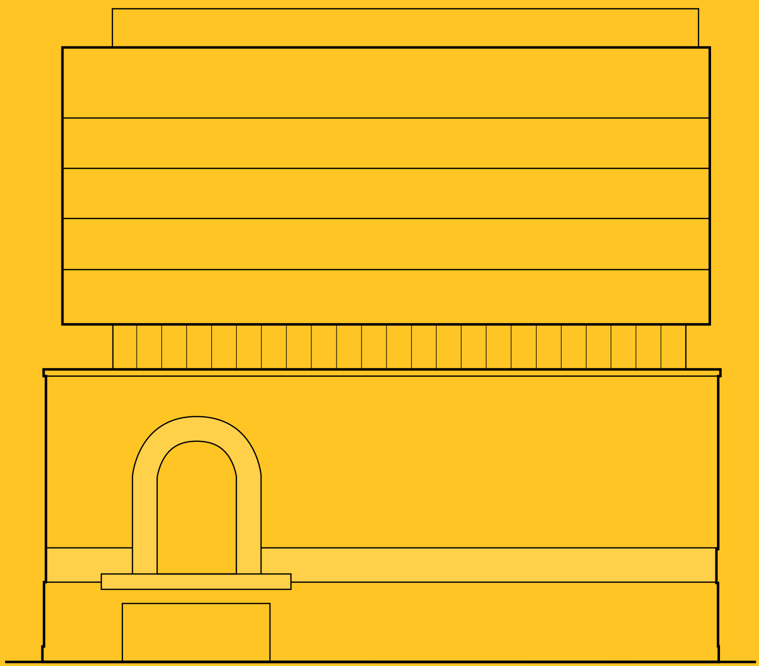


# SAVILLE THEATRE

## 135 SHAFTESBURY AVENUE

BASEMENT IMPACT ASSESSMENT

106885-PF-ZZ-XX-RP-C-0005-P03

PELL FRISCHMANN

| **Report Ref.** | **105465-PF-ZZ-XX-RP-C-0005-P03** |
|---|---|
| **File Path** | **https://pellf.sharepoint.com/sites/A1BuildingsStructuresandFire/Shared Documents/General/01 - WIP/Documents/Geotechnical Engineer/BIA/105465-PF-ZZ-XX-RP-C-0005-P03.docx** |

| Rev | Suit | Description | Date | Originator | Checker | Approver |
|---|---|---|---|---|---|---|
| P01 | S1 | First Issue | 16/01/2024 | E Roberts/ K Stone | K. Stone | A. Murray |
| P02 | S1 | Updated to incorporate Team/Client comments | 29/01/2024 | K Stone/A Murray | K. Stone | A. Murray |
| P03 | S1 | Updated to incorporate Team/Client comments | 30/01/2024 | K Stone/A Murray | K. Stone | A. Murray |
| | | | | | | |

**Prepared for**

**YC Saville Theatre Limited**

2 Bentinck Street
London
W1U 2FA

**Prepared by**

**Pell Frischmann**

5th Floor
85 Strand
London
WC2R 0DW

Pell Frischmann

# Contents

**Figures**



**Tables**



Appendices

# 1 Non- Technical Summary

## 1.1 Site Location and Description

The site is flat 1,100m$^2$ in area and approximately rectangular in shape. It is bound by Stacey Street to the southwest, St Giles Passage to the northeast, and New Compton Street to the northwest. The site is located in the London Borough of Camden and the approximate centre is at National Grid Reference 529977, 181149. The site location is show in Figure 1.

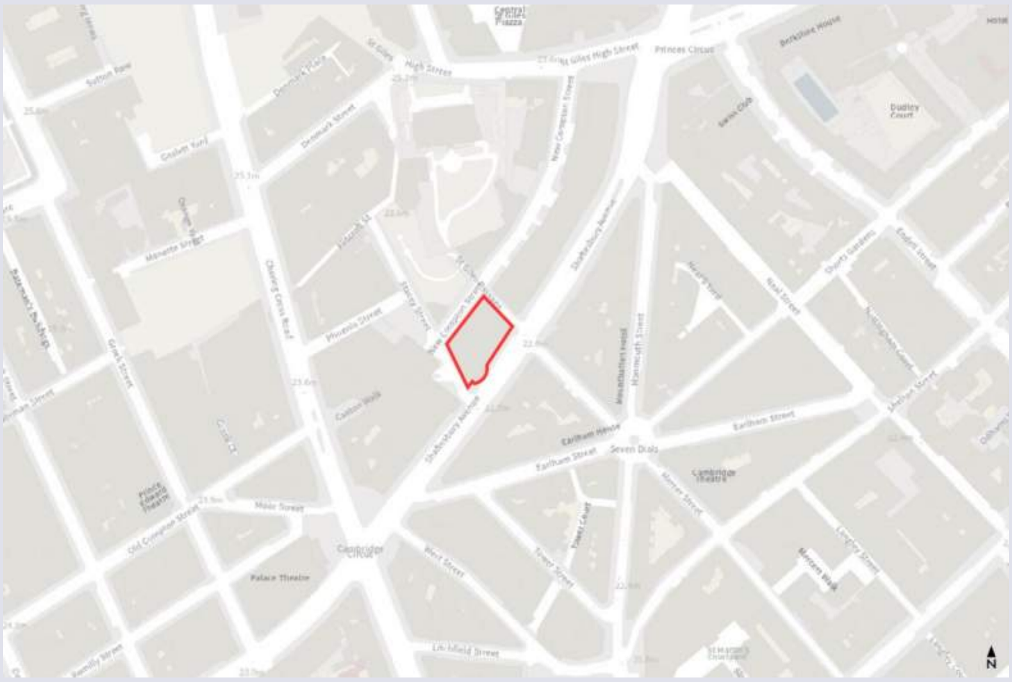


**Figure 1 Site Location**

The site is occupied by a Grade II listed six to seven storey, steel framed masonry building, with two levels of basement supported by reinforced concrete basement retaining walls. The ground level is used as a cinema with the upper floors used as ancillary office space, refer to Figure 2.

**Figure 2: Existing Building Looking from the South (Left) and the North (Right)**

## 1.2 The Proposed Development

The proposed development consists of the partial demolition retention and refurbishment of the former Saville Theatre. With respect to the basement this will involve;

(i) the removal all of the internal structure of the existing building, leaving the southern, western and eastern façade in place; the northern façade will be removed and reinstated as part of the works.

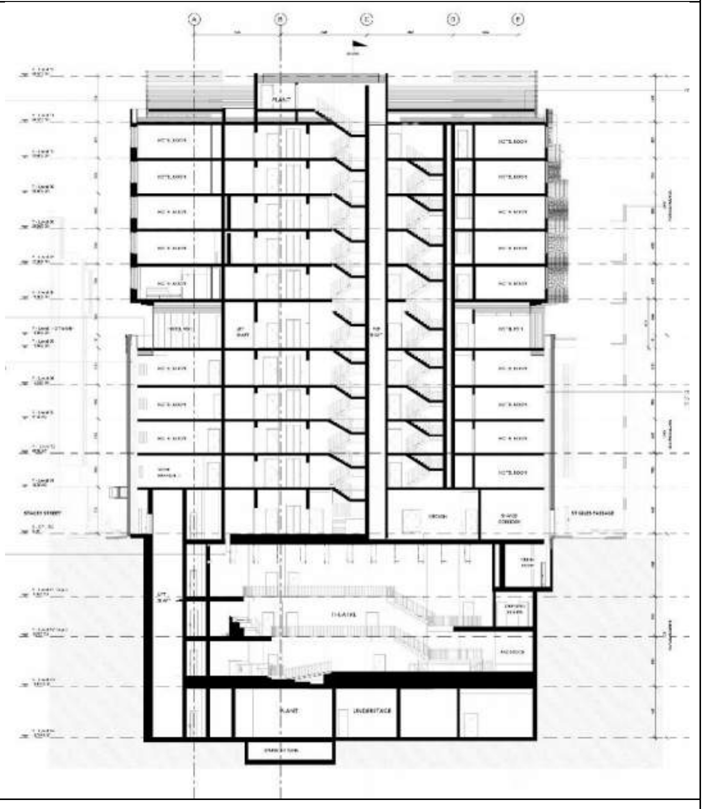
(ii) Creation of an additional two levels (B3 and B4) within the existing retaining walls, extending 8.8m below the existing (B2) basement slab.

(iii) Install a (1-1.5m thick) basement slab (B4) to support the structural loads from above. Within the footprint of the basement slab, an additional 3.4m of excavation (12.2m total below existing basement) is proposed for sprinkler water tanks.

The upper three levels of basement, existing levels B1 and B2 and the new level B3, are proposed to be used as theatre space, with B4 used for shared plant.

At ground level, theatre Front of House will be provided, with a multi-storey hotel extending above. **Figure 3** presents a schematic overview of the proposed works.

**Figure 3 Existing and proposed basement and superstructure works**

| | |
|---|---|
|  |  |
| Existing | Proposed |

## 1.3 Assessments Covered by this Document.

The following are covered by this document:

1. Desk Study
2. Screening
3. Scoping
4. Impact Assessment

## 1.4 Authors

This BIA has been co-authored by Dr Kevin Stone MICE, CEng, who is the Geotechnical Director for Pell Frischmann Consultants with over 35 years experience in structural, geotechnical and geoenvironmental engineering, Edward Roberts MICE, CEng, who is a Senior Geotechnical Engineer with over 10 years of geotechnical engineering experience, Andrew Murray (MIStructE) a Technical Director (Structures) at Pell Frischmann.

The hydrology and hydrogeological elements of this report have been provided by Andrew Gill, a Chartered Geologist with extensive experience in geotechnical, geological and hydrogeological engineering and assessment.

## 1.5 Groundwater

The groundwater monitoring results recorded groundwater levels at the upper boundary of the London Clay, which is interpreted to represent the presence of perched surficial water.

## 1.6 Construction Method

It is proposed to construct the new basement levels using either a multi-level sequenced mass concrete underpinning approach where pins are be installed in a pre-determined hit and miss sequence with temporary propping used to support each level of underpinning. On completion of the mass concrete underpinning a reinforced concrete internal lining wall shall be installed as the temporary props are removed. This lining wall shall support the long-term earth and water pressured.

Alternatively, a conventional embedded secant piled wall shall be installed and the new basement levels constructed in a conventional ‘bottom up’ sequence with temporary propping installed at the approximate locations of the permanent floor slabs. The secant pile wall shall be designed to resist earth and water pressures.

In the preparation of this Impact Assessment both of these construction methodologies have been considered.

## 1.7 Structural Monitoring Strategy

A structural monitoring strategy to control impacts of the works to neighbouring structures will comprise of vibration monitoring and displacement monitoring. Baseline readings should be undertaken for at least two weeks before the commencement of foundation and basement works, and monitored in real time during the substructure construction. Monitoring should continue for the duration of the superstructure construction, and for a period after completion of the works. The monitoring requirements and frequency of monitoring shall be detailed in a Monitoring Specification, but typically monitoring would extend for a period of six months after the completion of construction with the frequency of monitoring reducing with time.

## 1.8 BIA Summary

### 1.8.1 Land Stability

The BIA has assessed land stability and the impacts to neighbouring structures resulting from ground movement associated with the basement excavation and construction works. The impact of these ground movements have been assessed using a detailed 3D Finite Element analysis and the results are quantified in terms of a Burland Damage Category classification as presented in Section 8. The predicted damage classification is no greater than Category 1 for neighbouring structures. This is within the permitted value of Camden’s Policy A5 for Basements.

It is noted that the impact of construction works on Thames Water infrastructure shall be the subject of a separate detailed assessment.

It is anticipated that an Approval In Principle document will require to be submitted to Camden Highways as the design develops.

### 1.8.2 Slope Stability Impacts

The BIA has identified no potential slope stability impacts at the site. No mitigation measures are therefore required. However, the proposed basement induces some ground movements which requires monitoring of the neighbouring structures.

### 1.8.3 Hydrological Impacts

The BIA has identified no potential hydrological impacts at the site. No mitigation measures are therefore required.

### 1.8.4 Hydrogeological Impacts

The BIA has identified no potential hydrogeological impacts at the site. No mitigation measures are therefore required.

### 1.8.5 Flood Risk

The Flood Risk Assessment document 105465-PEF-ZZ-XX-RP-YE-000010-S2-P02_FRA_BOUND has identified that the site is wholly within Flood Zone 1 (Low Probability) and is so considered to be at low risk of flooding from Main Rivers and the sea. No mitigation measures are therefore required.

# 2 Introduction

The purpose of this assessment is to consider the impact of a proposed basement development at the Saville Theatre, 135-149 Shaftesbury Avenue, London WC2H 8AH. The site location is presented in Figure 1.

The BIA approach follows current planning procedure for basements and lightwells adopted by the London Borough of Camden and comprises the following elements (CPG Basements):

- Desk Study
- Screening
- Scoping
- Site Investigation, monitoring, interpretation, and ground movement assessment
- Impact Assessment

## 2.1 Authors

This BIA has been authored (in part), fully checked and reviewed by Dr Kevin Stone, a PhD and MPhil (Cantab) in Geotechnical Engineering, BEng in Civil Engineering, a chartered engineer (MICE, CEng), who is the Geotechnical Director for Pell Frischmann Consultants with over 35 years experience in geotechnical and geoenvironmental engineering, and Edward Roberts, BSc in Civil Engineering, a chartered engineer (MICE, CEng), who is a Senior Geotechnical Engineer at Pell Frischmann with over 10 years experience. Both assessors meet the qualification requirements of the Council guidance. Hydrology and hydrogeological input has been provided by Andrew Gill, Chartered Geologist and Divisional Head (Geotechnical Engineering) at Pell Frischmann with over 30 years experience.

## 2.2 Sources of Information

The material presented below has been referenced in undertaking this BIA.

| Reference | Author |
|---|---|
| Camden Geological, Hydrogeological, and Hydrological study (GHHS) Guidance for Subterranean Development. Issue 01 (2010) | Ove Arup & Partners Ltd |
| Basement Impact Assessments: Defining the scope of Engineering input, Guidance note 1v0 (accessed oct 2023) | London Borough of Camden |
| London Borough of Camden, Audit Process Terms of Reference. | London Borough of Camden |
| London Borough of Camden, Strategic Flood Risk Assessment (2014) | URS Infrastructure & Environment UK Ltd. |
| London Borough of Camden, Local Plan Policy A5 Basements (2017) | London Borough of Camden |
| Desk Study & Ground Investigation Report (2017) | Geotechnical & Environmental Associates Ltd |
| London Borough of Camden, Floods in Camden, Report of the Floods Scrutiny Panel (2013). | London Borough of Camden |
| Flood risk mapping: https://flood-warning-information.service.gov.uk/long-term-flood-risk/ | |
| British Geological Survey 1:50,000 series, England and Wales Sheet 256. North London. Bedrock and Superficial Deposits Geology); | BGS |

## 2.3 Existing and Proposed Development

The site is occupied by a Grade II listed six to seven storey steel framed masonry building with two levels of basement supported by reinforced concrete basement retaining walls. The ground level is used as a cinema with the upper floors used as ancillary office space and storage.

**Figure 4: Existing Building Looking from the South (Left) and the North (Right)**

The current two-level basement is formed by L-shaped reinforced concrete retaining walls, which are shown to be propped by floor slabs at B1 and B2 level. The upper section has a height of approximately 3.5m from ground level to underside of the wall foundation, and the lower section of the retaining wall is 4.2m from the underside of B1 to the underside of B2. For part of the southern and eastern basement walls, the L-shaped wall steps out to form a vault designated as a “Property Store” as identified on Figure 5 below.

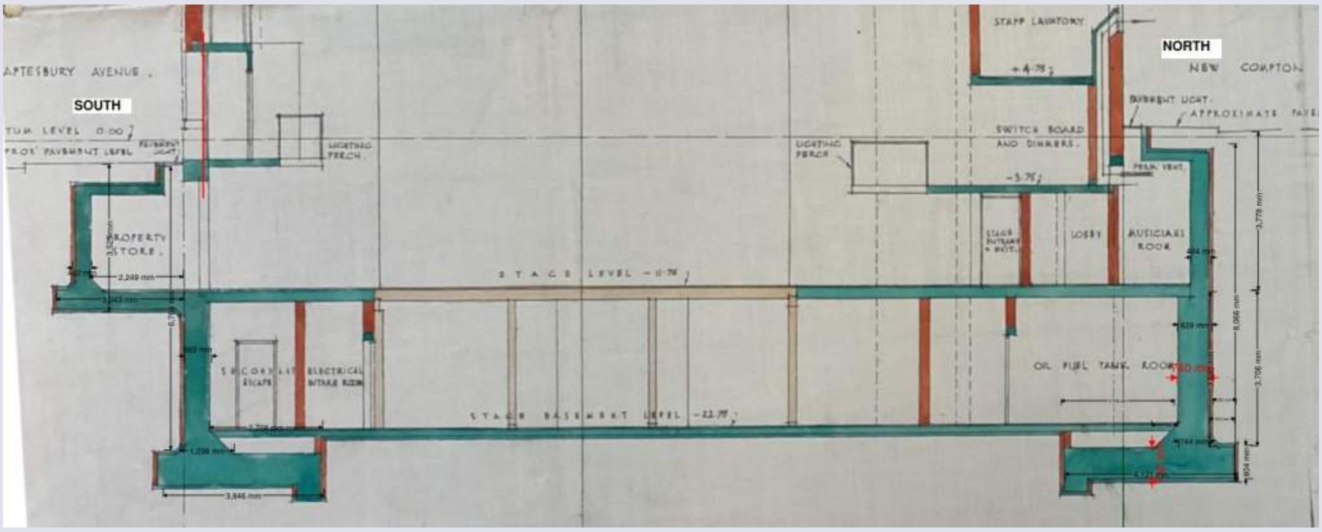



**Figure 5: Existing Basement Cross Section**

## 2.4 Proposed Development

The proposed works involve demolition of all the internal structure of the existing building, leaving the façade and basement retaining walls in place; the northern façade will be removed and reinstated as part of the works. An additional two levels of new basement will be formed by deepening the existing basement. The additional basement depth is 8.8m the existing B2 slab level to the top of the B4 slab, which is anticipated to be approximately 1.0m-1.5m thick to support the structural loads. Consequently, the total basement depth will be up to 16.5m over the four levels. Within the footprint of the base slab (B4), a further 3.4m of excavation is proposed to accommodate sprinkler tanks.

The upper three levels of basement (B1 to B3) are proposed to be used as theatre space, with the lower B4 level used for shared plant. At ground level, theatre Front of House will be provided with a multi-storey hotel (Citizen M) extending above.

# 3 Desk Study

A desk study has been prepared for the site by Pell Frischmann (Document 105465-PEF-ZZ-XX-RP-GG-600001_P01). A summary of the main elements of the desk study are presented in the following sections and the complete study is attached as Appendix A .

## 3.1 Site History

John Rocque's 1746 Map of London shows the road network to be essentially as existing, with the star shaped 'Seven Dials' road network to the southeast, Monmouth Street, later named Dudley Street and subsequently, Shaftesbury Avenue, along the southeastern boundary of the site. Steedwell Street is shown to the northwest and Browns Gardens, later Stacey Street, bordered the southwest of the site. St Giles church and churchyard are shown to the north. The 1827 Greenwood Map shows Steedwell Street as being renamed New Compton Street.

1874 mapping shows the site to have been developed with terraced houses and private courtyards; six of the houses fronted onto New Compton Street to the northwest and eight fronted onto Dudley Street to the southeast. A public house is shown on the corner of New Compton Street to the north and a large 'disused' graveyard is shown further to the north, and the site and houses on the northern side of Dudley Street are annotated as 'Site of the Hospital Wall', which refers to the hospital of St Giles which occupied the surrounding area since around 1120 and included 'Spittle houses' which were located between the graveyard and Shaftesbury Avenue, and comprised a small number of houses and orchards.

The map dated 1875 annotates the road to the northeast as 'church passage' and by 1895, Dudley Street was renamed Shaftesbury Avenue and trees are shown at regular intervals along the road. The Charles Booth Map of London, dated 1886 to 1903, indicates that the site was occupied by relatively high-end residential accommodation.

The Saville Theatre opened in 1931, originally comprising a theatre over three levels but converted into two cinemas and completely remodelled internally in the 1970s. The bomb damage maps of London indicate that the southern corner of the site was seriously damaged during World War II and surrounding buildings to the northwest and west were either seriously damaged, damaged beyond repair, or totally destroyed.

1953 mapping identifies the site as the Saville Theatre; Church Passage has been renamed St Giles Passage and terraced houses to the northeast of the site appear to have been replaced with apartments named Dial House. The 1961 map shows a car park to the northwest of the site.

By 1984, the land to the southeast of the site had been developed with a single large building and New Compton Street had been altered to stop at Stacey Street. The car park to the northwest had apparently tripled in size, while the site itself was no longer annotated as the Saville Theatre and had presumably been converted into the cinema by this time, while the site is annotated as a cinema on the 1994 map. An aerial photograph dated 1999 shows a construction site to the northwest of the site and this area is now developed with the Phoenix Garden.

In summary, from the earliest mapping the site has either been occupied by domestic dwellings or the Saville Theatre/Cinema. Similarly, the area surrounding the site has been exclusively residential with no industrial activity identified from the historical mapping.

## 3.2 Geology

The British Geological Survey (BGS) map of the area (Sheet 256) indicates the site is underlain by Lynch Hill Gravel over London Clay.

The London Clay is generally described as homogenous, slightly calcareous silty clay to very silty clay, with some beds of clayey silt grading to silty fine-grained sand. The Lynch Hill Gravel is generally described as comprising of sand and gravel, with lenses of silt, clay or peat.

A single cable percussion borehole, BH1, was completed in 2017 by Geotechnical & Environmental Associates Ltd. (GEA). The borehole was located adjacent to the site on New Compton Street and was drilled to a depth of 35.0m. In-situ testing comprising of Standard Penetration Testing (SPT) was undertaken, and samples were taken for laboratory testing. Groundwater monitoring was undertaken following the site investigation.

The investigation encountered Made Ground to a depths 3.5 m bgl. Below this, the Lynch Hill Gravel was encountered, typically described as a medium dense orange brown slightly clayey and silty gravelly sand, and extended to a depth of 4.7m bgl. The London Clay comprising firm becoming very stiff, dark brownish grey slightly sandy CLAY with occasional selenite crystals, claystones, shell fragments and pyrite nodules, was encountered from 4.7m bgl to 34.4m bgl. Beneath the London Clay the Lambeth Group soils described as very stiff slightly sandy CLAY were encountered from 34.4m bgl to the base of the hole at 35.0m bgl.

It is therefore apparent that the existing basement extends through the Lynch Hill Gravel to found within the London Clay.

## 3.3 Land Contamination

Refer to 105465-PEF-ZZ-XX-RP-GG-600001_P01 Saville Theatre PRA - Contaminated land assessment.

Part IIA of the Environmental Protection Act 1990, which was inserted into that Act by Section 57 of the Environment Act 1995, provides the main regulatory regime for the identification and remediation of contaminated land. The determination of contaminated sites is based on a “suitable for use” approach, which involves managing the risks posed by contaminated land by making risk-based decisions. This risk assessment is carried out on the basis of a source-pathway-receptor approach.

### 3.3.1 Source

The desk study has revealed that the site does not have a contaminative history in that it has been developed with housing and the existing theatre and cinema for its entire history.

### 3.3.2 Receptor

The future occupants of the hotel will represent relatively high sensitivity receptors. Buried services are likely to come into contact with any contaminants present within the soils through which they pass, and site workers are likely to come into contact with any contaminants present during construction works.

Groundwater is considered to be a moderately sensitive receptor, and the deep chalk aquifer is a highly sensitive receptor. Perched water may be present in the strata overlying the London Clay (Made Ground and Lynch Hill Gravel) or in the vicinity of existing foundations. However, such pockets of water are likely to be localised and unlikely to form part of a wider aquifer.

### 3.3.3 Pathway

Within the site, end users will be isolated from direct contact with any contaminants present within the Made Ground by the sub-structure and surrounding hard surfacing, thus no potential contaminant exposure pathways will exist with respect to end users. There are no areas of proposed soft landscaping where end users could potentially come into contact with contaminants. There will be a potential for contaminants to move onto or off the site horizontally within the Made Ground, although these pathways are already in existence. A pathway for ground workers to come into contact with any contamination will exist during construction work, and services will come into contact with any contamination within the soils in which they are laid.

### 3.3.4 Preliminary Risk Assessment

On the basis of the above, and the absence of any potential sources of contamination, it is considered that there is a LOW risk of there being any contamination at this site which would result in a requirement for remediation.

# 4 Screening

A screening process has been undertaken with regard to subterranean groundwater, land stability, surface water and flooding. The findings are presented in tabular form in the following sections.

## 4.1 Hydrology and Hydrogeology

| Question | Response | Details |
|---|---|---|
| 1a. Is the site located directly above an aquifer? | No | The site is located on unproductive strata of the London Clay Formation. |
| 1b. Will the proposed basement extend beneath the water table surface? | No | The existing basement already extends through the Lynch Hill Gravel and any perched water table and into the London Clay, such that the additional deepening of the basement will not extend into the groundwater. The London Clay cannot support a water table and is classified as an unproductive stratum. . |
| 2. Is the site within 100m of a watercourse, well (used / disused) or potential spring line? | No | The nearest surface water feature is 786 m to the southeast of the site. |
| 3. Is the site within the catchment of the pond chains on Hampstead Heath? | No | Figure 14 of the GHHS report confirms that the site is not located within this catchment area. |
| 4. Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas? | No | The proposed development will not extend beyond the existing basement footprint and there will be no change to paved/hardstanding areas. |
| 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 | Impermeable areas (hardstanding/ pavements/ roofs) shall remain unchanged. |
| 6. Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to, or lower than, the mean water level in any local pond (not just the pond chains on Hampstead Heath) or spring line? | No | There are no local ponds or spring lines in the vicinity and the London Clay is not able to support groundwater flow to these features. |

Based on the above screening process no potential issues relating to surface flow and flooding have been identified.

## 4.2 Land Stability

| Question | Response | Details |
|---|---|---|
| 1. Does the existing site include slopes, natural or man-made greater than 7 degrees (approximately 1 in 8)? | No | As indicated on the Slope Angle Map Fig 16 of the GHSS report. |
| 2. Will the proposed re-profiling of landscaping at the site change slopes at the property boundary to more than 7 degrees (approximately 1 in 8)? | No | The site shall not be re-profiled as part of the development. |
| 3. Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7 degrees (approximately 1 in 8)? | No | As indicated on the Slope Angle Map Fig 16 of the GHSS report. |
| 4. Is the site within a wider hillside setting in which the general slope is greater than 7 degrees (approximately 1 in 8)? | No | As indicated in the Slope Angle Map Fig 16 of the GHSS report. |

| | | |
|---|---|---|
| 5. Is the London Clay the shallowest strata at the site? | No | The Lynch Hill Gravel is the shallowest stratum |
| 6. Will any trees be felled as part of the development and/or are any works proposed within any tree protection zones where trees are to be retained? | No | There are no trees on the site. |
| 7. Is there a history of seasonal shrink-swell subsidence in the local area and/or evidence of such effects at the site?. | No | The Lynch Hill gravel is the shallowest stratum and not susceptible to shrink-swell behaviour. There is no evidence of any such effects on existing structures. |
| 8. Is the site within 100m of a watercourse or a potential spring line? | No | The nearest surface water feature is located 786 m to the southeast. |
| 9. Is the site within an area of previously worked ground? | No | According to the BGS geological map the site is not within an area of previously worked ground. |
| 10. Is the site within an aquifer?<br><br>If so, will the proposed basement extend beneath the water table such that dewatering may be required during construction? | No | The London Clay formation is considered an unproductive strata. The Lynch Hill Gravel is the shallowest stratum and this is classified as a Secondary 'A' Aquifer. The existing basement is already likely to extend through the Lynch Hill Gravel and into the London Clay, such that the deepening of the basement will not extend into the groundwater. The London Clay cannot support a water table and is classified as an unproductive stratum. |
| 11. Is the site within 50m of the Hampstead Heath Ponds? | No | No further assessment required. |
| 12. Is the site within 5m of a highway or pedestrian right of way? | Yes | The site is bounded by Shaftesbury Avenue to the southeast, Stacey Street to the southwest, New Compton Street to the northwest and St Giles Passage to the northeast.<br><br>Carried forward to scoping |
| 13. Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties? | Yes | The proposed development will increase the foundation depth with neighbouring structures due to the deepening of the existing basement to accommodate additional levels and sub-basement sprinkler tanks.<br><br>Carried forward to scoping |
| 14. Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines? | No | Crossrail will run at a depth of 17m, approx. 26 m from the northern corner of the site. Crossrail have confirmed that the site boundary is outside the limits of land subject to consultation under the Safeguarding Direction. Consequently, no further assessment is required with regard to potential impact on tunnels.<br><br>It is noted that the proximity of Crossrail is likely to require the implementation of measures to mitigate against the possible risk of groundbourne noise and vibration from the tunnel on the development. |

Based on the above screening process two potential issues relating to land stability have been identified and carried forward to scoping.

## 4.3 Surface Water and Flooding

| Question | Response | Details |
|---|---|---|
| 1. Is the site within the catchment of the ponds chains on Hampstead Heath? | No | Figure 14 of GHHS show that the catchment area of the ponds chains is approximately 1800m from the site. |
| 2. As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall | No | There will not be an increase in impermeable area across the ground surface above the basement, so the surface water flow regime will be unchanged. The basement will entirely be beneath the footprint of the |

| | | |
|---|---|---|
| and peak run-off) be materially changed from the existing route? | | building/hardstanding, both existing and proposed. Para 2.16 of the CPG4 therefore does not apply. |
| 3. Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas? | No | There will not be an increase in impermeable area across the ground surface above the basement. |
| 4. Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface water being received by adjacent properties or downstream watercourses? | No | There will not be an increase in impermeable area, so the surface water flow regime will be unchanged. The basement will be entirely beneath the footprint of the building/hardstanding, both existing and proposed. Para 2.16 of the CPG4 therefore does not apply. |
| 5. Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses? | No | The proposed basement will not result in any changes to the quality of surface water being received by adjacent properties or downstream watercourses as the surface water drainage regime and land usage will remain the same. |
| 6. Is the site in an area identified to have surface water flood risk according to either the Local Flood Risk Management Strategy or the Strategic Flood Risk Assessment or is it at risk from flooding, for example because the proposed basement is below the static water level of nearby surface water feature. | No | Refer to 105465-PEF-ZZ-XX-RP-YE-000010-S2-P02_FRA_BOUND - Flood risk assessment.<br><br>The findings of this BIA together with the Camden Flood Risk Management Strategy dated 2013 and Figures 3i, 5a and 5b of the SFRA dated 2014, in addition to the Environment Agency online flood maps show that the site has a very low flooding risk from surface water, sewers, reservoirs (and other artificial sources), and fluvial/tidal watercourses. Figure 4e of the SFRA shows that the site is at risk of groundwater flooding and it is possible that the basement will be constructed within a perched water table and the recommendations outlined in the BIA with regards to waterproofing and tanking of the basement will reduce the risk to acceptable levels.<br><br>The site is located within the Critical Drainage Area Group3_005, but not in a Local Flood Risk Zone as identified in the Camden SWMP and Updated SFRA Figure 6/Rev 2. |

No potential issues relating to surface flow and flooding have been identified.

## 4.4 Non-Technical Summary of Screening Process

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

Land Stability:

- (Q12) The site is within 5 m of Shaftesbury Avenue, Stacey Street, New Compton Street and St Giles Passage.
- (Q13) The proposed development will increase the foundation depth with neighbouring structures due to the deepening of the existing basement to accommodate an additional levels and sub-basement sprinkler tanks.

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

# 5 Scoping

The Scoping exercise will address each of the issues identified in the Screening process. An assessment methodology for each issue is proposed and a discussion on how any impact may be mitigated is presented. Both the issues identified concern land stability and the effect of the proposed works on the adjacent highway/pavement and neighbouring properties.

## 5.1 Differential Foundation Depth

The screening has identified that the proposed development will increase the differential foundation depth with neighbouring structures since the basement is to be significantly deepened. Construction and excavation activities associated with the basement works will cause ground movements that have the potential to damage the existing (i.e. retained facades) and neighbouring structures and Third-Party assets.

It is considered that the development proposals can be suitably designed to maintain ground stability and restrict ground movements and associated building damage to tolerable limits. In order to demonstrate this, site-specific ground information is presented in Section 6, with the construction methodology presented in Section 7 Construction Methodology/ Engineering Statementsand a ground movement assessment presented in 1)a)i)(1)(a)(i)Appendix G . The impact assessment is provided in Section 9.

# 6 Site Investigation/ Additional Assessments

## 6.1 Geological Mapping

The British Geological Survey (BGS) map of the area (Sheet 256) indicates the site is underlain by Lynch Hill Gravel overlying bedrock of the London Clay Formation. The Lynch Hill Gravel is described as generally comprising "*sand and gravel, with lenses of silt, clay or peat"*. The London Clay is described as "*homogenous, slightly calcareous silty clay to very silty clay, with some beds of clayey silt grading to silty fine-grained sand"*.

## 6.2 Previous Site Investigation

A single cable percussion borehole, BH1, was completed in 2017 by GEA Limited. The borehole was located adjacent to the site on New Compton Street, refer to Figure 6, and was drilled to a depth of 35.0m. In-situ testing comprised Standard Penetration Testing (SPT), and samples were taken for laboratory testing and groundwater monitoring was undertaken. The results of the intrusive investigation are presented in 1)a)i)(1)(a)(i)Appendix B

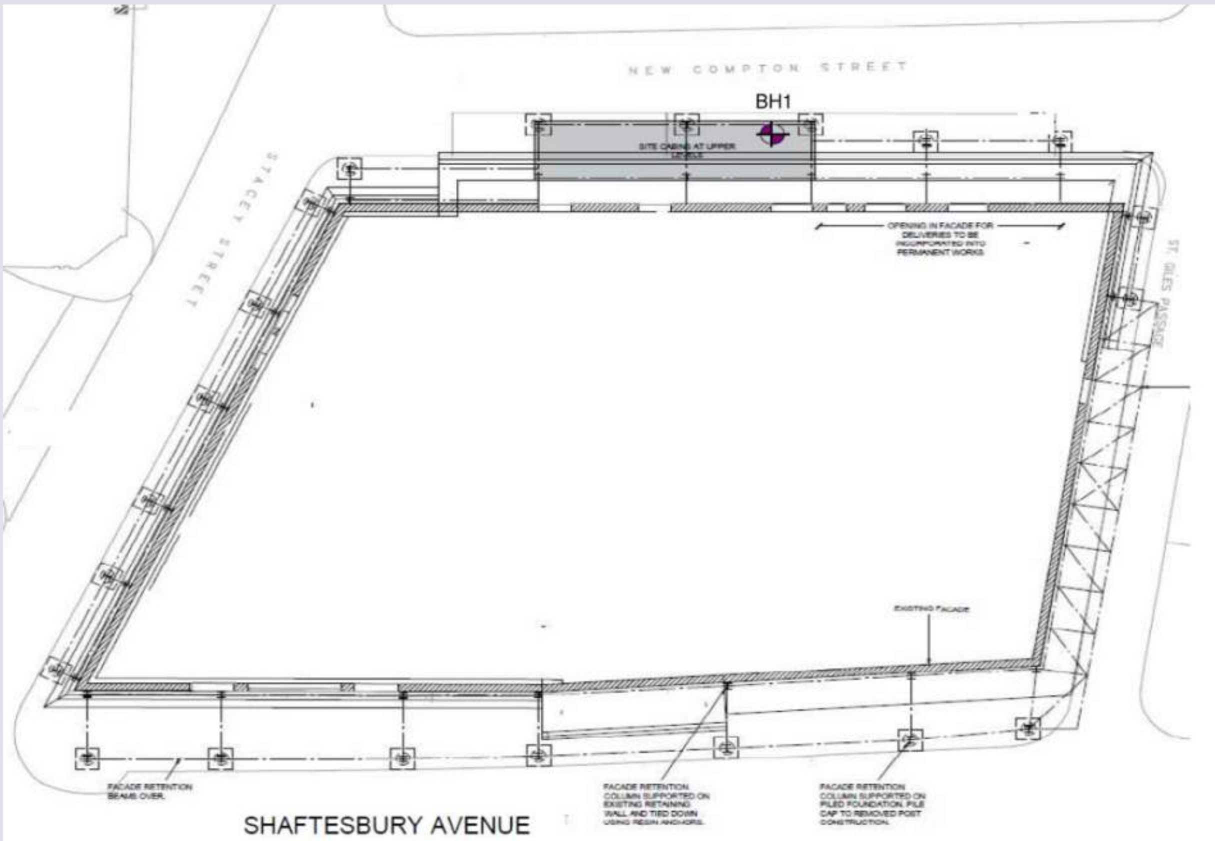



**Figure 6: Borehole Location**

### 6.2.1 Strata Encountered

The following strata was encountered in the GEA investigation.

- Made Ground comprising dark brown gravelly CLAY with brick was encountered to 3.5m bgl.
- Lynch Hill Gravel was found to comprise medium dense orange-brown gravelly SAND and was 1.2m in thickness.
- London Clay comprising firm becoming very stiff, dark brownish grey slightly sandy CLAY with occasional selenite crystals, claystones, shell fragments and pyrite nodules, was encountered from 4.7m bgl to 34.4m bgl.
- Lambeth Group soils described as very stiff slightly sandy CLAY were encountered from 34.4m bgl to the base of the hole at 35.0m bgl.

### 6.2.2 In-situ Testing

13 No. SPTs were undertaken throughout the depth of the borehole. These data were supplemented with historical borehole information obtained from the British Geological Society (BGS) historical borehole database.

### 6.2.3 Laboratory Testing

4 No. Atterberg limit tests were undertaken on samples of London Clay, returning an average Plasticity Index of 46% indicating a clay of medium to high plasticity.

12 No. moisture content tests were undertaken on samples of London Clay and 1 No. test was undertaken on Lambeth Group soils. An average water content of 26% was derived for the London Clay and the Lambeth Group test returned a result of 19%.

8 No. Undrained Unconsolidated (UU) triaxial tests were undertaken on samples of London Clay and 1 No. test was undertaken on a sample of a Lambeth Group soil. As the UU tests were undertaken on 100mm dia. samples, no reduction to the reported value was made to account for the effects of structure and fissuring.

## 6.3 Geotechnical Interpretation

The undrained shear strengths ($S_U$) from UU test results were combined with those derived from the SPT results using an $f_1$ correlation factor of based on plasticity index as recommended by Stroud (1974). The following $f_1$ factors were adopted:

- 5m bgl to 20m bgl: $f_1 = 4.5$,
  based on average plasticity index of 46%
- 20m bgl to 35m bgl: $f_1 = 6.0$,
  this value correlated better with the UU test results as outlined in White et. al (2019).

The resulting design line for the London Clay is defined below, where z is the depth below 20m bgl:

**5m to 20m below ground level:** **$S_U = 50 + 6z$,**

**20m to 35m below ground level:** **$S_U = 140 + 12z$,**

The undrained strength can be used with generic correlations to estimate undrained stiffness for a linear elastic soil model. Typically, the following relationship is applied for stiff insensitive cohesive soils based on over-consolidation ratio and Plasticity Index.

$$Eu / Su = 400\text{-}500$$

And the drained stiffness is generally related to the undrained stiffness as follows;

$$E' = 0.8\ Eu$$

It is noted that the simple elastic soil model is not a good representation of real soil behaviour, and in view of proposal to utilise a sequential underpinning approach a more advanced soil model utilising strain dependent stiffness was adopted for the ground movement analysis. Full details of the interpretation of factual ground investigation data and the development of an appropriate soil model is presented in the Ground Movement Assessment report appended in 1)a)i)(1)(a)(i)Appendix G .

## 6.4 Ground Model

BGS borehole records were reviewed adjacent to the site to better understand the deeper strata. Borehole TQ38SW5470 located 130m north of the site encountered the same sequence of strata, with chalk bedrock at 54.1m bgl (-33.88mOD).

Considering the site-specific ground investigation and nearby historical boreholes, the following Ground Model was adopted for design.

**Table 1: Ground Model**

| Strata | Description | Top of Layer (m bgl) | Top of Layer (m OD)[1] | Thickness (m) |
|---|---|---|---|---|
| Made Ground | Gravelly CLAY with brick | 0 | 122.0 | 3.5 |
| Lynch Hill Gravel | Medium dense gravelly SAND | 3.5 | 118.5 | 1.2 |
| London Clay | Slightly sandy stiff fissured CLAY | 4.7 | 117.3 | 29.7 |
| Lambeth Group | Very stiff slightly sandy fissured CLAY | 34.4 | 87.6 | 15.6 |
| Thanet Sands | Very dense silty fine to medium SAND, locally clayey | 50.0 | 72.0 | 4.1 |
| Chalk | Unstructured Chalk (Grade $D_M$) | 54.1 | 67.9 | - |
| 1: Estimated elevation of borehole | | | | |

Groundwater wasn't encountered during the GEA investigation during drilling. Generally, in London, the groundwater regime is characterised by the presence of an upper aquifer in the surficial soils and gravels, perched on top of the very low permeability London Clay that acts as an aquiclude. The Lambeth group comprises a mixture of cohesive and granular layers and therefore can act as both an aquiclude and part of a lower aquifer hydraulically connected to the Thanet Sand and Chalk.

The groundwater monitoring results recorded groundwater levels at the upper boundary of the London Clay, which is interpreted to represent the presence of perched surficial water.

## 6.5 Additional Assessments

- 105465-PEF-ZZ-XX-RP-GG-600001_P01 Saville Theatre PRA - Contaminated land assessment
- 105465-PEF-ZZ-XX-RP-YE-000010-S2-P02_FRA_BOUND - Flood risk assessment

# 7 Construction Methodology/ Engineering Statements

## 7.1 Geotechnical Design Parameters

Geotechnical parameters have been derived for each of the strata, based on the available in-situ testing, parameters recommended from the previous Ground Investigation Report (GIR) from GEA and experience of similar materials. The basic geotechnical parameters for use with a simple linear elastic soil model is summarised below in Table 2.

**Table 2: Geotechnical Parameters – Linear elastic model**

| Strata | $\gamma_{bulk}$ (kN/m³) | c' (kPa) | Φ (˚) | $S_U$ (kPa) | $E_U$ (MPa) | E' (MPa) |
|---|---|---|---|---|---|---|
| Made Ground | 17 | 0 | 25 | 20 | 8.1 | 6.5 |
| Lynch Hill Gravel | 19 | 0 | 33 | - | - | 24 |
| London Clay | 19 | 5 | 10 | $50+6z_1$<br>$140 + 12z_2$ | V:$22.5 + 2.7z_1$<br>H:$50.0 + 6.0z_1$<br>V:$63.0 + 5.4z_2$<br>H:$140 + 12.0z_2$ | V:$18.0 + 2.2z_1$<br>H:$40.0 + 4.8z_1$<br>V:$50.4 + 4.3z_2$<br>H:$112 + 9.6z_2$ |
| Lambeth Group | 20 | 10 | 30 | 320 | 320 | 260 |
| Thanet Sands | 22 | 0 | 42 | - | - | 320 |
| Chalk | - | - | - | - | - | - |

1 Depth below 4.7m bgl
2 Depth below 20.0m bgl

However, for the numerical modelling undertaken for the GMA a more sophisticated non-linear small strain stiffness model was used incorporating strain-dependent stiffness relationships for the London Clay and Lambeth Group strata. This model is presented in detail in the GMA (1)a)i)(1)(a)(i)Appendix G ) and summarised below in Table 3

**Table 3: Hardening Soil Small Strain Stiffness Model Parameters**

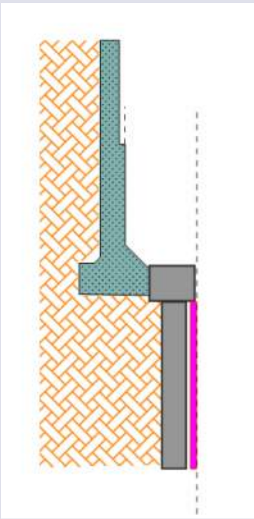
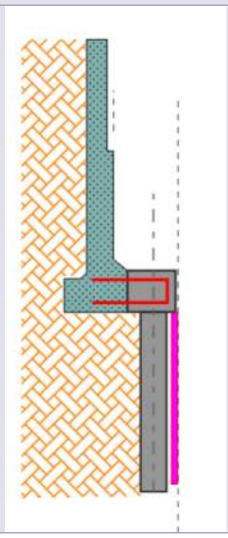
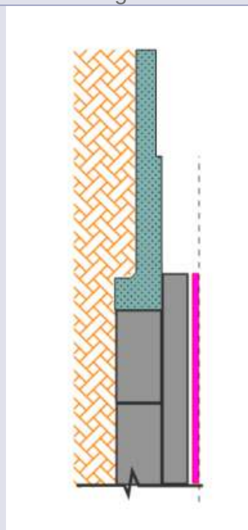
| Soil and Depth Range | m bgl | London Clay 4.7 to 20 | London Clay 20 to 34.4 | Lambeth Group 34.4 to 50 |
|---|---|---|---|---|
| Coefficient of earth pressure at rest[1] | K0 | 2.0[1] | 1.5[1] | 1.25[1] |
| Secant stiffness in standard drained triaxial test | $E_{50}^{ref}$ MPa | 10.5 | 12.2 | 13.5 |
| Tangent stiffness for primary oedometer loading | $E_{OED}^{ref}$ MPa | 7.4 | 8.5 | 9.5 |
| Unloading/reloading stiffness | $E_{UR}^{ref}$ MPa | 31.6 | 36.5 | 40.6 |
| Power for stress-level dependency of stiffness | m | 0.84[2] | 0.84[2] | 0.84[2] |
| Shear modulus at very small strain | $G_0$ MPa | 79.1[3] | 79.1[3] | 79.1[3] |
| Shear strain at which Gs/ G0 = 0.722 | $\gamma_{0.7}$ | 0.00035 | 0.00035 | 0.00037 |
| Poisson's ratio for unloading/reloading | $\nu_{ur}$ | 0.2 | 0.2 | 0.2 |
| Reference confining pressure | $P_{ref}$ kPa | 100 | 100 | 100 |
| Failure ratio, qf / qa | $R_f$ | 0.9 | 0.9 | 0.9 |

1: Hight et al. (2003)
2: Viggiani et al. [1997] and Hicher [1996]
3: Based on shear wave velocity = 200m/s for very small strains

## 7.2 Outline of Temporary and Permanent Works Proposals

Three potential options for the construction of the deepened basement have been considered as shown schematically below in Table 4; two options relate to a conventional embedded piled (secant or contiguous) wall, and the other option relates to basement wall construction using a sequential underpinning methodology.

**Table 4: Basement Construction Options**

| Option | Option 01 | Option 02 | Option 03 |
|---|---|---|---|
| **Description** | Separate embedded retaining wall (secant or contig) drilled offset from the base of the existing basement wall. | Hybrid embedded retaining wall (secant or contig) drilled offset from the base of the existing wall and dowelled into it. | Mass concrete underpinning with lining wall to underside of toe of retaining wall with internal RC lining wall. |
| **Sketch** |  |  |  |

### 7.2.1 Piled Wall Option

For the piling option, Options 01 and 02, it is understood that to meet the basement width requirements, 600mm diameter piles are the largest diameters available, with a 300mm structural lining wall cast in front. From a GMA perspective, provided similar stiffness of the embedded secant retaining wall are maintained during excavation, then similar induced ground movements are likely to occur for both Option 01 and Option 02.

### 7.2.2 Underpinning Option

The underpinning Option 03 assessment has considered sequencing of the works and dimensions of the pins in general accordance with Kier’s Basement Construction Appraisal for Saville Theatre, dated December 2022.

This proposed underpinning is made by forming pins 1.8m in width around the basement footprint in a 1 in 5 hit and miss sequence, resulting in 70 No. separate underpins per structural level. The pins are proposed to be 2.6m in height and 2.0m in thickness. The pins are to be constructed in three phases, where Phase 1 forms the corner sections, Phase 2 forms the intermediate sections and Phase 3 forms the largest span length across the basement wall, refer Figure 7 (right), where Phase 1 is shown in yellow, Phase 2 is shown in blue and Phase 3 in purple.

Three levels of temporary propping are proposed below the existing basement, with temporary props also being installed to support the existing basement on demolition of the floor slabs, refer to Figure 7.

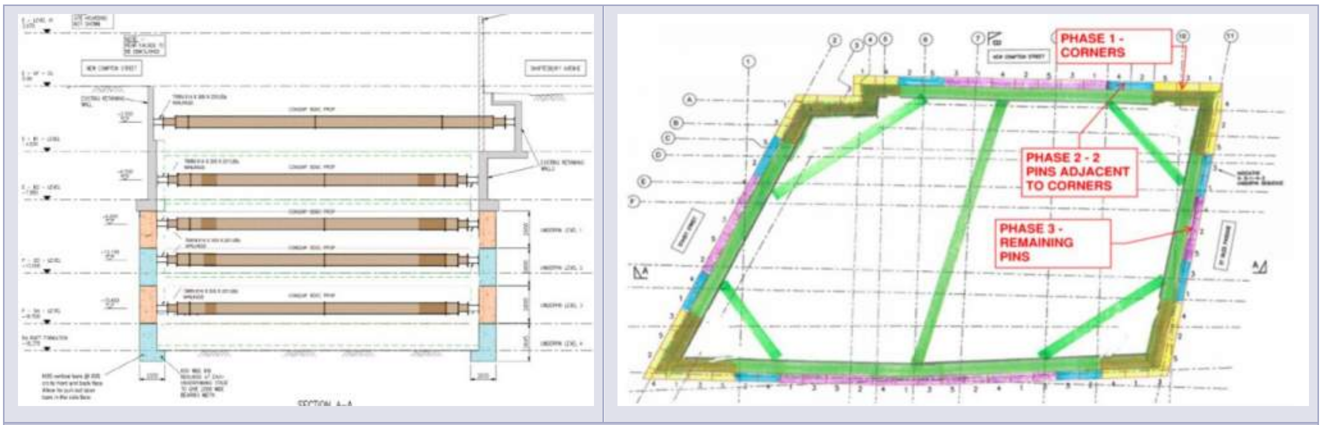



**Figure 7: Underpinning Arrangement (Kier Basement Appraisal)**

## 7.3 Permanent Works – Floor slabs

On completion of the basement deepening works the basement walls shall be permanently supported by floor slabs as follows:

*Ground Floor Slab:* A permanent ground floor slab across the whole basement footprint is proposed with no significant openings. The slab will prop the top of the existing reinforced concrete basement walls.

*Basement 01 (B1) Slab:* A partial floor slab is proposed to accommodate the theatre auditorium and viewing areas at both B1 and B2 level. This slab is proposed to be located at 3.9m below ground level (below top of existing basement walls). At this level all sections of the basement are propped except for the eastern façade adjacent to St Giles Passage which spans unsupported approx. 14.5m between the structural cores.

*Basement 02 (B2) Slab:* The partial floor slab at B2 will follow a similar outline to the B1 floor slab, located at a level of 7.3m below ground level

*Basement 03 (B3) Slab:* At B3 level (top of slab at approx. 13.0m below ground level) a floor slab will extend across the entire footprint with a significant opening (7.5m by 12.0m) to accommodate removable staging. The slab is thickened between the opening and the basement wall to act aa s deep horizontal beam.

*Basement 04 (B4) Slab:* The basement slab 1.0m and 1.5m thick at B4 level will be ground bearing with the top of the slab at 16.50m below ground. A formation level of 18.30m below ground was adopted to accommodate up to 1.8m of slab excavation.

*Sprinkler Tank Slab:* The sprinkler tank slab shall be 3.4m below the B4 slab with excavation commencing approximately 6.0m basement wall.

A summary of the proposed slab and temporary propping arrangement is shown below in Figure 8.

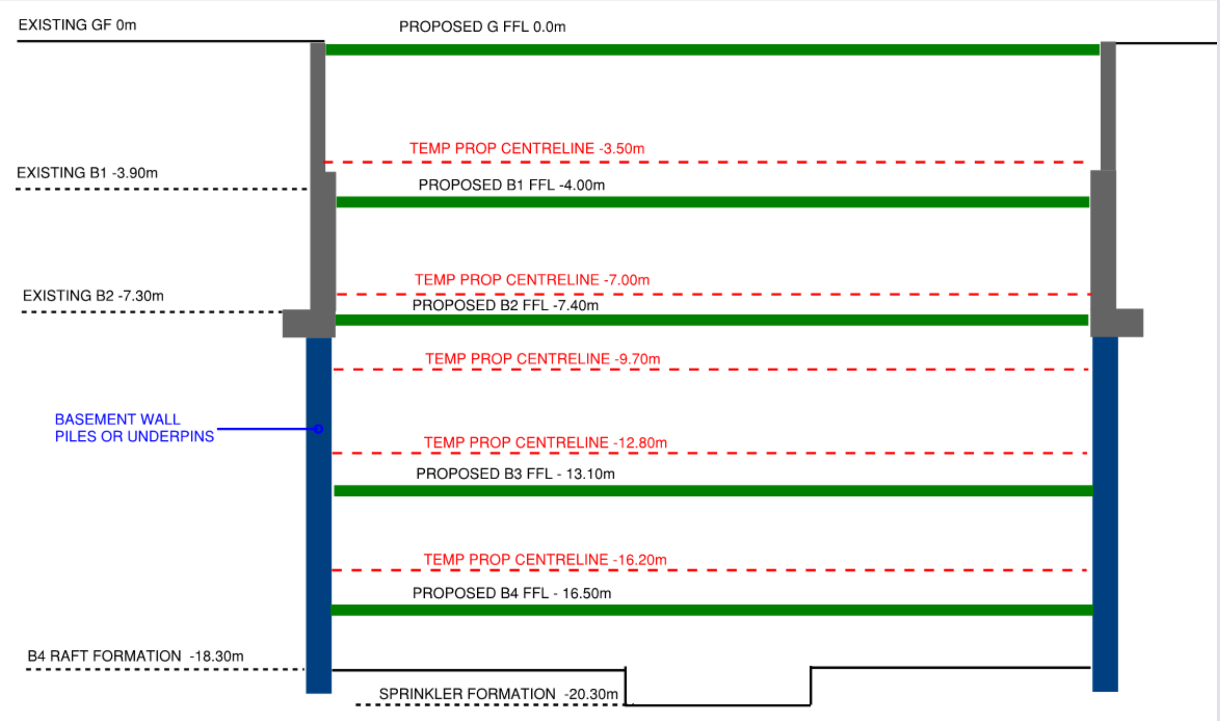



**Figure 8: Proposed Layout of Floor Slabs and Temporary Props**

## 7.4 Construction Sequence

The current proposed construction sequence at the time of preparation of this report is summarised below.

<u>Piled Wall Option:</u>

1. Demolition of existing internal structure.
2. Installation of façade supports to existing retaining wall stem (in reality parallel with 1 above).
3. Installation of walers and temporary props between Ground and B1 levels.
4. Demolition of existing B1 slab.
5. Installation of walers and temporary props between B1 and B2 levels.
6. Demolition of existing B2 slab and toe of existing retaining wall toe cut back to 400/600mm from internal face of retaining wall.
7. Piling works from B2 level and construction of capping beam at existing wall toe.
8. Excavation works to level of B3 temporary props.
9. Installation of walers and temporary props.
10. Excavation works to B4 temporary prop level.
11. Installation of walers and temporary props.
12. Excavation to B4 slab formation level and construction of B4 raft slab dowelled into piled wall.
13. Removal of B4 level walers and temporary props.
14. Construct lining wall between B4 and B3 levels.
15. Construction of B3 slab dowelled into piled wall.
16. Construction of B2 slab dowelled into piled wall capping beam.
17. Removal of B3 level walers and temporary props.
18. Construct lining wall between B3 and B2 levels.
19. Construct B1 slab dowelled into existing basement walls.
20. Removal of temporary props at B1 and B2 level.
21. Complete super structure.

## 7.4 Construction Sequence (cont'd)

Underpinning Option:

1. Demolition of existing internal structure.
2. Installation of façade supports to existing retaining wall stem (in reality parallel with 1 above).
3. Installation of walers and temporary props between Ground and B1 levels.
4. Demolition of existing B1 slab.
5. Installation of walers and temporary props between B1 and B2 levels.
6. Demolition of existing B2 slab and toe of existing retaining wall toe cut back to 400/600mm from internal face of retaining wall.
7. Excavation sequence of the Phase 1 (corner sections) underpins in a 1 to 5 hit and miss sequence:
    - Excavate and install trench box
    - Excavate underpin beneath existing reinforced concrete retaining wall
    - Install reinforcement and shuttering for the underpin
    - Remove formwork and remove trench box
    - Backfill trench box excavation with lean mix concrete
8. Install Phase 2 (section surrounding corner) underpins
9. Install Phase 3 (long span sections)
10. Once all underpinning installed, excavate to level of temporary props
11. Install temporary propping and walers
12. Excavate to next underpinning level and install 2$^{nd}$ level underpins, Phase 1 to Phase 3
13. Excavate to next level temporary props and install temporary propping and walers
14. Excavate to next underpinning level and install 3$^{rd}$ level underpins, Phase 1 to Phase 3
15. Excavate to next level temporary props and install temporary propping and walers
16. Excavate to next underpinning level and install 4$^{th}$ level underpins, Phase 1 to Phase 3
17. Excavate to next level temporary props and install temporary propping and walers
18. Excavation to B4 slab formation level
19. Cast permanent lining wall and construct B4 raft slab dowelled into wall
20. Removal of B4 level walers and temporary props.
21. Construct lining wall between B4 and B3 levels.
22. Construction of B3 slab dowelled into lining wall.
23. Construction of B2 slab dowelled into lining wall.
24. Removal of B3 level walers and temporary props.
25. Construct lining wall between B3 and B2 levels.
26. Construct B1 slab dowelled into existing basement walls.
27. Removal of temporary props at B1 and B2 level.
28. Complete super structure.

## 7.5 Ground Movement and Damage Impact Assessment

The CIRIA C760 guide presents empirical methods based on excavation depth to determine excavation induced ground movements or alternatively through utilising the deflected shape of the wall. Neither of these approaches are applicable to the sequential underpinning option, and consequently 3-D numerical modelling was undertaken for both the piled and underpinning methodologies using the 3D commercial finite element program PLAXIS. Full details of the GMA method can be found in the Ground Movement Analysis Report presented in 1)a)i)(1)(a)(i)Appendix G

A summary of the ground movements derived from the modelling for the piled wall and sequential underpinning approach to the basement walling is illustrated below in Figure 9 with very similar displacements being observed for both cases.

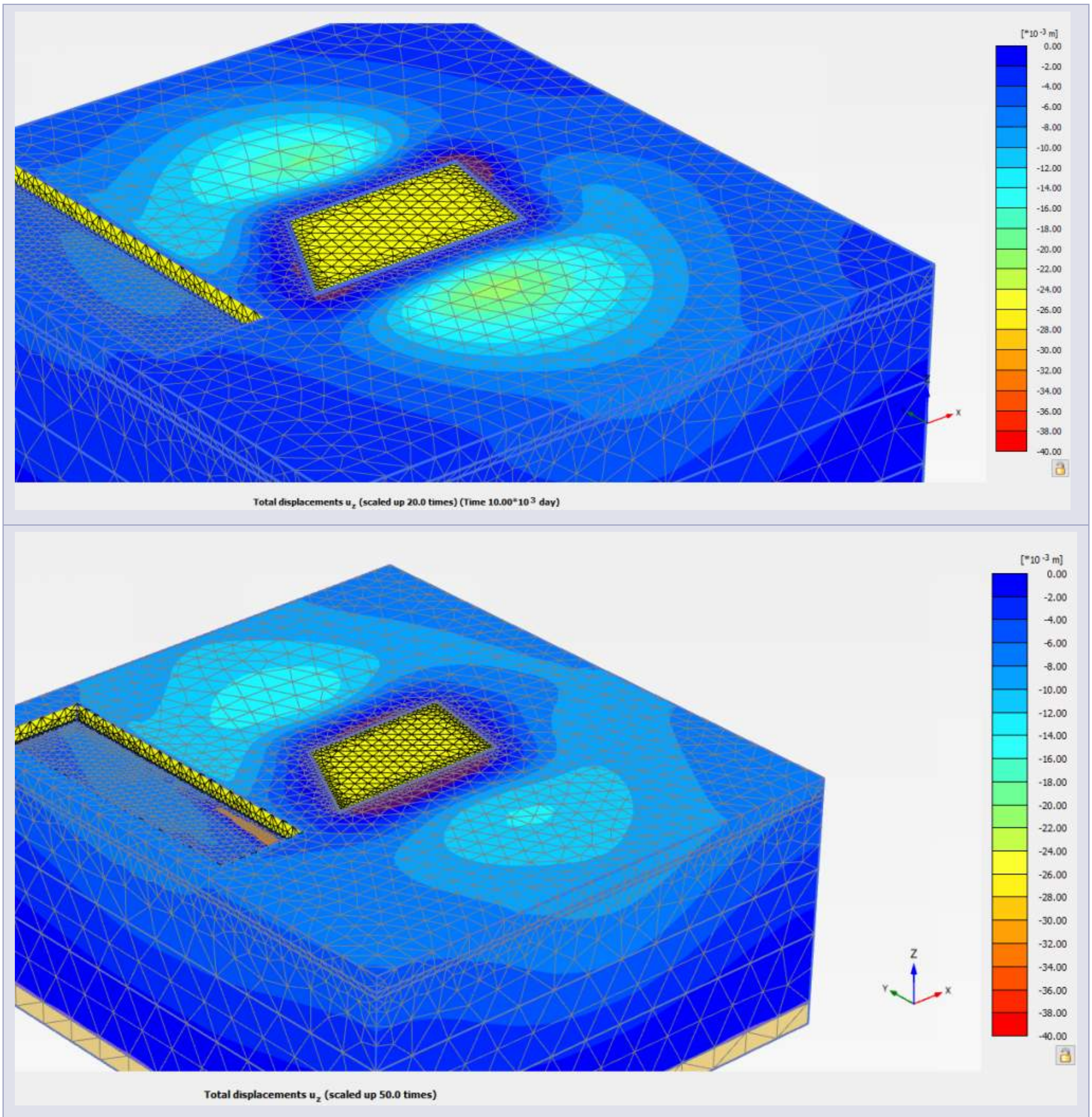



**Figure 9: Total Vertical Settlements around Basement for Piling (Top) and Underpin Case (Bottom)**

## 7.6 Building Damage Assessment

From the GMA, structures within the zone of influence of the basement construction works were identified, refer to Figure 10.

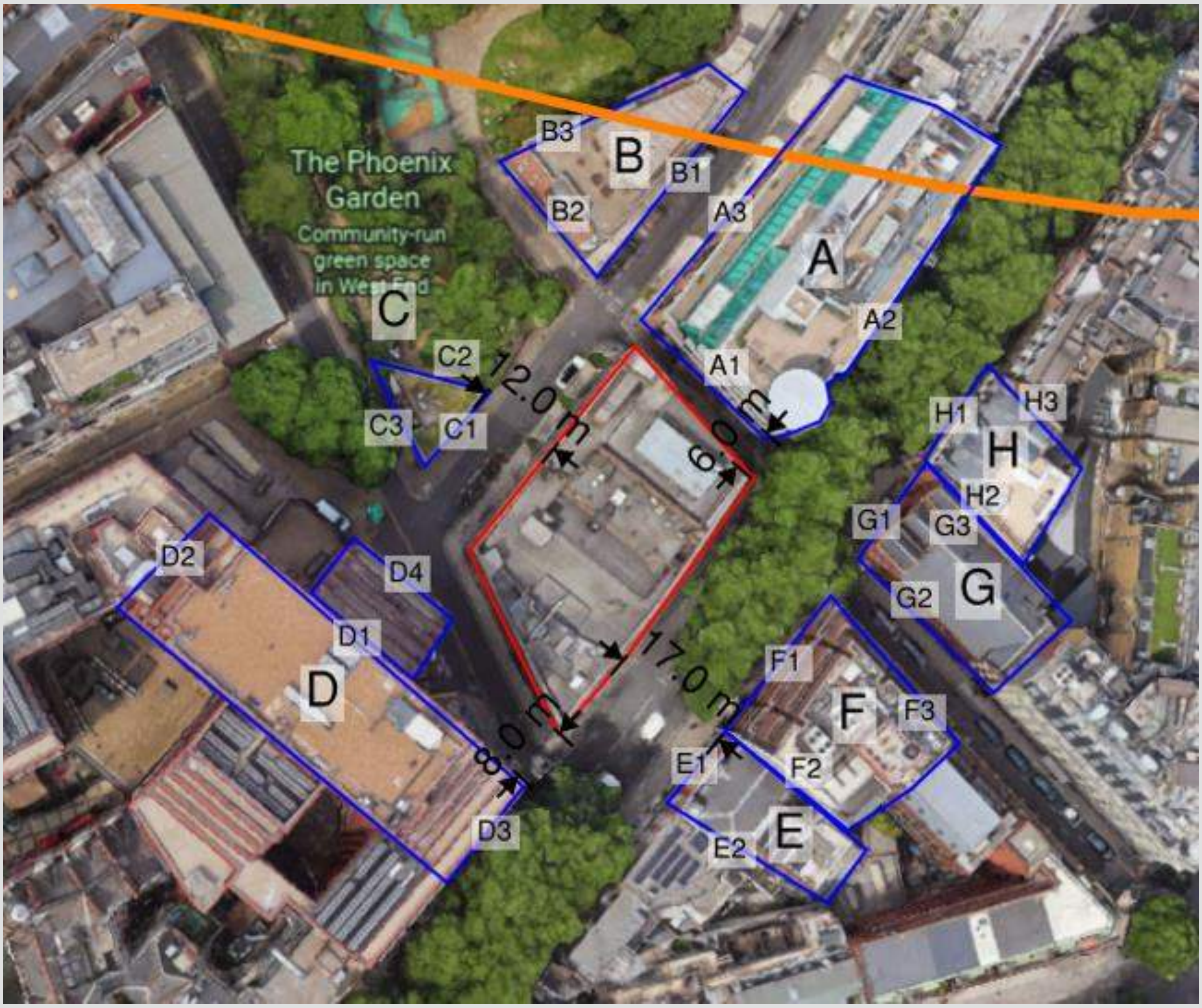



**Figure 10: Identification of structures in potential zone of influence**

# 8 Damage Impact Assessment

The GMA has been used to derive differential movements and strains on the façades of structures within the zone of influence and damage classifications have been derived in accordance with CIRIA C760, refer to Table 5, from which the relevant Burland Damage Category is defined ranging from 0 (Negligible) to 5 (Very Severe).

**Table 5: Damage Classifications as per Burland et al. (1977)**

| Category | Description and Typical Damage | Approximate Crack Width (mm) | Limiting Tensile Strain $\varepsilon_{lim}$ (%) |
|---|---|---|---|
| 0 Negligible | Hairline cracks of less than about 0.1 mm are classed as negligible | < 0.1mm | 0.0 to 0.05 |
| 1 Very slight | Fine cracks that can easily be treated during normal decoration. Perhaps isolated slight fracture in building. Cracks in external brickwork visible on inspection | < 1 | 0.05 to 0.075 |
| 2 Slight | Cracks easily filled. Redecoration probably required. Several slight fractures showing inside of building. Cracks are visible externally and some repointing may be required externally to ensure weathertightness. Doors and windows may stick slightly. | < 5 | 0.075 to 0.15 |
| 3 Moderate | The cracks require some opening up and can be patched by a mason. Recurrent cracks can be masked by suitable lining. Repointing of external brickwork and possibly a small amount of brickwork to be replaced. Doors and windows sticking. Service pipes may fracture. Weathertightness often impaired. | 5 to 15 or a number of cracks greater than 3 | 0.15 to 0.30 |
| 4 Severe | Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows. Windows and frames distorted, floor sloping noticeably. Walls leaning or bulging noticeably, some loss of bearing in beams. Service pipes disrupted. | 15 to 25 but also depends on number of cracks | > 0.30 |
| 5 Very Severe | This requires a major repair involving partial or complete rebuilding. Beams lose bearings, walls lean badly and require shoring. Windows broken with distortion, Danger of instability. | Usually greater than 25 but depends on number of cracks | - |

With reference to Figure 11Figure 11: Deflection Ratio (Left), Relationship between Deflection and Strain (Centre and Right), using the PLAXIS derived settlements to obtain deflection ratios (essentially a measure of bending strain) and horizontal strains, the resulting interaction is used to determine the damage category for the structure. This assessment conservatively considers the structures as masonry, however reinforced concrete-framed structures will be more flexible in shear than masonry, and are consequently less susceptible to damage.

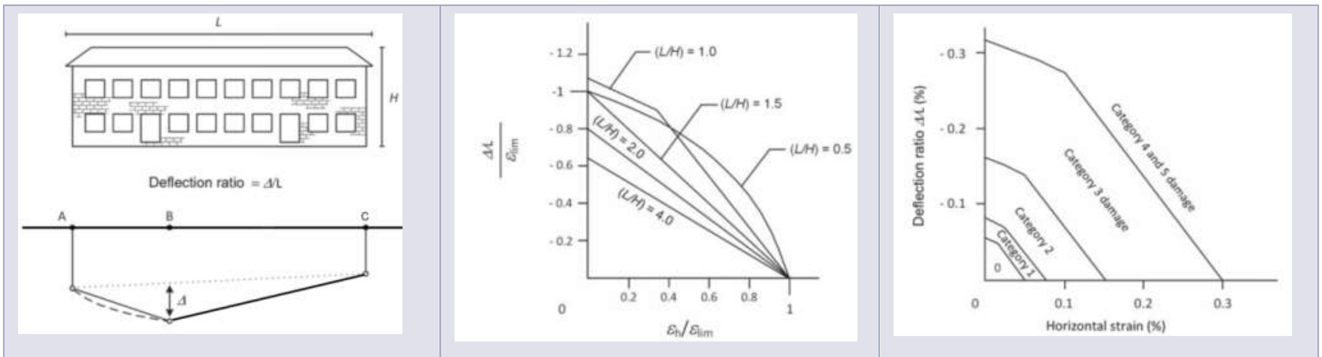



**Figure 11: Deflection Ratio (Left), Relationship between Deflection and Strain (Centre and Right)**

### 8.1.1 Building Damage Categories

A summary of derived Burland Damage Categories for all relevant structures is presented below in Table 6 and generally fall into Category 0, except for facade E1, where the change in differential movement over the relatively short façade span (15.0m) resulted in Category 1 damage.

In view of the derived building damage categories of no greater than 1, no mitigation is proposed to reduce ground movements, but damage impacts shall be monitored and appropriate intervention to be in place.

| Table 6: Adjacent Structures Movements | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Point A | | | Point B | | Point C | | | |
| Facade | Length (m) | Height (m)[1] | L/H Ratio | Length along Façade (m) | Settlement (mm) | Horizontal Movement (mm) | Length along Façade (m) | Settlement (mm) | Length along Façade (m) | Settlement (mm) | Horizontal Movement (mm) | Burland Damage Category |
| A1 | 25.0 | 25.0 | 1.00 | 0 | 8 | 17 | 5 | 9 | 25 | 2 | 2.5 | 0 |
| A2 | 50.0 | 25.0 | 2.00 | 0 | 8 | 18 | 5 | 12 | 50 | 0 | 2 | 0 |
| A3 | 50.0 | 25.0 | 2.00 | 0 | 8 | 18 | 5 | 12 | 50 | 0 | 2 | 0 |
| B1 | 35.0 | 20.0 | 2.00 | 0 | 7 | 12 | 8 | 8 | 35 | 8 | 5 | 0 |
| B2 | 20.0 | 20.0 | 1.00 | 0 | 7 | 12 | 10 | 11 | 20 | 8 | 6 | 0 |
| B3 | 30.0 | 20.0 | 1.50 | 0 | 6 | 11 | 15 | 4 | 30 | 2 | 4 | 0 |
| C1 | 15.0 | 3.5 | 4.50 | 0 | 15 | 21 | 10 | 24 | 12 | 21 | 25 | 0 |
| C2 | 20.0 | 3.5 | 5.50 | 0 | 22 | 26 | 2 | 24 | 20 | 16 | 19 | 0 |
| D1 | 30.0 | 40.0 | 1.00 | 0 | 10 | 11 | 7 | 14 | 30 | 10 | 16 | 0 |
| D2 | 10.0 | 40.0 | 0.50 | 0 | 8 | 8 | 3 | 9 | 10 | 3 | 5 | 0 |
| D3 | 70.0 | 40.0 | 2.00 | 0 | 6 | 4 | 18 | 11 | 60 | 6 | 4 | 0 |
| D4 | 20.0 | 40.0 | 0.50 | 0 | 4 | 6 | 10 | 4 | 20 | 4 | 6 | 0 |
| E1 | 15.0 | 15.0 | 1.00 | 0 | 21 | 26 | 8 | 20 | 15 | 18 | 14 | 0 |
| E2 | 25.0 | 15.0 | 1.50 | 0 | 15 | 21 | 2 | 14 | 21 | 8 | 12 | 0 |
| F1 | 25.0 | 20.0 | 1.50 | 0 | 21 | 26 | 10 | 16 | 20 | 16 | 22 | 1 |
| F2 | 20.0 | 20.0 | 1.00 | 0 | 21 | 26 | 10 | 16 | 20 | 9 | 15 | 0 |
| F3 | 25.0 | 20.0 | 1.50 | 0 | 15 | 8 | 19 | 14 | 25 | 8 | 12 | 0 |
| G1 | 15.0 | 20.0 | 1.00 | 0 | 14 | 22 | 8 | 18 | 15 | 8 | 14 | 0 |
| G2 | 30.0 | 20.0 | 1.50 | 0 | 14 | 14 | 15 | 12 | 30 | 6 | 10 | 0 |
| G3 | 30.0 | 20.0 | 1.50 | 0 | 10 | 14 | 15 | 9 | 30 | 7 | 8 | 0 |
| Crossrail | - | - | - | Maximum settlement of 3mm at the base of the tunnel | | | | | | | | |
| 1 Includes the height above ground level and basement depth | | | | | | | | | | | | |

## 8.2 Control of Construction Works

The construction works will be closely controlled in accordance with relevant technical guidelines for underpinning piling to describe control of construction works in relation to proposed basement.

A structural monitoring strategy will be developed to control construction works and maintain movements/damage impacts within acceptable limits. The strategy shall include, but is not limited to the following elements:

- A structural monitoring layout plan of instrumentation/survey points/critical sections.
- Programme/frequency of monitoring.
- Trigger values derived for each of the structures within the zone of influence.
- Contingency actions.

# 9 Basement Impact Assessment

## 9.1 Conceptual Site Model (CSM)

The proven ground conditions consist of Made Ground comprising dark brown gravelly CLAY to a maximum thickness of about 3.5m, overlying 1-2m of Lynch Hill Gravel; a medium dense orange-brown gravelly SAND, overlying ~30m of London Clay comprising firm becoming very stiff, dark brownish grey slightly sandy CLAY, which in turn overlies the Lambeth Group soils, described as very stiff slightly sandy CLAY.

Groundwater monitoring recorded levels at the upper boundary of the London Clay, which is interpreted to represent the presence of perched surficial water within the Made Ground and gravel.

The site is currently occupied by the Saville Theatre and the proposed works involve part demolition, restoration and refurbishment of the existing Grade II listed building, roof extension, and excavation of basement space, to provide a theatre at lower levels, with ancillary restaurant / bar space (Sui Generis) at ground floor level; and hotel (Class C1) at upper levels; provision of ancillary cycle parking, servicing and rooftop plant, and other associated works.

Demolition of all the internal structure of the existing building will be undertaken, leaving the façade and basement retaining walls in place with the northern façade being removed and reinstated. An additional two levels of new basement will be formed to be used as theatre space and shared plant.

Potential impacts are that the neighbouring structures (buildings) evaluated as no greater than Damage Category 1 in accordance with the Burland Scale, which conforms with paragraph 4.33 of Camden Planning Guidance: Basements.

No proposed mitigation is required beyond the design and implementation of construction control methods, and an appropriate monitoring regime. Residual impacts shall be within acceptable limits and verified with monitoring.

## 9.2 Land Stability/Slope Stability

The site investigation has identified a suitable founding stratum of London Clay Formation.

A Ground Movement Assessment has concluded that ground movements caused by the excavation and construction works will not be significant with Damage Impact to surrounding structures within the zone of influence being assessed as no higher than Burland Damage Category 1.

The BIA has therefore concluded that there will not be any significant land stability impact to the development or adjacent structures provided construction works is undertaken with adequate construction controls and monitoring.

## 9.3 Hydrogeology and Groundwater Flooding

The BIA has concluded there is a low risk of groundwater flooding. However, the basement walls shall be designed and constructed to be impermeable to remove the risk from seasonal perched ground water.

The BIA has concluded there are no impacts to the wider hydrogeological environment.

## 9.4 Hydrology, Surface Water Flooding and Sewer Flooding

The BIA has concluded there is a low risk of surface water/sewer flooding.

The BIA has concluded there are no impacts to the wider hydrological environment.