

**The British Museum
East Road Building
Basement Impact Assessment**

**Prepared for
The British Museum**

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The British Museum, East Road Building

Basement Impact Assessment

Contents

- 1.0 Non-technical summary
- 2.0 Introduction
 - 2.1 Authors
 - 2.2 Existing Development and Surrounding Buildings
 - 2.3 Proposed Development
- 3.0 Desk Study
 - 3.1 Site History
 - 3.2 Geology
 - 3.3 Hydrogeology
 - 3.4 Hydrology, Drainage and Flood Risk
- 4.0 Screening
 - 4.1 Non-technical summary of the screening
- 5.0 Scoping
 - 5.1 Conceptual Ground Model
 - 5.2 Hydrology
 - 5.3 Slope Stability
- 6.0 Further Investigations and Assessments
 - 6.1 Site Investigation
 - 6.2 Hydrological Impact Assessment
- 7.0 Construction Methodology
 - 7.1 Updated Ground Model
 - 7.2 Proposed Structural Design
 - 7.3 Basement Design
 - 7.4 Sequence of Construction
 - 7.5 Programme
 - 7.6 Construction Management Plan
 - 7.7 Ground Movements and Structural Damage
 - 7.8 Mitigation Measures
- 8.0 Basement Impact Assessment
 - 8.1 Hydrology and Groundwater
 - 8.2 Neighbouring Structures
 - 8.3 Trees
 - 8.4 Non-technical Summary of the Impact Assessment

Appendix A – Desk Study References

- Location plan
- Existing site plan
- Environment agency flood risk map
- Location geology

- Local area borehole study
- Figures from Guidance for Subterranean Development (GSD) by Ove Arup & Partners.

Appendix B – Screening Tables

Appendix C – Proposed Development Drawings

- Proposed structural plans
- Proposed structural sections
- Horizontal Load Transfer
- Vertical Load Transfer
- Net Building Loads

Appendix D – Assumed Sequence of Construction

Appendix E – Construction Programme

Appendix F – Site Investigations

- Harrison Group Desk Study Report
- Harrison Group Interpretive Report
- Trial pits findings and borehole logs
- Ground water monitoring results

Appendix G – Hydrological Impact Assessment

Appendix H – Ground Movement and Damage Impact Assessment

Appendix I – Arboricultural Report

Appendix J – Structural Engineering Calculations

- Secant piled wall calculations
- CFA pile calculation

1.0 Non-Technical Summary

The proposed development is located on the British Museum site on Great Russell Street, London, WC1B 3DG. Currently, the site is occupied by an existing single-storey building surrounded by:

- an access road to the east with the main museum building beyond
- a garden to an adjacent property to the north
- the rear gardens and basements of a series of houses on Montague Street to the east
- a single-storey building belonging to the neighbouring Grange Hotel to the south

We propose replacing the existing single-storey building with a new one with a similar footprint. It will have a single-storey basement, one full storey above ground and a partial second storey above ground.

This Basement Impact Assessment includes the following:

- A desk study of available record information
- A screening study to identify key issues relating to the impact of the basement on the neighbouring buildings and the local environment
- A scoping exercise identifying the investigations needed to understand and assess the issues raised by the screening study
- A report of the site investigations carried out to investigate the ground conditions and neighbouring foundations
- A hydrological impact assessment, considering the impact that the proposed basement will have on the flow of water within the ground
- A ground movement assessment predicting the movements and the resulting impact on the neighbouring buildings from the works
- An arboricultural report commenting on the impact of the proposals on the nearby trees

The ground conditions comprise a layer of previously disturbed ground over sand and gravel over clay. The basement will sit in the gravel layer. Groundwater is present near the bottom of the gravel layer.

The proposed basement will be formed with a secant piled retaining wall around the perimeter of the excavation. This will then be propped to support the surrounding ground while excavating the basement. An in-situ reinforced concrete basement slab and walls will be formed inside the piled walls.

As is normal, some ground movements will occur during the formation of the basement. These movements have been estimated and found to generally be within acceptable limits based on Camden Council's guidance. During the works, the neighbouring buildings will be monitored. Any movement will be compared to the predicted movements so that the impact on the surrounding buildings is not more onerous than predicted.

This assessment has highlighted the following potential impacts and has reached the following conclusions:

Impact	Response
The basement may affect the flow of water through the ground	An assessment of the impact of groundwater flows has been carried out. It has been determined that the impact will not be significant because water can flow around the basement as it is not restricted by neighbouring properties
The basement will be founded at a lower level than the foundations of the neighbouring buildings leading to ground movements.	The ground movements resulting from this change have been assessed, and measures have been proposed to monitor and mitigate the movements that will occur.
The ground movements from the works may cause damage to the neighbouring buildings	The impact on the neighbouring buildings has been predicted and generally found to be within acceptable limits defined within Camden Council's guidance on basement construction.

2.0 Introduction

The proposed redevelopment of the East Road Building (ERB) comprises the removal of the existing single-storey building and the construction of a new building of a similar footprint with a single-storey basement, a single-storey and a partial second-storey above ground. This is referred to as the proposed East Road Building.

We have been appointed to provide civil and structural engineering input to develop the proposals and support the planning application. The Client has appointed Wright and Wright as Architect, Steensen Varming as M&E engineers and Lead Consultant, and GCG and Harrison Group as geotechnical and hydrological consultants.

This report describes the basement structural scheme design, the overall sequence of construction, the impact of the basement construction on adjacent properties, surface and groundwater flows, and slope stability.

This report has been based on the following information and has been prepared in accordance with the London Borough of Camden's Basement Impact Assessment Pro-forma:

- Historical maps and in-house desk study
- Geological survey maps and BGS borehole records
- Geotechnical site investigations carried out by Harrison Group in January 2023 (Appendix F)
- Proposed layout drawings by Wright and Wright and Alan Baxter
- Site visits
- Arboricultural report prepared by Tree Works (Appendix I)

In preparing the BIA, reference has been made to the following London Borough of Camden documents:

- Guidance for Subterranean Development (GSD). Issue 01. November 2010. Ove Arup & Partners.

- Camden Planning Guidance (CPG): Basements (January 2021).
- Camden Local Plan 2017 - Policy A5 Basements and Policy CC3 Water and flooding.

Note: As the above documents are in the public domain and already in the possession of auditor Campbell Reith, copies of these have not been included with this report to limit the size of the document uploaded on Camden’s Planning website. We have discussed this with Campbell Reith on previous BIA reports and agreed that this approach is acceptable.

2.1 Authors

The BIA has been co-written by the following authors holding the stated qualifications:

Alan Baxter Ltd	Matthew Spink	MEng
GCG	R. Scarfone	MSc PhD
	M. Crilley	BSc MSc DIC
Harrison Group	John Keay	BS

The BIA has been reviewed by Fred Nyberg (MEng MStructE) & David Bowles (MICE) for Alan Baxter and Jamie Austin (CGeo) for Harrison Group.

2.2 Existing Development and Surrounding Buildings

The existing ERB is located in the northeast of the estate, in an area currently occupied by a single-storey workshop building. Refer to Appendix A for the existing site plan. Based on record information, it was built between the 1950s and the 1980s on the rear gardens of the Montague Street terraced houses (Perimeter Properties). The Museum added the external entrance ramp and steps in the 1980s on the western side of the building. Drawing S002 in Appendix A summarises the existing site and underground services.

The site is bounded to the north by the rear garden of 43 Russell Square, to the east by the rear of 8 to 11 Montague Street buildings, and to the south by a single-storey 20th-century rear extension of the Grange Hotel on Montague Street. The surrounding buildings are early 1800s Georgian terraced houses (apart from the hotel’s rear extension) and are Grade II listed. The west side of the ERB site is adjacent to East Road.

The existing single-storey workshop building is to be demolished. The building is a load-bearing masonry structure supported on mass concrete strip foundations around 1.3m deep, as verified by the site investigations in January 2023.

2.2.1 North Boundary

The northern external wall of the existing ERB building forms the boundary to 43 Russell Square. It acts as a retaining wall to the raised gardens to the north. The basement to No. 43 does not extend west beneath the gardens, and surveys show no significant buried services in this area. To the northwest of the ERB is a two-storey building, with bin stores on the ground floor and contractor offices on the first floor. These are referred to by the museum as the ‘Green Huts’. Some suspended services run at the first-floor level across this structure. We understand these buildings were erected as temporary sheds for contractor offices and have existed for many years. Immediately west of the bin stores is a stanchion for a portal frame that supports the Jade Gallery. This gallery connects the north wing and the King Edward Building (KEB) at level three and is positioned on the west side of East Road. The stanchion next to the bin stores is supported on a

mass concrete pad foundation one metre below the ground level, confirmed by trial pits during the investigations. The foundation partly projects above the ground level.

2.2.2 East Boundary

The backs of 8 to 11 Montague Street (Perimeter Properties) have various single-storey basements and garden rooms extending towards the ERB. A passageway between the Perimeter Properties and the ERB provides a buffer zone and access for maintenance. The perimeter properties are cellular loadbearing masonry structures with simple brick corbelled footings bearing in the natural ground around 0.5m to 1 metre below their basement floor levels. Foundation profiles and depths were verified by trial pits.

2.2.3 South Boundary

A single-storey extension to the Grange Hotel was built in 1988 and abuts the ERB's southern wall. It is a load-bearing brick structure with a flat roof supported on mass concrete strip foundations. We visited the hotel to view the spaces and obtained record drawings showing the construction of the extension. These show that the southern wall of the ERB has become a party wall between the two properties. The side walls of the extension run up to the party wall and are separated by vertical joints filled with mastic.

2.2.4 West Boundary

To the west of the ERB is the East Road, a service road for access and maintenance for Museum operations. The road contains many buried services, including high-voltage cables and below-ground drainage runs. The below-ground drainage is a combined run that serves the existing ERB, the Great Court and East Range and flows north toward Montague Place.

2.2.5 Trees

There are three small to medium-sized trees near the proposed building; two to the north and one to the south. These are discussed in the Arboricultural Report in Appendix I.

2.3 Proposed Development

The proposed ERB is generally a single-storey structure above ground with a local area extending to two stories. The building will also have a single-storey basement. The basement's footprint is slightly smaller than the ground floor structure, which cantilevers over the basement wall on the east and south sides. The roofs will be flat and generally used only for maintenance access.

The basement will be formed using a secant piled retaining wall with a reinforced concrete box structure inside the piles. The piles will be bored to reduce the noise and vibration generated, extending through the gravel layer into the London Clay. The basement box will be founded in the dense gravel layer.

North Boundary

The ground level of the garden to 43 Montague Street will be approx. 1.5m higher than the ground floor level of the new building. The status quo will be maintained by supporting the soil on a cantilever perimeter RC retaining wall from the ground floor slab. The two-storey buildings with bin stores will be demolished before the works are undertaken, providing additional working space in this area. The stanchion of the steel frame supporting the Jade Gallery will be retained, and the new building will be built alongside it.

East Boundary

The line of the basement on the east elevation will be set back from the superstructure above to provide construction tolerance and mitigate the impact on the neighbouring properties, as shown in drawing 0015 in Appendix C. At ground level, the passageway separating the existing ERB and

the backs of the gardens and garden rooms will be retained for access and maintenance. Where the proposed excavations extend to a lower depth than the adjacent existing basements, the piled retaining wall will support the ground, propped by the new ground floor slab.

South Boundary

The line of the basement will also be set back on the south elevation to provide a safe construction zone for the operation of the piling rig and mitigate the impact on the neighbouring Grange Hotel Extension. The ground level on the Grange Hotel side of the southern boundary will be higher than the ground level in the new East Road Building. An RC retaining wall will maintain lateral restraint to the bottom of the wall in place of the soil that will be removed. Further lateral restraint will be provided to the top of the wall by the new superstructure with stub beams projecting from the building at the first-floor level. This is illustrated in drawing 0202 in Appendix C. The connections will be detailed to allow differential vertical movement between the two structures on this line.

West Boundary

The East Road will be retained on the west boundary of the building and will continue to provide maintenance/service access to the Museum. The width of the road means that the basement excavation will not undermine the Museum's Grade 1 listed East Wing. However, the piled wall will restrain the ground along this boundary. This is shown in drawing 0200 in Appendix C. The services within the east road will be decommissioned or diverted ahead of the works as required.

3.0 Desk Study

A desk study of available record information has been undertaken to understand the site and inform the proposed scheme. The information gathered has also been used to carry out the screening stage of this basement impact assessment and identify areas requiring further consideration.

3.1 Site History

Based on available record information, the Montague Street properties were built in the early 19th century. Redevelopment of the British Museum site began around the 1830s, with the East Wing added circa. 1850. The site remained in a similar arrangement until the existing East Road Building was built between the late 1950s and 1960s on the rear gardens of the Montague Street buildings (Perimeter Properties). The Museum added an external entrance ramp and steps in the 1980s on the western side of the ERB.

3.2 Geology

The local geological map and record borehole logs from the British Geological Survey (BGS) and our records of previous projects undertaken on the estate show that the ground conditions across the site are reasonably consistent. These have been verified by a site investigation carried out in January 2023. The geotechnical reports are included in Appendix F.

The ground conditions comprise:

- Made Ground – Disturbed material to approx. 1.9m below ground level, mainly consisting of gravelly clays.
- Gravelly clay – A thin band (~0.9m) extending to 2.8m below ground level.
- Lynch Hill Gravel – Medium to dense sand and gravel (~3.4m), extending to 6.2m below ground. A water table was found within the stratum, which aligns with historical records from previous investigations.

- London Clay – Stiff grey clay with some bands of fine sand.
- From BGS record information, the Lambeth Group Clay sits approximately 20m below ground beneath the London Clay.

3.3 Hydrogeology

The Lynch Hill Gravel Member is classified as a Secondary Aquifer, while the underlying London Clay Formation is identified as unproductive. The site does not lie within a groundwater source protection zone.

3.4 Hydrology, Drainage and Flood Risk

Based on record borehole logs, the water table is expected to be within the Lynch Hill Gravel at approx. 5.5m bgl. This is summarised in the ground model shown on drawing 1910/50/SK1 in Appendix A.

The site is not located within 250m of any current or historical surface water features, nor is it within the catchment of the Hampstead Heath Pond Chain.

The site is within flood zone 1 for flooding from rivers and seas (Environment Agency Flood Zone Map, Appendix A). Based on Figures 12 and 15 from the Camden GSD in Appendix A, the site is not near to any surface water features, however surface water flooding maps from the “.Gov” website and LBC SFRA suggest that there is theoretical chance of surface water ponding near the development during an extreme rainfall event once the below ground drainage infrastructure has been overwhelmed.

The site is not within a critical drainage area. Currently, the existing surfaces are impermeable, with the majority covered by the existing building and the remaining area being hardstanding. In the proposed case, the new building will cover the site entirely. However, a new brown roof will provide some source control for rainwater run-off.

4.0 Screening

The purpose of the screening stage of the BIA is to identify any matters of concern which should be investigated further through the BIA process. The screening process has been undertaken as outlined in the Camden Planning Guidance (CPG): Basements (January 2021) and the Camden Basement Impact Assessment pro-forma. The screening table have been used and are provided in Appendix B. They list the items identified as relevant to this proposal and therefore require further assessment in the BIA.

4.1 Non-Technical Summary of the Screening

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

- Impact of the proposed basement on groundwater flows
- Increasing the differential depth of foundations relative to the basements of the Montague Street properties.
- Potential for surface water flooding in the vicinity of the site.

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

5.0 Scoping

The purpose of the scoping stage of the BIA is to define further the potential impacts identified within the screening stage as requiring additional investigation. The scoping stage has been undertaken as outlined in CPG: Basements 2021.

5.1 Conceptual Ground model

To assist the scoping stage, a conceptual ground model has been produced using the following;

- Information obtained during the screening stage of the BIA
- Readily available published data
- Application of hydrogeological principles
- Previous investigations undertaken on the Museum site

This is as follows:

Site location	British Museum – East Road Building
Local geology	Made Ground over Lynch Hill Gravel over London Clay. Beneath the thick stratum of London Clay is the Thanet Sands. See drawing 1910/50/SK1 in Appendix A.
Local ground levels	The site is reasonably level at approx. 24.6m AOD
Local surface water or below-ground water features	There are no significant surface or below-ground water features nearby.
Local groundwater level	The London Clay is effectively impermeable, while the Lynch Hill gravel is a secondary aquifer. A water table is expected to be present within the gravel, as was identified by past investigations
Impact of neighbouring structures on groundwater flows	The foundations of neighbouring properties and the shallow single-storey basements of the Montague Street properties are not expected to extend below the water table
Depth of neighbouring foundations	The Georgian single-storey basements of the Montague Street properties are expected to have foundations approx. 3m bgl. The East Range of the Museum has 3m deep foundations, which have already been identified by investigations to date.

Using the above conceptual ground model, the potential issues identified during the screening stage are discussed further.

5.2 Hydrology

1a. Is the site located directly above an aquifer?	Yes	Secondary A aquifer (Lynch Hill Gravel Member) although it is noted that CPG:Basements 2021 classes all areas where the London Clay does not outcrop as aquifers.
1b. Will the proposed basement extend beneath the water table surface?	Yes	The level of the water table has been established during the desk study based on historical borehole logs from across the museum site. The basement box has been designed to avoid extending beneath the water table. However, the proposed secant piled wall will extend below the water table.

The proposed secant piled wall will extend below the water table, and the underlying geology is designated as a Secondary Aquifer. There is potential for the basement to locally impact groundwater flow.

However, the surrounding basements and foundations do not extend below the water table, so there will not be a cumulative impact. To confirm this, a site-specific ground investigation and a hydrological impact assessment are presented in section 6.

5.3 Slope stability

13. Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	Yes	The basement will increase the differential depth of foundations relative to the basements of the Montague Street properties and Grange Hotel Extension
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The proposed development will increase the differential foundation depth between the East Road Building and the basements of the Montague Street Properties and Grange Hotel Extension. Piling and excavation will cause ground movements that have the potential to damage these neighbouring properties.

However, with good construction practices and stiff temporary propping of the basement excavation, the impact can be limited to accepted levels. In order to demonstrate this, a site-specific ground investigation is presented in section 6, and a ground movement assessment is presented in section 7.

5.4 Flood Risk

6. Is the site in an area identified to have surface water flood risk according to either the Local Flood Risk Management Strategy or the Strategic Flood Risk Assessment or is it at risk from flooding, for example because the proposed basement is below the static water level of nearby surface water feature.	Yes	The location of the proposed development is identified in the Camden SFRA as having an elevated risk of surface water flooding.
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The location of the proposed development is identified in the Camden SFRA as having an elevated risk of surface water flooding. A flood risk assessment has been undertaken to assess this risk in more detail. This is presented in Section 6.

6.0 Further Investigations and Assessments

Further investigations and assessments have been conducted to explore the issues identified during the screening and scoping stages. Harrison Group has undertaken a site investigation to validate the record information regarding the geology and groundwater levels and confirm the foundation details of the neighbouring buildings. Harrison Group has also undertaken a hydrological impact assessment to consider the impact of the proposed basement on groundwater flows.

6.1 Site Investigation

Harrison Group carried out a site investigation on the proposed site in January 2023. Copies of Harrison Group's desk study, factual and interpretive reports can be found in Appendix F. In addition, three trial pits were carried out by Harrison Group in August and September 2022, and the trial pit findings are also included in Appendix F on drawings and within the factual site investigation report. In total, the site investigation included the following:

- 2 no. 15m deep boreholes with standpipes for groundwater monitoring
- Soil sampling and testing to determine geotechnical properties
- 8 no. trial pits to expose the foundations to loadbearing walls of the existing building and the neighbouring buildings
- A contamination appraisal

The site investigation recorded the following ground conditions:

- Made Ground – Disturbed material to approx. 1.9m below ground level, mainly consisting of gravelly clays.
- Gravelly clay – A thin band (~0.9m) extending to 2.8m below ground level.
- Lynch Hill Gravel – Medium to dense sand and gravel (~3.4m), extending to 6.2m below ground. A water table was found within the stratum, which aligns with historical records

from previous investigations. The water levels record are noted below and illustrated graphically in Appendix F.

- London Clay – A stiff grey clay with some bands of fine sand extending beyond the depth of the boreholes.

Following the investigations, the level of the water table continued to be monitored and was found to be:

Test Location	Water Level Below Ground Level (m)			
	15/01/2023 (Strike during drilling)	07/02/2023	22/02/2023	07/03/2023
BHA (24.58m AOD)	5.5m BGL (19.08 AOD)	3.61 BGL (20.97 AOD)	3.55 BGL (21.03 AOD)	3.62 BGL (20.96 AOD)
BHB (24.80m AOD)	5.4m BGL (19.40 AOD)	3.41 BGL (21.39 AOD)	3.45 BGL (21.37 AOD)	3.41 BGL (21.35 AOD)

The trial pits identified the depths and profiles of the foundations of the neighbouring structures. These comprised a mix of brick corbelled footings, concrete strips and pad foundations. The foundations of the existing East Road Building were approximately 1m shallower than the Montague Street Property basements, which are the deepest structures currently neighbouring the site. The proposed junctions between the existing ERB and the adjacent structures in these locations are illustrated in the site investigation report in Appendix F.

The contamination appraisal determined that heavy contamination is not likely because the site has not had any previous uses that may have led to contamination of the soil. However, there remains a risk of asbestos within the made ground. Therefore, further testing should be carried out before the basement excavation to inform the appropriate disposal of the spoil.

6.2 Hydrological Impact Assessment

An assessment was carried out by Harrison Group for the proposed site in February 2023 and updated in November 2023 and can be found in Appendix G. Ground water monitoring results can be found in Appendix F. They used the geological and hydrological information gathered during the site investigation, the record information from the desk study and the water monitoring findings to create a groundwater model for the site. They then used the information about the neighbouring buildings and basements and the proposals to assess how the basement will impact groundwater flow. The following conclusions were reached:

- The level of the water table is relatively consistent at 3.4m bgl and within the Lynch Hill Gravel
- The proposed basement is a detached single-storey structure of modest size, and groundwater is expected to flow around the basement with minimal effect.
- The neighbouring basements and foundations do not extend below the water table, so there will not be a cumulative impact on groundwater flows.
- The top of the London Clay and therefore the phreatic surface is relatively flat, so significant ground water flows are not likely.

- The development is not expected to result in any specific issues relating to hydrogeology and hydrology.

6.3 Flood Risk Assessment

As noted in Section 5.4, the location of the proposed development is identified in the Camden SFRA as having an elevated risk of surface water flooding. A Flood Risk Assessment (FRA) has therefore been undertaken to assess this risk in more detail. This has concluded that the risk is low and when the local surface levels and topography are considered in detail, surface water would actually drain to the west of the site toward the existing WCEC basement. On this basis, the proposed development has been determined to not have an elevated risk of surface water flooding. The Flood Risk Assessment is included separately.

7.0 Construction Methodology

The methodology stage of the BIA describes the basement's proposed construction and installation sequence. It assesses the predicted impact of the works on the surrounding structures and explains how this impact will be mitigated.

7.1 Updated Ground Model

The ground model from the scoping stage has been updated to reflect the findings from the site investigation and has been used to inform the design of the basement and its construction and assess its effects on the potential issues highlighted in the scoping stage.

Site location	British Museum – East Road Building
Local geology	Made Ground – Disturbed material to approx. 1.9m below ground level, mainly consisting of gravelly clays. Gravelly clay – A thin band (~0.9m) extending to 2.8m below ground level. Lynch Hill Gravel – Medium to dense sand and gravel (~3.4m), extending to 6.2m below ground. London Clay – A stiff grey clay with some bands of fine sand extending beyond the depth of the boreholes.
Local ground levels	The site is reasonably level with a ground level of approx. 24.6m AOD
Local surface water or below-ground water features	There are no significant surface or below-ground water features nearby.
Local groundwater level	The water table is within the Lynch Hill gravel, approx. 3.4m bgl.
Depth of neighbouring foundations	The Georgian single-storey basements of the Montague Street properties have foundations approx. 2.85 to 3.70m bgl. The East Range of the Museum has 3m deep foundations. The pad foundation to the Jade Gallery stanchion is founded 1m bgl.

7.2 Proposed Structural Design

The proposed ERB is generally a single-storey structure above ground with a local area extending to two stories. The building will also have a single-storey basement. The basement's footprint is slightly smaller than the ground floor structure, which cantilevers over the basement wall on the east and south sides. The basement is also set back from the north façade by approximately 5m.

The basement will accommodate water storage tanks that supply the Museum's sprinkler system. The ground floor will be mixed-use, accommodating electrical plant equipment, including transformers, switchboard rooms, and workshops. The mixed-use first floor will contain an electrical plant room for switchboards and a mess room.

The roofs will be flat and generally used only for maintenance access, apart from a local area at the first-floor level, which will support external LV generators within a louvred enclosure. The roofs will have a brown roof build-up and an array of PV cells.

7.3 Basement Design

The basement will be formed using a secant piled retaining wall with a reinforced concrete box structure inside the piles. The piles will be bored to reduce the noise and vibration generated, extending through the gravel layer into the London Clay. The basement box will be founded in the dense gravel layer. Currently, the recorded groundwater level is around the proposed basement formation level, although it may rise further in the future. Ongoing monitoring is being undertaken at the moment. Water in the ground can exert hydrostatic pressure on basement retaining walls and the ground-bearing slab. The piled retaining walls will be designed to resist a worst-case situation of the water level rising to within 0.5 metres of the ground level. The piles will be embedded into the impermeable clay to form a cut-off that restricts water flow beneath the basement. The piled wall will also assist in managing the rate of groundwater entering the excavations during construction. This approach should mean only minor local pumping will be necessary during construction rather than more significant dewatering techniques, which could impact the surrounding Grade I listed buildings.

The horizontal surcharge, soil and water pressures will be transferred through the piled walls, and the basement and ground floor slabs will act as permanent stiff props.

A reinforced concrete lining wall will be provided in front of the piled wall. The architect proposes a drained cavity wall as part of their waterproofing strategy for the basement, which will sit in front of the lining wall. Water collected in the drained cavity will be pumped up to East Road using a proprietary sump pump system to their details.

The columns from the superstructure will generally be supported on the perimeter piled wall on top of the capping beams. A line of internal columns within the basement will support the ground floor slab and superstructure. These columns will be supported on a central reinforced concrete strip foundation in the basement that bears onto the dense gravel.

The weight of the proposed building is slightly less than the weight of the soil that will be removed during the excavation. The London Clay will therefore experience a slight load reduction. However, because the excavation remains some way above the London Clay and the amount of unloading is small, heave pressures from the clay are not expected to be significant and will be accommodated by the ground-bearing slab without heave protection being required. A drainage layer will be provided beneath the basement slab, using no-fines concrete and perforated pipes connected to a sump pump. This arrangement will remove any small amounts of water seepage from beneath the basement slab and avoid large hydrostatic pressures building up beneath the substructure.

The basement is set back from the superstructure on the east and south sides to allow space for the piled wall to be installed. The ground floor slab will cantilever over the basement walls to support the superstructure above, helped by the widened capping beam in these areas.

We have designed the ground floor slab as two-way spanning, supported on the perimeter piled wall and internal columns. A new reinforced concrete vertical circulation core is provided at the north part of the building with a new platform lift and in-situ reinforced concrete staircase.

At the northern end of the building, the superstructure extends beyond the basement and will be supported on separate piles and pile caps. The ground floor slab in this area will span between the basement secant piled wall and the perimeter pile caps.

There will be two independent GRP sprinkler tanks within the basement with a combined storage capacity of approximately 230m³. Access zones around the perimeter of the tanks are included for maintenance. In addition, the construction of the tanks allows them to be removed in the future without compromising the basement structure.

Two service trenches with RC walls will bring services into the building below ground floor level to serve the transformers. These will form a bulkhead within the basement space and span between the piled wall and the internal columns.

7.4 Sequence of Construction

In our design, we have considered how we see the new basement and building being constructed, which is as follows:

- The existing ERB and two-storey contractor offices and bin store building will be demolished as part of an enabling works package to prepare the site for the new building.
- The Contractor will be required to mitigate noise, vibration and dust throughout the construction works to ensure they comply with the Council's and Museum's requirements. This will be achieved through screens, hoarding, careful traffic management, material movements and appropriate construction techniques. Where appropriate, non/percussive construction techniques will be considered.
- The Contractor will be required to manage dust from excavated materials by misting them with water and covering arisings throughout the works
- The noise and dust levels need to be monitored during the construction works. In addition, the Contractor needs to keep a dialogue with the Museum throughout the works to keep them updated with progress and status in line with requirements defined by a specialist.
- The party wall along the southern boundary of the hotel will be separated from the rest of the building, and temporary propping will be inserted to restrain the wall until the permanent works are in place. Monitoring of the wall will be carried out during the works.
- The existing ERB foundations will be grubbed out, and the ground level will be lowered by approximately 1.5m to match the level of the East Road on the three sides.
- The ground level will be battered back along the north and east boundaries. Along the south boundary, temporary support will be needed at the base of the party wall when levels are lowered. In addition, temporary protection of any exposed walls should be provided in line with the architect's requirements.
- At this stage, temporary propping will be installed beneath the gantry supporting the Jade Gallery before any piling works.

- A piling rig will be brought from Montague Place along East Road to the site. A piling mat will be needed to create a stable base for the rig. Existing services, particularly within the east road, will be decommissioned in line with the M&E engineer's strategy to create a safe working environment.
- Monitoring of the Museum buildings adjacent to the construction site will then be installed, and the elevations will be monitored for the duration of the basement construction in line with an agreed strategy and trigger levels.
- After this, the piling can commence for the perimeter basement walls.
- The capping beam will be cast to tie the tops of the piles, and a stiff propping arrangement will be inserted to prop the top of the walls before excavations start. The proposed basement construction will follow a 'bottom-up' approach, with stiff propping provided to restrain the piled walls during the basement excavations.
- Local groundwater pumping may be needed when the excavations reach the formation level but will be limited due to the cut-off created by the secant piled wall.
- At this stage, the formation level will be prepared by installing the below-ground drainage, drainage layer and concrete blinding and casting any sumps and manholes.
- The next step will be to fix the reinforcement and cast the basement slab with thickenings. Once the slab has been cast, the lining walls and internal columns can follow.
- After this, the ground floor slab can be formed, which provides the permanent top restraint to the capping beam, at which point the temporary propping can be removed.
- The superstructure can then proceed, constructing the r.c. walls and columns for the first-floor lift. On completion, the first-floor slab with upstands can be cast.
- The vertical structure and roof will follow over the area with a first floor.
- This completes the construction of the structural works, and the cladding and roofs can be installed.

7.5 Programme

The existing East Road Building will be demolished over a 3-month period between December 2023 and March 2024. Following this, the proposed building will be constructed over 16 months between March 2024 and July 2025.

Summary and detailed construction programmes are included in Appendix E.

7.6 Construction Management Plan

- The Contractor will be required to submit their own detailed Construction Management Plan and Site Waste Management Plan before work commences on site. The contents of this plan will be in accordance with The London Borough of Camden's guidance and be agreed upon by them.
- The Contractor will be required to demonstrate due diligence and commitment toward minimising environmental disturbance to local residents and will be required to complete the work in accordance with the Considerate Constructors Scheme standards.

- Noise, dust and vibration will be controlled by employing best practices as prescribed in legislation such as; The Control of Pollution Act, 1972; The Health & Safety at Work Act, 1974; The Environmental Protection Act, 1990; Construction Design and Management Regulations, 1994 and The Clean Air Act, 1993. In addition, noise, vibration and dust monitoring are also to be implemented.
- The Contractor will need to produce a Traffic Management Plan. This should consider vehicle movements and their impact on other road users, pedestrians, residents and the environment. Mitigation measures should be implemented where necessary.
- The Contractor will erect site hoarding to define the boundaries of the site. However, as the site is within the larger Museum Estate, the impact on the public will be limited.
- Working hours are to be restricted as required by the London Borough of Camden and the Museum.
- Vehicles should be washed and cleaned before leaving the site and not be left idling.
- Measures should be adopted to prevent site runoff of water or mud.
- Water is to be used as a dust suppressant.
- Skips should be covered.
- All temporary works are to be designed by a qualified Temporary Works Coordinator.
- Movements of surrounding buildings should be monitored throughout construction, the results reviewed, and action taken to mitigate excessive movements. The appointed Contractor will confirm the detailed proposals for monitoring as part of their detailed Construction Management Plan.

7.7 Ground Movements and Structural Damage

A ground movement assessment has been carried out by Geotechnical Consulting Group (GCG) in accordance with CIRIA C760, and the impact of ground movements on nearby structures has been assessed in accordance with the Burland Categories of damage – see Appendix H.

The damage categories for the neighbouring buildings are summarised below:

- **Museum East Wing:** The building falls into Burland Category 0 (Negligible). No mitigation measures are required.
- **Montague Street Properties:** The assessed damage falls into Burland Category 1 (very slight), within the acceptable limits set out by CPG: Basements January 2021. Mitigation measures are described in section 7.8.
- **Grange Hotel Extension:** The assessed damage generally falls into Burland Category 1 (very slight), within the acceptable limits set out by CPG: Basements January 2021. Mitigation measures are described in section 7.8. The assessed damage for one modern wall falls into Damage Category 2. While this exceeds the generally acceptable limits set out by CPG: Basements January 2021, a detailed justification and mitigation for this is set out within the GMA.
- **Jade Gallery:** A steel framed structure that doesn't feature any masonry, the Burland Categories are not strictly applicable to the Jade Gallery. However, the ground movement assessment concluded that the potential movements will be relatively small and GCG expect the impact on the Jade Gallery to be very slight to negligible and therefore in line with the level of impact on the other surrounding buildings which is acceptable.

Other surrounding buildings have not been assessed, as they are sufficiently far from the proposed basement for the damage to be negligible.

An assessment of the impact on existing buried services within the East Road has also been undertaken. This has shown that the impact on these services is within normal acceptable limits.

7.8 Mitigation Measures

The following mitigation measures will be implemented to control ground movement.

- In the permanent case, the structural proposals have been designed to provide stiff supports to the basement retaining walls. The stiff reinforced concrete retaining walls and secant piled wall will be propped during construction, limiting ground movement during construction and in the permanent case.
- High-stiffness propping at frequent intervals to the piled retaining walls will be provided during construction. This will constrain the contractor slightly during the construction stage, but will reduce movements caused by the excavation behind the retaining wall and the effect of the basement construction on neighbouring properties.
- During the basement construction, the Contractor will be required to undertake monitoring of the groundwater levels to ensure that the assumptions and findings from the BIA remain valid.
- Movements of surrounding buildings will be monitored throughout construction, the results reviewed, and action taken to mitigate excessive movements. The appointed Contractor will confirm the detailed proposals for monitoring as part of their detailed Construction Management Plan.

- Unloading of the soil during the basement excavation is expected to produce some heave as the London Clay below the Lynch Hill gravel expands. This has been considered as part of our design, and the basement slab has been designed to take account of upwards ground heave forces. Below-ground drainage will be encased in concrete.
- The piled retaining wall has been set back from the building line above on the east and south elevations

In summary, with careful sequencing and temporary propping, as shown on the assumed sequence of construction drawings, movements will be very small and will not result in structural damage to the adjacent properties.

8.0 Basement Impact Assessment

Attribute	Existing Condition or Requirement	Proposed
Groundwater levels and flows	Water table within the Lynch Hill Gravel at 3.4m bgl	No expected significant changes from baseline values.
Differential depth to neighbouring foundations	Approx. 1m differential depth between existing East Road Building foundations and neighbouring basements	Differential depth will increase to approx. 2m with the new basement lower than the neighbouring basements. Ground movements have been assessed, and mitigation measures have been proposed.
Structural integrity of surrounding structures	Burland Category 1 or lower	Impact on surrounding structures assessed as Burland Category 1 or lower, except for one modern wall which has been conservatively assessed as Burland Category 2. A justification for this is included within the GMA.
Contamination	Some risk of asbestos within the ground from general historical construction and demolition	Further testing is to be carried out, and material disposed of appropriately
Trees	No trees have been identified as being adversely affected by the proposals	No change from the existing arrangement

8.1 Hydrology and Groundwater

The impact on the flow of water above and below ground has been assessed, and the conclusions are:

- There is a low risk of flooding
- There will be no significant change to the extent of impermeable surfaces

- There will be no change to the amount of surface water discharged into the ground
- The proposed basement will not significantly affect the flow of groundwater

8.2 Flood Risk

A Flood Risk Assessment has been undertaken, which has concluded that the proposed development is not at an elevated risk of flooding from surface water or other sources.

8.3 Neighbouring Structures

- The proposed basement will be founded in the Lynch Hill Gravel, which itself will not generate significant heave pressures.
- The depth of the London Clay is not directly below the basement, and the weight of the proposed building is similar to the weight of the soil removed, meaning heave from unloading of the clay will be limited.
- The proposed basement will increase the differential depth to the neighbouring structures, but the resulting ground movements have been predicted, and measures to mitigate the movements have been proposed.
- The impact of the movements on the neighbouring structures has been assessed and found to be acceptable.

8.4 Trees

- Trees are not proposed to be removed
- The proposed basement will not impact nearby trees

8.5 Non-Technical Summary of the Impact Assessment

A basement impact assessment, as required for planning by the London Borough of Camden, has been undertaken by Alan Baxter Ltd, Harrison Group and GCG for the proposed basement for the new East Road Building on the British Museum site.

The engineering rationale and construction issues associated with the proposed construction of the new basement have been explored and summarised in this report. A structural scheme design has been prepared along with a construction sequence to demonstrate that the proposals can be built safely without detrimental impact on the local groundwater regime, surface water regime, adjacent structures or slope stability. In addition, the risk of surface water flooding is low.

The structural proposals and construction methodology for the proposed basement have been developed with regard to the existing site constraints and site-specific ground conditions. The structure has been designed to maintain the stability and integrity of the surrounding land and existing structures. Anticipated ground movements have been shown not to cause structural damage to the existing buildings, and ground movements are limited to acceptable values by a combination of the structural design, suitably designed temporary works and good workmanship.

Appendix A

Desk Study References

Appendix B

Screening Tables

Appendix C

Proposed Development Drawings

Appendix D

Assumed Sequence of Construction

Appendix E

Construction Programme

Appendix F

Site Investigations

Appendix G

Hydrological Impact Assessment

Appendix H

Ground Movement & Damage Impact Assessment

Appendix I

Arboricultural Report

Appendix J

Structural Engineering Calculations

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