4 Ground Conditions

4.1 Geology

A site investigation specific to the proposed development has been carried out by GEA Ltd at the site which included one 15m borehole, a window sample, 14 trial pits, and gas and water monitoring wells. This revealed the stratigraphy to be made ground overlying London Clay at depths exceeding 15m depth. The site investigations confirmed the stratigraphical succession suggested by the published geological records. Detailed geographical data as well the logged records of the boreholes and window samples are available in the full site investigation report prepared by GEA Ltd in Appendix D. This document should be reviewed when using geological information for design purposes, the summary included in this document is for general information only.

Description	Constituents	Depth to top of strata (m)	Thickness (m)
Made Ground	Dark brown and grey very silty sandy gravelly clay, sand and silt with cobbles, fragments of brick, concrete and pockets of ash	Ground Level	1.9 – 3.9m
London Clay	Initial weathered horizon of firm fissured medium strength brown and pale grey mottled silty clay with orange-brown sand partings, occasional coarse selenite and pockets of bluish grey sand and silt	1.9m and 3.9m	3.0m and ~2.1m
London Clay	Firm becoming stiff fissured medium to high strength pale grey and brown mottled silty clay with fine selenite, becoming very silty	4.9m and 6.0m+	10.1m+ and ~9.0m+

4.2 Soil Parameters

GEA have defined the following design parameters for the London Clay:

Stratum	Bulk Density (kg/m3)	Effective Cohesion (c' – kN/m2)	Effective Friction Angle (Φ' – degrees)
Made Ground	1700	Zero	27
London Clay	1950	Zero	23

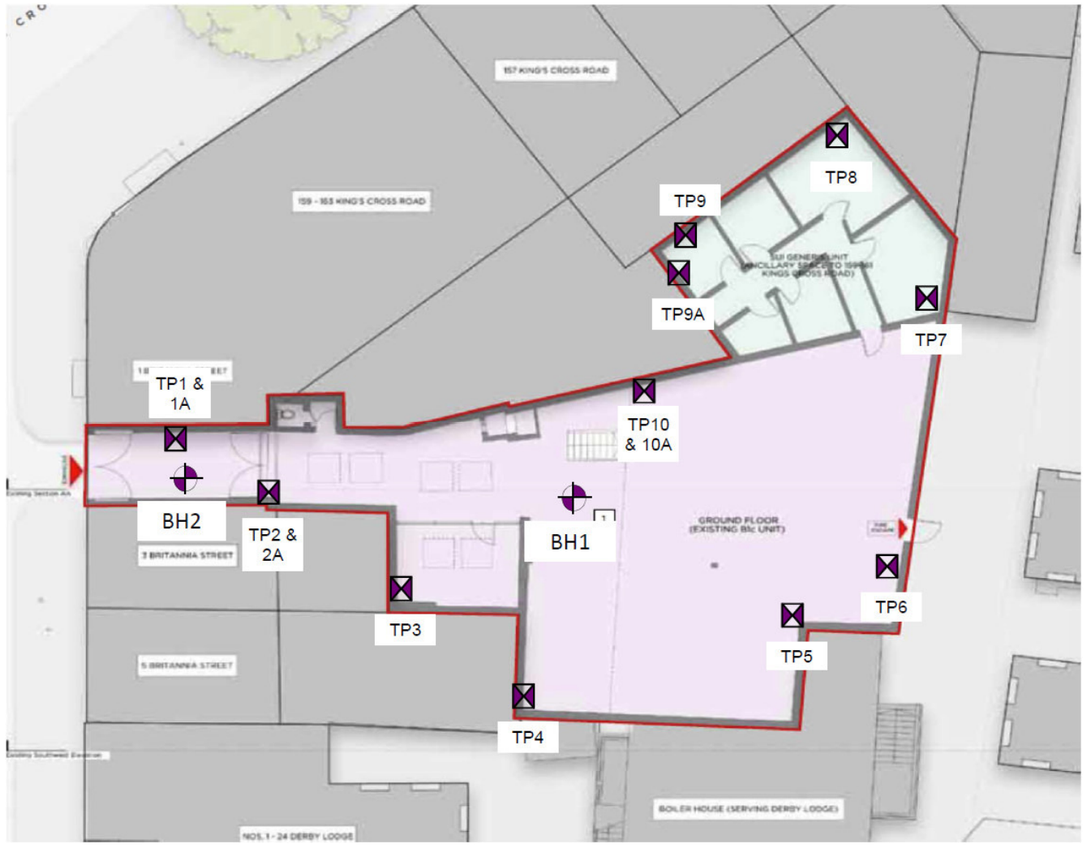
Refer to Appendix D for further details on testing techniques and the sample selected.

4.3 Ground Water

Groundwater was encountered during drilling in Borehole No 2 only, at a depth of 3.0 m towards the base of the made ground, which extended to a depth of 3.8 m. Monitoring of the standpipes has indicated the groundwater to be at depths of 5.0 m and 2.6 m in Borehole Nos 1 and 2 respectively, four weeks after completion of the boreholes. While groundwater was found, the report highlights that "significant inflows of groundwater are not anticipated to be encountered within the basement excavation, although monitoring of the standpipes should be continued to confirm water levels. Shallow inflows of localised perched water are likely to be encountered from within the made ground which should be adequately controlled through sump pumping. It would be prudent, once access is available, to carry out a number of trial excavations, to depths as close to the full basement depth as possible, to provide an indication of the likely groundwater conditions."

4.4 Ground Contamination

4No. Samples of ground were tested for contaminants, the results of these tests can be seen in detail within Appendix D. The contamination report concludes that "The results of the contamination testing have indicated no elevated concentrations of contaminants within any of the four samples tested."



Ground Works Location Plan

4.5 Hydrology and Hydrogeology

The site hydrogeology is outlined in detail within the GEA report and can be summarised as follows:

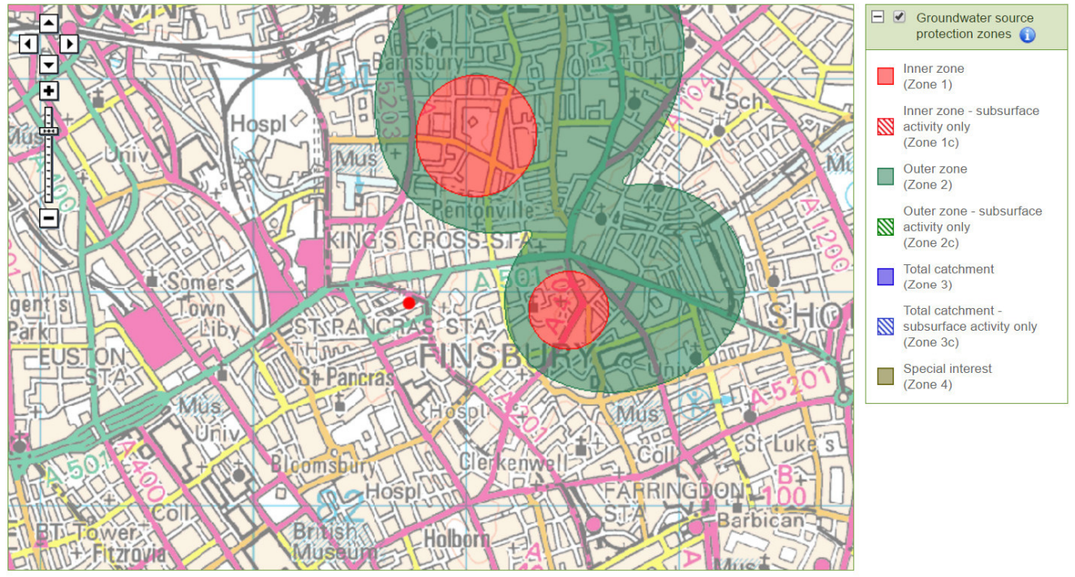
1. The Environment Agency Maps shows the site is outside of the Environment Agencies Source Protection Zone (SPZ)

2. The London Clay is classified as an Unproductive Stratum, which refers to rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow, as defined by the Environment Agency (EA). Any groundwater flow within the London Clay will be at a very slow rate, due to its negligible permeability. The permeability will be predominantly secondary, through fissures in the clay.

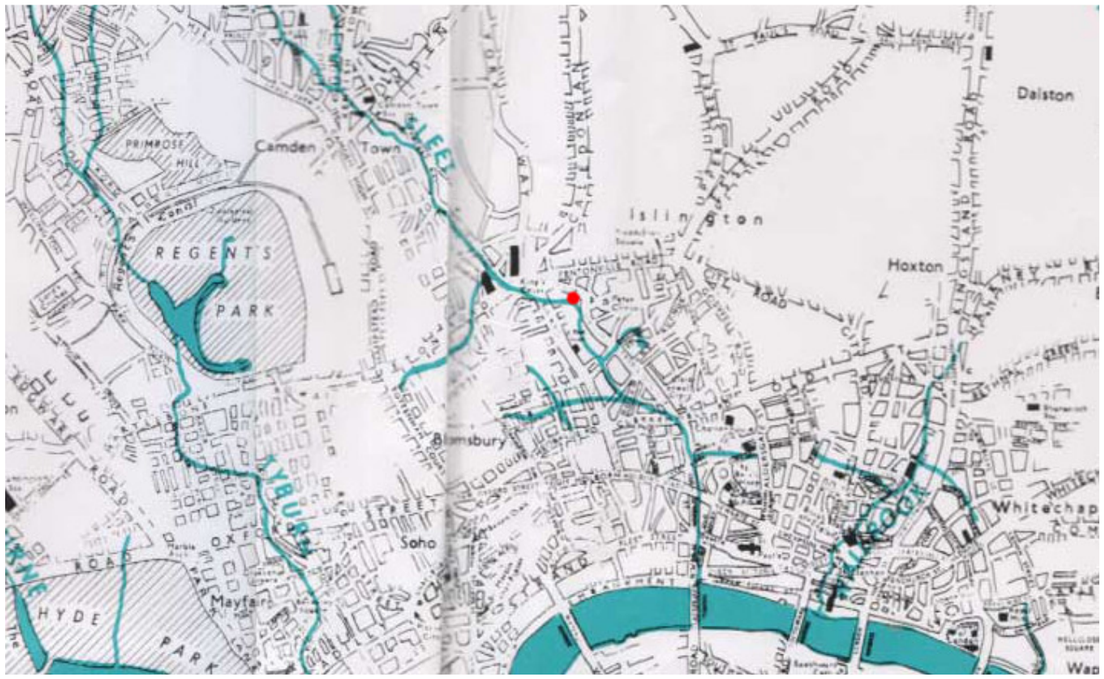
3. Surface water features such as canals and ponds are not present in the locality.

4. The route of river fleet has which has been shown to have historically run through Kings Cross Road along its route to the Thames has been assessed, the report concludes "The Fleet is now entirely covered and culverted and plans of the nearby sewer system, which indicate a major sewer to follow the line of King's Cross Road, presumably represents the course of the former river. It is likely that any groundwater flow beneath the site within the London Clay Formation would follow topographic contours, although the site is located within a topographical basin, with an Ordnance Datum level of between 10 m OD and 15 m OD."

5. The site is not at risk of flooding from rivers or sea, and is defined by the Environment Agency as being within an area of low risk of surface water flooding, see section *16 Assessment of Flood Risk* of this report for further details



SPZ zones within Camden



River Fleet

5 Underground Rail Assets

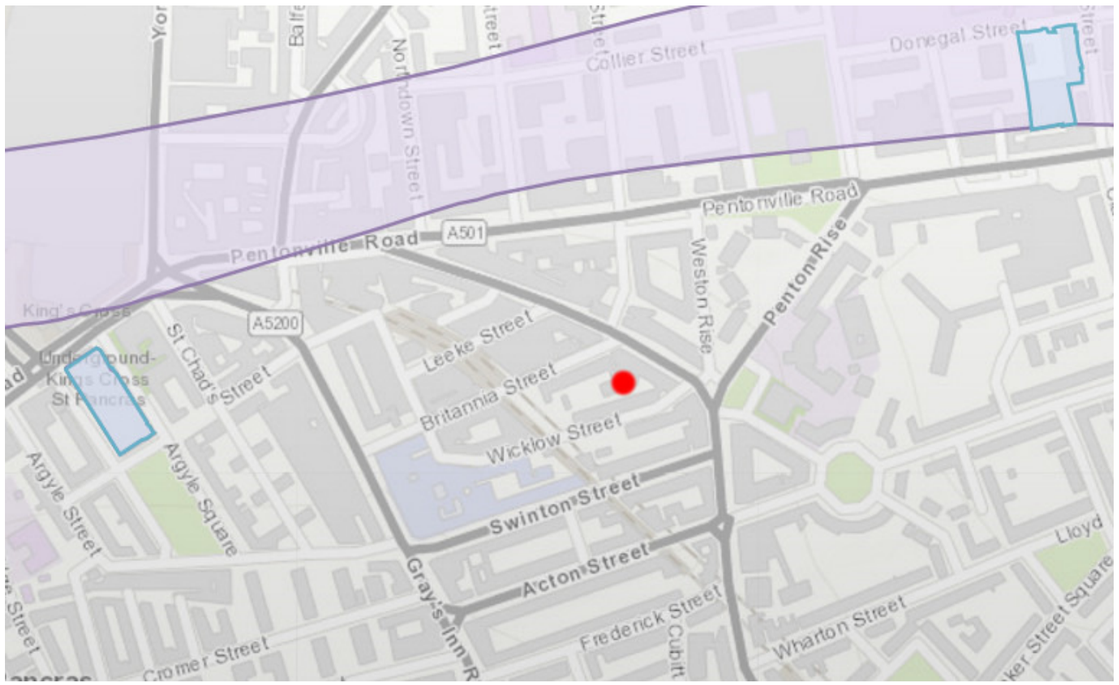
5.1 Current LUL Assets

The Metropolitan, Circle, and Hammersmith Lines between Kings Cross and Farringdon pass through a sunken route which passes under Britannia Street, the site and proposed works are entirely clear of the LUL exclusion zone and as such will not impact on the LUL assets.

LUL Exclusion Zone Map

5.2 Crossrail 2 Safeguarding Zone

As with the existing railways, the site is outside of the safeguarding zone the future development of Crossrail 2 which broadly follows the Pentonville road route, and as such does not impact the development in question.



Crossrail 2 Safeguarding Zone Map

6 Existing Structure

6.1 Material and Geometry

The existing building on the site is loadbearing masonry structure with masonry corbel footings, the double hipped roof is supported by a series of Fink Trusses of mild steel angles which bear directly into the masonry walls. The north side of the structure which leads toward Britannia Street has a newer timber roof bearing on the older masonry walls, and there is an internal steel floor structurally independent of the main structure which occupies most of the warehouse space, this is supported directly on the concrete ground bearing slab. The observations given here are based on visual inspection and trial pitting works only.

6.2 Soil Load Profile

Based on the above observations and estimations of the Storage Live Load, an 'all-up load' of 9kN/m2 has been calculated to establish an existing surcharge on the ground.

6.3 Foundations

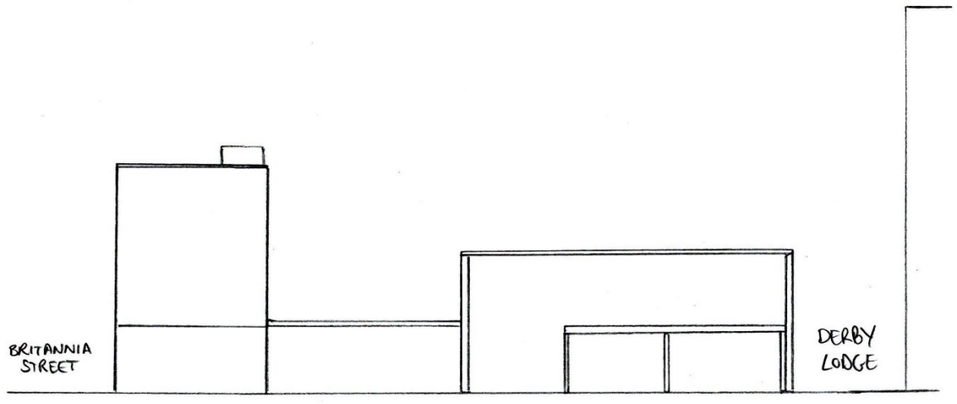
6.3.1 Internal Foundations

The internal structurally independent steel frame is unlikely to have its own foundation as this appears to have been built at a later date from the surrounding structure, and an attempt has been made to spread the steel column load above slab level, this indicates that this frame is likely to be supported directly by the ground bearing slab.

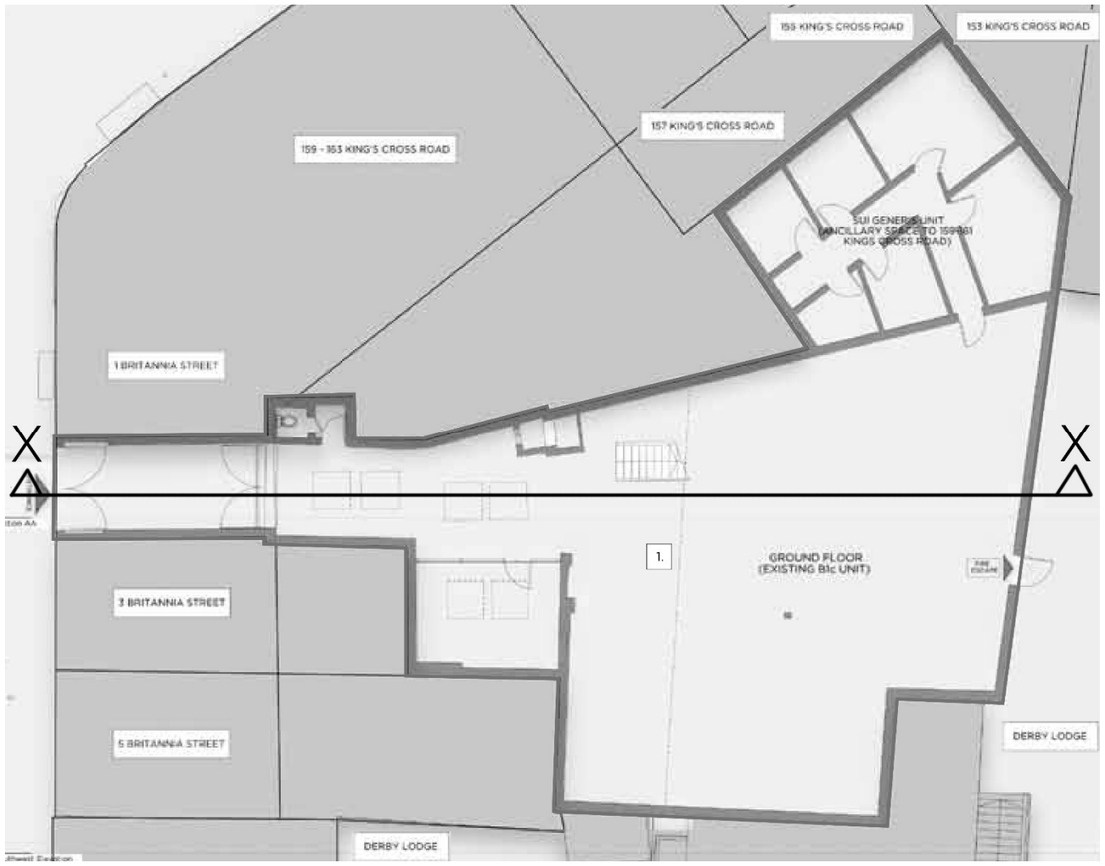
6.3.2 Perimeter Foundations

The trial pitting works have shown that the masonry walls are supported on masonry corbel foundations, typically at a depth of -1.5m below ground level, however some variation in this level exists across the site. Foundation maximum depths are shown in the following table.

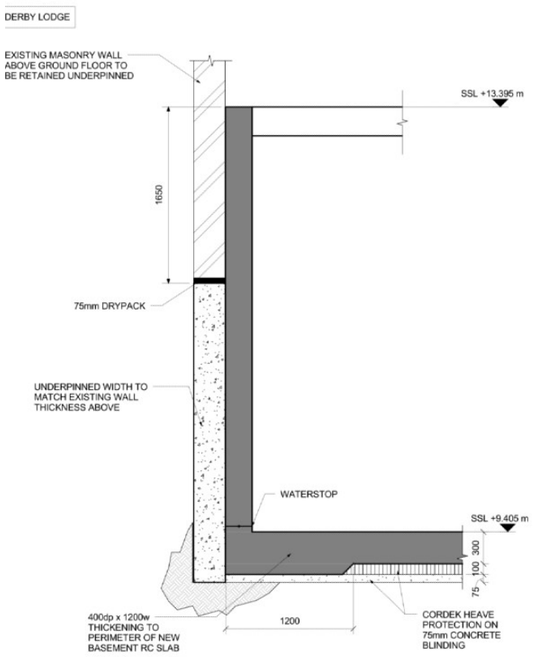
TRIAL PIT DATA		
Partywall Shared With	Trial Pit Number	Depth Below Ground (mm)
1 Britannia Street	TP1	-4,000+ (Underpinned)
3 Britannia Street	TP2	-1,900
3 and 5 Britannia Street	TP3	-900
5 Britannia Street and Derby Lodge	TP4	-1,420
Derby Lodge	TP5	-1,430
Derby Lodge	TP6	-1,300
153 Kings Cross Road	TP7	-1,460
153-155 Kings Cross Road	TP8	-1,400
159-163 and 157 Kings Cross Road	TP9	-1,700+
159-163 Kings Cross Road	TP10	-1,850



Section X-X



Measured Survey Plan of LVL0



SECTION H - H
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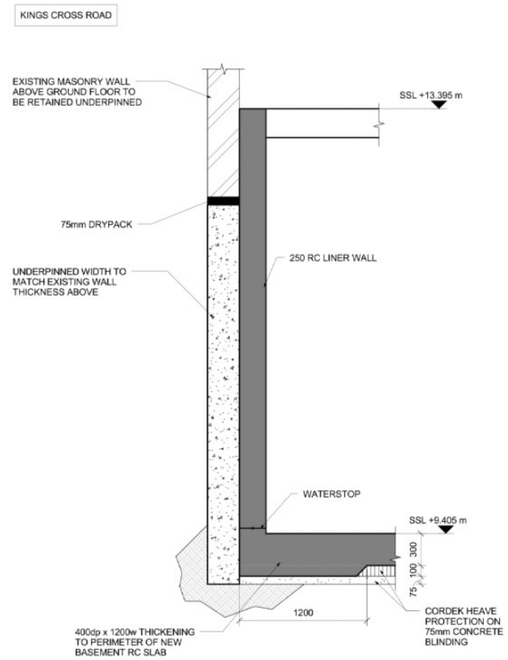

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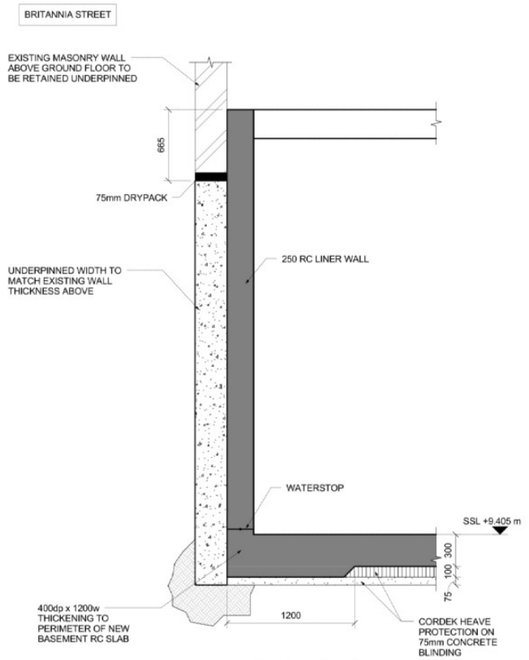

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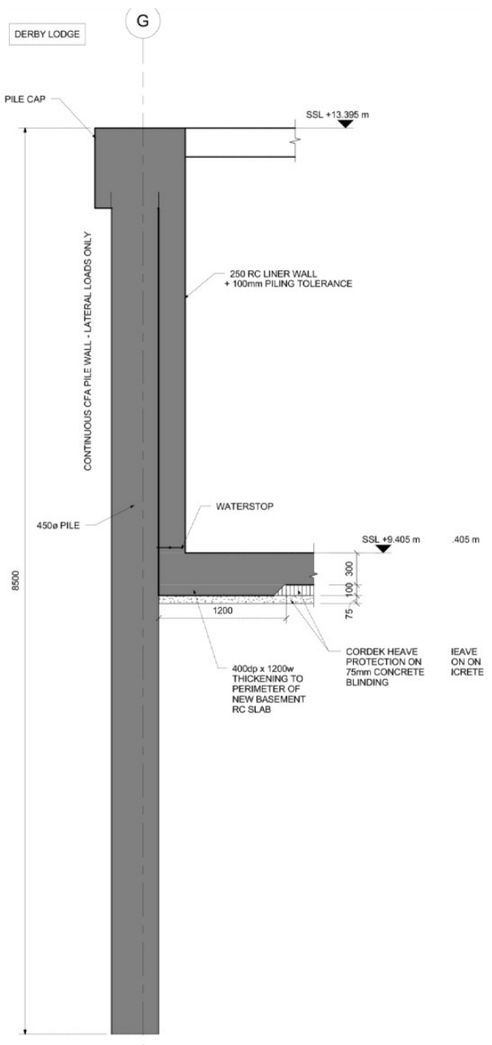


SECTION J - J
Scale: 1 : 25

West Boundary
Derby Lodge

East Boundary
159-163 Kings
Cross Road

North Boundary
3 Britannia Street

South Boundary
Derby Lodge

Sections Through Retaining Walls showing nearby Foundations

7 Proposed Structure

7.1 Overview

The proposed scheme involves the demolition of the existing building with the exception of the partywalls which will need to be retained. Once this is complete the underpinning works and retaining walls will be constructed, followed and the basement excavation. Refer to Section 8 for details of the sequencing, and Appendix A for further details of the proposed structure.

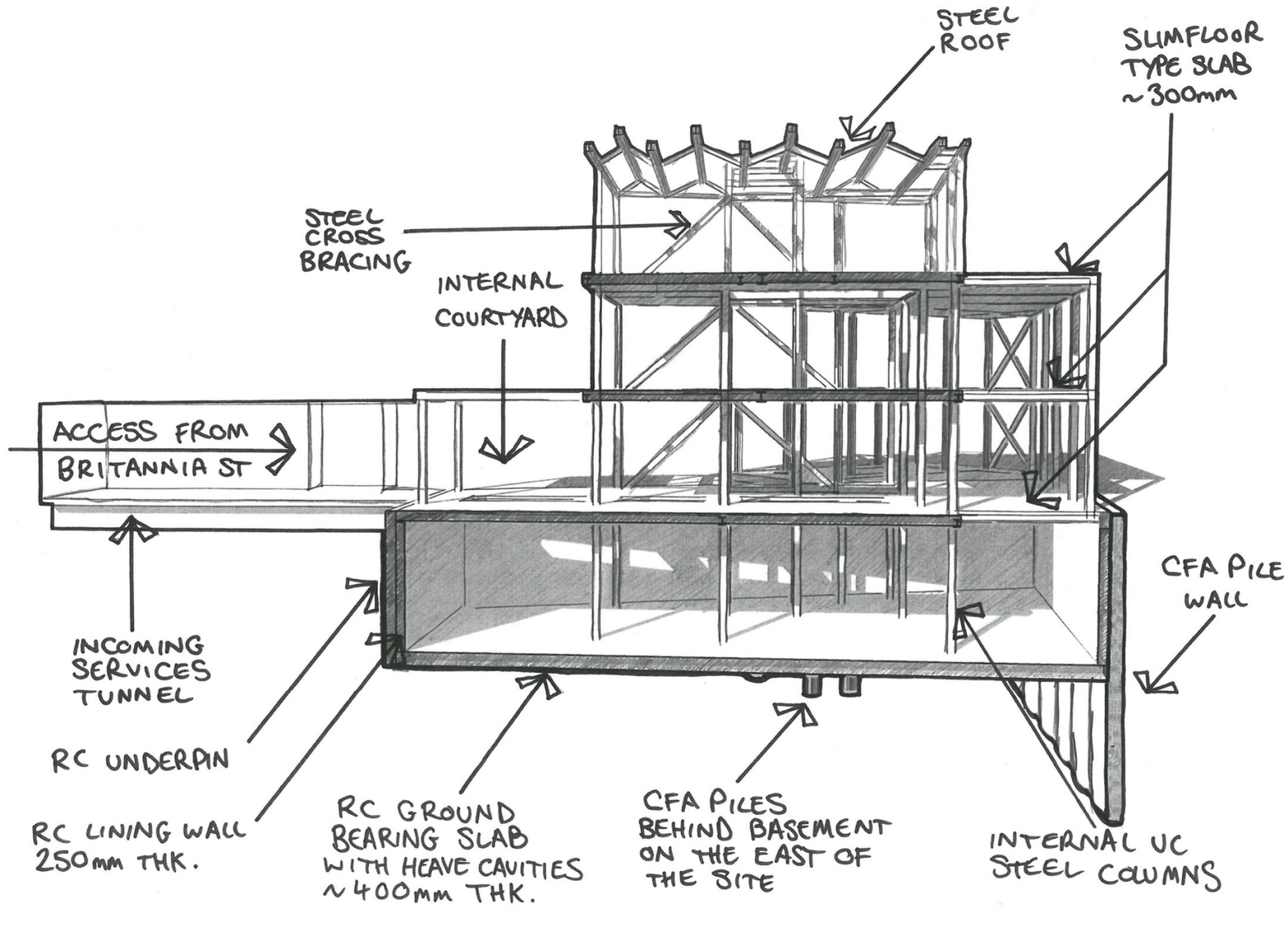
7.2 Superstructure

The proposed superstructure will be an integrated steel beam and composite deck type slab with depths of approximatly 250~300mm, built in the conventional sequence of works.

The Steel section will be Steel UC section with support plates welded to their base to support the non-composite deck. Some transfer beams will be incorporated, however the columns are predominantly continuous to foundation level, these forces will be supported with the new linings wall and basement slab.

The development has a proposed average service load of 54kN/m2 as a summation of all floors, which will result in a net reduction in load once the removal of the soil is accounted for. As such, the basement slab will be designed for the resultant heave due to unloading of the soil, and hydrostatic uplift. Heave cavities will be used to reduce the heave forces.

The ground and basement floor slab will act as rigid diaphragms to restrain the top and base of the retaining walls and transfer lateral earth pressures from each retaining wall to the opposing side. Where lightwells are required at the ground level, the wall will require sufficient stiffness to ensure the retaining walls will prevent appreciable movement.



Concept Perspective Illustration of Proposed Structure with Cut

7.3 Substructure

7.3.1 Assumptions

The following assumptions have been made during the design of the substructure of the building:

- The site investigation data obtained and collated by GEA Ltd in Appendix D is representative of the ground conditions beneath the footprint of the existing building.
- The basement level will be within the London Clay
- The formation level of the main basement will be below the water table
- The basement will be Class 3 in accordance with BS8102
- Final temporary works design will be finalised by the contractor

7.3.2 Basement Raft Slab or Spread Footing

Given the ground conditions, shape and form of the building it is proposed to found the building on spread/strip footings with a suspended concrete slab, which will be tied into the perimeter retaining walls. At this stage it is envisaged this will be in the order of 400mm thick. As there is a risk of heave in the ground, heave cavities will be used under the suspended slab. The exact design of the ground bearing element will be further developed during the detailed stage.

The 4.4 m deep excavation of the basement will result in a unloading of approximately 90 kN/m2 and the removal of the existing structure will further unload the ground by 9kN/m2. The P-Disp analysis indicates that, by the time the basement construction is complete 10 mm to 15 mm of heave is likely to have taken place at the centre of the proposed excavation, reducing to around 5 mm to 10 mm at the edges. Due to the addition of a uniform load across the new basement in the long term, the magnitude of heave at the centre of the basement is unlikely to exceed about 5 mm. To confirm this a full ground movement analysis has been undertaken which has assessed the effects of the new development on existing/surrounding buildings paying particular regard to the effects of the demolition of the existing building. (see Appendix D)

The northern entrance way will have a service trench installed to bring services to the building, the proposed detail can be seen within Appendix A – Drawing 205 – Section K-K. The attenuation tank which was present in an earlier revision has been omitted.

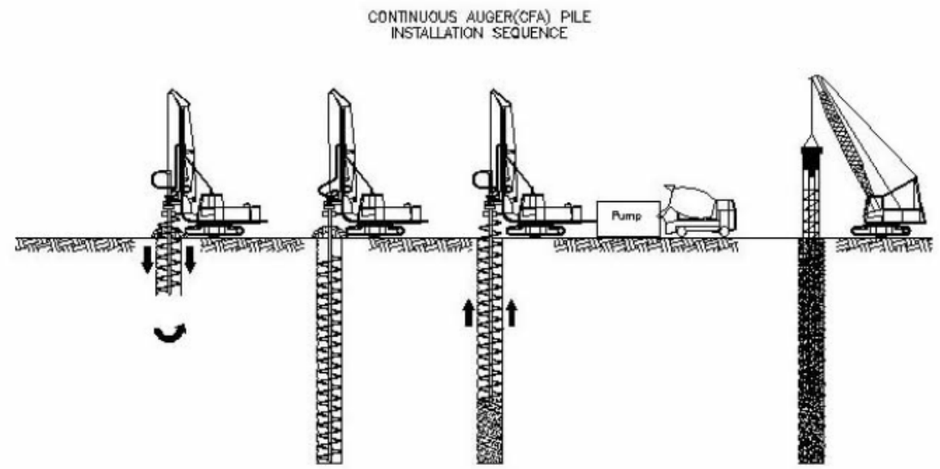
7.3.3 Basement Retaining Walls on Party Wall Lines

Given the nature and location of the site, it is proposed to construct the basement using an underpinned retaining wall with liner box. Refer to Section 8 for details of the sequencing, and Appendix A for further details of the proposed structure.

The basement formation level will be reached using mass concrete underpins, with anticrack mesh reinforcement on the inside face of the underpin. These will be constructed in a sequence to be agreed with the approved inspector and neighbouring Partywall Surveyors. Given the nature of the ground conditions it is envisaged these will be excavated in 4.4m deep sections, with suitable temporary works installed at the end of each stage to ensure no ground movements occur during excavation to the basement formation level.

7.3.4 Continuous flight auger (CFA) piles in Areas of the East and West (see Appendix A - Proposed Structural Drawings

CFA piles (see figure below) are a common and efficient method of installing a piled wall. In addition, the CFA piling technique is almost vibration free and one of the quietest forms of piling, making it ideal for environmentally sensitive and built up areas. Adopting this approach will keep construction phase vibration to the practical minimum. The pile diameter is likely to be 600 diameter.



1. The hollow-stemmed Continuous Flight Auger is drilled into the ground by means of the drive-head.	2. The auger is drilled down to the founding level	3. The concrete / grout is pumped down the hollow-stemmed flight as the latter is gradually withdrawn.	4. The steel reinforcing cage is lowered into the wet concrete / grout in the pile shaft until it is at the correct level

7.3.5 Basement Contiguous Piled Retaining Walls on Site Boundary and Internally

The internal retaining wall and the Southern boundary are not supporting existing masonry walls above and as a result can be formed with a contiguous piled wall, these walls will have CFA piles measuring 8.5m in length from ground level to minimise disturbance. The contiguous will have lateral forces applied to it while the gravity loads from the new superstructure will be supported by the basement liner walls and basement slab to reduce the risk of differential settlement. The walls will be propped during construction, to keep ground movements within agreed limits.

7.3.5.1 Basement Grade

The basement will be grade 3 to BS8102 (see table 1 below), consequently the underpin wall will be lined with a reinforced concrete wall to provide a flat surface for fixing of the drained cavity layer. The drained cavity protection would be provided by means of non load-bearing block walls around the full basement perimeter and a traditional raised screed across the lowest floor. A pump will then be connected to the drained cavity layer to remove any small amounts of water that leak through the primary concrete waterproofing shell.

Grade	Example of use of structure	Performance level
1	Car parking; plant rooms (excluding electrical equipment); workshops	Some seepage and damp areas tolerable, dependent on the intended use B) Local drainage might be necessary to deal with seepage
2	Plant rooms and workshops requiring a drier environment (than Grade 1); storage areas	No water penetration acceptable Damp areas tolerable; ventilation might be required
3	Ventilated residential and commercial areas, including offices, restaurants etc.; leisure centres	No water penetration acceptable Ventilation, dehumidification or air conditioning necessary, appropriate to the intended use

Table 1 – Basement Grading from BS8102

To achieve this level of waterproofing it is recommended that the lining wall is to be fully tanked, and a drainage cavity be installed, however other appropriate methods can also be considered.