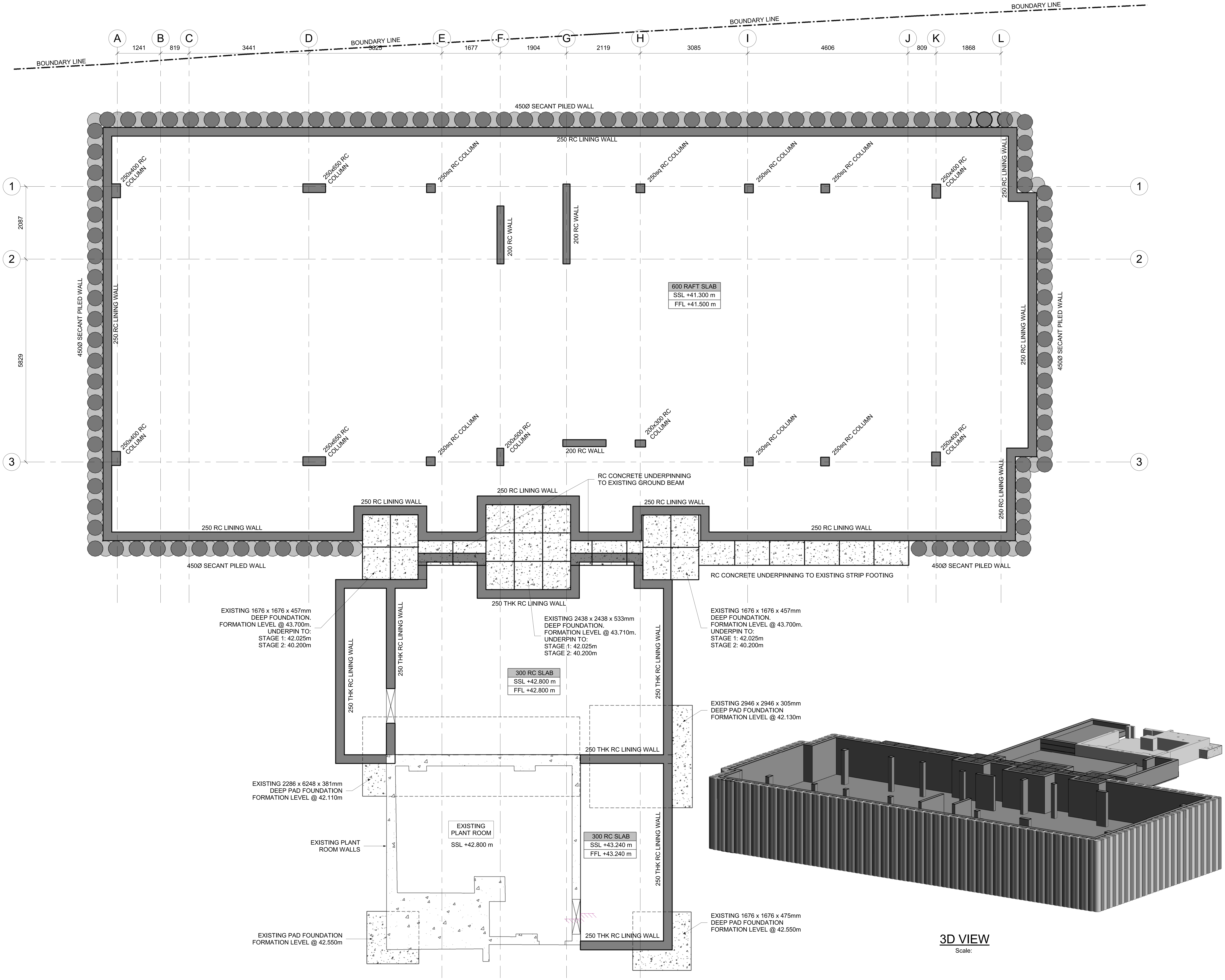

3D VIEW

Scale:

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REV	DATE	DESCRIPTION	BY
P01	01.02.18	PRELIMINARY ISSUE.	S.E.

Project:
BARRIE HOUSE

Title:
GENERAL ARRANGEMENT LOWER GROUND FLOOR

Client:
KALEMINSTER Ltd.

Architect:
MWA

INFORMATION

Designed: AM | Drawn: AJE
Checked: BP | Date: JAN '18
Project No: 1805 | Scale @ A1: 1 : 50

Drawing No:
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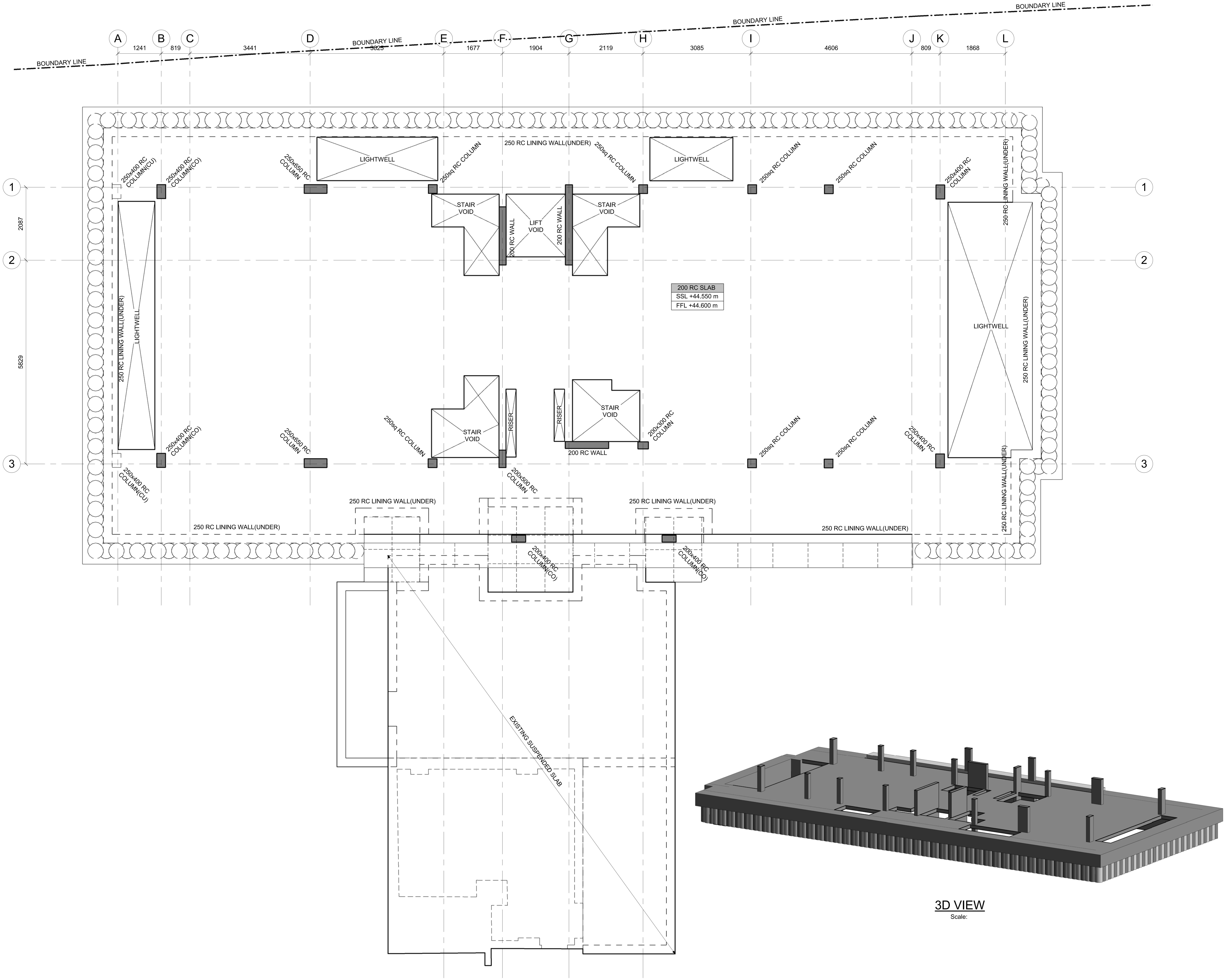

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P01	01.02.18	PRELIMINARY ISSUE.	S.E.
REV	DATE	DESCRIPTION	BY

Project:

BARRIE HOUSE

Title:

GENERAL ARRANGEMENT GROUND FLOOR

Client:

KALEMINSTER Ltd.

Architect:

MWA

INFORMATION

Designed: AM
Drawn: AJE
Checked: BP
Date: JAN '18
Project No: 1805
Scale @ A1: 1 : 50

Drawing No:

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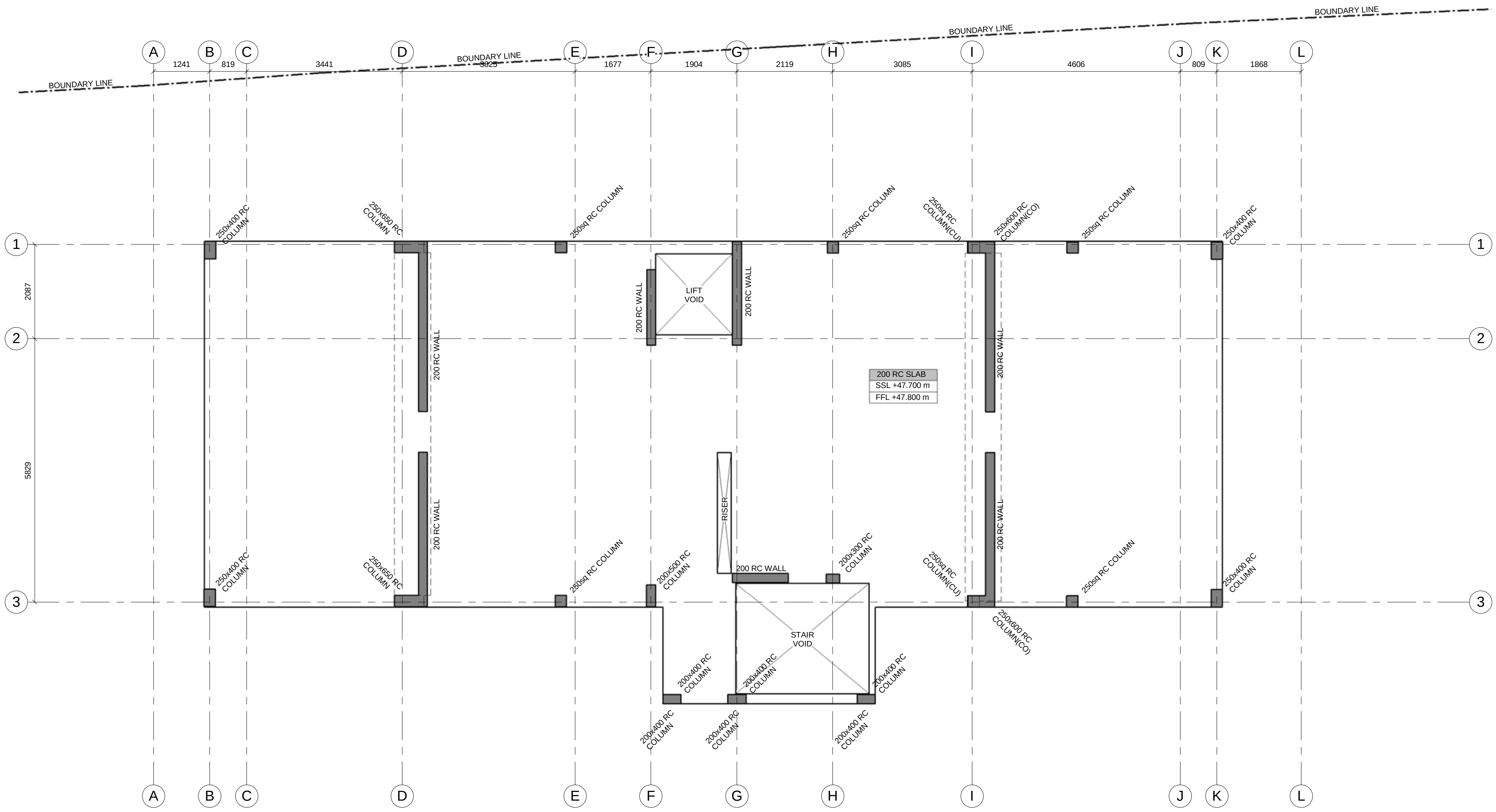

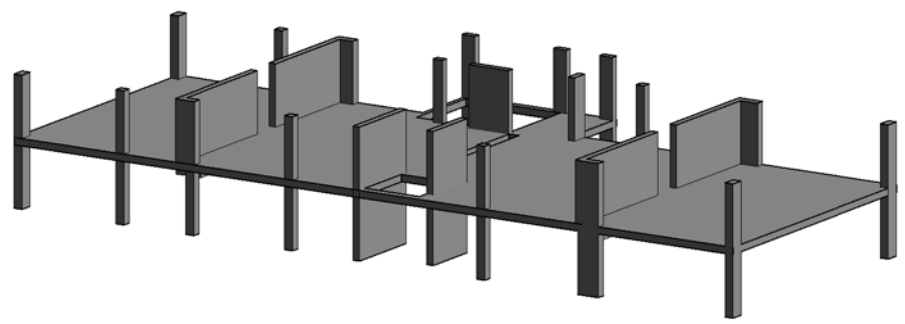

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REV	DATE	DESCRIPTION	BY

Project:
BARRIE HOUSE

Title:
GENERAL ARRANGEMENT
FIRST FLOOR

Client:
KALEMINSTER Ltd.

Architect:
MWA

INFORMATION

Designed:	AM	Drawn:	AJE
Checked:	BP	Date:	JAN '18
Project No:	1805	Scale @ A1:	1 : 50

Drawing No:
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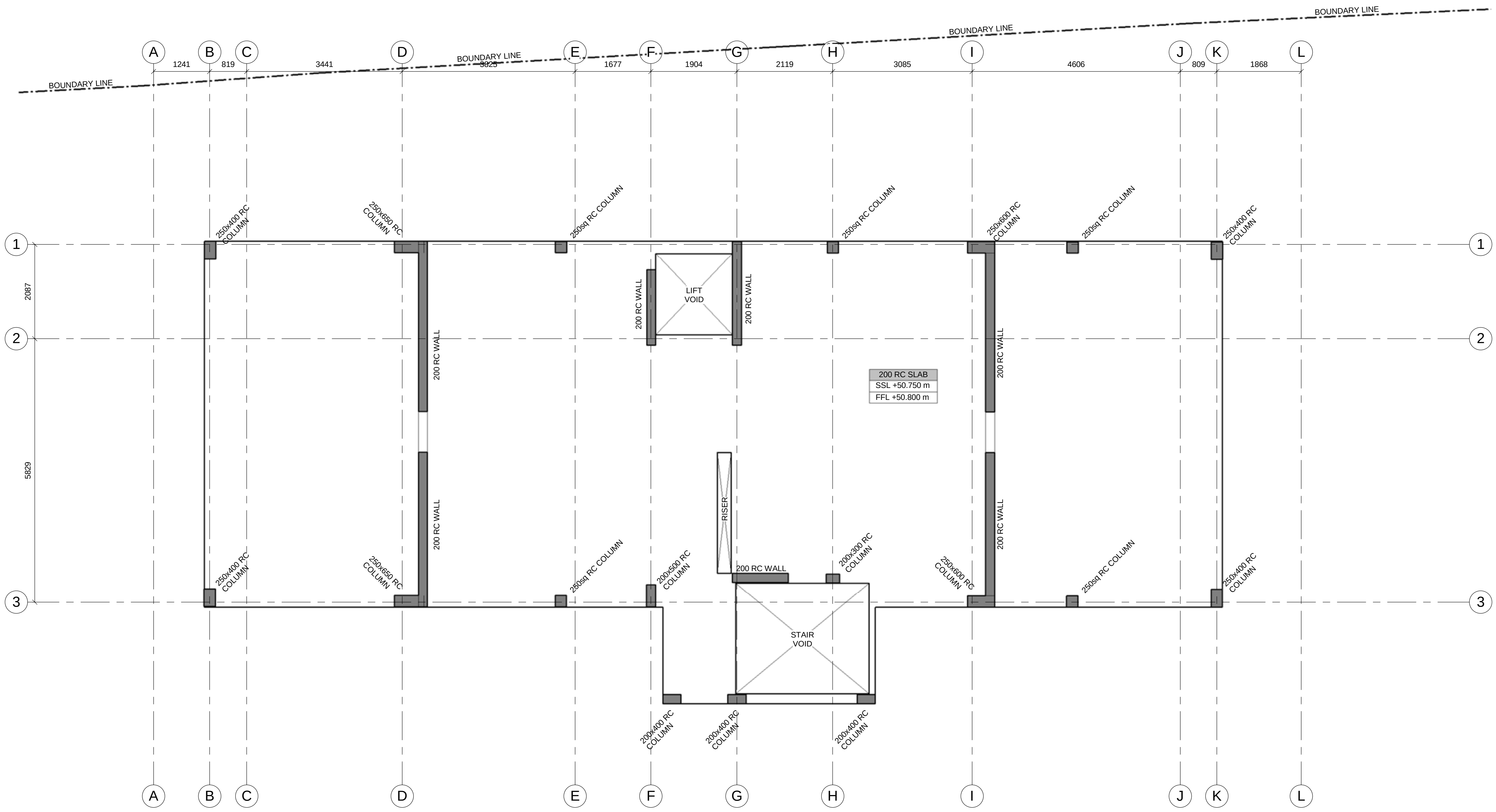

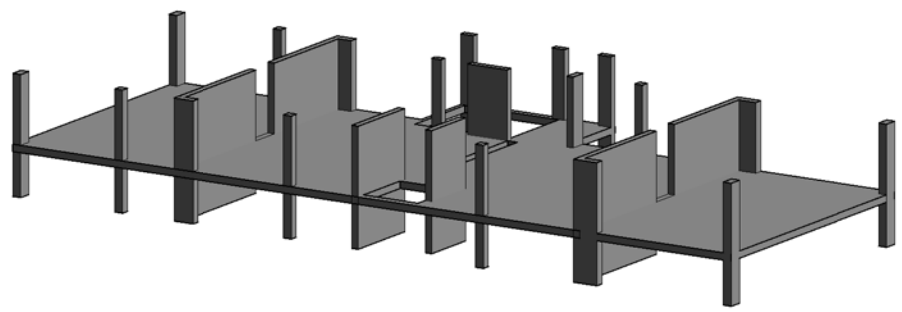

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REV	DATE	DESCRIPTION	BY

Project:
BARRIE HOUSE

Title:
GENERAL ARRANGEMENT SECOND FLOOR

Client:
KALEMINSTER Ltd.

Architect:
MWA

INFORMATION

Designed:	AM	Drawn:	AJE
Checked:	BP	Date:	JAN '18
Project No:	1805	Scale @ A1:	1 : 50

Drawing No:
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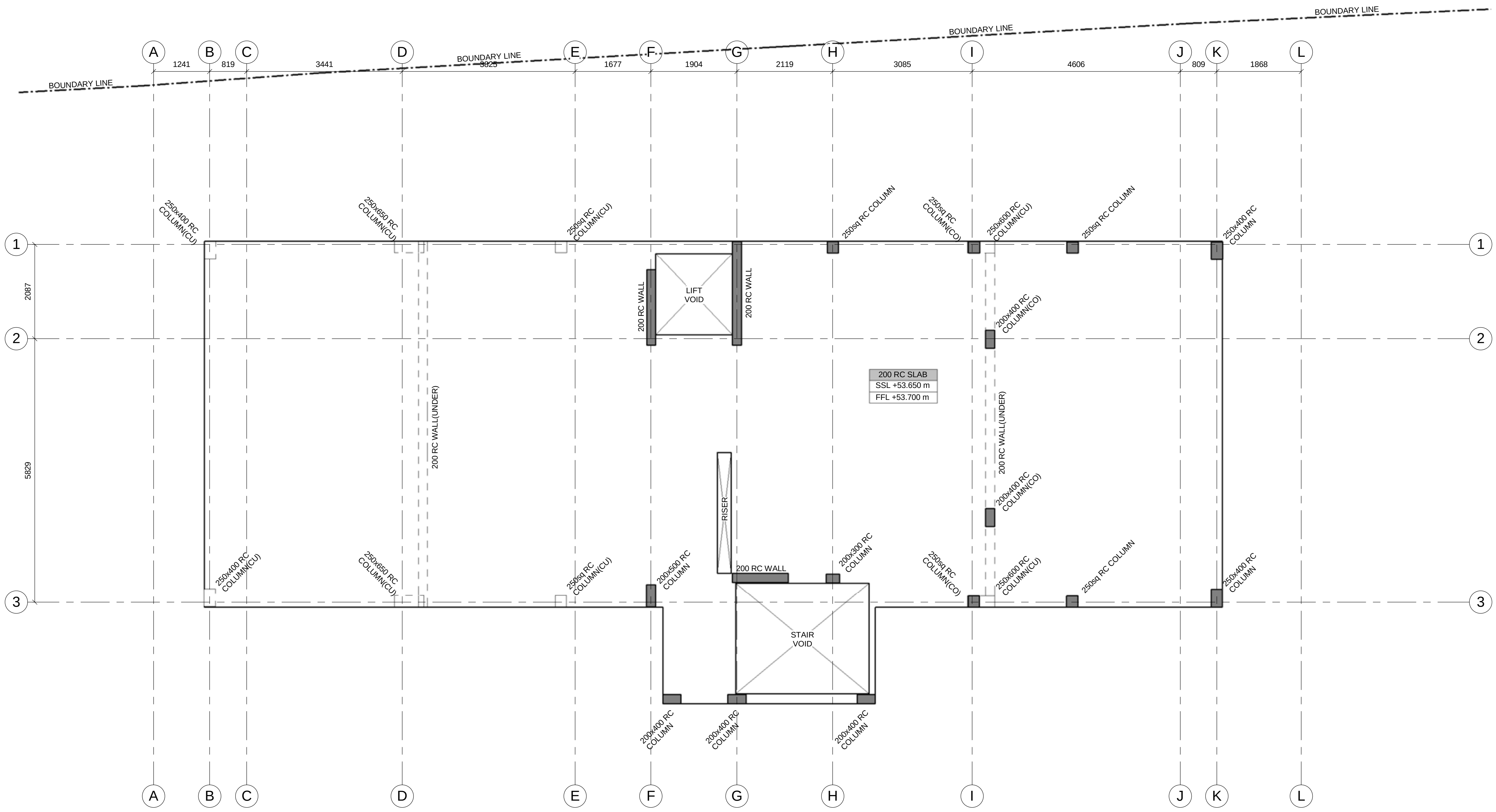

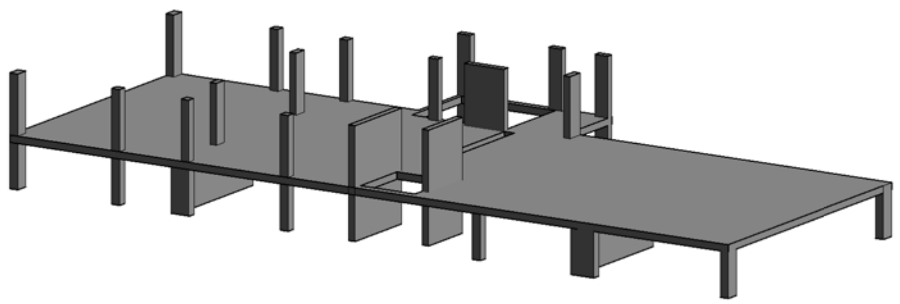

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REV	DATE	DESCRIPTION	BY

Project:

BARRIE HOUSE

Title:

GENERAL ARRANGEMENT
THIRD FLOOR

Client:

KALEMINSTER Ltd.

Architect:

MWA

INFORMATION

Designed:	AM	Drawn:	AJE
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Drawing No:

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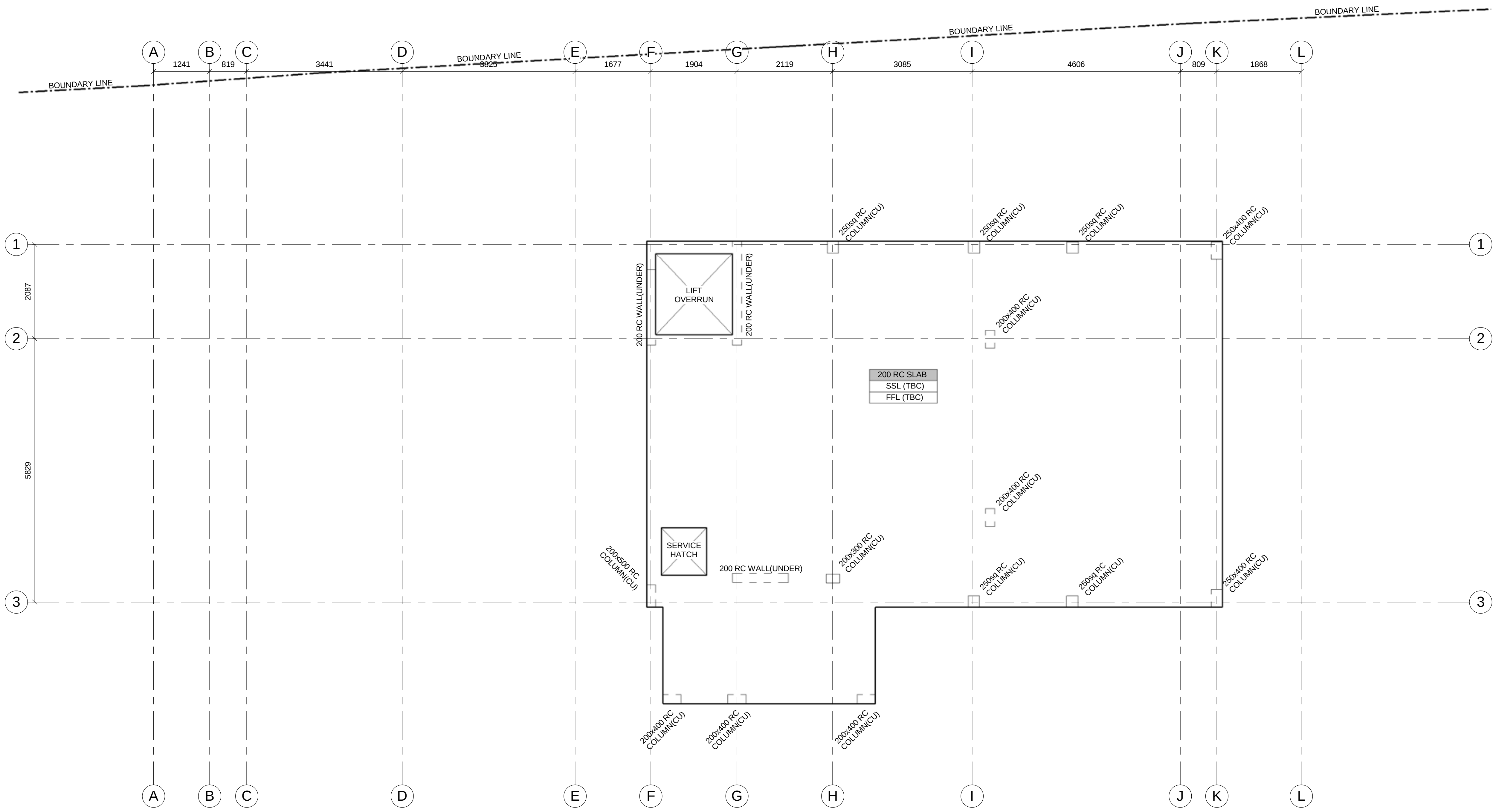

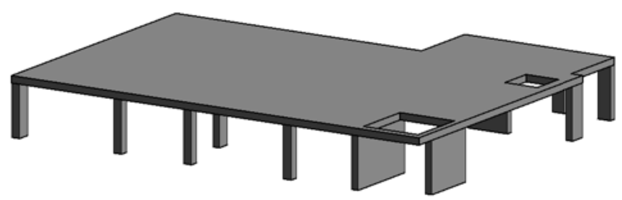

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REV	DATE	DESCRIPTION	BY

Project:
BARRIE HOUSE

Title:
GENERAL ARRANGEMENT ROOF PLAN

Client:
KALEMINSTER Ltd.

Architect:
MWA

INFORMATION

Designed:	AM	Drawn:	AJE
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Project No:	1805	Scale @ A1:	1 : 50

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APPENDIX 2
CGL Ltd Ground Investigation Report

Parmarbrook

Barrie House

Basement Impact Assessment
Revision 1

January, 2018

Card Geotechnics Limited
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Approved	Richard Ball, Technical Director *MSc BSc CEng MICE FGS*		
Reference CG/28408	Revision 0	Issue Date Jan 2018	
	1	Jan 2018	

Contents

FIGURES

Appendices

1. INTRODUCTION

It is proposed to develop the site "Barrie House" at 29 St Edmund's Terrace in the London Borough of Camden (LBC). The proposed development involves the construction of a four storey extension including a single storey basement level to the existing Barrie House structure. Card Geotechnics Limited (CGL) have been instructed by Parmarbrook ('the client') to undertake a *Basement Impact Assessment (BIA),* including a detailed ground movement analysis for the proposed development to determine its potential effect on nearby structures, surface water runoff and groundwater flow.

The LBC's guidance document *"CPG4, Basements and Lightwells"*[1]*,* requires a Basement Impact Assessment (BIA) to be undertaken for new basements in the Borough and sets out five stages for a BIA to "*enable the Borough to assess whether any predicted damage to neighbouring properties and the water environment is acceptable or can be satisfactorily ameliorated by the developer*". The five stages are set out below:

1. Screening
2. Scoping
3. Site investigation
4. Impact assessment
5. Review and decision making

A site investigation has previously been undertaken at the site by Soil Consultants[2] in 2012. The results of this have been used to inform the Screening, Scoping, Impact Assessment and Decision Making Stages.

This report identifies the key issues relating to land stability, hydrogeology and hydrology as part of the screening process (Stage 1) and includes a review and interpretation of existing site investigation data to establish a conceptual site model (Stages 2 and 3). The report provides an impact assessment (Stage 4) of potential ground movements on adjacent structures and the hydrogeology of the surrounding area for the purposes of planning.

[1] Camden Planning Guidance. (2014). *CPG4, Basements and Lightwells, July 2015.*
[2] Soil Consultants. (2012). *Ground Investigation Report - Barrie House* Ref. 9241/OT

2. SITE CONTEXT

2.1 Site Location

The Site is located at Barrie House, 29 St Edmund's Terrace, London NW8 7QH. The site is located within the London Borough of Camden. The approximate National Grid Reference for the site is 527495E, 183575N. A site location plan is presented as Figure 1.

2.2 Site Description

A site walkover was undertaken by a CGL Engineer on 6th December 2017. The site was found to comprise a roughly square plot approximately 0.18 hectares in area and is currently occupied by Barrie House, an eight storey detached residential block constructed in the 1950's. The existing structure includes a partial basement beneath the centre of the Barrie House structure. The basement currently houses the plant room and several small rooms. Historical structural drawings and site visits indicate a backfilled void exists adjacent to the existing partial basement. The void is surrounded by a masonry wall, below the ground floor slab. The space is understood to have been backfilled to a level of approximately 44.8mOD based on historical structural drawings provided in Appendix A.

The existing building of Barrie House is located centrally within the site. A small (approximately 7m^2) two storey porter's lodge is present on the north west side of the site, where the ground level is approximately 45 meters above ordnance datum (mOD). Landscaped gardens are presented around the on-site structures with a large number of deciduous trees. The trees are mainly clustered in an area to the east of the building. Several large stumps are also present along the south and west of the site. The trees were observed to be around 2m to 3m tall and appeared to be mature. Vehicular access to the site is off Broxwood Way and leads to a tarmacked car parking area in the west of the site.

It is understood that the existing ground floor of the building is founded on pad foundations on the London Clay Formation. A single storey ground floor extension constructed in 1959 at the rear of the building is founded on strip floorings. Where the basement is present it is understood to be founded on strip footings on the London Clay Formation[2].

The site is bound to the south east by St Edmund's Terrace and to the west by Broxwood Way. Two rows of terraced houses / apartment blocks are present to the north of the site, referred to as Nos. 32 to 72 Kingsland and Nos. 1 to 16 Kingsland. The closest properties of each of these rows are No. 16 and No.72 Kingsland. The closest point of the neighbouring properties is the southern corner of No. 72, which is approximately 7.5m from the proposed development. At its closest point No. 16 is approximately 9.5m from the proposed piled wall and approximately 9m from the porters lodge (to be demolished). The porters lodge is approximately 10.0m from the road of Broxwood Way. The proposed piled wall is approximately 12.8m from Broxwood Way. To the east of the site, a building is present named Regent Heights and Nos. 30 to 36 St Edmund's Terrace. These structures are approximately 20m from the closest part of the Barrie House building. There are no existing party wall structures. CGL's in-house information indicates the presence of the King's Scholar Pond Sewer approximately 145m west of the site and the Middle Level Sewer No. 8, and enlargement of Northern Outfall Sewer approximately 110m south of the site. The site layout is presented in Figure 2.

2.3 Proposed Development

The proposed development is understood to comprise the demolition of the porter's lodge and the construction of a four storey extension adjacent to the northern wall of existing Barrie House including a new basement. It is proposed to remove the backfilled soil in the space adjacent to the existing plant room. The proposed development will accommodate nine new residential flats with the excavated backfilled void proposed to be used as a bike storage area.

The new basement will be retained by a contiguous piled wall around the perimeter of the basement with the exception of the section of the basement perimeter beneath the existing Barrie House structure, which will not have a piled wall. The existing structure at this section of the wall is to be underpinned.

The proposed new basement will be founded on pad foundations below a 600mm thick concrete slab with formation level of 40.85mOD. The formation level of the pads and underpins will be at 40.35mOD, 0.5m below the formation level of the basement slab. This will involve an excavation of up to approximately 5.15m of soil from the existing ground level of approximately 46mOD.

The excavation of the backfilled void area will be from a level of approximately 44.8mOD to a formation level of approximately 42.5mOD, some 2.3m of excavation. The excavated backfilled void area will have a 300mm basement slab, with floor level at 42.8mOD.

Indicative proposed development plans provided by the structural engineer are provided as Appendix B.

2.4 Topography

The site generally slopes from down from north to south with the highest point located in the north east corner of the site at approximately 48.6mOD. The lowest point is in the south west corner of the site with a level of approximately 42mOD. The distance on site between these points is approximately 55m, results in a slope of about 1 in 8. With reference to the topographical map of Camden within

Camden's Strategic Flood Risk Assessment[3] (SFRA) the local area around the site appears to slope down from Primose Hill (approximately 200m north east of the site) towards the south west. There is also a small slope down to the south towards *Regents Park* (approximately 200m south of the site).

The steepest slope on site is within the west of the building where there is a vehicular ramp down from the car park/building entrance, where the level is approximately 45.4mOD to the level of Broxwood Way, some 43.0mOD. This change in level occurred over approximately 13.5m, indicating a slope of around 1 in 5.5.

[3] URS (2014) *London Borough of Camden – Strategic Flood Risk Assessment*

3. GROUND AND GROUNDWATER CONDITIONS

3.1 Published Geology

The British Geological Survey (BGS) map of the area[4] indicates that the site is underlain by the London Clay Formation. The London Clay Formation is indicated to be approximately 50m thick, with the base of the stratum anticipated at around -10mOD. The London Clay Formation is in turn documented to be underlain by approximately 15m of the Lambeth Group, which is in turn underlain by approximately 15m of the Thanet Sand Formation. The Thanet Sand Formation is underlain by the Chalk at a level of around -50mOD.

The London Clay Formation is described as stiff to very stiff, over-consolidated, dark grey clay with selenite crystals and occasional sand lenses. The clay weathers to a firm orange brown.

The map additionally shows superficial head deposits overlaying the London Clay Formation at the site. No thickness of these deposits is indicated, and it is noted that the locations of the head deposits are interpreted by digital slope analysis and are not mapped deposits that have been verified by fieldwork.

3.2 Unpublished Geology

Nearby borehole records from the BGS[5] have been reviewed to provide insight into the local ground conditions. The records indicate that the area is directly underlain by London Clay, which is weathered at shallow depths. Three records from approximately 50m of the site have been summarised in Table 1. The borehole records are provided in Appendix C.

Table 1. Summary of Unpublished Ground Conditions

Strata	*Description*	*Top Level (mOD) [mbgl]*	*Thickness (m)*
Made Ground	Tarmac / Soft grey-brown / dark brown and black silty clay with chalk and brick fragments *Not present in TQ28SE409*	38.0 to 38.2 [0]	0 to 2.5
Weathered London Clay Formation	Firm to stiff fissured brown clay becoming stiffer with depth. Silty with yellow brown silt parting in borehole TQ28SE1231. Silt partings and blue grey mottling in TQ28SE1230.	35.7 to 50.1 [0 to 2.5]	8.7 to 10.4
London Clay Formation	Stiff to very stiff grey – blue / dark grey fissured clay. Mudstone boulders and sand fissures noted in TQ28SE409, also with traces of shell fragments and lignite at 66.5mOD. Silt clay and carbonaceous impurities noted in TQ28SE1231.	27.0 to 39.8 [10.4 to 11.2]	Proven to 67mbgl (-17mOD)

Note. mbgl = meters below ground level

[4] British Geological Survey (*1998*). *South London Sheet 270*. England and Wales. Solid and Drift Geology. 1:50,000
[5] http://mapapps.bgs.ac.uk/geologyofbritain/home.html? (Accessed Dec 2017)

Groundwater was noted within the Made Ground at borehole TQ28SE1231 at approximately 36.08mOD (2.1meters below ground level (mbgl)). Groundwater was not reported in the two other records.

3.3 Hydrogeology and Hydrology

The site is approximately 170m north of *Regents Canal* and approximately 750m north of the *Boating Lake* in *Regents Park.* Reference to CGL archive information and Barton's *Lost Rivers of London*[6] indicates the historical (culverted) *River Tyburn* is located approximately 230m south west of the site (at its closets point) and flows broadly north to south towards *Regents Park* and into the *Boating Lake.* Based on the local topography sloping towards the south west it is considered that groundwater onsite will run towards the historical *River Tyburn* to the south west.

The Environment Agency (EA) mapping indicates the site is within a Flood Zone 1. This indicates the site has a less than 1 in 1000 annual probability, a 'low' probability, of flooding from river or sea flooding. As the site is less than one hectare in size a flood risk assessment is not required for the site by the Environment Agency. The flood maps included within CPG4[1] and Camden's SFRAA[3]indicate the site location has a 'very low' risk of surface water flooding (less than 1 in 1000 years). Around the border of Primrose Hill (approximately 200m north of the site) the risk from surface water flooding is shown as 'low' to 'medium'. The site is not shown to have experienced extreme flooding in 1975 or 2002 flooding events. According to the Camden SFRA SuDS Drainage Potential Map the site on the border of an area that is highly compatible for infiltration SUDS and an area with very significant constraints. Environment Agency groundwater flood incidents have been recorded approximately 300m west of the site. The site is located within a critical drainage area but is not located within a local flood risk zone[3].

The EA[7] has produced an aquifer designation system consistent with the requirements of the Water Framework Directive. The designations have been set for superficial and bedrock geology and are based on the importance of aquifers for potable water supply, and their role in supporting surface water bodies and wetland ecosystems. The site does not overlie a designated superficial or bedrock aquifer and is noted as being underlain by the London Clay Formation, designated a 'non-productive stratum' by the Environment Agency.

The site does not fall within a Groundwater Vulnerability Zone as indicated by EA mapping. The site is located within a Source Protection Zone 1, related to the Barrow Hill reservoir approximately 20m

[6] Barton, N. (1992) *The Lost Rivers of London*. Hertfordshire Historical Publications.
[7] http://www.environment-agency.gov.uk (accessed November 2016)

north east of the site. This reservoir is of new construction (2014) and is a tanked, concrete lined reservoir.

3.4 Previous Site Investigation

A site investigation has previously been undertaken by Soil Consultants[2] in 2012 comprising three foundation inspection pits (TP1 to TP3) to expose foundation positions of the Barrie House building. A 75mm diameter hole was drilled through each pad to measure the thickness of the foundations. Three window sample boreholes (WS1 to WS3) were then progressed from these trial pit locations, with the concrete pad being cored out to enable window sampling at WS1 and WS3, and the borehole WS2 being progressed from the edge of the pad. The window sample boreholes were undertaken to a maximum depth of 5mbgl (39.6mOD). A cable percussion borehole (BH1) was completed in the carpark area to a depth of 7.5mbgl (38.5mOD).

In-situ testing was undertaken comprising Standard Penetration Tests (SPTs) at regular intervals in borehole BH1 and regular Hand Shear Vane and Pocket Penetrometer tests undertaken within the window sample boreholes. Groundwater monitoring standpipes were installed in window sample boreholes WS1 and WS2, both with plain pipe from 0mbgl to 1mbgl and with slotted pipe from 1mbgl to 4mbgl.

3.4.1 Ground Conditions

The ground conditions encountered by the previous investigation were found to be consistent with the published geology and are summarised in Table 2 below.

Table 2. Summary of Ground Conditions

Strata	*Description*	*Top Level (mOD) [mbgl]*	*Thickness (m)*
[MADE GROUND – PAD LOCATIONS]	Brown topsoil and clay with occasional building rubble. Soft to firm brown clay with occasional flint gravel and dark brown sand/ silt lenses in WS2 only.	44.6 to 45.6 [0.0]	0.5 to 2.1
[CONCRETE FOUNDATION – PAD LOCATIONS]	*Only observed in WS1 and WS3. One reinforcement bar circa. 10mm diameter observed in WS3 concrete core.*	44.4 to 44.7 [0.9]	0.7 to 0.9
[MADE GROUND – CAR PARK AREA]	Asphalt over grey/black mixture of ashy sand with asphalt, clinker and flint gravel becoming clayey at 45.65mOD (0.35mbgl).	46.0 [0]	0.5
[LONDON CLAY FORMATION]	Stiff brown CLAY with some orange patches, occasional grey gleying, selenite crystals and rare orange sand partings. Noted as soft to firm in BH1 and becoming stiff at 6mbgl in WS1.	42.5 to 45.5 [0.5 to 2.1]	*Base not proven at 38.5mOD (7.5mbgl)*

The details of the strata encountered are discussed in the following report sections. A plot of the undrained shear strength (c_u) data versus level (mOD) from the Soil Consultants report[2] is presented in Figure 3.

3.4.2 Made Ground

Made Ground was identified above each foundation pad and generally comprised a topsoil layer followed by brown clay with some occasional building rubble (primarily concrete and brick). Borehole WS2 was undertaken adjacent to a pad. A similar topsoil and brown clay was identified above the pad level at this location. From the top level of the pad the Made Ground at borehole WS2 was reported at depths between 43.47mOD (1.13mbgl) and 42.50mOD (2.1mbgl) and was found to comprise a soft to firm brown clay with occasional flint gravel and dark brown sand/ silt lenses.

The concrete pads at the window sample locations were found to be between 0.72m and 0.8m in thickness. At boreholes WS1 and WS2 where cores of the concrete pad were extracted, only borehole WS3 was noted to have reinforcement. This consisted of one reinforcement bar approximately 10mm in diameter located 0.5m from the top of the pad (43.9mOD, 1.3mbgl).

At the borehole BH1 in the car park the Made Ground was reported as an asphalt layer approximately 100mm thick over a grey/black mixture of ashy sand with asphalt, clinker and flint gravel becoming clayey at 45.65mOD (0.35mbgl).

3.4.3 London Clay Formation

The London Clay Formation was identified directly beneath the Made Ground in boreholes BH1 and WS2 and directly beneath the concrete pads at boreholes WS1 and WS3. The base of the London Clay Formation was not proven in any location, with the maximum depth reached being 38.5mOD (7.5mbgl).

The stratum was found to be soft in the first 1.6mbgl (to a level of 44.4mOD) within borehole BH1 and firm between 1.6mbgl and 6.0mbgl (44.4mOD to 40.0mOD). At the window sample locations the London Clay Formation was reported as being a stiff brown clay with occasional grey gleying, selenite crystal and rare orange partings. At borehole WS2 the top of the London Clay Formation was reported to be stiff, locally firm with orange patches at depths between 42.5mOD to 42.4mOD (2.1mbgl to 2.3mbgl) . The top of the London Clay Formation was interpreted to be weathered to a depth of approximately 42.4mOD, with the clay becoming more uniformly brown with depth. Claystone was recorded as “incipient claystone” at in WS1 and WS3 at 2.1mbgl (43.6mOD and 43.3mOD, respectively).

SPTs undertaken at borehole BH1 recorded SPT 'N' values between N=6 (at 2.3mbgl (43.7mOD)) and N=16 (at 6.3mbgl (39.7mOD)), correlating to undrained shear strengths of 27kN/m^2 to 72kN/m^2 (based on f1 = 4.5[8]).

Hand shear vane tests were undertaken in the soils retrieved from the window samples boreholes. The undrained shear strengths measured by the hand shear vanes were found to range between 43kN/m^2 and 120kN/m^2. Each of the hand shear vane undrained shear strength results, excluding the 40kN/m^2 at WS1 (-1.9mbgl (43.7mOD)), were found to be over 60kN/m^2. Pocket penetrometer testing was additionally undertaken and found a strength profile similar to that obtain from the hand shear vane. One Quick Undrained Triaxial test (QUT) was undertaken in the London Clay from borehole BH1 at 44.9mOD (1.1mbgl) and the undrained shear strength of the sample was found to be 26kN/m^2 indicating a soft clay of low strength[9].

Laboratory testing for Atterberg Limits was undertaken on ten samples of the London Clay Formation, with 33 samples tested for moisture content. The results of this testing indicated the following percentages:

- Moisture content: 20% to 34%;
- Liquid limit: 70% to 91%;
- Plastic Limit: 25% to 30%;
- Plastic limit: 42% to 61%

The ten samples tested for Atterberg Limits were additionally tested for the percentage passing 425 µm. It was found that >95% of the particles were smaller than 425µm. Based on this the modified plasticity index is between approximately >40% and >58%. The laboratory testing results indicate the London Clay Formation at the site has a 'very high' to 'extremely high' plasticity[9], and has a 'high' volume change potential[10]. Based on this and the large number of trees it is recommended that the various trees on site should be identified by an arboriculturalist to determine potential future grown and potential root penetration. Trees should not be planted or removed without expert advice about the potential effects and management.

[8] Stroud, M.A. (1975). *The standard penetration test in insensitive clays and soft rocks. Proceedings of the European Symposium on Penetration Testing,* 2, 367-375.
[9] British Standards Institution (2015) *Code of practice for site investigations.* BS 5930:2015
[10] NHBC (2013) *NHBC Standards. Chapter 4.2 Building near trees.*

3.5 Groundwater

The Soil Consultants[2] investigation did not identify groundwater in the boreholes on site during the drilling of the boreholes, with the exception of standing water being observed in borehole WS1 at 44.2mOD (1.4mbgl). Monitoring standpipes were installed in boreholes WS1 and WS2. A single monitoring visit was undertaken on 15th October 2012. Groundwater was recorded in borehole WS1 44.95mOD (0.95mbgl) and in borehole WS2 at 41.1mOD (3.5mbgl). The groundwater level in borehole WS1 was recorded 1.1m above a claystone band.

The response zone of WS1 is within the Weathered London Clay Formation/London Clay Formation/ concrete. The response zone of WS2 is the same, with the very top of the response zone also within the Made Ground. It is possible that isolated pockets of groundwater are present in the Made Ground, Weathered London Clay Formation and London Clay Formation. Based on these variable groundwater levels further monitoring visits were undertaken by CGL at the Soil Consultants[2] boreholes WS1 and WS2, the findings of these visits are presented in Section 6 of this report.

3.6 Geotechnical Design Parameters

Geotechnical design parameters have been determined based on the description of the soils, field testing and laboratory test results from the site. The design levels have been based primarily on borehole BH1, the most representative location for the new basement development. The geotechnical design parameters are summarised in Table 3. For the purposes of the analysis the Weathered London Clay and the London Clay Formation are considered as a single unit.

Table 3. Geotechnical Design Parameters

Strata	Design level (mOD) [mbsl]	Bulk unit weight γ_b (kN/m3)	Undrained cohesion c_u (kPa) [c']	Friction Angle φ' (°)	Young's modulus E_u (MPa) [E']
Made Ground	46	18	[0]	28	[15]
London Clay Formation	45.5	20	$30 + 12z^a$ [5]	22^b	$18 + 7.2z^c$ $[13.5 + 5.4z]^d$

[a] *z = depth below top of strata*
[b] *British Standards institution. (1994). Code of practice for Earth retaining structures. BS 8002:1994.]*
[c] *Based on 600c_u*
[d] *Based on 0.75E'*

4. SCREENING

4.1 Introduction

CGL has adopted a screening process based on the Camden Borough Council basement development guidance '*Basements and Lightwells CPG4*'[1]. Relevant questions for the site in and proposed development are presented below.

4.2 Subterranean (Groundwater) Flow

This section answers the questions relating to groundwater flow. Table 4 presents a summary of these answers.

Table 4. Responses to Figure 3, CPG4

Question	*Response*	*Action required*
1a. Is the site located directly above an aquifer?	No. The nearest designated aquifers are 1.5km to the south of the site and 1km to the north of the site. Both are designated Secondary A Aquifers.	None
1b. Will the proposed basement extend beneath the water table surface?	Potentially. Variable water levels identified in the previous site investigation. The Made Ground onsite is directly underlain by the London Clay Formation and as such groundwater is not anticipated.	Further monitoring visits
2. Is the site within 100m of a watercourse, well, or potential spring line?	No. The nearest water course is the *Regent Canal* approximately 170m south of the site. The nearest natural water course is the culverted *River Tyburn* approximately 230m west of the site.	None
3. Is the site within the catchment of the pond chains on Hampstead Heath?	No.	None
4. Will the proposed basement development result in a change in the proportion of hard surfaced/paved areas?	No. The proposed basement will be constructed in the existing carpark area which is currently covered by hardstanding.	None
5. As part of site drainage, will more surface water than at present be discharged to ground (e.g. via soakaways and/or SUDS)?	No. It is anticipated surface water will be discharged to the existing infrastructure. Soakaway type drainage is unlikely to be feasible given the geology at the site.	None
6. Is the lowest point of the proposed excavation close to, or lower than, the mean water level in any local pond or spring lines?	No. There are no evident ponds or spring lines in the vicinity of the site.	None

4.2.1 Non-Technical Summary: Subterranean (Groundwater) Flow

The proposed development is underlain by the London Clay Formation, designated an 'unproductive stratum' by the EA. The proposed basement extension will be in the car park area currently covered by hardstanding. As such the proportion of hardstanding will not be increased and the development is not anticipated to have a significant impact on groundwater infiltration rates.

The previous site investigation did not encounter laterally pervasive groundwater on site during drilling. One monitoring visit was undertaken by Soil Consultants and found variable groundwater levels across the site during monitoring. The site is underlain by a limited thickness of Made Ground and then by the London Clay Formation. The London Clay Formation is a relatively impermeable stratum and is classed as an unproductive aquifer and as such significant groundwater is not anticipated and groundwater is not anticipated to impact the development. As the groundwater levels across site have been found to be variable, further monitoring visits will be undertaken to confirm the groundwater level at the existing monitoring wells. The groundwater monitoring visits undertaken by CGL are discussed later in Section 6.

It is noted that the site is within a Source Protection Zone (SPZ) Inner Zone 1, relating to Barrow Hill reservoir. However as the proposed development is within the relatively impermeable London Clay Formation, the reservoir is a tanked, concrete lined reservoir, and is upstream from the site, the proposed development is not anticipated to have an impact on the SPZ Inner Zone 1.

4.3 Slope/Land Stability

This section answers the questions relating to site topography, trees, neighbouring infrastructure and potential ground movements associated with basement development. Table 5 presents a summary of these answers.

Table 5. Responses to Figure 4, CPG4

Question	*Response*	*Action required*
1. Does the site include slopes, natural or manmade, greater than about 1 in 8?	Yes. The maximum slope on site is marginally over 1 in 5 to the west / south west of the existing apartment block. The slope stability was assessed in the Soil Consultants report2 and a factor of safety of 1.45 was found for the slope stability indicating the overall stability should be acceptable. No signs of deep-seated failure were observed.	None
2. Will the proposed re-profiling of the landscaping at site change slopes at the property boundary to greater than about 1 in 8?	No. The proposed development will not significantly alter the profile of the landscaping at the site boundaries.	None
3. Does the development neighbour land including railway cuttings and the like with a slope greater than about 1 in 8?	No.	None

Question	Response	Action required
4. Is the site within a wider hillside setting in which the general slope is greater than about 1 in 8?	No. Whilst there is a steep slope on site where the car park / building entrance area slopes down to Broxwood Way, the hill slopes around the site have a gentler gradient.	None
5. Is the London Clay the shallowest stratum on site?	No. Made Ground has been found over the London Clay on the site. However, the effect of heave of the London Clay due to excavation to form the new area of the basement will still need to be considered though due to the limited thickness of the Made Ground in the car park area.	Impact assessment
6. Will any trees be felled as part of the proposed development and/or are any works proposed within any tree protection zones where trees are to be retained?	None. From the proposed development drawings, it is understood no trees will be felled as part of the development.	None
7. Is there a history of shrink/swell subsidence in the local area and/or evidence of such at the site?	Seasonal swelling is likely to occur due to the large number of trees present. As no trees are to be felled the development will not significantly change ground/structure interaction. Additionally, the proposed foundations for development will be at a level of approximately 40.35mOD, considered to be beyond the depth of influence of the tree roots.	None
8. Is the site within 100m of a watercourse or a potential spring line?	No.	None
9. Is the site within an area of previously worked ground?	There is a limited thickness of Made Ground on site likely to be associated with the construction of the existing building. The Made Ground was found to be thicker at the locations of the pad foundations of the existing building as would be expected. In the car park area, the Made Ground was found to be of a minimal thickness of 0.35m.	None
10. Is the site within an aquifer?	No.	None
11. Is the site within 50m of Hampstead Heath Ponds	No.	None
12. Is the site within 5m of a highway or pedestrian right of way?	Yes. The site is within 5m of Broxwood Way, however the basement development on site will be over 15m from Broxwood Way.	None
13. Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	Potentially but neighbours are not directly adjacent to development. The closest neighbour is approximately 7.5m from the proposed basement development on site. It will be necessary to determine the potential ground movements from the proposed development at the neighbouring properties.	Impact assessment
14. Is the site over (or within the exclusion zone of) any tunnels?	No. The site is not understood to be over or within the exclusion zone of tunnels.	None

4.3.1 Non-Technical summary: Slope/Land Stability

The Soils Consultants report[2] found the maximum slope on site to be marginally over 1 in 5, from the west / south west of the existing apartment block. The slop stability was assessed in the Soil

Consultants report2 and a factor of safety of 1.45 was found for the slope stability indicating the overall stability should be acceptable. No signs of deep-seated failure were observed. The slopes around the site do not exceed a gradient of 1 in 8. As such the site is not considered to be at risk from slope stability issues.

An impact assessment will be required as the basement excavation will result in unloading of the London Clay Formation, which could result in heave movement. The ground movements generated by the proposed development at the location of the neighbouring properties are anticipated to be low based on the distance to the properties, this will be confirmed by the impact assessment. Measures to mitigate potentially damaging movements will be provided if found to be necessary.

The London Clay Formation on site has the potential to create a shrink/swell hazard. Due to the high plasticity of the London Clay Formation the removal of any trees could have an effect on the shrink/swell potential of the clay. If any trees are planted or removed further advice may be required. However, it is noted that there are no changes to number of trees planned and that the foundations of the proposed development will be around 40.35mOD, considered to be beyond the likely depth of influence of tree roots.

4.4 Surface Flow and Flooding

This section answers questions relating to the impact of the proposed development on existing drainage, permeable surfacing and flood risk. Table 6 presents a summary of these answers.

Table 6. Responses to Figure 5, CPG4

Question	*Response*	*Action required*
1. Is the site within the catchment of the pond chains on Hampstead Heath?	No.	None
2. As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off), be materially changed from the existing route?	No. There may be a marginal change in route on site as surface water will flow around the proposed above ground extension where currently it can flow over the carpark area. This is a minor change in route though as the surface water would already flow around the existing building from the highest point in the north east of the site to the lowest point in the south west of the site.	None
3. Will the proposed development result in a change in the proportion of hard surfaced/paved external areas?	No. The proposed basement will be constructed in the existing carpark area which is currently covered in hardstanding.	None
4. Will the proposed basement result in a change to the profile of the inflows of surface water being received by adjacent properties or downstream watercourses?	No. The nearest surface water features are over 300m from the site. Impacts of the proposed development on surface water flow are anticipated to be minimal and over the distance of over 300m from the site to surface water features the effects of the proposed development will dissipate.	None

5. Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	No.	None
6. Is the site in an area identified to have surface water flood risk according to either the Local Flood Risk Management Strategic or the Strategic Flood Risk Assessment or is at risk from flooding, for example because the proposed basement is below the static water level of nearby surface water features?	EA mappings indicates the site is at a 'low' risk of surface water flooding and it is noted that the site did not experience flooding in the significant flooding events in 1975 and 2002.	None

4.4.1 Non-Technical Summary: Surface Flow and Flooding

The proposed basement extension will be constructed in the area of the site currently used as a car park. As such the proposed development will not involve the removal of soft landscaped areas and therefore the proportion of hardstanding on site will not change due to the development.

There could potentially be a marginal change in route on site as surface water will flow around the proposed above ground extension where currently it can flow across the carpark area. This would be a very minor change in route, however as the surface water would already flow around the existing building in the general north east to south west direction. The nearest surface water feature (excluding historical features) is over 300m from the site and any changes in surface water flow on site would be expected to dissipate over this distance, being negligible at the surface water feature.

4.5 Summary

Based on this screening exercise, further stages of basement impact assessment are required for this site. These should address the items presented in Table 7.

Table 7. Summary of Screening Exercise

Item	*Description*
1.	***Subterranean (groundwater) flow*** Investigation – Groundwater levels across site have been found to be variable. Further monitoring visits will be undertaken to confirm the groundwater level at the existing monitoring wells. The proposed development will not increase the proportion of hardstanding on site and is therefore not anticipated to impact the amount of surface water able to drain into soils.
2.	***Slope/land stability*** Assessment – The proposed development is potentially at risk from shrink/swell of the London Clay Formation, however the proposed development is not anticipated to affect the shrink/swell capacity of the clay. The impact on the existing structure and nearby properties of unloading of the soils/re-loading with the proposed above ground extension will be considered in a ground movement assessment.
3.	***Surface flow and flooding*** None – the proposed development will not increase the proportion of hardstanding on site and is anticipated to have a negligible impact on surface water run-off or surface water attenuation characteristics.
4.	***Cumulative impacts*** As groundwater flow would not be expected within the London Clay, it is expected that cumulative impacts from the construction of the basement will be negligible. As the proportion of hardstanding on the site will not change the proposed

Item	Description
1.	***Subterranean (groundwater) flow*** Investigation – Groundwater levels across site have been found to be variable. Further monitoring visits will be undertaken to confirm the groundwater level at the existing monitoring wells. The proposed development will not increase the proportion of hardstanding on site and is therefore not anticipated to impact the amount of surface water able to drain into soils.
2.	***Slope/land stability*** Assessment – The proposed development is potentially at risk from shrink/swell of the London Clay Formation, however the proposed development is not anticipated to affect the shrink/swell capacity of the clay. The impact on the existing structure and nearby properties of unloading of the soils/re-loading with the proposed above ground extension will be considered in a ground movement assessment.
	development is not anticipated to impact to surface water flow onsite. Based on the distance to neighbouring properties the ground movements are anticipated to have a negligible impact on the neighbouring structures.

5. SCOPING

On the basis of the screening report, further groundwater monitoring visits are required and a Basement Impact Assessment should be undertaken.

The groundwater monitoring visits will aim to determine groundwater levels on the site, if groundwater is present. The findings of these groundwater monitoring visits are presented within Section 6.

The Basement Impact Assessment will be used to find the impact of the proposed development on the exiting apartment block and to predict the ground movements at the neighbouring properties as a result of the proposed development. A building damage assessment for the existing apartment block and the neighbouring buildings will be included within the basement impact assessment.

6. ADDITIONAL GROUNDWATER MONITORING

6.1 Groundwater Monitoring

Groundwater monitoring visits were undertaken at the site by CGL on 6th, 14th and 20th December 2017. The groundwater level at the two Soil Consultants monitoring wells (boreholes WS1 and WS2) were recorded on each visit. The wells were found to be 20mm standpipes with no covers. It was not possible to purge the wells to measure recharge rates due to the diameter of the standpipe and boreholes being located under foliage. The results are presented in Table 8 below. The records of the groundwater monitoring visits are included as Appendix D.

Table 8. Summary of Groundwater Monitoring Visits

Borehole	Response Zone	Date	Groundwater level (mOD) [mbgl]
WS1	Weathered London Clay Formation and London Clay Formation	06.12.17	44.4 [1.2]
WS1		14.12.17	44.8 [0.8]
WS1		20.12.17	44.7 [1.0]
WS2	Made Ground, Weathered London Clay Formation and London Clay Formation	06.12.17	42.7 [1.9]
WS2		14.12.17	42.8 [1.8]
WS2		20.12.17	42.8 [1.8]

The groundwater was found at levels between 42.7mOD (1.9mbgl) and 44.78mOD (0.82mbgl). The groundwater levels were generally consistent at each of the window sample locations, however the groundwater level at borehole WS2 was approximately 1m lower than the groundwater level at borehole WS1. It is noted that as pipes had no cover and that some of the water could be standing water that has entered during rainfall.

The groundwater level at borehole WS1 was broadly consistent with the level reported in the Soil Consultants report[2], which was found to be at a level of 44.95mOD (0.95mbgl). The groundwater level measured by CGL at borehole WS2 was found to be higher than the level of 41.1mOD (3.5mbgl) reported by Soil Consultants[2].

The observed groundwater levels indicate that groundwater is likely to be encountered during the excavation of the proposed basement and as such ground water control measures will be required. Additionally, as the groundwater is within the Weather London Clay / London Clay Formation the ingress rate is anticipated to be slow and groundwater control is likely to be achieved by sump pumping as the excavation progresses. The water could potentially be perched within the Made Ground, in which case it would be expected to be of limited volume.

7. BASEMENT IMPACT ASSESSMENT

7.1 Conceptual Site Model

A conceptual site model (CSM) relating to potential ground movement, has been developed based on the available data. The CSM is presented in Figure 4.

7.2 Damage Categories

Ground movements have been calculated and used to assess potential 'damage categories' that may apply to the existing building on site and neighbouring structures due to the proposed basement construction method and assumed construction sequence. The methodology proposed by Burland and Wroth[11] and later supplemented by the work of Boscardin and Cording[12] has been used, as described in *CIRIA Special Publication 200*[13].

General damage categories are summarised in Table 9 below.

Table 9. Classification of damage visible to walls (reproduction of Table 2.5, CIRIA C580[14])

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. Recurrent cracks can be masked by suitable linings. 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 also 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).

The above assessment criteria are primarily relevant for assessing masonry structures founded on strip footings. Therefore, this methodology is appropriate for the assessment of the development.

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[11] Burland, J.B., and Wroth, C.P. (1974). *Settlement of buildings and associated damage*, State of the art review. Conference on Settlement of Structures, Cambridge, Pentech Press, London, pp611-654

[12] Boscardin, M.D., and Cording, E.G., (1989). *Building response to excavation induced settlement*. J Geotech Eng, ASCE, 115 (1); pp 1-21.

[13] Burland, Standing J.R., and Jardine F.M. (eds) (2001), *Building response to tunnelling, case studies from construction of the Jubilee Line Extension London*, CIRIA Special Publication 200.

[14] CIRIA (2003). *Embedded retaining walls – guidance or economic design*. CIRIA C580.

7.3 Land / Slope Stability

The following sections assess the ground movements that may results from the construction of the basement and how these could affect the nearby structures. It is understood the excavation will be retained by a contiguous piled wall with underpins proposed where the proposed basement eastern wall is beneath the existing ground floor western wall of Barrie House.

Ground movements are derived from:

- Pile wall installation: Vertical and horizontal ground movements will be generated during the installation of the contiguous pile wall proportional to the length of the piles.
- Pile wall deflection: Deflections occur as the excavation proceeds and the piled wall is loaded with retained earth and water pressures, this can give rise to lateral and vertical ground movements.
- Heave movements: The London Clay Formation is susceptible to short term heave and time dependant swelling on unloading, which will occur as a result of basement excavation, generating upward ground movements.
- Long term ground movement: The net loading on formation soils will generate ground movement, which could affect adjacent foundations. This takes into account existing stress conditions, additional loads from the basement structure and the weight of soil removed.
- 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 one wall of the existing Barrie House structure will be underpinned as part of the development. The north west wall of Barrie House will be underpinned with the formation level of the underpins proposed to be 40.35mOD, 0.5m below the formation level of the basement slab. The wall to be underpinned is at a distanced beyond the influence of neighbouring properties. Lateral deflection movements can be generated at the underpinned wall, however the neighbouring properties are outside of the zone of influence of these movements. As such these movements have not been analysed in the basement impact assessment. The underpins are stiff concrete walls and lateral movements will be controlled by propping. Lateral movements of the underpins is likely to be less than 5mm.

Whilst these movements have not been assessed, the vertical underpin loads for the underpins beneath the north western wall of Barrie House have been included in the analysis of unloading and reloading of the soils.

7.4 Ground Movements: Pile Wall Installation and Deflection

7.4.1 Pile Wall Installation and Deflection Assessment

A contiguous piled wall is proposed as part of the development around the perimeter of the new basement. The installation of these piles and the excavation of material for the basement will generate vertical and horizontal ground movements. An impact assessment has been undertaken to assess the magnitude of movement at the closest neighbouring properties of No. 16 and No.72 Kingsland, located 9.5m and 7.5m from the site, respectively.

The assessment of the ground movements has been undertaken by CGL using CIRIA C760[15] to calculate the horizontal and vertical movements resulting from the excavation and the installation of the piled wall. The analysis has been undertaken assuming high support during excavation. The depth of embedment of the contiguous piles has been modelled as being equal to the excavation depth of 5.15m. The excavation depth is understood to be some 5.15m, therefore the pile lengths have been assumed as 10.3m.

The assessment of movements caused by excavation in front of the walls has been undertaken assuming “high support stiffness” during excavation with surface movements being 0.15% of the excavation depth. It has been assumed that the distance behind the wall to negligible movement due to excavation in front of the piled wall will be 4 times the excavation depth (20.6m) for horizontal movements and 3.5m times the excavation depth (18.0m) for vertical movements. The horizontal and vertical movements due to contiguous pile installation have been taken as 0.02% of the wall depth based on Ball and Creighton (2014)[16] which showed that with good construction control and modern piling techniques an installation movement of 0.02% pile length or lower can be achieved. It has been assumed the distance to negligible movements due to installation of the piles will be 1.5 times pile length for horizontal movements and 2 times pile length for vertical movements. These are conservative assumptions as per CIRIA C760[17].

7.4.2 Pile Wall Installation and Deflection Results

7.4.2.1 Ground movements

The results indicate that the ground movements at the piled wall at ground level (46mOD) due to installation and deflection of the piled wall, and excavation behind the wall, will be approximately 9.8mm of horizontal movement and 7.2mm of vertical movement directly adjacent to the wall. At a

[15] CIRIA C760. (2017). *Guidance on embedded retaining wall design.* CIRIA C760.
[16] Ball. R., Langdon. N., Creighton. M. (2014). *Ground Engineering Technical Paper: Prediction of party wall movements using CIRIA report C580.*
[17] CIRIA C760. (2017). *Guidance on embedded retaining wall design.* CIRIA C760.

distance of 14m away from the proposed piled wall the horizontal and vertical movement are predicted to be less than 1mm. It is assumed that the movements dissipate in a non-linear, parabolic curve with distance from the wall.

The maximum movements at a neighbouring properties of No. 72 (7.5m from the proposed development) and No.16 (9.5m from the proposed development) are summarised in Table 10. The distances for movement to become less than 1mm are presented in Figure 5.

Table 10. Summary of Ground Movements due to piled wall installation and deflection

Stage	*Max horizontal movements (mm)*	*Max vertical movements (mm)*
No. 72	3.7	2.6
No. 16	2.5	1.8

The movements at Broxwood Way, at around are predicted to be approximately 12.5m from the site, are predicted to be a maximum of 1.3mm of horizontal movements and 0.8mm of vertical movement. These are not anticipated to impact the roadway.

7.5 Ground Movements: Unloading / Reloading

An assessment of the vertical ground movements resulting from the proposed development has been undertaken using *PDISP (Pressure Displacement)* analysis software. *PDISP* assumes that the ground behaves as an elastic material under loading, with movements calculated based on the applied loads and the soil stiffness (E_u and E') for each stratum input by the user.

7.5.1 Excavation / demolition unloading

The proposed development will involve the unloading of around 5.15m of soil. Based on the ground conditions presented in Table 2 this would be expected to result in an unloading of some 102kN/m^2.

The excavation of the backfilled void area is understood to involve the removal of soil from approximately 44.8mOD to 42.5mOD, some 2.3m of excavation. The backfilled material is assumed to be Made Ground type material and to not be well compacted. A soil unit weight of 18kN/m^3 is assumed. Therefore the excavation of the backfilled void will result in an unloading of 48.6kN/m^2.

An unloading of 30kN/m^2 has been applied to the PDISP model at 45mOD for the demolition of the two storey porters lodge.

7.5.2 Structural loading

7.5.2.1 Building loads

Loads for the building have been supplied by the structural engineer. These are provided in Appendix B. The building is proposed to be supported by a series of internal columns and liner walls around the perimeter of the basement. Loads supplied by the structural engineer are summarised in Table 11. The London Clay Formation at this level is predicted to have an allowable bearing capacity of some 200kN/m^2 based on the c_u of the London Clay Formation at the formation level (40.35mOD) being 100kN/m^2. The pad foundations are to be approximately 2m^2. Pads at some columns were required to be extended slightly greater than 2m^2 to remain within the allowable bearing capacity. Where pads were found to overlap, the pads were merged and loads totalled and spread over the combined pad area. Where loads are indicated as wall loads, these have been modelled as having pad foundations with bearing area adjusted to limit pressure to 200kN/m^2 or less. These are indicative pad dimensions only.

The foundation dimensions and the foundation pressures calculated based on the allowable bearing capacity of around 200kN/m^2 that are input into the PDISP analysis are presented in Table 11. The loads have been referenced on Figure 6.

Table 11. Summary of Proposed Column Loads and Indicative Required Foundation Areas

Load reference	*Proposed load (combined)[kN]*	*Required pad area (m^2)*	*Foundation pressure (kN/m^2)*
A	280	4	70.0
B	210	4	52.5
C	310	4	77.5
D	225	4	56.3
E	645	7.89	81.7
F	565	6.014	93.9
G	200	4	50.0
H	640	4	160.0
I	210	4	52.5
J	260	4	65.0
K	800	5.0625	158.0
L	320	4	80.0
M	280	4	70.0
N	210	4	52.5
O	310	4	77.5
P	310	16	93.8
Q	300		
R	685		
S	280		
T	235	4.41	150.8
U	665	4	52.5

It is understood that the perimeter liner wall loads will be carried by the contiguous pile wall and as such have not been included in the PDISP analysis.

7.5.2.2 Underpin loading

The existing foundations of the existing Barrie House structure, for the north west ground floor wall, are understood to be founded at 43.85mOD within the London Clay Formation. The underpins are proposed to be founded at 40.35mOD, within the London Clay Formation, 0.5m below the proposed slab formation level of 40.85mOD. The underpin arrangement and loads have been supplied by the structural engineer. The underpin loads have been input to PDISP as gross loads. The underpin column and wall loads have been spread over the areas indicated by the drawing Proposed Lower Ground Floor Plan P_20 provided in Appendix B. The underpinned pad foundations sizes will match the dimension of the existing pad foundations.

7.5.3 PDISP analysis results

The predicted short term and long term total ground movements for the proposed development are presented in Figure 7. The movements are summarised in Table 12.

Table 12. Predicted Vertical Movement Summary

Stage	*Max heave within basement footprint (mm)*	*Max settlement within basement footprint (mm)*	*Max vertical movement at No. 72 Kingsland (closest neighbouring property) (mm)*
Short term	8.0	0.0	0.0
Total movements	8.5	0.5	Less than 0.5

The total vertical movements at the closest neighbouring properties of No. 16 and No.72 Kingsland at the proposed new basement formation level (40.35mOD) are predicted to be less than 0.5mm.

The vertical movements from the demolition of the porters lodge at ground level (46mOD) are predicted to be a maximum of 8.5mm of heave in the long term. This is predicted to dissipate to less than 1mm at approximately 7m from the porters lodge. The movements due to the demolition are predicted to be negligible at the neighbouring properties.

The PDISP analysis output summary is provided in Appendix E.

7.6 Damage Assessment – Cumulative Movements

The cumulative total movements at the closest neighbouring properties of No. 16 and No. 72 Kingsland due to the proposed basement development are summarised in Table 13 and Table 14. The cumulative vertical movements have been calculated from the combined pile wall installation, deflection and excavation movements and the unloading / reloading movements. The horizontal movements that will impact the neighbouring properties are anticipated to be from the pile wall installation, deflection and excavation movements only. The deflections and horizontal strain have been calculated for No. 72 and No. 16 assuming 5m widths of buildings. The cumulative movements at the neighbouring properties are presented on Figure 8 and corresponding damage categories on Figure 9.

Table 13. Summary of Cumulative Horizontal Movements

Property	*Horizontal movements from piled wall installation and basement excavation (mm)*	*Cumulative horizontal movements (mm)*	*Maximum horizontal strain (%) over property*
No.72 Kingsland	3.7	5.9	0.048
No. 16 Kingsland	2.5	4.4	0.037

Table 14. Summary of Cumulative Vertical Movements

Property	*Vertical movements from piled wall installation and basement excavation (mm)*	*Vertical movements from unloading / reloading of soil (mm)*	*Cumulative vertical movements (mm)*	*Maximum vertical deflection ratio over property*
No.72 Kingsland	-2.6	Negligible	-2.6	0.016
No. 16 Kingsland	-1.8	Negligible	-1.8	0.008

Note. +ve = heave, -ve = settlement

The assessment indicates that Damage Category 1 “very slight damage” is applicable for No. 72 and Damage Category 0 “negligible damage” is applicable for No. 16 Kingsland. The predicted movements at the neighbouring properties are small and are unlikely to result in damage in excess of Category 1 (‘very slight’). This is within the allowable limits specified within London Borough of Camden’s basement planning guidance.

A construction monitoring scheme will be required to demonstrate that movements are within those predicted by the CGL analysis. Monitoring will be carried out by the contractors or their representatives using targets and methods agreed with party wall surveyors prior to the beginning of construction.

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

8. SUBTERRANEAN (GROUNDWATER) FLOW

8.1 Introduction

This section provides a qualitative assessment of the effect the basement will have on the local hydrogeological regime and whether this will affect adjacent properties.

8.2 Groundwater Conditions

Groundwater has been found by CGL monitoring to be present on site at levels between 42.7mOD (1.9mbgl) and 44.8 (0.8mbgl) within the Weathered London Clay / London Clay Formation. The groundwater level was found to be deeper in the south of the site – indicating that if the groundwater encountered in WS1 and WS2 is laterally consistent – it is likely to flow down gradient to the south of the site. The flow rates through the London Clay would be expected to be very slow and a regional 'water table' would not be mobile and affected by the proposed development.

Whilst groundwater was encountered in both window sample boreholes WS1 and WS2 it was not encountered in borehole BH1 or window sample WS3. It is therefore considered likely that the groundwater is not laterally persistent. Based on this and the low permeability of the strata the groundwater is in, the proposed excavation is not anticipated to act as an obstruction to groundwater flow or to have a significant impact on local groundwater.

8.3 Impact on Adjacent Properties/Infrastructure

No significant change in groundwater pressures around the site perimeter is anticipated and therefore ground movements / settlement due to changing groundwater levels are not expected to occur.

8.4 Recommendations for Groundwater Control

The basement will be constructed using a combination of underpinning and contiguous piling. These structures will help to restrict ingress of water into the excavation. As the groundwater has been encountered within the London Clay Formation, a relatively impermeable soil, ingress would be expected to be slow and manageable through groundwater control measures such as sump pumping.

9. SURFACE FLOW AND FLOODING

9.1 Flood Risk

With reference to EA mapping, the site is at a ‘low’ risk from surface water flooding. The proposed excavation for the basement will be on an area currently covered by hardstanding. As such the excavation will not change the potential for surface water flooding. It is noted the site did not experience flooding in the significant flooding events in 1975 and 2002.

There could potentially be a marginal change in route on site as surface water will flow around the proposed above ground extension where currently it can flow over the carpark area. This would be a very minor change in route however as the surface water would already flow around the existing building in the general north east to south west direction. The nearest surface water feature (excluding historical features) is over 300m from the site and any changes in surface water flow on site would be expected to dissipate over this distance, being negligible at the surface water feature.

10. NON-TECHNICAL SUMMARY

10.1 Conclusions

The results of this Basement Impact Assessment are informed by the previous site investigation[2], CGL groundwater monitoring visits and published and unpublished records. The analysis is also informed by drawings and loadings provided by the structural engineer, and is undertaken on the assumption of high quality workmanship during the construction of the basement.

- The ground conditions on site comprise a thin layer of Made Ground over cohesive Weathered London Clay and subsequently the London Clay Formation.
- The construction of the basement will generate ground movements due to a variety of causes including heave, settlement, and installation of a contiguous pile wall and underpin deflection. However, there are no party wall structures and the nearest neighbouring structure is approximately 7.5m from the proposed development.
- Based on a typical 45° load spread from the proposed development the neighbouring structures will be out of the zone of influence of the proposed development.
- The movements due to excavation of the basement and installation of the contiguous pile wall are anticipated to dissipate to less than 1mm at a distance of 14.0m from the pile wall and as such will not significantly impact the neighbouring structures.
- The largest movements at the neighbouring structures due to the excavation and installation of the piled wall and excavation behind the wall are anticipated to be 3.7mm of horizontal movement at the southern corner of No.72 Kingsland and 2.5mm of horizontal movement at No. 16 Kingsland.
- The vertical movements due to installation of the piled wall and excavation behind the wall are predicted to be 2.6mm and 1.8mm of settlement at No.72 and No.16, respectively.
- The maximum vertical ground movement from unloading/ reloading of soils, at the neighbouring properties is predicted to be less than 1mm.
- The assessment indicates that Damage Category 1 “very slight” will be applicable to No. 72 Kingsland, whilst Damage Category 0 “negligible” will be applicable t No. 16 Kingsland.
- It is currently proposed to underpin foundations along one wall of the existing Barrie House structure. It is noted that settlement of the underpins would not affect neighbouring properties.

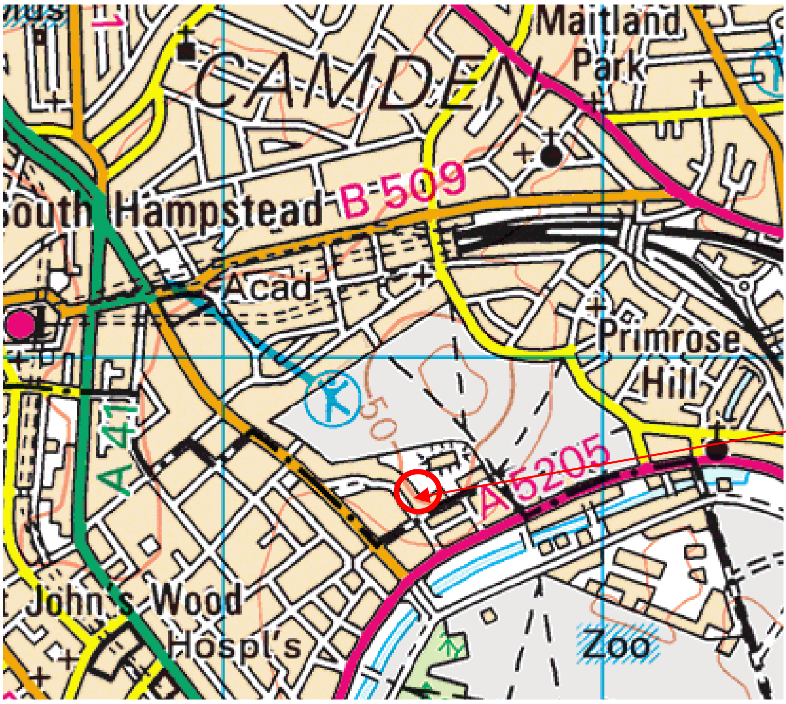
- Groundwater has been encountered within the Weathered London Clay / London Clay Formation on site. Due to the low permeability of the London Clay Formation, water ingress is anticipated to be low. Groundwater control is likely to be achieved by sump pumping as the excavation proceeds.

- It is recommended that prior to construction commencing, a condition survey be conducted for the neighbouring properties. Once construction begins the movement of the walls and the facades of the adjoining properties should be regularly monitored.

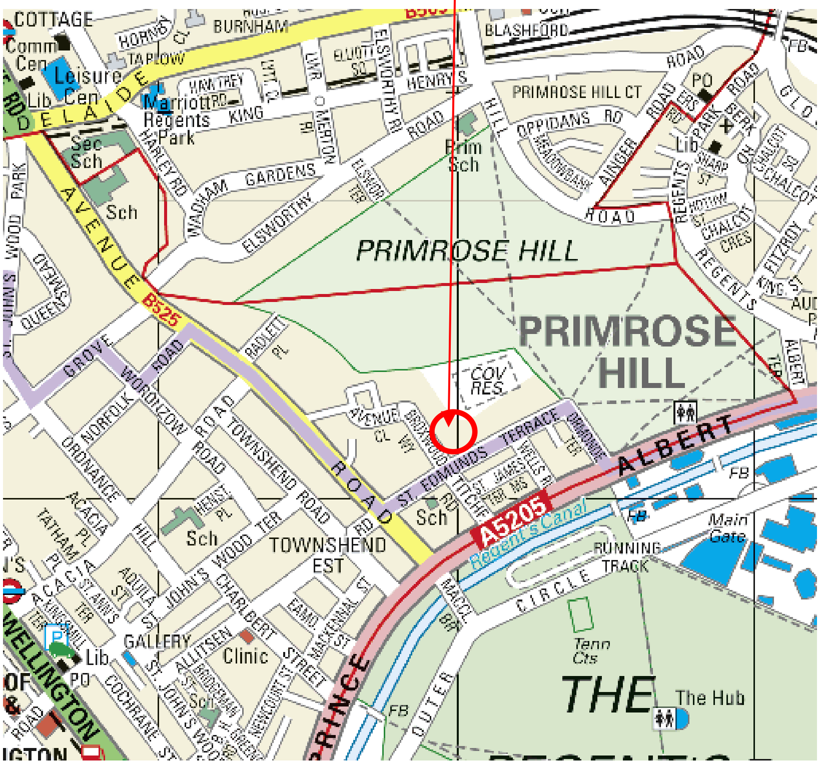
- It is predicted that the proposed development will have a negligible impact on the neighbouring properties and at the nearby roads of Broxwood Way and St Edmunds Terrace.

- The proposed footprint of the basement is currently covered by hardstanding. Therefore surface water flow and water ingress into the ground will not change. Groundwater has been identified in some areas on site and is likely to be encountered during excavation, however ingress rates are anticipated to be slow. Groundwater ingress is likely to be controlled through normal sump and pump dewatering.

FIGURES



Site location: Barrie House, NW8 7QH



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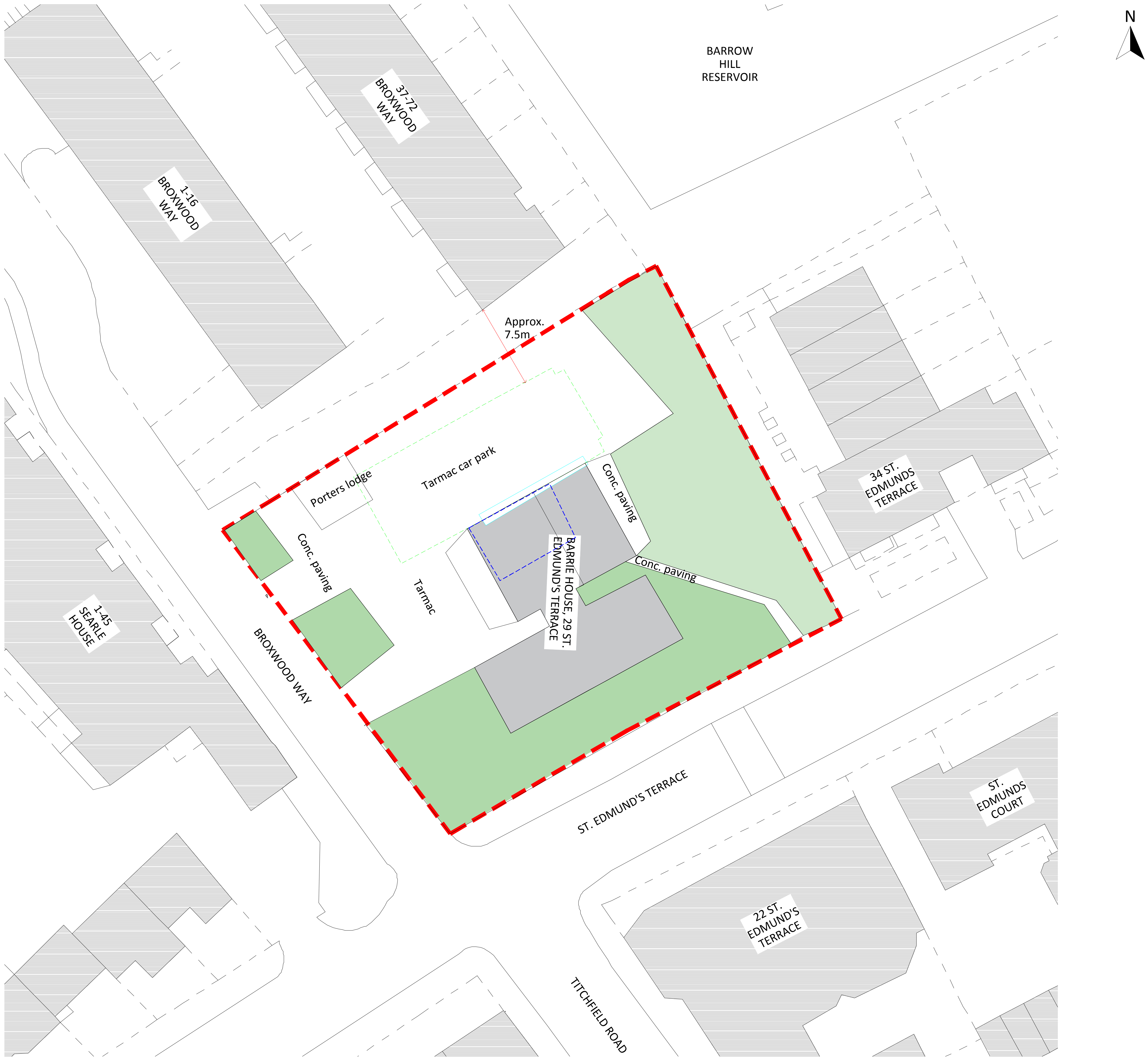
Client	Project	Job No
Parmarbrook	**Barrie House**	**CG/28408**
	Title **Site Location Plan**	**Figure 1**



KEY

- Site Boundary
- Proposed new basement outline (approx.)
- Section of wall to be underpinned
- Existing Barrie House structure
- Existing areas of soft landscaping
- Backfilled void area

Rev	Date	Comments
0	02/01/18	

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Surrey
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Project: **Barrie House, London**

Client: **Parmabrook**

Drawing title: **Figure 2 - Site Layout Plan**

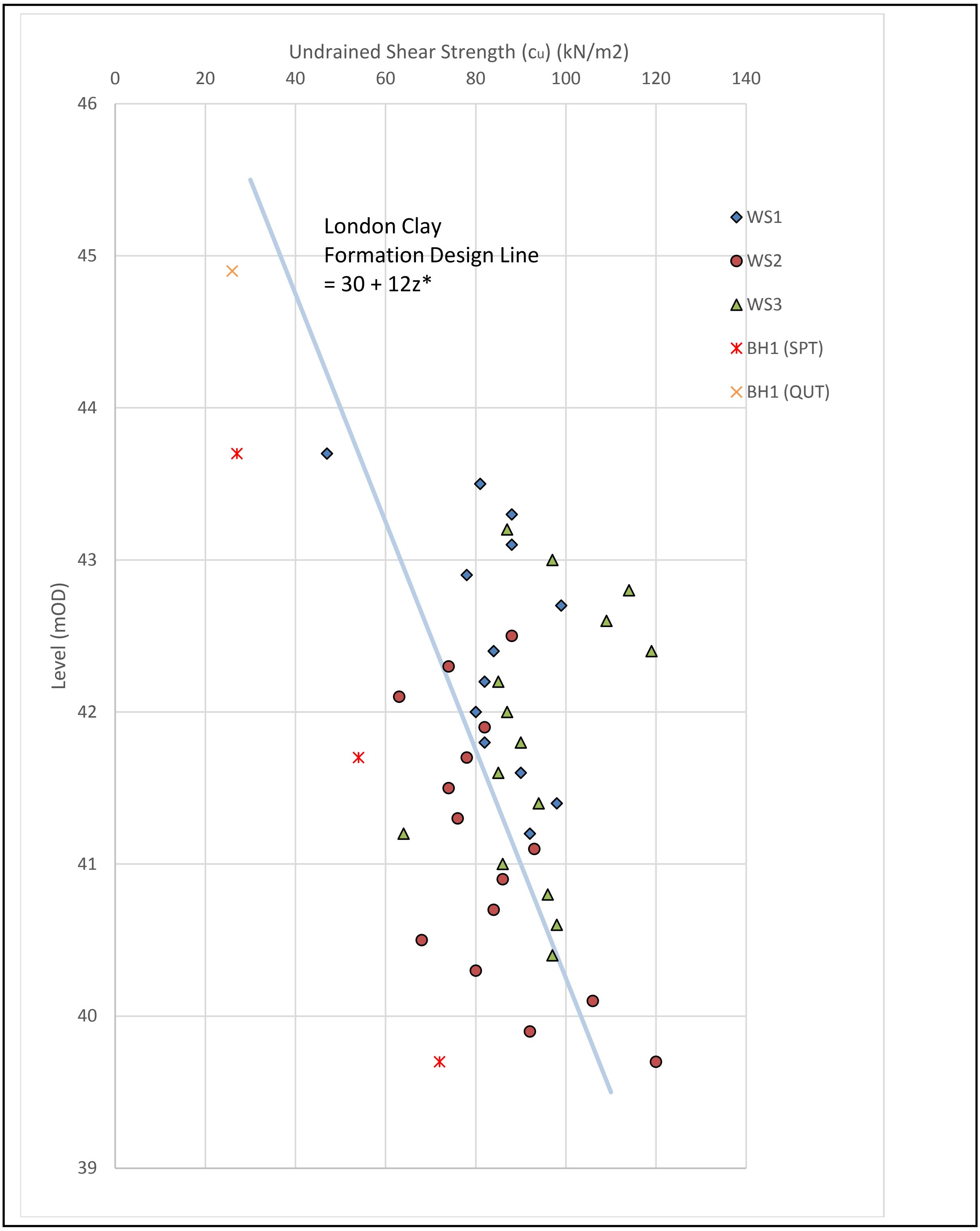
Scale(s): **NTS**

Job No.: **CG/28408**

Drawn	TSB	02/01/18
Checked	JMS	02/01/18
Approved	RJB	03/01/18

Dwg No.: **CG/28408-001**

Rev.: **0**



z = depth below top of strata

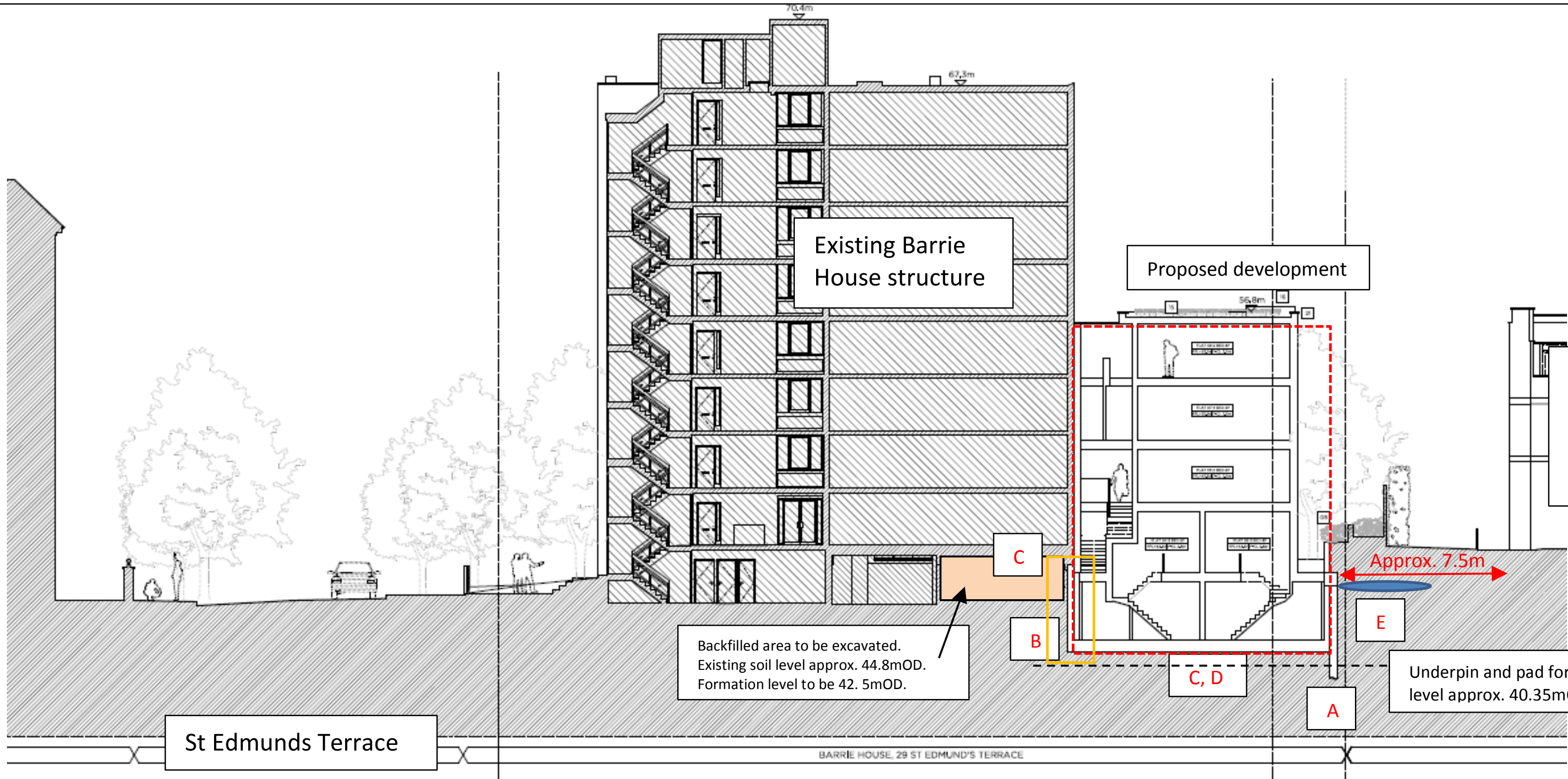
Client	Project	Job No
Parmarbrook	**Barrie House**	**CG/28408**
CGL	Title **Undrained Shear Strength (c_u) vs Level**	**Figure 3**

Potential source of ground movement:

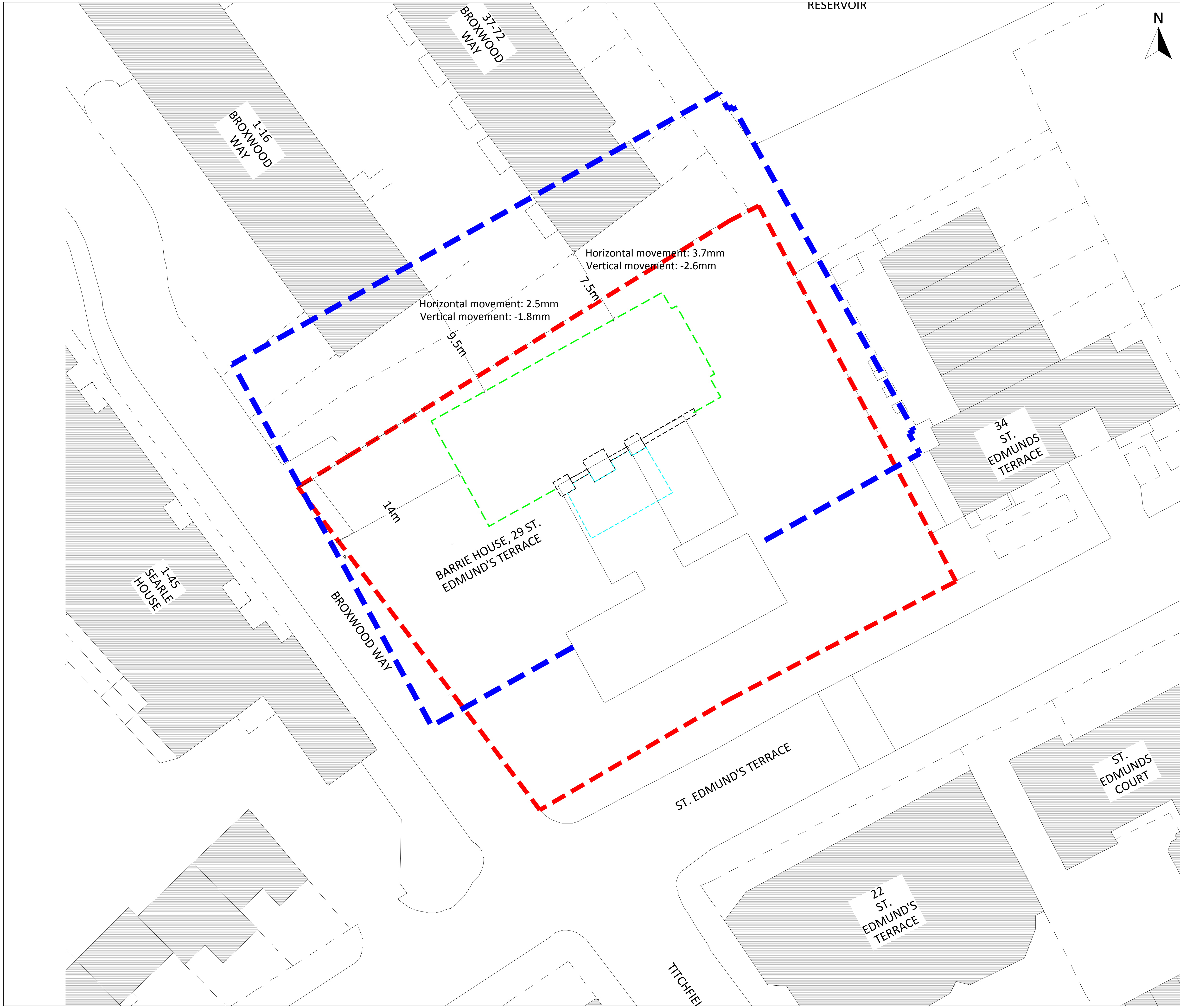
A. Contiguous pile wall installation and deflection during excavation
B. Possible settlement due to underpinning of existing Barrie House structure
C. Possible short and long term heave due to unloading of London Clay Formation
D. Possible settlement due to building loads of the proposed development

Groundwater:

E. Groundwater present on site within the London Clay Formation - the groundwater is located within a relatively impermeable soil and if groundwater is encountered during the excavation of the lower ground floor ingress is expected to be slow and manageable.



Client	Project	Job No
Parmarbrook	**Barrie House**	**CG/28408**
CGL	Title **Conceptual Site Model**	**Figure 4**



KEY

- Site Boundary
- Distance to negligible movements (<1mm)
- Proposed contiguous pile wall (approx.)
- Backfilled void area
- Underpinning locations

Notes.

1. -ve vertical movement = settlement

Rev	Date	Comments
1	25/01/18	

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Project: **Barrie House, London**

Client: **Parmabrook**

Drawing title: **Figure 5 - Excavation and Pile Wall Installation Movements - Distance to Negligible Movements Plan**

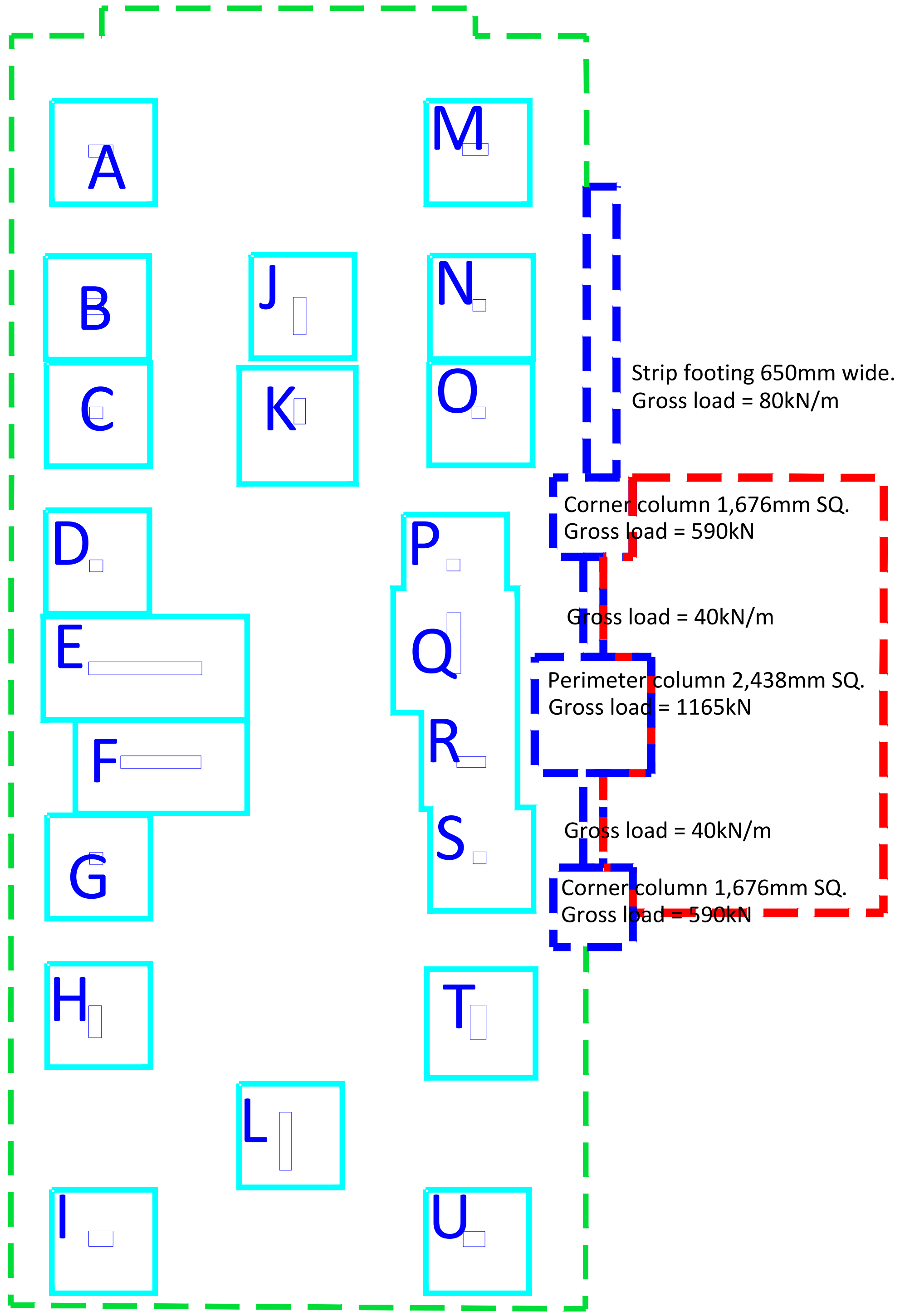
Scale(s): **NTS**

Job No.: **CG/28408**

Drawn	TSB	02/01/18
Checked	JMS	02/01/18
Approved	RJB	03/01/18

Dwg No.: **CG/28408-002**

Rev.: **0**



KEY

Proposed contiguous pile wall

Indicative pads for PDISP model

Proposed column / wall load locations

Underpinning locations

Backfilled void area to be excavated

Rev	Date	Comments
1	25/01/18	MRG-Update underpin details and backfilled void area

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Project: **Barrie House, London**

Client: **Parmabrook**

Drawing title: **Figure 6 - Column Load Reference Plan and Indicative Pads**

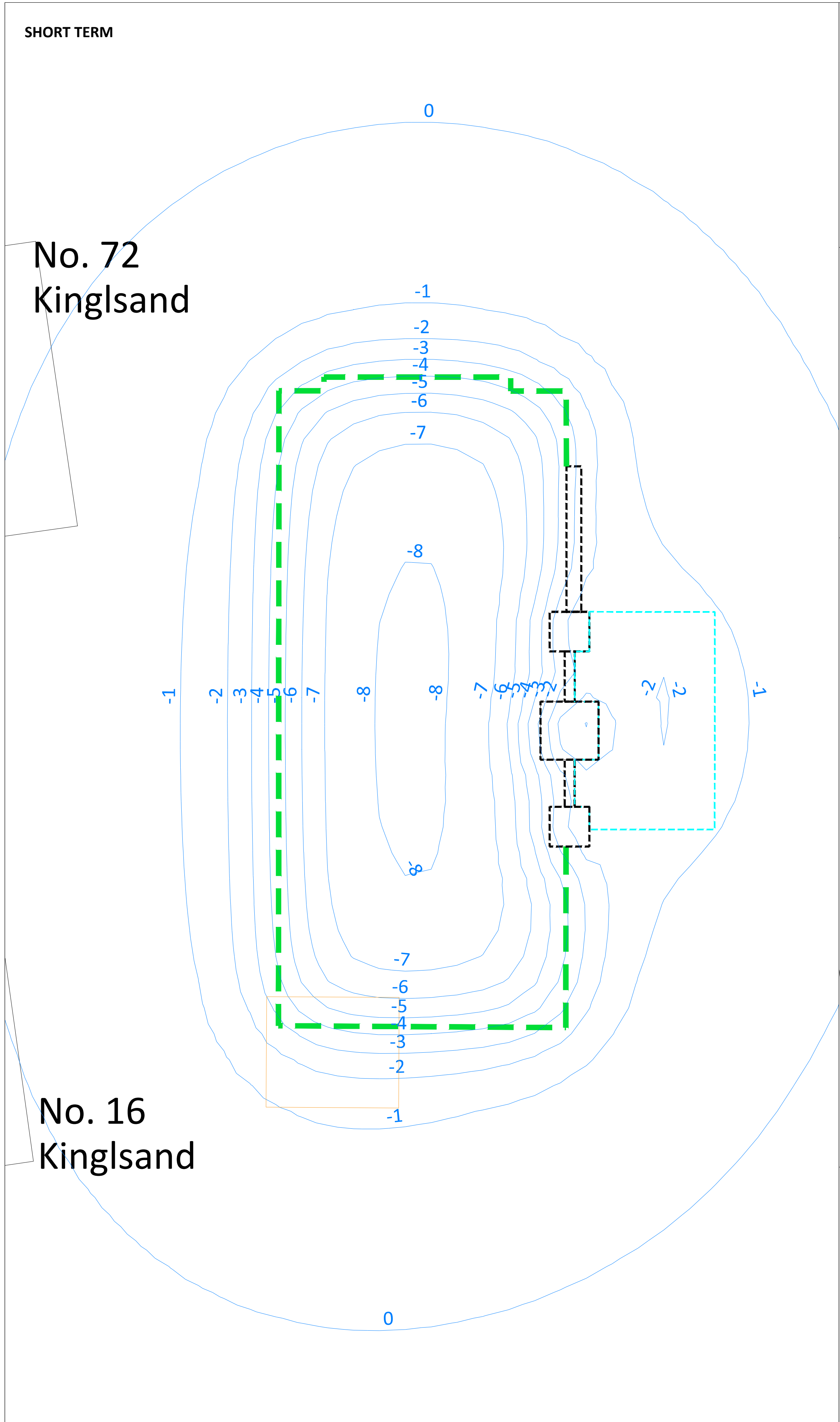
Scale(s): **NTS**

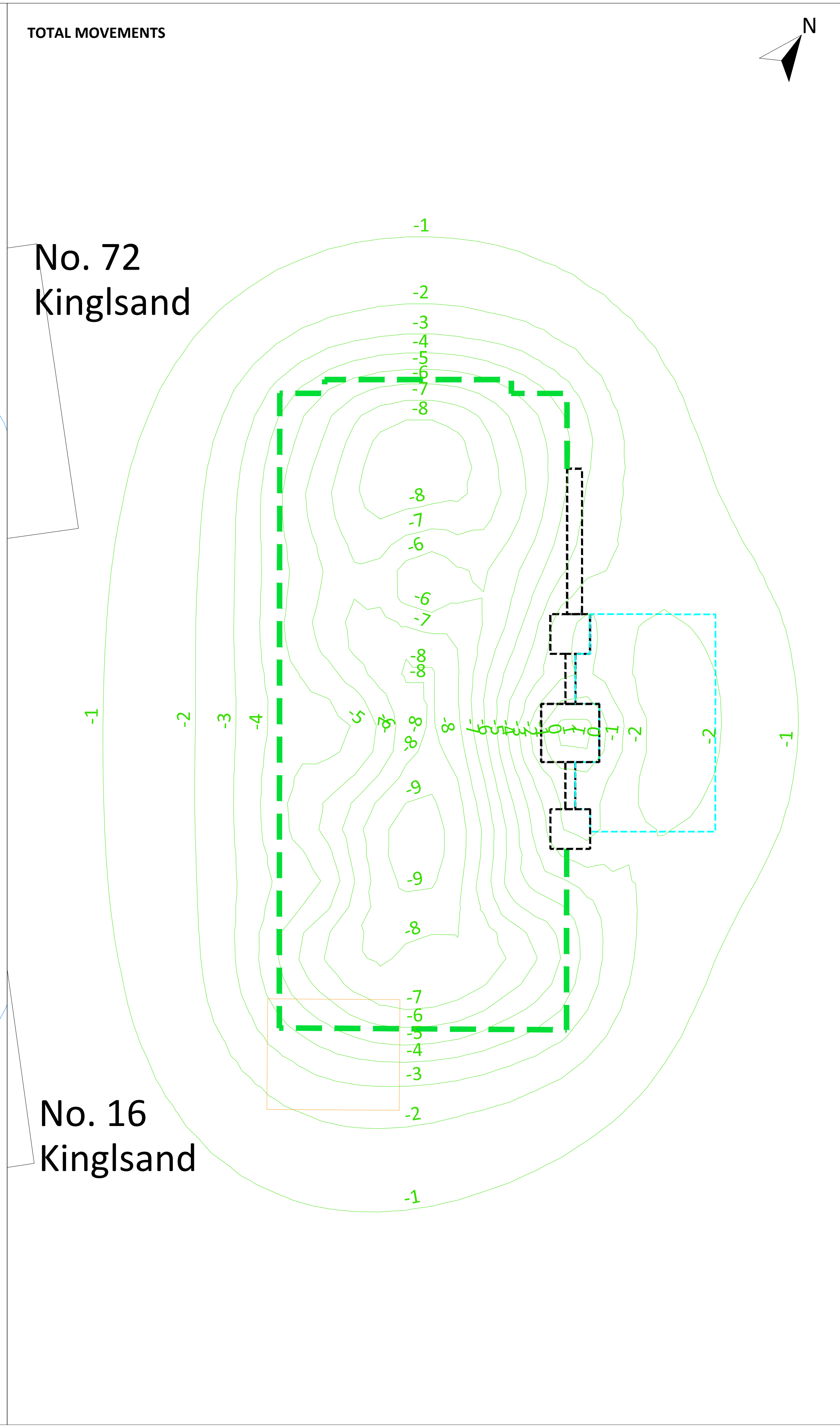
Job No.: **CG/28408**

Drawn	TSB	02/01/18
Checked	JMS	02/01/18
Approved	RJB	03/01/18

Dwg No.: **CG/28408-003**

Rev.: **1**





KEY

Proposed contiguous pile wall

Underpinned section

Backfilled void area to be excavated

Porters lodge (at Ground Level 46.0mOD)

Notes

1. Contours are in mm.
2. Postive values indicate settlement and negative values indicate heave.

Rev	Date	Comments
0	02/01/18	

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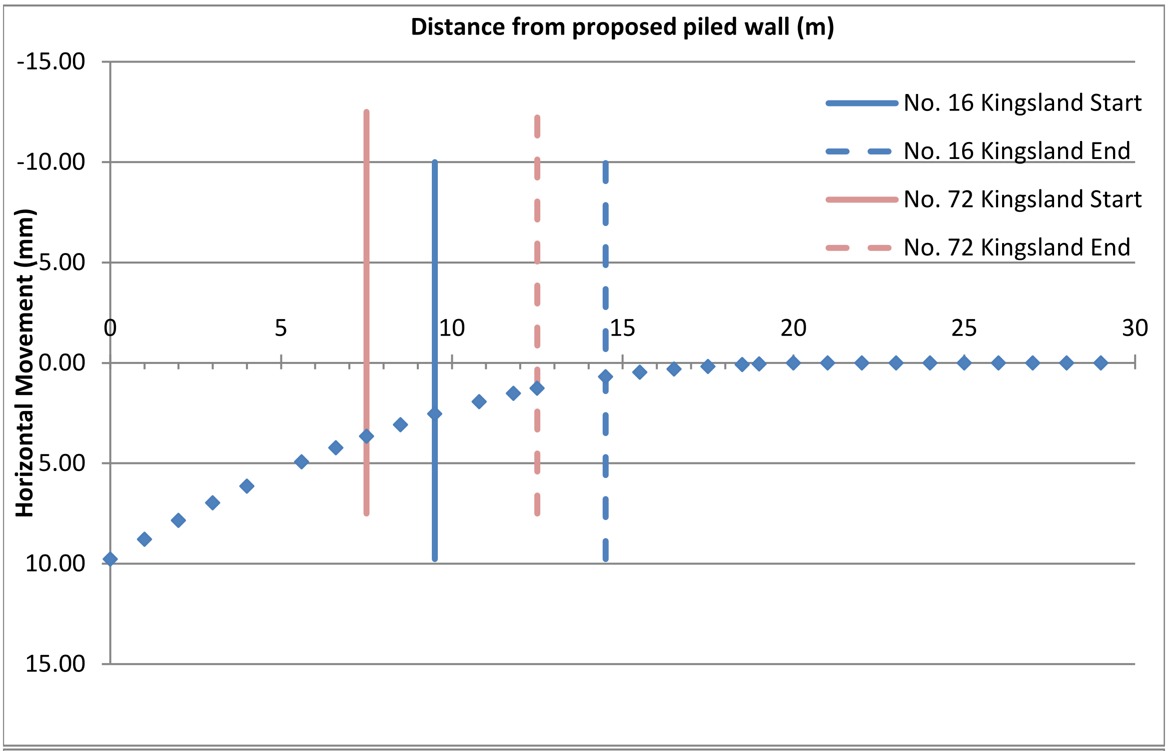
Project **Barrie House, London**

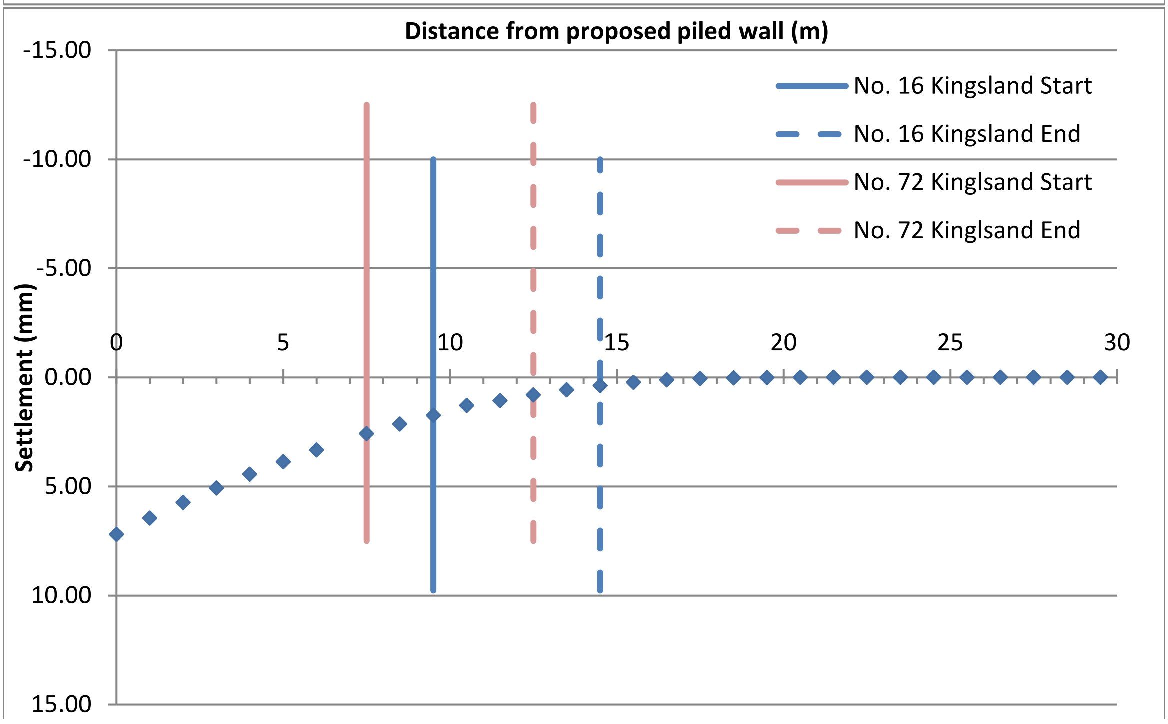
Client **Parmabrook**

Drawing title **Figure 7 - Vertical Ground Movements at Formation Level (40.35mOD)**

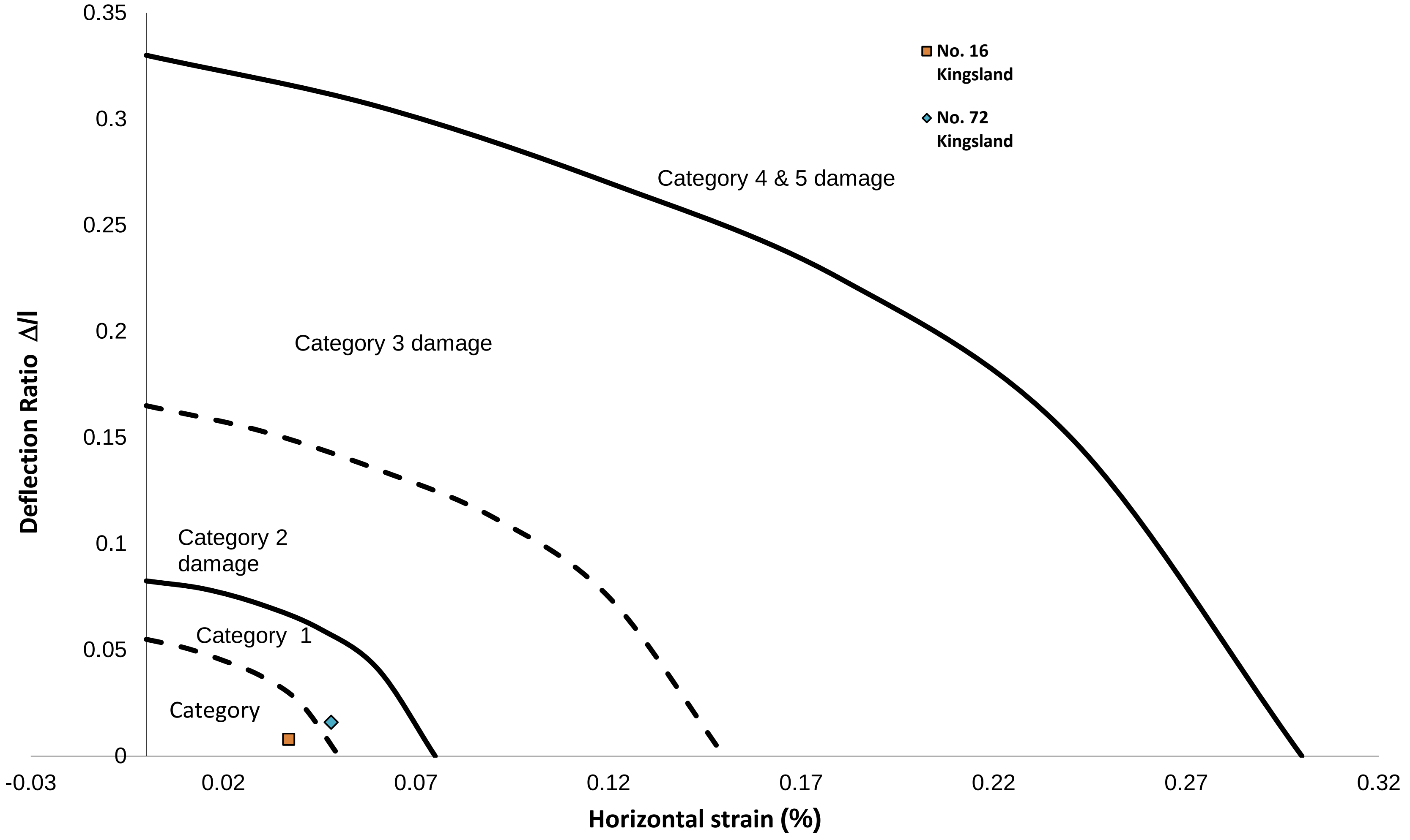
Scale(s)	Job No.
NTS	**CG/28408**

			Dwg No.	Rev.
Drawn	TSB	26/01/18	**CG/28408-004**	**0**
Checked	JMS			
Approved	RJB			





Client	Project	Job No
Parmarbrook	**Barrie House**	**CG/28408**
CGL	Title **Horizontal and Vertical Movements at Neighbouring Properties**	**Figure 8**



Client	Project	Job No
Parmarbrook	**Barrie House**	**CG/28408**
CGL	Title **Building Damage Assessment**	**Figure 9**

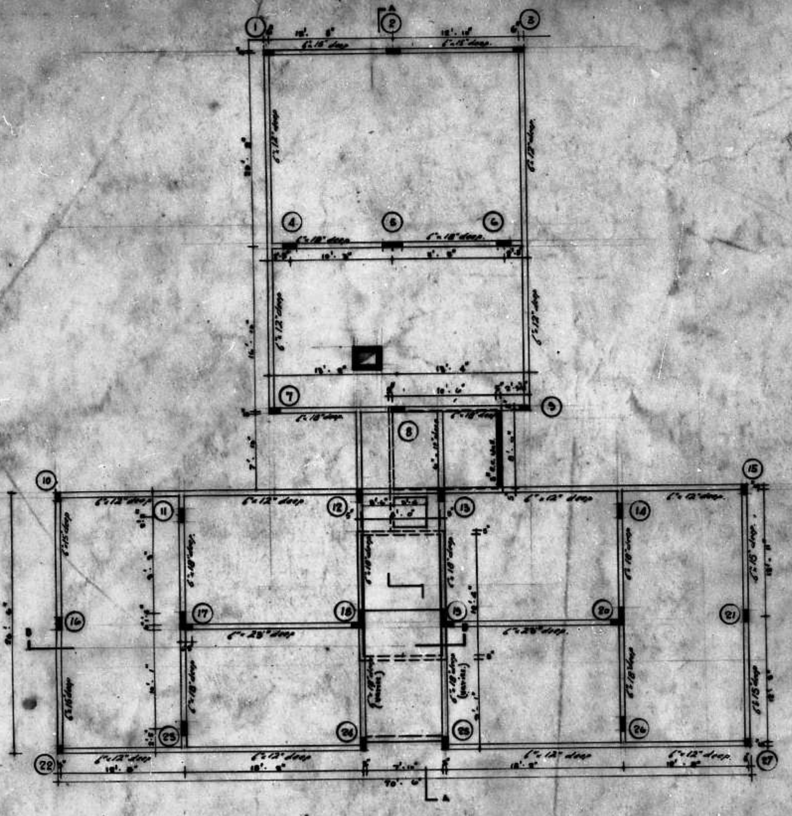
APPENDIX A

Historical Structural Drawings

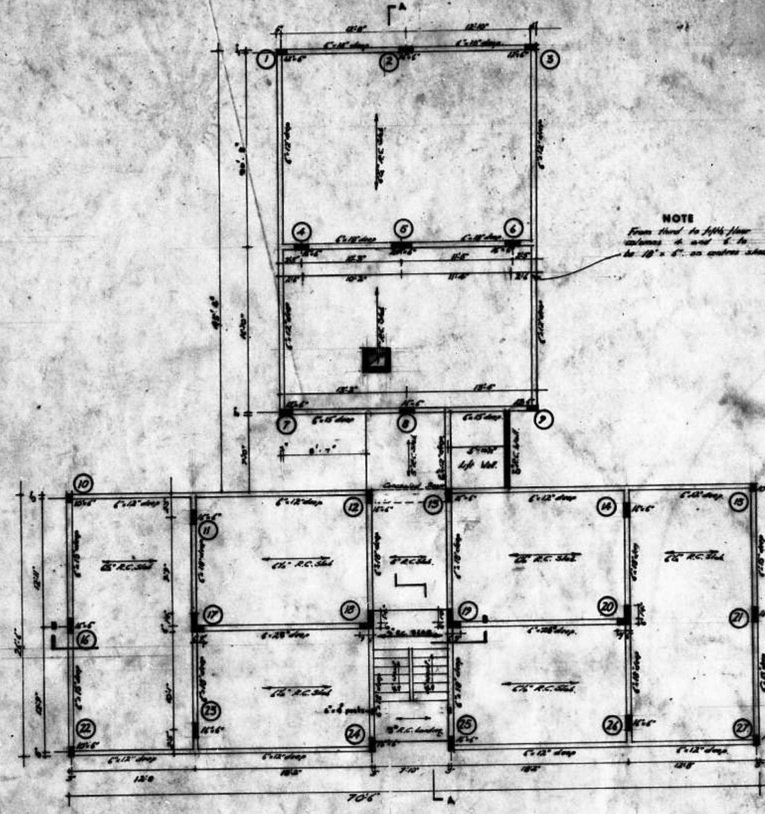
NOTES:-

CONCRETE MIXES:-

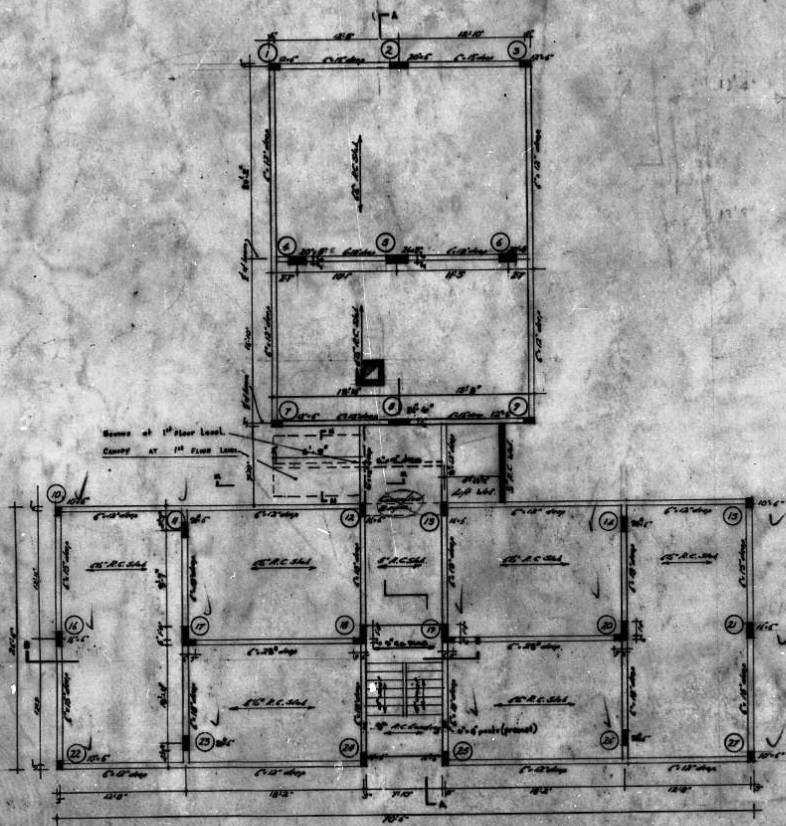
GRADE "A" CONCRETE TO BE USED IN ALL COLUMNS, AND ALL CROSS BEAMS. | Grade above 4th flr.
6" COLUMNS TO HAVE LIMESTONE AS AGGREGATE.
GRADE "B" CONCRETE TO BE USED IN ALL LONGITUDINAL EDGE BEAMS.
GRADE "C" CONCRETE TO BE USED IN ALL SLABS AND STAIRCASES;
IN BASEMENT WALL AND FLOOR "C.W." TO BE USED
GRADE "E" CONCRETE TO BE USED IN ALL COLUMN FOOTINGS.
GRADE "F" CONCRETE TO BE USED FOR BLINDING CONCRETE UNDER BASEMENT.
GRADE "G" CONCRETE TO BE USED FOR BLINDING CONCRETE TO FOOTINGS.
SULPHATE RESISTING CEMENT TO BE USED IN ALL CONCRETE AND MORTAR IN CONTACT WITH THE SOIL, EXCEPT SKIRT BEAMS.
IN ALL 6" WIDE COLUMNS EITHER LIMESTONE AGGREGATE OR ¼" MESH TO BE USED AS SPECIFIED.



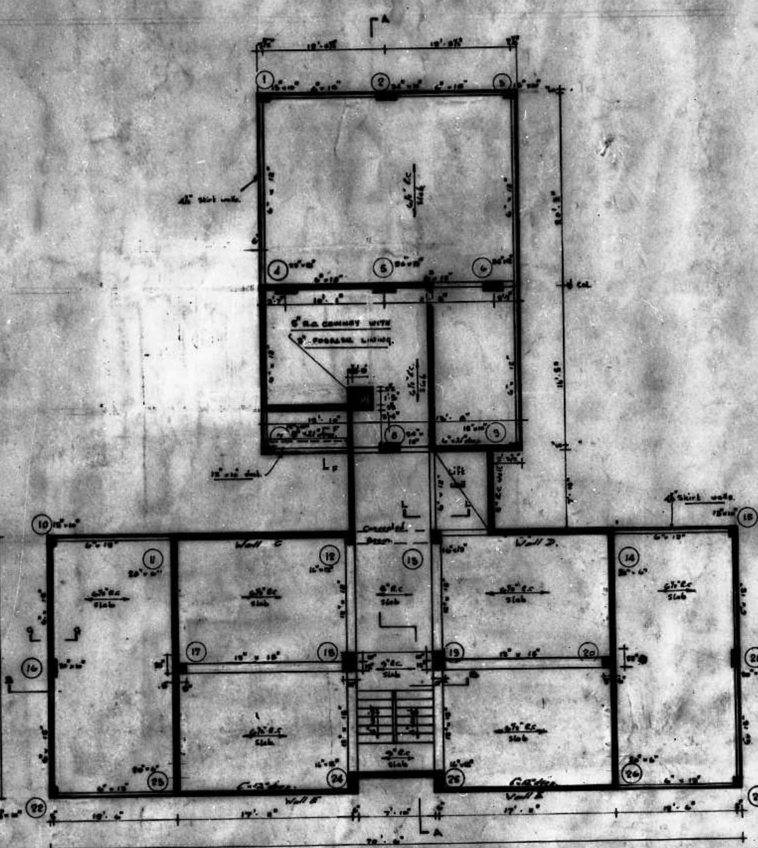
ROOF PLAN



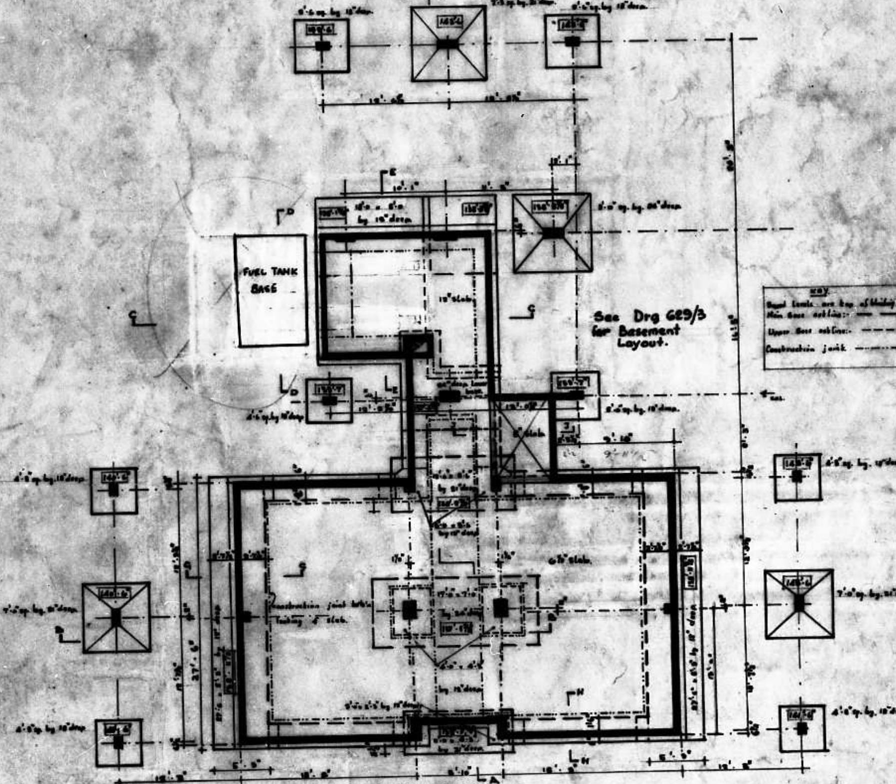
SEVENTH FLOOR PLAN
SIXTH TO THIRD FLOORS SIMILAR



SECOND FLOOR PLAN
FIRST SIMILAR



GROUND FLOOR PLAN



FOUNDATION PLAN

ISSUE	DATE	AMENDMENTS
A	21 Aug 57.	Floor plan revised.
B	OCT. 1957.	VARIOUS AMENDMENTS.
C	OCT. 1957	VARIOUS MINOR AMENDMENTS, BASEMENT & FOUNDATION ADDED
D	NOV. 1957.	MINOR ALTERATIONS AND ADDITIONS.
E	NOV. 1957.	SETTING OUT ; 4 DIM. and COL. SIZES ALTERED.
F	Mar 58	Beam 7-8-9 at ground floor level amended.
G	APR. 58	FUEL HOPPER REMOVED.

TITLE

29 ST EDMUNDS TERRACE N.W.8.

FLOOR PLANS FOUNDATION PLAN

SCALE 1/8" TO 1' 0"

ARCHITECT
PLANNING & DEVELOPMENT LTD
20 KNIGHTSBRIDGE S.W.1.

DRG. No 629/1g

DRAWN	R.S.L.R. & T.T.L.
DATE	AUGUST 57.
CHECKED	P

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