**GD Partnership Ltd**

# BASEMENT IMPACT ASSESSMENT

## FOR Plots B & C

## TRANSFORMATION OF THE UGLY BROWN BUILDING

## 2-6 ST PANCRAS WAY, LONDON NW1 0TB

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## 2-6 ST PANCRAS WAY, LONDON NW1 0TB

**Issuing Record**

| Issue | Date | Description | status |
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| Version A | 22.09.17 | First issue | Preliminary |
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| Version C | 06.02.18 | Contiguous piled wall to form perimeter retaining wall and drawings revised.<br>Phase 2 SI specification added.<br>Author Qualifications added.<br>Temporary works method statement added.<br>Ground movement monitoring strategy added<br>Geotechnical design parameters added | Preliminary |
| Version D | 21.12.20 | Plot B, Additional basement level added.<br>Phase 2 Site Investigation, GMA, Retaining Wall Assessment, Thames Water (TW) Asset Assessment and TW Reports together with Thames Water Mid-Level 2 condition survey and Lower Sewer along St Pancras Way survey added. | Preliminary |
| Version E | 23.2.21 | Additional information on introduction and minor amendment on clause 4.2.2. | Preliminary |
| Version F | 11.05.21 | Minor amendments on introduction and clause 2.3 | Preliminary |
| Version G | 04.03.23 | Plot C added. Plots B & C, removal of level 2 basements. Small area of double basement under plot C southwest area retained. | Preliminary |

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# NON-TECHNICAL SUMMARY

| NON-TECHNICAL SUMMARY | |
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| Site Description | The site is located at 2-6 St Pancras Way in the London Borough of Camden and occupied with a concrete structure known as the Ugly Brown Building (UBB). This was originally occupied by a five-storey masonry structure called 'St Pancras Ale & Corn store', later became known as the Granary.<br><br>The Regent's Canal is located to the Northeast of the site. To the Southwest of the site is St Pancras Way, with Granary Street to the Southeast beyond which lies St Pancras Hospital. The existing building 'Canal Side Studios' formerly known as 'Atlantic Metals Building' occupies the Northwest boundary of the site.<br><br>The UBB is a 4-5 storey large concrete building with flat roofs and hard paving around the site boundary. Originally designed for mechanised letter sorting office, the building comprises an Administration block, Welfare block and a sorting office block. The administration block is currently a non-occupied building while the Welfare block, transformed to office space, is now occupied by Ted Baker Plc. The sorting office block is occupied by Verizon Data Centre.<br><br>There are 30 no. individual trees within influence of the application area according to the Arboricultural Impact assessment issued by Aspect in April 2017.<br><br>The canal wall along the north-eastern boundary was a 1.6m wide brick retaining wall with cantilevered sheet pile wall added alongside during construction of UBB. The IStructE Paper titled 'The structural Engineer Vol 63A' published during the construction of the existing Mechanised letter-sorting office building (hereafter called IStructE Paper) gives further detail. The documents are attached to Appendix 3 of this report.<br><br>The middle level sewer no. 2, a part of London's historic sewer system and now part of the Thames Water Authority's system, was constructed by tunnelling across the northern part of the site. The sewer is approximately 2.12m internal diameter and is brick lined throughout, with its crown about 5.00m below the canal bed level. The administration block of UBB has been built bridging over the sewer with contiguous piles outside the easement area. |
| Proposed Development | The proposed redevelopment will involve the demolition of the existing building and erection of 6 new buildings ranging in height from 2 storeys to 12 storeys in height above ground and a single basement level comprising a mixed-use business/Laboratories floorspace, residential, gym, flexible retail and storage space development with associated landscaping work. The landscaping includes a new public realm plaza, retail streets, an active and engaging canal frontage, and a contextual street frontage. The new development comprises three plots A, B & C in which 'Plots A and B' will be offices and 'Plot C' will comprise 4 major buildings for mixed-use offices/Laboratories, gym, residential & retail spaces.<br><br>The proposed basement level at the site varies from 15.75m to 18.00m AOD while the canal water level is at 23.13m AOD and canal bed is at average 21.15m AOD. Plot A will have a single basement at 17.2m/18.0m AOD. Plots B and C will have a single basement for most of the areas at 15.75m except for a small second basement under the Southwestern corner of Plot C at 11.50m AOD. |

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| | The site would therefore be a single subterranean level in the Plots A, B and C for most of areas and two subterranean levels (upper and lower basements) in the Plot C to the Southwest corner of the site. Refer to General Arrangement drawings attached to Appendix 1 of this document. |
| Ground / Ground water condition | According to The IStructE Papers attached to Appendix 4, the former granary building was founded upon a concrete raft foundation that was placed directly upon London Clay by excavating approximately 6m below the canal water level. This was confirmed within nine borehole records which indicated that the hardstanding of the former granary building was underlain by approximately 20m of London Clay that is in turn underlain by clay of the 'Woolwich and Reading Beds'. The geology is also predicted from BGS bore hole records within 100m of the site which confirms the London clay is underlain by Woolwich and Reading Beds and the Thanet Sands on upper Chalk. Relevant borehole records from BGS and some neighbouring developments have been attached to Appendix 5 of for reference.<br><br>There will be no historic record of perched ground water around the site. London Clay forms an impermeable layer classified as a non-aquifer (non-productive stratum).<br><br>Phase II site investigation had been carried out by RSK within the plots A and B areas and the final Geo-environmental and Geotechnical Site Investigation Report ref. 371654-01 (01) dated August 2019 has been included in Appendix 3.<br><br>CGL–Tribeca, Camden Plot C, Geotechnical, Geo-environmental Factual and Interpretive Report ref. CGL/09751-0 dated Feb. 2023 has also been included in Appendix 3. |
| Screening and Scoping | **Surface flow and flooding:**<br>No potential impacts identified beyond the scoping stage.<br><br>**Subterranean (ground water) flow**:<br>No potential impacts identified beyond the scoping stage.<br><br>**Land stability:**<br>Potential impacts identified relate to ground movements associated with:<br>- Retaining wall installation and ground excavation adjacent to the TW Sewer.<br>- Elastic heave of the London Clay in the basement excavation due to relief of overburden. |

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| Impact Assessment | The following nearby structures were identified as being potentially at risk from damaging ground movements:<br>- The Thames Water Sewer line beneath the site across plot A.<br>- Phased construction between Plots A which is under construction, Plots B and C will be demolished simultaneously and re-build from Plot B to C continuously.<br>- The Regent canal structure.<br>- Culverted Fleet River running underneath the St Pancras Way.<br>- Retaining wall along the Granary Street opposite St Pancras hospital.<br>- Adjoining buildings along the St Pancras Way.<br><br>**Structural stability of adjacent structures from heave of the basement excavation.**<br><br>Contiguous piled retaining wall structure will be installed around the perimeter of the site which will be designed to supports both horizontal and vertical loads and to resists/minimise movement by heave and subsidence. A numerical assessment of heave potential will be followed by monitoring of ground movement before, during and after excavation at predetermined time intervals and at strategic locations. It is expected that the horizontal and vertical ground movement will be controlled within our detail design so that the damage category of 'very slight' (Burland scale 1) applies.<br><br>The historical data accumulated in the IStructE paper gives evidence of significant thickness of made ground underlying the site which was encountered while demolishing the existing brick structure, 'The Granary'. This has in turn been supported by a concrete raft at about 6m depth within the London Clay formation. The bases to the cast-iron columns of the building were formed by positioning several layers of 225 mm-thick sandstone blocks on a 4.2 m grid. Infilling above the concrete raft and around the sandstone blocks was carried out with approximately 1- 2 m of clay on which a brick sett floor was constructed.<br><br>During construction of existing Ugly Brown building, it was observed that, any potential movements were significantly less than those predicted because of the significant thickness of the made ground, which has a large component of non-shrinkable granular material. Any potential effects will be investigated and mitigated as necessary during design at the detailed design stage.<br><br>It is expected that the horizontal and vertical ground movement will be controlled by design so that the damage category of 'very slight' (Burland scale 1) applies.<br><br>Phase ll Site Investigation report for Plots A & B was done by RSK dated August 2019 Ref. 371654-01 (01) and is included in Appendix 3.<br><br>Following the results of the Phase ll Site Investigation report for Plot C, we have further carried out Ground Movement Analysis (GMA) and Canal Wall Impact Assessment, GMA and Sewer Impact Assessment and GMA and Highway & Building Damage Assessment Reports ref. CGL/0751A which were done by CGL dated December 2022 are included in Appendix 3.<br>CGL–Tribeca, Camden Plot C, Geotechnical, Geo-environmental Factual and Interpretive Report ref. CGL/09751-0 dated Feb. 2023 has also been included in Appendix 3. |

# 1 INTRODUCTION

## 1.1 Instruction

GD Partnership Ltd. have been instructed by Reef Group to provide a Basement Impact Assessment (BIA) for the proposed development of Ugly Brown Building at 2-6 St Pancras way of the London Borough of Camden (hereafter defined as 'Site').

Application 2017/5497/P was granted full planning permission on the 17th March 2020 for the following development:

Demolition of the existing building (Class B1 and B8) and erection of 6 new buildings ranging in height from 2 storeys to 12 storeys in height above ground and single basement level comprising a mixed use development of business floorspace (B1), 73 residential units (C2) (10xstudio, 29x1 bed, 27x2 bed 7x3 bed), hotel (C1), gym (D2), flexible retail (A1 - A4) and storage space (B8) development with associated landscaping work.

This permission grants consent for the use of Plot B as a nine-storey building with a single basement, which would be used as a hotel at lower levels, with office use above. The entire building was to be occupied by Ted Baker, who would operate the hotel and occupy the office space.

In the time since the permission was granted, changing economic circumstances and the Covid-19 pandemic mean that a hotel no longer represents the optimal use of the site. Furthermore, Ted Baker will no longer be retained as occupiers of the proposed building.

As a result, the applicant is now proposing a single application for the following works:

A new proposal for the Plots B and C element of the site, which will remove the hotel, and create a building comprising flexible commercial space, offices/Lab, and ancillary storage, along with design and landscaping revisions.

Amendments to the Plot C element of the site, comprising changes to the design, to align with the revised Plot B proposal, and changes to the affordable housing provision on Plot C2, increasing the provision of affordable housing to 50.8%.

A separate application was submitted in March 2021 for amendments to the Plot A element of the Site. Documents for this application have been prepared based on a scenario in which these amendments have been implemented.

The changes to the Plot C residential tenure mix will have no impact on the basement and will therefore not be considered in this document.

## 1.2 Regulatory context

This assessment is designed to be compliant with guidance provided by the London Borough of Camden in their guidance document 'Camden Planning Guidance Basements (CPGB), January 2021 and its supporting study 'Camden Geological, Hydrogeological and Hydrological Study' produced for Camden by ARUP in November 2010. All the technical analysis and recommendations contained within the planning guidance are taken from this latter study, which is treated as the evidence based technical advice when Camden are assessing Basement Impact Assessments.

The document CPGB is a supporting document forming a part of supplementary planning guidance of Camden's development plan. 'Camden Local Plan' is the key document in Camden's development plan, which is the name given to the group of documents that set out the Council's planning policies.

This document will be specific to the Ugly Brown Building Project, demonstrating that the new basement to the proposed development will not cause harm to the built and natural environment, including to the local water environment and ground conditions according to the requirement set up in Camden's Protecting Amenity Policy A5 in 'Camden Local Plan'.

Basement Impact Assessment (BIA) will be included the following stages:

- **Screening**: the identification of any matters of concern with regard to hydrogeology, hydrology or ground stability, which should be investigated.
- **Scoping:** production of a statement that defines further the matters of concern identified at the screening stage.
- **Site Investigation and Study:** undertaken to establish the baseline conditions. This can be done by utilising existing information and/or collecting new information.
- **Impact Assessment:** undertaken to determine the impact of the proposed basement on the baseline conditions, taking into account any mitigation measures proposed.
- **Review and Decision-Making:** this final stage is undertaken by Camden and consists of an audit of the information supplied and a decision on the acceptability of the impacts of the basement proposal.

The purpose of the BIA is to enable Camden Council to assess whether any predicted damage to neighbouring properties and the water environment is acceptable or can be satisfactorily ameliorated by the developer which covers the requirements as stated in Policy A5 in 'Camden Local Plan'

## 1.3 Background

By way of background to the current project, a Preliminary Risk Assessment (PRA) and a Flood Risk Assessment and SUDS Strategy (FRA) have been undertaken for the site. The IStructE paper produced during the construction of existing building, the then mechanised letter-sorting office, which gives immense background to the site history, has been referenced throughout the project. The report is attached with this document. Topographic surveys of the site had been carried out including the recent survey carried out by Laser Surveys dated Jan. 2023 as in Appendix 6.

A phase II site investigation for Plots A, B and C had been done and confirmed the geological, hydrogeological and hydrological information contained within this report as in Appendix 3.

Intrusive investigations and testing had also been carried out to the canal side sheet piled wall, existing contiguous piled wall along North boundary and adjacent Thames Water sewer to determine exact position, depth, integrity, durability and their design capacities. The following reports are included within the Appendix 3 and Appendix 9 and are as follow:

- CGL – Tribeca, Camden Plot C, Geotechnical, Geo-environmental Factual and Interpretive Report ref. CGL/09751-0 dated Feb. 2023.
- CGL – Plot C Ground Movement Analysis and Highway & Building Impact Assessment – ref. CGL/0751A dated Dec. 2022.
- CGL – Plot C Ground Movement Analysis & Canal Wall Impact Assessment – ref. CGL/09642 dated CGL/0751A dated Dec. 2022.
- CGL – Plot C Ground Movement Analysis & Sewer Impact Assessment – ref. CGL/09642 dated CGL/0751A dated Dec. 2022.
- RSK – Geo-environmental and Geotechnical Site Investigation ref. 371654-01 (01) dated Aug 2019.
- RSK - Retaining Wall assessment – Ugly Brown Building ref. 371654-L01 (00) dated 19th. May 2020.
- Thames Water Survey – CCTV Survey Report to Local Sewer – St. Pancras Way dated 30/01/19 and St. Pancras Way Sewer Condition Report carried by Plowman Craven – St. Pancras Way – Mid-Level 2 Report dated 1 July 2019.

## 1.4 Standards and Limitations

This report is based on information available at the time of writing. This will be updated to adjust any mitigation measures following proposed intrusive investigations, testing and any other matters which may come to light during the design development.

This report may be re-considered in the light of any changes in the legislation, statutory requirement or industry practices that occur subsequent to the date of issue.

# 2 SITE DETAILS

## 2.1 Site description

The site is located at 2-6 St Pancras Way in the London Borough of Camden, at National Grid reference TQ 296837, as shown on Figure 1. The site lies within a conservation area alongside the Regent's Canal, is historically being occupied by 'The Granary', then 'the Ugly Brown Building'. The site is approximately 1.14 ha wedge-shaped piece of land between St. Pancras Way and the Regent's Canal and lies just to the north of St. Pancras Hospital as shown on Figure 2.


**Figure 1: Location of Proposed Development Site**

Historically, the ground sloped from east to west with a fall of approximate 3 m towards the River Fleet which is now culverted and lies to the west of St. Pancras Way towards the College Street. The location of the culverted river is shown in Figure 3.

The Regent's Canal runs along the northeast boundary of the site. To the southwest of the site is St Pancras Way, with Granary Street to the southeast beyond which lies St Pancras Hospital. The existing building, 'Canal Side Studios' makes the northwest boundary of the site.

The Middle Level Sewer no. 2, a part of London's historic sewer system, now part of the Thames Water Authority's system, has been constructed by tunnelling under the northern part of the site. The sewer is 2.12m in diameter and is brick lined throughout, with its crown about 5.5m below the canal bed level. The existing building has been built bridging over the sewer with contiguous piles outside the easement area.


**Figure 2: Ariel Photograph of site**

The canal wall along the north-eastern boundary is a substantial 720mm wide brick wall construction with cantilevered sheet pile wall added alongside during construction of existing UBB in 1985. It was mentioned that there is a brick retaining wall along the south-east boundary.

The current site conditions may slightly vary from those in this report especially on There is an existing RC retaining wall along the canal behind the old brick retaining wall that will require further investigation during pre-construction stage to determine and confirm its position and construction.

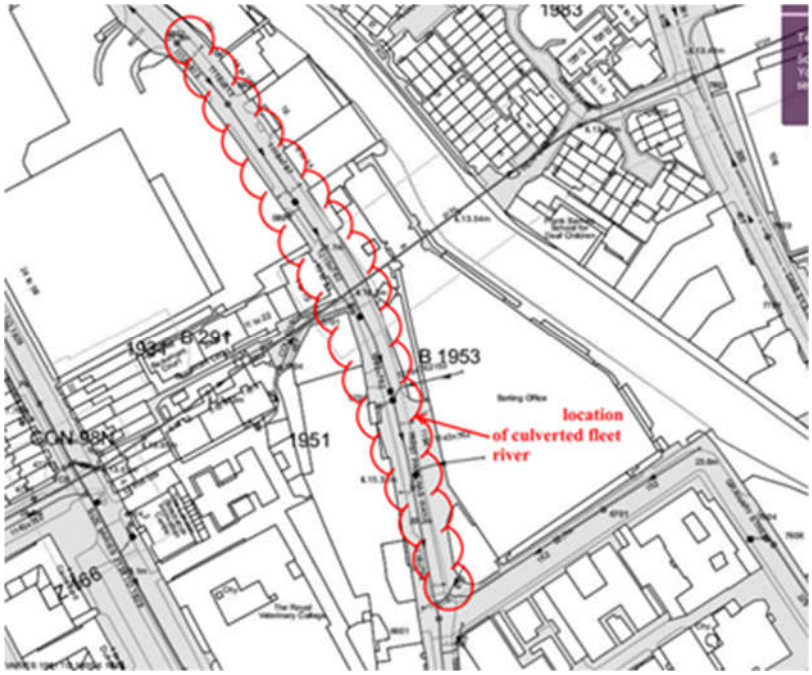


**Figure 3: Location of culverted Fleet river. Refer to Appendix 9.**

## 2.2 Proposed Development

The proposed redevelopment will involve the demolition of the existing building and erection of 6 new buildings ranging in height from 2storeys to 12 storeys in height above ground and single basement level for most of the area at 15.750m AOD comprising a mixed-use business floorspace, residential, gym, flexible retail and storage space development with associated landscaping works. The landscaping includes a new public realm plaza, retail streets, an active and engaging canal frontage, and a contextual street frontage as shown on Camlin's drawing TRI-CLA-ZZ-00-DR-L-0001 GA - Public Realm Plans as attached to Appendix 6.

The development has been named as 'Plots A, B and C' for offices/Laboratories. Under Plot C, Plot C1 and C3 for mixed use of offices/Lab, Plot C2 residential and C4 pavilion. Plot A will be built in place of existing administration building and it is now under construction. Plot B which was Ted Baker Building will be re-build as offices/Laboratories and Plot C which was occupied previously by Verizon digital building will also be re-built simultaneously as offices/Laboratories etc as marked up in figure 4.

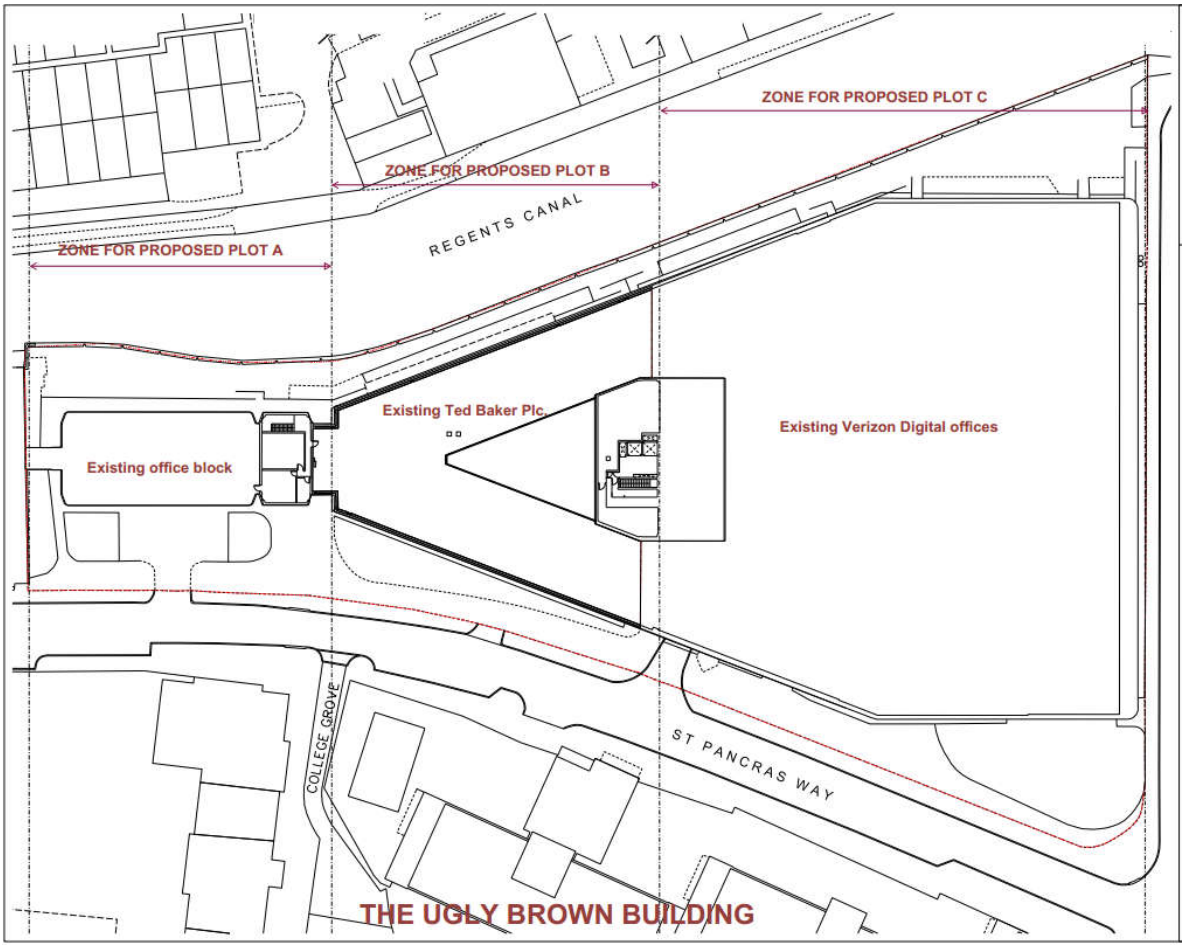


**Figure 4: Existing Site - The Ugly Brown Building**

The proposed basement level at the site varies from 15.750m to 17.200m AOD while the canal water level is at 23.13m AOD and canal bed is at average 21.15m AOD. Plot A will have a single basement at 17.2m/18.0m AOD. Plots B and C will have a single basement for most of the areas at 15.750m except for a small second basement under the Southwestern corner of Plot C at 11.500m AOD. Appendix 1 gives General Arrangement of site plans and sections illustrating the proposed development.

The site a single subterranean level in the Plots A, B and C for most areas. However, there is a small area of two subterranean levels (upper and lower basements) in the Southwest corner of the Plot C. Refer to General Arrangement drawings attached to Appendix 1 of this document.

In the temporary case, a propped perimeter contiguous piled wall is proposed to support the basement excavation, inside which the basement box will be constructed from reinforced concrete with reinforced concrete slabs at basement and ground floor levels forming propping in the permanent condition. It is proposed to support the structure on piled foundations.

## 2.3 The proposed detailed sequence of work:

1. Basement Construction Plan for Plot A had been submitted and approved. The building is now under construction with the basement box had been completed and had been approved by TW. The construction of super-structures is now underway.
2. Phase 2 Geo-Environmental and Geotechnical Site Investigation Report for Plots A and B carried out by RSK ref. 371654-01 (01) Aug 2019 had been done and have been included in Appendix 3.

3. Phase 2 Site Investigation report had been done for Plot C by CGL ref. CGL/09751-0 dated Feb. 2023 has been included in Appendix 3.
4. Due to the revised scheme, Plots B and C will now be demolished and re-build simultaneously.
5. Carry out detail designs for the Plots B and C. It is expected that the horizontal and vertical ground movement will be controlled during detail design so that the damage category of 'very slight' (Burland scale 1) applies.
6. Precondition surveys for all the surrounding structures to be carried out including TW sewers. Monitoring system will be installed to the adjoining structures and are to be maintained throughout the demolition and construction works to the agreed triggered level. All construction works will be stopped when triggered level is reached and investigate the cause of it and provide the necessary remediation works where required before commencing further works. Precondition surveys to the existing TW sewers had been surveyed and included in Appendix 9.
7. Carefully demolish existing plot B building down to ground floor level.
8. Remove plot B existing ground floor slab including RC ground beams and pile caps.
9. Carry out further site investigations to determine the existing lower RC retaining wall that provide the footpath along the canal and the diameter, reinforcement, depth, durability and capacity of the existing piles for possible re-use where required.
10. Carry out survey to locate existing piles and identify them onto the drawings to ensure that they are not clashing with the new proposed pile's locations.
11. Due to the possible old foundations within the existing footprint of the building, carry out probing at every new proposed pile position to ensure that no underground obstructions encountered prior to piling.
12. Install contiguous piled walls along the canal side to form the canal boundary and progress along the St Pancras Way according to the piling specialist design. Temporary steel piled wall will be required along the St. Pancras Way in order to construct the RC capping beam which will be lower than the existing pavement level.
13. The contiguous piled wall that had been installed between plots A and B would form as the divisional basement wall. This wall had been designed and installed for a double basement construction.
14. Install the bearing piles and carry out construction works following the detail design procedure.
15. Carry out basement excavation in accordance with the design methodology. Temporary propping / waling beams will be installed as required by detail design methodology.
16. Movements will be monitored before, during and after excavation at predetermined time intervals dictated by the detailed design.
17. Carry out construction for the basement foundations, slabs, walls, ground floor slabs and super-structure to be followed by detail design procedure.
18. Following the demolition of plot C, follow the same procedure above.
19. Install the perimeter contiguous piled walls and bearing piles and carry out construction of basements and super structure following detail design.

## 2.4 The Subterranean Construction Method statement:

Some of the issues that affect the sequence of works on this project are:

- The integrity of the adjacent Regent Canal, Thames Water sewer across Block A and culverted Fleet River running underneath St. Pancras Way.
- The integrity of the adjoining buildings including phased construction of the new buildings.
- The stability of adjacent roads.
- Forming sensible access onto the site to minimise disruption to the neighbouring residents.
- Providing a safe working environment.

The undertaking of such projects is specialist work and GDP will be involved in the selection of an appropriate Contractor who will need the relevant expertise and experience for this type of project. Drawings illustrating the sequence of basement construction and temporary works are included in Appendix 2.

**Noise & Vibration**

The Contractor shall undertake the works in such a way as to minimise noise, dust and vibration when working in order to protect the amenities of the nearby buildings and infrastructure.

The breaking out of existing structure shall be carried out by saw cutting or shearing where possible to minimise vibration to the adjacent properties and associated construction noise. All demolition and excavation work will be undertaken in a carefully controlled sequence, taking into account the requirement to minimise vibration and noise, and stability of adjacent structures.

### 2.4.1 Site set up

- Erect a fully enclosed painted plywood site hoarding along all boundary walls, this should not impede on the neighbouring properties or roads.
- The services within the site should be identified and isolated as necessary. All below ground obstructions should also be removed to allow the works to progress.

### 2.4.2 Construction of Basements

1. The exact positions of the existing Thames Water sewer and the existing culverted Fleet River had been established including the conditions of these sewers as the report in the Appendix 9.
2. Prior to any works adjacent to the canal, review the stability of the existing canal steel sheet piled wall and provide any temporary works required to ensure its stability is maintained throughout the construction. Refer to section S(SK)-GA 53, 54 and 104 for typical sections through canal edge for Plots B and C as in Appendix 1.
3. New contiguous piled wall along the canal structure will be designed and installed by piling specialist and checked to withstand water pressure/ surcharge from the canal and other surrounding design loadings.
4. Complete the installation of new contiguous piled walls around perimeter of basements Plots B and C as plans S(SK)-GA-50 and 100 including RC capping beams and Install monitoring systems as shown on drawings PB-(SK)-S-3015 and PC-(SK)-S-3015 for Plots B & C respectively as in Appendix 1.
5. Provide temporary supports as shown on the drawings TRI-GDP-PB-ZZ-SK-S-003010-P02, 3011-P02, 3012-P01, 3020-P01, and 3021-P02 as in Appendix 2.

6. Carefully excavate the ground to the required basement formation level and construct pile caps and basement slab.
7. The results of the monitoring systems are continuously monitored during the construction of the new basements and compare these with the predicted analysis data. Actions will be taken if any of the results deviates from the anticipated results.
8. Construction of basement for Plot C will be followed in a similar manner during relevant construction phase. For preliminary pile layout refer to drawings 21-131_GDP_S(SK) GA-100 as in Appendix 1 together with the construction sequence as shown on drawings TRI-GDP-PC-ZZ-SK-S-3010-P1, 3011-P1, 3020-P1 and 3021-P1 as in Appendix 2.

## 2.5 Ground / Groundwater Conditions

### 2.5.1 Topography

Site topographical survey was carried out by Clugston Survey Services in February 2016 including the latest Topographical survey carried by Laser Surveys dated Jan 2023. The site generally slopes towards St Pancras Way with an average 3m fall. The ground levels vary between 20.4m AOD at the southernmost corner of the site and 23.6 AOD along the edge of the canal at the North-eastern boundary. The ground level increases north along St Pancras Way ranging from 20.4 m to 21.9 m AOD and rises more steeply east along Granary Street from 20.4 m to 23.6 m AOD. Drawings TRI-CLA-ZZ-00-DR-L-0001 GA - Public Realm Plans as attached to Appendix 6.

### 2.5.2 British Geological Survey Data

The published 1:10,000 scale BGS maps (Extracted pages from Camden Geological, Hydrogeological and Hydrological Study attached to Appendix 7) evidenced the Site belongs to area of London Clay Formation. Phase ll SI had been done for Plots A, B and C, please refer to RSK- Geo-environmental and Geotechnical Assessment SI Report 371654-01 (01) Aug 2019 and CGL report ref. CGL/09751-0 dated Feb. 2023 in Appendix 3.

### 2.5.3 Hydrology & Hydrogeology

The nearest surface water is the Regent's Canal located adjacent the Northeast boundary of the site. According to the IStructE paper the canal edge is lined with a sheet steel wall and sealed back into existing brick retaining wall at each end. Given the sheet pile will act as a barrier and the low permeability of the underlying London Clay, the site is not considered sensitive with respect to surface water. Proposed basement development will have a completely impermeable barrier along the canal to mitigate any associated risks to the development.

Phase ll SI had been done for Plots A, B and C, please refer to RSK- Geo-environmental and Geotechnical Assessment SI Report 371654-01 (01) Aug 2019 and CGL report ref. CGL/09751-0 dated Feb. 2023 in Appendix 3.

### 2.5.4 Site Specific Intrusive Investigation Data

Phase ll SI had been done for Plots A, B and C, please refer to RSK- Geo-environmental and Geotechnical Assessment SI Report 371654-01 (01) Aug 2019 and CGL report ref. CGL/09751-0 dated Feb. 2023 in Appendix 3.

Further site investigations, intrusive surveys and testing to be carried out are explained in section 5 of this document.

# 3 STAGE 1 - SCREENING

This section of the report provides information for the purpose of screening in accordance with CPGB and addresses all questions raised within the relevant sections of that document. Tables summarising the screening flowcharts are shown as Tables 1 to 3. In accordance with procedure set out in Camden Planning Guidance Basements (CPGB), Jan. 2021, where a 'yes' or 'unknown' response is returned, the potential issue is taken to the scoping stage in Section 4.

## Table 1 – Surface flow and flooding Screening

| | Question | Answer | Evidence / Comment |
|---|---|---|---|
| 1. | Is the site within the catchment of the pond chains in Hampstead Heath? | No | The site lies 3.0km southeast of the nearest Hampstead Heath drainage catchment, will therefore not impact any catchments. |
| 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? | No | The proposed development will have a large provision of biodiverse roofs (green/Brown Roofs) resulting in significantly reduced hard roof area and providing a multitude of other benefits.<br><br>These will be drained to the canal by gravity at a controlled discharge rate subject to confirmation of ongoing liaison with the Canal & River Trust. The areas not covered by biodiverse roofs and the remaining areas at ground level will be attenuated within ground floor / basement underground storage and will be drained to sewer network at a permitted rate by the Thames Water.<br><br>Currently the site drainage is conveyed to the existing sewer system without sustainable urban drainage system.<br><br>Therefore, surface water flow routes will not be materially changed, but improved surface water management system will significantly help to eliminate any associated risks of flooding. |
| 3. | Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas? | Yes | See section 4.1.1 (scoping) |
| 4. | Will the proposed basement result in changes to the profile of the inflows | No | Page 23 of Geological, Hydrogeological and Hydrological study & Guidance for subterranean development in |

| | | | |
|---|---|---|---|
| | (instantaneous and long term) of surface water being received by adjacent properties or downstream watercourses? | | Camden (reference 213923) prepared by Arup for Camden Council states:<br>'The Regent's Canal runs east to west through the Borough between Regent's Park, Camden Town and King's Cross. In general canals are considered to pose a low flood risk as they have limited surface water inputs; they are not natural drainage channels fed by surface runoff but subject instead to controlled inflows to maintain the water level.'<br><br>Given the general impermeability of London Clay and that the canal is a man-made structure with controlled inflows, it is considered that there will be no hydraulic continuity (surface water or groundwater flow) between the canal and the surroundings.<br><br>Surface water within the site will be discharged to the canal and the Thames sewer network via biodiverse roof and below ground attenuation systems at a controlled discharge rate.<br><br>Therefore, the basement will have no impact in relation to surface water flow to adjacent properties and nearby water course. |
| 5. | Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses? | No | As noted in 4. above, there will be no impact on surface water flow in and around the basement area due to impermeability of the underlying strata.<br><br>Surface water within the site will be discharged to the canal and the Thames sewer network via biodiverse roof and below ground attenuation systems at a controlled discharge rate.<br><br>Therefore, there will be no impact on quality of the surface water being received due to the basement. |
| 6. | Is the site in an area known to be at risk from surface water flooding, such as South Hampstead, West Hampstead, Gospel Oak and King's Cross, or is it at risk from flooding, for example because the proposed basement is below static water level of a nearby surface water feature? | No | The latest online Environment Agency Flood Zone maps indicate that the site lies in Flood Zone 1 and is therefore considered to be at 'very low' risk of flooding from rivers or the sea.<br><br>Proposed basement is below the adjacent canal water level. However, as described for item 4 above, there will be a low risk of flooding from the Regent's Canal.<br><br>The basement will also be designed waterproofed to grade 3 level of protection (table 2 of BS 8102) via a cavity drain system to mitigate against any residual risk of water ingress to the basement from the surrounding soils. |

# Table 2 – subterranean (ground water) Screening

| | Question | Answer | Evidence / Comment |
|---|---|---|---|
| 1a. | Is the site located directly above an aquifer? | No | The existing site is underlain by 2m-5m of made ground underlain by approximately 20m of London Clay formation. London Clay forms an impermeable layer classified as a non-aquifer (non-productive stratum).<br>The geology is confirmed by<br>1. BGS recorded boreholes approximately within a 100m radius of the site (refer to table 3.1 of PRA attached).<br>2. The bedrock geology underlying the site shown on the BGS online maps consists of London Clay Formation. No superficial deposits are shown in the area. (page extracted from Camden Geological, Hydrogeological and Hydrological Study attached to the Appendix 6).<br>3. Environment Agency Aquifer Designation based on BGS Mapping also shows the site is located on unproductive strata. (page extracted from Camden Geological, Hydrogeological and Hydrological Study attached to the Appendix 6).<br>4. Phase ll SI had been done for Plots A, B and C, please refer to RSK- Geo-environmental and Geotechnical Assessment SI Report 371654-01 (01) Aug 2019 and CGL report ref. CGL/09751-0 dated Feb. 2023 in Appendix 3.<br>5. IStructE paper for 'The Granary site – design and construction of a mechanised letter-sorting office' published in 1985 in Appendix 3 |
| 1b. | Will the proposed basement extend beneath the water table surface? | No | BGS recorded boreholes, approximately within a 100m radius of the site, indicates there will be no ground water encountered (refer to table 3.1 of PRA). Perched water may be encountered locally within the made ground (TBC by phase II site investigation), ponding on top of the immediate London Clay. This does not constitute a water table.<br><br>Within a few meters of the ground surface the London clay can assumed to be saturated, i.e. all available pore space within the clay filled with water. Porosity within this material is so low that it does not maintain significant volumes of water and is described as 'unproductive'. In this case water recorded within the London Clay records pore water pressure and the concept of a 'ground water table' does not apply. |

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| | | | Therefore, the proposed development does not penetrate any water tables that might affect ground water levels or flows.<br><br>Phase ll SI had been done for Plots A, B and C, please refer to RSK- Geo-environmental and Geotechnical Assessment SI Report 371654-01 (01) Aug 2019 and CGL report ref. CGL/09751-0 dated Feb. 2023 in Appendix 3. |
| 2. | Is the site within 100m of water course, well (used /disused), or potential spring line? | yes | See section 4.2.1 (scoping) |
| 3. | Is the site within the catchment of the pond chains on Hampstead Heath? | No | The Site lies 3.3km southeast of the nearest Hampstead Heath drainage catchment will therefore not impact any catchments. |
| 4. | Will the proposed basement development result in a change in the proportion of hard surfaced /paved areas? | yes | See section 4.2.2 (scoping) |
| 5. | As part of site drainage, will more surface water (e.g. rainfall and run- off) than at present be discharged to the ground (e.g. via soakaways and / or SUDS)? | No | The new development is proposed to have biodiverse roofs with attenuation and the surface water will be discharged to the canal under controlled discharge rate to be agreed by the Canal & River Trust. The areas not covered by biodiverse roofs and the remaining areas at ground level will be attenuated within ground floor / basement underground storage and will be drained to the sewer network at a permitted rate by Thames Water. |
| 6. | Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) or close to, or lower than, the mean water level in any local pond (not just the pond chains in Hampstead Heath) or spring line? | yes | See section 4.2.3 (scoping) |

# Table 3 – Slope Stability Screening

| | Question | Answer | Evidence / Comment |
|---|---|---|---|
| 1. | Does the existing site include slopes, natural or manmade, greater than 7°? (Approximately 1 in 8) | No | Existing site does not have any natural slopes but the canal side retaining wall creates a slope of 45° locally maintaining access to existing ground floor level from canal frontage walk. This is considered as a part of building and not functioning as a site slope.<br><br>Site is naturally sloping towards the west with a slope of 3° to 5° falling from canal side to St Pancras Way.<br><br>Slope Angles calculated from Digital Terrain Model Provided by Camden Borough Council evidenced that the Site does not have natural slopes greater than 7°. See slope angle map extracted from Camden Geological, Hydrogeological and Hydrological Study in Appendix 6. |
| 2. | Will the proposed re-profiling of landscaping at site change slopes at the property boundary to more than 7°? (Approximately 1 in 8) | No | There is a 3m level difference across the site falling from canal side to St Pancras Way. This is formed in the public realm with Part M compliant steps and ramps. Different floor levels are maintained within the building to suit the perimeter external levels such that the level access is achieved through out. Refer to Architect's drawing TRI-PWA-ZZ-00-DR-A-01100-B&C - GA - GROUND FLOOR & Camlins drawings TRI-CLA-ZZ-00-DR-L-0001 GA - Public Realm Plan (1 of 2) in Appendix 6 for levels. |
| 3. | Does the development neighbour land, including railway cuttings and the lake, with a slope greater than 7°? (Approximately 1 in 8) | No | As in 1. above, Slope Angles calculated from Digital Terrain Model Provided by Camden Borough Council evidenced that site does not have natural slopes greater than 7°. See slope angle map extracted from Camden Geological, Hydrogeological and Hydrological Study in Appendix 7. |
| 4. | Is the site within a wider hillside setting in which the general slope is greater 7°? (Approximately 1 in 8) | No | Slope Angles calculated from Digital Terrain Model Provided by Camden Borough Council evidenced that site does not have natural slopes greater than 7°.<br>The 1:50000 scale geological map for the area indicates that the site does not lie within an 'Area of Significant Land Slide potential'. The BGS landslide potential map is extracted from Arup report attached to Appendix 7. |
| 5. | Is the London Clay the shallowest strata at the site? | Yes | See section 4.3.1 (scoping) |
| 6. | Will any tree/s be felled as part of the proposed development and/or are any works proposed | Yes | See section 4.3.2 (scoping) |

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| | within any tree protection zones where trees are to be retained? | | |
| 7. | Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site? | No | There is no evidence of seasonal shrink-swell effects on site. Given that the underlying natural ground is high volume change potential London clay, there is potential for such effects, but it is not known whether there are any structures that have been affected in wider area. |
| 8. | Is the site within 100m of a watercourse or a potential spring line? | Yes | See section 4.3.3 (scoping) |
| 9. | Is the site within an area of previously worked ground? | Yes | See section 4.3.4 (scoping) |
| 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 existing site is underlain by 2m-5m of made ground underlain by approximately 20m of London Clay formation. London Clay forms an impermeable layer classified as a non-aquifer (non-productive stratum).<br>Phase ll SI had been done for Plots A, B and C, please refer to RSK- Geo-environmental and Geotechnical Assessment SI Report 371654-01 (01) Aug 2019 and CGL report ref. CGL/09751-0 dated Feb. 2023 in Appendix 3. |
| 11. | Is the site within 50m of the Hampstead Heath ponds? | No | The Site lies 3.0km Southeast of the nearest Hampstead Heath drainage catchment, will therefore not impact any catchments. |
| 12. | Is the site within 5m of a highway or pedestrian right of way? | Yes | See section 4.3.5 (scoping) |
| 13. | Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties? | Yes | See section 4.3.6 (scoping) |
| 14. | Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines? | Yes | See section 4.3.7 (scoping) |

# 4 STAGE 2 - SCOPING

## 4.1 Surface Flow and Flooding Scoping

**4.1.1 QUESTION**:
Will the proposed basement development result in a change in the proportion of hard surfaced/paved external areas?

**POTENTIAL IMPACT**:
A change in the proportion of hard surface or paved areas of a property will affect the way in which rainfall and surface water are transmitted away from a property. This includes changes to the surface water received by the underlying aquifers, adjacent properties and nearby watercourses.

**SCOPE:** All surface water drainage from existing site, including on the canal-side, appears to flow into the public combined sewer. The site in its existing state does not provide any attenuation of surface water, and during an extreme storm event it is expected to overload the public sewer network and flow onto adjacent land/canal.

The proposed development will have a large provision of biodiverse roofs resulting in significantly reduced hard roof area. From the biodiverse roof with attenuation, surface water will be discharged to the canal under controlled rate that had been agreed by the Canal & River Trust. The areas not covered by biodiverse roofs and the remaining areas at ground level will be attenuated within ground floor/basement underground storage and will be drained to the sewer network at a permitted rate by the Thames Water. We will be liaison with Canal River Trust and Thames Water Utilities Ltd as we have done on Plot A.

Therefore, the new development will have further improved surface water management system that will help to reduce the risk of flooding in the surrounding area. There is no risk of free flow of surface water in and around the site caused by new development.

## 4.2 Subterranean (Ground water) Scoping

**4.2.1 QUESTION**:
Is the site within 100m of a watercourse, well (used/disused) or potential spring line?

**POTENTIAL IMPACT**:
The flows or levels of water features may be impacted if the groundwater flow regime that supports them is affected by a proposed basement.

**SCOPE:** The north-eastern boundary of the site is immediately adjacent to the canal bank of the Regent's Canal. The canal wall along the boundary had been a massive 0.72m wide brick wall construction. According to the IStructE report published during the construction of existing mechanised post office building, following investigations, a decision had been made to construct an impermeable sheet pile wall alongside the massive brick wall. Therefore, the boundary along the canal now consists of cantilever sheet pile wall which will not be disturbed by the new construction. Water level in the canal is 23.13m AOD and the canal is approximately 1.5m to 2.0m deep (i.e., the base of the canal is at approximately 21.15m AOD).

In addition, it is assumed that the culverted Fleet River, one of the 'Lost Rivers of London' follows a course down St Pancras Way. The section of the Fleet River between Camden and Kings Cross was culverted during the development of the Regents Canal from 1812 onwards and now exists as a large underground sewer. This feature is not indicated to impinge on the site.

Given the general impermeability of London Clay and that the Regent's canal is a man-made structure with controlled inflows, it is considered that there will be no hydraulic continuity between the site and the canal. Therefore, there should be no impact in relation to groundwater flow regime or the canal water flow or level.

**4.2.2 QUESTION:**
Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?

**POTENTIAL IMPACT:** The sealing off the ground surface by pavements and buildings to rainfall will result in decreased recharge to the underlying ground. In areas of non-aquifers (i.e. London Clay), this may mean changes in infiltration and the degree of ground saturation, which in turn may affect stability.

**SCOPE:** In its current configuration, the site is considered to be predominantly impermeable, consisting of concrete buildings with large flat roofs and hard paving around the buildings. A CCTV survey of the existing site drainage undertaken by Drainage Technical Services Ltd on 2dn April 2017 confirms all surface water drainage from the site, including on the canal-side, appears to flow into the public combined sewer under St Pancras Way via a connection between plot A and B. There are no existing surface water outfalls to Regent's Canal from the site.

For the proposed development, the underlying London Clay geology is unlikely to be appropriate for direct infiltration of surface water. Surface water therefore will only leave the site via Regent's Canal or the Thames Water combined sewer network and will be actively managed on site through the provision of Sustainable Drainage Systems (SUDS) where possible.

The proposed development will have a large provision of biodiverse roofs, resulting in significantly reduced hard roof area, and providing a multitude of other benefits. Biodiverse roofs provide a certain amount of attenuation, but they will be enhanced to provide an additional volume of 'blue' roof attenuation.

These will be drained to the canal by gravity at a controlled discharge rates per plot as agreed with the Canal & River Trust as the approved FRA report dated the August 2017. The areas not covered by biodiverse roofs and the remaining areas at ground level will be attenuated within ground floor/basement underground storage and will be drained to the sewer network at a permitted rate by the Thames Water.

The system will be designed such that runoff from the 1% annual probability rainfall event and +40% for climate change is fully retained on the site within biodiverse roofs attenuation tanks and discharged at a controlled rate. Please refer to the approved FRA report rev. C which was issued Mar 2018 as in Appendix 10.

We can confirm that the core principles of the FRA and SuDS report for Plot A as submitted for planning in August 2017 remain unchanged for Plots B and C. Details of the Sustainable Drainage Strategy are still to be resolved as the building and roof layout is still under review, however the design intent is to discharge as much as possible of the clean surface-water drainage to the adjacent canal, in accordance with the principles previously agreed with CRT. Key components of the drainage strategy include Green Roofs, Blue Roofs and a shallow drainage system which will discharge to via a demarcation chamber to the Canal. For areas of the site which are below the canal level, site runoff will discharge to the public sewer via a gravity drainage system, attenuated to a restricted rate to be agreed with Thames Water.

Therefore, there will be no risk of infiltration or ground saturation and any associated risks like ground stabilisation. Site will also be watertight with cavity drained system mitigating any risk from perched ground water while the perimeter contiguous pile wall will form the structural stability.

The phase II site investigation has now been commissioned and any mitigation measures will be clarified /included in detail design as necessary.

**4.2.3 QUESTION:**
Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to, or lower than, the mean water level in any local pond (not just the pond chains on Hampstead Heath) or spring line?

**POTENTIAL IMPACT**:
Groundwater may drain from the water feature and flow into the basement excavation space.

**SCOPE:** The site is adjacent to the Regent's canal. Water level in the canal is at 23.13m AOD and the canal is approximately 2m deep which means the base of the canal is at approximately 21.15m AOD.

The proposed basement level at the site varies from 11.50 to 18.00m AOD, some 9.65m below the base of the canal at its deepest area.

However, as noted 4.2.1 above, given the construction of the canal wall and the general impermeability of the London Clay, it is considered that there should be no hydraulic continuity between the site and this feature and that the proposed basement development should have no impact in relation to groundwater, and vice versa. Please refer to the Phase ll SI reports in appendix 3

## 4.3 Slope Stability Scoping

**4.3.1 QUESTION**:
Is the London Clay the shallowest strata at the site?

**POTENTIAL IMPACT**:
The London Clay is prone to shrink-swell (subsidence and heave)

**SCOPE:** As previously noted, the existing site is underlain by a layer of Made ground underlain by London Clay formation which have been confirmed by Phase II site investigations. There will be both vertical and horizontal soil movements as a result of deep excavations.

Contiguous piled retaining wall structure will be installed around the perimeter of the site which will be designed to resist both horizontal and vertical movement by heave and subsidence. A numerical assessment of heave potential will be followed by monitoring of ground movement before, during and after excavation at predetermined time intervals.

An Impact Assessment based on site investigation and study have been carried out as the detail design stage and reported in section 6

**4.3.2 QUESTION**:
Will any tree/s be felled as part of the proposed development and/or are any works proposed within any tree protection zones where trees are to be retained?

**POTENTIAL IMPACT**:
The soil moisture deficit associated with felled trees will gradually recover. In high plasticity clay soils (such as the London Clay) this will lead to gradual swelling of the ground until it reaches a new value. This may reduce the soil strength which could affect ground stability.

**SCOPE:** There are 30 no. individual trees within influence of the application area according to the Arboricultural Impact assessment issued by Aspect in April 2017. The proposed development will require all the existing trees to be removed. 21 out of 30 trees are completely within the proposed basement footprint and will be removed entirely by the new excavations. Remaining trees along the canal edge will also be removed in order to accommodate the new landscape.

As noted in section 4.3.1, any impact from heave or subsidence will be taken into account during detail design.

**4.3.3 QUESTION**:
Is the site within 100m of a watercourse or a potential spring line?

**POTENTIAL IMPACT**:
Seasonal spring lines and changes to groundwater regimes within slopes can affect slope stability.

**SCOPE:** As previously noted, northeast boundary of the site is immediately adjacent to the Regent's Canal. The ground and groundwater conditions identified through the Phase 2 Site Investigations reveals there is no mobile or significant groundwater regime beneath the site and no significant slopes in the site area.

Given the general impermeability of London Clay and that the canal is a man-made structure with controlled inflows, it is considered that there will be no hydraulic continuity between the site and the canal. Therefore, there will be no impact in relation to ground water flow, slopes or stability to the proposed basement.

**4.3.4 QUESTION**:
Is the site within an area of previously worked ground?

**POTENTIAL IMPACT**:
Previously Worked ground may be less homogeneous than natural strata and may include relatively uncontrolled backfill zones.

**SCOPE:** The IStructE paper included a summary of an intrusive site investigation that was undertaken prior to construction of the sorting office.

It was indicated that the former granary building had been founded upon a concrete raft foundation that had been placed by excavating down approximately 6m below the water level of the adjacent canal, above which 225mm thick sandstone blocks had been placed on a 4.2m grid to form bases to cast iron columns. According to the paper the concrete raft had been placed directly upon London Clay and infilling above the concrete raft and around the sandstone blocks had been carried out with approximately 1.2m of reworked clay upon which the floor had been constructed.

This has been confirmed within twenty-two borehole records which indicated that the hardstanding of the former granary building was underlain by approximately 20m of London Clay that was in turn underlain by clay of the 'Lambeth Group Reading Formation'.

Phase II site investigations confirmed these ground conditions and most of the made ground material will be removed as part of the new development and the new structure will be supported on piled foundation secured with contiguous perimeter walls. Basement slabs will be suspended on ground beams supported by pile caps with collapsible compressible material as a heave protection layer underside. Therefore, there will be no impact or risk of land stability.

As described in item 4.3.1, contiguous piled retaining wall structure will be installed around the perimeter of the site which will be designed to resist both horizontal and vertical movement by heave and subsidence.

An Impact Assessment based on site investigation and study will be carried out at the design stage and reported in section 6.

**4.3.5 QUESTION**:
Is the site within 5m of a highway or pedestrian right of way?

**POTENTIAL IMPACT**:
Excavation for a basement may result in damage to the road, pavement or any underground services buried in trenches beneath the road or pavement.

**SCOPE:** Granary Street and St Pancras way are located to the immediate south and southwest of the site, respectively. There is the potential for ground movements associated with basement excavation to impact the adjacent highways.

Contiguous piled retaining wall structure will be installed around the perimeter of the site which will be designed to resist both horizontal and vertical movement by heave and subsidence. A numerical assessment of heave potential will be followed by monitoring of ground movement before, during and after excavation at predetermined time intervals.

An Impact Assessment based on site investigation and study will be carried out at the design stage and reported in section 6.

**4.3.6 QUESTION**:
Will the proposed basement significantly increases the differential depth of foundations relative to neighbouring properties?

**POTENTIAL IMPACT**:
Excavation for a basement may result in structural damage to neighbouring properties/ structures if there is a significant differential depth between adjacent foundations.

**SCOPE:** The following nearby structures were identified as being potentially at risk from damaging ground movements and differential depths in foundations:

- The Thames Water Sewer line beneath the site across plot A. However, Plot A is currently under construction and the basement box have now been constructed and approved by TW.
- Phased construction between Plots A which is under construction, Plots B and C will be demolished simultaneously and re-build from Plot B to C continuously.
- The Regent canal structure.
- Culverted Fleet River running underneath the St Pancras Way.
- Retaining wall along the Granary Street opposite St Pancras hospital.
- Adjoining buildings along the St Pancras Way.

Contiguous piled retaining wall structure will be installed around the perimeter of the site which will be designed to resist both horizontal and vertical movement by heave and subsidence. A numerical assessment of heave potential will be followed by monitoring of ground movement before, during and after excavation at predetermined time intervals.

An Impact Assessment based on site investigation and study will be carried out at the design stage and reported in section 6.

**4.3.7 QUESTION**:
Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?

**POTENTIAL IMPACT**:
Excavation for a basement may result in damage to the underground structure.

**SCOPE:** There are no tunnels, tunnel exclusion zones, but there is a Thames Water Sewer line across the site. The middle level sewer no. 2, a part of London's historic sewer system, now part of the Thames Water Authority's system, has been constructed by tunnelling under the northern part of the site. The sewer is approximately 2.2m

in diameter and is brick lined throughout, with its crown about 5.5m below the existing ground level. The existing building has been built bridging over the sewer with contiguous piles outside the easement area.
New contiguous piled wall will be installed outside the easement zone to resist both lateral and vertical movement by heave and subsidence. A numerical assessment of heave potential will be followed by monitoring of ground movement before, during and after excavation at predetermined time intervals.

Detailed designs had been carried out and provided a "Structural Robust Solution" that had been submitted and approved by TW. The construction of this "Structural Robust Solution" have now been constructed and completed and therefore no further impact assessment is required. Please note that 600mm diameter contiguous piled wall had been installed and designed to support a double basement construction for plot B which had been submitted to TW previously and approved. Current scheme is only to provide a single basement construction under plot B.

# 5 SITE INVESTIGATION AND STUDY

The following studies have already been undertaken to date and submitted with this report.

1. Phase II Site Investigations for Plots A and B had been done and issued. Phase II Site Investigation for Plot C had been done and included in Appendix 3.
2. Thames Water sewers beneath Plot A and along the St. Pancras Way had been investigated, surveyed, and located and the reports have been included in Appendix 9.
3. Existing canal steel sheet piled wall including the brick retaining wall had been investigated and surveyed.
4. The approved Flood Risk Assessment (FRA) by Water Environment Limited.
5. Ordinary Meeting paper on The Granary Site – Design and construction of a mechanised letter sorting office including the discussion paper.
6. Predicted heave movement during construction for the existing UBB building.
7. The original sections and plans of the existing buildings (Appendix 6).
8. Topographical surveys by Clugston Survey Services and Laser Surveys.

The following investigations are to be carried out prior to detail design:

Further Intrusive investigations to determine the existing piles diameter, reinforcement, depth, durability and capacity for possible re-use within the plot B and C where required.

The report will be extended to include geotechnical assessments/calculations, predicted movements, Burland scale and proposed foundation designs etc. will be completed before commencement of construction.

# 6 IMPACT ASSESSMENT

This stage is concerned with evaluating the direct and indirect implications of the proposed basement development. It involves describing, quantifying and aggregating the effects of the development on those attributes or features which have been identified in the scoping stage as being potentially affected.

**Surface flow and flooding:** No potential impacts identified beyond the scoping stage.

**Subterranean (ground water) flow:** No potential impacts identified beyond the scoping stage.

**Land stability:** Potential impacts identified relate to ground movements associated with:

- Phase construction between Plots A/ B & C.
- Retaining walls installation and ground excavation to Plots B and C.
- Existing Thames Water Sewer beneath the St. Pancras Way.
- Elastic heave of the London Clay in the basement excavation due to relief of overburden.

GDP will complete the detailed design following the receipt of additional Ground Movement Assessment set out in section 5.0.

As part of the assessment the following nearby structures have been identified as being potentially at risk from damaging ground movements:

- Phased Construction of the new buildings Plot A which is currently under construction, Plot B and Plot C.
- Surrounding buildings along Granary Street and the St. Pancras Way.
- The Regent Canal structures.
- Thames Water culverted Fleet River sewer running underneath the St Pancras Way.

Likely ground movements and building strains associated with basements construction can be estimated in two ways: by an empirical approach adopted by reference to previous case studies of similar developments, and computer analysis employed to model the basement excavation and its construction.

For this project PLAXIS 3D analysis will be used which is a geotechnical finite element soil-structure interaction program developed for the analysis of deformation, stability and groundwater flow in geotechnical engineering in three dimensions for the prediction of ground movements.

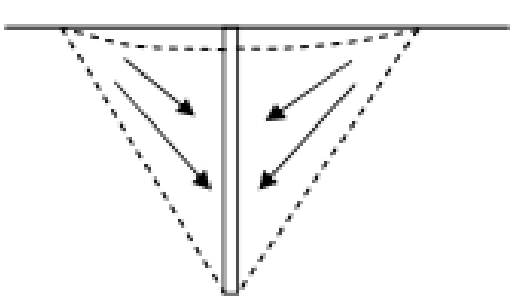
Contiguous piled retaining wall structure will be installed around the perimeter of the site which will be designed to resist both horizontal and vertical movement by heave, settlement and subsidence. The results from the assessment of movement potential will be followed by monitoring of ground movement before, during and after excavation at predetermined time intervals.

## 6.1 Structural stability of adjacent structures from Retaining wall and basement excavation.

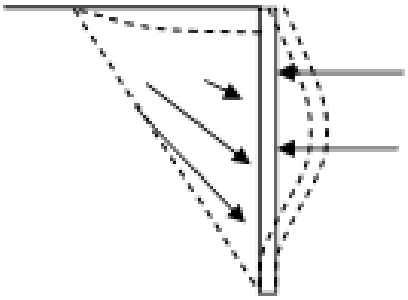
Below ground construction, involving the installation of basement retaining walls and excavation of the ground to form the basement accommodation space, has the potential to cause movements in the surrounding ground.

We will have undertaken ground movement analyses based on the empirical approach described in CIRIA C580 “Embedded Retaining Walls – Guidance for Economic Design”. This document provides charts of vertical and horizontal ground movements resulting from installation of embedded retaining walls and excavation in front of the walls, as shown schematically in Illustration 1 below. The C580 charts have been normalised with wall length and excavation depth to facilitate their use for new developments.

**Illustration 1**: Schematic illustration of potential ground movements associated with contiguous bored pile wall installation and excavation in front of the retaining wall.



Ground Movement Due to Pile Installation



Ground and Wall Movement Due to Excavation

In the temporary condition, the proposed basement excavation will be retained by a contiguous bored pile wall supported by rigid propping. In the permanent condition, the retaining wall will be rigidly propped by the basement floor and ground floor reinforced concrete slabs.

The proposed basement level across the site varies from 11.50m to 18.00m AOD while the canal water level is at 23.13m AOD, canal Bed is at 21.15m AOD, Canal bank is at 23.6 AOD, and St Pancras Road level varies from 21.690m to 20.275 AOD adjacent site boundary. This indicates that excavations beneath the site are likely to extend up to approximately 4.49m on the North-western boundary to approximately 8.775m on the Southwestern boundary where the double basement proposed. In summary, Plot A excavation depth varies from 4.15m to 5.6m, Plots B and C excavation depth varies from approximately 5.83m to 8.775m. Appendix 1 gives General Arrangement of site plans and sections illustrating the proposed development.

For this analysis, we have assumed a minimum embedment depth of 1.5 times the retained height for the contiguous bored pile wall, wholly embedded in stiff clay under conditions of a high standard of workmanship during construction. We have considered the retaining wall to be of high stiffness on the basis that temporary props of high stiffness will be installed before permanent props at high level (in accordance with C580. Final design and checking of the Contiguous piled walls will be carried out by piling specialists.

Ground Movement Analysis reports had been carried out by CGL to provide assessments on the following:

9. Highway & Building Damage Assessment ref. CGL09751A_TribecaCamden-PlotC_GMA&BDA_December2022.
10. Sewer Impact Assessment ref. CGL09571A_TribecaCamden-PlotC_GMA&SIA_December2022.
11. Canal Wall Impact Assessment ref. CGL0751A_TribecaCamden-PlotC_GMA&CWIA_December2022.

The information and tables below are the summary results from the above assessments and extracted from their reports.

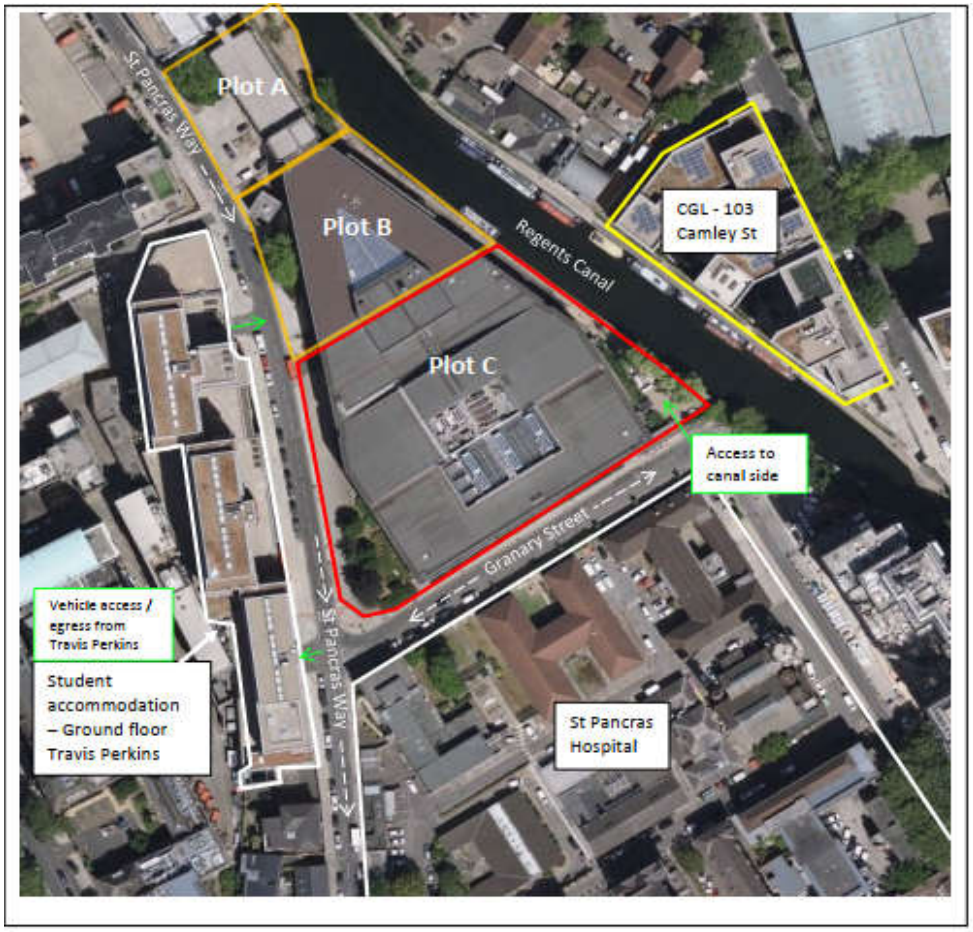



Figure 5: Location of neighbouring structures.

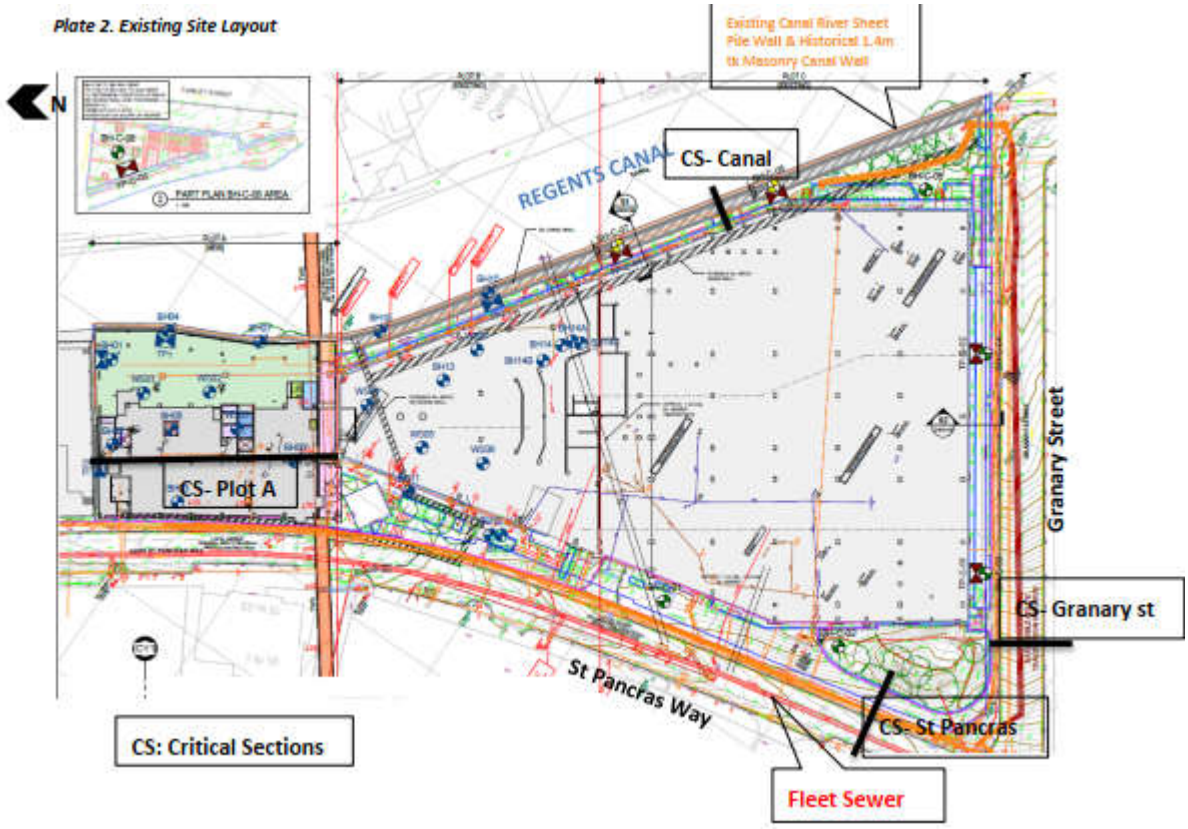



Figure 6: Existing site.

**Predicted Pile Wall Movements.**

Please refer to CGL09751A_TribecaCamden-PlotC_GMA&BDA_December2022.

Tables 11 and 12 shows the maximum vertical movements and deflection at each pile wall for plots B & C.

*Table 11. Plot B - Pile Wall Vertical and Horizontal movements Summary*

| Continue wall Boundary | Pile Wall Vertical Movement uz – Plot B Excavation Stage (mm) | Pile Wall Deflection u3 – PlotB Excavation Stage (mm) | Pile Wall Vertical Movement uz – Plot B Short Term Construction (mm) | Pile Wall Deflection u3 – PlotB Short Term Construction (mm) | Pile Wall Vertical Movement uz – PlotB Long Term Construction (mm) | Pile Wall Deflection u3 – PlotB Long Term Construction (mm) |
|---|---|---|---|---|---|---|
| North (Plot A) | +8.0 | **11.0** | -3.0 | 10.0 | +5.0 | 5.0 |
| East (Canal) | +12.0 | 20.0 | -8.0 | **23.0** | +5.0/-4.0 | 22.0 |
| West (highway) | +11.0 | 15.0 | -10.0 | **20.0** | -3.0 | 18.0 |

*Table 12. Plot C - Pile Wall Vertical and Horizontal movements Summary*

| Continue wall Boundary | Pile Wall Vertical Movement uz – PlotC B2 Excavation Stage (mm) | Pile Wall Deflection u3 – PlotC B2 Excavation Stage (mm) | Pile Wall Vertical Movement uz – PlotC Short Term Construction (mm) | Pile Wall Deflection u3 – PlotC Short Term Construction (mm) | Pile Wall Vertical Movement uz – PlotC Long Term Construction (mm) | Pile Wall Deflection u3 – PlotC Long Term Construction (mm) |
|---|---|---|---|---|---|---|
| East (Canal) | +6.0 | **27.0** | -9.0 | 26.0 | -7.0 | 25.0 |
| South (Granary Street) | +6.0 | 22.0 | -7.0 | **23.0** | -10.0 | 20.0 |
| West (highway) | +7.0 | 21.0 | -4.0 | **23.0** | -4.0/+3.0 | 23.0 |

**Building and Highway Damage Assessment.**

Please refer to CGL09751A_TribecaCamden-PlotC_GMA&BDA_December2022.

***Table 13. Classification of Damage Visible to Walls (Reproduction of Table 6.4, CIRIA C760)***

| *Category* | *Definition* |
|---|---|
| 0<br>(Negligible) | Negligible – hairline cracks. |
| 1<br>(Very slight) | Fine cracks that can easily be treated during normal decoration (crack width <1mm). |
| 2<br>(Slight) | Cracks easily filled, redecoration probably required. Some repointing may be required externally (crack width<br><5mm). |
| 3<br>(Moderate) | The cracks require some opening up and can be patched by a mason. Recurrent cracks can be masked by<br>suitable linings. Repointing of external brickwork and possibly a small amount of brickwork to be replaced<br>(crack width 5 to 15mm or a number of cracks > 3mm). |
| 4<br>(Severe) | Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows<br>(crack width 15mm to 25mm but also depends on number of cracks). |
| 5<br>(Very Severe) | This requires a major repair involving partial or complete re-building (crack width usually >25mm but depends<br>on number of cracks) |

*Table 14. Summary of assumed dimensions and foundation depths for the critical sections*

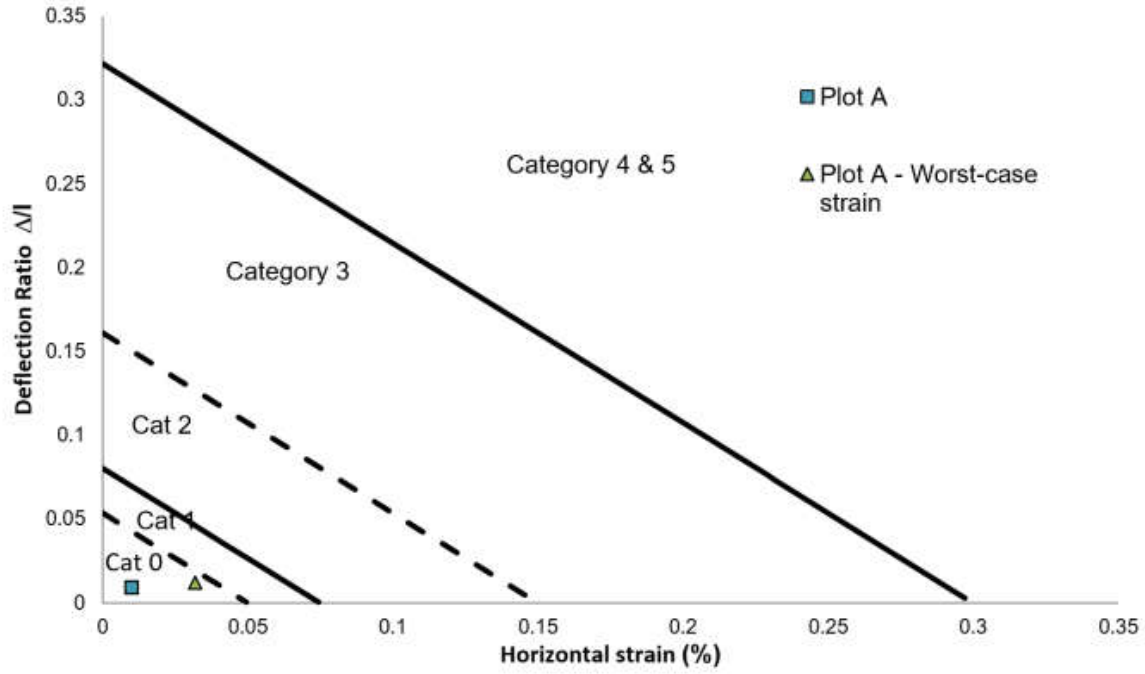
| Critical Section Ref | Building/Highway | Distance from edge of the excavation (m) | Length [m] | Height [m] | Foundation Level [mOD] |
|---|---|---|---|---|---|
| CS1 | Plot A (to the north) | ~0 | 44 | 32.5 | +16.70 |
| CS2 | Granary Street (to the south) | ~0 | 15 | N/A | +21.50 |
| CS3 | Highway (to the west) | ~0 | 16 | N/A | +21.50 |

**Critical section 1 – Plot A.**

*Table 15. Building Damage Assessment – Plot A Summary*

| Building | Façade Dimensions L/H | Calculated Maximum Horizontal Deflection (mm) | Calculated Maximum Vertical Deflection (mm) | Angular Distortion | Deflection Ratio Δ/L[a] (%) | Strain $\delta_h/L^b$ (%) | Damage Category |
|---|---|---|---|---|---|---|---|
| Plot A | 1.35 | 8.0 | 3.0 | 1/2000[d] | 0.009[c]<br>0.012[d] | 0.010[c]<br>0.032[d] | 0 |

*Plate 35. Building Damage Assessment Plot for Plot A*




**Critical section 2 – Granary Street Highway.**

Combined vertical and horizontal movement profiles at +21.50mOD for Granary Street are presented in Plate 36 and Plate 37. It can be observed that the worst-case movements at +21.50mOD are anticipated to occur over the B2 excavation and the construction stage in the short-term condition. Approximately, 4mm of heave is expected below the highway at +21.50mOD, whereas ~5mm of settlement is expected on the opposite end of the highway at the same level.

A maximum horizontal movement of 20mm and ~10mm is anticipated under the highway at ~0m and 18m away from the proposed basement, respectively. This accounts for horizontal ground movements induced by installation of the piled wall and the deflection of the wall due to the proposed excavation works.

These values are not expected to significantly affect the highway and are considered to be within acceptable limits.

*Plate 36. Combined Vertical Movements for Granary Street at +21.50mOD*

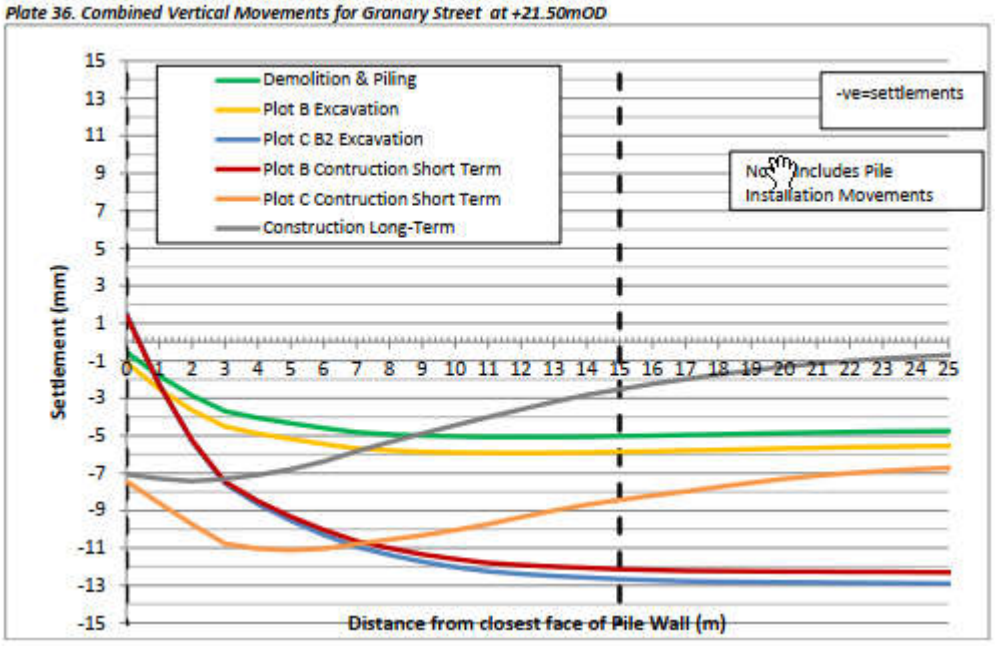
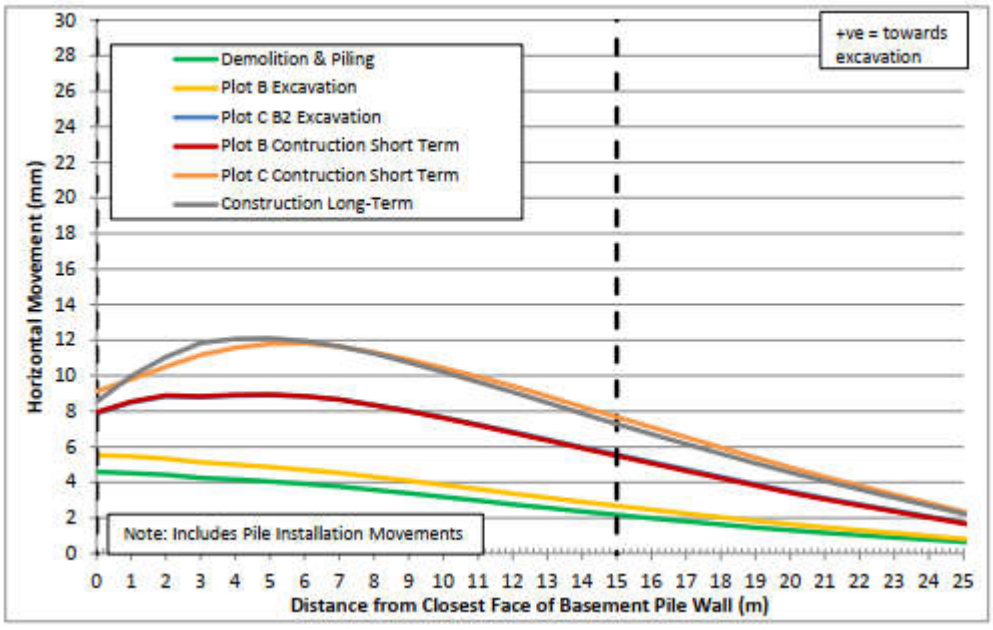



*Plate 37. Combined Horizontal Movements for Granary Street at +21.50mOD*




**Critical section 3 – St. Pancras Highway.**

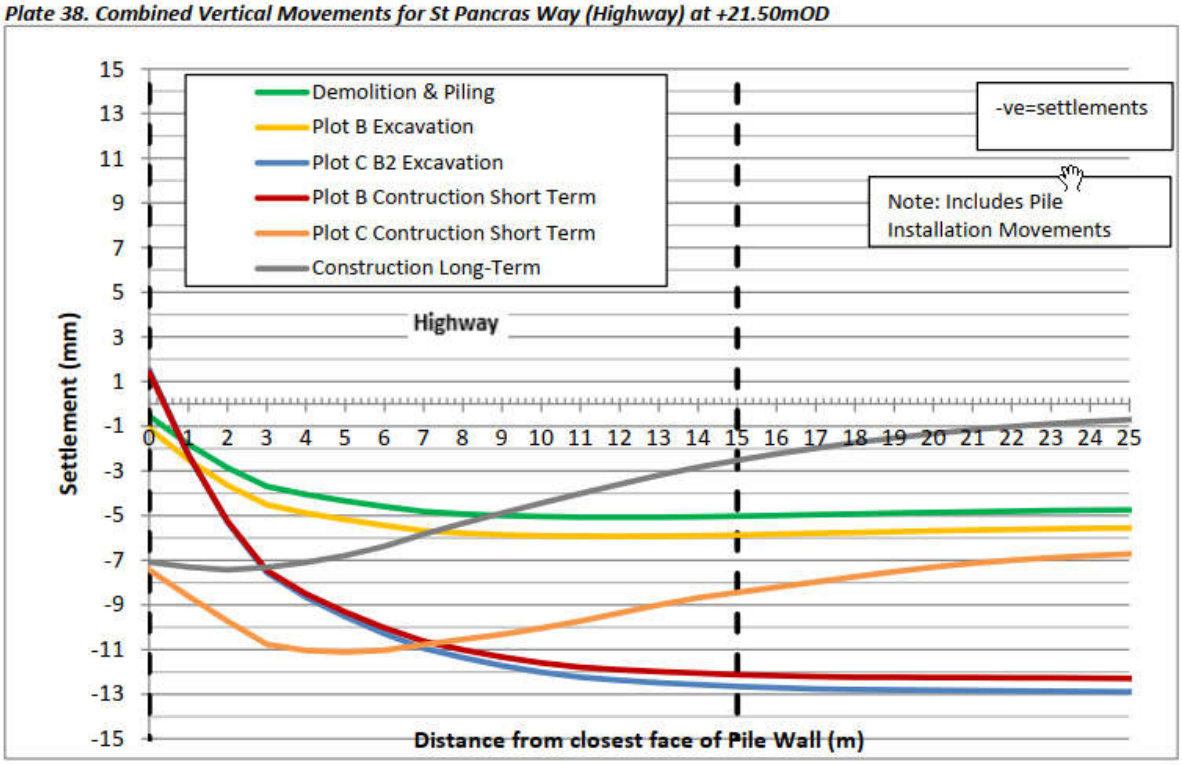
Combined vertical and horizontal movement profiles at +21.50mOD for the St Pancras Highway are presented in Plate 38 and Plate 39. It can be observed that the worst-case movements at +21.50mOD are anticipated to occur over the B2 excavation and the construction stage in the long-term condition.

Approximately 3mm of heave is expected below the highway at +21.50mOD close to the basement, whereas ~12mm of settlement is expected on the opposite end of the highway at the same level.

A maximum horizontal movement of 13mm is predicted 5m behind the wall reducing to 7mm at the opposite end of the highway. This accounts for horizontal ground movements induced by installation of the piled wall and the deflection of the wall due to the proposed excavation works.

These values are not expected to significantly affect the highway and are considered to be within acceptable limits.

*Plate 38. Combined Vertical Movements for St Pancras Way (Highway) at +21.50mOD*




**Sewer Impact Assessment.**

Please refer to CGL0751A_TribecaCamden-PlotC_GMA&CWIA_December2022.

The predicted maximum vertical and horizontal movements and corresponding strain at the crown level is summarised in Table 15.

Detailed plots at the crown level are presented in the appended Figure 2 to Figure 12 for the fleet sewer on pages 57 to 67 in the above report.

*Table 15. Impact Assessment Output Summary*

| Asset | Maximum perpendicular horizontal displacement (mm) | Maximum parallel/axial horizontal displacement (mm) | Maximum vertical displacement (mm) | Maximum combined strain – Tension (με) | Maximum combined strain – Compression (με) |
|---|---|---|---|---|---|
| Fleet Sewer | +16.0 | +9.0 | -10.0 | +250 | -250 |

Based on the above, and consideration of the overall results and behaviour of the assets, the risk of impact of the proposed development works on the sewer is considered to be low and within acceptable limits.

Monitoring will be provided to control and manage risk to the sewer during construction stage and to be agreed with Thames Water.

**Canal Walls Impact Assessment.**

Please refer to CGL0751A_TribecaCamden-PlotC_GMA&CWIA_December2022 for the predicted sheet pile & masonry canal wall movement.

*Table 13. Historical Masonry Brick Canal Wall And Sheet Pile Wall - Vertical and Horizontal movements Summary (-ve Horizontal = toward the basement, -ve Vertical= Settlements)*

| Canal River Trust Walls | Wall Vertical Movement uz – B2 Excavation Stage (mm) | Wall lateral movements u3 – B2 Excavation Stage (mm) | Wall Vertical Movement uz – Short Term Construction (mm) | Wall lateral movements u3 – Short Term Construction (mm) | Wall Vertical Movement uz – Long Term Construction (mm) | Wall lateral movements u3 – Long Term Construction (mm) |
|---|---|---|---|---|---|---|
| Canal Sheet Pile Wall | -9.0 | 22.0 | -9.0 | 21.0 | -3.0 | 21.0 |
| Masonry Historical Wall | -9.0 | 21.0 | -10.0 | 20.0 | -5.0 | 20 |

The adopted height and length of the critical canal wall have been summarised in Table 14 below.

*Table 14. Summary of assumed dimensions for the canal wall.*

| Critical Section Ref | Section Name | Brick Wall Distance from pile wall centreline (m) | Sheet Pile Wall Distance from pile wall centreline (m) | Brick Wall Top [toe] Level (mOD) | Sheet Pile Wall Top [toe] Level (mOD) |
|---|---|---|---|---|---|
| CS1 | Canal Wall (to the east) | ~3.7 | ~6.5 | 23.7 [20.2] | 23.7 [17.5] |

The combined vertical and horizontal movement profiles at +20.15mOD for the masonry Canal Wall are as shown on Plate 42 and Plate 43 below.

*Plate 42. Combined Horizontal Movements for the Canal Wall at +20.15mOD*

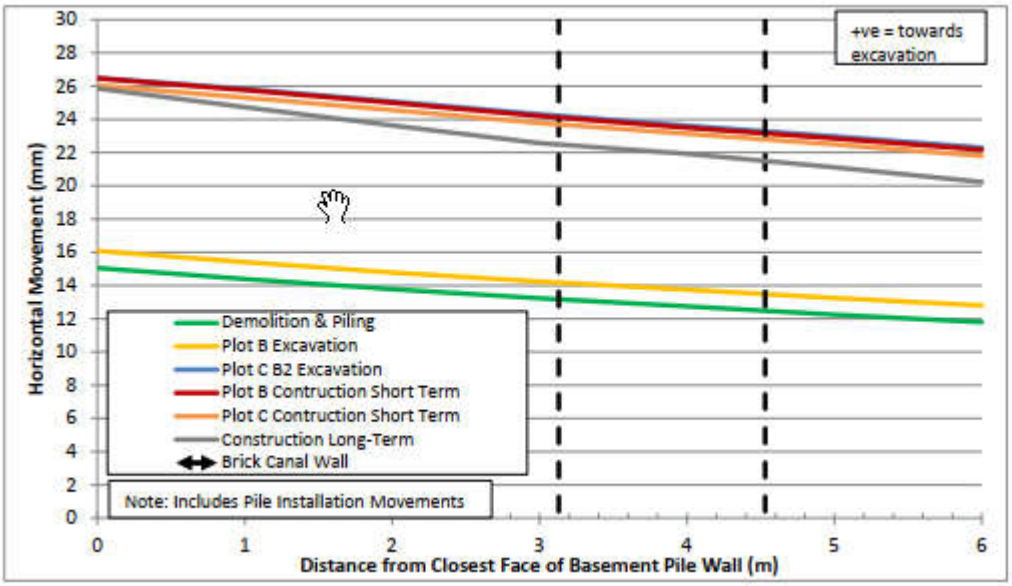
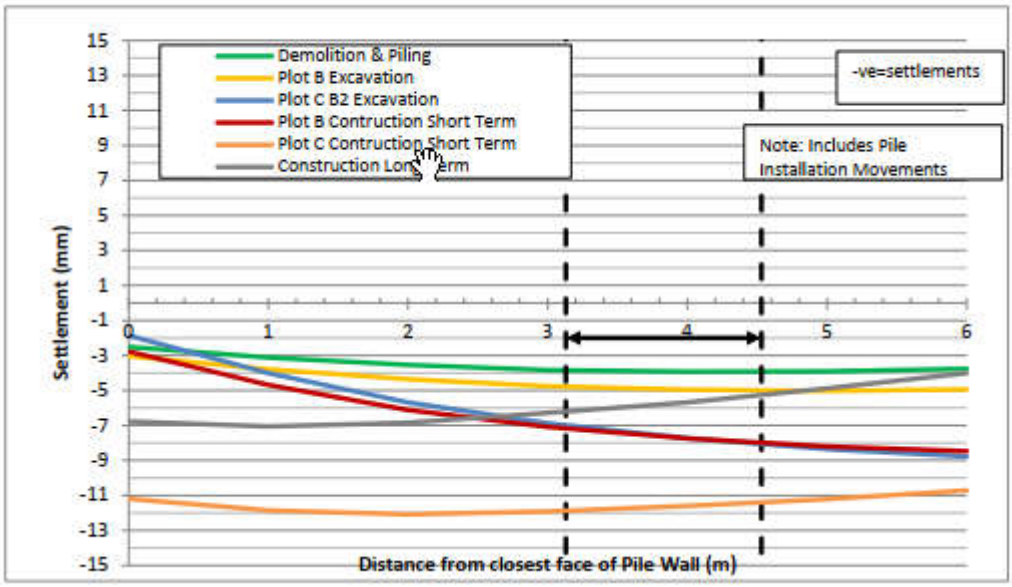


*Plate 43. Combined Vertical Movements for the Canal Wall at +20.00mOD*

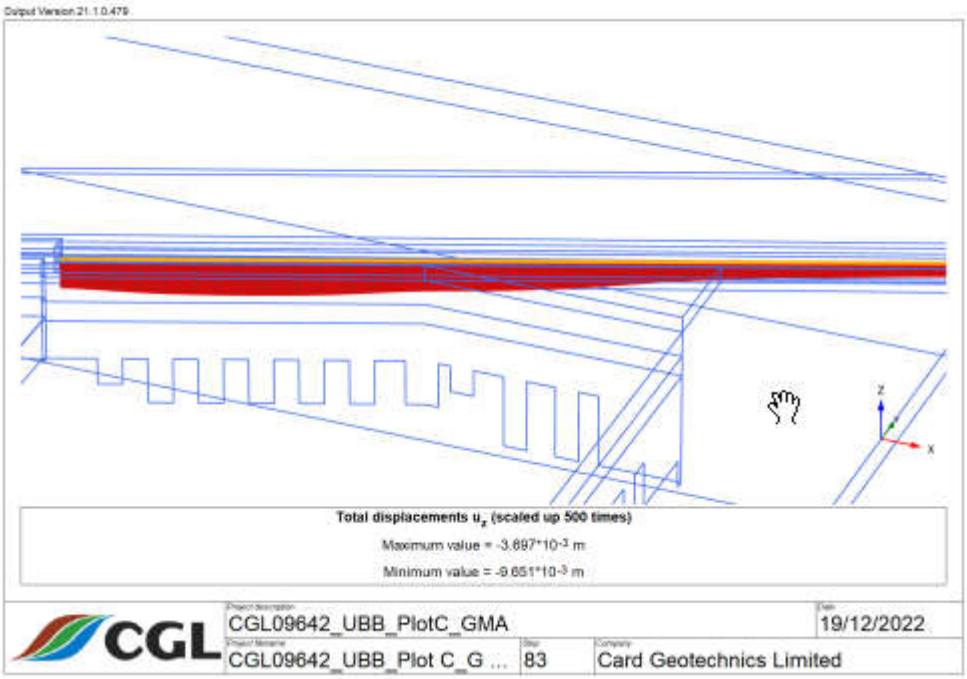



The maximum deflection is observed to be below 1mm and as such, it results in a deflection ratio of less than **0.03%**. A total maximum horizontal movement between 23mm to 24mm is predicted under the Canal Wall at +20.15mOD, which is approximately 3m away from the closet external face of the proposed basement pile wall. This results in a horizontal strain of some **0.071%** over the assumed width of the Canal Wall. The maximum differential settlement anticipated is ~1mm, which corresponds to an angular distortion of **~1/1400.** This value is within the acceptable published limits according to Skempton and MacDonald (1956)[16], for which the differential movement criteria typical for limiting damage to structural elements is 1 in 500.

The maximum differential vertical movement along the walls longitudinal direction, as presented in Plate 44 below, is approximately 6mm over more than 30m, which corresponds to an angular distortion of **~1/5000.** This value is well within the acceptable published limits according to Skempton and MacDonald (1956)[17], for which the differential movement criteria typical for limiting damage to structural elements is 1 in 500.

The maximum deflection along longitudinal direction is observed to be below 5mm over 20m length and as such, it results in a deflection ratio of less than **0.03%**.

Plate 44. Historical masonry wall - Maximum Longitudinal Vertical movements – Short Term Construction Stage




## 6.2 Structural stability of adjacent structures from heave of the basement excavation

The removal of overburden due to excavation and subsequent reloading from the building may potentially cause some vertical ground movement in the underlying soils, the final magnitude depending on the net loading applied at the formation level.

Therefore, an analysis will have been undertaken to elucidate any potential risk from the excavation of the new basement to the identified nearby structures. PLAXIS 3D modelling have been carried out to determine the conditions at key stages in the construction process, namely:

- Unloading due to demolition of the existing buildings and excavation for the new basements; and
- Full loading following construction of the new basements and buildings.

It should be noted, however, that this method will not take into consideration the influence of the contiguous bored pile basement perimeter wall, as the increased stiffness at this boundary cannot be incorporated into the model. As such, the analyses can be considered conservative.

Please refer to CGL GMA and Highway & Building Damage Assessment which have analyses the maximum vertical displacement predicted due to the full Plot B and Plot C excavation, short-term and long-term construction stages.

A maximum heave of ~28mm is predicted at formation level of Plot C during the full excavation stage. The heave decrease to ~23mm to the northern half of the site and to ~2 to 8mm in the southern part. During the long-term construction stage, the maximum heave further reduces to 18mm to the north of the site and decrease to approximatively 3mm of settlement to the southern part, where the majority of the construction loads are applied.

Plot B maximum predicted heave movements are approximatively 35mm during excavation stage, reducing to 15mm at the short-term construction stage and increasing again to >40mm in the long-term condition.

However, they are expected to be lower and similar to the movements obtained for Plot C, due to presence of bearing piles and their skin friction, which have not been specifically modelled within this analysis for Plot B as the focus of the assessment is at shallower levels.

### 6.2.1 Movements arising from demolition and basement excavation

For the initial unloading stage (demolition and excavation), the underlying clay soils will be in fully undrained conditions, therefore the analysis will have been undertaken using short-term parameters.

Long-term (drained) conditions have not been described at this stage as it is considered extremely unlikely that this condition will arise during a standard construction programme. However, we will have ground movement monitoring procedure in place after construction for a reasonable period of time following pre/ during construction monitoring.

Please refer to CGL09751A_TribecaCamden-PlotC_GMA&BDA_December2022 - tables 11 & 12 above.

### 6.2.2 Movements arising following re-loading from the construction

For the final loading stage, a drained analysis will be undertaken as fully drained conditions are expected to occur in the long-term.

Piled foundations are the preferred option for the proposed development. At the time of writing, no detailed piling scheme has been developed for the site. The predicted UDL loadings along the piles retaining wall and approx. column loadings have been included on drawings TRI-GDP-PB-F0-DR-S-001590 rev. P04, TRI-GDP-PC-F0-DR-S-1600 rev. P03, 1610 rev. P02, 1620 rev. P02 and 1630 rev. P02 as attached to Appendix 3. However, please refer to CGL GMA report for their preliminary pile capacities and minimum required toe levels shown on tables 4, 5 and 9 on pages 17, 19 and 25.

In reality, for an analysis for a piled foundation solution, the load carried by each pile would be applied at a depth equal to 2/3 of the pile length over an area determined assuming a 1 in 4 spreads of load from the top of the pile in accordance with Tomlinson's "Pile Design in Construction Practice". This would result in higher stiffness and smaller movements than those predicted.

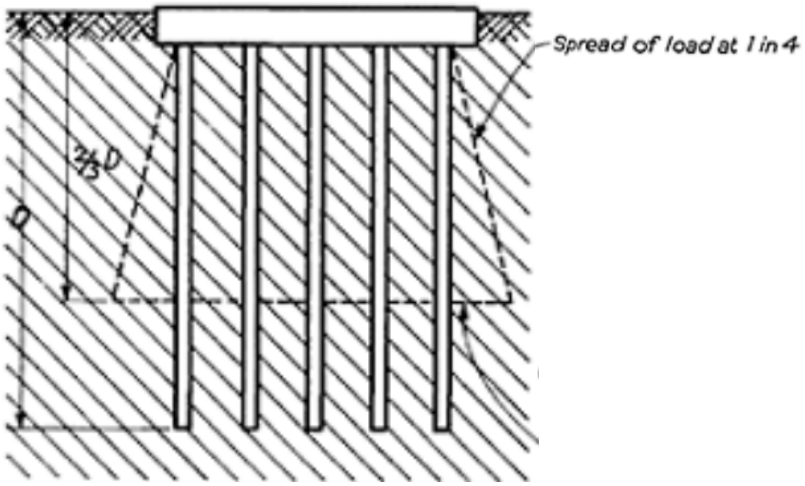



Illustration 3: Load Transfer to Soil from Pile Group (Source: Tomlinson)

Please refer to CGL tables 11 and 12 for the predicted vertical and horizontal movements summaries.

# 7 CONCLUSION OF IMPACT ASSESSMENT FOR LAND STABILITY

The tables below show the predicted movements extracted from CGL Ground Movement and Building Damage Assessment Reports for Plots B and C scheme as in Appendix 3 for the contiguous piled wall installation and excavation in front of the walls.

*Table 11. Plot B - Pile Wall Vertical and Horizontal movements Summary*

| Continue wall Boundary | Pile Wall Vertical Movement uz – Plot B Excavation Stage (mm) | Pile Wall Deflection u3 – PlotB Excavation Stage (mm) | Pile Wall Vertical Movement uz – Plot B Short Term Construction (mm) | Pile Wall Deflection u3 – PlotB Short Term Construction (mm) | Pile Wall Vertical Movement uz – PlotB Long Term Construction (mm) | Pile Wall Deflection u3 – PlotB Long Term Construction (mm) |
|---|---|---|---|---|---|---|
| North (Plot A) | +8.0 | **11.0** | -3.0 | 10.0 | +5.0 | 5.0 |
| East (Canal) | +12.0 | 20.0 | -8.0 | **23.0** | +5.0/-4.0 | 22.0 |
| West (highway) | +11.0 | 15.0 | -10.0 | **20.0** | -3.0 | 18.0 |

*Table 12. Plot C - Pile Wall Vertical and Horizontal movements Summary*

| Continue wall Boundary | Pile Wall Vertical Movement uz – PlotC B2 Excavation Stage (mm) | Pile Wall Deflection u3 – PlotC B2 Excavation Stage (mm) | Pile Wall Vertical Movement uz – PlotC Short Term Construction (mm) | Pile Wall Deflection u3 – PlotC Short Term Construction (mm) | Pile Wall Vertical Movement uz – PlotC Long Term Construction (mm) | Pile Wall Deflection u3 – PlotC Long Term Construction (mm) |
|---|---|---|---|---|---|---|
| East (Canal) | +6.0 | **27.0** | -9.0 | 26.0 | -7.0 | 25.0 |
| South (Granary Street) | +6.0 | 22.0 | -7.0 | **23.0** | -10.0 | 20.0 |
| West (highway) | +7.0 | 21.0 | -4.0 | **23.0** | -4.0/+3.0 | 23.0 |

The findings are summarised as follows:

1. At Plot C, the maximum basement wall deflection is predicted to be some ~23mm to ~27m.
2. At Plot B, the maximum basement wall deflection is predicted to be some ~11mm to ~23m.
3. The Building Impact Assessment has been undertaken for the neighbouring buildings, Plot A, and adjacent Highways, St Pancras Way and Granary Street. An assessment of the results of the detailed ground movement analysis and displacement profiles of the above indicate that, with good construction control and high level of workmanship, the movements predicted at Plot A building can be restricted to damage category 0 which indicate negligible damage.
4. The impact of the proposed development on both St Pancras Way and Granary Street highways is considered to be within acceptable limits and of low risk.
5. The results of the assessment indicate that the displacement of the Thames Water sewers are relatively low and within 10 to 15mm, with corresponding strains within the limiting Thames Water assessment criteria. In summary, based on the findings of this assessment, the risk of impact of the proposed works on the Thames Water buried assets is considered to be low, and within acceptable limits.
6. An impact assessment has been undertaken for the canal wall, and the results predict that with good construction control and high level of workmanship, impact on the canal will be low and within acceptable limits.

7. All pile walls have been modelled to be head propped in the temporary excavation stages and an additional level of propping has been included for the B2 excavation at Plot C. The temporary propping scheme used within this analysis is preliminary only to inform the construction sequencing of the basements within the PLAXIS modelling. The detailed design and layout of the temporary propping will be undertaken separately.
8. Robust monitoring regime will be adopted during construction to control and manage risk and potential damage to adjacent assets.
9. CGL has also carried out Preliminary Temporary Work Design to enable Basement Excavation and Construction which provide lesser deflections to those critical sections than specified above during the construction works. Please refer to their report ref. CGL/09751D rev. 0 dated the 23/02/23 within the Appendix 3.

## 7.1 Control of ground movements

In order to reduce the potential for any movement over and above that expected, the following methods of safe practice should be considered prior to and during construction:

- Good workmanship will be required to ensure that pile installation induced settlements are kept to a minimum. It will be essential to ensure that the made ground is not allowed to collapse prior to casting of the contiguous piled wall;
- The contiguous piled wall should be installed to a suitable depth and have adequate embedment in stiff strata for satisfactory vertical and lateral stability;
- It should be ensured that basement slab is cast as early as possible and tight to the piled retaining wall. Sufficient time should be given for the slab to cure and gain strength prior to continuation of excavation below;
- Where temporary props are required they should be designed to provide adequate restraint to limit lateral ground movements. Walings should be tied in so they do not rely on friction or adhesion between the prop end and waling to be held in place;
- The first stage of excavation should be minimised and the first (stiff) support should be installed as early as possible in the construction sequence;
- The construction of the wall and its support systems should not be delayed;
- Over-excavation should be avoided;
- Monitoring both above and below ground should be carried out to ensure that the expected displacements are not exceeded. Limits of lateral and vertical displacement should be set beyond which the method of construction should be re assessed.

## 7.2 Monitoring ground movements and adjoining buildings.

Conditions surveys will be carried out to all buildings affected by the development including Thames Water sewer where required as post construction condition survey would be done when Plots B and C had been constructed and the reports are to be agreed by all parties prior to commencement of works on site.

Monitoring system will be installed prior to demolition works, during construction and post construction. The length of time of post construction monitoring is to be agreed with all parties. The type of monitoring system to be installed such as live monitoring or/and fix stations is to be discussed and agreed with the Principal Contractor (PC), Monitoring Specialist/Surveyor (MC) and third parties. The positions of the monitoring system are to be placed strategically on the following:

1. Canal Tow Paths.
2. Thames Water sewers (to be agreed).
3. Fix monitoring stations to be placed on the top or sides of the newly cast RC capping beams to monitor any deflections of the piles.
4. Inclinometer will be installed in the piles, but this will depend on the final design of the piles which will be discussed and agreed with the PC, piling specialist and MC.
5. Pavement precise studs along the Granary Street and St. Pancras Way.

### 7.2.1 Scope of Works

The works comprise:

1. Visual Monitoring of the party walls.
2. Attachment of Tell tales or Demec Studs to accurately record movement of significant cracks that have been identified during the condition surveys.
3. Attachment of levelling targets to monitor settlement of existing buildings and horizontal movements of existing retaining walls.
4. Attachment of levelling targets to monitor horizontal movements of new contiguous piled walls after installation.
5. The monitoring of the above instrumentation is in accordance with monitoring frequency strategy (7.2.2). The number and precise locations of instrumentation may change during the works; this shall be subject to agreement with the Principal Contractor (PC)/third parties involved.
6. All instruments are to be adequately protected against any damage from construction plant or private vehicles using clearly visible markings and suitable head protection e.g. manhole rings or similar. Any damaged instruments are to be immediately replaced or repaired.
7. Reporting of all data in a manner easily understood by all interested parties.
8. Co-ordination of these monitoring works with other site operations to ensure that all instruments can be read and can be reviewed against specified trigger values both during and post construction.
9. Regular site meetings by PC and MS to review the data and their implications.
10. Review of data by GD Partnership (GDP), the Consulting Engineers.

In addition, the PC will have responsibility for the following:

- Review of methods of working/operations to limit movements, and
- Implementation of any emergency remedial measures if deemed necessary by the results of the monitoring.

The MC shall allow for settlement and crack monitoring measures to be installed and monitored on various parts of the structure described as directed by the PC and Party Wall Surveyor (PWS) for the Client.

## 7.2.2 Monitoring Frequency

| Instrument | Monitoring stage | Frequency of recording & details |
|---|---|---|
| Monitoring existing cracks if available<br><br>Monitoring of Horizontal movement<br><br>Monitoring vertical movement | Pre-construction | Record of existing cracks, crack widths, distance between multiple cracks and photographic evidence |
| | Demolition of the structure up to ground floor level | Record any movements in cracks or horizontal and vertical levelling gauge readings. |
| | During contiguous piled wall installation | Record any movements in cracks or horizontal and vertical levelling gauge readings. |
| | Installation of new RC pile caps and temporary propping before excavation | Record any movements in cracks or horizontal and vertical levelling gauge readings. |
| | During basement excavation | staged monitoring at an agreed time interval to gauge the effect of excavation benchmarks reading |
| | Construction of basement slab, ground floor slab and removal of temporary propping. | carry on staged monitoring at an agreed time interval to gauge the effect of new loadings |
| | Construction of super structure | carry on staged monitoring at an agreed time interval to gauge the effect of new loadings |
| | Post construction | Long term monitoring strategy to be agreed with all parties. |

Monitoring frequency

The following accuracies/ tolerances shall be achieved:

Party Wall settlement +1.5mm

Crack monitoring +0.75mm

## 7.2.3 Report of results and trigger levels

- Within 24 hours of taking the readings, the MS will submit a single page summary of the recorded movements.
- All readings shall be immediately reviewed by GDP prior to reporting to the PWS and other third parties.
- Within one working day of taking the readings the MS shall produce a full report.
- The following system of control shall be employed by the PC and appropriate contractors for each section of the works.
- The Trigger value, at which the appropriate action shall be taken, for each section, is given in Table below.
- During works measurements are taken, these are compared with the limits set out below table.

Trigger Levels to Adjoining Buildings.

| Movement | CATEGORY | ACTION |
|---|---|---|
| 0mm- 5mm | Green | - No action required |
| 5mm-12mm | AMBER | - Crack Monitoring.<br>- Carry out a local structural review.<br>- Frequency of the surveying shall increase<br>- Preparation for the implementation of remedial measures should be required.<br>- implement any additional propping or change in methodology as required |
| >12mm | RED | - All works are to stop immediately<br>- Crack Monitoring.<br>- Implement structural support as required.<br>- Cease works with the exception of necessary works for the safety and stability of the structure and personnel.<br>- Review monitoring data and implement revised method of works |

Preliminary Movement limits between adjacent sets of Tell-tales or stud sets or datum points.

Any movements which exceed the individual amber trigger levels for a monitoring measure given on the above Table shall be immediately reported to GDP and PWS, and a review of all the current monitoring data for all monitoring measures must be implemented to determine the probable causes of the trigger level being exceeded. Monitoring of the affected location must be increased and the actions described above implemented. Assessment of exceeded trigger levels must not be carried out in isolation from an assessment of the entire monitoring regime as the monitoring measures are inter-related. Where required, measures may be implemented or prepared as determined by the specific situation and combination of observed monitoring measurement data.

# 8 STATUTORY AUTHORITY CORRESPONDANCE

The proposed development will have a large provision of biodiverse roofs resulting in significantly reduced hard roof area. From the biodiverse roof with attenuation, surface water will be discharged to the canal under controlled rate agreed by the Canal & Rivers Trust. The areas not covered by biodiverse roofs and the remaining areas at ground level will be attenuated within ground floor/basement underground storage and will be drained to the sewer network at a permitted rate by the Thames Water. We will be liaising with Canal & Rivers Trust and Thames Water Utilities Ltd including the partywall surveyor during the detail design in order to get their approvals as in Appendix 12.

# 9 GROUND MOVEMENT ASSESEMENT (GMA) BY CGL

Card Geotechnics Ltd. (CGL) have been appointed to carry out the Ground Movement Assessment (GMA) and their findings and conclusions are shown on Appendix 3.

The Ground Model design parameters presented in Table 3 below extracted from CGL report are based on the Phase ll site investigation from RSK's ground investigation at the site and previous design and assessment works undertaken by CGL on this scheme. Moderately conservative geotechnical design parameters are outlined below.

***Table 3. Characteristic Ground Model Profile & Geotechnical Parameters***

| *Stratum* | *Top of Stratum (mbgl) [mOD][a]* | *$K_o$* | *Density (kN/m³)* | *Cu [c'] (kN/m³)* | *$\phi'$ (°)* | *$E_u$ [E'] (MPa)* |
|---|---|---|---|---|---|---|
| Granular Made Ground | (0.00) [23.7] | 0.47 | 18 | - | 32[b] | [30][b] |
| Cohesive Made Ground | (0.00) [21.7] | 0.56 | 18 | 50 [0] | 26 | 30 [22.5] |
| London Clay Formation | (3.7) [20] | 1.0 | 20 | 60 + 7.0z [5] | 24 | 36 + 4.2z[e,c] [27 + 3.1z[e,d]] |
| Lambeth Group | (24.3) [-3.0] | 1.0 | 20 | 220 + 10.9z [5] | 26 | 132 + 6.5z[e,c] [99+4.9z[e,d]] |

a. *mbgl = meters below ground level; mOD = meters above ordnance datum. Sourced from RSK GGIR for the site.*
b. *Burland, J.B et al (Ed.) (2001) Building response to tunnelling, case studies from construction of the Jubilee Line Extension London, CIRIA Special Publication 200.*
c. *Based on Eu = 600 x Cu - Burland, Standing J.R., and Jardine F.M. (eds) (2001), Building response to tunnelling, case studies from construction of the Jubilee Line Extension London, CIRIA Special Publication 200. Based on 1000cu for London Clay for embedded retaining wall analysis in accordance with C760.*
d. *Based on 0.75 x Eu. Burland, J.B et al (Ed.) (2001) Building response to tunnelling, case studies from construction of the Jubilee Line Extension London, CIRIA Special Publication 200.*
e. *z = depth below surface of the soil layer.*

# 10 AUTHOR'S QUALIFICATIONS

GD Partnership Ltd.

The author Rudy Djajasaputra is a director of GD Partnership Ltd. He is a Chartered Engineer and has been a member of the Institution of Structural Engineer since 1993. He has been involved in many basements design and construction in London including recent major projects on excavation adjacent to one of the busiest Network Rail at Selly Oak and Redhill Warwick Quadrant Re-development. He is currently involve in the construction of Plot A .

Rudy Djajasaputra BSc(Hons), CEng, MIStructE

Card Geotechnics Ltd. (CGL)

Antonella Galliani is the Principal Numerical Analyst who has been appointed to provide Ground Movement Assessment (GMA), Canal Wall Impact assessment, and Thames Water Asset Assessment reports.

Antonella Galliani MSc BSc(Hons) GMICE FGS.

RSK Environment Ltd

Dr. Shon Williams is a Director of Geotechnics of RSK who has been appointed to provide preliminary Ground Movement Assessment (GMA).

Shon Williams BSc PhD CEng MICE

Water Environment Ltd

Dr. Tony Clothier is a director of Water Environment Ltd. has been appointed to provide Flood Risk Assessment (FRA) report for the project including the hydrology of the site.

Tony Clothier PhD, BSc Eng, (Civil) CEng, CEnv, MCIWEM