graduated tell-tales.
- Movement monitoring of retaining wall/capping beams via targets surveyed using electronic levels.
- Monitoring of adjacent pavement levels via studs surveyed using electronic levels.
- Monitoring of retaining wall movements via use of Inclinometers cast in secant piles .
- Potential use of extensometer bored in place to monitor heave movements in clay.

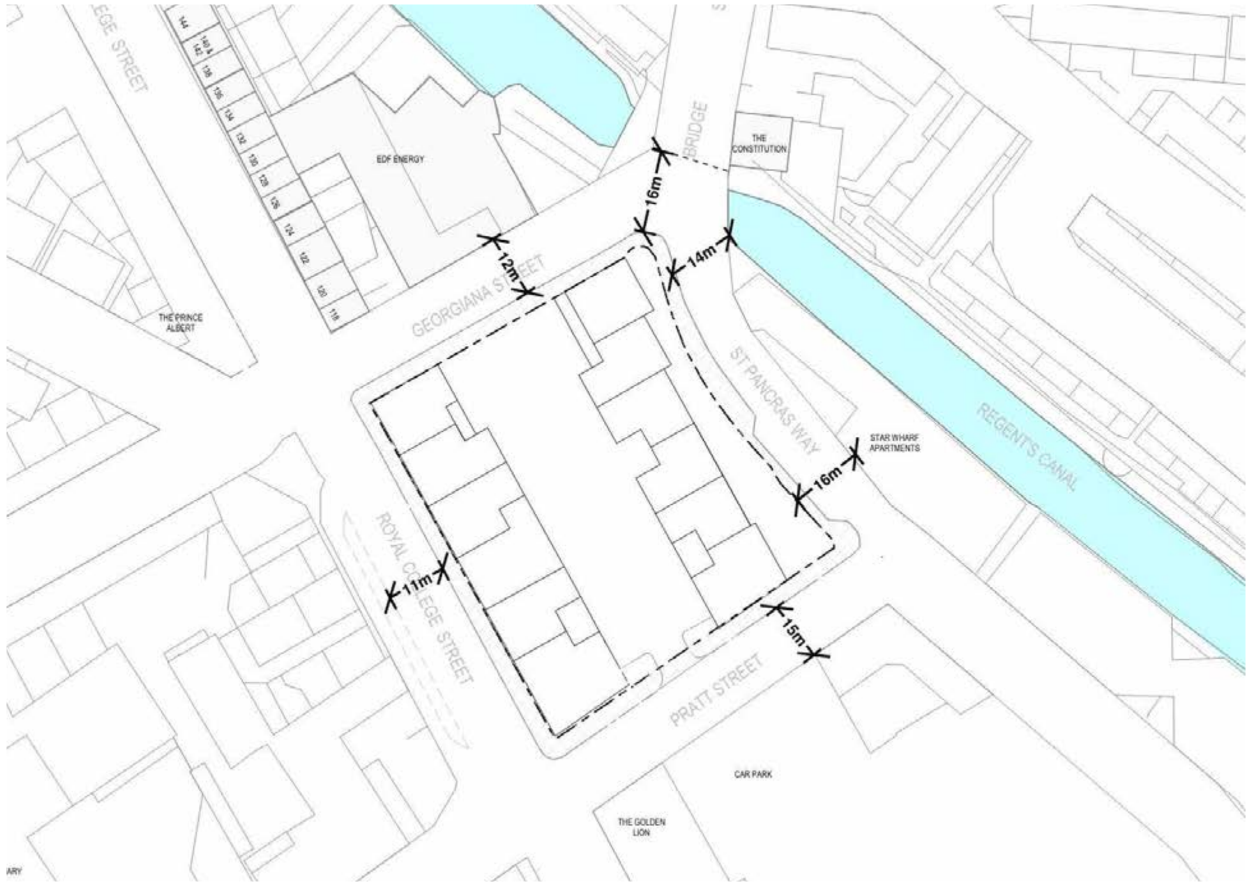


Figure 8.1 Proposed site plan with approximate distances to neighbouring structures

Table 6.4 Classification of visible damage to walls (after Burland et al, 1977, Boscardin and Cording, 1989, and Burland, 2001)

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	

Notes

1 In assessing the degree of damage, account must be taken of its location in the building or structure.

2 Crack width is only one aspect of damage and should not be used on its own as a direct measure of it.

Figure 8.2 CIRIA C760 damage criteria for varying levels of strain

8.2.3 Utilities approval

Statutory searches have been undertaken as part of the initial desk study carried out. From the fndings of these searches, it is expected that the following third party approvals will be required prior to the commencement of construction activities.

UKPN & Telecommunications

A statutory utilities search indicates that there are a number of services in the vicinity of the site which include UKPN, British Telecommunications, and British Telecommunication assets. These are likely to be located beneath the surrounding pavements and will require third party approvals.

THAMES WATER

Generally speaking, depending on advised construction type and proximity, sewers can be sensitive to movements generated as the ground heaves and settles from demolition, excavation, and construction activities.

In this respect, dialogue has been established with Thames water with regards to assets present in the immediate vicinity of the site. In particular, conversations have been engaged with regards to the old Fleet Sewer which connects to the trunk network along the North-East corner of the site, beneath the public highways which border the site. This sewers appears to be of Victorian masonry construction and of varying sizes.

8.2.4 Highway approval

The proposed basement construction is adjacent to public roadways on all four sides. An Approval In Principle (AIP) document will potentially be required in accordance with the provisions of the Highways Agency and the London Borough of Camden. Where appropriate assumptions on temporary works shall be outlined within the AIP. Final methodologies shall be determined by the Contractor who shall be expected to adhere to the specifcations of the permanent works.

The Contractor will be expected to liaise with the third parties as necessary to obtain the necessary licenses for temporary works supporting adjacent highway structures.

8.2.5 Groundwater flow

With the completion of the Site Investigation report groundwater was recorded at 41m below ground level within the boreholes on site. The perched water table was found in the Made Ground at approximately 4.13m and 5.48m below ground level.

Once the basement is formed, over time the hydrostatic profile will find its equilibrium and the building as a whole will need to resist any associated up-lift loads. As the bottom of the basement will be approximately 5m below ground level, it is not expected to significantly obstruct perched water level; it is possible however that localised 'damming' will arise locally in the upstream water levelsand in effect cause a decline in downstream water levels. Due to large obstructions potentially present on site, as indicated by the desk study report and the completed site investigation works, it is not expected that the proposed development will not change the current flow which is expected to already be disturbed by the underground obstructions.

As stated in "Guidance for subterranean development" (London Borough of Camben, 2010):

"A solitary, isolated basement which intersects the groundwater table is unlikely to affect the groundwater flows in the wider area: the water will simply flow around the obstruction. The effects on water level are likely to be small and less significant than seasonal or other existing variations in the groundwater table".

This document was published by the Borough of Camden, based on this and the clarifications in this note it is considered that the proposed new basement for the St Pancras Campus development is unlikely to have a significant impact on the shallow groundwater table.

8.2.6 Surface water flow

The majority of the site in its current condition is paved or features hardstanding. The area of hardstanding is not expected to increase as a result of the current proposals.

For further detail please refer to the independent Flood Risk Assessment report.

8.2.7 Land/slope stability

The site is at approximately 25m AOD and has variance of approximately 4m in elevation over a 74m horizontal distance from the highest point at the North most point of the site to the East of the site. This generates a maximum approximate slope of 3 degrees on the site.

Information obtained through statutory searches from the Landmark Information Group have not indicated any known historic land instabilities or geological faults beneath the site.

8.2.8 Archaeology

An archaeological desk based study was performed by the Archaeology Collective, it was concluded that no world heritage sites or monuments would be contained in the site. Although it was determined there may be a medium to high potential of remains from St Pancras Vestry Refuse Destructor and the St Pancras Generating Station.

Reference should be made to the independent site specifc archaeological documentation included in the relevant submittal for further information.

8.2.9 Construction management plan

Reference is drawn to the draft Construction Management Plan (CMP) included with the submission and the notes related to phasing contained within this report. This will be further developed during subsequent stages of design and planning of the works following discussions with and the appointment of a main contractor.

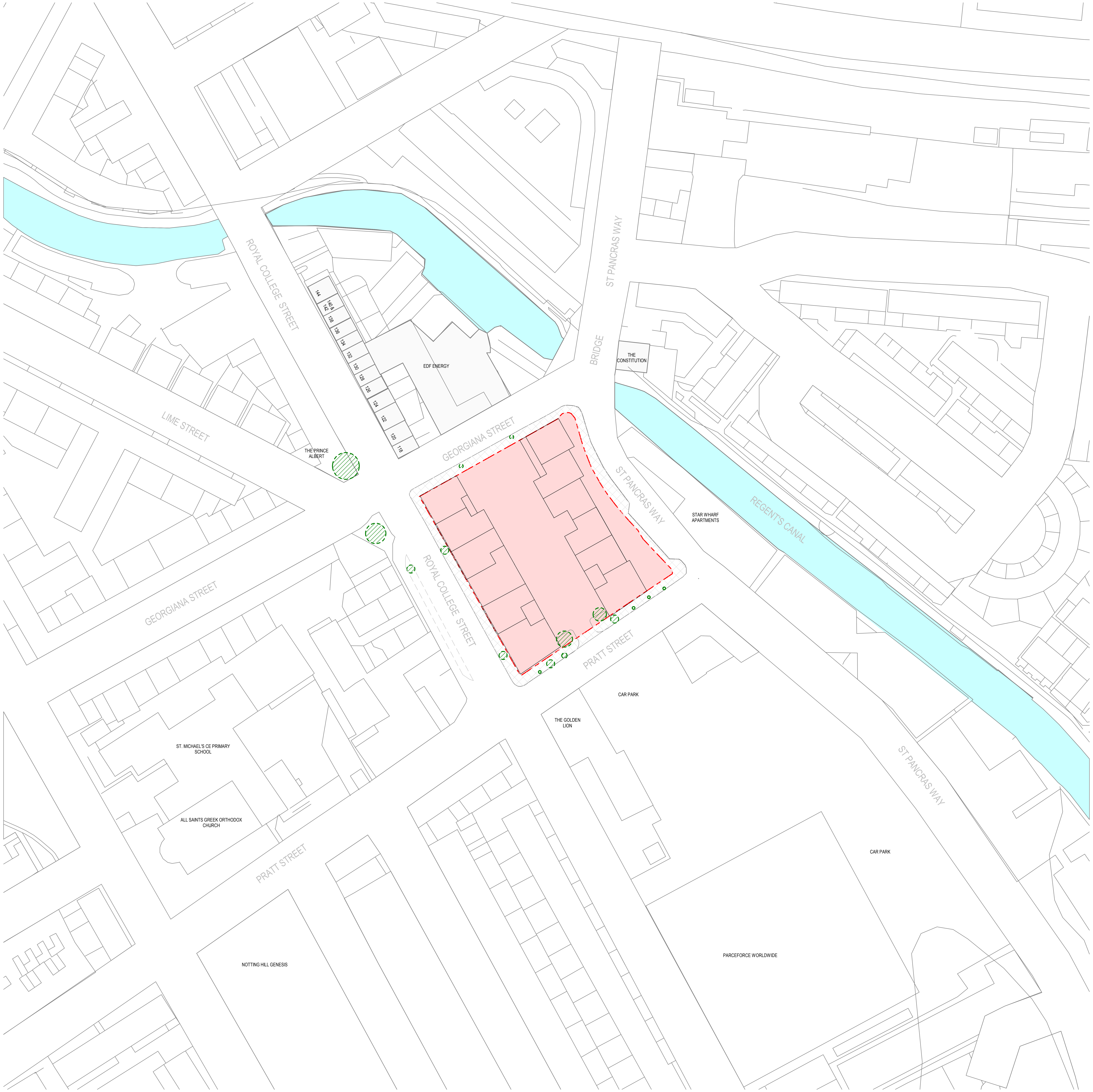
9 Conclusion

The information presented in this document provides an overview of the proposed development of the St Pancras Commercial Centre scheme with emphasis on the substructure and the basement impact assessment.

As noted in the previous sections of this report, the framework, design philosophy, and procedures set out above will form the basis for the detailed analysis and assessment works that will subsequently be required to secure the necessary third party approvals prior to commencing works on site.

Appendix 1

Site Constraints



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GENERAL NOTES

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL DIMENSIONS ARE IN MILLIMETRES (mm) AND ALL LEVEL ARE IN METRES (m) UNLESS NOTED OTHERWISE.
3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.
4. THE LOCATION OF EXISTING SERVICES ARE INDICATIVE ONLY. AND THE EXACT LOCATIONS MUST BE CONFIRMED ON SITE.

LEGEND

- PROPOSE SITE BOUNDARY T.B.C.
- EXISTING BUILDINGS
- EXISTING ADJACENT BUILDINGS
- EXISTING PAVEMENT
- INDICATIVE LOCATION OF THE EXISTING TREE . ROOTS PROTECTION AERA TO BE CONFIRMED BY THE ARBOCULTURAL SURVEY.

REV	DATE	DESCRIPTION	BY	CHKD
P01	03.05.19	ISSUED FOR STAGE 2 REPORT	SK	LM

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WESTMINSTER REAL ESTATE

CLIENT

ST. PANCRAS CAMPUS

PROJECT

SITE CONSTRAINTS - SHEET 1
ABOVE GROUND

TITLE

SS DRAWN	LM CHECKED	01.08.2018 DATE	A1 SHEET SIZE
STAGE 2 STATUS			S4 SUITABILITY CODE

FOR INFORMATION ONLY

4409-AKT-XX-XX-SK-S-00050

DRAWING No. REVISION

01/05/2019 11:07:30

GENERAL NOTES

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL DIMENSIONS ARE IN MILLIMETRES (mm) AND ALL LEVEL ARE IN METRES (m) UNLESS NOTED OTHERWISE.
3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.
4. THE LOCATION OF EXISTING SERVICES ARE INDICATIVE ONLY. AND THE EXACT LOCATIONS MUST BE CONFIRMED ON SITE.

LEGEND

- EXISTING TELECOMUNICATIONS
- EXISTING GAS
- EXISTING SEWER
- EXISTING WATER
- EXISTING POWER DISTRIBUTION
- EXISTING HIGH VOLTAGE
- PROPOSE SITE BOUNDARY T.B.C.
- EXISTING BUILDINGS
- EXISTING SUBWAY UNDER T.B.C.
- EXISTING VAULTS UNDER PAVEMENT T.B.C.
- POTENTIAL EXISTING CHIMNEY FOUNDATION LOCATION T.B.C.
- INDICATIVE LOCATION OF THE EXISTING TREE . ROOTS PROTECTION AERA TO BE CONFIRMED BY THE ARBOCULTURAL SURVEY.

NOTE:

THE UTILITIES SHOWN ARE BASED ON LANDMARK REPORT ISSUED ON JUNE 2018, FILE NAME "Digital Utility Overview Plan_B ". THE EXACT LOCATION MUST BE CONFIRMED ON SITE.

THE POTENTIAL VAULTS AND SUBWAY WERE TAKEN FROM HISTORICAL DOCUMENTATION, BASED ON DESK STUDY REPORT, THE VAULTS ARE CURRENTLY UNKNOWN AND WILL BE INFORMED BY THE FABRIC SURVEY ON NEXT STAGE.

REV	DATE	DESCRIPTION	BY	CHKD
P01	03.05.19	ISSUED FOR STAGE 2 REPORT	SK	LM

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PROJECT

SITE CONSTRAINTS - SHEET 2
BELOW GROUND
TITLE

DRAWN	CHECKED	DATE	SHEET SIZE
SS	LM	01.08.2018	A1

STATUS	SUITABILITY CODE
STAGE 2	S4

FOR INFORMATION ONLY

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