



Alexander Smirnov

**'Guildens', Courtenay
Avenue, Highgate, London**
Basement Impact Assessment

Revision 2

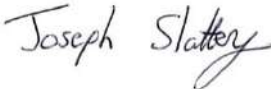
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Card Geotechnics Limited
4 Godalming Business Centre
Woolsack Way, Godalming GU7 1XW
Telephone: 01483 310600
www.cgl-uk.com

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Author	Thomas Perry, Graduate Engineer <i>MEng (Hons) GMICE</i>				
	Hal Godwin, Chartered Senior Engineer <i>MSc BSc (Hons) DIC CGeol FGS</i>				
Checked	Tom Fairweather, Principal Engineer <i>MSc BSc DIC CGeol FGS RoGEP</i>				
Approved	Joseph Slattery, Technical Director <i>MEng (Hons) BEng CEng MICE MIEI FGS RoGEP</i>				
	Nick Langdon, Director <i>MSc BEng DIC CEnv CEng CMgr FICE FGS FCMI MIOd</i>				
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1. INTRODUCTION

Card Geotechnics Limited (CGL) has been instructed by BTP Group on behalf of Alexander Smirnov (“the Client”) to undertake a Basement Impact Assessment (BIA) for the proposed residential development at ‘Guildens’ house, Courtenay Avenue, Highgate, London. The proposed development involves demolishing a detached three storey building, which includes a lower ground level, and constructing a five storey (three storeys above ground level) detached residential building. The development includes increasing the footprint of the existing lower ground level and creating a new single basement level limited to the north-west corner of the proposed development.

A site investigation and geotechnical factual and interpretive report have been completed by CGL¹. The findings of this previous report have been used within this report with regard to ground conditions and geotechnical parameters of the conditions on the site.

The site is location within the London Borough of Haringey and under Policy DM18 of the Development Management DPD² a Basement Impact Assessment (BIA) must be submitted as part of the planning application. As the borough does not have a Supplementary Planning Document (SPD) specifically for BIAs, the Camden Planning Guidance on Basements³ Planning Document (SPD) adopted by the London Borough of Camden will be used.

This report identifies key issues relating to land stability, hydrogeology and hydrology. It reviews existing site investigation data in the vicinity of the site and also data from an investigation carried out on the site itself. The report provides an impact assessment of potential ground movements on adjacent properties and the hydrogeology of the surrounding area for the purpose of planning.

The original version of this BIA was completed in July 2018. This current revision of the BIA re-assesses the anticipated ground movements resulting from recent revisions to the proposed redevelopment works on site.

¹ CGL (2017). ‘Guildens’, Courtenay Avenue, Highgate, London – Geotechnical Factual and Interpretive Report-Revision 1. July 2017.

² London Borough of Haringey. (2017). *Development Management DPD*. (July 2017)

³ London Borough of Camden. (2021). *Camden Planning Guidance Basement*. (January 2021)

2. SITE CONTEXT

2.1 Site location

The site is located at 'Guildens' house, Courtenay Avenue, Highgate, London, N6 4LP. The National Grid Reference of the approximate centre of the site is 527060E, 187824N. The location of the site is shown in Figure 1.

2.2 Site layout

The site covers an area of approximately 2400m², with the existing building occupying an approximate area of 320m² and consists of a front garden with off-road parking, the existing property and a rear garden with a tennis court. The rear garden is accessible via footpaths along the sides of the property. The existing property has three levels including a lower ground level. Due to the ground level at the front of the building being higher than at the rear, the lower ground level is founded at ground level at the rear of the property and below ground at the front of the property. The existing lower ground level has a formation level of approximately 99.5mOD.

About 3m from the existing northern edge of 'Guildens' is the neighbouring property 'Blue Orchard'. The property is detached and is assumed to not have a basement level but does have a lower ground level, which is assumed to be at the same level as 'Guildens' lower ground level. About 10.7m from the existing southern edge of 'Guildens' is another neighbouring property called 'Braken Knoll'. This property is also detached and has a basement level at a formation level of approximately 99.74mOD.

Ground level across the site varies, with the ground level at the front of the property (to the west of the property) at approximately 101.86m above Ordnance Datum (mOD) and at the rear of the property (to the east of the property) at between approximately 99.03-100.92mOD. Additionally, the site is located on a gentle slope with a downward gradient running from south to north.

Drawings showing the existing layout of the property can be found in Appendix A and the site layout plan in Figure 2.

2.3 Proposed development

It is currently proposed to demolish the existing property. The proposed building will have three levels above ground level, a lower ground level and a basement level. The footprint of the property will be extended towards the rear (towards the east) and along the southern side of existing property. The proposed lower ground level will occupy and expand the existing lower ground level to the extent of

the above ground levels. The basement level will be limited to the north and west of the proposed property footprint.

It is proposed to retain the excavated faces around the majority of the lower ground level using a pile retaining wall. Shallow foundations will be used to support the internal spine wall and external wall where a retaining wall is not required. The excavated basement level will be retained using a pile wall.

A copy of the proposed development drawings can be found in Appendix B.

2.4 Geology

2.4.1 Published

According to the British Geological Survey⁴ (BGS) there are no superficial geological deposits of soil in the area around the site. Figure 3 shows the “bedrock” deposits of soil in and around the site. The map shows the site to be located on a deposit of Claygate Member, which is formed of clay, silt and sand. To the north of the site lies the London Clay Formation consisting of clay, silt and sand. To the south lies the Bagshot Formation which is made up of sand.

2.4.2 Unpublished

A borehole record located approximately 30m to the north of the site along Courtenay Avenue, was drilled to a depth of 15m below ground level (mbgl). The record shows the Claygate Member to a depth of 8mbgl and described as a silty slightly sandy clay. Below this to 15m, silty clay was recovered, described as London Clay Formation. The location of this borehole and the record itself is provided in Appendix C.

2.5 Hydrogeology & hydrology

The historical borehole record in Appendix C shows that groundwater was struck during drilling at 3.95mbgl. Given the close proximity and the likelihood of similar ground conditions, it is possible that groundwater will be encountered on site at ‘Guildens’ house.

The site is situated over a Secondary A aquifer⁵, due to the underlying stratum having sufficient permeability to support water supplies.

⁴ British Geological Survey. (2018). Geology of Britain viewer. [ONLINE] Available at <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>. July 2018.

⁵ Natural England. 2018. Magic Map. [ONLINE] Available at <http://magic.defra.gov.uk/MagicMap.aspx> [Accessed 20 July 2018].

There are no significant surface water bodies within the vicinity of the site. Additionally, there are no nearby lost rivers within approximately 570m radius of the site. The Upper Mutton Brook is present at the downhill end of Courtenay Avenue and therefore does not present a flood risk.

Information provided by the Environment Agency⁶ indicates that the site is within flood risk zone 1, which indicates an area with low probability of flooding.

⁶ Environment Agency. (2018). Flood map for planning. [ONLINE] Available at <https://flood-map-for-planning.service.gov.uk/>. July 2018.

3. SCREENING

3.1 Introduction

A screening assessment has been undertaken to assess the potential risk posed to local hydrology, hydrogeology and land stability. The assessment is undertaken in the form of a series of tables, setting out the questions with regard to the primary concerns associated with the proposed construction. Where 'yes' or 'unknown' may be simply answered with no analysis required, these answers have been provided.

3.2 Subterranean (groundwater) flow

This section answers questions relating to subterranean (groundwater) flow in Table 1 below.

Table 1. Subterranean (groundwater) flow

Question	Response	Action Required
1a. Is the site location directly above an aquifer?	Yes. The site is located over the Claygate Member which is designated as a Secondary A aquifer.	Investigation and Assessment
1b. Will the proposed basement extend beneath the water table surface?	Very likely. Historical borehole record indicates a groundwater level of around 3.95mbgl.	Investigation and Assessment
2. Is the site within 100m of a watercourse, well or potential spring line?	No.	None
3. Will the proposed development result in a change in the proportion of hard surface/paved external areas?	Yes. It is proposed that the new building will exceed the footprint of the existing property.	Investigation and Assessment
4. As part of site drainage, will more surface water than at present be discharged to ground (e.g. via soakaways and/or SUDS)?	No. The published geology information for the area indicates that the site is situated over the Claygate Member stratum. While the permeability of this stratum can vary, it is not considered suitable for soakaway drainage.	None
5. Is the lowest point of the proposed excavation close to, or lower than, the mean water level in any local pond or spring line?	No. There is no indication of any local ponds or spring lines in the vicinity of the site.	None

In summary the site is located directly above a Secondary A aquifer within the Claygate Member stratum. Historical borehole logs as described in Section 2.4.2 indicate that the Claygate Member is the shallowest natural stratum meaning that the groundwater level could be close to ground level. Therefore it will be necessary to investigate the groundwater level during a site investigation. It is proposed to increase the footprint of the proposed development beyond the footprint of the existing building. However, there will still be a significant area of garden around the property to allow surface water to discharge into the ground if suitable.

3.3 Slope/Land stability

This section answers questions relating to slope or land stability in Table 2 below.

Table 2. Slope/land stability

Question	Response	Action Required
1. Does the site include slopes, natural or manmade, greater than 1 in 8?	No The gradient of the slope on which the site rests is approximately 1 in 40.	None
2. Will the proposed re-profiling of the landscape at the site change the slopes at the property greater than about 1 in 8?	No	None
3. Does the development neighbour land including railway cuttings and the like with a slope greater than about 1 in 8?	No	None
4. Is the site within a wider hillside setting in which the general slope is greater than about 1 in 8?	No. The site rests on a slope with an approximate gradient of 1 in 40.	None
5. Is the London Clay the shallowest stratum on the site?	No. BGS records show that the site is likely to rest of Claygate Member. Site investigation to confirm.	Investigation to confirm stratum levels
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?	Unknown.	This is beyond the scope of this report.
7. Is there a history of shrink/swell subsidence in the local area and/or evidence of such at the site?	Unlikely. BGS records indicate that the side is likely to rest on Claygate Member deposits. This stratum is less susceptible to shrink/swell behaviour than London Clay, which typically has a high volume change capacity.	Investigation and assessment
8. Is the site within an area of previously worked ground?	No. While the site is currently occupied by a residential building which is proposed to be demolished, there is no evidence to suggest that the ground around the building has been worked.	None
9. Is the site within 5m of a highway or pedestrian?	No. The existing building and proposed building will be further than 5m from the private road along Courtenay Road.	None
10. Will the proposed basement significantly increase the differential depth of the foundations relative to the neighbouring properties?	Yes The foundations for the proposed basement level are likely to be deeper than at least one neighbouring property.	Investigation and assessment
11. Is the site over (or within the exclusion zone of any tunnels)?	No.	None

In summary, an investigation and impact assessment is required to verify ground conditions and to access the magnitude of ground movements that may result from the proposed development, as these may affect neighbouring properties.

3.4 Surface flow and flooding

This section answers questions relating to surface flow and flooding in

Table 3. Surface flow and flooding

Question	Response	Action Required
1. 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. While it is proposed to extend the existing lower ground level and above ground levels into the rear garden by about 10.8m, the Claygate Member stratum typically has a low vertical permeability, meaning that existing surface infiltration will be limited. Therefore surface water flow is considered likely to remain unchanged.	None
2. Will the proposed development result in a change in the proportion of hard surfaced/paved external.	No. While it is proposed to increase the footprint of the property the Claygate Member typically has a low vertical permeability, which limits the existing infiltration rate. Therefore the infiltration rates are unlikely to change.	None
3. Will the proposed basement result in a change to profile of the inflows of surface water being received by adjacent properties or downstream watercourses?	No.	None
4. Will the proposed basement result in a changes to the quality of surface water being received by adjacent properties or downstream watercourses?	No.	None
5. Is the site in an area known to be at risk from surface flooding or is it at risk from flooding because the proposed basement is below the static level of a nearby surface water feature?	No. Environment Agency ⁶ maps show that the site is at low probability from flooding.	None

In summary, while the proposed development does involve increasing the footprint of the existing property, the existing ground conditions across the site limit vertical groundwater infiltration into the ground. Therefore, surface water infiltration rates are likely to remain the same. Environment Agency maps show the site to be in 'Flood Zone 1' and therefore the site is at low probability from flooding. As a result, a flood risk assessment is not required.

3.5 Non-technical summary

Based on the screening exercise, a BIA is required for this site, which will address the following:

1. Groundwater flow – An investigation should determine the groundwater level;
2. Slope/Land stability - An investigation to verify the ground conditions including the geotechnical parameters of the ground;
3. Slope/Land stability – Impact assessment to determine the effect of construction on neighbouring properties and infrastructure.

4. SCOPING

Based on the outcome of the screening process, an intrusive investigation has been conducted on site to determine the underlying geological sequence, groundwater levels and to derive geotechnical design parameters to support the impact assessment calculations.

The intrusive investigation involved the drilling of three 10m boreholes with in-situ testing undertaken at regular intervals. Disturbed soil samples were obtained and sent away for laboratory testing, in order to derive geotechnical characteristic design parameters. A monitoring well was installed in each borehole to allow gas and groundwater monitoring. The details and findings of the ground investigation are discussed in the following section.

5. GROUND AND GROUNDWATER CONDITIONS

5.1 Site investigation

An intrusive investigation was undertaken by CGL on 6th to 8th June 2018 and comprised three 10m boreholes (BH1 to BH3) drilled within the front garden (BH1) and rear garden (BH2 & BH3) of the property, using a modular window sampling rig (BH2-BH3) and a standard window sampling rig (BH1). The boreholes were drilled from ground level, which varied between all three locations. In-situ Standard Penetration Tests (SPTs) and Hand Shear Vane tests (HSV) were undertaken at regular intervals throughout.

The borehole was logged by a CGL engineer and disturbed samples were obtained and sent for geotechnical laboratory testing. Foundation trial pits were also dug to determine the depth of the existing foundations.

Upon completion, a monitoring well was installed within each borehole, with the response zone within the Head Deposit and Claygate Member. Each monitoring well standpipe was fitted with an end cap and flush cover at the surface. A single monitoring visit was undertaken on 15th June 2018.

The site investigation was undertaken broadly in accordance with the principals set out by BS 5930:2015⁷.

A geotechnical factual and interpretive report has been produced by CGL¹, detailing the findings and recommendations for the proposed development. The following section summarises the ground and groundwater conditions as well as the geotechnical design parameters derived from the previous report. Reference should be made to the previous CGL report for full details and findings of the ground investigation.

5.2 Geotechnical laboratory testing

A total of 31 soil samples were submitted to i2 Analytical Limited (a UKAS and MCERTS accredited laboratory) to conduct the following tests:

- Moisture content;
- Atterberg limit test;
- Sulfate content and pH testing.

⁷ British Standards Institution (2015). BS 5930:2015 – Code of practice for ground investigations.

An additional 6 water samples were submitted to i2 Analytical Limited for sulfate and pH testing.

The laboratory tests results are included in Appendix D.

5.3 Ground conditions

The ground conditions encountered on site are presented in Table 4. In general, Made Ground was encountered at ground level, with natural ground consisting Head Deposits overlying Claygate Member below. Both natural soil strata were found to contain fine sand.

Table 4. Summary of ground conditions encountered during site investigation

Stratum	Depth to top of stratum (mbgl) [Level to top of stratum (mOD)]	Typical thickness (m)
The description of this stratum varied across the site. Typically comprised of soft orange to dark brown gravelly silty sandy clay. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of concrete, brick and flint. [MADE GROUND]	0 [99.03 – 103.23]	0.4 – 1.5
Very soft to soft orange to light grey sandy silty CLAY. Sand is fine. Medium, subangular gravel of flint encountered in BH2. Organic odour present and frequent fragments of wood present in BH2. [HEAD DEPOSIT]	0.4 – 1.5	1.25 – 3.45
Very soft to stiff dark grey silty sandy CLAY. Sand is fine. Occasional rare shell fragments present. [CLAYGATE MEMBER]	2.0 – 4.95	5.05 – 8.0

The observed strata are discussed separately in the following sections together with the results of the geotechnical testing. A plot of the SPT 'N' versus depth (mbgl) is presented in Figure 4. The recorded SPT 'N' values have been normalised to take into account the high energy efficiency of the drilling equipment used during the site investigation.

5.3.1 Made Ground

Made Ground was encountered at ground level and ranged between 0.4m to 1.5m in thickness. The stratum was found to be predominately cohesive with some granular material, except for the top 1.2m in borehole BH1 which was predominately granular. As the majority of the stratum was predominately cohesive, the stratum is considered cohesive for the purpose of this report.

The stratum description varied significantly between each of the boreholes and foundation trial pits. Borehole WS1 was found to be formed of loose brown slightly clayey gravelly sand, with roots present to a depth of 1.2mbgl. From 1.2m to 1.5mbgl the description changed to soft dark brown gravelly sandy clay. The gravel was found to be formed of fine to coarse, subangular to subrounded brick, concrete and flint. The Made Ground in borehole WS2 was found to comprise of soft orange brown to orange grey slightly sandy slightly gravelly silty clay. The gravel was found to be formed of medium particle size, subangular brick, coal and flint. The Made Ground in borehole WS3 was found to be formed of soft dark brown black clayey sandy silt, with fragments of wood present. The Made Ground in borehole

WS3 was limited to 0.4mbgl. The trial pits were typically found to be formed of soft dark brown to orange silty gravelly sandy clay. In the top 0.6m of TP03 and the whole of TP02 the stratum was found to be predominately granular and was described as loose dark brown dark grey silty clayey (only in TP02) gravelly sand. In the trial pits, the sand is fine to coarse, while the gravel is fine to coarse, angular to subrounded of flint, brick, concrete, brick tile, slate tile and flint.

An SPT 'N' value of 3 was recorded at depth of 1.2mbgl within a clay horizon of the Made Ground. This correlates to a c_u value of 18kPa⁸ based on a correlated 'N₆₀' value of 4.

A single geotechnical sample of Made Ground at 1.2mbgl in BH1 was tested and a moisture content value of 20% was obtained.

5.3.2 Head Deposit

The Head Deposit stratum was encountered at 1.5mbgl in borehole BH1, at 0.75mbgl in borehole BH2 and at 0.4mbgl in borehole BH3 and extended to a depth of 4.95mbgl, 2.0mbgl and 2.2mbgl respectively. The stratum was found to be predominately cohesive. In general, the stratum comprised of mottled orange grey silty sandy CLAY. Rare gravel formed of medium, subangular flint was encountered in BH2 along with fragments of wood and an organic odour.

The recorded SPT 'N' values ranged from 2 to 8 and were correlated to give a value range of 3 to 11. This correlates to an undrained shear strength of 14kPa to 53kPa⁹. HSV values for the stratum range from 33kPa to 67kPa, which corresponds to a 'low' to 'medium'¹⁰ strength soil.

Eleven geotechnical samples of Head Deposit were tested, and the following values were obtained:

- Moisture content = 18 to 31%
- Liquid limit = 48 to 53%
- Plastic Limit = 24 to 25%
- Plasticity index = 23 to 29%

⁸ Based on a f_1 value of 4.5. Correlated from plasticity index.

⁹ Based on a f_1 value of 4.8. Correlated from plasticity index.

¹⁰ British Standard. BS 5930:2015 – Code of practice for site investigations. 2015.

5.3.3 Claygate Member

The Claygate Member stratum was encountered at 4.95mbgl in borehole BH1, 4mbgl in borehole BH2 and 2.2mbgl in BH3 and was proven to the base of the boreholes at 10mbgl. The stratum was found to be predominately cohesive and generally comprised of dark grey silty sandy CLAY.

The recorded SPT 'N' values ranged from 3 to 21 and were correlated to give a value range of 4 to 27. This correlates to an undrained shear strength of 19kPa to 130kPa¹¹. The HSV values for the stratum range from 22kPa to 85kPa 'low' to 'high'¹⁰ strength soil.

Seventeen geotechnical samples of Claygate Member were tested, and the following values were obtained:

- Moisture content = 11 to 33%
- Liquid limit = 33 to 52%
- Plastic limit = 20 to 23%
- Plasticity index = 11 to 29%

5.4 Groundwater conditions

Groundwater strikes were encountered in all three boreholes during drilling. A summary of the groundwater strikes encountered during drilling and standpipe installation depths are presented in Table 5.

Table 5. Borehole groundwater strikes and monitoring well installation summary

Borehole reference	Water strikes during drilling	Standpipe response depth (mbgl)	Standpipe response zone
BH1	Groundwater seepage at 5mbgl, rising to 4.7mbgl after 20 minutes	2.8 to 5.8	Head Deposit/Claygate Member
BH2	Groundwater seepage at 5.3mbgl, falling to 6.0mbgl after 20 minutes	1.0 to 8.0	Head Deposit/Claygate Member
BH3	Groundwater seepage at 4.2mbgl	1.0 to 6.0	Head Deposit/Claygate Member

A site monitoring visit was undertaken on 15th June 2018 to record the groundwater level in all three boreholes. The results of the monitoring visit are summarised in Table 6.

Table 6. Groundwater monitoring summary on 15/06/2018

Borehole reference	Groundwater depth (mbgl)	Groundwater level (mOD)
BH1	2.85	99.01
BH2	0.96	98.07
BH3	1.52	99.4

¹¹ Based on a f_1 value of 4.8. Correlated from plasticity index.

The levels recorded in the standpipes indicate that the groundwater flow direction is from south to north across the site, which is the same direction of the downward gradient of the slope on which the site is situated.

Upon bailing the standpipes dry, the groundwater level recharged to the original groundwater level within an hour.

5.5 Geotechnical design parameters

The geotechnical design parameters were derived from in-situ SPT, HSV testing, geotechnical soil parameters and published empirical relationships. The parameters presented in Table 7 are considered to be characteristic unfactored parameters, which are applicable to Serviceability Limit State (SLS) situations appropriate for predicted ground movements.

Table 7. Geotechnical design parameters

Stratum	Design Depth (mbgl)	Bulk Unit Weight, γ_b (kN/m ³)	Undrained Cohesion, c_u [Drained Cohesion, c'] (kPa)	Angle of Friction, ϕ' (°)	Undrained Young's Modulus (MPa)	Drained Young's Modulus, E' (MPa)
Made Ground (cohesive)	99.03 to 101.86	19	18 [0]	27 ^b	9 ^c	6.75 ^e
Head Deposits	98.28 to 100.52	20	40 [3]	26 ^b	24 ^d	18 ^e
Claygate Member	97.5	20	40 + 7z ^a [5]	26 ^b	[24 + 4.2z ^a] ^d	[18 + 3.15z ^a] ^e

a. z – depth below stratum design level

b. BS 8002:2015, Code of practice of earth retaining structures

c. Based on 500 c_u

d. Based on 600 c_u – 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.

e. Based on 0.75 E_u – 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.

A plot of undrained shear strength, c_u vs level is shown in Figure 5.

6. SUBTERRANEAN (GROUNDWATER) FLOW

6.1 Introduction

This section addresses outstanding considerations raised by the screening process regarding groundwater flow, as summarised in Section 3.2.

6.2 Impact on groundwater flow

Based on the findings of the site investigation and follow up monitoring visit, groundwater is expected at around 0.96mbgl at the rear of the property and 2.85mbgl at the front of the building. The groundwater level in relation to the ground level is shown in Table 8.

Table 8. Groundwater level in relation to ground level

Position	Assumed ground level (mOD)	Groundwater level (mOD)
At front of property	101.86	99.01
At rear of property	99.03 – 100.92	98.07 – 99.4

The proposed formation depth of the basement level is 7.26mbgl in relation to the front of the building and 5.38mbgl in relation to the rear building (around 94.60mOD). Therefore, the basement level will be below the groundwater level. The proposed increased footprint of the lower ground level will involve excavating into the ground around the front and southern side of the existing property. Given that the formation level of the lower ground level will be around 3.76mbgl (98.10mOD) in relation to front of the property, it is expected that the lower ground level formation level will also be below the groundwater level.

The Claygate Member stratum typically has low vertical permeability but higher horizontal permeability, due to the more permeable granular lenses within the stratum. Given that the area in the vicinity of the site is relatively free of the underground structures, it is expected that the groundwater will flow horizontally around the proposed excavations within the more permeable granular horizons.

6.3 Recommendations for the ground control

Based on the findings of the site investigation, it is recommended that a secant pile wall or sheet piles be used to retain the basement and lower ground level excavations. These should be extended to sufficient depth to provide a groundwater cut off for the duration of the construction period. If shallow foundations are used to support sections of the lower ground level not requiring a permanent retaining structure, then the excavations can be supported using temporary trench sheeting or sheet pile walls. Sump pumps may be used to control isolated ground seepage or infiltration into the basement excavation.

7. LAND STABILITY

7.1 Introduction

This section contains calculations to determine possible ground movements that may arise from the demolition of the existing structure, the installation of the secant pile wall, the excavation to form the lower ground and basement levels and the construction of the new building. A retaining wall will be constructed around the perimeter of the new basement level and partially around the perimeter of the lower ground level where a permanent soil retaining structure is required.

Possible ground movement mechanisms are outlined below:

- Heave movement: The Head Deposits and Claygate Member are both susceptible to short term and time dependant swelling after loading, which will occur as a result of the demolition of the existing building and the excavation of the lower ground and basement levels;
- Long term ground movements: The net loading on formation soils will generate ground movements, which could affect the foundations of adjacent buildings. This takes into account existing stress conditions, removal of loads from the demolition of the existing structure, excavation unloading and applied loads from the new structure ;
- Retaining wall deflection: Pile retaining walls are prone to deflection under applied earth pressures as soil is excavated in front of the wall, which lead to ground movements behind the wall;
- Installation settlement of the retaining wall: The installation of the retaining wall results in vertical and lateral ground movements behind the wall. These movements can be minimised with good construction including installing the piles in a hit and miss construction sequence.

7.2 Pile wall design

A preliminary pile design of the pile retaining wall has been conducted to determine the length of the piles for the purpose of the ground movement assessment and are summarised in Table 9.

The design assumes:

- Secant piled wall of 450mm diameter with hard piles at 600mm centre spacing;
- Continuous Flight Auger (CFA) or bored piles terminating within the Claygate Member;

- Only the pile length below the base of the excavation contributes to the bearing capacity of the pile;
- The pile capacity calculations have been undertaken in accordance with Eurocode 7 Design Approach 1, Combination 1 and Combination 2 assuming no working or preliminary pile load test:
 - Combination 1 applies partial factors to the dead and live loads of 1.35 and 1.5 respectively, while leaving the geotechnical parameters un-factored;
 - Combination 2 applies partial factors to the dead and live loads of 1.0 and 1.3, with geotechnical partial factors of 1.6 for the skin friction, 2.0 for the base capacity and 1.4 for the model factor (model factor value is based on the case of no working or preliminary pile load tests);
- The capacity calculations assume an end bearing capacity factor, N_c of 7.5. Additionally, an adhesion value of 0.5 and a limiting skin friction of 110kPa has been assumed in accordance with The London District Surveyor's Association (LDSA)¹².

Table 9. Pile design summary

Total Unfactored Load (kN/m)	Combination 1 Load (kN/m)	Combination 2 Load (kN/m)	Minimum Required Pile Embedment Length Combination 1 [Combination 2] (m)	Design Pile Embedment Length (m)	Safe Working Load (kN/m)	Base resistance as a percentage of overall capacity (%)
370	513	397	5.5 [7.0]	7.0	415	23
225	309	235.5	4.5 [6.0]	6.0	255	23

7.3 Assumed loading

7.3.1 Demolition

To model uplift pressures induced by the demolition of the existing building on the site, the existing building loads shown in Appendix E were converted into unloading pressures assuming an existing foundation width of 1m. Figure 6 shows the pressures inputted into ground movement model from the demolition stage.

7.3.2 Excavation

To model the excavation of the basement to the final formation levels, the uplift pressures were calculate using the unit weight of each soil stratum excavated, multiplied by the excavated depth of each corresponding soil stratum. The unit weights adopted for each soil stratum are shown in Table 7.

¹² London District Surveyor's Association. *Foundations, Guidance Notes for the Design of Straight Shafted Bored Piles in London Clay*. London District Surveyor's Association 2017.

The calculated excavation uplift pressures are shown in Table 10, with the corresponding zone locations shown in Figure 7.

Table 10. Excavation uplift pressures

Excavation Zone	Total Depth of Excavation (m)	Depth of Excavated Made Ground (m)	Uplift Pressure from Made Ground Excavation (kPa)	Depth of Excavated Head Deposits (m)	Uplift Pressure from Head Deposits (m)	Depth of Excavated Claygate Member (m)	Uplift Pressure from Claygate Member (m)	Total Uplift Pressure (kPa)
Zone A	7.4	3.72	70.68	0.73	14.6	2.95	59	144.28
Zone B	4.6	0.92	17.48	0.73	14.6	2.95	59	91.08
Zone C	4.9	1.22	23.18	0.73	14.6	2.95	59	96.78
Zone D	1.1	0.92	17.48	1.1	22.0	-	-	39.48
Zone E	6.3	2.62	49.78	0.73	14.6	2.95	59	123.38
Zone F	3.9	3.72	70.68	0.18	3.6	-	-	74.28
Zone G	3.9	3.72	70.68	0.18	3.6	-	-	74.28

7.3.3 Structural loads from new structure

The construction of the new building will transfer downward pressures, which will counteract the uplift pressures from the demolition and excavation stages. Appendix E includes the structural loads from the proposed development, which have been converted where appropriate into pressures and applied in the ground movements model. Figure 8 shows the layout of the loads from this stage.

The perimeter loads have been modelled as either strip footings at 1mbgl over a width of 1m or as applied to a secant pile wall. The pile wall end bearing loads were converted into pressures by dividing the line loads by the width of the wall, which is 0.45m. In order to model the skin friction along the pile wall, an equivalent vertical pressure was produced by assuming that at a depth of 2/3 of the length of the piles a rectangular pressure field is applied. The width of this rectangle is 1/2 of the depth at which this field is applied plus the width of the wall. The line load carried by the skin friction of the wall is then divided by the width of the rectangular pressure field to determine the equivalent skin pressure. This pressure is applied at the depth of 2/3 of the embedment length of the pile wall. A summary of the skin friction and end bearing pressures is shown in Table 11. The corresponding pile wall section references are shown in Figure 8.

Table 11. Pile wall end bearing and shaft pressures

Pile Wall Section	Total Load (kN/m)	Pile Shaft Load (kN/m)	End Bearing Load (kN/m)	Depth at which Equivalent Shaft Friction is Applied (mOD)	Equivalent Pile Shaft Pressure (kPa)	End Bearing Pressure (kPa)
A	245	188.7	56.4	89.33	67.80	125.2
B	315	242.6	72.5	89.33	87.1	161.0
C	370	284.9	85.1	89.33	102.7	189.1
D	225	173.3	51.8	93.50	70.7	115.0

7.4 Ground movements arising from proposed development

The analysis of the ground movements has been conducted in PDISP (Pressure Induced Displacement Analysis), a numerical analysis software. The programme calculates the movements caused by vertical pressures, in an elastic half-space. The programme can use both linear elastic and non-linear soil conditions. In this analysis only linear elastic conditions were considered. Additionally, the ground movements from the pile wall installation and deflection following excavation have been derived from guidance in CIRIA C760¹³.

The loadings used in the analysis are described in Section 7.3 of this report.

Several models were created to simulate each stage of construction. The assumed construction sequence is as follows:

- Stage 1 – Demolition of the existing structure;
- Stage 2 – Installation of the pile retaining wall to a maximum toe level of 87.0mOD;
- Stage 3 – Excavate down to a maximum level of 94.6mOD;
- Stage 4 – Construct the formation slabs and the new building from the basement up;
- Stage 5 – In the long term excess pore pressures will dissipate in the underlying strata causing further ground movements to occur as soils consolidate.

Apart from stage 5; in all the other stages it is assumed that the underlying strata will be undrained during construction (short term).

The project site has two adjacent buildings; 'Blue Orchard', Courtenay Avenue and 'Braken Knoll', Courtenay Avenue. It is not known if 'Blue Orchard' has a basement level, however from observation and survey drawings it is believed that the property does have a lower ground level, which for the purpose of this assessment is assumed to be at the same level as the existing lower ground level of 'Guildens', at 99.5mOD. Historical planning drawings show that 'Braken Knoll' has a basement level which is assumed to be founded at 99.74mOD.

7.4.1 Stage 1 – Demolition

Stage 1 involves the demolition of the existing structure. The pressures inputted into the PDISP model for this stage are shown in Figure 6.

¹³ CIRIA C760 (2017), *Guidance on embedded retaining wall design*, CIRIA.

The analysis shows a maximum ground movement under the assumed lower ground level of 'Blue Orchard' at 99.5mOD, between the values of 0 to -2mm as shown in Figure 9. Ground movements under 'Braken Knoll' are negligible.

7.4.2 Stage 2 – Pile wall installation

Stage 2 considers the impact of installing the pile retaining wall around the perimeter of the proposed basement and lower ground levels. This stage was modelled using guidance from CIRIA C760¹³. The guidance provides recommendations on the amount of vertical and lateral (horizontal) ground movements at the pile wall face and the distance from the wall to negligible movements. Langdon, Ball & Giles (2021)¹⁴ have shown that the ground movements due to pile installation can be reduced by 50% if the wall is constructed in a hit and miss construction sequence. Based on this the horizontal and vertical ground movements have been reduced to 0.02% of the wall depth. The recommended values for secant pile walls are presented in Table 12, provided the piles are installed to a good level of workmanship. The ground movements away from the wall face were then interpolated using a parabola function. The ground movements at the wall face and beneath the nearest wall of the neighbouring buildings are presented in Table 13.

Table 12. Secant pile wall installation ground movements

Horizontal Movements		Vertical Movements	
Surface movement at wall (percentage of wall depth)	Distance behind wall to negligible movement (multiple of wall depth)	Surface movement at wall (percentage of wall depth)	Distance behind wall to negligible movement (multiple of wall depth)
0.02 ¹⁴	1.5 ¹³	0.02 ¹⁴	2 ¹³

Table 13. Secant pile installation ground movements

	'Blue Orchard' (3.5m away)	'Braken Knoll' (8m away)
Maximum vertical ground movement beneath neighbouring wall (mm)	4.0	2.3
Maximum horizontal ground movement beneath neighbouring wall (mm)W	4.0	2.3

Notes:

Blue Orchard basement level taken as 99.5mOD and Braken Knoll taken as 99.74mOD

7.4.3 Stage 3 – Excavation of lower ground and basement levels

Stage 3 involves the excavation of the ground to the level of the new lower ground level (formation level 98.1mOD) and basement level (formation level 94.6mOD). The PDISP model for this stage includes the pressures shown in both Figure 6 and Figure 7, in order to model the cumulative effects of both stages. The results show a maximum vertical ground movement under the site at the assumed lower

¹⁴ Langdon, N., Ball, R. & Giles, D. (2021). *Ground movement prediction for a piles basement: A case study from Garlickhythe, City of London*. Ground Engineering, pp 26-33.

ground level of 'Blue Orchard' at 99.5mOD, to be between the values of 0 and -3mm as shown in Figure 10. Vertical ground movements under 'Braken Knoll' within the PDISP model are negligible.

The excavation works will cause the pile walls to deflect laterally towards the excavation and the ground behind the pile wall to settle. The ground movements have been calculated based on guidance from CIRIA C760¹³ and recommended values for secant pile walls are presented in Table 14, assuming that the pile wall will be propped at the top. The ground movements due to this action are presented in Table 15. The results presented in this table are in addition to the ground movements mentioned in the paragraph above.

Table 14. Secant pile wall ground movements due to excavation works (values taken from CIRIA C760¹³)

Horizontal Movements		Vertical Movements	
Surface movement at wall (percentage of max excavation depth)	Distance behind wall to negligible movement (multiple of max excavation depth)	Surface movement at wall (percentage of max excavation depth)	Distance behind wall to negligible movement (multiple of max excavation depth)
0.15	4	0.1	3.5

Note: Ground movements are for the case of high support stiffness, such as high propped pile wall

Table 15. Secant pile excavation ground movements

	'Blue Orchard' (3.5m away)	'Braken Knoll' (8m away)
Maximum vertical ground movement beneath neighbouring wall (mm)	6.0	3.9
Maximum horizontal ground movement beneath neighbouring wall (mm)	9.8	6.2

Notes:

Blue Orchard basement level taken as 99.5mOD and Braken Knoll taken as 99.74mOD

7.4.4 Stage 4 – Construction of new structure

Stage 4 involves the construction of the new building and application of the new structural loads. This stage was modelled using the pressures shown in Figure 8, as well as Figure 6 and Figure 7. The results shown in Figure 11 show a maximum ground movements under 'Blue Orchard' at the proposed basement level of 99.5mOD to range between 0mm and -2mm. The lateral ground movements remain unchanged from the previous stage. The ground movements under 'Braken Knoll' within the PDISP model are negligible.

7.4.5 Stage 5 – Long term ground movements

Over time excess pore pressures in the underlying soil strata will dissipate, causing further ground movements to occur. This action was modelled in PDISP by changing the soil parameters shown in Table 7 from undrained to drained. It is assumed that the lateral ground movements remain unchanged from the previous stage, as the piled wall will be rigidly propped in the long term by the basement and ground floor slab. The results show a maximum vertical ground movement under the

edge of 'Blue Orchard' at 99.5mOD to range between -2mm and 0mm, as shown in Figure 12. The ground movements under 'Braken Knoll' within the PDISP model are negligible.

8. DAMAGE CATEGORY ASSESSMENT

The calculated ground movements have been used to assess the potential 'damage categories' that may apply to neighbouring properties due to the proposed development. The methodology proposed by Burland and Wroth¹⁵ and later supplemented by the work of Boscardin and Cording¹⁶ has been used, as described in *CIRIA Special Publication 200*¹⁷ and *CIRIA C760*¹³. General damage categories are summarised below in Table 16.

Table 16. Classification of damage visible to walls (reproduction of 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)

'Blue Orchard' is located nearest to the proposed development of the two neighbouring properties and 'Braken Knoll' is understood from historical planning drawings to have a basement level, while 'Blue Orchard' is not known to have one. Additionally, the proposed basement level is located closer to the boundary between 'Blue Orchard' and 'Guildens' which will lead to higher ground movements, compared to the boundary between 'Guildens' and 'Bracken Knoll', where there is only a lower ground level. Furthermore, the ground movements presented in Section 7.4 show that the ground movements across the 'Braken Knoll' are negligible. Therefore, for the purpose of this assessment the ground movements across 'Blue Orchard' present the critical case and therefore only the damage category for this property has been assessed.

Figure 13 and Figure 14 shows the combined vertical and horizontal ground movement profiles across 'Blue Orchard'. An allowance for settlement due to pile wall installation is included in stages 2-5 and an allowance for pile wall deflection is included in stages 3-5. The vertical ground movements due to these actions are shown in Figure 13. Figure 13 indicates that the maximum angular distortion across the width of 'Blue Orchard' (23.5m) is approximately 1/5900. This value is conservative as the calculation

¹⁵ 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.

¹⁶ Boscardin, M.D., and Cording E.G., (1989). *Building response to excavation induced settlement*. J Geotech Eng, ASCE, 115(1), pp 1-21.

¹⁷ 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.

does not include the stiffness of the foundation slab of the neighbouring property and assumes fully flexible loaded zones. This maximum angular distortion across the width of the neighbouring property is within the limits identified by Skempton and MacDonald (1956)¹⁸ for structural damage, where it is stated that the safe limit of angular distortions for a framed concrete structure is 1/200 for structural damage and 1/500 for limiting damage to partitions and walls within a frame concrete building.

Table 17 shows the calculated damage category for 'Blue Orchard', which is considered the most sensitive neighbouring property. The value of the deflection is obtained graphically as shown in Figure 13. The values for horizontal strain and deflection ratio have been calculated based on the assumption that the width of 'Blue Orchard' is 23.5m.

Table 17. Summary of ground movements and corresponding damage category

Party Boundary Reference	Critical Construction Stage	Horizontal Movement ^a (mm)	Vertical Deflection (mm)	Horizontal Strain, $\delta_h/L^{b,c}$ (%)	Deflection Ratio, Δ/L^b	Damage Category
'Blue Orchard'	Stage 1	9.8	1.5	0.041	0.006	Category 0 (Negligible)

a. The movement corresponding to the ground level at 99.5mOD across the width of the structure

b. See Box 6.3 CIRIA C760 (2017)¹³ (Δ = relative deflection; L = Length of adjacent structure in metres)

c. See Figure 6.27 CIRIA C760 (2017) (δ_h = horizontal movement in metres)

The Damage Category for this property was determined by plotting the horizontal strain and deflection ratio values as summarised in Table 17 and presented graphically in Figure 15.

Assuming a good standard of workmanship and controlling lateral deflection of the walls to within the limiting values provided, the predicted Damage Category is expected to fall within Category 0 'negligible' damage including hairline cracks. In arriving at this result it has been assumed that the pile wall along the northern side will be propped in the short term with temporary supports and in the long term using the internal structural slabs. If the pile wall is not propped in the short and long term, then the Damage Category will be revised up to Category 2 from Category 0. The predicted Damage Category is also dependant on contractor workmanship and the installation of the pile wall in a hit and miss construction sequence.

Detailed design of the retaining wall using WALLAP or similar soil structure interaction software should be undertaken to ensure that horizontal movements are not exceeded.

¹⁸ Skempton, A.W., and MacDonald, D.H., (1956). *Allowable settlement of buildings*. Proceedings of the Institute of Civil Engineers, part 3, vol 5, pp 727-768.

9. MONITORING STRATEGY

The results of the ground movement analysis suggest the likely Damage Category to the neighbouring properties can be controlled to within Category 0. This is dependant on providing temporary support to the retaining wall and construction control. To manage this during the works it is recommended that a monitoring strategy be considered and put in place to observe and control ground movements during construction.

The monitoring strategy should be in broad accordance with the 'Observational Method' define in CIRIA Report R185¹⁹. Monitoring can be undertaken by installing survey targets to the top of the lower ground and basement wall, as well as the face of the adjacent buildings. Prior to construction baseline readings should be established. Once construction commences regular readings should be undertake and analysed to determine whether unacceptable horizontal movement, vertical movement or tilting has occurred. Mitigation strategies should be prepared prior to construction and be implements 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.

¹⁹ Nicholson, E., Tse, Che-Ming., Penny, C., *The Observational Method in ground engineering: principles and applications*. CIRIA report R185, 1999.

10. CONCLUSION AND RECOMMENDATIONS

This report has assessed the possible impact cause by demolition of a three storey building and the construction of a new five storey building (includes two below ground levels) over the site of the former. The report has used information provided by the Structural Engineer and has assumed that the construction work will be carried out to a good standard of workmanship and following an assumed construction sequence.

From the analysis of the possible ground movements the key findings are as follows:

- Groundwater is expected to be above final lower ground and basement formation level. Surface water flow is expected to remain unchanged post construction, due to the low vertical permeability of the ground conditions across the site. Subsurface groundwater flow is anticipated to flow around the proposed lower ground and basement levels, due to horizontal granular lenses within the underlying soil strata;
- A secant pile wall is recommended to control lateral water ingress into the excavation and should be of sufficient length in order to support structural loads in the permanent condition and cut off groundwater laterally for the duration of construction. Isolated groundwater seepage should be controlled using sump pumps during the construction stage;
- Ground movements have been determined across the neighbouring property called 'Blue Orchard'. The vertical ground movements along the boundary between the site boundary and 'Blue Orchard' are anticipated to be between 0 to -3mm. Lateral ground movements due to pile wall installation and deflection across 'Blue Orchard' are anticipated to be 9.8mm. With good contractor control and detailed retaining wall design it is anticipated that the damage to the neighbouring properties will not exceed Category 0 'negligible' damage.

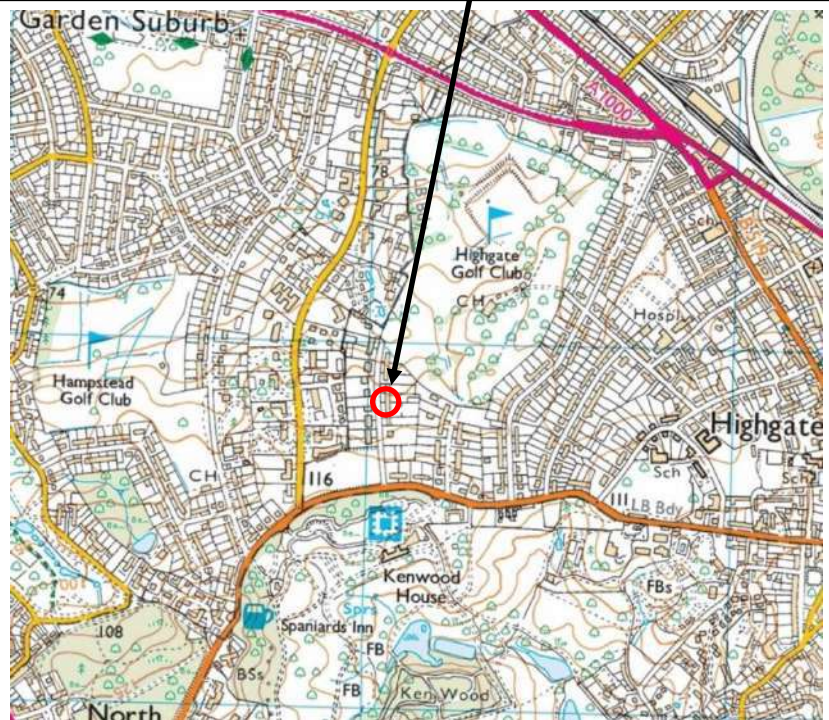
It is recommended that prior to construction commencing, a condition survey be conducted and an observation strategy be put in place. Once construction begin the movement of the walls and the façades of the neighbouring properties should be regularly monitored.

Construction of the piled retaining wall should follow a hit and miss construction sequence in order to minimise installation movements. Additionally, temporary props should be used to support the retaining wall during excavation works and the internal floor slabs should be designed to support the walls in the long term, particularly along the northern perimeter of the site, and adjacent to neighbouring properties.

FIGURES

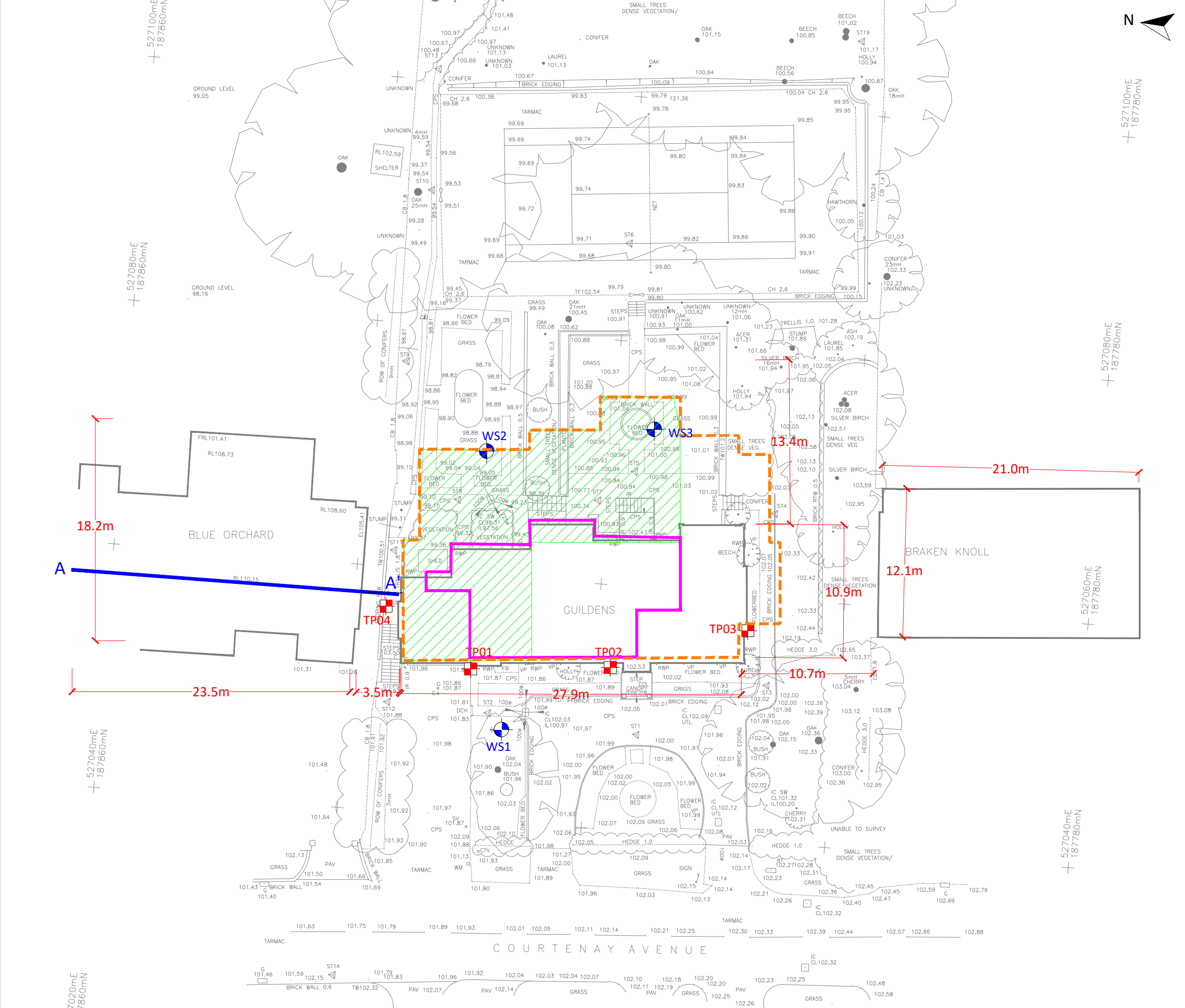


Site Location



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Client Alexander Smirnov	Project 'Guildens', Courtenay Avenue, Highgate, London	Job No CG/28630A
	Title Site location plan	Figure 1



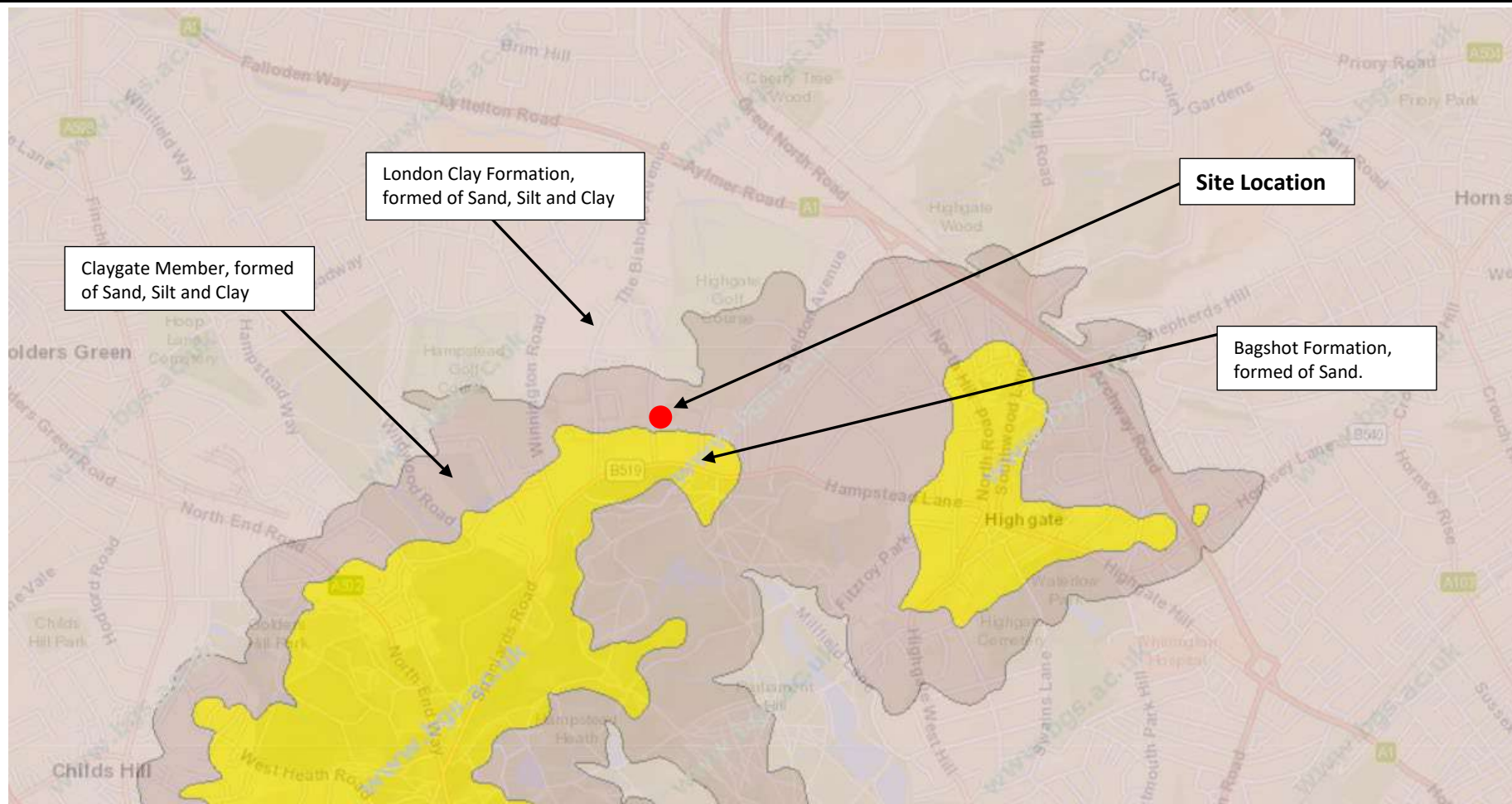
KEY

-  Borehole
-  Trial Pit
-  Critical Section Line
-  Proposed Basement Outline
-  Existing Lower Ground Outline
-  Proposed Lower Ground Outline

Notes

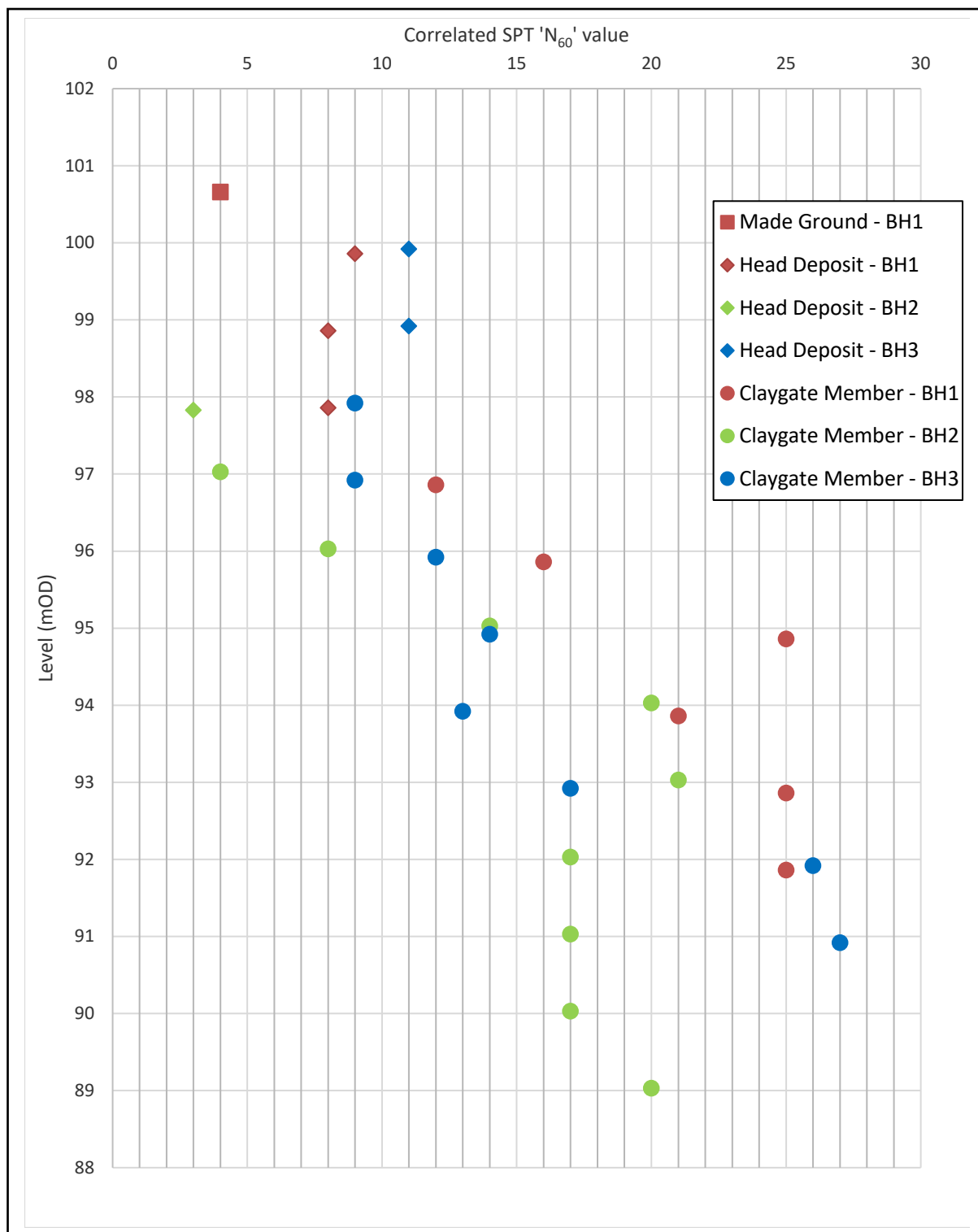
- Do not scale from this drawing.
- Topographical survey taken from Wolff Architects 'Existing Site Plan' drawing ref '1802-FE-100' (02/03/2018).
- Proposed Lower Ground Floor Outline taken from Wolff Architects drawing ref '1802-PL-201' Rev E (12/05/2022).
- Proposed Basement Outline taken from Wolff Architects drawing ref '1802-PL-206' Rev E (12/05/2022).

0	17/01/2023	
Rev	Date	Comments
 Card Geotechnics Ltd 4 Godalming Business Centre Woolsack Way Godalming Surrey GU7 1XW T: 01483 310600		
Project	'Guildens', 16 Courtenay Avenue, Highgate N6 4LP	
Client	Alexander Smirnov	
Drawing title	Figure 2 - Site Layout & Exploratory Hole Location Plan	
Scale(s)	NTS	Job No. CG/28630A
Drawn	TSB 17/01/2023	Dwg No. CG/28630A-001
Checked	TWF 27/01/2023	Rev. 0
Approved	JMS 30/01/2023	
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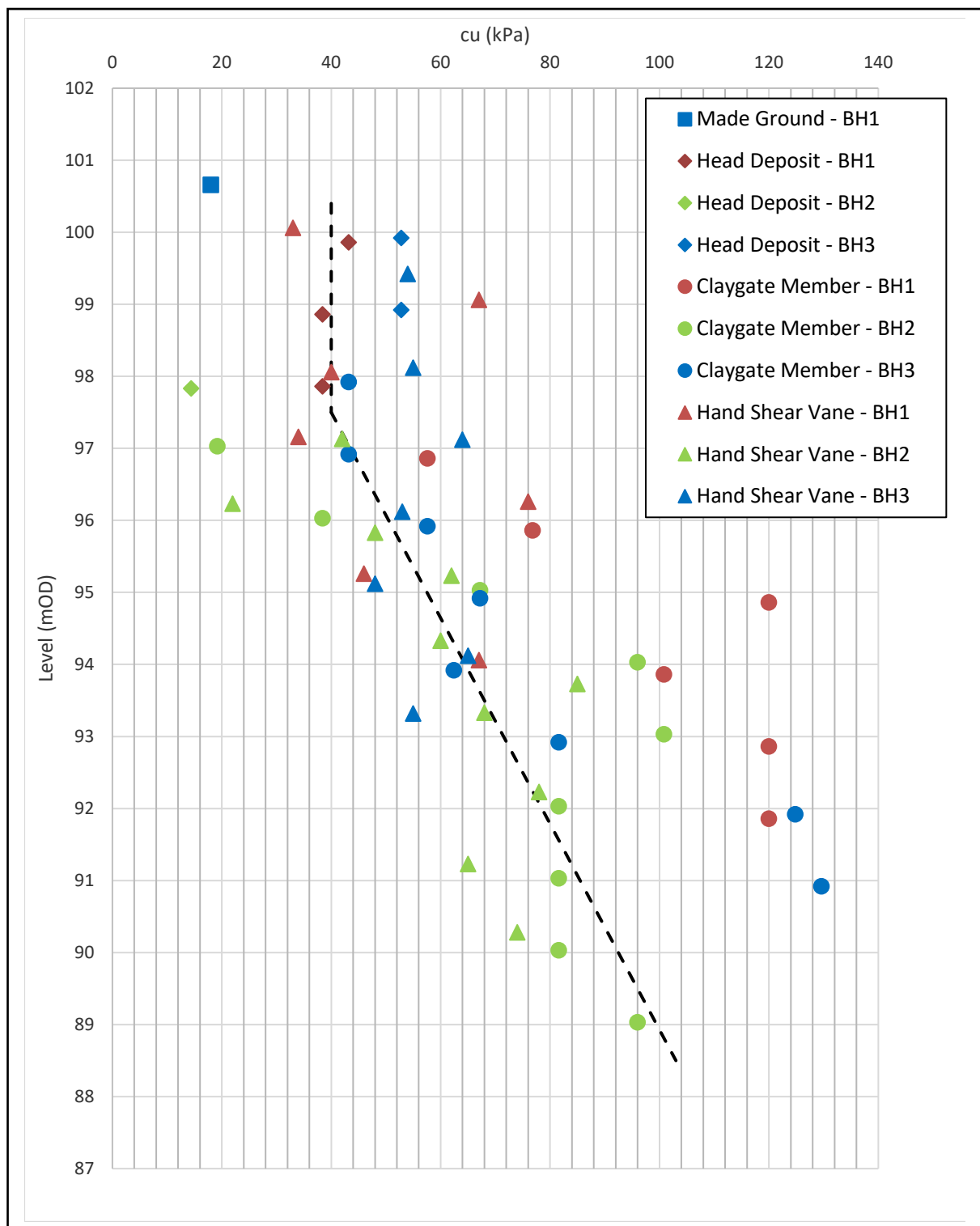


British Geological Survey. 2023. Geology of Britain viewer. [ONLINE] Available at <http://mapapps.bgs.ac.uk/geologyofbritain/home.html> [Accessed January 2023].

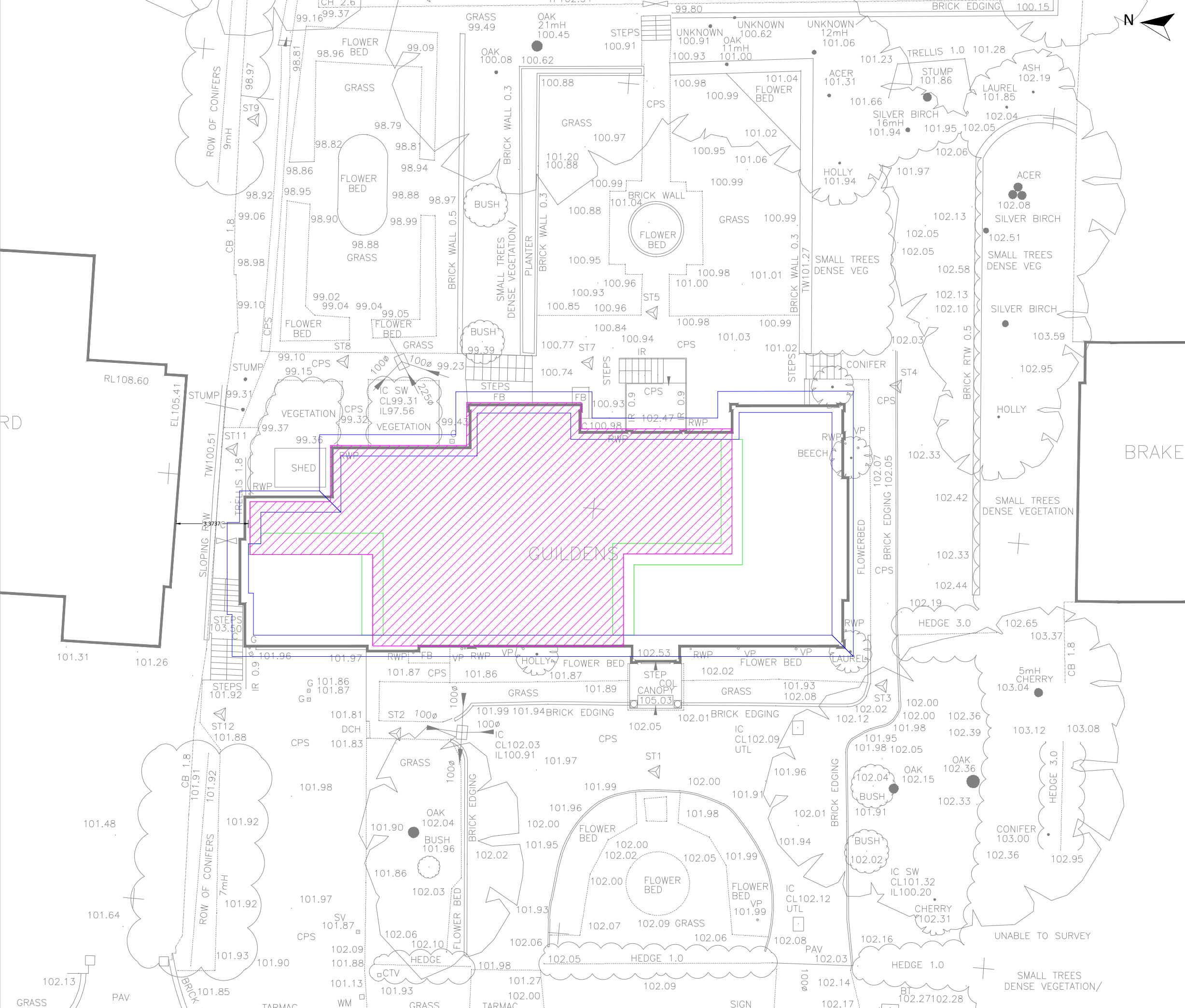
Client	Project	Job No
Alexander Smirnov	'Guildens', Courtenay Avenue, Highgate, London	CG/28630A
	Title	
	Bedrock Geological Deposits	Figure 3



Client Alexander Smirnov	Project 'Guildens', Courtenay Avenue, Highgate, London	Job No CG/28630A
	Title Standard Penetration Test (SPT) 'N₆₀' values vs Level	Figure 4



Client Alexander Smirnov	Project 'Guildens', Courtenay Avenue, Highgate, London	Job No CG/28630A
	Title Undrained shear strength, c_u vs level	Figure 5



KEY

Existing Internal Footing

Unloading Pressure = -181kPa

Existing External Footing

Unloading Pressure = -181kPa

Existing Lower Ground Load

Unloading Pressure = -15kPa

- Notes
1.

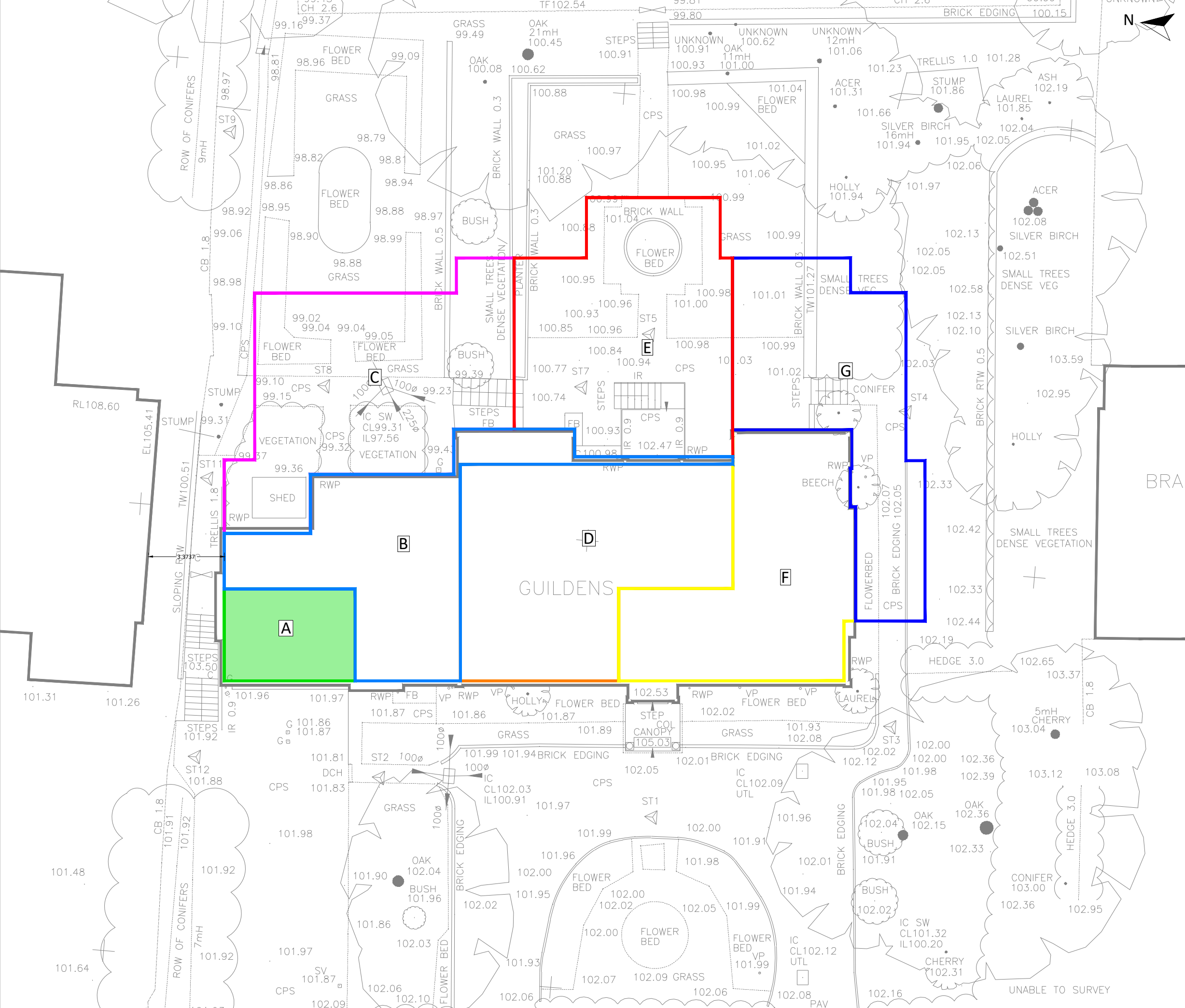
Do not scale from this drawing.
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Topographical survey taken from Wolff Architects 'Existing Site Plan' drawing ref '1802-FE-100' (02/03/2018).
3.

Proposed Lower Ground Floor Outline taken from Wolff Architects drawing ref '1802-PL-201' Rev E (12/05/2022).
4.

Negative surcharge represents upward surcharge.

0	25/01/2023	
Rev	Date	Comments
 Part of the CTS Group Card Geotechnics Ltd 4 Godalming Business Centre Woolsack Way Godalming Surrey GU7 1XW T: 01483 310600		
Project	'Guildens', 16 Courtenay Avenue, Highgate N6 4LP	
Client	Alexander Smirnov	
Drawing title	Figure 6 - PDISP Demolition Stage Load Layout	
Scale(s)	NTS	Job No. CG/28630A
Drawn	TSB 25/01/2023	Dwg No. CG/28630A-002
Checked	TWF 27/01/2023	Rev. 0
Approved	JMS 30/01/2023	
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KEY

Excavation Zone A

Unloading Pressure = -144.28kPa

Excavation Zone B

Unloading Pressure = -91.08kPa

Excavation Zone C

Unloading Pressure = -96.78kPa

Excavation Zone D

Unloading Pressure = -39.48kPa

Excavation Zone E

Unloading Pressure = -123.38kPa

Excavation Zone F

Unloading Pressure = -74.28kPa

Excavation Zone G

Unloading Pressure = -74.28kPa

- Notes
1.

Do not scale from this drawing.
2.

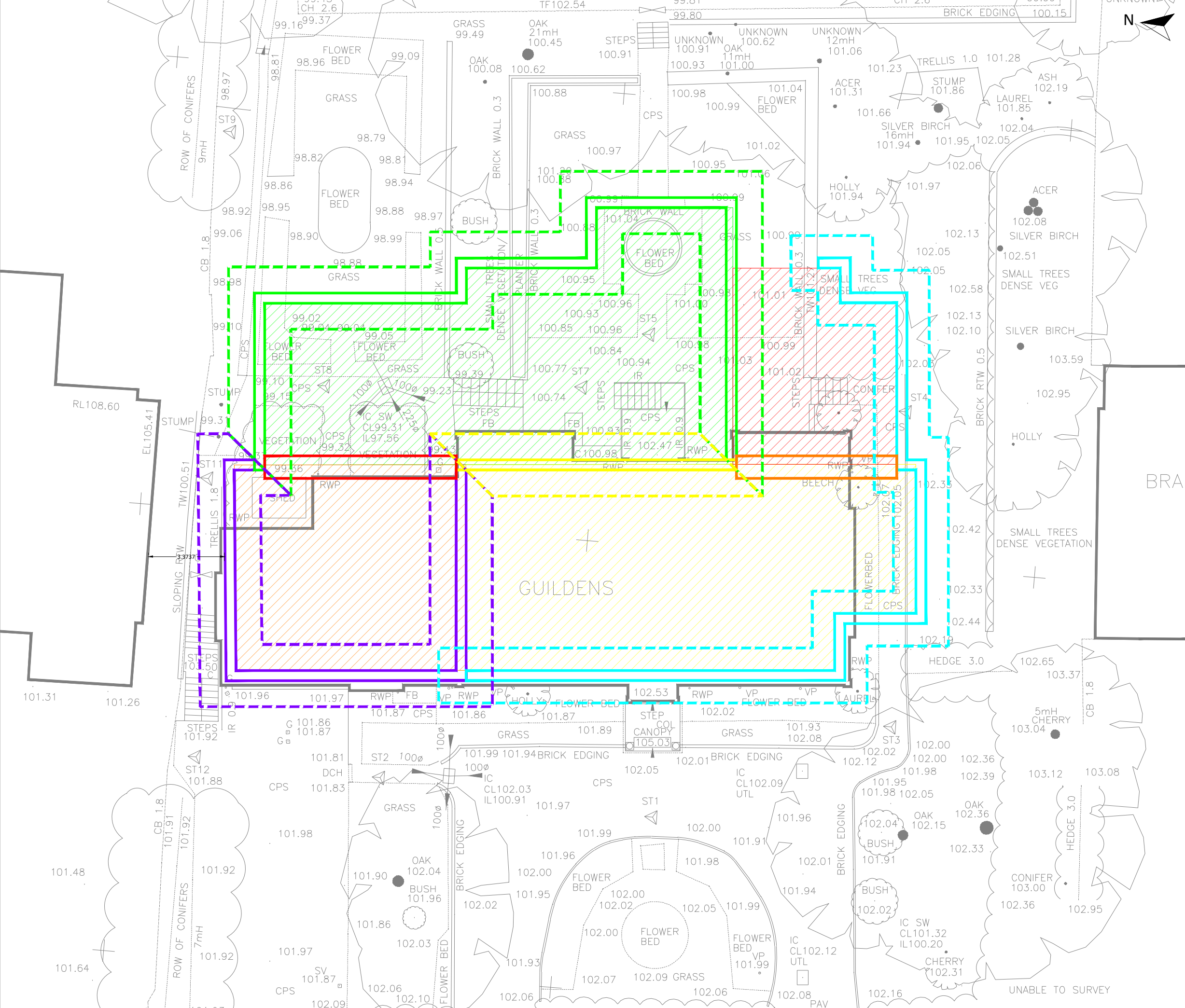
Topographical survey taken from Wolff Architects 'Existing Site Plan' drawing ref '1802-FE-100' (02/03/2018).
3.

Proposed Lower Ground Floor Outline taken from Wolff Architects drawing ref '1802-PL-201' Rev E (12/05/2022).
4.

Negative surcharge represents upward surcharge.

0	18/01/2023	
Rev	Date	Comments
 Card Geotechnics Ltd 4 Godalming Business Centre Woolsack Way Godalming Surrey GU7 1XW T: 01483 310600		
Project	'Guildens', 16 Courtenay Avenue, Highgate N6 4LP	
Client	Alexander Smirnov	
Drawing title	Figure 7 - PDISP Excavation Stage Load Layout	
Scale(s)	NTS	Job No. CG/28630A
Drawn	TSB 18/01/2023	Dwg No. CG/28630A-003
Checked	TWF 27/01/2023	Rev. 0
Approved	JMS 30/01/2023	

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KEY

Construction Zone 1

Surcharge = 52.00kPa

Construction Zone 2

Surcharge = 27.00kPa

Construction Zone 3

Surcharge = 47.50kPa

Construction Zone 4

Surcharge = 55.00kPa

End Bearing 1

Surcharge = 125.20kPa

End Bearing 2

Surcharge = 161.00kPa

End Bearing 3

Surcharge = 189.10kPa

End Bearing 4

Surcharge = 115.00kPa

Lower Ground Internal Wall

Surcharge = 480.00kPa

Basement Internal Wall

Surcharge = 240.00kPa

Pile Wall Shaft Resistance 1

Surcharge = 67.78kPa

Pile Wall Shaft Resistance 2

Surcharge = 87.78kPa

Pile Wall Shaft Resistance 3

Surcharge = 102.36kPa

Pile Wall Shaft Resistance 4

Surcharge = 70.71kPa

Notes

1. Do not scale from this drawing.

2. Topographical survey taken from Wolff Architects 'Existing Site Plan' drawing ref '1802-FE-100' (02/03/2018).

3. Proposed Lower Ground Floor Outline taken from Wolff Architects drawing ref '1802-PL-201' Rev E (12/05/2022).

0	18/01/2023	
Rev	Date	Comments



Card Geotechnics Ltd
4 Godalming Business Centre
Woolsack Way
Godalming
Surrey
GU7 1XW
T: 01483 310600

Project

'Guildens', 16 Courtenay Avenue, Highgate N6 4LP

Client

Alexander Smirnov

Drawing title

Figure 8 - PDISP Construction Stage Load Layout

Scale(s)

NTS

Job No.

CG/28630A

Drawn

TSB

18/01/2023

Dwg No.

CG/28630A-004

Rev.

0

Checked

TWF

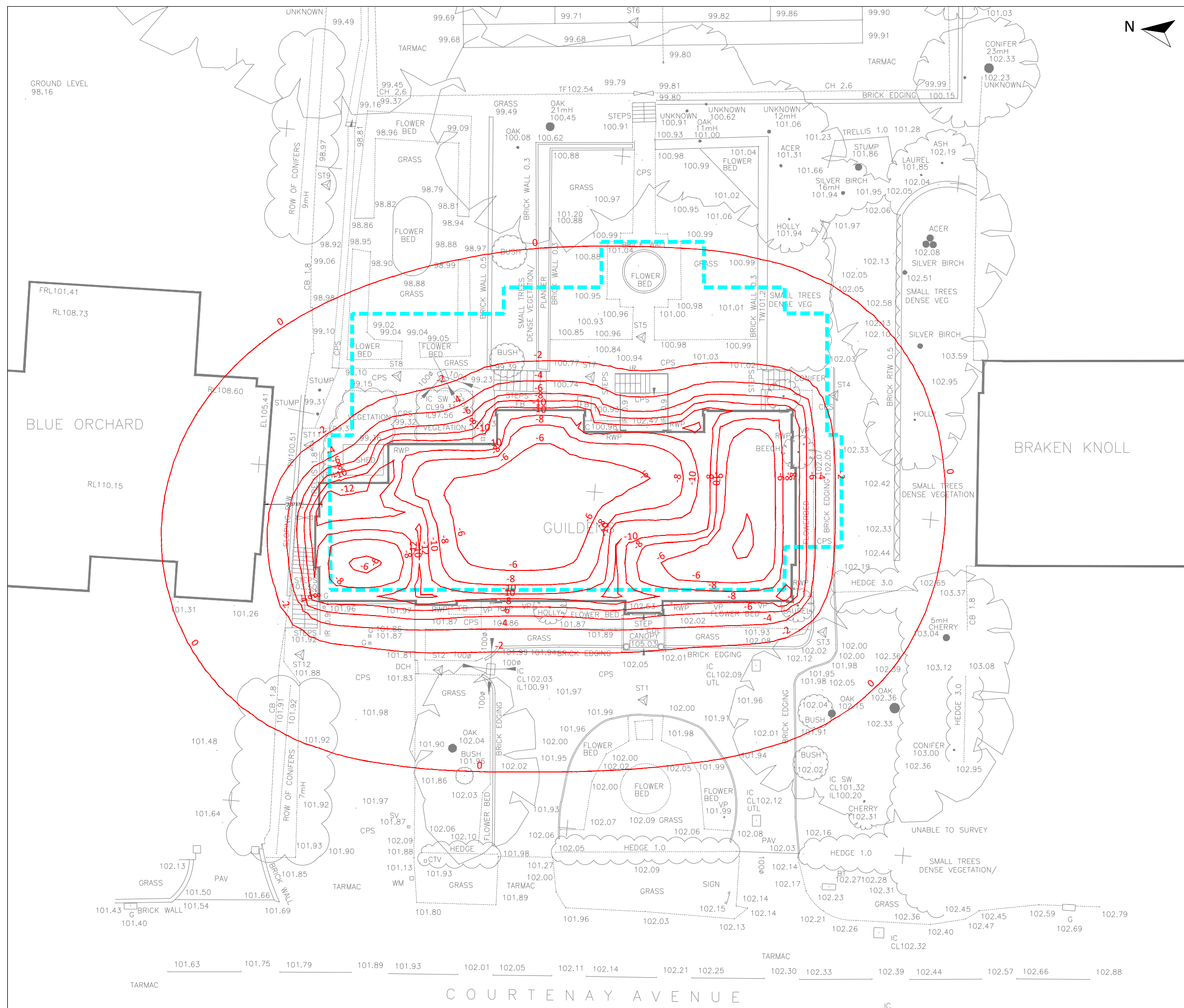
27/01/2023

Approved

JMS

30/01/2023

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KEY

- ### Notes
1. Do not scale from this drawing.
 2. Topographical survey taken from Wolff Architects 'Existing Site Plan' drawing ref '1802-FE-100' (02/03/2018).
 3. Proposed Lower Ground Floor Outline taken from Wolff Architects drawing ref '1802-PL-201' Rev E (12/05/2022).
 4. Contours are in mm.
 5. Positive contour values indicate settlement and negative contours values indicate heave.

0	26/01/2023		
Rev	Date	Comments	
		Card Geotechnics Ltd 4 Godalming Business Centre Woolsack Way Godalming Surrey GU7 1XW T: 01483 310600	
Project		'Guildens', 16 Courtenay Avenue, Highgate N6 4LP	
Client		Alexander Smirnov	
Drawing title		Figure 9 - Stage 1 Vertical Ground Movements	
Scale(s)		Job No.	
NTS		CG/28630A	
Drawn	TSB	26/01/2023	Dwg No.
Checked	TWF	27/01/2023	
Approved	JMS	30/01/2023	
CG/28630A-005			Rev.
			0

Project **'Guildens', 16 Courtenay Avenue, Highgate
N6 4LP**

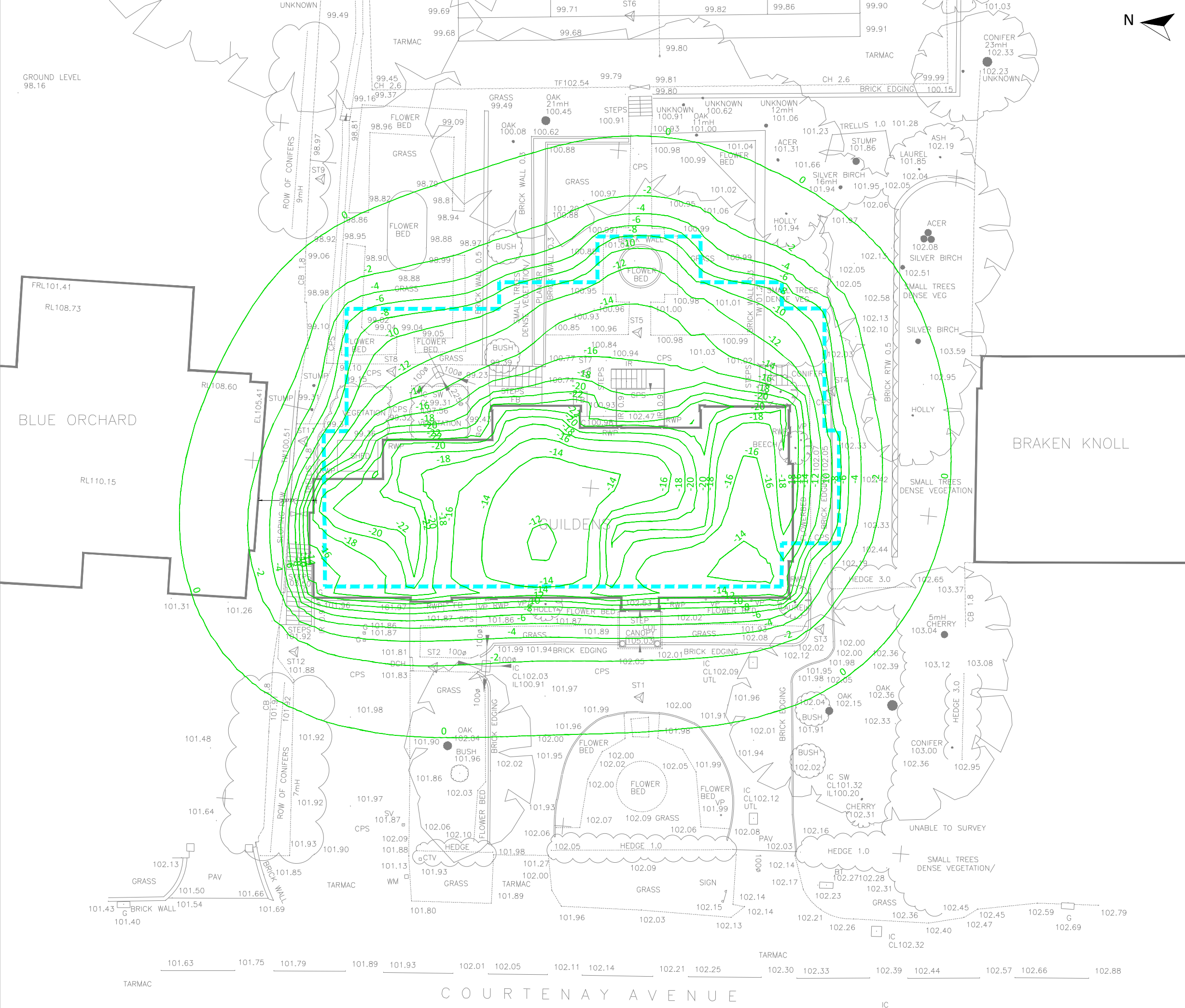
Client **Alexander Smirnov**

Drawing title **Figure 9 - Stage 1 Vertical Ground Movements**

Scale(s) NTS	Job No. CG/28630A
------------------------	-----------------------------

Drawn	TSB	26/01/2023	Dwg No. CG/28630A-005
Checked	TWF	27/01/2023	

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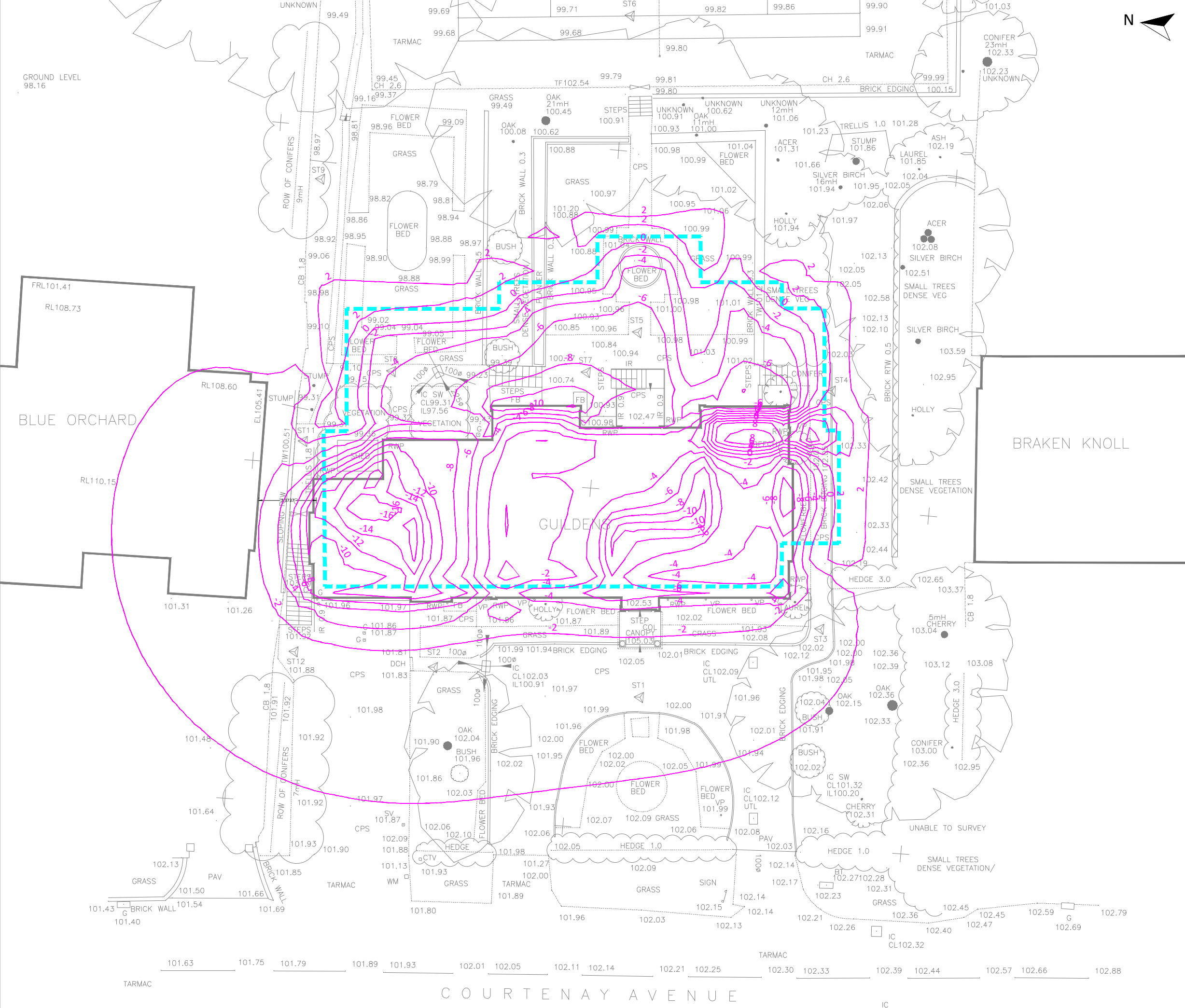
KEY

Proposed Lower Ground Outline

Notes

- Do not scale from this drawing.
- Topographical survey taken from Wolff Architects 'Existing Site Plan' drawing ref '1802-FE-100' (02/03/2018).
- Proposed Lower Ground Floor Outline taken from Wolff Architects drawing ref '1802-PL-201' Rev E (12/05/2022).
- Contours are in mm.
- Positive contour values indicate settlement and negative contours values indicate heave.

0	26/01/2023	
Rev	Date	Comments
 Card Geotechnics Ltd 4 Godalming Business Centre Woolsack Way Godalming Surrey GU7 1XW T: 01483 310600		
Project	'Guildens', 16 Courtenay Avenue, Highgate N6 4LP	
Client	Alexander Smirnov	
Drawing title	Figure 10 - Stage 3 Vertical Ground Movements	
Scale(s)	Job No.	
NTS	CG/28630A	
Drawn	TSB	26/01/2023
Checked	TWF	27/01/2023
Approved	JMS	30/01/2023
Dwg No.	CG/28630A-006	Rev.
		0
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KEY

Proposed Lower Ground Outline

Notes

1. Do not scale from this drawing.

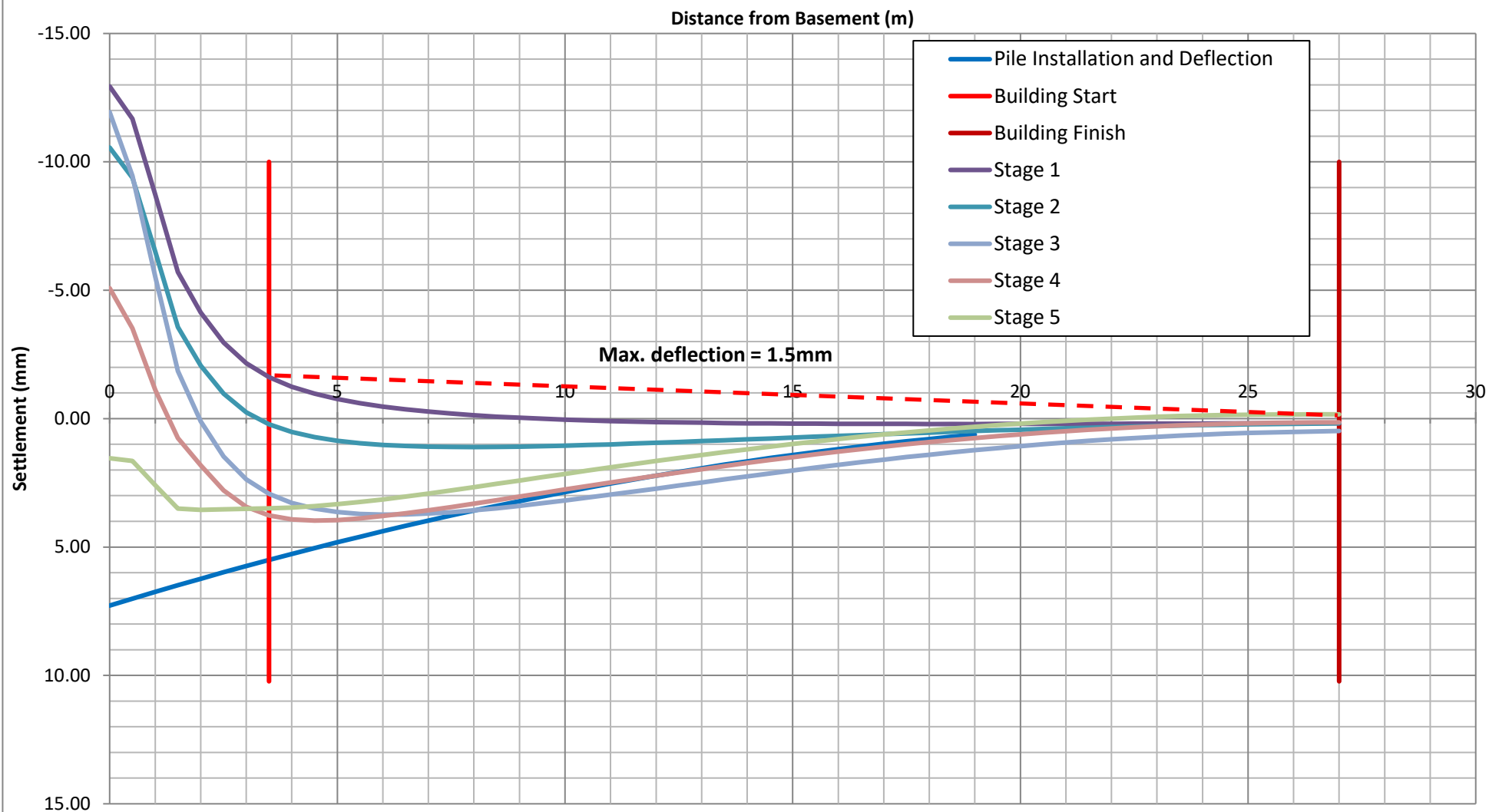
2. Topographical survey taken from Wolff Architects 'Existing Site Plan' drawing ref '1802-FE-100' (02/03/2018).

3. Proposed Lower Ground Floor Outline taken from Wolff Architects drawing ref '1802-PL-201' Rev E (12/05/2022).

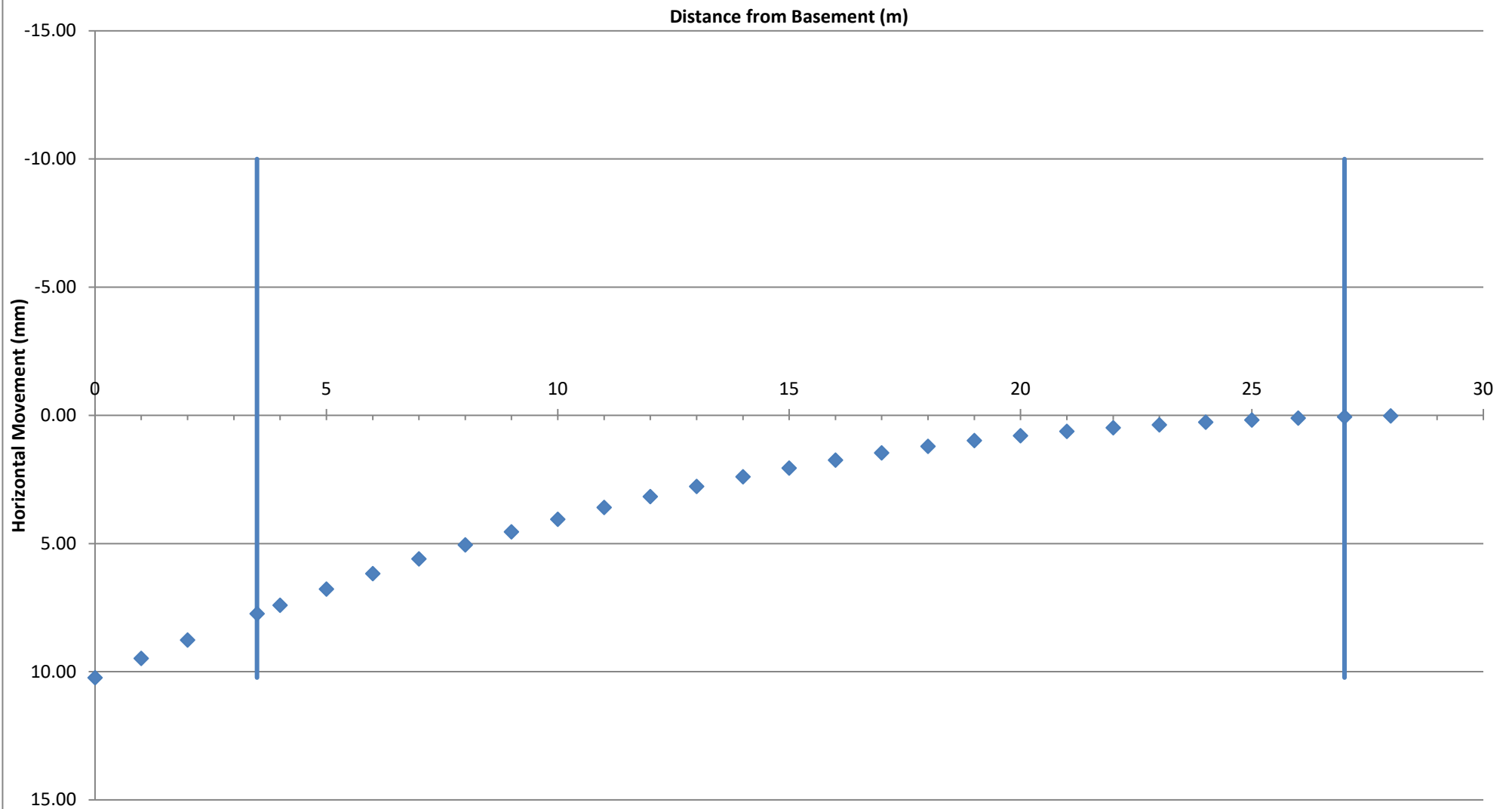
4. Contours are in mm.

5. Positive contour values indicate settlement and negative contours values indicate heave.

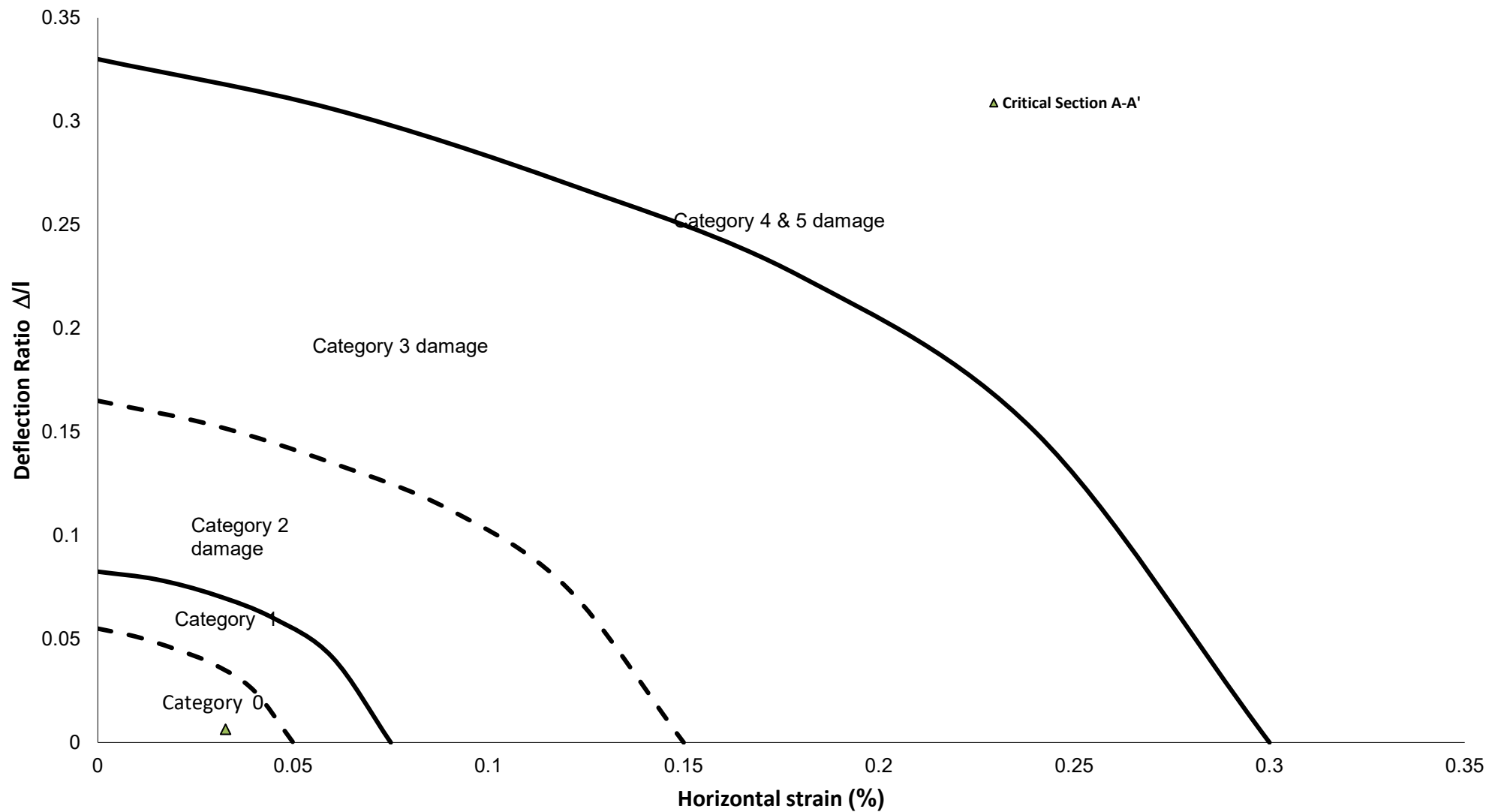
0	26/01/2023	
Rev	Date	Comments
 Card Geotechnics Ltd 4 Godalming Business Centre Woolsack Way Godalming Surrey GU7 1XW T: 01483 310600		
Project	'Guildens', 16 Courtenay Avenue, Highgate N6 4LP	
Client	Alexander Smirnov	
Drawing title	Figure 11 - Stage 4 Vertical Ground Movements	
Scale(s)	Job No.	
NTS	CG/28630A	
Drawn	TSB	26/01/2023
Checked	TWF	27/01/2023
Approved	JMS	30/01/2023
Dwg No.		Rev.
CG/28630A-007		0
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Client	Project	Job No
Alexander Smirnov	'Guildens', Courtenay Avenue, Highgate, London	CG/28630
	Title	Figure 13
	'Blue Orchard' Vertical Ground Movements	



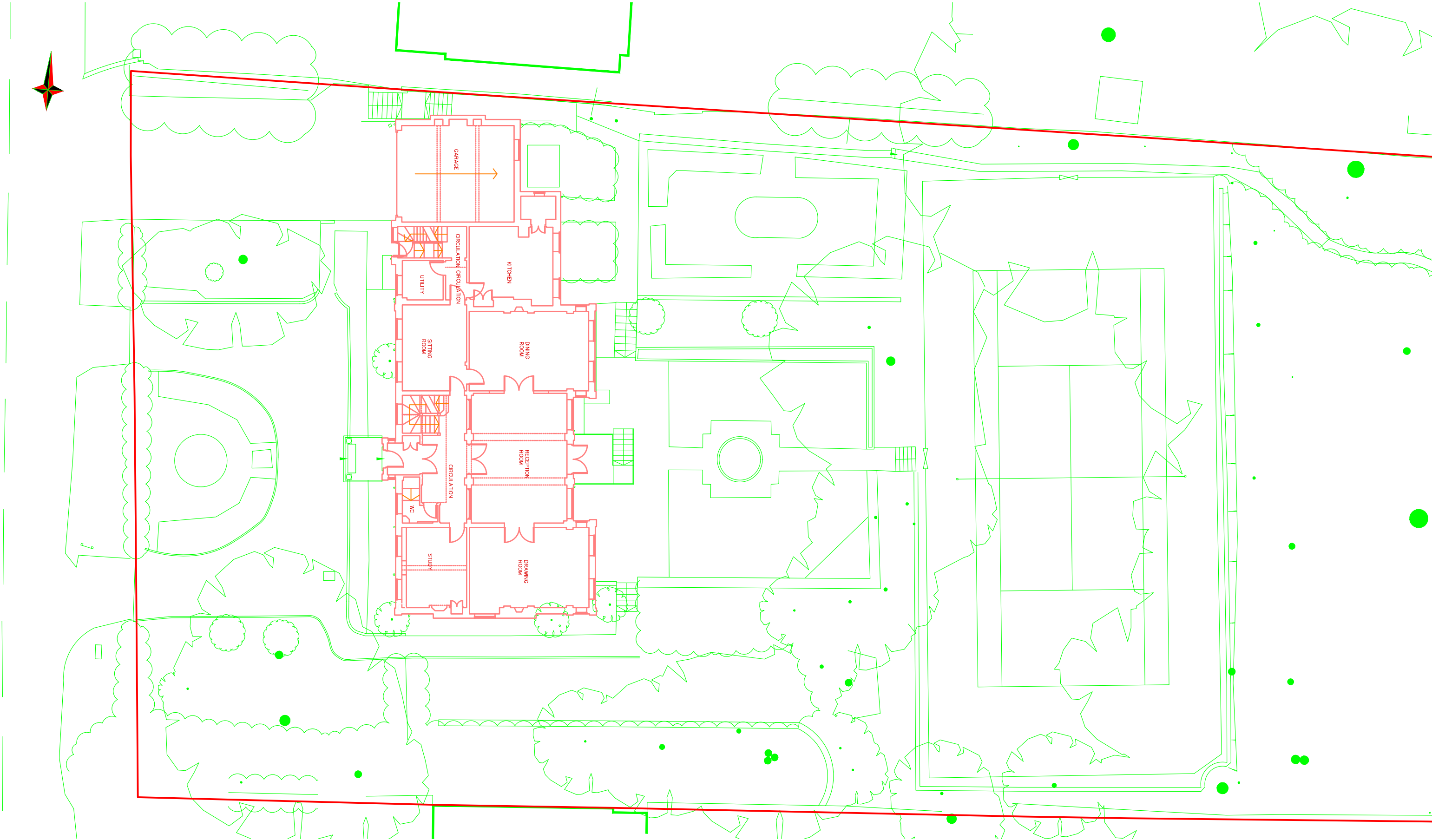
Client	Project	Job No
Alexander Smirnov	'Guildens', Courtenay Avenue, Highgate, London	CG/28630A
	Title	Figure 14
	'Blue Orchard' Horizontal Ground Movements	



Client	Project	Job No
Alexander Smirnov	'Guildens', Courtenay Avenue, Highgate, London	CG/28630A
	Title	Figure 15
	Building Interaction Chart	

APPENDIX A

Existing site layout



London 16 Lambton Place Notting Hill
London W11 2SH T +44 (0)20 7229 3125

Oxford Chandos Yard 83 Bicester Road
Long Crendon HP18 9EE T +44 (0)1844 203310

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Rev.	Description	Date	Rev.	Description	Date	Rev.	Description	Date
0	First issue.	02.03.18						

Status

FEASIBILITY

Project Title

'Guildens', Courtenay Avenue 16
London, N6 4LP

Drawing Title

Existing Site Plan

Drawn by

EZ

Checked by

DW

Scale

200 @ A3

Project No.

1802

Work Stage

FE

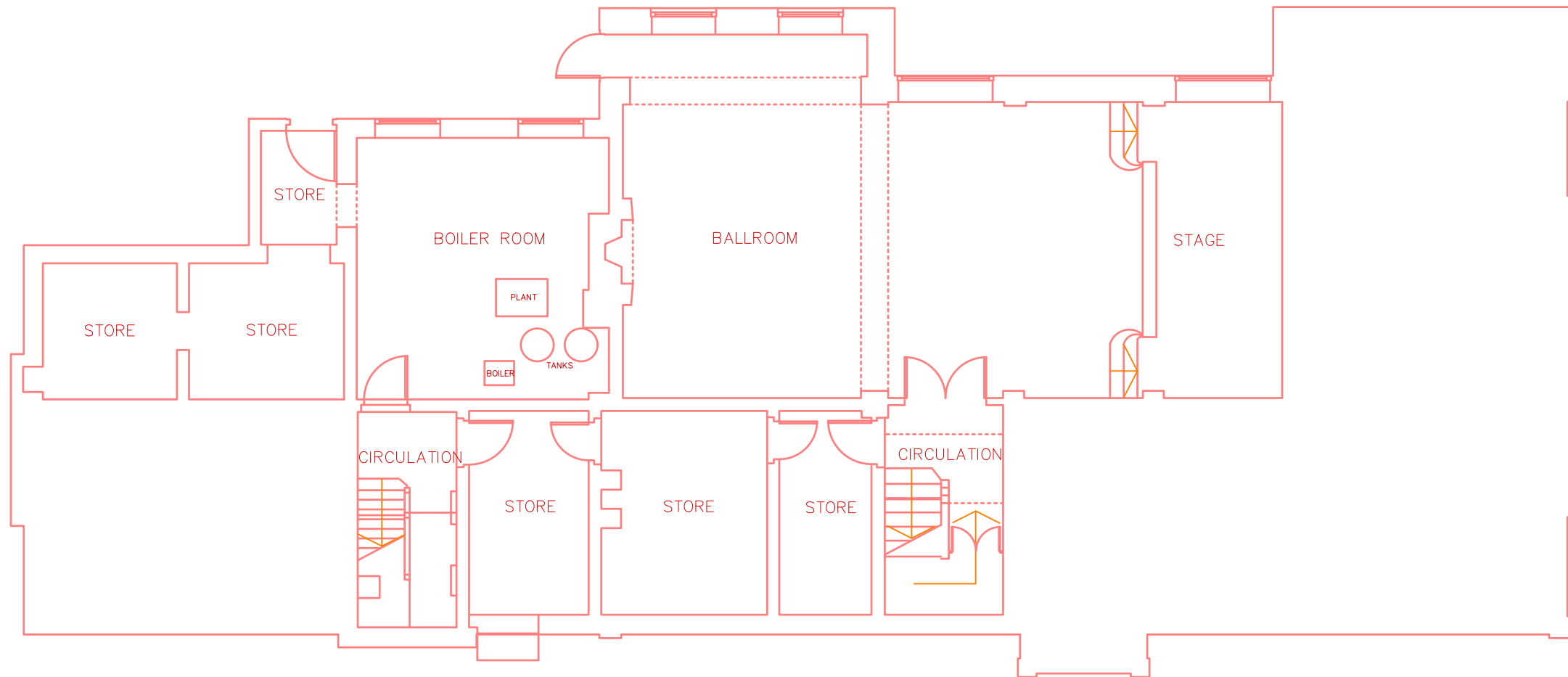
Dwg. No.

100

Rev.

-

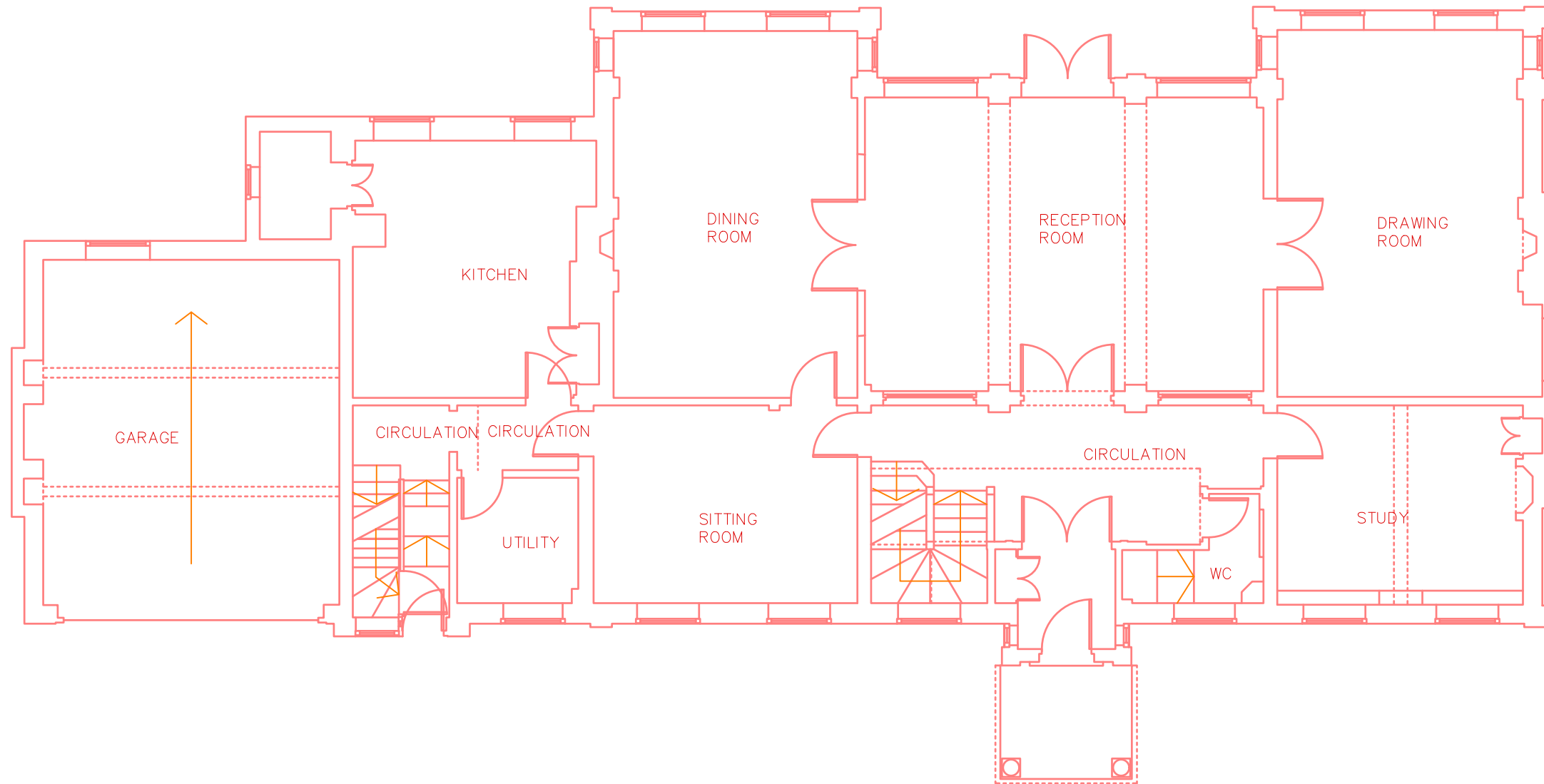
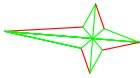




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Status	Project Title 'Guildens', Courtenay Avenue 16 London, N6 4LP						
	Drawing Title Existing Basement Plan						
	Drawn by EZ	Checked by DW	Scale 100 @ A3	Project No.	Work Stage	Dwg. No.	Rev.
FEASIBILITY			1802-	FE	- 101 -		



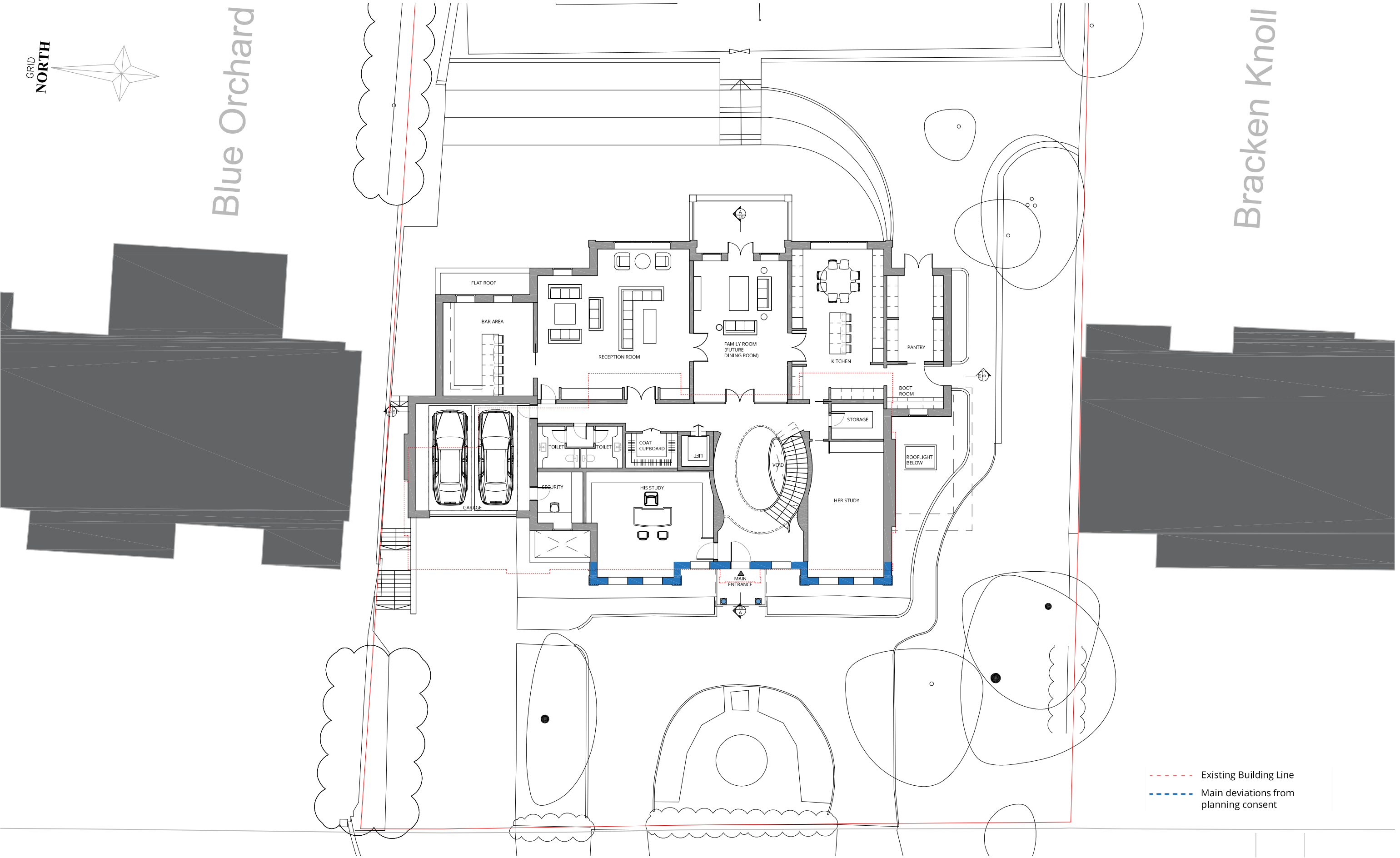


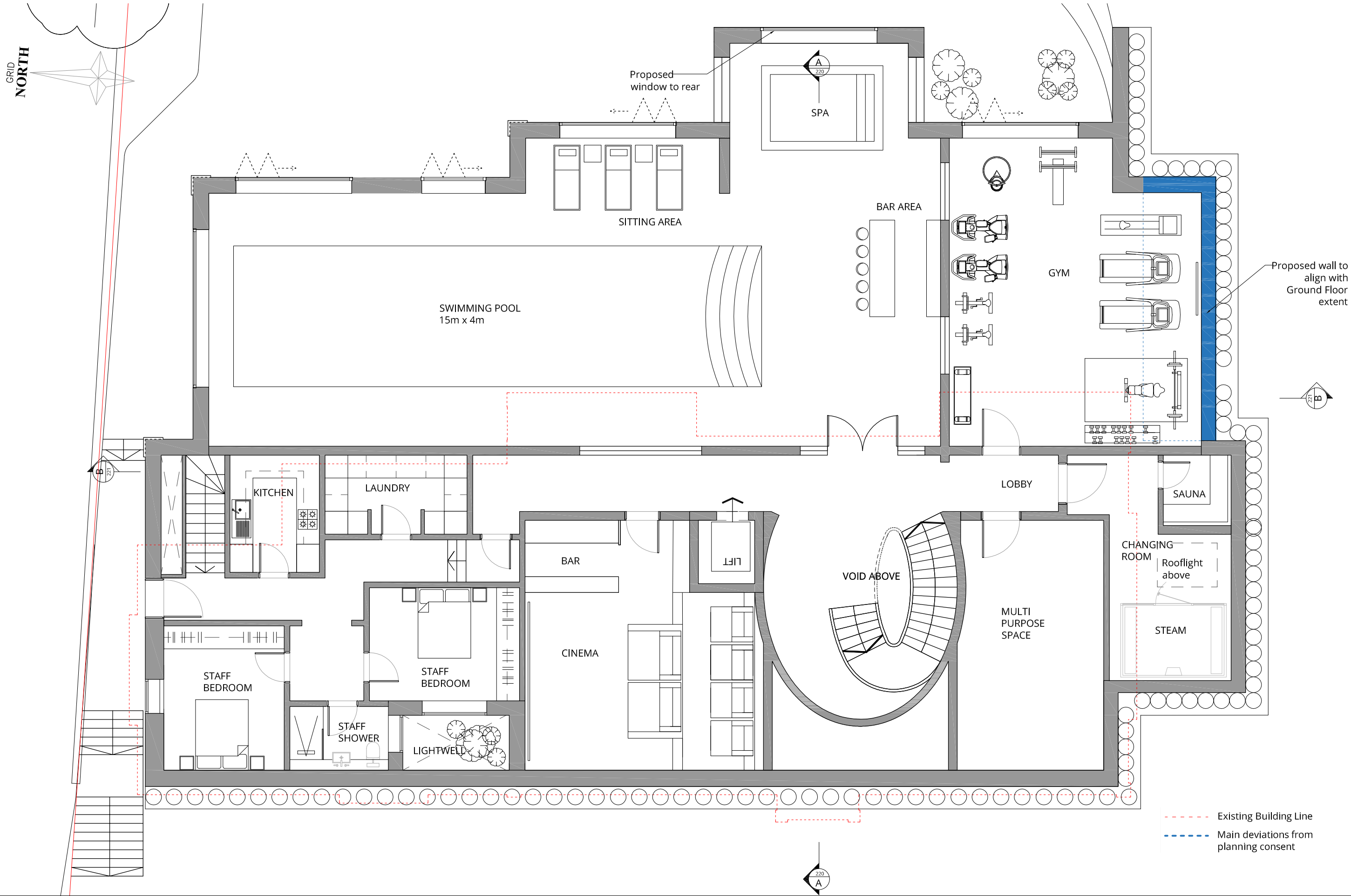
Rev.	Description	Date	Rev.	Description	Date	Rev.	Description	Date
0	First issue.	02.03.18						



APPENDIX B

Proposed development drawings

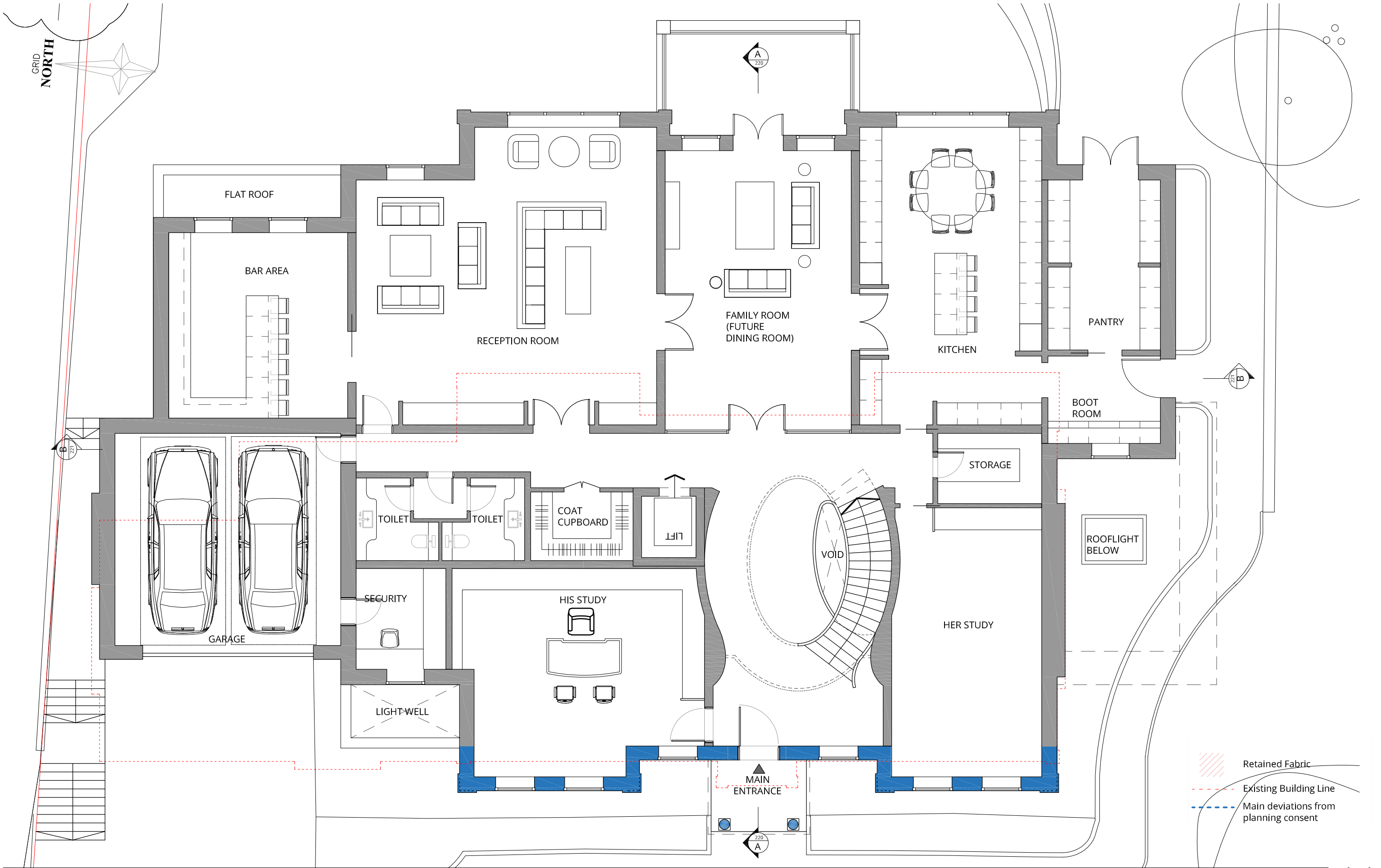




Rev.	Description	Date
0	First issue.	23.03.18
A	Post pre-app revisions.	12.10.18
B	Issue for Planning.	10.04.19
C	Updated Planning drawings	02.07.19
D	Planning drawings revised	26.07.19
E	Updated Planning drawings	12.05.22

Rev.	Description	Date

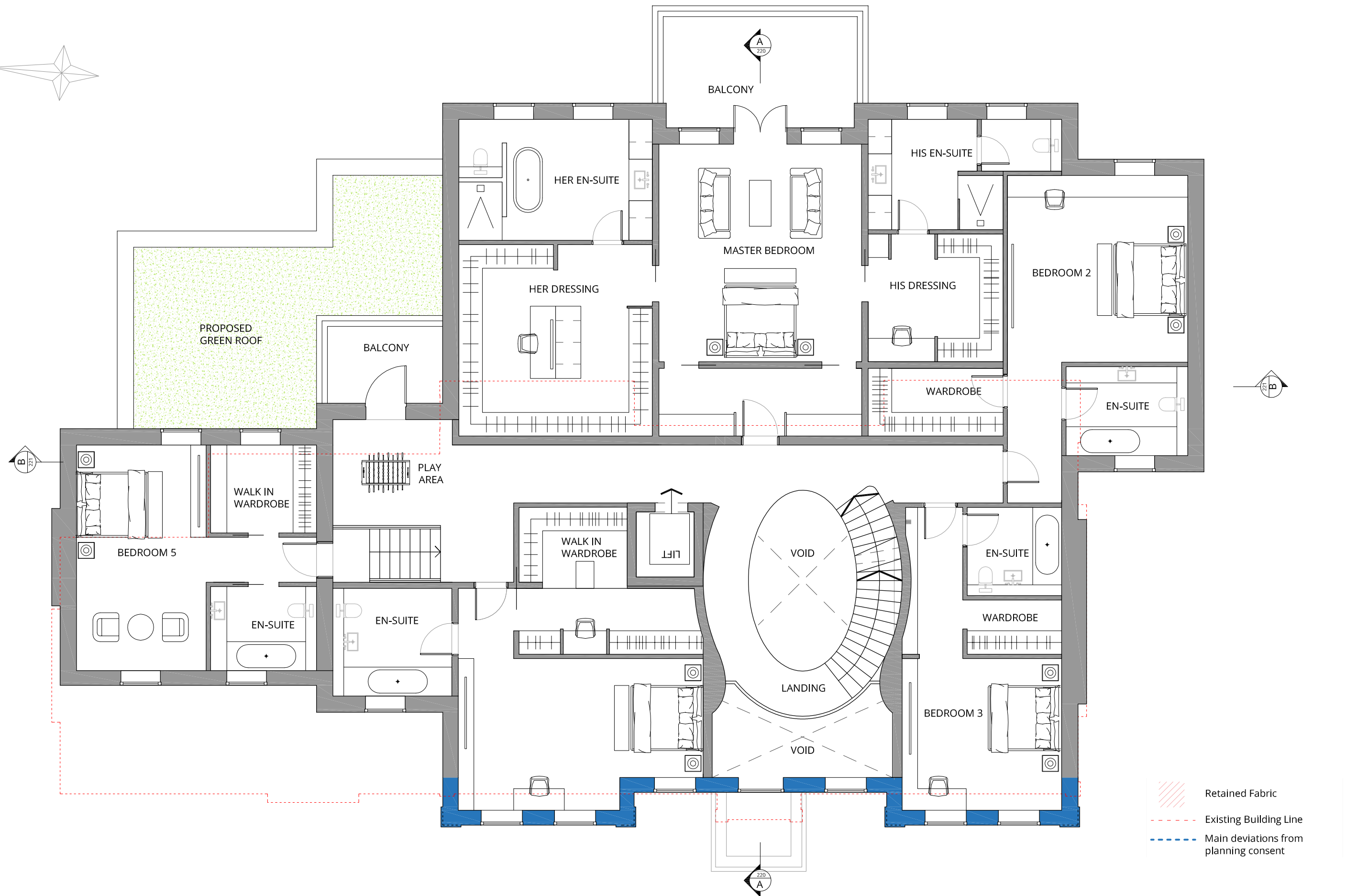
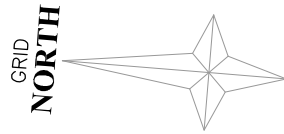
Rev.	Description	Date



Rev.	Description	Date
0	First issue.	23.03.18
A	Post pre-app revisions.	12.10.18
B	Issue for Planning.	10.04.19
C	Updated Planning drawings	02.07.19
D	Planning drawings revised	26.07.19
E	Updated Planning drawings	12.05.22

Rev.	Description	Date

Rev.	Description	Date



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Rev.	Description	Date
0	First Issue.	23.03.18
A	Post pre-app revisions.	12.10.18
B	Issue for Planning.	10.04.19
C	Updated Planning drawings	02.07.19
D	Planning drawings revised	26.07.19
E	Updated Planning drawings	12.05.22

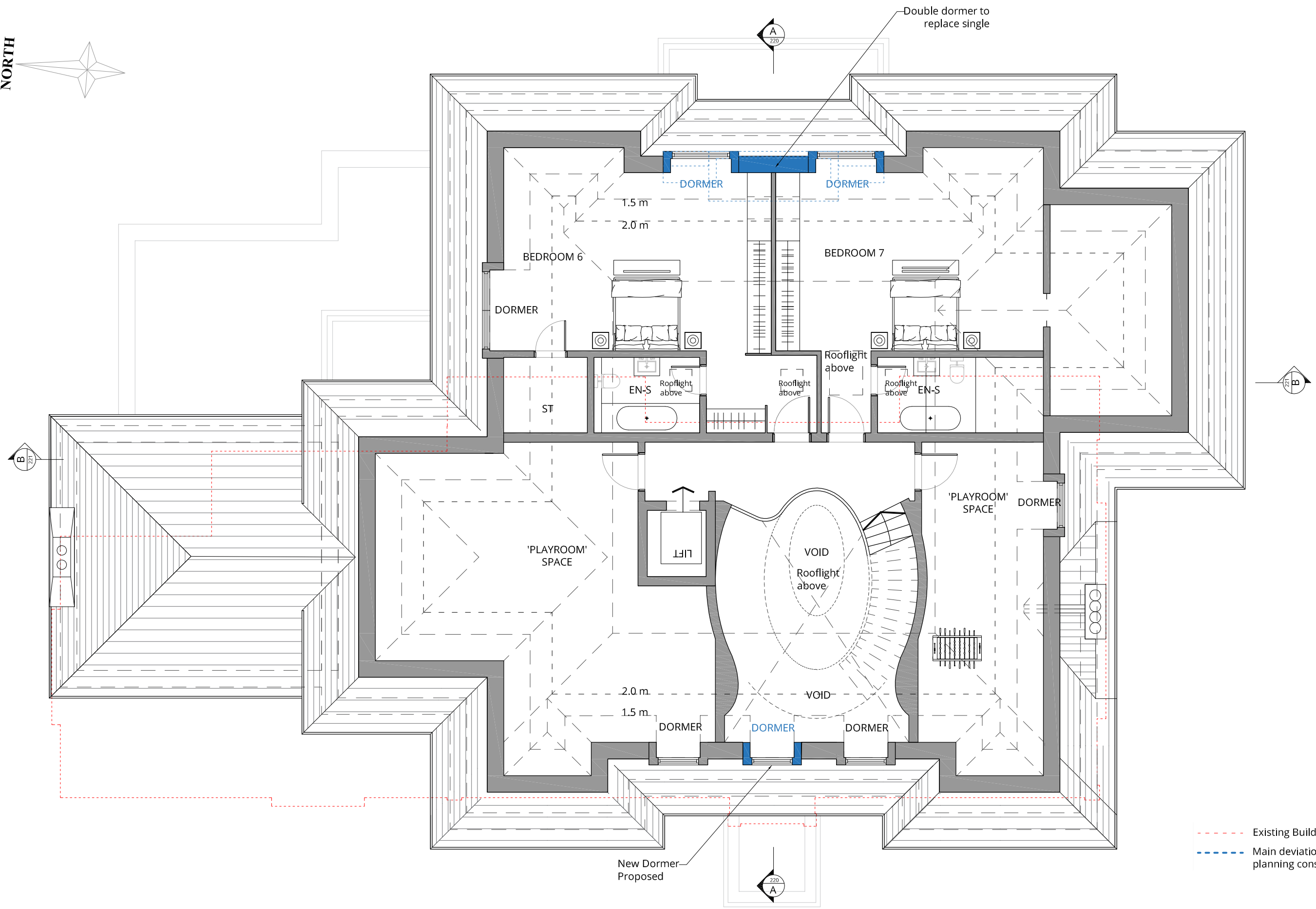
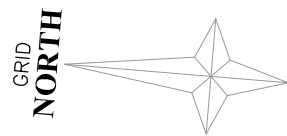
Rev.	Description	Date

Rev.	Description	Date

Status
PLANNING

Project Title 'Guildens', Courtenay Avenue 16 London, N6 4LP			
Drawing Title Proposed First Floor Plan			
Drawn by IPS	Checked by DU	Scale 100 @ A3	Project No. Work Stage Dwg. No. Rev. 1802 - PL - 203 - E





--- Existing Building Line
--- Main deviations from planning consent



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Rev.	Description	Date	Rev.	Description	Date	Rev.	Description	Date
0	First issue.	23.03.18						
A	Post pre-app revisions.	12.10.18						
B	Issue for Planning.	10.04.19						
C	Updated Planning drawings	02.07.19						
D	Planning drawings revised	26.07.19						
E	Updated Planning drawings	12.05.22						

Project Title
'Guildens', Courtenay Avenue 16
London, N6 4LP

Drawing Title
Proposed Second Floor Plan

Status
PLANNING

Drawn by
IPS

Checked by
DU

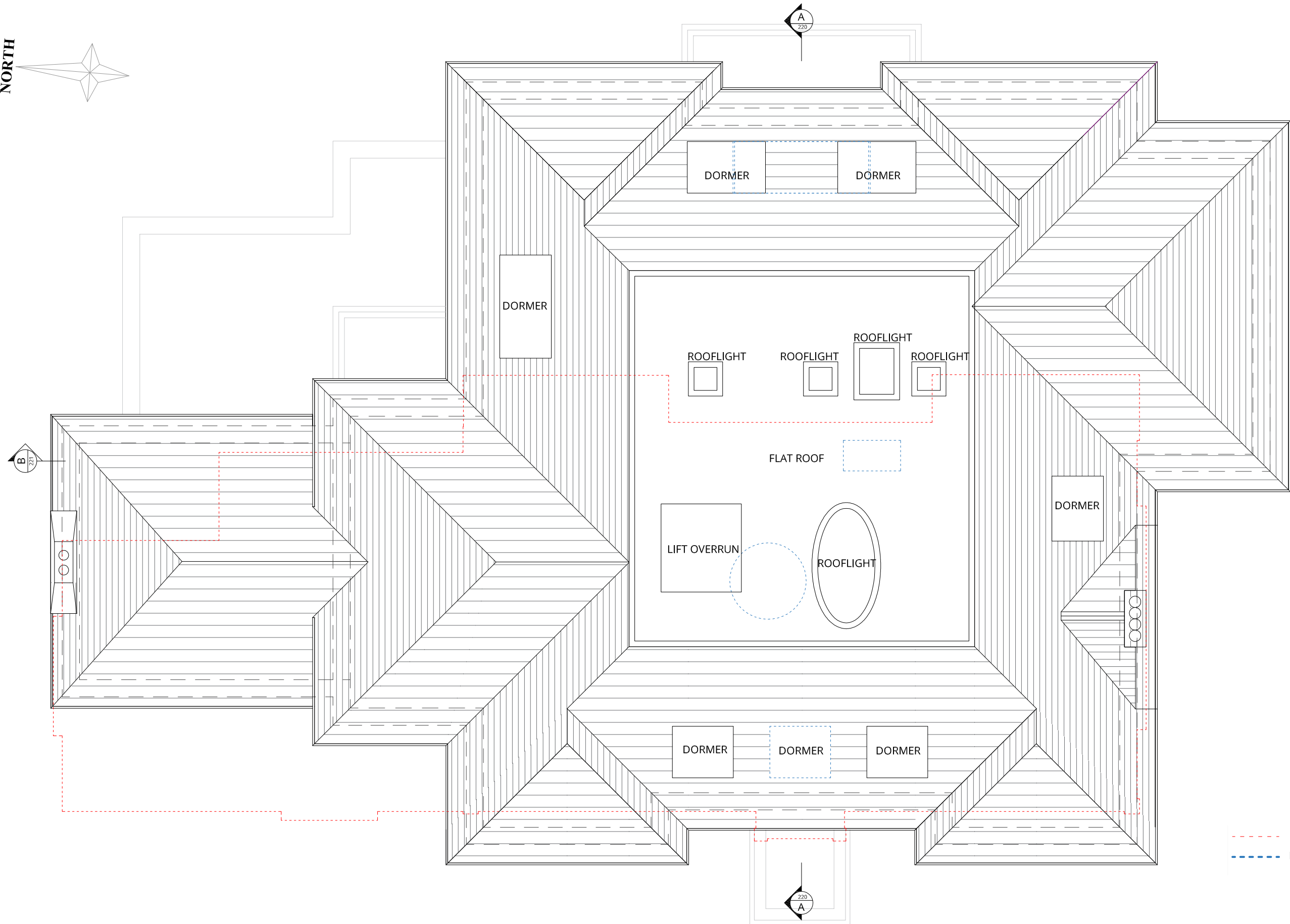
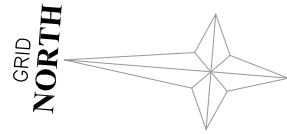
Scale
100 @ A3

Project No.
1802

Work Stage
PL

Dwg. No.
204

Rev.
E



--- Existing Building Line
--- Main deviations from planning consent



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Rev.	Description	Date
0	First issue.	23.03.18
A	Post pre-app revisions.	12.10.18
B	Issue for Planning.	10.04.19
C	Updated Planning drawings	02.07.19
D	Planning drawings revised	26.07.19
E	Updated Planning drawings	12.05.22

Rev.	Description	Date

Rev.	Description	Date

Project Title
'Guildens', Courtenay Avenue 16
London, N6 4LP

Drawing Title
Proposed Roof Plan

Status
PLANNING

Drawn by
IPS

Checked by
DU

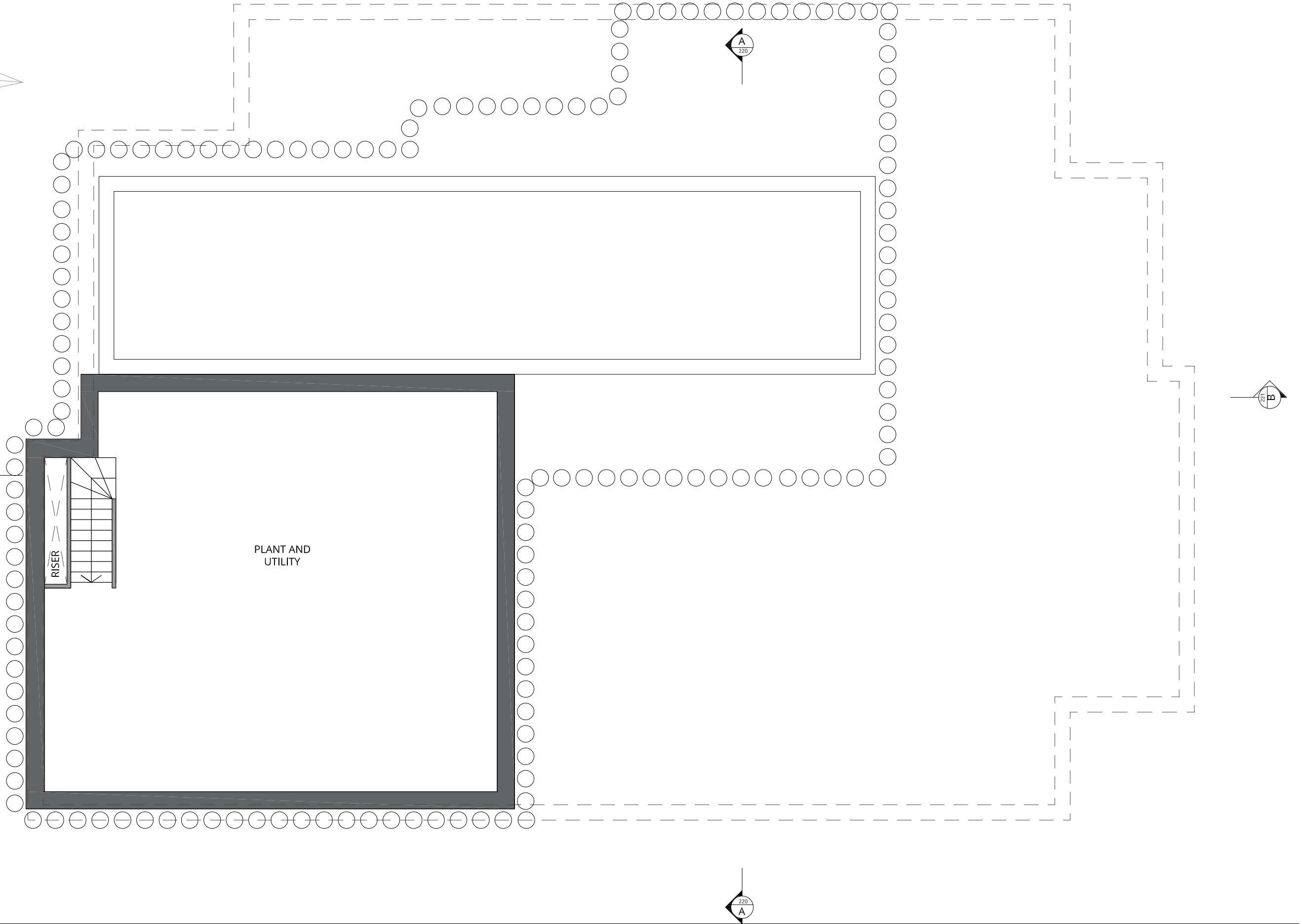
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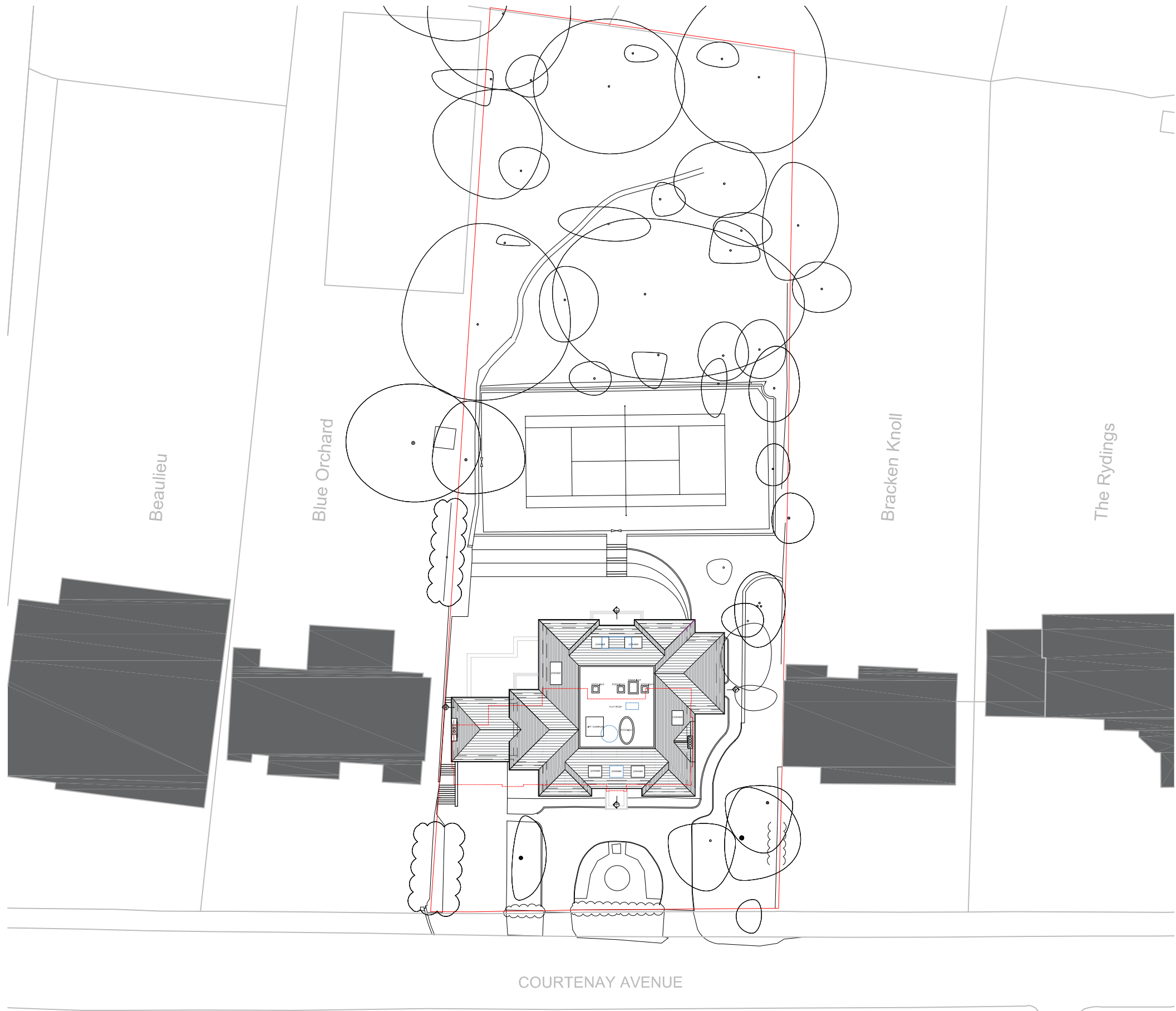
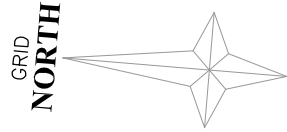
Project No.
1802 - PL

Work Stage
- 205 -

Dwg. No.
E

Rev.
E





--- Existing Building Line
--- Main deviations from
planning consent



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Rev.	Description	Date	Rev.	Description	Date	Rev.	Description	Date
0	First Issue.	23.03.18						
A	Post pre-app revisions.	12.10.18						
B	Issue for Planning.	10.04.19						
C	Updated Planning drawings	02.07.19						
D	Planning drawings revised	26.07.19						
E	Updated Planning drawings	12.05.22						

Project Title
'Guildens', Courtenay Avenue 16
London, N6 4LP

Drawing Title
Proposed Footprint

Drawn by IPS	Checked by DU	Scale 500 @ A3	Project No. 1802	Work Stage PL	Dwg. No. 207	Rev. E
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--- Existing Building Line
--- Planning consent

Rev.	Description	Date
0	First issue.	23.03.18
A	Post pre-app revisions.	12.10.18
B	Issue for Planning.	10.04.19
C	Updated Planning drawings	02.07.19
D	Planning drawings revised	26.07.19
E	Updated Planning drawings	12.05.22

Rev.	Description	Date

Rev.	Description	Date

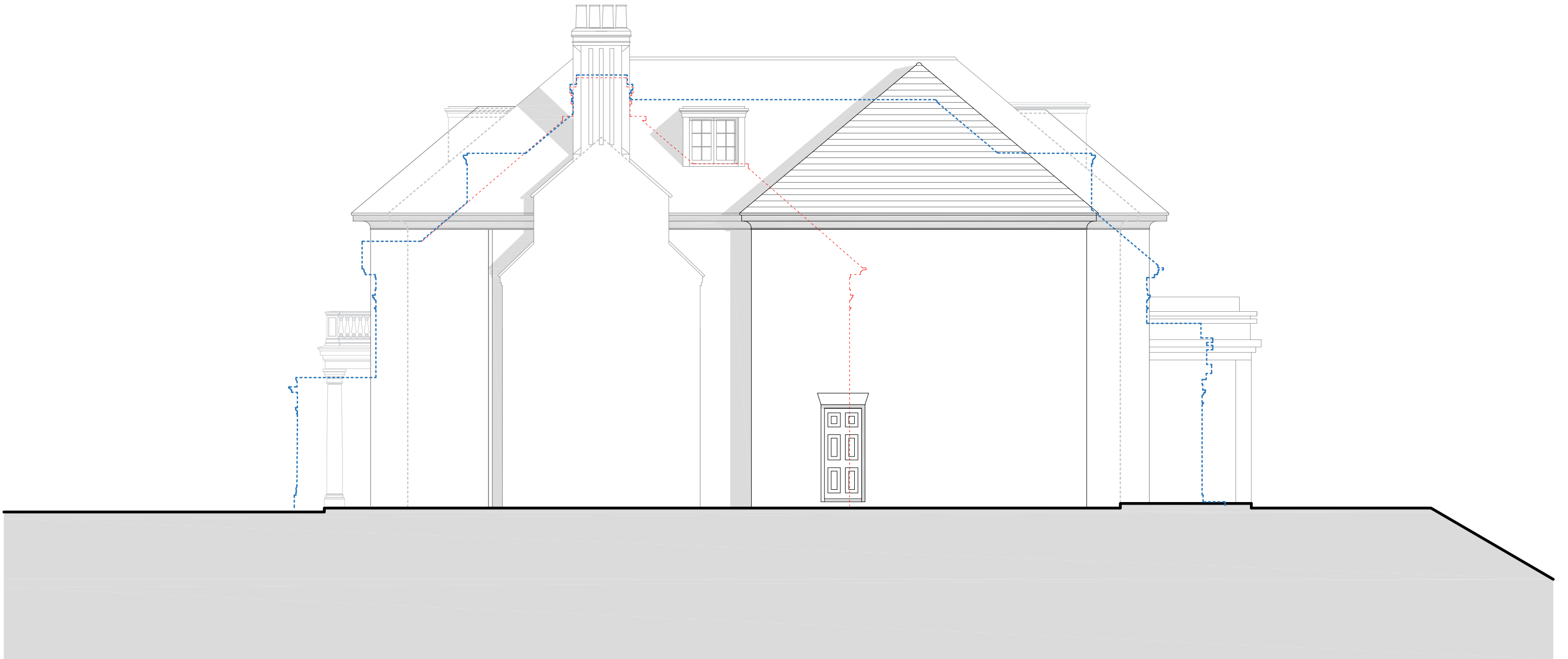


--- Existing Building Line
--- Planning consent

Rev.	Description	Date
0	First issue.	23.03.18
A	Post pre-app revisions.	12.10.18
B	Issue for Planning.	10.04.19
C	Updated Planning drawings	02.07.19
D	Planning drawings revised	26.07.19
E	Updated Planning drawings	12.05.22

Rev.	Description	Date

Rev.	Description	Date

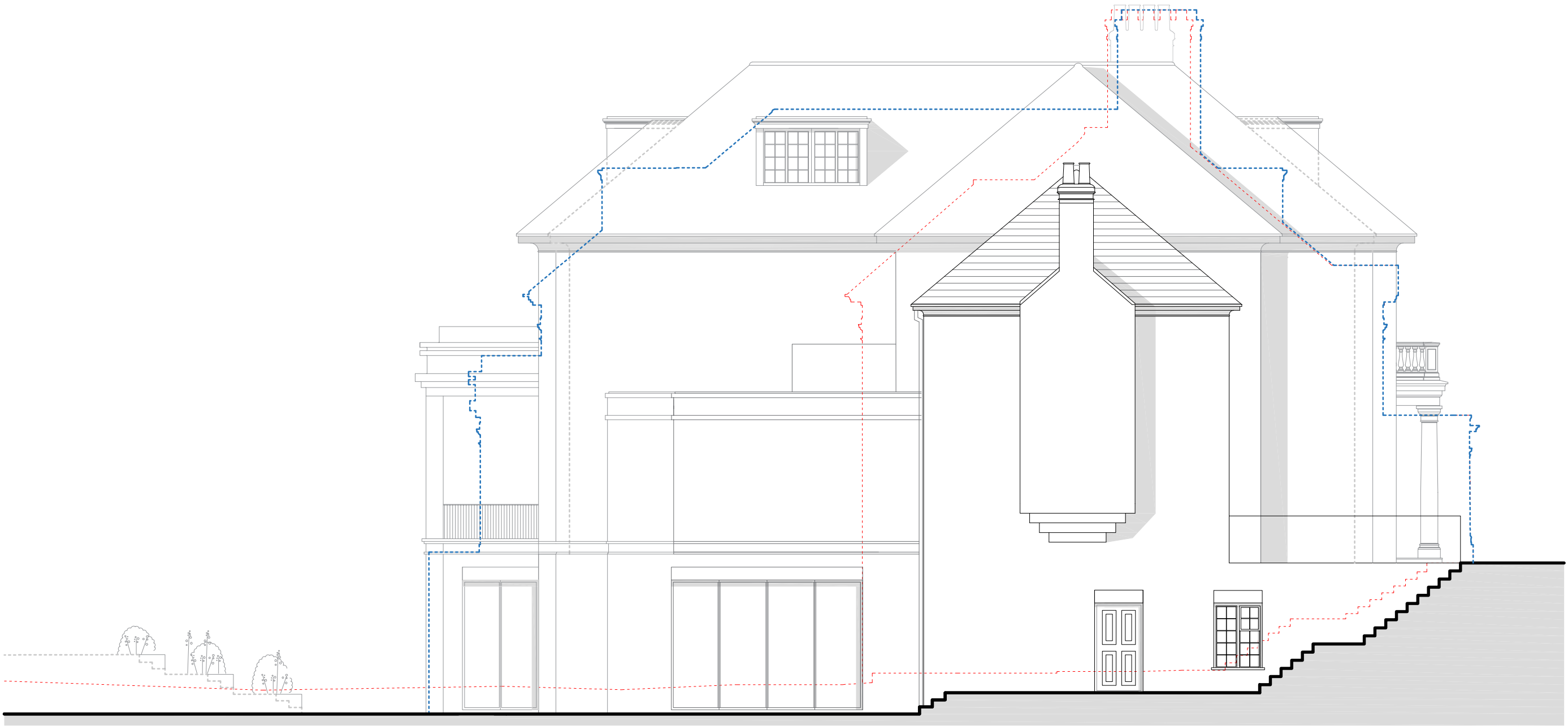


--- Existing Building Line
--- Planning consent

Rev.	Description	Date
0	First issue.	23.03.18
A	Post pre-app revisions.	12.10.18
B	Issue for Planning.	10.04.19
C	Updated Planning drawings	02.07.19
D	Planning drawings revised	26.07.19
E	Updated Planning drawings	12.05.22

Rev.	Description	Date

Rev.	Description	Date



--- Existing Building Line
--- Planning consent

Rev.	Description	Date
0	Issue for Planning.	10.04.19
A	Updated Planning drawings	02.07.19
B	Issue for Planning.	10.04.19
C	Updated Planning drawings	02.07.19
D	Planning drawings revised	26.07.19
E	Updated Planning drawings	12.05.22

Rev.	Description	Date

Rev.	Description	Date

Status
PLANNING

Project Title 'Guildens', Courtenay Avenue 16 London, N6 4LP				Drawing Title Proposed North Elevation			
Drawn by IPS	Checked by DU	Scale 100 @ A3	Project No. 1802	Work Stage PL	Dwg. No. 213	Rev. E	





Rev.	Description	Date
0	First Issue.	23.03.18
A	Post pre-app revisions.	12.10.18
B	Issue for Planning.	10.04.19
C	Updated Planning drawings	02.07.19
D	Planning drawings revised	26.07.19
E	Updated Planning drawings	12.05.22

Rev.	Description	Date

Rev.	Description	Date



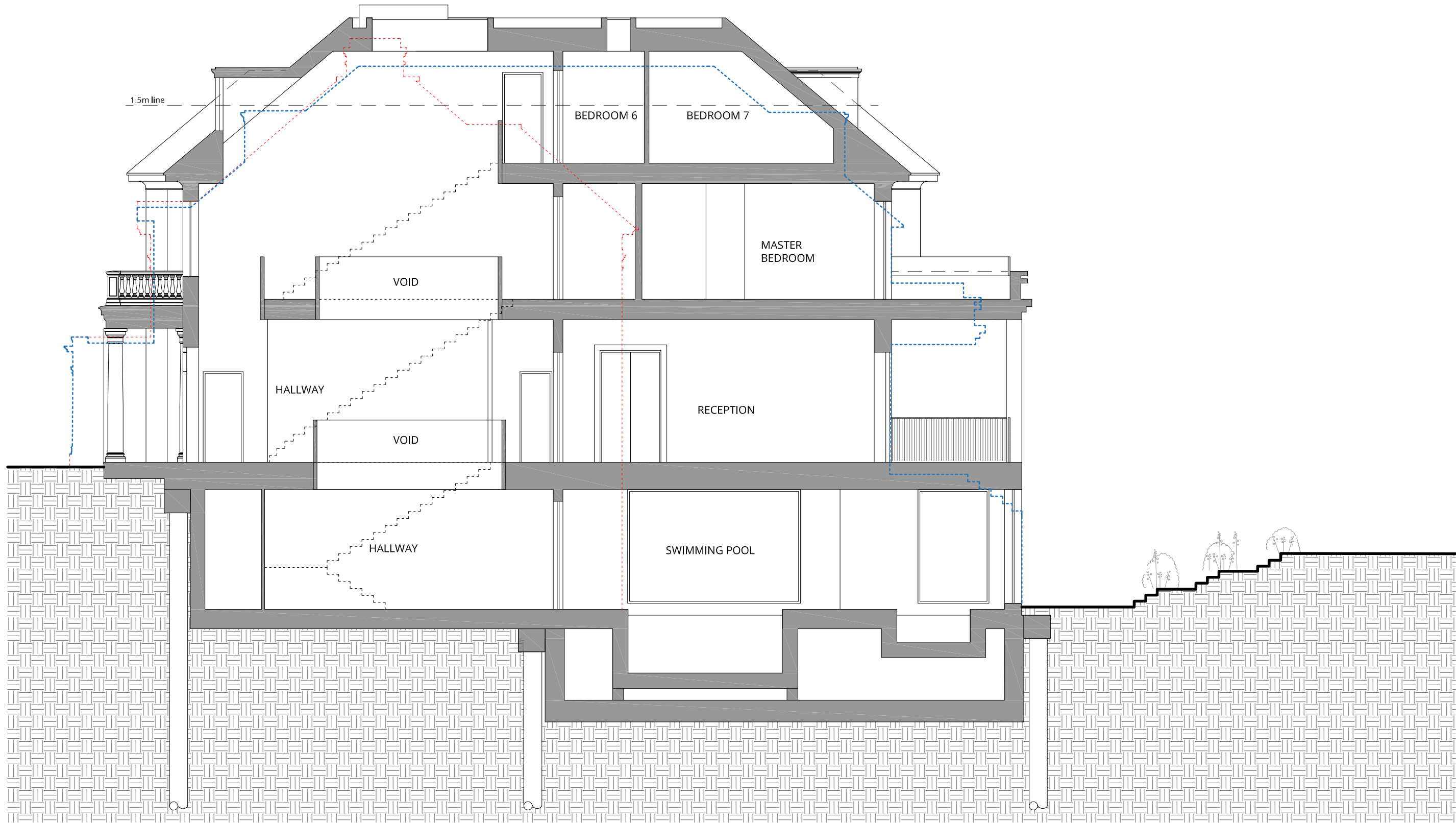
--- Existing Building Line
--- Planning consent

Rev.	Description	Date
0	First issue.	23.03.18
A	Post pre-app revisions.	12.10.18
B	Issue for Planning.	10.04.19
C	Updated Planning drawings	02.07.19
D	Planning drawings revised	26.07.19
E	Updated Planning drawings	12.05.22

Rev.	Description	Date

Rev.	Description	Date



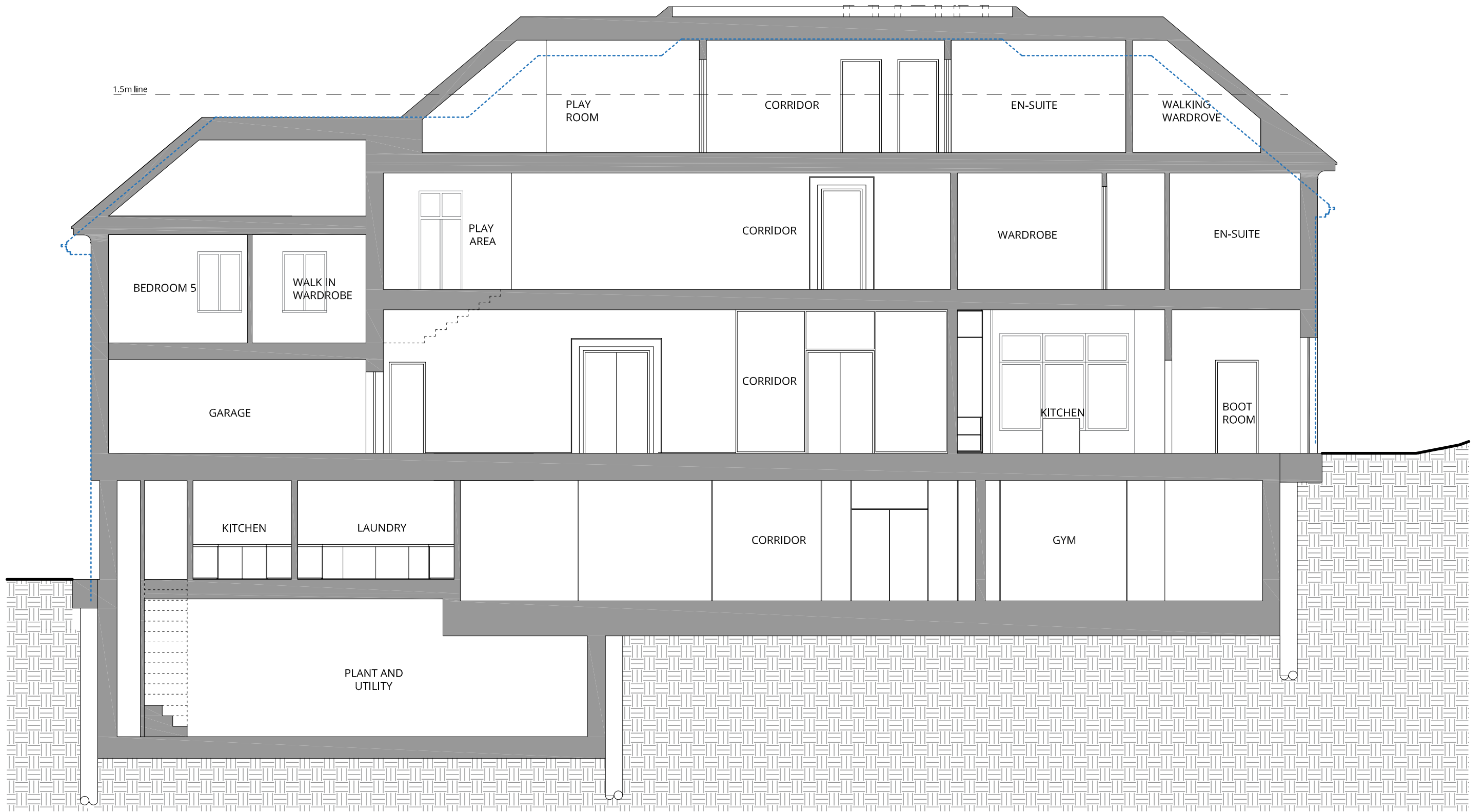


- proposed
- Existing Building Line
- Planning consent

Rev.	Description	Date
0	Issue for Planning.	10.04.19
A	Keys amended	24.04.19
B	Updated Planning drawings	02.07.19
C	Planning drawings revised	26.07.19
D	Updated Planning drawings	12.05.22

Rev.	Description	Date

Rev.	Description	Date



- proposed
- Existing Building Line
- Planning consent

Rev.	Description	Date
0	Issue for Planning.	10.04.19
A	Keys amended	24.04.19
B	Updated Planning drawings	02.07.19
D	Planning drawings revised	26.07.19
E	Updated Planning drawings	12.05.22

Rev.	Description	Date

Rev.	Description	Date



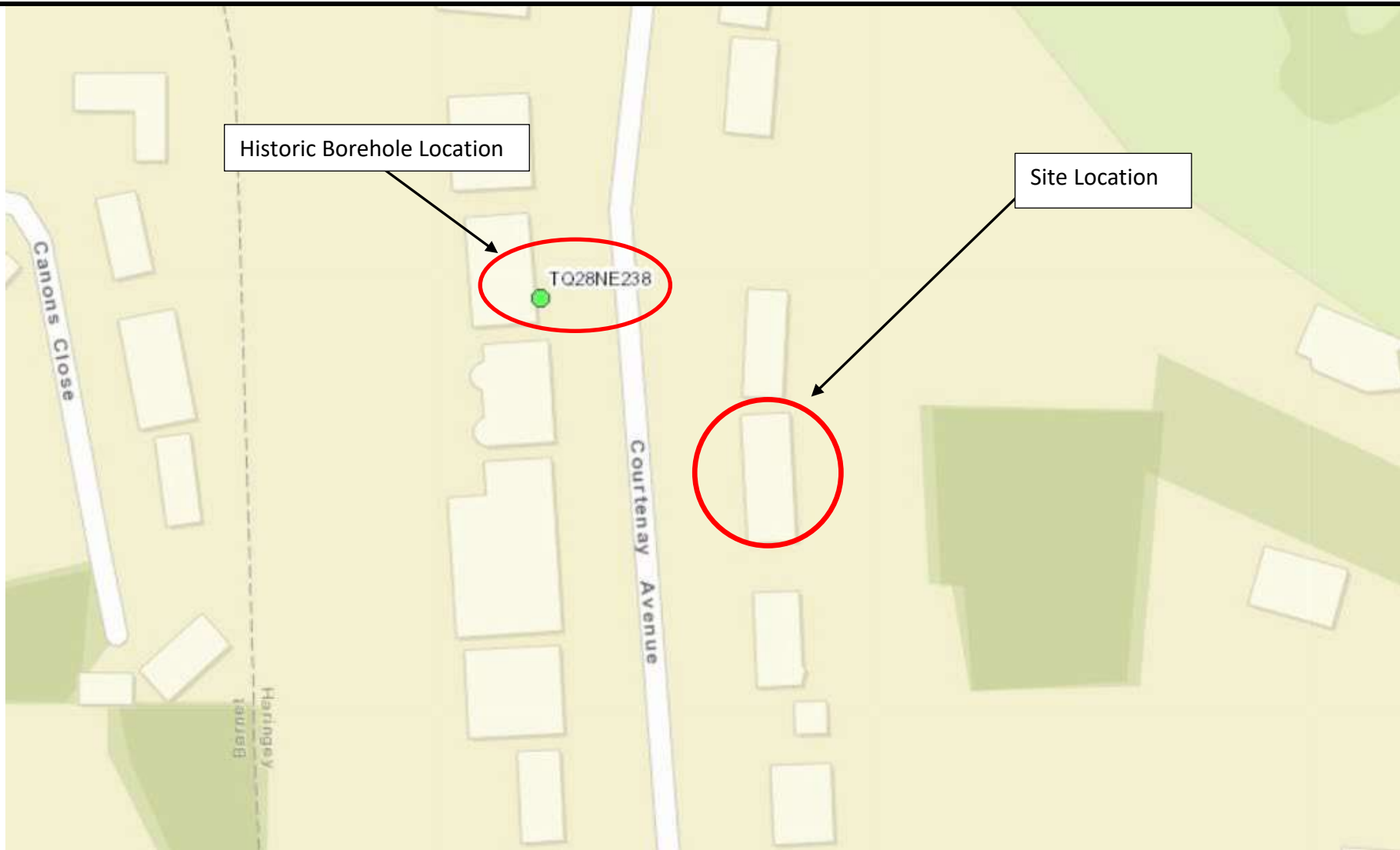
APPENDIX C

Historical borehole record

Contract: Courtenay Avenue, N6 Client: F B Eilmer Limited					Borehole No. 1 Sheet No. 1 of 2 Depth 0 to 10 metres			
Equipment and Methods Light Cable Percussion Boring 150mm diameter			Ground Level : 76.403 m.O.D. Coordinates :		Job Number : 992/T223 Location : Dates : 5/2/92 6/2/92			
Orientation : Vertical			British Geological Survey					
Daily Prog.	Meter Levels	Remarks	In Situ Tests	Samples Taken	Depth (thick)	Reduced Level	Description	Legend
					0.00		TOPSOIL	
					0.30		Firm to stiff orange-brown and light grey silty slightly sandy CLAY with scattered pockets and partings of light grey silty fine sand occasional traces of medium gravel and some roots	
				J 1				
				U 2				
				J 3				
				U 4	13.75			
				J 5				
				U 6				
	5/2			J 7				
				U 8	4.05			
				J 9				
				U 10				
				J 11				
				U 12				
	5/2			J 13	13.95			
				U 14				
				J 15				
				U 16	8.00			
				J 17	17.00			
					10.00			
							Continued	
Operator MC		General Remarks Water level observation tubing installed with perforated tubing from 8.00m to 1.00m depth, gravel filter from 8.00m to 1.00m depth and plain tubing from 1.00m depth to ground level						Appendix 1
Scale 10m/sheet		British Geological Survey						Sheet No. 1

Contract: Courtenay Avenue, N5 Client: F B Elmer Limited						Borehole No. 1 Sheet No. 2 of 2. Depth 10 to 20 metres.		
Equipment and Methods Light Cable Percussion Boring 150mm diameter			Ground Level : m.O.O. Coordinates :		Job Number : S92/T223 Location : Dates : 5/2/92 6/2/92			
Orientation : Vertical								
Daily Prog.	Water Levels	Remarks	In Situ Tests	Samples Taken	Depth (Thick)	Reduced Level	Description	Legend
				U 18 J 19	10.00		Stiff becoming very stiff with depth mid-grey silty CLAY with occasional traces of shells and occasional pockets and partings of light grey silty fine sand	
				U 20 J 21				
				U 22 J 23	17.00			
				U 24 J 25				
					15.00			
5/2			End of Borehole					
Operator MC		General Remarks: Water level observation tubing installed with perforated tubing from 8.00m to 1.00m depth, gravel filter from 8.00m to 1.00m depth and plain tubing from 1.00m depth to ground level						Appendix 1
Scale 10m/sheet								Sheet No. 2





Client Alexander Smirnov	Project ‘Guildens’, Courtenay Avenue	Job No CG/28630
	Title Historic Borehole Location	Appendix C

APPENDIX D

Laboratory test results

**Tom Perry**

Card Geotechnics Ltd
4 Godalming Business Centre
Woolsack Way
Godalming
Surrey
GU7 1XW

t: 01483 310600
f: 01483 527285
e: thomasp@cgl-uk.com

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 18-89119

Project / Site name:	Courtenay Avenue	Samples received on:	11/06/2018
Your job number:	CG-28630	Samples instructed on:	15/06/2018
Your order number:	POP000889	Analysis completed by:	27/06/2018
Report Issue Number:	1	Report issued on:	27/06/2018
Samples Analysed:	7 soil samples		

Signed:

Jordan Hill
Reporting Manager
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :	soils	- 4 weeks from reporting
	leachates	- 2 weeks from reporting
	waters	- 2 weeks from reporting
	asbestos	- 6 months from reporting

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Analytical Report Number: 18-89119
Project / Site name: Courtenay Avenue
Your Order No: POP000889

Lab Sample Number				982349	982350	982351	982352	982353
Sample Reference				BH1	BH1	BH1	BH2	BH2
Sample Number				D26	D31	D38	D2	D10
Depth (m)				1.20	3.00	7.00	2.00	8.00
Date Sampled				08/06/2018	08/06/2018	08/06/2018	06/06/2018	06/06/2018
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	16	15	17	17	19
Total mass of sample received	kg	0.001	NONE	0.25	0.30	0.42	0.29	0.53

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.3	7.4	7.6	7.8	7.8
Total Sulphate as SO ₄	mg/kg	50	MCERTS	-	240	1200	190	940
Water Soluble Sulphate (Soil Equivalent)	g/kg	0.0025	MCERTS	0.067	-	-	-	-
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	67	-	-	-	-
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.034	0.039	0.47	0.031	0.42
Total Sulphur	mg/kg	50	MCERTS	-	110	4700	120	7600



Analytical Report Number: 18-89119
Project / Site name: Courtenay Avenue
Your Order No: POP000889

Lab Sample Number				982354	982355			
Sample Reference				BH3	BH3			
Sample Number				D12	D16			
Depth (m)				1.00	5.00			
Date Sampled				07/06/2018	07/06/2018			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1			
Moisture Content	%	N/A	NONE	18	17			
Total mass of sample received	kg	0.001	NONE	0.25	0.32			

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	5.5	6.5			
Total Sulphate as SO ₄	mg/kg	50	MCERTS	280	660			
Water Soluble Sulphate (Soil Equivalent)	g/kg	0.0025	MCERTS	-	-			
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	-	-			
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.031	0.21			
Total Sulphur	mg/kg	50	MCERTS	230	6600			



Analytical Report Number : 18-89119

Project / Site name: Courtenay Avenue

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
982349	BH1	D26	1.20	Brown clay and sand with rubble and coal.
982350	BH1	D31	3.00	Light brown clay.
982351	BH1	D38	7.00	Brown sandy clay.
982352	BH2	D2	2.00	Light brown sandy clay.
982353	BH2	D10	8.00	Brown sandy clay.
982354	BH3	D12	1.00	Light brown sandy clay.
982355	BH3	D16	5.00	Grey clay.

Analytical Report Number : 18-89119

Project / Site name: Courtenay Avenue

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
Total sulphate (as SO ₄ in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L038-PL	D	MCERTS
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, and MEWAM 2006 Methods for the Determination of Metals in Soil	L038-PL	D	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30°C.

**James Morrice**

Card Geotechnics Ltd
4 Godalming Business Centre
Woolsack Way
Godalming
Surrey
GU7 1XW

t: 01483 310600
f: 01483 527285
e:

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 18-89247

Project / Site name:	16 Courtenay Avenue	Samples received on:	15/06/2018
Your job number:	CG-28630	Samples instructed on:	18/06/2018
Your order number:	POP000893	Analysis completed by:	20/06/2018
Report Issue Number:	1	Report issued on:	20/06/2018
Samples Analysed:	3 water samples		

Signed:

Jordan Hill
Reporting Manager
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :	soils	- 4 weeks from reporting
	leachates	- 2 weeks from reporting
	waters	- 2 weeks from reporting
	asbestos	- 6 months from reporting

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Analytical Report Number: 18-89247

Project / Site name: 16 Courtenay Avenue

Your Order No: POP000893

Lab Sample Number				983186	983187	983188		
Sample Reference				BH01	BH02	BH03		
Sample Number				WS1	WS2	WS3		
Depth (m)				None Supplied	None Supplied	None Supplied		
Date Sampled				15/06/2018	15/06/2018	15/06/2018		
Time Taken				None Supplied	None Supplied	None Supplied		
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status					

General Inorganics

pH	pH Units	N/A	ISO 17025	7.0	7.4	6.9		
Sulphate as SO ₄	µg/l	45	ISO 17025	102000	39500	109000		

Heavy Metals / Metalloids

Magnesium (dissolved)	mg/l	0.005	ISO 17025	36	26	41		
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U/S = Unsuitable Sample I/S = Insufficient Sample



Analytical Report Number : 18-89247

Project / Site name: 16 Courtenay Avenue

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in water by ICP-OES (dissolved)	Determination of metals in water by acidification followed by ICP-OES. Accredited Matrices SW, GW, PW, PrW.(Al, Cu,Fe,Zn).	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
pH at 20oC in water (automated)	Determination of pH in water by electrometric measurement. Accredited matrices: SW PW GW	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	W	ISO 17025
Sulphate in water	Determination of sulphate in water by acidification followed by ICP-OES. Accredited matrices: SW PW GW, PrW.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.



4041

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.3 & 5: Definitive Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS



Client: Card Geotechnics Ltd
Client Address: 4 Godalming Business Centre
Woolsack Way
Godalming
Surrey, GU7 1XW
Contact: Tom Perry
Site Name: Courtenay Avenue
Site Address: Not Given

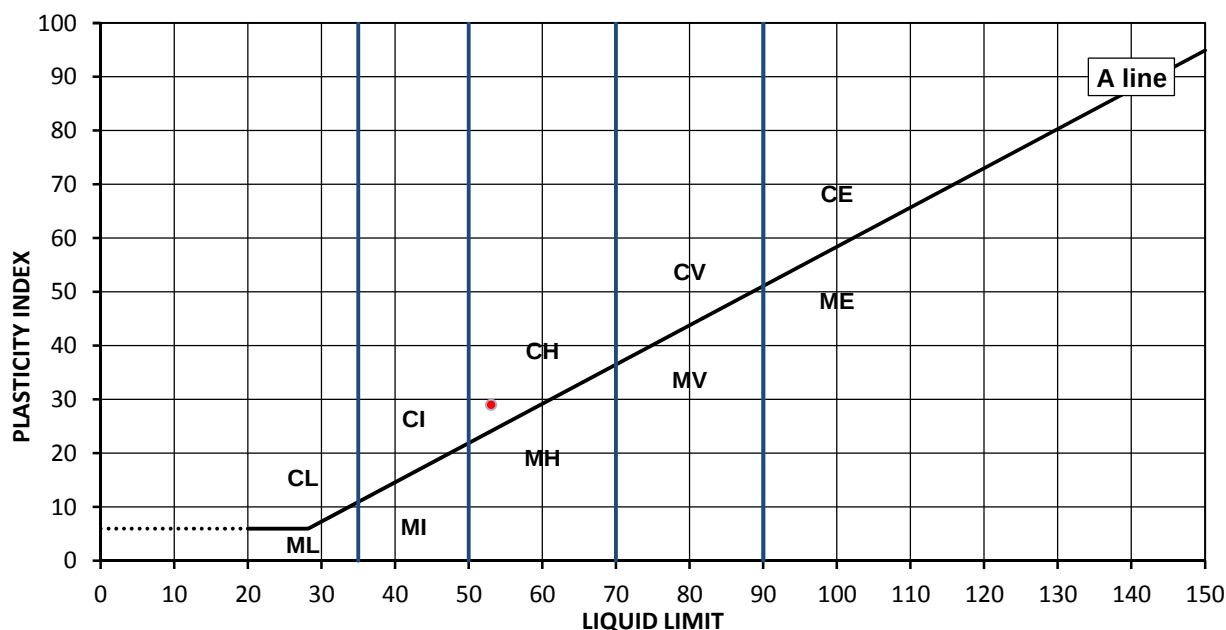
Client Reference: CG28630
Job Number: 18-89422
Date Sampled: 08/06/2018
Date Received: 11/06/2018
Date Tested: 22/06/2018
Sampled By: TBP

Test Results

Laboratory Reference: 984282
Hole No.: BH1
Sample Reference: D33
Soil Description: Yellowish brown slightly sandy CLAY
Sample Preparation: Tested in natural condition

Depth Top [m]: 4.00
Depth Base [m]: Not Given
Sample Type: D

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
28	53	24	29	100



Legend, based on BS 5930:2015 Code of practice for site investigations

Plasticity		Liquid Limit
C	Clay	below 35
M	Silt	35 to 50
L	Low	50 to 70
I	Medium	70 to 90
H	High	exceeding 90
V	Very high	
E	Extremely high	
Organic	O	append to classification for organic material (eg CHO)

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory
Manager
Date Reported: 28/06/2018

Signed:

Darren Berrill
Geotechnical General
Manager

for and on behalf of i2 Analytical Ltd

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The results included within the report are representative of the samples submitted for analysis.
The analysis was carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland."



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Tested in Accordance with BS1377-2: 1990: Clause 4.3 & 5: Definitive Method

i2 Analytical Ltd
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Client: Card Geotechnics Ltd
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Surrey, GU7 1XW
Contact: Tom Perry
Site Name: Courtenay Avenue
Site Address: Not Given

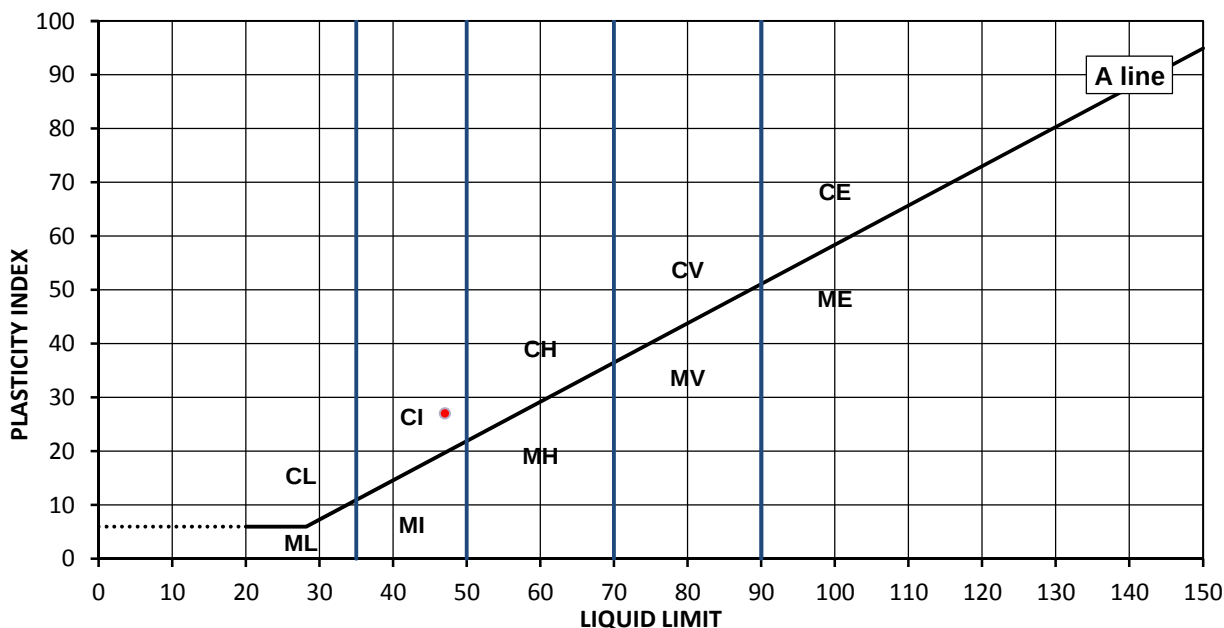
Client Reference: CG28630
Job Number: 18-89422
Date Sampled: 08/06/2018
Date Received: 11/06/2018
Date Tested: 22/06/2018
Sampled By: TBP

Test Results

Laboratory Reference: 984285
Hole No.: BH1
Sample Reference: D40
Soil Description: Dark brown sandy CLAY
Sample Preparation: Tested in natural condition

Depth Top [m]: 9.00
Depth Base [m]: Not Given
Sample Type: D

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
27	47	20	27	100



Legend, based on BS 5930:2015 Code of practice for site investigations

Plasticity		Liquid Limit
C	Clay	below 35
M	Silt	35 to 50
L	Low	50 to 70
I	Medium	70 to 90
H	High	exceeding 90
V	Very high	
E	Extremely high	
Organic	O	append to classification for organic material (eg CHO)

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory
Manager
Date Reported: 28/06/2018

Signed:

Darren Berrill
Geotechnical General
Manager

for and on behalf of i2 Analytical Ltd

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Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.3 & 5: Definitive Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS



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Woolsack Way
Godalming
Surrey, GU7 1XW
Contact: Tom Perry
Site Name: Courtenay Avenue
Site Address: Not Given

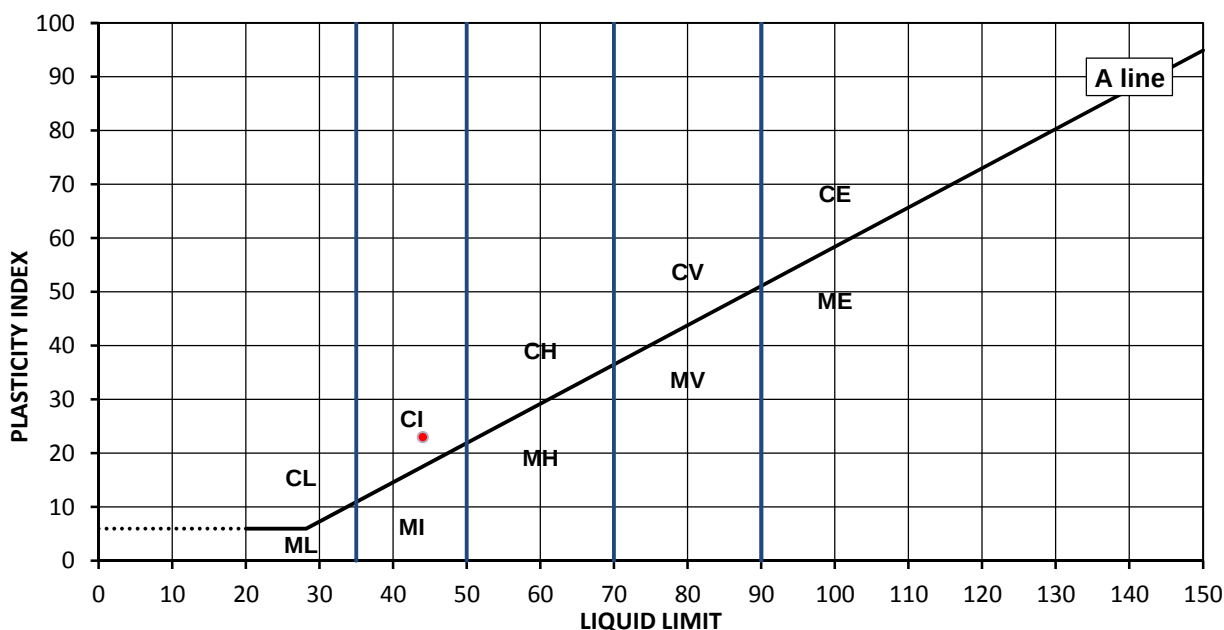
Client Reference: CG28630
Job Number: 18-89422
Date Sampled: 06/06/2018
Date Received: 11/06/2018
Date Tested: 22/06/2018
Sampled By: TBP

Test Results

Laboratory Reference: 984291
Hole No.: BH2
Sample Reference: D5
Soil Description: Brown slightly sandy CLAY
Sample Preparation: Tested in natural condition

Depth Top [m]: 4.00
Depth Base [m]: Not Given
Sample Type: D

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
24	44	21	23	100



Legend, based on BS 5930:2015 Code of practice for site investigations

Plasticity		Liquid Limit
C	Clay	below 35
M	Silt	35 to 50
L	Low	50 to 70
I	Medium	70 to 90
H	High	exceeding 90
V	Very high	
E	Extremely high	
Organic	O	append to classification for organic material (eg CHO)

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory
Manager
Date Reported: 28/06/2018

Signed:

Darren Berrill
Geotechnical General
Manager

for and on behalf of i2 Analytical Ltd

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Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.3 & 5: Definitive Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS



Client: Card Geotechnics Ltd
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Woolsack Way
Godalming
Surrey, GU7 1XW
Contact: Tom Perry
Site Name: Courtenay Avenue
Site Address: Not Given

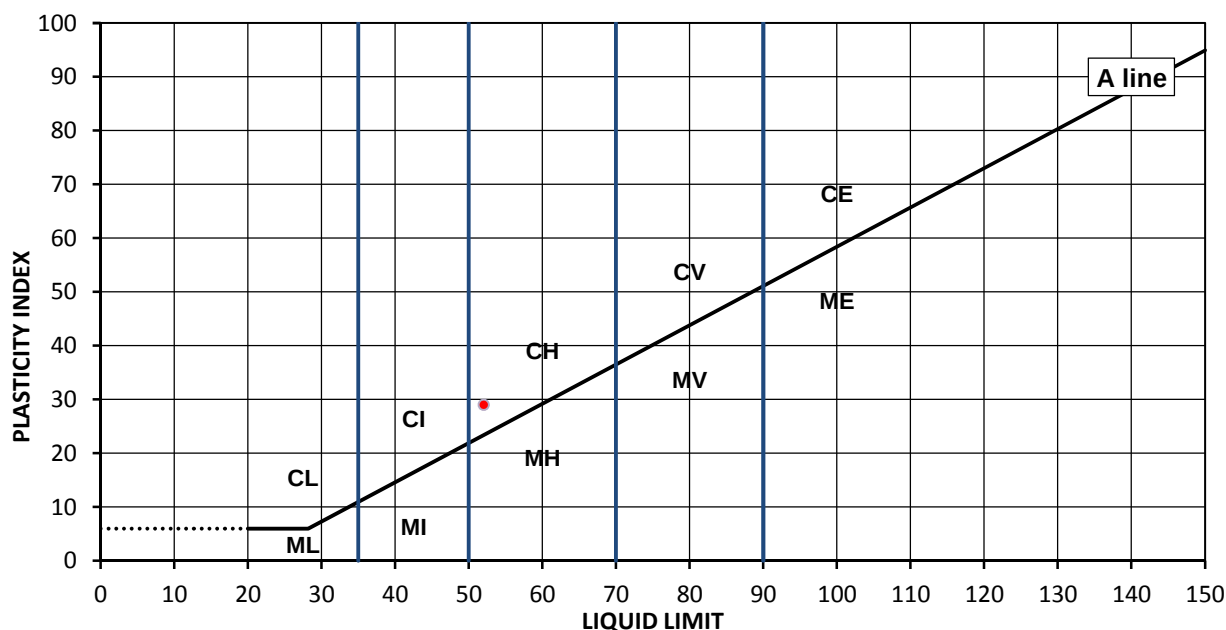
Client Reference: CG28630
Job Number: 18-89422
Date Sampled: 06/06/2018
Date Received: 11/06/2018
Date Tested: 22/06/2018
Sampled By: TBP

Test Results

Laboratory Reference: 984293
Hole No.: BH2
Sample Reference: D11
Soil Description: Brownish grey slightly sandy CLAY
Sample Preparation: Tested in natural condition

Depth Top [m]: 10.00
Depth Base [m]: Not Given
Sample Type: D

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
32	52	23	29	100



Legend, based on BS 5930:2015 Code of practice for site investigations

Plasticity		Liquid Limit
C	Clay	below 35
M	Silt	35 to 50
L	Low	50 to 70
I	Medium	70 to 90
H	High	exceeding 90
V	Very high	
E	Extremely high	
Organic	O	append to classification for organic material (eg CHO)

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory
Manager
Date Reported: 28/06/2018

Signed:

Darren Berrill
Geotechnical General
Manager

for and on behalf of i2 Analytical Ltd

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Determination of Liquid and Plastic Limits

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Site Address: Not Given

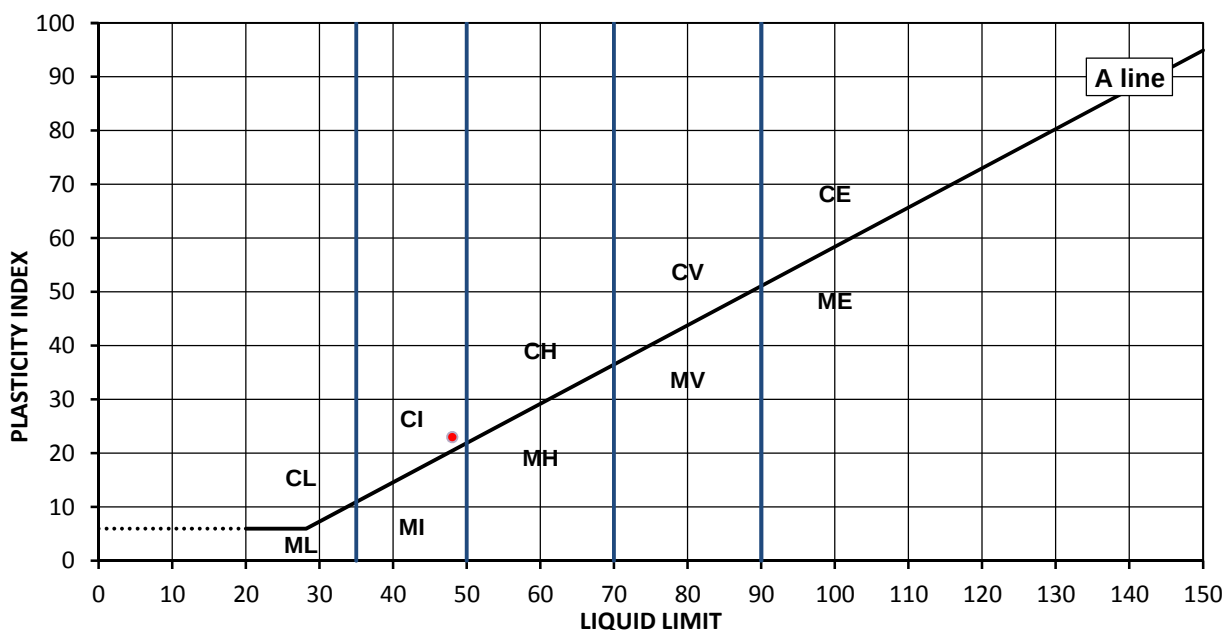
Client Reference: CG28630
Job Number: 18-89422
Date Sampled: 07/06/2018
Date Received: 11/06/2018
Date Tested: 22/06/2018
Sampled By: TBP

Test Results

Laboratory Reference: 984296
Hole No.: BH3
Sample Reference: D13
Soil Description: Brown slightly sandy CLAY
Sample Preparation: Tested in natural condition

Depth Top [m]: 2.00
Depth Base [m]: Not Given
Sample Type: D

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
28	48	25	23	100



Legend, based on BS 5930:2015 Code of practice for site investigations

Plasticity		Liquid Limit
C	Clay	below 35
M	Silt	35 to 50
L	Low	50 to 70
I	Medium	70 to 90
H	High	exceeding 90
V	Very high	
E	Extremely high	
Organic	O	append to classification for organic material (eg CHO)

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory
Manager
Date Reported: 28/06/2018

Signed:

Darren Berrill
Geotechnical General
Manager

for and on behalf of i2 Analytical Ltd

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Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.3 & 5: Definitive Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS



Client: Card Geotechnics Ltd
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Woolsack Way
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Site Address: Not Given

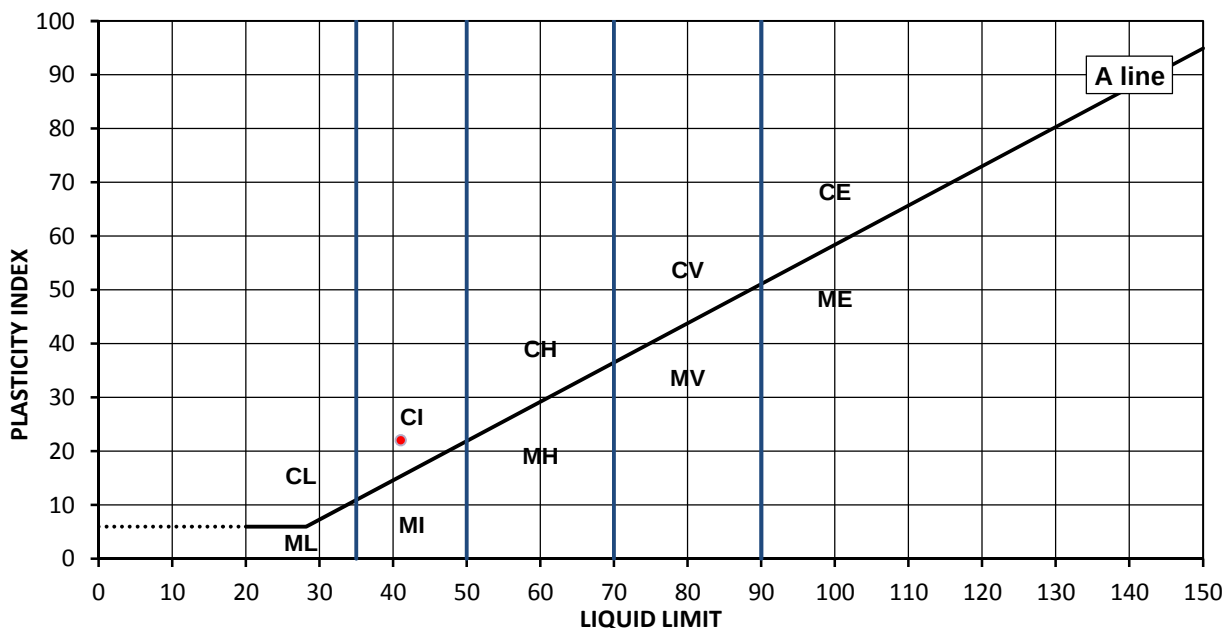
Client Reference: CG28630
Job Number: 18-89422
Date Sampled: 07/06/2018
Date Received: 11/06/2018
Date Tested: 22/06/2018
Sampled By: TBP

Test Results

Laboratory Reference: 984303
Hole No.: BH3
Sample Reference: D17
Soil Description: Dark grey sandy CLAY
Sample Preparation: Tested in natural condition

Depth Top [m]: 6.00
Depth Base [m]: Not Given
Sample Type: D

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
26	41	19	22	100



Legend, based on BS 5930:2015 Code of practice for site investigations

Plasticity		Liquid Limit
C	Clay	below 35
M	Silt	35 to 50
L	Low	50 to 70
I	Medium	70 to 90
H	High	exceeding 90
V	Very high	
E	Extremely high	
Organic	O	append to classification for organic material (eg CHO)

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory
Manager
Date Reported: 28/06/2018

Signed:

Darren Berrill
Geotechnical General
Manager

for and on behalf of i2 Analytical Ltd

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4041

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.3 & 5: Definitive Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS



Client: Card Geotechnics Ltd
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Woolsack Way
Godalming
Surrey, GU7 1XW
Contact: Tom Perry
Site Name: Courtenay Avenue
Site Address: Not Given

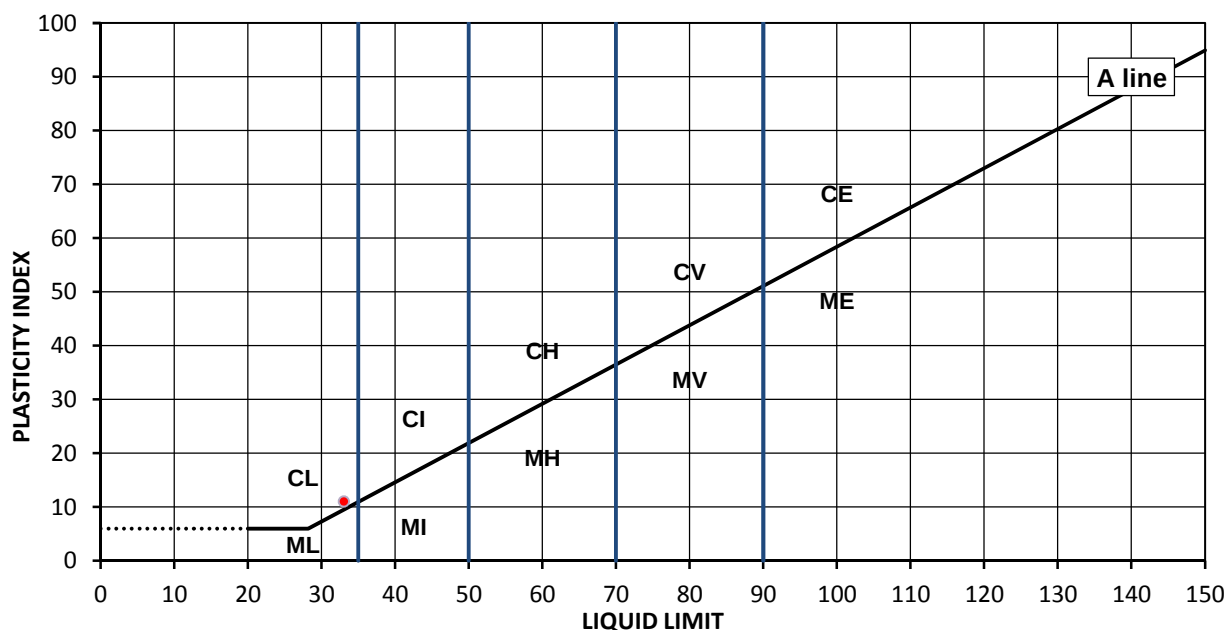
Client Reference: CG28630
Job Number: 18-89422
Date Sampled: 07/06/2018
Date Received: 11/06/2018
Date Tested: 22/06/2018
Sampled By: TBP

Test Results

Laboratory Reference: 984304
Hole No.: BH3
Sample Reference: D20
Soil Description: Dark grey very sandy CLAY
Sample Preparation: Tested in natural condition

Depth Top [m]: 9.00
Depth Base [m]: Not Given
Sample Type: D

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
31	33	22	11	100



Legend, based on BS 5930:2015 Code of practice for site investigations

C	Clay	Plasticity	Liquid Limit
M	Silt	L Low	below 35
		I Medium	35 to 50
		H High	50 to 70
		V Very high	70 to 90
		E Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory
Manager
Date Reported: 28/06/2018

Signed:

Darren Berrill
Geotechnical General
Manager

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Summary of Classification Test Results

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS



Client: Card Geotechnics Ltd
Client Address: 4 Godalming Business Centre
Woolsack Way
Godalming
Surrey, GU7 1XW
Contact: Tom Perry
Site Name: Courtenay Avenue
Site Address: Not Given

Client Reference: CG28630
Job Number: 18-89422
Date Sampled: 08/06/2018
Date Received: 11/06/2018
Date Tested: 22/06/2018
Sampled By: TBP

Test results

Laboratory Reference	Hole No.	Sample				Soil Description	M/C	Atterberg				Density		Total Porosity
		Reference	Top depth [m]	Base depth [m]	Type			% Passing 425um	LL	PL	PI	bulk	PD	
												Mg/m3	Mg/m3	
							%	%	%	%			Mg/m3	
984276	BH1	D26	1.20	Not Given	D	Brown sandy GRAVEL with rootlets	20							
984277	BH1	D27	1.50	Not Given	D	Mottled brown slightly gravelly sandy CLAY	18							
984278	BH1	D28	2.00	Not Given	D	Yellowish brown slightly sandy CLAY	24							
984279	BH1	D29	2.50	Not Given	D	Yellowish brown slightly sandy CLAY	23							
984280	BH1	D31	3.00	Not Given	D	Yellowish brown slightly sandy CLAY	24							
984281	BH1	D32	3.50	Not Given	D	Yellowish brown slightly sandy CLAY	25							
984282	BH1	D33	4.00	Not Given	D	Yellowish brown slightly sandy CLAY	28	100	53	24	29			
984283	BH1	D34	4.50	Not Given	D	Yellowish brown slightly sandy CLAY	31							
984284	BH1	D35	5.00	Not Given	D	Dark brown slightly sandy CLAY	26							
984285	BH1	D40	9.00	Not Given	D	Dark brown sandy CLAY	27	100	47	20	27			

Comments:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Date Reported: 28/06/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

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This report may not be reproduced other than in full without the prior written approval of the issuing laboratory.
The results included within the report are representative of the samples submitted for analysis.
The analysis was carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland."

TEST CERTIFICATE

Summary of Classification Test Results

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS



Client: Card Geotechnics Ltd
Client Address: 4 Godalming Business Centre
Woolsack Way
Godalming
Surrey, GU7 1XW
Contact: Tom Perry
Site Name: Courtenay Avenue
Site Address: Not Given

Client Reference: CG28630
Job Number: 18-89422
Date Sampled: 06/06 - 07/06/2018
Date Received: 11/06/2018
Date Tested: 22/06/2018
Sampled By: TBP

Test results

Laboratory Reference	Hole No.	Sample				Soil Description	M/C	Atterberg				Density		Total Porosity
		Reference	Top depth [m]	Base depth [m]	Type			% Passing 425um	LL	PL	PI	bulk	PD	
												Mg/m3	Mg/m3	
							%	%	%	%			Mg/m3	
984286	BH2	D1	1.20	Not Given	D	Dark brown slightly sandy CLAY	30							
984287	BH2	D2	2.00	Not Given	D	Yellowish brown slightly sandy CLAY	27							
984288	BH2	D4	2.50	Not Given	D	Yellowish brown slightly sandy CLAY	24							
984289	BH2	D3	3.00	Not Given	D	Yellowish brown slightly sandy CLAY	28							
984290	BH2	D6	3.50	Not Given	D	Brown slightly sandy CLAY	27							
984291	BH2	D5	4.00	Not Given	D	Brown slightly sandy CLAY	24	100	44	21	23			
984292	BH2	D7	5.00	Not Given	D	Dark brown silty CLAY	24							
984293	BH2	D11	10.00	Not Given	D	Brownish grey slightly sandy CLAY	32	100	52	23	29			
984294	BH3	D12	1.00	Not Given	D	Yellowish brown slightly silty CLAY	26							
984295	BH3	D22	1.50	Not Given	D	Orangish brown silty CLAY	25							

Comments:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Date Reported: 28/06/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

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Date Sampled: 07/06/2018
Date Received: 11/06/2018
Date Tested: 22/06/2018
Sampled By: TBP

Test results

Laboratory Reference	Hole No.	Sample				Soil Description	M/C	Atterberg				Density		Total Porosity
		Reference	Top depth [m]	Base depth [m]	Type			% Passing 425um	LL	PL	PI	bulk	PD	
												Mg/m3	Mg/m3	
							%	%	%	%				
984296	BH3	D13	2.00	Not Given	D	Brown slightly sandy CLAY	28	100	48	25	23			
984297	BH3	D23	2.50	Not Given	D	Grey CLAY	28							
984298	BH3	D14	3.00	Not Given	D	Dark grey silty CLAY	28							
984299	BH3	D24	3.50	Not Given	D	Dark grey silty CLAY	24							
984300	BH3	D15	4.00	Not Given	D	Dark brown silty CLAY	27							
984301	BH3	D25	4.50	Not Given	D	Dark brown silty CLAY	33							
984302	BH3	D16	5.00	Not Given	D	Dark brown silty CLAY	11							
984303	BH3	D17	6.00	Not Given	D	Dark grey sandy CLAY	26	100	41	19	22			
984304	BH3	D20	9.00	Not Given	D	Dark grey very sandy CLAY	31	100	33	22	11			

Comments:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Date Reported: 28/06/2018

Signed:

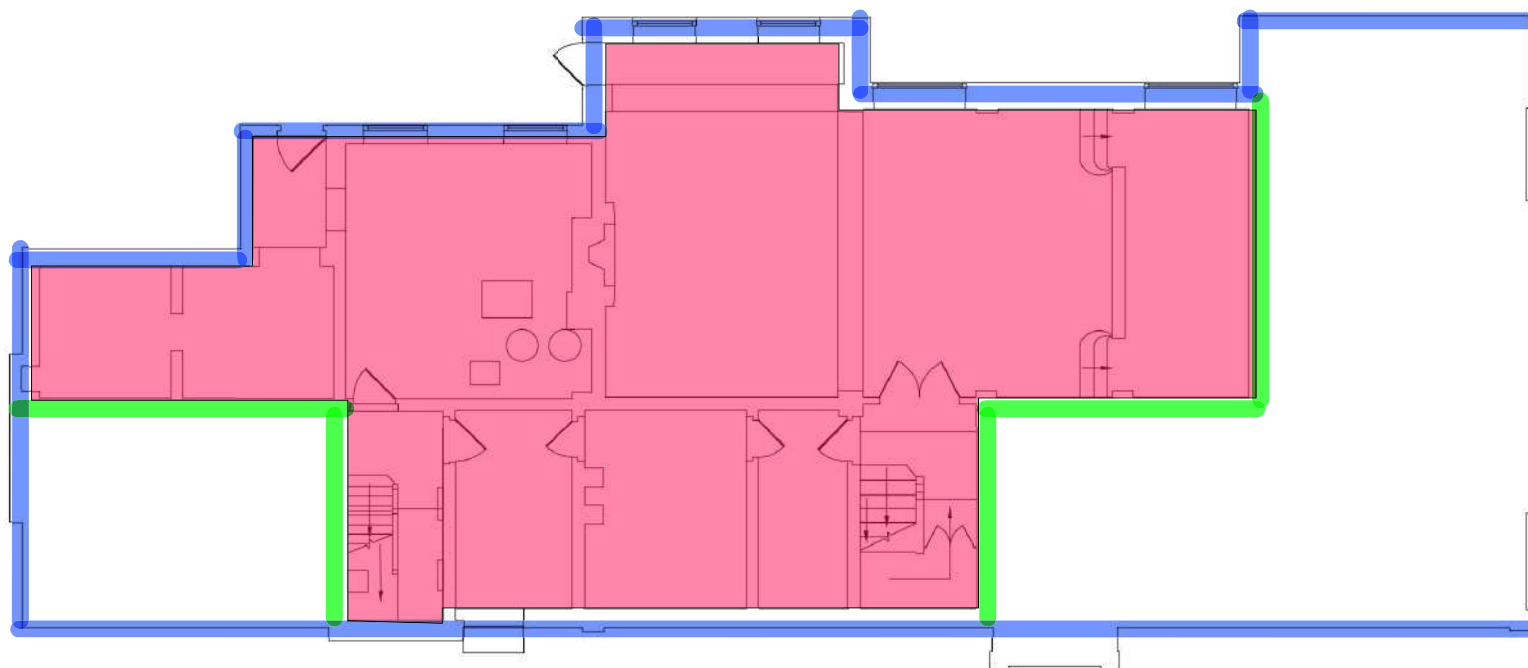
Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

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APPENDIX E

Existing building loads



KEY FOR LOADINGS:



Area Load for assumed basement slab.

Dead = 10kN/m²
Live = 5.0kN/m²



Perimeter wall line load
Dead = 150 kN/m
Live = 31 kN/m



Perimeter wall line load
Dead = 150 kN/m
Live = 31 kN/m



Rev.	Description	Date	Rev.	Description	Date
0	First issue.	[02.03.18]			

sketch title
Proposed and Existing Loads for
Basement (SLS)

Mark-up

scale (s) date drawn
1:10@A3 13.06.18 JNu

elliottwood

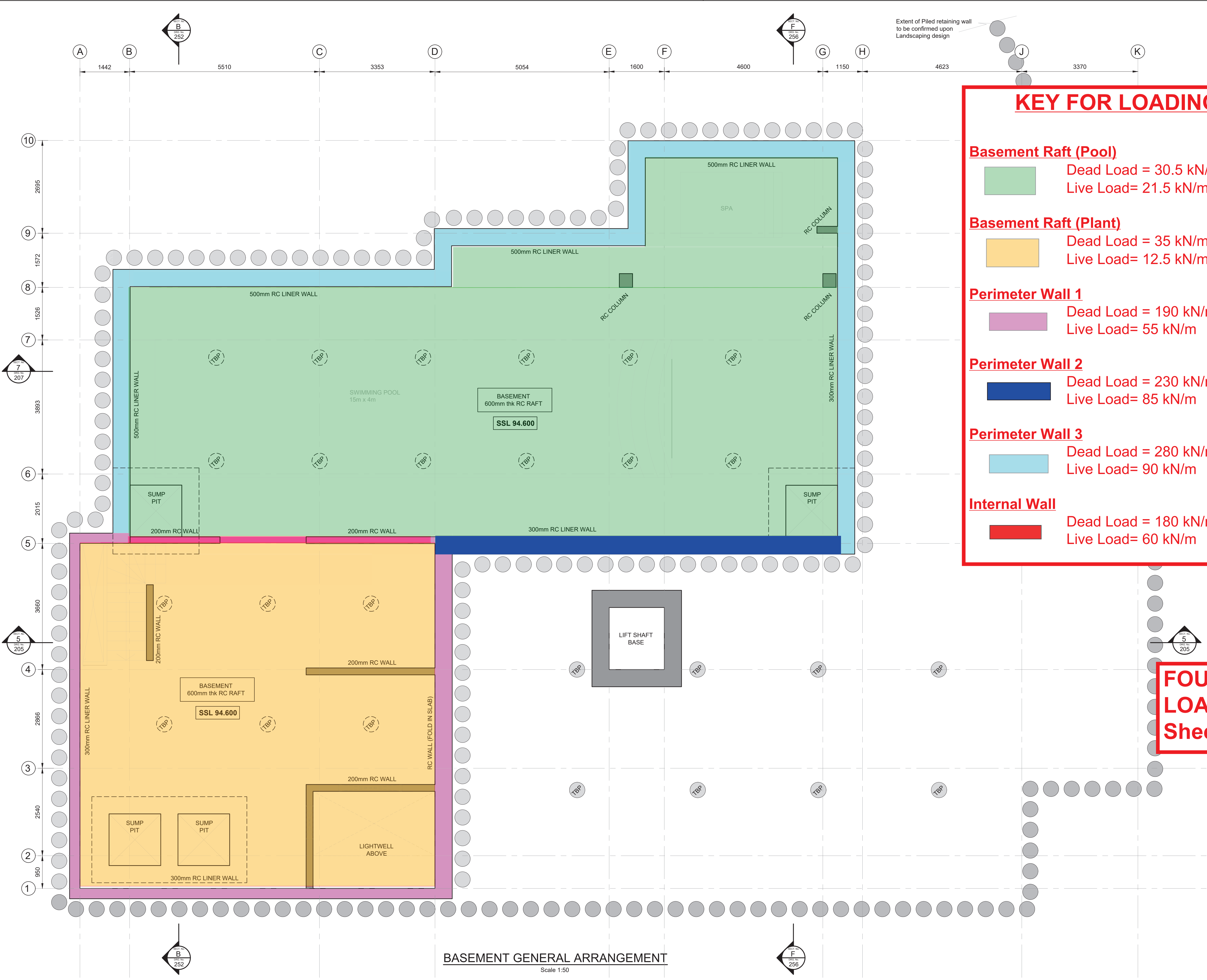
Elliott Wood Partnership Ltd
Wimbledon • Central London • Nottingham
Consulting Structural and Civil Engineers
tel. (020) 7499 5888. www.elliottwood.co.uk

project
'Guildens' Courtenay Avenue

Project no.
2180244

Sketch no.
0002

revisio
P1



NOTES	
1.	This drawing shall be read in conjunction with all relevant Architects & Engineers drawings and specifications.
2.	Do not scale any dimensions. All dimensions are in millimetres and to be checked on site.

KEY FOR LOADINGS (SLS)

Basement Raft (Pool)



Dead Load = 30.5 kN/m²
Live Load = 21.5 kN/m²

Basement Raft (Plant)



Dead Load = 35 kN/m²
Live Load = 12.5 kN/m²

Perimeter Wall 1



Dead Load = 190 kN/m
Live Load = 55 kN/m

Perimeter Wall 2



Dead Load = 230 kN/m
Live Load = 85 kN/m

Perimeter Wall 3



Dead Load = 280 kN/m
Live Load = 90 kN/m

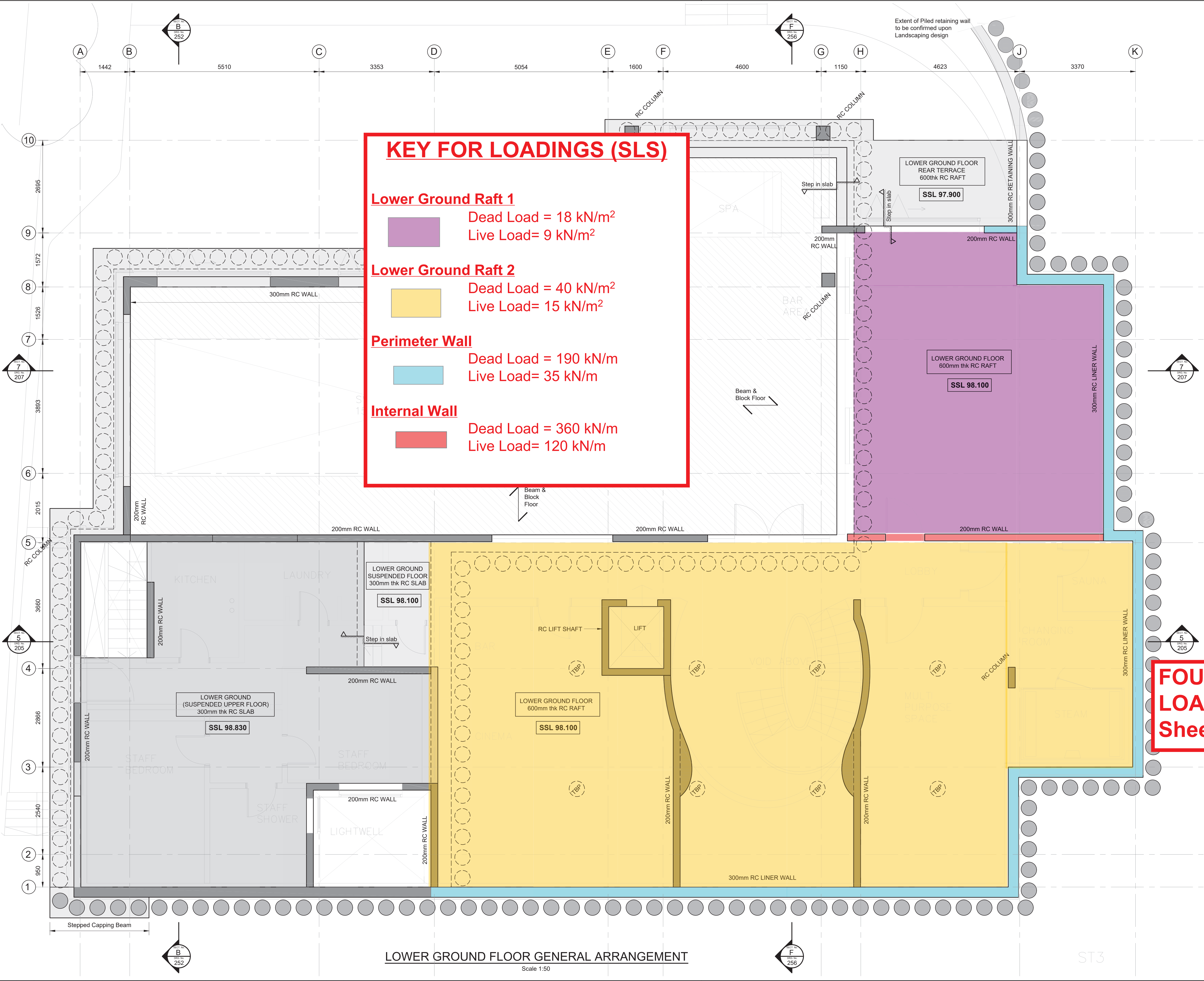
Internal Wall



Dead Load = 180 kN/m
Live Load = 60 kN/m

FOUNDATION LOADING Sheet 1 of 2

Architect WOLFF ARCHITECTS	
Project Title GUILDENS, 16 COURTENAY AVE LONDON, N6 4LP	
Drawing Title BASEMENT GENERAL ARRANGEMENT	
 Michael Alexander Berkeley House 304 Regents Park Road London N3 2JX tel +44 (0)20 8445 9115 email mail@maengineers.com web www.maengineers.com	Drawn SH DEC 2022
	Checked JMcS DEC 2022
	Scale 1:50 1:100
	Size A1 A3
Project No. P5258	Drawing No. 080 Rev. P1



KEY FOR LOADINGS (SLS)

Lower Ground Raft 1

Dead Load = 18 kN/m²

Live Load= 9 kN/m²

Lower Ground Raft 2

Dead Load = 40 kN/m²

Live Load= 15 kN/m²

Perimeter Wall

Dead Load = 190 kN/m

Live Load= 35 kN/m

Internal Wall

Dead Load = 360 kN/m

Live Load= 120 kN/m

NOTES

1.

This drawing shall be read in conjunction with all relevant Architects & Engineers drawings and specifications.
2.

Do not scale any dimensions. All dimensions are in millimetres and to be checked on site.

LEGEND

- RC Structure
- RC Structure below
- 450mm dia Pile @ 600mm crs
Cut Off Level Ground Floor
- 450mm dia Pile @ 600mm crs
Cut Off Level Lower Ground Floor
- 450mm dia Tension/Bearing Piles

FOUNDATION
LOADING
Sheet 2 of 2

Architect WOLFF ARCHITECTS		
Project Title GUILDENS, 16 COURTENAY AVE LONDON, N6 4LP		
Drawing Title LOWER GROUND FLOOR GENERAL ARRANGEMENT		
MichaelAlexander Berkeley House 304 Regents Park Road London N3 2JX tel +44 (0)20 8445 9115 email mail@maengineers.com web www.maengineers.com	Drawn SH	DEC 2022
	Checked JMcS	DEC 2022
	Scale 1:50 1:100	Size A1 A3
	Project No. P5258	Drawing No. Rev. 000 P1