

6. STAGE 4 – BASEMENT IMPACT ASSESSMENT

6.1 Subterranean (Groundwater) Flow

Based on the ground investigation data and the development plans provided, the proposed development and underpins will be formed within the Kempton Park Gravel Member. It is assumed that the basement will be above groundwater level. As the basement is not keyed into the underlying London Clay Formation it is considered that groundwater flow (if present) is not impeded.

It is considered that the proposed basement extension will have negligible impact on groundwater flows and levels in the vicinity of the site.

6.2 Slope Stability

Impacts on slope stability are assessed as part of the ground movement assessment in Section 7 of this report below.

6.3 Surface Flow and Flooding

It is anticipated that surface water runoff will be diverted to existing drainage infrastructure, with negligible changes in peak drainage outflows anticipated from the site. The site is not located within a zone at risk from flooding by rivers or within a surface water flood risk hotspot area, as defined by Westminster, SPD¹. The immediate vicinity of the site is associated with a risk of surface water flooding however, it is considered that the risk this poses to the site can be mitigated through appropriate drainage design.

The development is likely to provide enhanced attenuation given its requirement to be drained in accordance with Building Regulations. Based on the above, it is considered that the development will not affect surface water flow and flooding.







7. GROUND MOVEMENT ASSESSMENT

7.1 Introduction

A Ground Movement Assessment (GMA) has been undertaken to predict the ground movements that may be generated from the proposed development, and to assess the impact these movements may have on the neighbouring properties to the north, the road to the south, and the party walls to the east and west, in accordance with relevant guidance. The GMA considers the ground conditions, construction methodology and existing structure present at the site.

7.2 Construction Sequence


The construction sequence has been interpreted from the Structural Engineer's marked up proposed development plans, included as Appendix C. The anticipated construction sequence is presented below:

-  Excavation along northern and southern boundary and casting of underpins which are assumed to be 0.6m wide;
-  Excavation of basement down to approximately 3.3mbgl;
-  Construction of two new steel columns and their foundations at approx. 3.3mbgl. Foundations are assumed to be built into the raft slab with local thickenings if required;
-  Construction of the 0.3m thick raft slab at approx. 3.3mbgl.
-  Application of net loading along existing party wall's underpins with 16 and 18 Eaton Mews North; and
-  Application of drained 'long term' conditions.

7.1 Sources of ground movement

The ground movement assessment section of this BIA considers ground conditions, construction methodology and existing structures/infrastructure present on and close to the site.

Possible ground movement mechanisms are outlined below:

-  Heave movement: The London Clay is susceptible to short term and time dependant swelling after unloading, which will occur as a result of demolition of the existing building, and

- reduction in site levels to incorporate floor slabs and the basement excavation, creating upward ground movement.
- Settlement of underpins: Some settlement of underpins following construction is anticipated, however this can be limited by following good construction practice. It is noted that no party wall structures are to underpinned as part of the proposed development.
 - Long term ground movements: The net loading on formation soils will generate ground movement, which could affect adjacent foundations. This takes into account existing stress conditions, unloading due to demolition of the existing building, additional loads from the new structure, installation movements of the underpins and the weight of soil removed.

7.2 Ground Movement Assessment Methodology

The magnitude of vertical ground movements has been calculated using OASYS Limited *PDISP* (Pressure Induced *DIS*placement) analysis software.

The total movement predicted from the proposed works has been estimated considering the following elements:

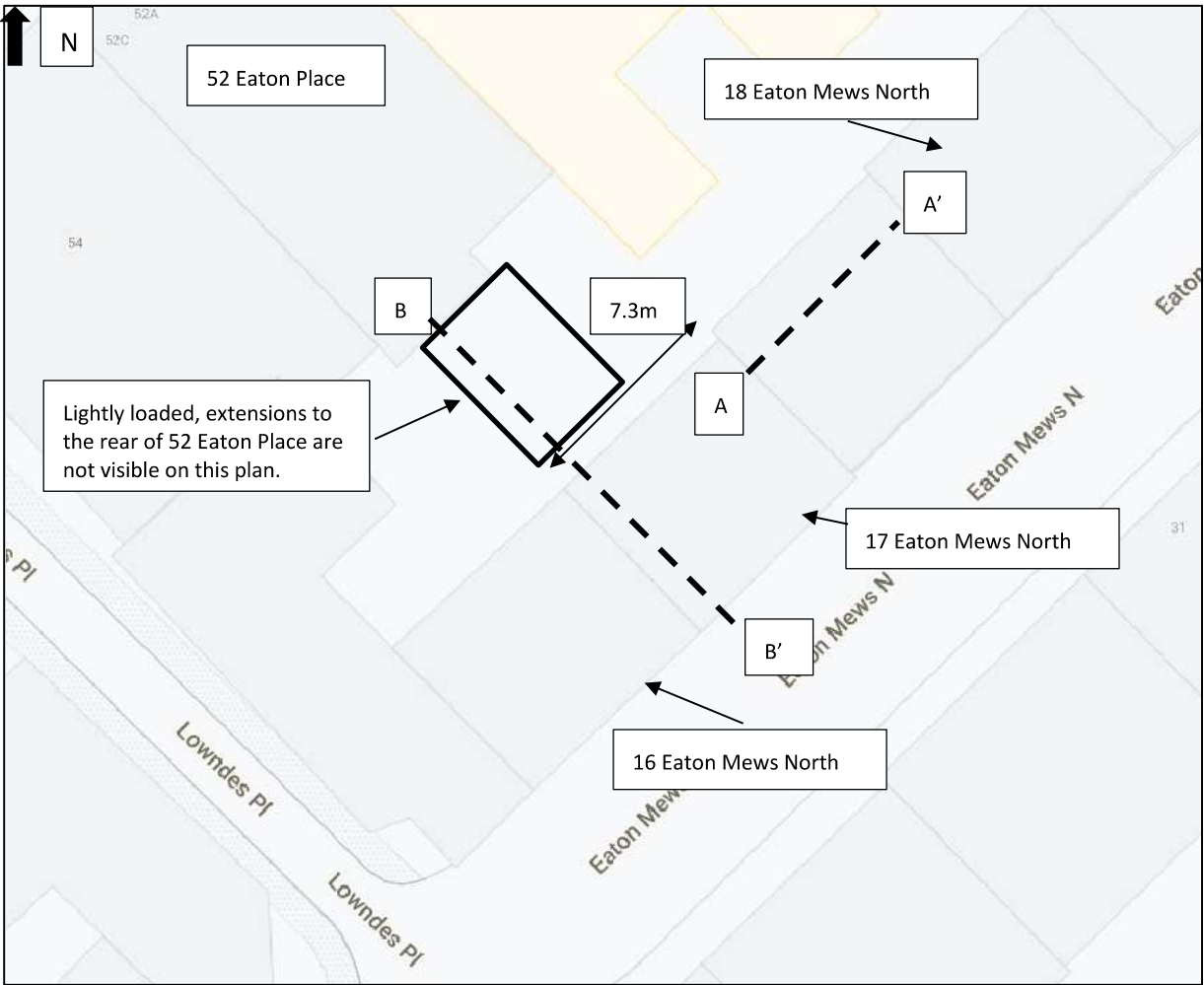
- Drained conditions will be adopted due to the presence of granular deposits around and beneath the basement;
- Application of net increased loading along the existing party walls with 16 and 18 Eaton Mews North;
- Application of net increased loading along front and rear wall associated with new underpins;
- Application of unloading across footprint of the basement associated with removal of soils; and
- Application of net total loads across location of proposed columns

7.3 Conceptual Site Model and Critical Sections

A conceptual site model (CSM) of the proposed site conditions has been developed based on the available data to illustrate the conceptual understanding of the ground and is presented in Figure 2.

Two critical section lines have been identified, the first, A-A' is taken across 18 Eaton Mews North, whilst the section, B-B', is taken through the small extensions to the rear of 52 Eaton Place and the road along Eaton Mews North. Critical section A-A' is shown on shown in Figure 2 and Plate 7, whilst critical section B-B' is shown on Figure X and Plate 7, below.

Plate 7. Critical Section Plan



The neighbouring properties of 16 and 18 Eaton Mews north appear to be of a consistent width as 17 Eaton Mews North (7.3m). CGL has therefore adopted a width of 7.3m for the neighbouring properties.

7.3.1 Excavation / Demolition Unloading

Construction of the basement and basement slab will result in the excavation of approximately 3.3m of soil. Assuming a bulk unit weight of soil of 20kN/m³, it is calculated that approximately 66kPa of soil will be removed from across the footprint of the basement, excluding the existing underpins along the party walls shared with 16 and 18 Eaton Mews North and the new underpins the north and south.

7.3.2 Structural loading

7.3.2.1 Underpin loading

The loads provided by the Structural Engineer have been converted to pressures and summarised in Table 6, below. For the purpose of the assessment, it has been assumed that both the existing and proposed underpins at the site measure 0.6m wide.

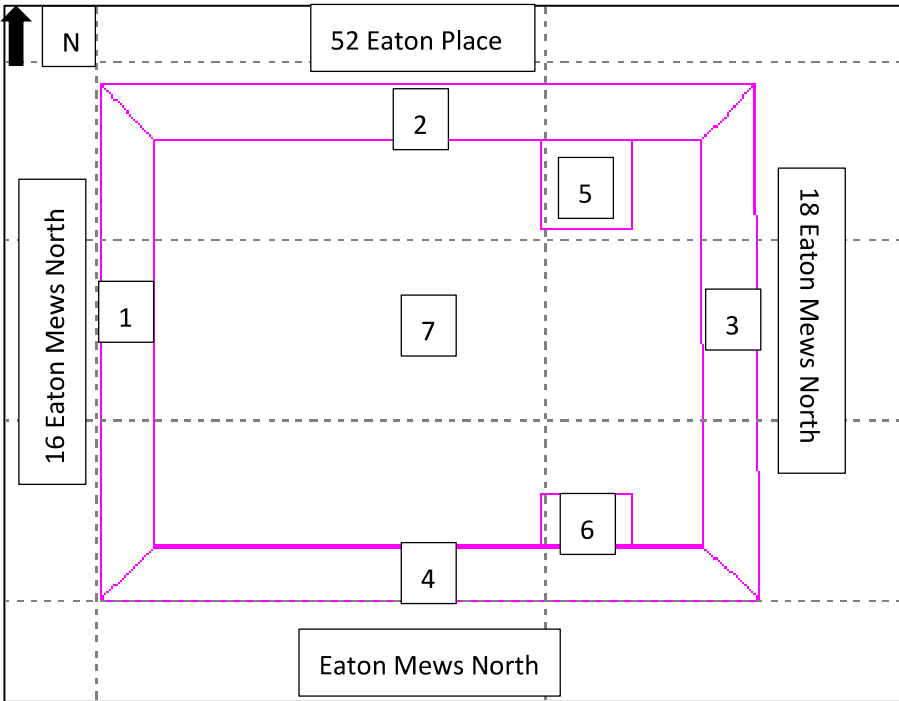
Table 6. Summary of loaded areas

ID	Loaded area	Load applied (kPa)	Load removed (kPa)	Net load change (kPa)
1	Underpin West (existing)**	67	0	67
2	Underpin North (proposed)***	133	0	133
3	Underpin East (existing)**	42	0	42
4	Underpin South (proposed)***	133	0	133
5	Column North	100 (assuming 1 x 1m foundation)	-66 (removal of 3.3m of soil)	34
6	Column South	100 (assuming 1 x 1m foundation)	-66 (removal of 3.3m of soil)	34
7	Excavation area ex. underpin and column	7.5 (self weight of raft)	-66 (removal of 3.3m of soil)	-58.5

*+ve values indicate load increase, -ve values indicate load removal.
**Where loads are applied on existing underpins these loads at net values.
***Where loads are applied to proposed underpins these are total values.

The loading layout analysed within PDISP is presented as Plate 8.

Plate 8. Loaded zones across proposed basement



7.3.2.2 Total Bearing Stress Check

The new underpins will result in loading of the Kempton Park Gravels, beneath the site. The new proposed load has been taken as 133kPa, assuming a 0.6m wide underpin. The allowable bearing capacity of the gravels across the formation of the underpin has been calculated at 136kPa (FOS of 3), assuming an embedment of 0.3m, to reflect the thickness of the proposed raft slab thickness. The calculated allowable bearing capacity assumes that groundwater is not identified at formation level. The newly applied load will not exceed the allowable bearing capacity of the formation soils.

7.3.3 PDISP Analysis Results

The total predicted vertical ground movements due to the basement construction, including movements occurring in both the short (undrained) and long term, are summarised in Table 7. The PDISP analysis output summary is provided in Appendix D.

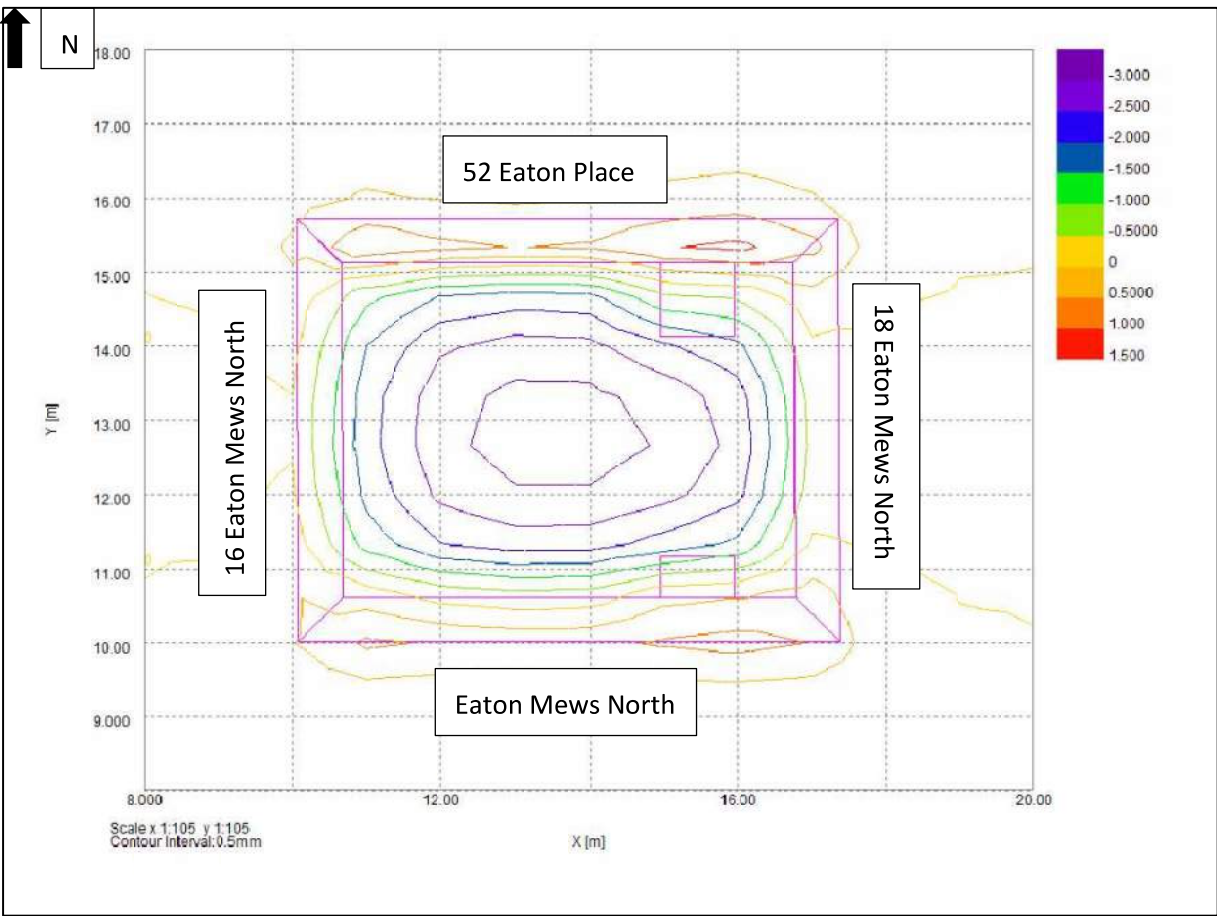
Table 7. Predicted Vertical Movement Summary

Stage	Max heave within basement footprint (mm)	Max settlement within basement footprint (mm)	Max vertical movement at No. 16 Eaton Mews North (mm)	Max vertical movement at No. 18 Eaton Mews North (mm)
Total movement	-3.0	1.5	0.3	-0.1

*-ve value indicates heave.

The predicted values are also presented on Plate 9, below.

Plate 9. Drained 'total' movements at 17 Eaton Mews North



*-ve values indicate heave.

8. DAMAGE IMPACT ASSESSMENT

8.1 Introduction

The ground movements for each of the identified potential impacts to the identified structures/assets are discussed separately below, based on cumulative movements for demolition, short and long term movement due to excavation, and underpin installation.

The calculated ground movements have been used to assess the potential ‘damage categories’ that may apply to the neighbouring properties due to the proposed development. The methodology proposed by Burland and Wroth⁹ and later supplemented by the work of Boscardin and Cording¹⁰ has been used, as described in CIRIA Special Publication 200 and CIRIA 760. General damage categories are summarised below in Table 8.

Table 8. Classification of damage visible to walls (reproduced from Table 2.5, CIRIA C760)

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

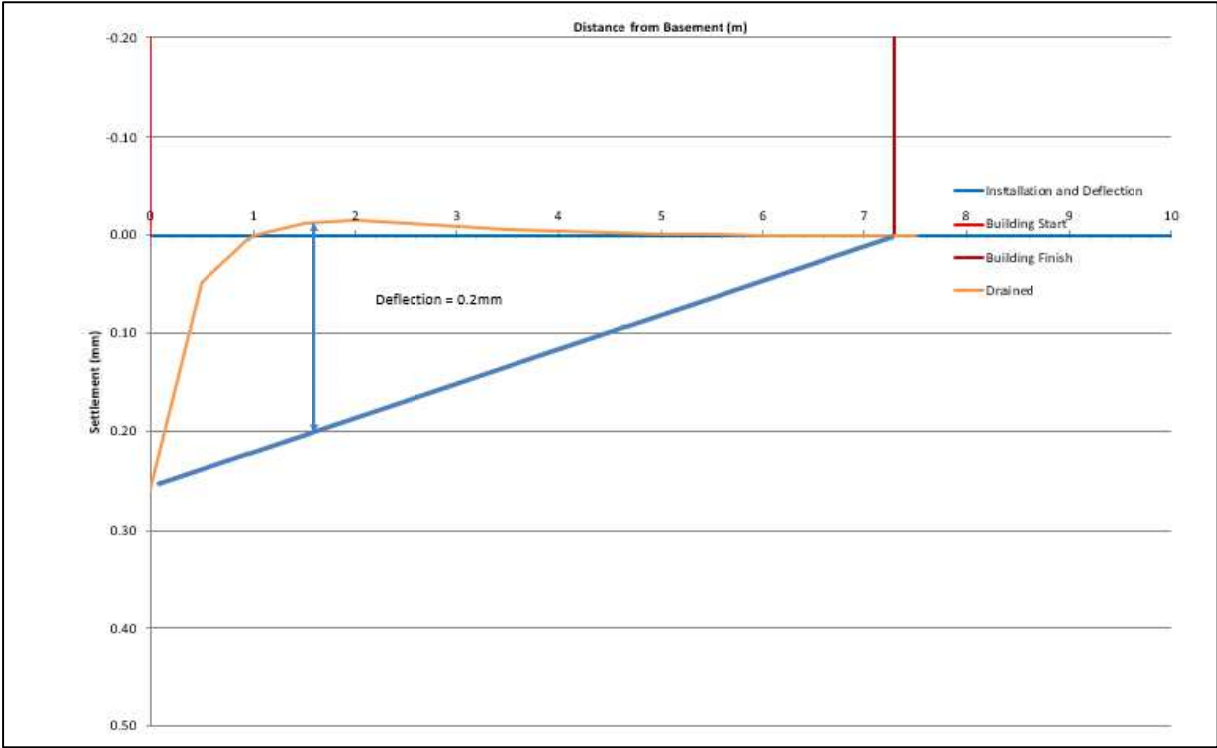
8.2 18 Eaton Mews North

The impact assessment for the foundations at 18 Eaton Mews North has been undertaken for section line A-A’, shown on the site layout plan in Figure 2.

The greatest vertical ground movement, as a result of the proposed loadings, occurs across 18 Eaton Mews. It is predicted that approximately 0.3mm of settlement will occur immediately beneath the existing underpins, reducing to approximately 0mm across the width of 18 Eaton Mews at the far eastern wedge of the property. Lateral movements are expected to be negligible as the party walls are already underpinned. The resulting deflection is calculated to be 0.2mm.

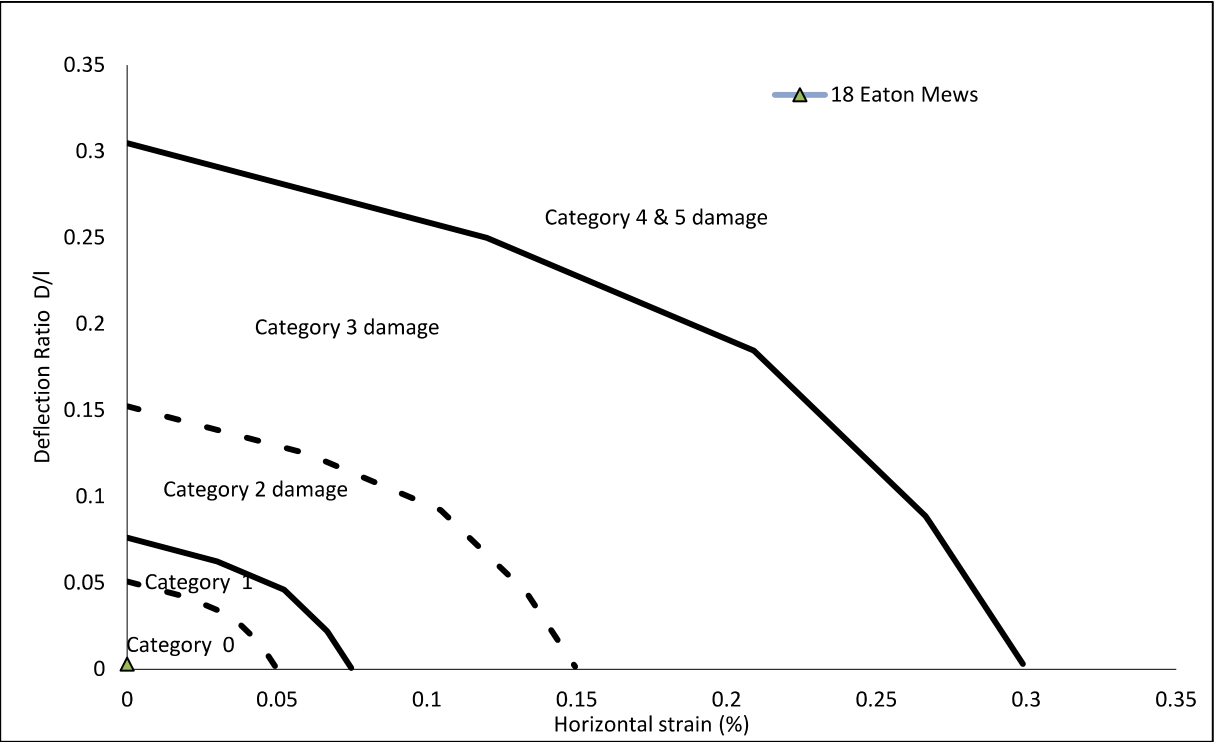
⁹ Burland, J.B., and Wroth, C.P., (1974). *Settlement of buildings and associated damage*, Stage of the art review. Conference on Settlement of Structures, Cambridge, Pentrech, London, pp 611-654.
¹⁰ Boscardin, M.D., and Cording, E.G., (1989). *Building response to excavated induced settlement*. J. Geotech Eng, ASCE, 115(1), pp 1-21.

Plate 10. Cumulative vertical movements at 18 Eaton Mews North



Damage Categories are expected to not exceed Category 0 ‘negligible’ damage, as shown in Plate 11. Horizontal strains should be restricted to 0.05% to remain with Category 0.

Plate 11. Building damage assessment – 18 Eaton Mews



8.3 16 Eaton Mews North

The anticipated movements at 16 Eaton Mews (0.15mm of heave) are lower than predicted movements at 18 Eaton Mews (0.3mm of settlement), as a result the predicted damage impact is as per that predicted for 18 Eaton Mews North.

8.4 52 Eaton Place

Assuming that the contractor demonstrates good workmanship during construction of the underpins (<5mm of settlement) it is predicted that there is negligible risk to 52 Eaton Place due to its distance from basement.

8.5 Eaton Mews North Road

It is estimated that approximately 1.5mm of settlement will occur along the new underpins. In addition to this an allowance for a further 5mm of settlement, for construction of the underpins, should be made.

The magnitude of ground movements predicted are not considered to pose a significant risk to the pavements or road of Eaton Mews North road, nor the services within these pavements.

8.6 17 Eaton Mews North – site movements

It is estimated that approximately 1.5mm of settlement will occur along the new underpins. In addition to this an allowance for a further 5mm of settlement, for construction of the underpins, should be made. The total predicted settlement across the areas of new underpins is predicted to be approximately 6.5mm. It is considered that there is a risk to property, specifically the small extension attached to the rear of the property, associated with the calculated ground movements. It is predicted that the extension may experience minor cracking (indicative of Category 1) which can be addressed through redecoration.

Additionally, there is a potential risk of differential settlement along the new underpins which may cause damage of the building's façade. However, with good underpinning workmanship/ practice it is likely that the damage would be restricted to Category 1, occurring on the façade of the property being underpinned (17 Eaton Mews North).

9. CONTROL OF CONSTRUCTION WORKS (MONITORING STRATEGY)

The results of the ground movement analysis suggest the Damage Category to the neighbouring properties can be controlled to within Damage Category '0'. It is anticipated that Category '1' damage could be experienced at 17 Eton Mews, specifically the rear extension. However, this can be remediated through redecoration. Damage to the façade of 17 Eaton Mew North may occur however, it is considered that this can be restricted to Category 1 with good underpinning workmanship/ practice.

To manage this during the works it is recommended that a monitoring strategy be put in place to observe and control ground movements during construction.

The monitoring strategy should be in broad accordance with the 'Observational Method' defined in CIRIA Report R185. Monitoring can be undertaken by installing survey targets to the top of the basement wall and face of the adjacent buildings. Prior to construction baseline readings should be established. Once construction commences regular readings should be taken and analysed to determine whether unacceptable horizontal movement, vertical movement or tilting has occurred.

Mitigation strategies should be prepared prior to construction and implemented if unacceptable movements occur.

Monitoring data should be checked against predefined trigger limits and reviewed regularly to assess and manage the damage category of the adjacent buildings as construction progresses.

It is recommended that a condition survey is undertaken on all adjacent walls and property facades prior to works commencing and ideally when monitoring baselines are established. Existing cracks or structural defects should be carefully recorded, documented and regularly inspected as construction progresses.



10. CONCLUSIONS

10.1 Subterranean (Groundwater) Flow – Conclusion

Local historical investigation data indicates that the groundwater is likely to be at significant depth beneath the proposed basement. Therefore, the risk to groundwater and impact on groundwater flooding caused by proposed basement are considered to be negligible.

10.2 Slope Stability – Conclusion

Local site investigation has indicated that the basement will be founded within the Kempton Park Gravel Member, which will provide favourable conditions for shallow foundations.

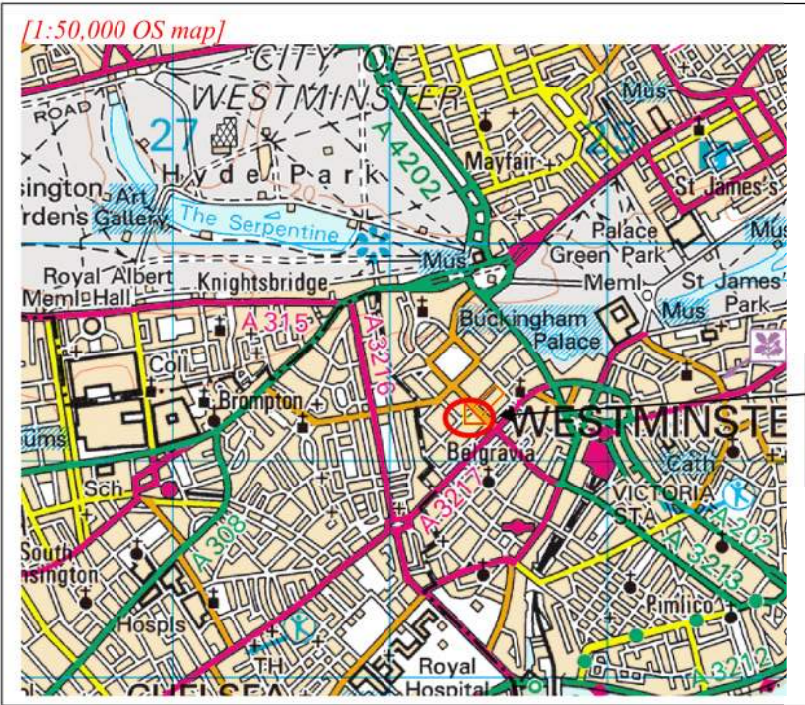
The potential Damage Impact to surrounding structures within the zone of influence has been assessed as Category ‘0’ in accordance with the Burland Scale. It is predicted that 17 Eaton Mews, specifically the rear extension, may experience minor damage up to Category ‘1’, which can be remediated through redecoration.

It is recommended that prior to construction commencing, a condition survey is conducted and an observation strategy be put in place. Once construction begins the movement of the walls and the facades of the neighbouring properties should be regularly monitored.

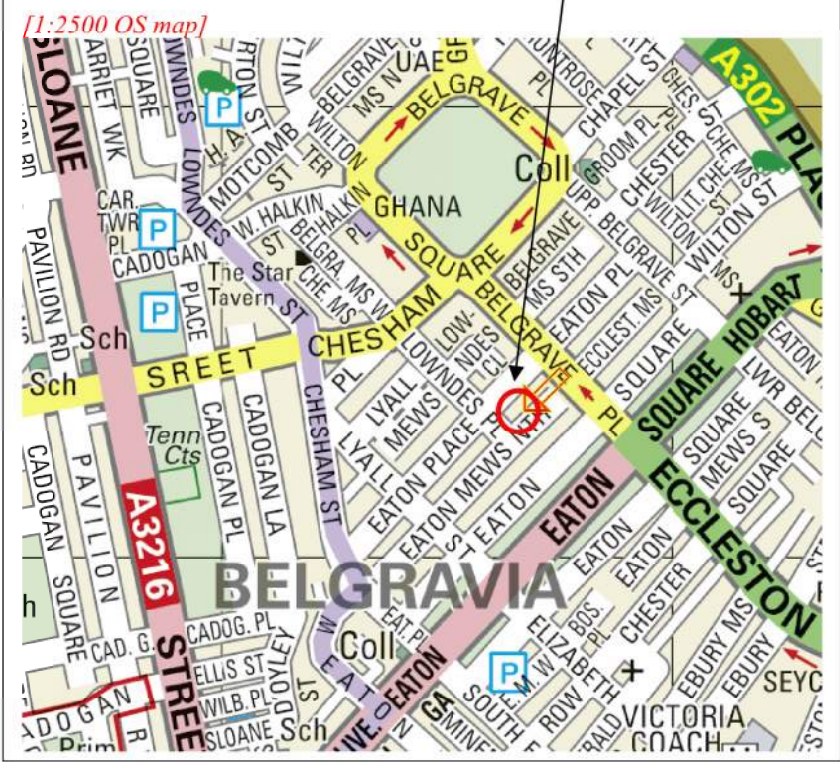
10.3 Surface Flow and Flooding – Conclusion

The site is not located within a surface water flood risk hotspot¹ however, the local area is typically associated with low to medium flood risk from surface waters. It is considered that the site-specific risk can be mitigated through appropriate drainage design as part of the proposed works.


FIGURES



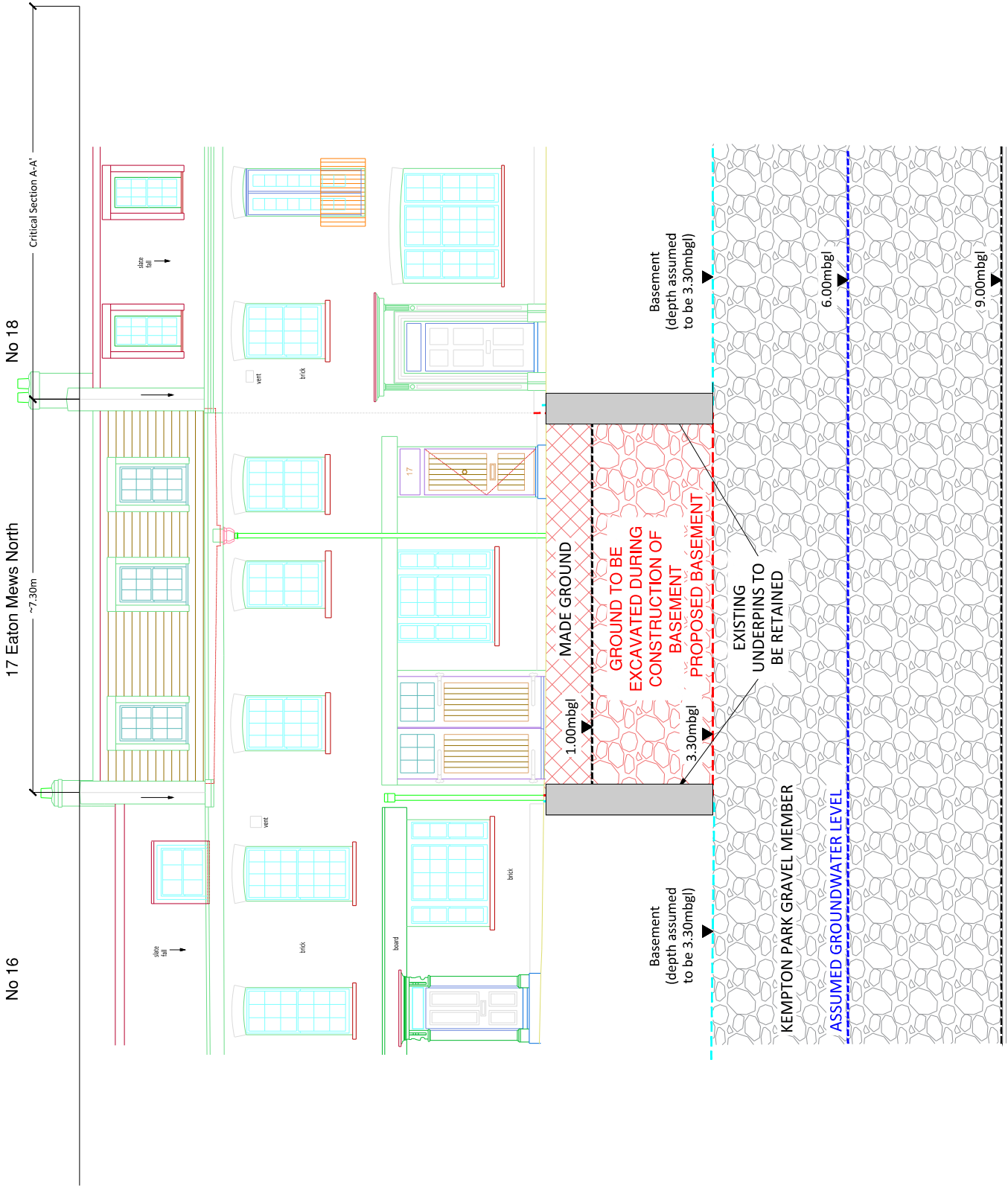
Approximate
location of the Site




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Client	Project	Job No
Mr James Busta	17 Eaton Mews North, London	CG/38829
	Title	Figure 1
	Site Location Plan	

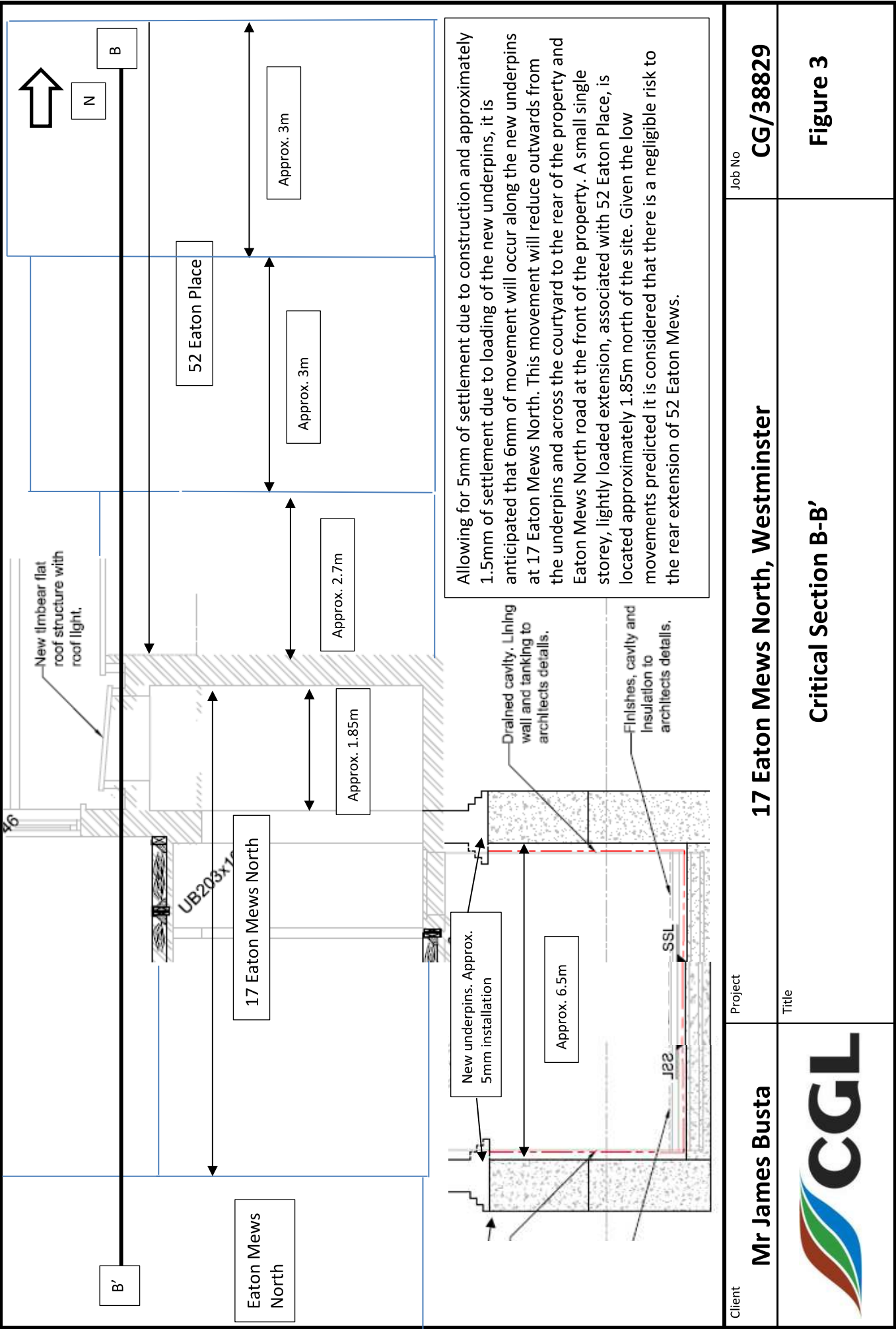
KEY



- Notes:
- Do not scale from this drawing
 - Section taken from M1H Land & Building Surveyors 'Front and Rear Elevations' drawing 0345-04 (October 2020).

Rev	Date	Comments
0	07/05/2021	
		
Card Geotechnics Ltd 4 Godwin Business Centre Woolack Way Godalming GU7 1XW T: 01483 310600		
Project		
17 Eaton Mews North, London		
Client		
Mr James Busta		
Drawing title		
Figure 2 - Site Layout & Conceptual Site Model		
Scale(s)		
NTS		
Job No.		
CG/38829		
Drawn	1:50	07/05/2021
Checked	1:50	07/05/2021
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LONDON CLAY FORMATION



APPENDIX A

Proposed Development Plan