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Basement Impact Assessment Report

Proposed basement development

8A Hampstead Hill Gardens, London

November 2021

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Document history and status

Revision	Date	Description	Author	Checker	Reviewer
A	June 2021	First Issue	AW	ID	ID
B	Nov 2021	Revised following updated basement plans	AW	ID	ID
C	Nov 2021	Updated following minor Client comment	AW	ID	ID
D	Nov 2021	Updated following further minor Client comments	AW	ID	ID

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Non Technical Summary

The site is located at 8A Hampstead Hill Gardens, London, NW3 2PL.

The site is generally flat although the garages to the rear are sunken with a sloped access road from Hampstead Hill Gardens. The site is part of a wider hillside setting with ground levels falling from west to east.

The site comprises the existing residential property (No. 8a) which is part of a four storey building, and a garage unit to the rear of the existing property with associated hardstanding. Hampstead Hill Tunnel, which carries the North London Line, is situated circa 20m from the site. The crown of the tunnel is approximately 14m below ground level in this locale.

The site was occupied by a field prior to the development of Hampstead Hill Gardens at some point between 1871 and 1895, by which point several of the current properties recorded. A structure is recorded onsite in 1896 but the structure is hatched to suggest a glazed roof structure (possible conservatory to adjacent property). By 1934 the structure onsite is recorded as a more permanent structure consistent with the adjacent property. There are no other significant changes until circa 1970 when the garage structure to the rear is recorded. There are some changes to the main building of No. 8 Hampstead Hill gardens at this time and it is conjectured the entire site was re-developed. No further significant changes are recorded to modern day.

The proposed development comprises demolition of the existing garage unit followed by the construction of a two storey building including single storey basement. The footprint of the existing garage will be marginally increased.

A ground investigation was undertaken in April 2021. Ground conditions comprise Made Ground sequentially overlying Head and London Clay. Groundwater was encountered during the site investigation within the Head deposits. Post fieldwork monitoring recorded groundwater at a depth of circa 2.50m below ground level.

Ground movement analyses have been undertaken to assess the impact on the adjoining properties from the proposed works. Those analyses conclude that with appropriate controls, the potential damage to adjoining properties can be limited to Burland Category 1, in accordance with planning guidance

1 Introduction

1.1 Objectives

1.1.1 This report presents a Basement Impact Assessment (BIA) for a proposed basement at 8A, Hampstead Hill Gardens, London, NW3 2PL. This report considers the effect of the proposed basement on the local hydrology, geology, hydrogeology and potential impacts to neighbours and the wider environment. A site location plan is presented as Drawing 01.

1.1.2 The principal objective of the assessment is to present evidence to support a planning application for the project as required by policy A5 Basements in the Camden Local Plan (2017), Policy BA1 in the Hampstead Neighbourhood Plan (2018) and Camden Planning Guidance – Basements (March 2018).

1.2 Client instructions and confidentiality

1.2.1 This report has been produced following instructions received from Price and Myers on behalf of our mutual client, Mr Daniel Jaffe.

1.3 Author qualifications

1.3.1 The report has been prepared by a Chartered Civil Engineer with 10 years relevant experience in geotechnical engineering. A copy of the CV is presented in Appendix A.

1.3.2 This report has also been reviewed by a Chartered Geologist to satisfy Camden planning guidance with respect to groundwater flow; a letter of approval is presented as Appendix B.

1.4 Sources of information

1.4.1 Specific documents are referenced at appropriate places within this report. Reference has also been made to the following documents:

- Camden Planning Guidance – Basements (London Borough of Camden, 2018)
- Camden geological, hydrogeological and hydrological study – Guidance for subterranean development (Arup, 2010)
- Camden Local Plan (London Borough of Camden, 2017)

1.4.2 A construction method statement has been prepared by a Structural Engineer which is presented separately.

1.5 Revision B

1.5.1 This report has been updated following initial issue due to the proposed basement layout changing. The changes are considered to be minor. Whilst the changes are considered minor, a holistic review of all elements (including ground movement analysis) has been undertaken to ensure the validity of the original conclusions.

2 Study

2.1 Description of the existing site

2.1.1 The existing features at the site are presented as Drawing 02.

2.1.2 The site comprises the existing residential property (No. 8a) which is part of a four storey building. The site also includes a large garage unit to the rear of the existing property and associated hardstanding. The existing property and garage unit are currently unoccupied.

2.1.3 The site is located on the side of a hill with the ground sloping down towards the east at a gradient of approximately 1V:15H. The level of the site is approximately 72m above Ordnance Datum (AOD).

2.1.4 The locale is dominated by residential properties of masonry construction, many of which have a basement or lower ground floor.

2.1.5 There is a gap in the houses along both sides of Hampstead Hill Gardens circa 20m to the south of the site. This gap coincides with the alignment of a railway line, owned and operated by London Overground, which passes through a tunnel.

2.2 Project proposals

2.2.1 The proposed development comprises demolition of the existing garage unit followed by the construction of a two storey building including single storey basement.

2.2.2 The project proposals are shown on the drawings presented as Appendix C.

3 Desk Study

3.1 Site History

3.1.1 A review of Ordnance survey and London town maps dating back to 1850 has been undertaken.

3.1.2 The site is recorded as undeveloped until ~1896 although significant development is recorded in the wider area on mapping from 1879 including the railway entering the assumed tunnel to the east. A map extract from 1879 is shown below.

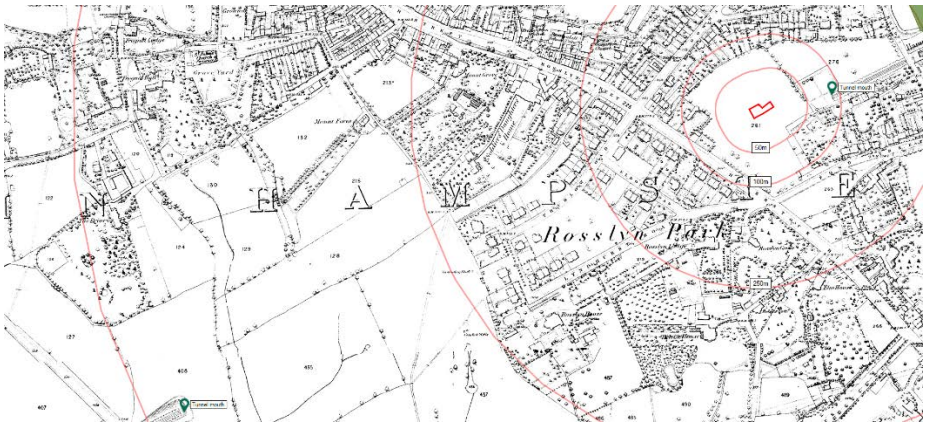


Figure 3-A: Extract of 1879 mapping

3.1.3 The railway tunnel, which connects Hampstead Heath Station in the East to Finchley Road and Frognal Station in the west, is understood to have been opened in 1860 (https://www.theundergroundmap.com/article.html?id=3364)

3.1.4 By 1896 Hampstead Hill Gardens is recorded with several of the current properties recorded. The remaining properties along Hampstead Hill Gardens were largely constructed prior to 1915.

3.1.5 In 1896 a structure is recorded onsite which is largely consistent with the current layout, although the structure is hatched to suggest a glazed roof structure (possible conservatory to adjacent property). By 1934 the structure onsite is recorded as a more permanent structure consistent with the adjacent property. The extracts below show this transition. Two houses below are also recorded at this time.

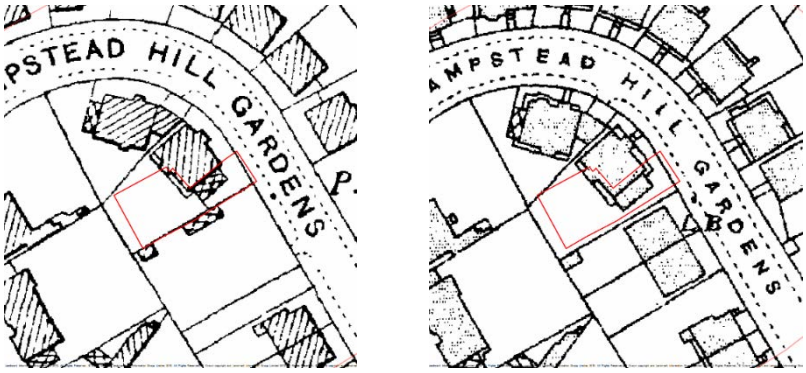


Figure 3-B: 1896 and 1934 map extracts

3.1.6 There are no other significant changes until construction of the garage. There are OS maps indicating the presence of the garage in 1954, however other maps do not record it until 1970. There are some changes to the main building of 8 Hampstead Hill gardens at this time and it is understood that the entire site was re-developed. No further significant changes are recorded to modern day.

3.2 Geology

3.2.1 Reference has been made to the 1:50 000 scale geological map published by the British Geological Survey (BGS) – Sheet 256 North London (2006). Reference has also been made to historical exploratory hole logs available from the BGS GeoIndex.

3.2.2 The site is indicated to be underlain by London Clay, which is anticipated to extend for tens of metres beneath the site.

3.2.3 No superficial deposits have been mapped at or in close proximity to the site. However, head propensity is mapped at the site indicating a possible chance of encountering head deposits.

3.3 Hydrogeology

3.3.1 The site is underlain by London Clay which is designated as an unproductive stratum.

3.3.2 The site is not located within a Source Protection Zone.

3.4 Hydrology, drainage and flood risk

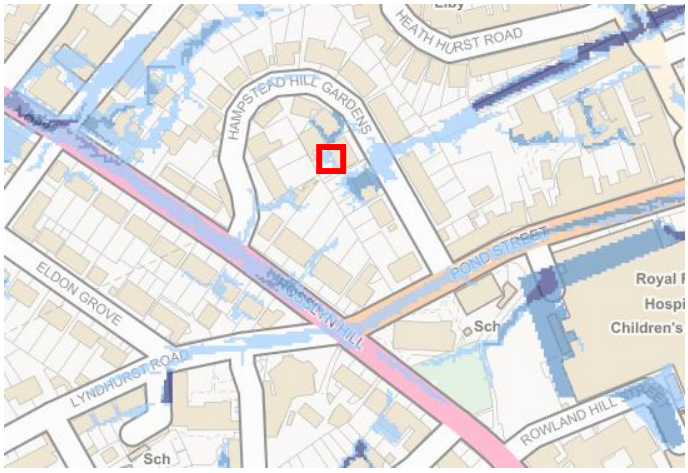
3.4.1 The site is not located within close proximity (250m) of any surface water features.

3.4.2 Reference has been made to Figure 11 from the Camden Geological, Hydrogeological and Hydrological Study (Arup, 2010). The site is not located within close proximity to any historical watercourses. An extract of Figure 11 is presented below with the approximate position of the site represented by the red box.

3.4.3 The site lies outside of the catchment of the Hampstead Heath Ponds.

3.4.4 The site is hard surfaced to facilitate access to the garage. It is understood that there is an existing drainage pipe situated between the garage and the existing building which discharges to the main sewer on the street.

3.4.5 Reference has been made to GOV.UK website to assess the risk of flooding due to a variety of sources. The site is indicated to be at low to medium risk of flooding from surface water, sometimes referred to as flash flooding.



3.4.6 Reference has been made to Figure 15 of the Camden Geological, Hydrogeological and Hydrological Study (Arup, 2010). That Figure shows the property to be remote from areas of historical flooding.

3.4.7 Reference has been made to the London Borough of Camden, Strategic Flood Risk Assessment (URS, 2014). Figure 6 of that document indicates that the site is not situated within a Critical Drainage Area. A Critical Drainage Area (CDA) is defined as *"a discrete geographic area (usually a hydrological catchment) where multiple and interlinked sources of flood risk (surface water, groundwater, sewer, main river and/or tidal) cause flooding in one or more Local Flood Risk Zones during severe weather thereby affecting people, property or local infrastructure"*

3.5 Quarrying and mining

3.5.1 The site is not within an area affected by mining.

3.5.2 Inspection of historical Ordnance Survey maps dating back to 1850 does not reveal any quarrying activities within 250m of the property.

3.6 Unexploded Ordnance (UXO)

3.6.1 Reference has been made to The London County Council Bomb Damage Maps, 1939 – 1945 (Ward, 2015). Those maps show that the site and immediate vicinity did not suffer bomb damage during World War 2.

3.6.2 Additionally, a preliminary risk review was commissioned by Soiltechnics and undertaken by MACC International Ltd who are a UXO specialist. They concluded that the risk of encountering UXO within the site boundary was low.

3.7 Below ground services and infrastructure

3.7.1 We have contacted the following Statutory Undertakers (SUs) to obtain copies of their records for the purposes of our ground investigation activities. Copies of statutory undertaker's responses are presented in Appendix D.

- BT Openreach Ltd;
- Cadent Gas Ltd;
- Thames Water;
- UK Power Networks; and
- London Underground Ltd.

3.7.2 There is an existing railway tunnel situated circa 20m to the south of the site. The crown of the tunnel is estimated to be ~14m below ground level.

3.7.3 There is a sewer and a water main indicated to be located within the centre of the highway. BT cables are indicated to be present beneath the pavement closest to the site. A gas pipe is indicated to be present in the footpath furthest from the site.

4 Screening

4.1 Introduction

4.1.1 A screening process has been undertaken to satisfy Stage 1 of Camden Planning Guidance – Basements; this section of the report provides direct responses to the questions posed in Figures 12 to 14.

4.2 Subterranean (groundwater) flow

Question	Response	Details
1a. Is the site located directly above an aquifer?	No	The site is underlain by London Clay.
1b. Will the proposed basement extend beneath the water table surface?	No	The London Clay Formation comprises reasonably homogenous relatively impermeable clays which are not able to transmit groundwater under normal hydraulic gradients
2. Is the site within 100m of a watercourse, well (used / disused) or potential spring line?	No	The site is remote (in excess of 100m) of any known watercourse. The geology of the area is not conducive to spring lines or wells for extraction of water.
3. Is the site within the catchment of the pond chains on Hampstead Heath?	No	The site is outside the catchment area.
4. Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?	No	The basement will be almost entirely beneath the existing garage unit. Accordingly, there will be negligible change to the impermeable area.
5. As part of site drainage, will more surface water (e.g. rainfall and run-off) than at present be discharged to the ground (e.g. via soakaways and/or SUDS)?	No	The site is hard surfaced and therefore no water currently discharges to the ground. This approach will continue.
6. Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to, or lower than, the mean water level in any local pond (not just the pond chains on Hampstead Heath) or spring line?	No	There are no ponds or spring lines within 100m of the site.

Table 4-A: Responses to subterranean (groundwater) flow screening questions

4.3 Slope stability

Question	Response	Details
1. Does the existing site include slopes, natural or man-made greater than 7 degrees (approximately 1 in 8)?	No	The site is generally flat although the garage structure is slightly sunken with a slope down from Hampstead Hill Gardens. The slope is <7°
2. Will the proposed re-profiling of landscaping at the site change slopes at the property boundary to more than 7 degrees (approximately 1 in 8)?	No	N/A
3. Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7 degrees (approximately 1 in 8)?	No	The site is located on the side of a hill with the ground sloping down from west to east at a gradient of approximately 1V:15H
4. Is the site within a wider hillside setting in which the general slope is greater than 7 degrees (approximately1 in 8)?	No	The wider site setting comprises a hill sloping down to the east at a gradient of circa 1V:15H.

Question	Response	Details
5. Is the London Clay the shallowest strata at the site?	Yes	A nominal, inconsequential, thickness of Made Ground associated with the existing garage unit is anticipated.
6. Will any trees be felled as part of the development and/or are any works proposed within any tree protection zones where trees are to be retained?	No	No trees to be removed.
7. Is there a history of seasonal shrink-swell subsidence in the local area and/or evidence of such effects at the site?	Yes	London Clay is susceptible to shrink swell subsidence. However, the proposed basement foundations will be below the depth of susceptibility.
8. Is the site within 100m of a watercourse or a potential spring line?	No	The site is remote from any current watercourses. The geology of the area is not conducive to spring lines or wells for extraction of water.
9. Is the site within an area of previously worked ground?	No	There is no evidence to suggest quarrying has taken place at the site.
10. Is the site within an aquifer. If so, will the proposed basement extend beneath the water table such that dewatering may be required during construction?	No	The property is underlain by London Clay, which is relatively impermeable.
11. Is the site within 50m of the Hampstead Heath Ponds?	No	The site is circa 350m away from the Hampstead No. 1 Pond.
12. Is the site within 5m of a highway or pedestrian right of way?	No	The basement will be beneath the existing garage unit and therefore remote from the existing highway.
13. Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	Yes	Excavation of a basement will naturally increase the differential depth of foundations.
14. Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?	Yes	The site is situated circa 20m north of an existing railway tunnel. The crown is of the tunnel is understood to be at circa 14m below ground level.

Table 4-B: Responses to slope stability screening questions

4.4 Surface flow and flooding

Question	Response	Details
1. Is the site within the catchment of the ponds chains on Hampstead Heath?	No	The site is outside the catchment of the ponds.
2. As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route?	No	The existing site is hard surfaced and positively drained. Flows will not be materially changed by the development.
3. Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	No	The existing site is hard surfaced.
4. Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface water being received by adjacent properties or downstream watercourses?	No	There will be negligible change to the drainage pattern on site.
5. Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	No	There will be negligible change to the drainage pattern on site.

Question	Response	Details
6. Is the site in an area identified to have surface water flood risk according to either the Local Flood Risk Management Strategy or the Strategic Flood Risk Assessment or is it at risk from flooding, for example because the proposed basement is below the static water level of nearby surface water feature.	No	The site is indicated to be at low to medium flood risk from surface water flooding. However, there have been no floods recorded at the site historically. Furthermore, the strategic flood risk assessment does not record the site as being at risk from flooding.

Table 4-C: Responses to surface flow and flooding screening questions

4.5 Non-technical summary of screening process

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

- Potential damage to neighbouring properties
- Potential impact on the railway tunnel that passes underground close to the site

5 Scoping

5.1 Introduction

5.1.1 A scoping assessment has been undertaken to satisfy Stage 2 of Camden Planning Guidance – Basements; this section of the report provides an assessment and discussion of each of the issues that have arisen from the screening process.

5.2 Potential damage to neighbouring properties

5.2.1 Construction of the proposed basement will cause ground movements that have the potential to cause damage to existing neighbouring structures.

5.2.2 It is considered that the scheme can be suitably designed and constructed to maintain stability therefore minimise damage. A detailed ground movement analysis is presented in Section 7.

5.3 Potential impact on railway tunnel

5.3.1 The proposed building has the potential to result in an increased stress on the existing Network Rail tunnel. The tunnel crown is situated circa 14m below ground level and circa 20m south of the site. Accordingly, it is considered that the impact to the tunnel from the scheme will be negligible. Nevertheless, it is understood that Network Rail will be consulted, and approval sought, as the project progresses.

6 Ground Investigations

6.1 Scope

6.1.1 A ground investigation was undertaken in April 2021 and comprised:

- 1 no. borehole drilled using cable percussive techniques to a depth of 10m to confirm underlying ground conditions
- 3 no. trial pits to investigate existing foundation details of the garage unit

6.2 Ground conditions encountered

6.2.1 Ground conditions in the vicinity of the proposed basement comprised Made Ground sequentially overlying Head and London Clay Formation.

6.2.2 The Made Ground was encountered in TP03 to a depth of 0.45m and was described as a very soft brown and grey gravelly Clay. The trial pit was terminated at this depth and therefore the base of the Made Ground was not proven. Made Ground was also encountered to 0.25m in BH01.

6.2.3 Head was encountered in the borehole and is interpreted to extend to 3.00m BGL. It was described as firm bluish brown slightly gravelly Clay overlying firm to stiff blue grey Clay. The gravel comprised fine to medium subrounded to rounded flint. A possible claystone bound was encountered at 2.70m BGL and was recovered as coarse sandy gravel.

6.2.4 London Clay Formation was encountered from 3.00m BGL. The unit comprised firm brown mottled grey Clay becoming firm to stiff blue and grey Clay.

6.2.5 Groundwater was encountered at 2.70m BGL in BH01 and was sealed out with casing as the hole advanced. There was no observed rise in water level after the strike. Subsequent monitoring recorded groundwater at 2.57m BGL. It is interpreted that flow rates will be relatively minor given the predominantly clayey nature of the soil.

6.3 Ground model

6.3.1 The following table summarises the ground model proposed for the site:

Stratum	Depth to top (m BGL)	Depth to base (m BGL)
Made Ground	0	0.25
Head	0.25	3.00
London Clay	3.00	>>10

Table 6-A: Adopted ground model

6.3.2 Groundwater is assumed to be at 2.50 m below ground level.

6.4 Existing foundations

6.4.1 It is understood that No. 10 has a lower ground floor. However, the footprint extent is not known. Similarly, the foundations of No. 8 Hampstead Hill Gardens are not known. Given the age and size of these buildings it is assumed that foundations will be circa 1.00m BGL.

7 Engineering

7.1 Outline geotechnical design parameters

7.1.1 Relevant geotechnical parameters have been derived from laboratory testing, technical standards, industry publications and wider literature. The following table summarises those parameters:

7.1.2 Relevant geotechnical parameters for London Clay have been derived from laboratory testing, technical standards, industry publications and wider literature. The following table summarises those parameters:

Parameter / Property	Value	Derivation
Characteristic unit weight, γ (kN/m^3)	20	BS8004
Characteristic constant volume angle of shearing resistance, ϕ (°)	21	Correlation with plasticity index
Characteristic undrained shear strength, c_u (kN/m^2)	70 + 6Z where z = depth below 3.00	In situ and laboratory testing
Undrained modulus, E_u (MN/m^2)	29.75 + 2.55Z where z = depth below 3.00	Correlation with c_u ($E_u = 425c_u$)

Table 7-A: Geotechnical parameters – London Clay

7.1.3 Head was encountered at the site and will be retained by the basement walls. The following parameters will be adopted:

Parameter / Property	Value	Derivation
Characteristic unit weight, γ (kN/m^3)	19	BS8004
Characteristic constant volume angle of shearing resistance, ϕ (°)	21	Correlation with plasticity index

Table 7-B: Geotechnical parameters – Head

7.1.4 Made Ground associated with the general development of the site is anticipated to be encountered at shallow depth and would therefore be also retained by the basement walls. It was encountered as Clay material and is conjectured to be derived from the Head and London Clay. Therefore the following parameters will be adopted for design of the retaining wall:

Parameter / Property	Value	Derivation
Characteristic unit weight, γ (kN/m^3)	19	BS8004
Characteristic constant volume angle of shearing resistance, ϕ (°)	21	Assumed from to be derived from the Head / London Clay.

Table 7-C: Geotechnical parameters – Made Ground

7.2 Outline temporary and permanent works proposals

7.2.1 The proposed development comprises demolition of the existing garage unit followed by the construction of a two storey building including single storey basement.

7.2.2 The proposed construction will adopt an underpinning technique to construct reinforced concrete L shaped retaining walls around the perimeter of the basement. A reinforced concrete slab will then be constructed between and tied to the toes of the L shaped retaining wall sections.

7.2.3 The L shaped retaining walls will be founded on London Clay. Ultimate limit state analyses (bearing capacity) have been undertaken in accordance with BS EN 1997-1 (Eurocode 7) to derive the following values:

- Combination 1 – 390 kN/m^2
- Combination 2 – 280 kN/m^2

7.2.4 Demolition of the existing garage building and excavation of the basement will cause an unloading of stress on the soil and consequently heave is likely to occur towards the centre of the basement and diminish towards the perimeter walls. Ignoring boundary effects and therefore adopting a worst case scenario it is estimated that total heave will be less than 40mm, which comprises immediate heave of circa 10mm and long-term heave of up to 30mm. Accordingly, the structural design of the slab will account for this heave.

7.3 Ground movement and damage impact assessment

7.3.1 Camden Planning Guidance – Basements, require that basement construction does not cause structural damage to neighbouring buildings. The risk of structural damage should be assessed using the Burland Scale and the classification must be no higher than Category 1 – very slight.

7.3.2 Ground movement analyses have been undertaken with the aid of computer software package XDisp Version 20.1 developed by OASYS. The software estimates the ground movements induced by basement excavation using the movement profile curves presented within CIRIA Report C760 or user specified movement profiles. The building damage is then assessed within the software against the damage criteria presented by Burland.

7.3.3 Construction of the basement will induce ground movements within the soil that have the potential to cause damage to neighbouring properties. Ground movement will occur due to the following activities:

- Construction of the underpins
- Excavation of the basement leading to inward yield
- Long term settlement of the soil due to the loads acting on the underpins

7.3.4 There is very limited published information on ground movements due to construction of underpins. However, assuming good construction practice and workmanship it is estimated that ground movement will be limited to 5mm of vertical movement and 5mm of horizontal movement per lift. It is further assumed that this will affect a zone extending 45° from the base of the underpin layer.

7.3.5 The underpins will be founded on the London Clay at a depth of circa 5.00m BGL. It is assumed that the existing foundations for Nos. 8 and 10 Hampstead Hill Gardens are at 1.00m BGL. On this basis the 'effective' depth of the excavation that has the potential to induce ground movement is 4.00m.

7.3.6 Benefits due to corner stiffening effects have been ignored in the analyses; accordingly, full plane strain conditions have been assumed at the corners as well.

7.3.7 Following discussion with Campbell Reith on previous projects, ground movement due to excavation of the basement has been estimated with the aid of computer software package PDisp Version 20.0 developed by OASYS. Pre-defined ground movement curves within XDisp have not been used as this would then result in double counting the effects of the excavation.

7.3.8 Settlement of the soil due to the loads on the underpins has also been estimated with the aid of PDisp. Settlement beneath the neighbouring properties (Nos. 8 and 10 Hampstead Hill Gardens) has been assessed. These calculated displacements have been imported into XDisp and combined with the estimated ground movements due to underpin construction to determine a worst-case assessment. The results of the assessment are presented below:

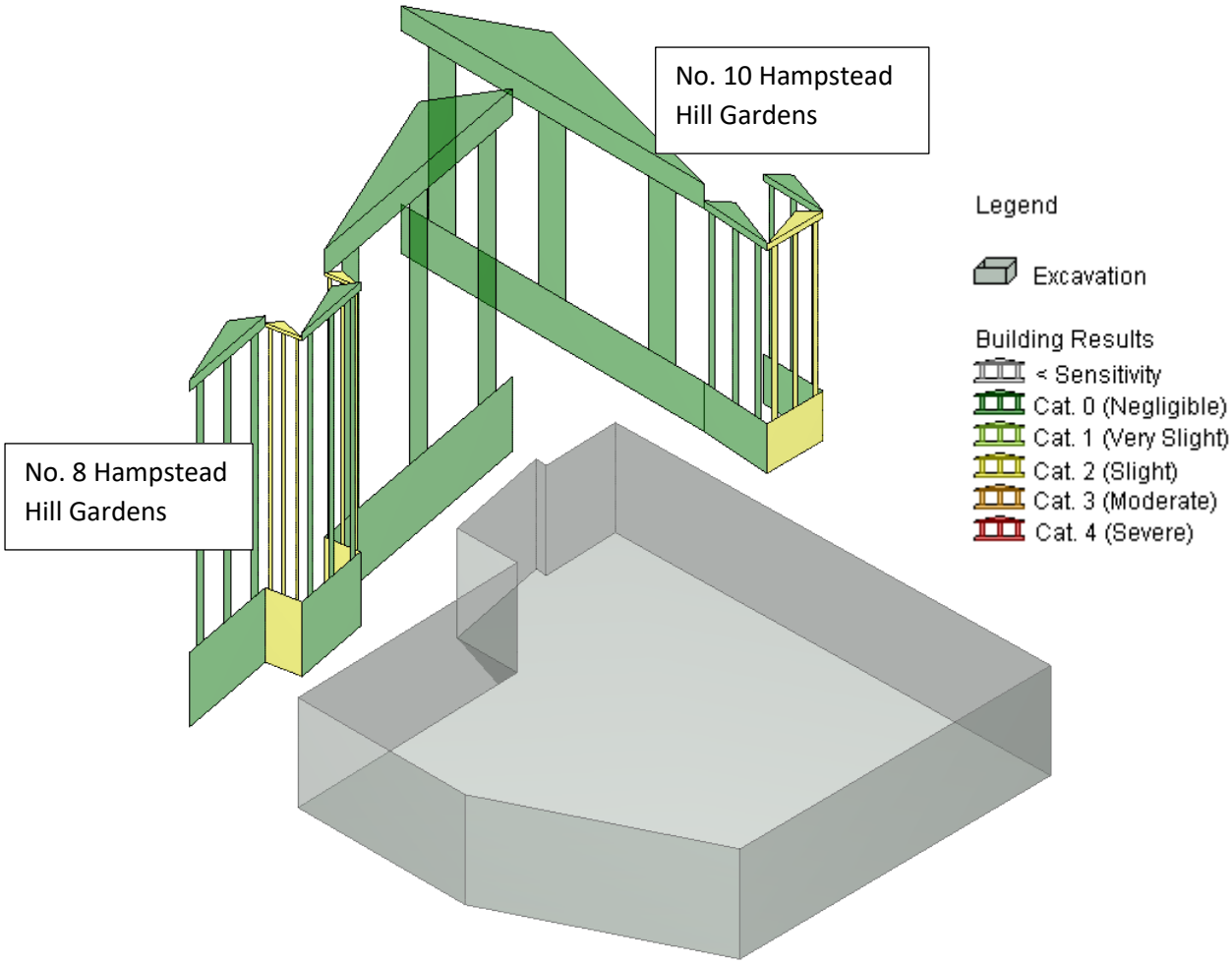


Figure 7-A: Extract from XDisp modelling with Burland categories shown

7.3.9 The analysis indicates that the damage will generally be limited to Burland Category 1 or better. However, there are three panels shown to be at Category 2, which indicates unacceptable levels of damage. However, these results are not considered to be an accurate representation. The software assumes that each panel acts independently as stand-alone panels. In reality the buildings comprise a series of interlocking panels that will offer some restraint to this rotational movement towards the excavation. The underpin excavations will be not more than 1m in length with the next bay not being excavated until the adjacent pin has gained full strength. Furthermore, the proposed basement will be propped during construction which will limit inward yield and therefore reduce movement beneath the masonry panels. Given these factors it is considered that the Damage Category can be limited to Category 1. Nevertheless the neighbouring properties will be monitored with appropriate trigger levels and control measures agreed prior to commencement of works.

7.4 Construction works controls

7.4.1 A detailed construction methodology, including appropriate control measures, has been developed by the structural engineer and is presented separately.

8 Basement Impact Assessment

8.1 Ground stability

8.1.1 The basement will be founded on London Clay Formation.

8.1.2 Ground movement analyses have been undertaken in accordance with CIRIA Report C760 with the aid of computer software packages PDisp and XDisp. Damage to surrounding structures has been assessed using the Burland scale and concluded that, with appropriate controls, the damage will be within Burland Category 1.

8.1.3 The site is locally flat but is part of a wider hillside setting with ground levels falling from west to east. The existing garage unit currently acts as a retaining wall at the west of the site. The proposed building will also serve as a retaining structure.

8.2 Hydrogeology and groundwater flooding

8.2.1 The proposed development will have negligible impact to the wider hydrogeological environment.

8.2.2 Groundwater monitoring indicates that perched groundwater is present within the depth of the basement at about 2.7m below ground level. It is anticipated that groundwater flow rates will be relatively minimal given the clayey nature of materials encountered. Accordingly, groundwater flows encountered during construction, if any, will be collected via a sump and suitably discharged

8.3 Hydrology, surface water flooding and sewer flooding

8.3.1 The proposed development will have negligible impact to the wider hydrological environment.

8.3.2 The proposed development will not increase the likelihood of surface water or sewer flooding.

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Drawings

8A Hampstead Hill Gardens
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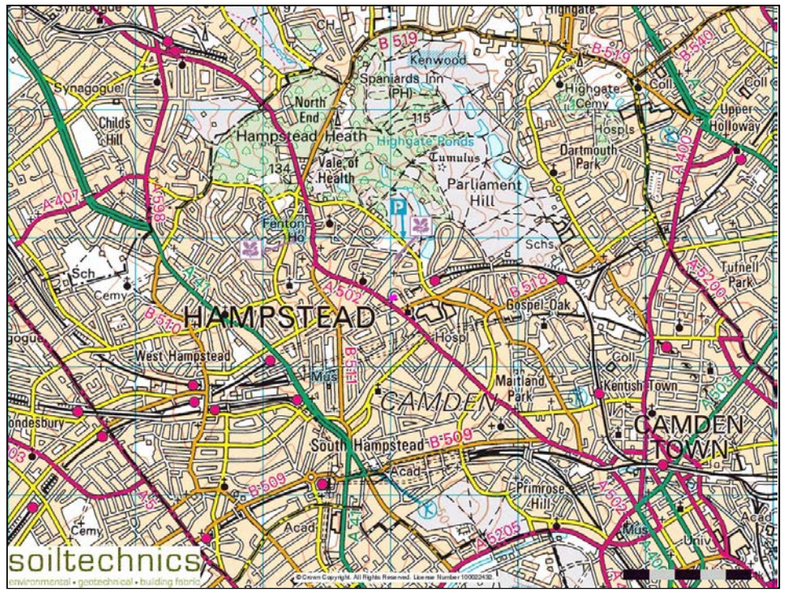
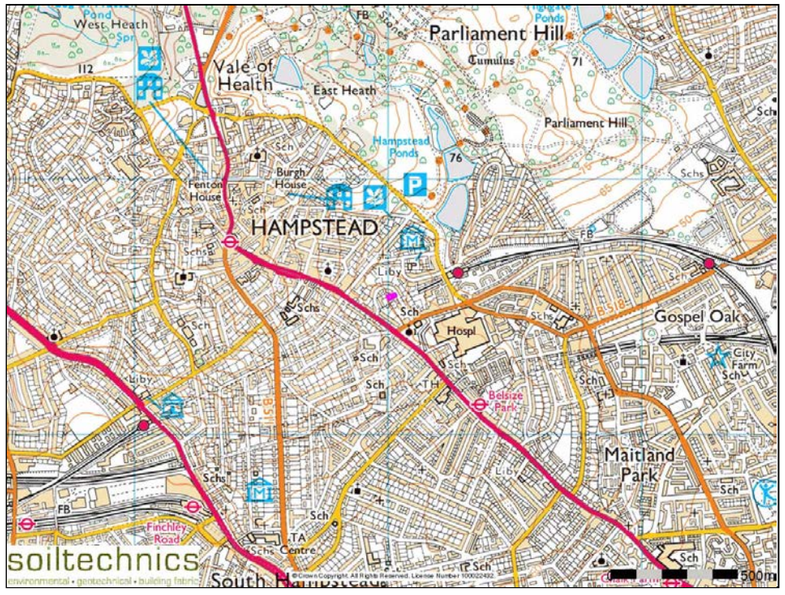
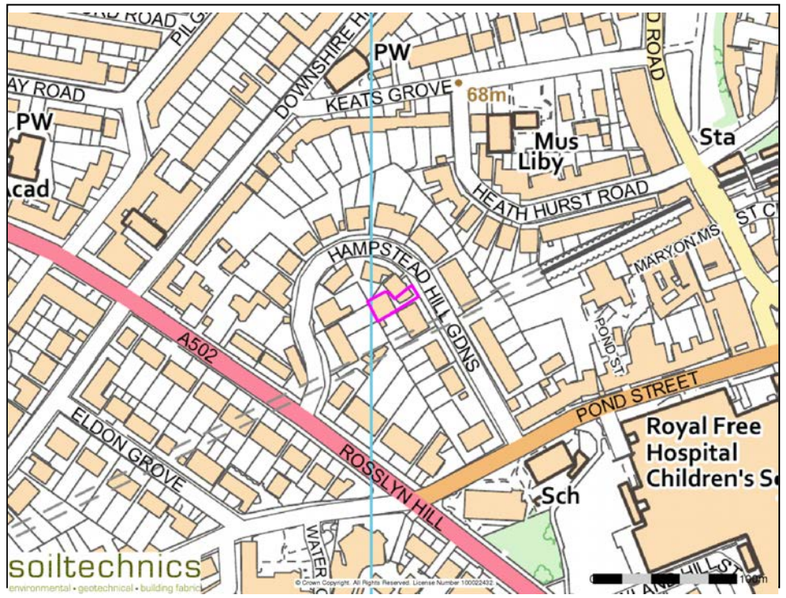


Neighbourhood extract from Ordnance Survey map



Town extract from Ordnance Survey map

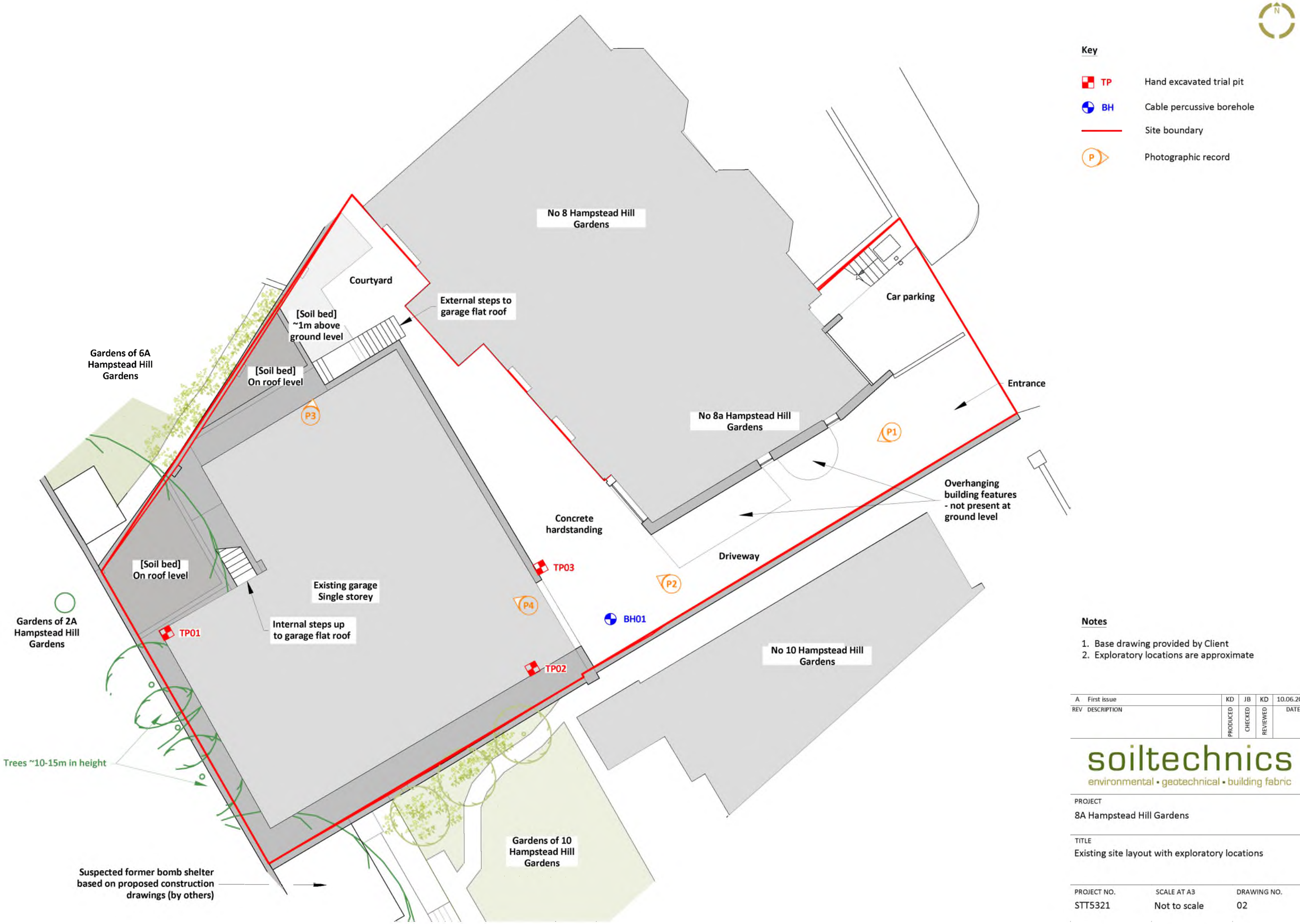


Detail extract from Ordnance Survey map

Title	Scale	Drawing number
Site location plan	Not to scale	01

Revision: A

Created: 27/05/21



Notes

1. Base drawing provided by Client
2. Exploratory locations are approximate

REV	DESCRIPTION	PRODUCED	CHECKED	REVIEWED	DATE
A	First issue	KD	JB	KD	10.06.2021

soiltechnics
environmental • geotechnical • building fabric

PROJECT
8A Hampstead Hill Gardens

TITLE
Existing site layout with exploratory locations

PROJECT NO.	SCALE AT A3	DRAWING NO.
STT5321	Not to scale	02

Appendix A Author's CV

Curriculam Vitae
Angus Wilson CEng MICE
UK RoGEP – Professional

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Qualifications

- Chartered Civil Engineer – Member of the Institution of Civil Engineers (2014)
- UK Registered Ground Engineering Professional (2014)
- National Grid G17 Civil Systems Approver – Geotechnics (2015)

Career History

Soiltechnics
(2018 – Present)

Position of Associate Technical Director with the following primary responsibilities:

- Provide technical direction to engineers throughout the life cycle of a project.
- Oversee engineers in the design and execution of ground investigations including scheduling of laboratory testing and subsequent derivation of ground model with geotechnical parameters.
- Supervise engineers undertaking calculations for a range of geotechnical problems including earth retaining structures, ground movement analyses and foundation assessments.
- Design and prepare specifications for earthworks control.
- Providing the role of Designer's Geotechnical Advisor in accordance with CD 622 Managing Geotechnical Risk.
- Preparing tenders for a range of Clients.
- Write and review Basement Impact Assessments for submission as part of planning applications.

Jacobs
(2009 – 2018)

Position of graduate geotechnical engineer through to Principal Geotechnical Engineer held at Jacobs, Birmingham (UK). Attained competence and experience in the following areas:

- Deriving complex ground models combining topographical mapping, geological mapping and ground investigation data.
- Undertaking concept engineering through to detailed design for a number of geotechnical problems including slope stability, earthworks, foundation design, earth retaining structures and seepage related analyses.
- Designing and supervising ground investigations, scheduling laboratory testing and deriving geotechnical design parameters.
- Writing desk study reports, geotechnical interpretative and geotechnical design reports in accordance with Eurocode 7 and HD22/08 – Managing Geotechnical Risk.
- Contract management including tender submissions, producing fee estimates, programme of works, managing budgets and raising early warnings and compensation events.
- Acting as Client's representative to validate earthworks and other construction elements.
- Producing and maintaining geotechnical risk registers.
- Discharging the duties of a Designer in accordance with CDM (2015) Regulations.

Publications

Wilson, A. K. & Ashton, J., 2012. An engineering geological model of the Conwy Valley, east of Dolgarrog, In, Nichol, D. & Bassett, M.G. (Eds), Urban Geology in Wales: 4. National Museum of Wales Geological Series No. 27, Cardiff, 2015

Curriculam Vitae
Angus Wilson CEng MICE
UK RoGEP – Professional

soiltechnics
environmental ▪ geotechnical ▪ building fabric

Project Experience (Key Roles)	
A47 Highway Improvements	This project comprised the dualling of the A47 highway immediately west of Norwich and the realignment of a roundabout south west of Wisbech. As the GI Contractor's project manager Angus was responsible for the delivery of the ground investigation. Drawing upon his experiences as a designer Angus was able to advise the Client and designer the best ways of obtaining the GI data required for the design balancing cost, safety and geotechnical risk.
M42 / A45 Trenchless Crossings	Angus is the Designer's Geotechnical Advisor responsible for managing the geotechnical risks throughout the project and liaising with the Overseeing Organisation's Geotechnical Advisor and wider project team. He worked collaboratively with the Client and surveyor to develop a monitoring regime that minimised traffic disruption but ensure early warning in the event of adverse events. Through automation he provided an innovative way of ensuring seamless, real time data transfer between field and office
HS2 Gas Pipeline Diversions	Angus was the geotechnical project manager and, leading a team of engineers across three offices, he was responsible for the delivery of geotechnical design elements for each of the 23 diversions. The project faced a variety of ground conditions, environmental constraints and engineering challenges including trenchless crossing beneath watercourses, railways and highways. Angus provided technical consistency across the project incorporating lessons learned from other diversions where possible. Angus led the project from Desk Study phase through to ground investigation, interpretation and preparation of geotechnical design reports in accordance with National Grid Specification CE/2. He advised the Client throughout the commission with respect to geotechnical issues and frequently offered cost effective ways of optimising the design to improve buildability and safety.
Jackfield Stabilisation	Angus was the lead Geotechnical Engineer for the stabilisation of a 1 million m^3 shallow translational landslide within a UNESCO World Heritage Site. He was responsible for reviewing geotechnical data, determining the failure mechanism, optioneering at outline design and supervising a team of graduate engineers during detailed design. Furthermore, he provided site supervision and validation of the design throughout the construction stage and reviewing Contractor's remediation proposals to address defects. Angus led a collaborative work effort with the Contractor's temporary works designer to ensure sufficient knowledge transfer between geotechnical specialists and ensuring safe working methods were proposed within an active landslide environment.
Netherton Tunnel Remediation	This scheme involved the remediation of a 3km masonry lined canal tunnel. He was the Project Engineer responsible for reviewing of 150 years' worth of data before forensically engineering the tunnel to determine the failure mechanism. He led a survey team to establish construction joints within the tunnel and undertook outline design of remediation measures.
	Wilson, A. K. & Ashton, J., 2012. An engineering geological model of the Conwy Valley, east of Dolgarrog, In, Nichol, D. & Bassett, M.G. (Eds), Urban Geology in Wales: 4. National Museum of Wales Geological Series No. 27, Cardiff, 2015

Appendix B Letter of Approval from Chartered Geologist

Angus Wilson
Soiltechnics Ltd
Cedar Barn
White Lodge
Walgrave
Northampton
NN6 9PY

Your Ref: 8A Hampstead Hill Gardens
Our Ref: 1127/LJE080621

For the attention of: Angus Wilson

8th June 2021

Proposed Basement at 8A Hampstead Hill Gardens, London, NW3 2PL: BIA Review

Dear Angus,

Further to your instruction to proceed on behalf your client (Price and Myers on behalf of Mr Daniel Jaffe) I have undertaken a review of the Basement Impact Assessment (BIA) prepared by Soiltechnics Ltd for the proposed basement development at 8A Hampstead Hill Gardens, London NW3 2PL.

I have reviewed the design of the proposed basement development, together with the information presented within the above documents, against the requirements of the Camden BIA guidance set out within Policy A5 (Basements) of the Camden Local Plan (2017), Camden Planning Guidance on basements (adopted March 2018) and the Camden geological, hydrogeological and hydrological study report 'Guidance for subterranean development ', produced by Arup (2011) on behalf of the London Borough of Camden.

Chord Environmental Ltd specialise in the provision of hydrogeological services with extensive experience in the UK supporting both private and public sector clients. I am a geologist and hydrogeologist and have a BSc. in geology from the University of Bristol, a MSc. in hydrogeology from the University of East Anglia and am also a Chartered Geologist and fellow of the Geological Society. I am Managing Director at Chord Environmental and was previously a Technical Director with Paulex Environmental Consulting and managed Hyder Consulting (UK) Ltd's (now Arcadis) groundwater team.

I have been a hydrogeologist for over 20 years. During that time, I have advised on over 150 basement developments. Much of my career has been spent assessing the impact of development on the quality and quantity of groundwater resources. I have worked for both promoters and regulators of schemes and have acted as an expert witness for the Highways Agency and on BIA schemes.

Development proposal

The site comprises the existing residential property (No. 8A) which is part of a four-storey building. The site also includes a garage unit to the rear of the existing property and associated hardstanding and is located on the side of a hill at an elevation of 72 m above Ordnance Datum (OD) with the ground falling away to the east at a gradient of 1:15.

The surrounding area is dominated by residential properties of masonry construction, many of which have a basement or lower ground floor. There is a gap in the houses along both sides of Hampstead Hill Gardens c.20m to the south of the site which coincides with the alignment of a London Overground railway tunnel at a depth of c.14m.

The proposed project comprises the demolition of the existing garage unit followed by construction of a two-storey building including a single level basement. The footprint of the existing garage unit will remain essentially similar.

Environmental Site Setting

The BIA screening assessment has identified 8A Hampstead Hill Gardens to be underlain by the Eocene London Clay as shown on the British Geological Survey 1:50,000 scale map (Sheet 256 – North London) to a depth of c.80m. The London Clay is classified as Unproductive Strata by the Environment Agency, defined as strata with low permeability that have negligible significance for water supply or base flow to rivers. The very low permeability of the London Clay results in very low rates of rainfall infiltration and correspondingly, very high rates of rainfall runoff. The London Clay, together with the clays of the Eocene Lambeth Group, acts as an effectively impermeable confining layer over the Chalk which lies at a depth of over 100m beneath the site.

The closest surface water feature, based on the Ordnance Survey 1:25,000 scale map, is the southern-most Hampstead Pond which lies approximately 350m to the north east of the site. Figure 11 of the "Camden Geological, Hydrogeological and Hydrological Study", shows 8A Hampstead Hill Gardens to lie between the former headwaters of the rivers Fleet and Tyburn which ran over 300m to the north east and 450m south west of the proposed development respectively. The Tyburn and Fleet are now culverted and discharge to the Thames.

The proposed 8A Hampstead Hill Gardens development does not lie within an area of fluvial or tidal flood risk as designated by the Environment Agency and was not identified as being on one of the roads affected by the surface water flooding events of the area which occurred during 1975 and 2002 (Figure 15 of the Arup report 2010).

Screening assessments have been undertaken to satisfy Stage 1 of Camden Planning Guidance – Basements

Subterranean (Groundwater) Flow Screening Assessment

I have commented on the answer to each question below.

- **Question 1a: Is the site located directly above an aquifer?**

  As the Site is mapped as being underlain by a significant thickness of London Clay, designated as Unproductive Strata by the Environment Agency, I agree it is not located above an aquifer and the hydrogeology of the area is well understood.

- **Question 1b: Will the proposed basement extend beneath the water table surface?**

  No. The hydraulic properties of the very low permeability and cohesive London Clay do not allow it to support a water table and transmit groundwater in any significant quantities under normal hydraulic gradients.

- **Question 2: Is the site within 100m of a watercourse, well (used/disused) or potential spring line?**

  No mapped surface water features are present within 100m of the site and the London Clay is not capable of providing groundwater baseflow to watercourses. The proposed basement would therefore not act to prevent groundwater flow to any watercourses, wells or spring lines.

- **Question 3: Is the site within the catchment of the pond chains on Hampstead Heath?**

  The Site is located more than 300m south west, and down topographic gradient, of the Hampstead Heath ponds and therefore lies outside their hydrological catchment area (refer to Figure 14 of the Camden Geological, Hydrogeological and Hydrological Study).

- **Question 4: Will the proposed development result in a change in the proportion of hard surfaced / paved area?**

  No. The basement would lie beneath the existing garage footprint and existing paved areas.

- **Question 5: As part of the site drainage, will more surface water (e.g. rainfall and run-off) than at present be discharged to ground (e.g. via soakaways and/or SUDS)?**

  No. There will be negligible change to the existing drainage arrangement.

- **Question 6: Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to, or lower than, the mean water level in any local pond (not just the pond chains on Hampstead Heath) or spring line?**

  No - there are no mapped local groundwater dependent ponds or spring lines present within 100m of the Site. This is consistent with the geology and hydrogeology of the area.

Slope Stability Assessment

The BIA screening, scoping and risk assessments have followed the Camden Planning Guidance - Basements criteria and screening questions. The potential ground movement issues raised by the screening and scoping exercises have been appropriately addressed by Angus Wilson (C.Eng) of Soiltechnics Ltd within the BIA report and no areas of concern relating to the proposed development were identified.

Surface Flow and Flooding Assessment

The BIA screening, scoping and risk assessments have followed the Camden Planning Guidance - Basements criteria and screening questions. No potential surface flow or flooding issues were raised by the screening and scoping exercise and no areas of concern relating to the proposed development were identified.

Conclusions

The BIA report has appropriately characterised 8A Hampstead Hill Gardens with respect to its geological and groundwater site setting. As the site is underlain by low permeability London Clay, the geological and hydrogeological setting of 8A Hampstead Hill Gardens is not sensitive with respect to groundwater resources or flow. Isolated pockets of groundwater may be encountered during excavation and some form of groundwater control may be required (e.g., sump pumping) however significant inflows of groundwater are not anticipated.

The purpose of the Basement Impact subterranean or groundwater flow assessment is to identify the potential for the proposed basement development to cause groundwater impacts and subsequently identify areas which require further investigation. The proposed development would be constructed within a significant thickness of London Clay and no potential adverse groundwater impacts have been established by these assessments.

Yours sincerely,

THE GEOLOGICAL SOCIETY
CGeol
CHARTERED GEOLOGIST
Fellow No. 1012979

John Evans BSc MSc CGeol.
Director

Appendix C Project Proposals

PLANNING ISSUE

N

0m 2m 4m

Drawing Key

Site Boundary

Skylight

Gym
22.4m2
Gym
FFL -7525
SSL -7775

Cinema
25.6m2
Cinema
FFL -7525
SSL -7775

C C

B B

Existing Manhole

Garage
126.3m2
Garage
FFL -7635
SSL -7775

Foul Sump
1.4 dia
SSL -10135

Plantroom
14.3m2
Plant
FFL -7635
SSL -7775

Cavity Drain

Car Turntable
4.5m Ø
FFL -8035
SSL -8135

Shutter

Car Lift
2.9 x 5.25 m
FFL -8635
SSL -8735

Issue/Revision ↑ Date ↑ Rev ↑

Hayhurst & Co Architects
26 Fournier Street, London, E1 6QE
+44 (0) 20 7247 4028
mail@hayhurstand.co.uk
www.hayhurstand.co.uk

Subject: **Proposed - Basement Floor Plan - levels**

Drawing no: **288-SK330 -**

Project: **Refurbisment and Extension**

Address: **8A Hampstead Hill Gardens**

Date: **28.10.2021**

Scale: **1:100**

Original size: **A3**

PLANNING ISSUE

N

0m 2m 4m

Drawing Key

Site Boundary

Elevation GG A206
Elevation HH A207
Elevation EE A204
Elevation II A208
Elevation FF A205
Elevation AA A200
Elevation BB A201
Elevation CC A202
Elevation DD A203

WC
Skylight
VOID
Kitchen
F/F
OVEN
PANTRY
Courtyard
Dining
Sliding Door
Gallery
Lower Ground Floor
FFL - various
SSL - 3785
Living
Courtyard
Garden room /Play
Bootroom/ Store (8.5sqm)
Hallway Link
Hall
FFL - 2785
SSL - 3285
Cloaks
Car Lift
Double Height Space
Shower
WM
TD
Utility
RWP
Bin Store

Issue/Revision	Date	Rev

Hayhurst & Co Architects
26 Fournier Street, London, E1 6QE
+44 (0) 20 7247 4028
mail@hayhurstand.co.uk
www.hayhurstand.co.uk

Project:	**Refurbisment and Extension**
Address:	**8A Hampstead Hill Gardens**
Date:	**28.10.2021**
Scale:	**1:100**
Original size:	**A3**
Subject:	**Proposed - Lower ground floor Plan - levels**
Drawing no:	**288-SK331 -**

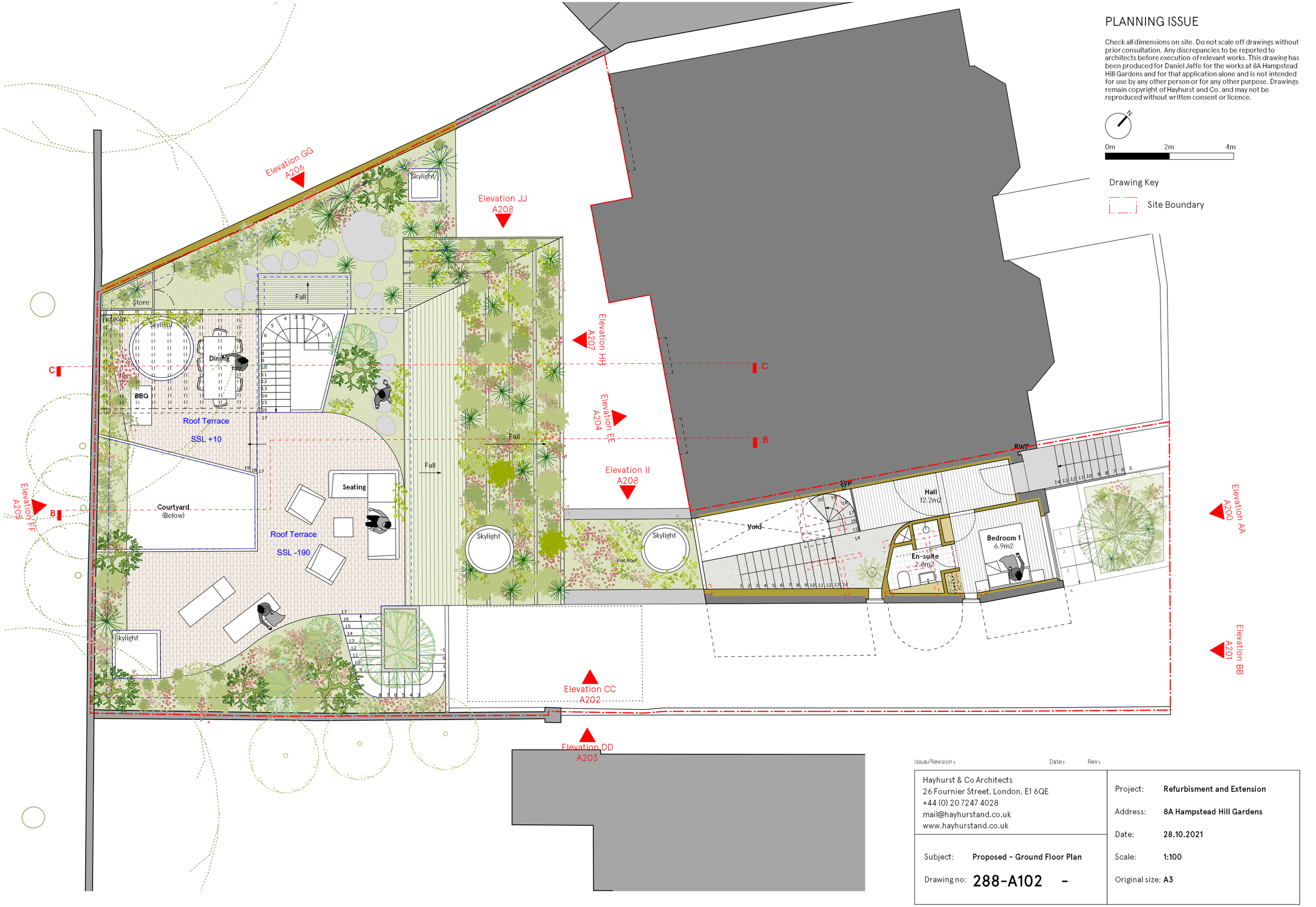
PLANNING ISSUE

N

0m 2m 4m

Drawing Key

Site Boundary



Issue/Revision	Date	Rev

Hayhurst & Co Architects
26 Fournier Street, London, E1 6QE
+44 (0) 20 7247 4028
mail@hayhurstand.co.uk
www.hayhurstand.co.uk

Subject: **Proposed - Ground Floor Plan**

Drawing no: **288-A102 -**

Project: **Refurbisment and Extension**

Address: **8A Hampstead Hill Gardens**

Date: **28.10.2021**

Scale: **1:100**

Original size: **A3**

Appendix D Statutory Undertakers Responses

Asset location search

Property Searches

Soiltechnics Limited
Cedar Barn
White Lodge
WALGRAVE
NN6 9PY

Search address supplied 8a
Hampstead Hill Gardens
London
NW3 2PL

Your reference STT5321

Our reference ALS/ALS Standard/2021_4392297

Search date 31 March 2021

Knowledge of features below the surface is essential for every development

The benefits of this knowledge not only include ensuring due diligence and avoiding risk, but also being able to ascertain the feasibility of any development.

Did you know that Thames Water Property Searches can also provide a variety of utility searches including a more comprehensive view of utility providers' assets (across up to 35-45 different providers), as well as more focused searches relating to specific major utility companies such as National Grid (gas and electric).

Contact us to find out more.

Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW
DX 151280 Slough 13

searches@thameswater.co.uk
www.thameswater-propertysearches.co.uk

0800 009 4540

Asset location search

Property Searches

Search address supplied: 8a, Hampstead Hill Gardens, London, NW3 2PL

Dear Sir / Madam

An Asset Location Search is recommended when undertaking a site development. It is essential to obtain information on the size and location of clean water and sewerage assets to safeguard against expensive damage and allow cost-effective service design.

The following records were searched in compiling this report: - the map of public sewers & the map of waterworks. Thames Water Utilities Ltd (TWUL) holds all of these.

This searchprovides maps showing the position, size of Thames Water assets close to the proposed development and also manhole cover and invert levels, where available.

Please note that none of the charges made for this report relate to the provision of Ordnance Survey mapping information. The replies contained in this letter are given following inspection of the public service records available to this company. No responsibility can be accepted for any error or omission in the replies.

You should be aware that the information contained on these plans is current only on the day that the plans are issued. The plans should only be used for the duration of the work that is being carried out at the present time. Under no circumstances should this data be copied or transmitted to parties other than those for whom the current work is being carried out.

Thames Water do update these service plans on a regular basis and failure to observe the above conditions could lead to damage arising to new or diverted services at a later date.

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0800 009 4540, or use the address below:

Thames Water Utilities Ltd
Property Searches
PO Box 3189
Slough
SL1 4WW

Email: searches@thameswater.co.uk
Web: www.thameswater-propertysearches.co.uk

Waste Water Services

Please provide a copy extract from the public sewer map.

Enclosed is a map showing the approximate lines of our sewers. Our plans do not show sewer connections from individual properties or any sewers not owned by Thames Water unless specifically annotated otherwise. Records such as "private" pipework are in some cases available from the Building Control Department of the relevant Local Authority.

Where the Local Authority does not hold such plans it might be advisable to consult the property deeds for the site or contact neighbouring landowners.

This report relates only to sewerage apparatus of Thames Water Utilities Ltd, it does not disclose details of cables and or communications equipment that may be running through or around such apparatus.

The sewer level information contained in this response represents all of the level data available in our existing records. Should you require any further Information, please refer to the relevant section within the 'Further Contacts' page found later in this document.

For your guidance:

- The Company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Any private sewers or lateral drains which are indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an ‘as constructed’ record. It is recommended these details be checked with the developer.

Clean Water Services

Please provide a copy extract from the public water main map.

Enclosed is a map showing the approximate positions of our water mains and associated apparatus. Please note that records are not kept of the positions of individual domestic supplies.

For your information, there will be a pressure of at least 10m head at the outside stop valve. If you would like to know the static pressure, please contact our Customer Centre on 0800 316 9800. The Customer Centre can also arrange for a full flow and pressure test to be carried out for a fee.

Asset location search

Property Searches

For your guidance:

- Assets other than vested water mains may be shown on the plan, for information only.
- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

Payment for this Search

A charge will be added to your suppliers account.

Further contacts:

Waste Water queries

Should you require verification of the invert levels of public sewers, by site measurement, you will need to approach the relevant Thames Water Area Network Office for permission to lift the appropriate covers. This permission will usually involve you completing a TWOSA form. For further information please contact our Customer Centre on Tel: 0845 920 0800. Alternatively, a survey can be arranged, for a fee, through our Customer Centre on the above number.

If you have any questions regarding sewer connections, budget estimates, diversions, building over issues or any other questions regarding operational issues please direct them to our service desk. Which can be contacted by writing to:

Developer Services (Waste Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

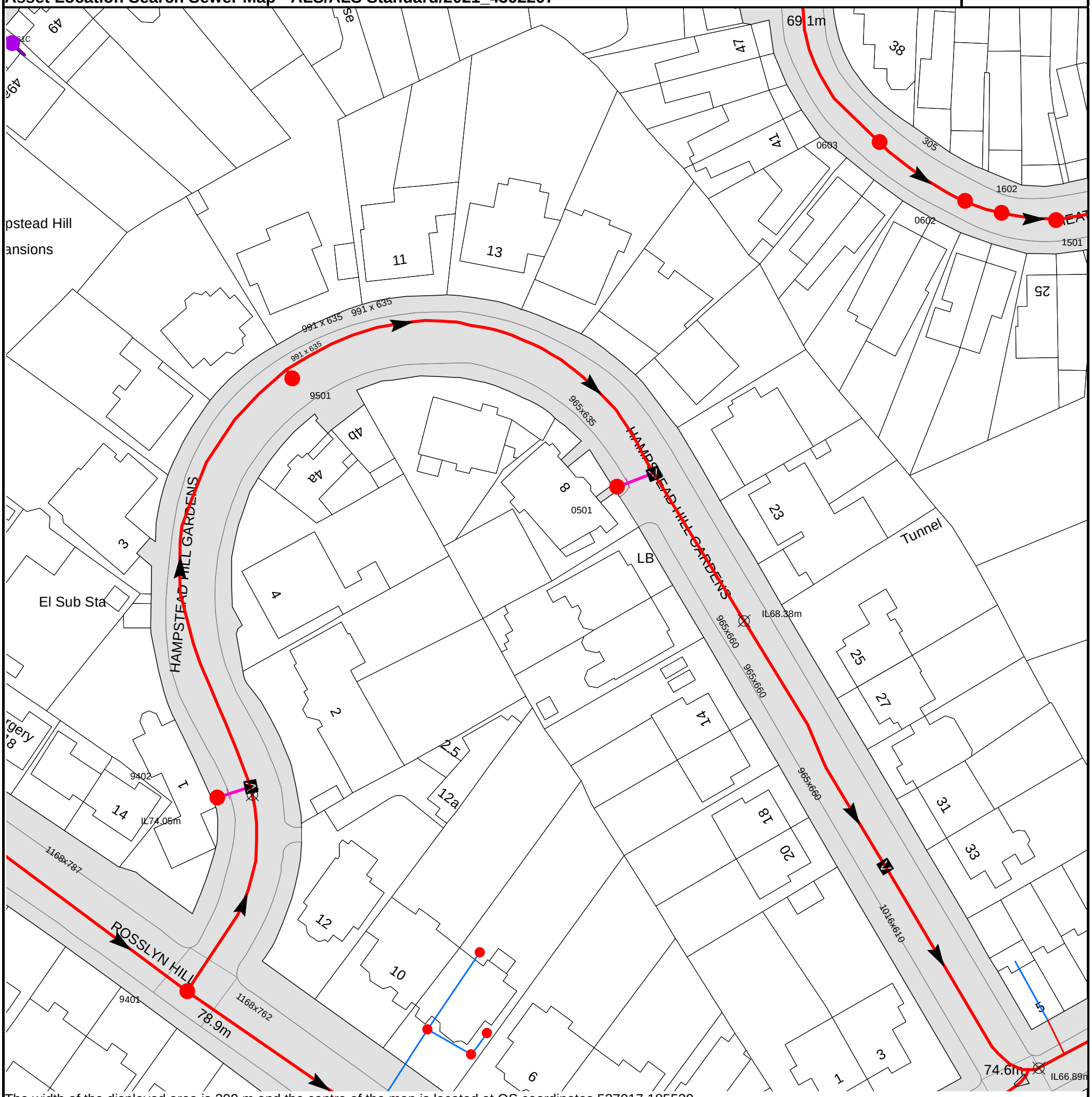
Clean Water queries

Should you require any advice concerning clean water operational issues or clean water connections, please contact:

Developer Services (Clean Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

Asset Location Search Sewer Map - ALS/ALS Standard/2021_4392297



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 527017,185539

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
1501	68.17	64.89
961C	n/a	n/a
9501	75.45	n/a
0501	n/a	n/a
0603	69.49	65.26
0602	69.01	65.28
1602	68.74	65.26
9401	78.9	74.93
9402	n/a	n/a
941A	n/a	n/a
041C	n/a	n/a
041A	n/a	n/a
041B	n/a	n/a

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

Air Valve

Dam Chase

Fitting

Meter

Vent Column

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example. A hydrobrake limits the flow passing downstream.

Control Valve

Drop Pipe

Ancillary

Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol, Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

Outfall

Undefined End

Inlet

Other Symbols

Symbols used on maps which do not fall under other general categories

Public/Private Pumping Station

Change of characteristic indicator (C.O.C.I.)

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

Proposed

Abandoned Sewer

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn

2) All measurements on the plans are metric.

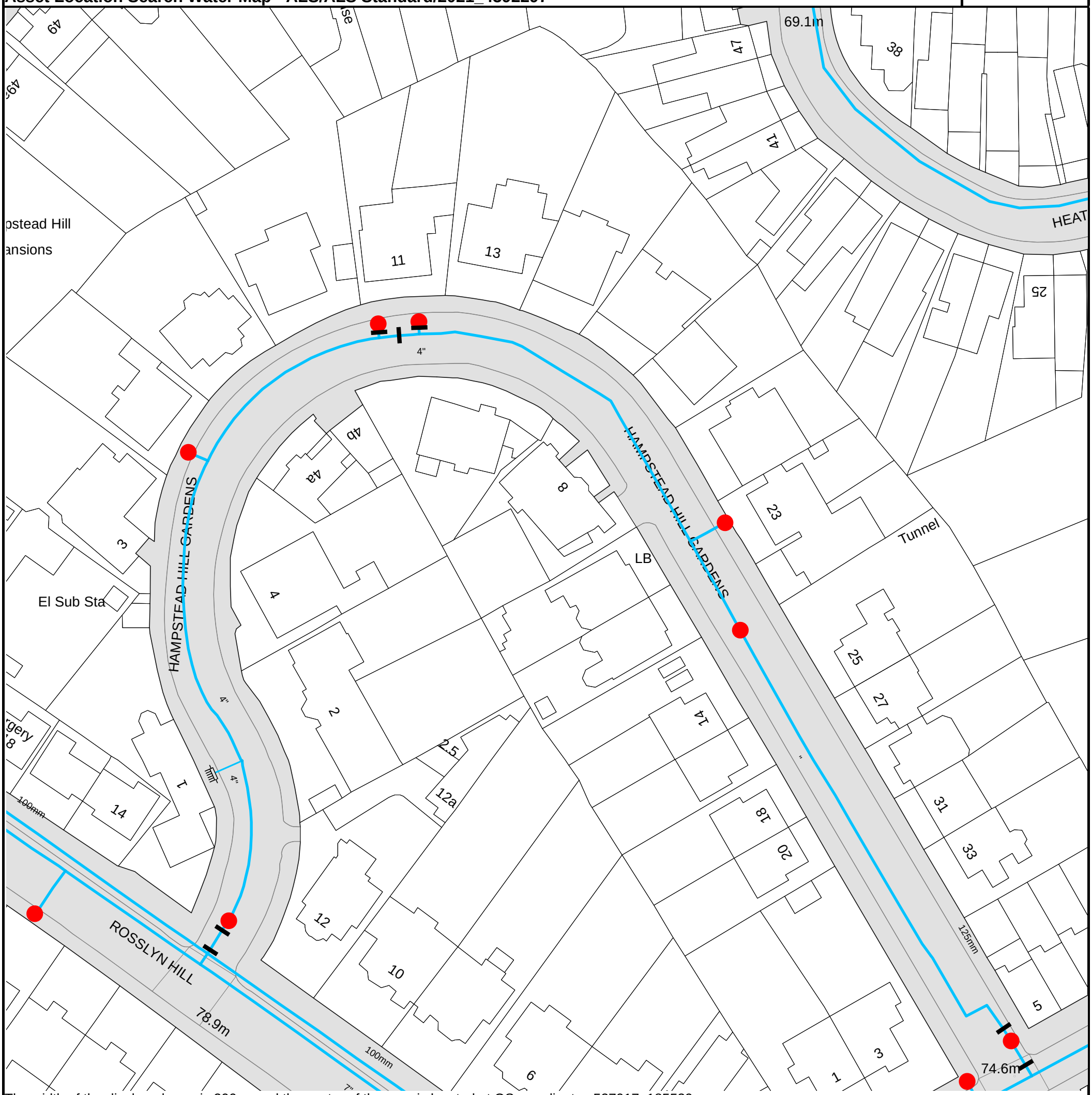
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.

4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded

5) 'na' or '0' on a manhole level indicates that data is unavailable

6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres Text next to a manhole indicates the manhole reference number and should not be taken as a measurement If you are unsure about any text or symbology present on the plan, please contact a member of Property Searches on 0800 009 4540.

Asset Location Search Water Map - ALS/ALS Standard/2021_4392297



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 527017, 185539.

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

4"

Distribution Main: The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.

16"

Trunk Main: A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.

3" SUPPLY

Supply Main: A supply main indicates that the water main is used as a supply for a single property or group of properties.

3" FIRE

Fire Main: Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.

3" METERED

Metered Pipe: A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.

Transmission Tunnel: A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.

Proposed Main: A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

Valves

- General Purpose Valve
- Air Valve
- Pressure Control Valve
- Customer Valve

Hydrants

- Single Hydrant

Meters

- Meter

End Items

Symbol indicating what happens at the end of a water main.

- Blank Flange
- Capped End
- Emptying Pit
- Undefined End
- Manifold
- Customer Supply
- Fire Supply

Operational Sites

- Booster Station
- Other
- Other (Proposed)
- Pumping Station
- Service Reservoir
- Shaft Inspection
- Treatment Works
- Unknown
- Water Tower

Other Symbols

- Data Logger

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

Other Water Pipes (Not Operated or Maintained by Thames Water)

Other Water Company Main: Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.

Private Main: Indiates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

Terms and Conditions

All sales are made in accordance with Thames Water Utilities Limited (TWUL) standard terms and conditions unless previously agreed in writing.

1. All goods remain in the property of Thames Water Utilities Ltd until full payment is received.
2. Provision of service will be in accordance with all legal requirements and published TWUL policies.
3. All invoices are strictly due for payment 14 days from due date of the invoice. Any other terms must be accepted/agreed in writing prior to provision of goods or service, or will be held to be invalid.
4. Thames Water does not accept post-dated cheques-any cheques received will be processed for payment on date of receipt.
5. In case of dispute TWUL`s terms and conditions shall apply.
6. Penalty interest may be invoked by TWUL in the event of unjustifiable payment delay. Interest charges will be in line with UK Statute Law 'The Late Payment of Commercial Debts (Interest) Act 1998'.
7. Interest will be charged in line with current Court Interest Charges, if legal action is taken.
8. A charge may be made at the discretion of the company for increased administration costs.

A copy of Thames Water's standard terms and conditions are available from the Commercial Billing Team (cashoperations@thameswater.co.uk).

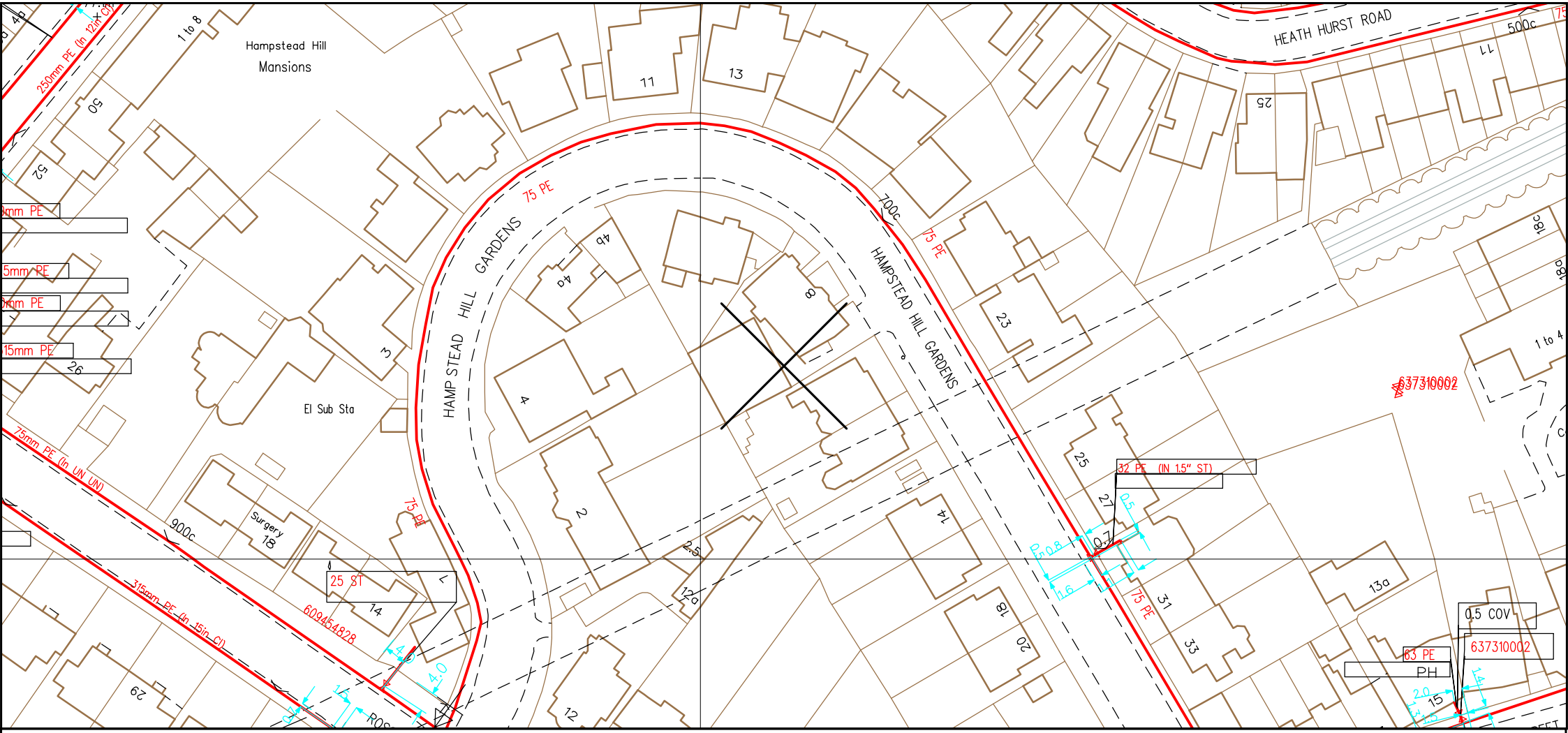
We publish several Codes of Practice including a guaranteed standards scheme. You can obtain copies of these leaflets by calling us on 0800 316 9800

If you are unhappy with our service you can speak to your original goods or customer service provider. If you are not satisfied with the response, your complaint will be reviewed by the Customer Services Director. You can write to her at: Thames Water Utilities Ltd. PO Box 492, Swindon, SN38 8TU.

If the Goods or Services covered by this invoice falls under the regulation of the 1991 Water Industry Act, and you remain dissatisfied you can refer your complaint to Consumer Council for Water on 0121 345 1000 or write to them at Consumer Council for Water, 1st Floor, Victoria Square House, Victoria Square, Birmingham, B2 4AJ.

Ways to pay your bill

Credit Card	**BACS Payment**	**Telephone Banking**	**Cheque**
Call **0800 009 4540** quoting your invoice number starting CBA or ADS / OSS	Account number **90478703** Sort code **60-00-01** A remittance advice must be sent to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW.** or email **ps.billing@thameswater.co.uk**	By calling your bank and quoting: Account number **90478703** Sort code **60-00-01** and your invoice number	Made payable to '**Thames Water Utilities Ltd**' Write your Thames Water account number on the back. Send to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW** or by DX to **151280 Slough 13**



SCALE: Not to scale	LP MAINS
USER ID: ABand	MP MAINS
DATE: 30/03/2021	IP MAINS
EXTRACT DATE: 01/03/2021	LHP MAINS
MAP REF: TQ2785	
CENTRE: 527016, 185537	

Some examples of Plant Items:

Valve | Depth of Cover | Syphon | Diameter Change | Material Change | Out of Standard Service

This plan shows those pipes owned by Cadent Gas Ltd in their role as a Licensed Gas Transporter (GT). Gas pipes owned by other GTs, or otherwise privately owned, may be present in this area. Information with regard to such pipes should be obtained from the relevant owners. The information shown on this plan is given without warranty, the accuracy thereof cannot be guaranteed. Service pipes, valves, syphons, stub connections, etc. are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Cadent Gas Ltd or their agents, servants or contractors for any error or omission. Safe digging practices, in accordance with HS(G)47, must be used to verify and establish the actual position of mains, pipes, services and other apparatus on site before any mechanical plant is used. It is your responsibility to ensure that this information is provided to all persons (either direct labour or contractors) working for you on or near gas apparatus. The information included on this plan should not be referred to beyond a period of 28 days from the date of issue. Further information on all DR4s can be determined by calling the DR4 hotline on 01455 892426 (9am-5pm) A DR4 is where a potential error has been identified within the asset record and a process is currently underway to investigate and resolve the error as appropriate.

MAPS Viewer Version 5.8.0.1

Local Machine

Network Records NetMAP Symbols Booklet - London

This symbol booklet is intended as a general guide only - some local variations of these symbols may be found.

Version 1.2

Released October 2010

Always check with your local Network Records office or the UK Power Networks server to ensure that you are using the most up to date copy of this booklet.Tel: 08000 565866

Index:-

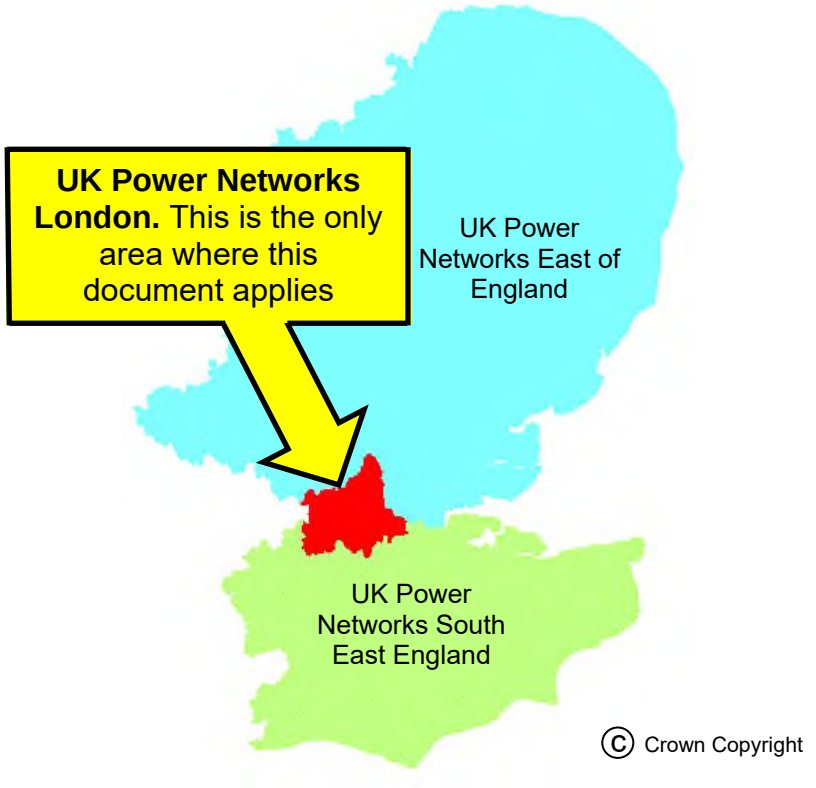
Guidance notes.

Important notice:
If you do not understand the NetMAP record that you are using, please contact UK Power Networks Network Records for guidance
Tel: 08000 565866.

- The position of apparatus shown on NetMAP is believed to be correct, but the original landmarks may have altered since the apparatus was installed.
- It must be assumed that there is at least one service to each property, lamp column, street sign etc. A separate record may be available.
- When excavations are to be carried out near Extra High Voltage (EHV) cables, further details must be obtained before commencement of work.
- Third party cables are not usually shown.
- When two or more maps are supplied for the same area, the maps must be read in conjunction with each other and with this symbol booklet.
- All LV cables are assumed to be 4 core, and all HV cables assumed to be 3 core – unless otherwise stated.
- All Imperial cable sizes are assumed to be copper and all metric cable sizes are assumed to be aluminium – unless otherwise stated.

Plan Provision Team
Fore Hamlet
Ipswich
Suffolk IP3 8AA
Tel: 08000 565866

The area covered by this guide:



Please see the anomalies map at the end of this safety booklet for greater map area detail, and a breakdown of the more significant anomalies within the London area.

Scenery

NetMAP system	Scanned image	Description
		100 metre Ordnance Survey grid line (on O/S based maps only)
		Property fence line
		Building line
		Kerb line
		Kerb line on majority of ways & mains maps
TUNNEL		Cable tunnel or subway
NOT APPLICABLE	or	Borough or City boundary and UK Power Networks boundary
	or	UK Power Networks or Electrical boundary

Scenery for UK Power Networks use only - boxed in red

NetMAP system	Scanned image	Description
 Inset Network – Contact xxxx IDNO for further information	Not applicable	Area of inset network - not the asset of UK Power Networks (only visible to UK Power Networks and their immediate contractors)
	Not applicable	Proposed Cross Rail route (only visible to of UK Power Networks and their immediate contractors)
	Not applicable	High pressure pipelines in the general vicinity (only visible to of UK Power Networks and their immediate contractors)

Note: Pipelines are only viewable on NetMAP by UK Power Networks staff and their immediate contractors. Do not carry out any excalvation without consent from the relevant agency - legally protected high pressure petroleum products pipeline route in the general vicinity - consult www.linewatch.co.uk for contacts and guidance. Pipeline contact numbers can also be found on the intranet – out of hours, contact our Control Centre.

	Not applicable	Water - surface water (only visible to UK Power Networks and their immediate contractors)
	Not applicable	Water - Source Protection Zone 1 (only visible to UK Power Networks and their immediate contractors)
	Not applicable	Water - Source Protection Zone 2 (only visible to UK Power Networks and their immediate contractors)
	Not applicable	Water - Source Protection Zone 3 (only visible to UK Power Networks and their immediate contractors)

section continued on next page

Scenery for UK Power Networks use only - boxed in red

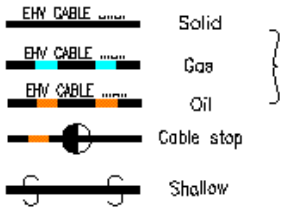
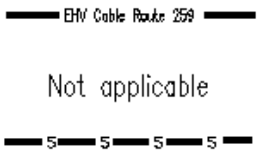
NetMAP system	Scanned image	Description
	Not applicable	Historical - Scheduled Monuments (only visible to UK Power Networks and their immediate contractors)
	Not applicable	Historical - Parks and Gardens (only visible to UK Power Networks and their immediate contractors)
	Not applicable	Historical - Areas of Archaeological Potential (AAP) (only visible to UK Power Networks and their Immediate contractors)
	Not applicable	Nature - Ramsar Wetlands of International Importance (only visible to UK Power Networks and their immediate contractors)
	Not applicable	Nature - Special Area of Conservation (SAC) (only visible to UK Power Networks and their immediate contractors)
	Not applicable	Nature - Special Protected Area (SPA) (only visible UK Power Networks and their immediate contractors)
	Not applicable	Nature - Site of Special and Scientific Interest (SSSI) (only visible to UK Power Networks and their immediate contractors)

section continued on next page

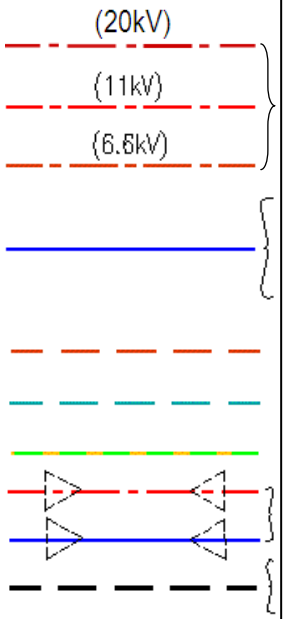
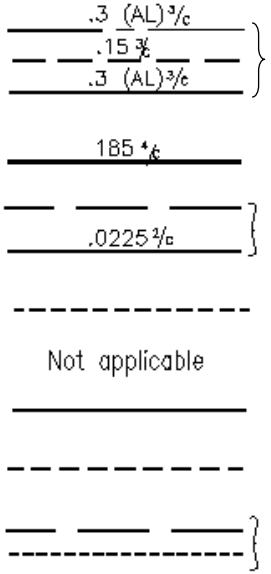
Scenery for UK Power Networks use only - boxed in red

NetMAP system	Scanned image	Description
	Not applicable	Nature - Local Nature Reserve (only visible to UK Power Networks and their immediate contractors)
	Not applicable	Nature - National Nature Reserve (only visible to UK Power Networks and their immediate contractors)
	Not applicable	Nature - Area of Outstanding Natural Beauty (AONB) (only visible to UK Power Networks and their immediate contractors)
	Not applicable	Nature - National Park (only visible to UK Power Networks and their immediate contractors)
	Not applicable	Fluid filled cables - very high sensitivity (only visible to UK Power Networks and their immediate contractors)
	Not applicable	Fluid filled cables - high sensitivity (only visible to UK Power Networks and their immediate contractors)
	Not applicable	Fluid filled cables - medium sensitivity (only visible to UK Power Networks and their immediate contractors)
	Not applicable	Fluid filled cables - low sensitivity (only visible to UK Power Networks and their immediate contractors)

Primary distribution cables

NetMAP system	Scanned image	Description
		UK Power Networks route (11,000 , 22,000 to 132,000 volts) Oil/gas cable stop Part of UK Power Networks cable route where cover is less than normal

Secondary distribution cables

NetMAP system	Scanned image	Description
		HV cable (up to 20kV) 3 phase LV cable (230V or 400/230V) 1 or 2 phase LV cable (230V or 400/230V) Pilot or Telephone cable, often not shown in plan if running with other cables Fibre-optic cable Earth cable HV or LV cable in duct Duct route(s) not containing live cables

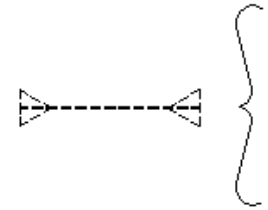
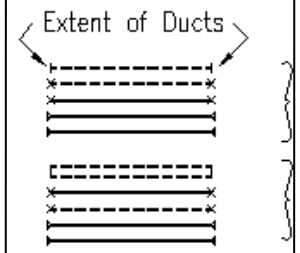
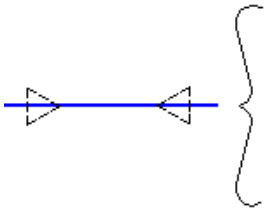
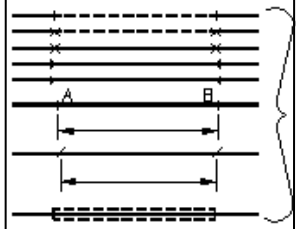
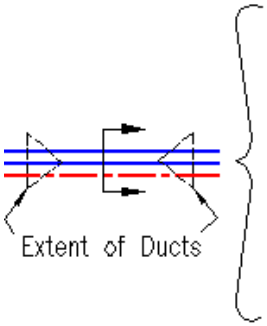
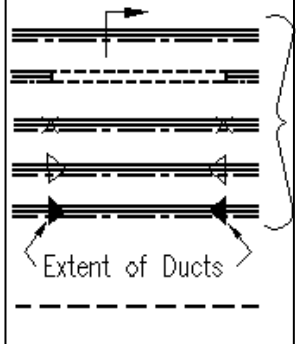
Cable terminology

NetMAP system	Scanned image	Description
PL	PL	Paper Lead
PLS	PLS	Paper Lead Served
PLST or PLSW	PLA	Paper Lead Armoured
PLSTS	PLTS	Paper Lead Steel Tape Served
PLSTS	PLDT	Paper Lead Double Tape
PLSWS	PLWS	Paper Lead Steel Wire Served
PLSW	PLBW	Paper Lead Bright Wire
PLS	LC & H	Lead Covered & Hessian
PLST or PLSW	LC & A	Lead Covered & Armoured
PLSW	LC & BA	Lead Covered & Bright Armoured
PLST	DSTA	Double steel tape armoured
PLST	STA	Steel Tape Armoured
PLSW	SWA	Steel Wire Armoured
Al	Al	Aluminium
Cu	Cu	Copper
WV	WV	Waveconal
CS	CS	Consac
PVC	PVC	Polyvinyl Chloride
EPR	EPR	Ethylene Propylene Rubber
XLPE	XLPE	Cross Linked Polyethylene
SOL	SOLIDAL	Solid Aluminium
ax	TRIPLEX	Triplex (aluminium)
cx	TRIPLEX	Triplex (copper)

Cable size abbreviations

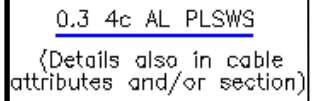
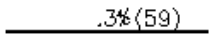
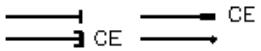
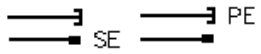
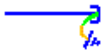
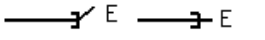
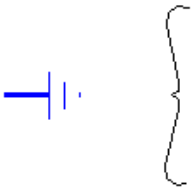
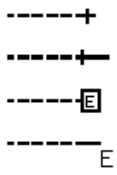
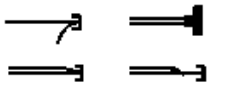
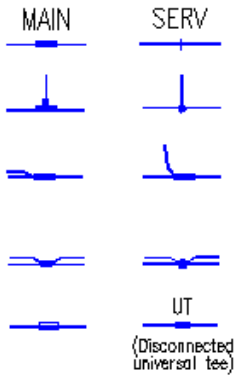
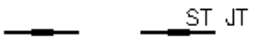
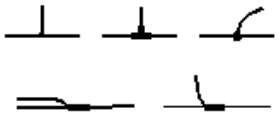
NetMAP system	Scanned image	Description
1c	1c	Single core.
c/c	c/c	Concentric cores
t/c	T/c or T/cc	Triple concentric cores
4c	4c	Four cores
3c CNE	3c (CN)	Three cores and concentric neutral – not of the Waveconal type
2c	2c (or Tw)	Two cores (or twin)
s/c	s/c	Split concentric cores
3c	3c	Three cores
DC	DC	Direct current
P	P	Pilot
Pr	Pr	Number of telephone pairs

Cable ducts

NetMAP system	Scanned image	Description
		Single empty ducts
		Cluster of empty ducts (two or more)
		Cable in single duct
		Group of cables shown in a cluster of ducts, plus one or more empty (shown in section)
		Ex-Western area 'ways' maps: This symbol indicates one or more ducts.

On City of London area maps "extent of ducts" symbols are not in general use as most duct runs are between pits or boxes

Other NetMAP symbols

NetMAP system	Scanned image	Description
		Cable size (and year laid)
		Cable capped end
		Cable pressure (or pot) end or signal end
		Pressure/pot end & earth cable/electrode
		Earth rod (vertical) Earth rod (horizontal) Earth plate Earth plate or end
		Bottle or trouser joint or combined crutch & pressure end – (CPE)
		Straight joints
		Tee joints
		Crutch (or spur) joints (CJ) straight & crutch joints combined (S&CJ)
		Double crutch (or spur) joint
		Sleeve

section continued on next page

Other NetMAP symbols

NetMAP system	Scanned image	Description
		Four way underground disconnecting boxes(DB)
		Link boxes(LB)
		Network boxes(NB) or (NWB)
		4 way 6 entry
		6 way box
		6 way 8 entry
		Split bus-bar
123456	LB123456	Link box with identification number
	or	3 way underground disconnecting boxes
	or	2 way underground disconnecting boxes
		1 way underground disconnecting boxes
123456 0.3 4c PLSWS TAILS DISTRIBUTION PILLAR		Feeder pillars
		Split bus-bar distribution pillar
		Double bus-bar distribution pillar
		Blind pit/pit
		Pit with access

section continued on next page

Other NetMAP symbols

NetMAP system	Scanned image	Description
	or or	Transformer chambers (T/C) & transformer compounds
		Underground transformer chamber
CAUTION Missing Information	Not applicable	Missing data in or near this location
U/G TANK		Underground tank
12 14 ROYAL MEWS	12 14 ROYAL MEWS	Indicates service between separate buildings is looped
Phasing details are in the joint 'world'	29 29	Jointing schedule numbers or phasing diagram
Contaminated Land refer to SHE 01 016	Not applicable	Contaminated land reference
(Cable size/type) ITC	(Cable size/type) Cable traced using CAT	Instrument traced cable or ITC - cable traced electronically using Cable Avoidance Tool (CAT) or similar

Services

NetMAP system	Scanned image	Description

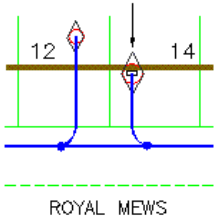
SRC = Service Record Card

Address point

Supply point

Also see SRC and joint/cable attributes

Service in external cabinet

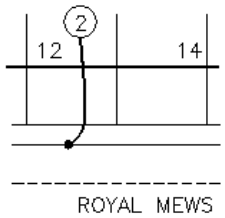


Also see SRC and joint/cable attributes

To a property/metered supply (also see SRC)

Also see SRC

W	Single phase service
1	Connected to 1 core & neutral
R	Connected to red core & neutral
	Three phase service
+	Connected to inner & outer cores of triple conc cable
−	Connected to middle & outer cores of triple conc cable
±	Connected to all three cores of triple conc cable



Existence of a service with its core connection shown in circle

section continued on next page

Services

NetMAP system	Scanned image	Description

Please note that newly edited street furniture no longer has an address point or an SRC

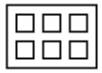
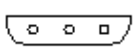
(Street furniture general)

(Street furniture feeder pillar or cabinet)

To street furniture/un-metered supply (also see SRC)

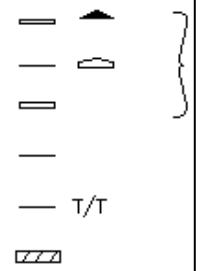
P.L.S.261 / LC / S.L.261	Public lighting / Street lighting
WB	Wall bracket
TL	Traffic light control
FB	Flashing beacon
TS	Traffic sign
B / IGP	Bollard/illuminated guard post
TK / TCB; TK,TC / FP	Telephone kiosk, traffic controller, feeder pillar

Symbols used in cross sections

NetMAP system	Scanned image	Description
		Cable laid direct
		Cable laid in duct
		Blocked duct (sometimes used for unidentified cables)
		Single earthenware duct
2½" S		Single steel pipe
		Square cable duct
		Group of circular ducts
		Group of circular ducts (Sykes)
		Group of square ducts (Doulton)
		Cable trough
		Bitumen casing (Crompton)
		Bitumen filled iron trough (Trunks)
		Bitumen casing (Tri-case)

section continued on next page

Symbols used in cross sections

NetMAP system	Scanned image	Description
Timber		Protective slab Tiles. Concrete slabs Steel plate Plastic tile tape Timber

Abbreviations used in cross sections

NetMAP system	Scanned image	Description
EW	E.W.D(s) or EW.	Earthenware ducts
F	F.P or F or F.D	Fibre duct
A	ASB or A	Asbestos
P	P	Plastic or pitch fibre
S	S.P or S	Steel
C	C.I or C or C.I.P	Cast iron
WI	W.I	Wrought iron pipe
F	F or F.D	Fibre duct
PRD	PRD	Plastic Rigiduct
Left blank – means NR	D.N.K or D:NR	Depth not known
	N.R or (N.R)	No record
E.V	E.V.P or E.V	Everite pipe
T/T	T/T	Tape Tile
N/A	3/62 or NOV 79	Date cable laid
N/A–destination now only shown in cable attribute	ABCD etc	HV cable destination (See section sheet HV ref)

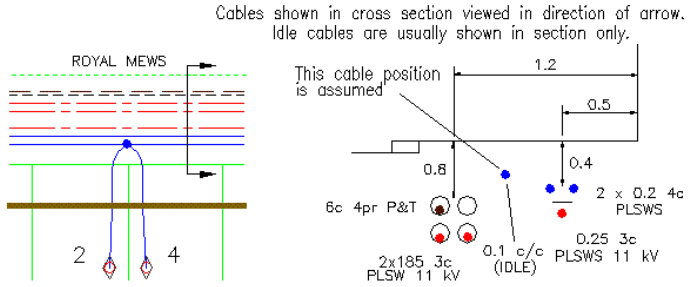
Please note:

Ducts are assumed to be 4"/100mm earthenware – unless otherwise stated

Typical plan and cross section representations

Multi-line composite NetMAP/vector representation

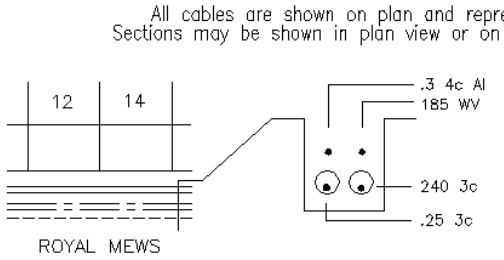
All areas – drawn/redrawn using NetMAP GIS



Applies to all composite vector records in both shaded and unshaded areas of the anomalies map.

Multi-line representation - general composite raster (style 1)

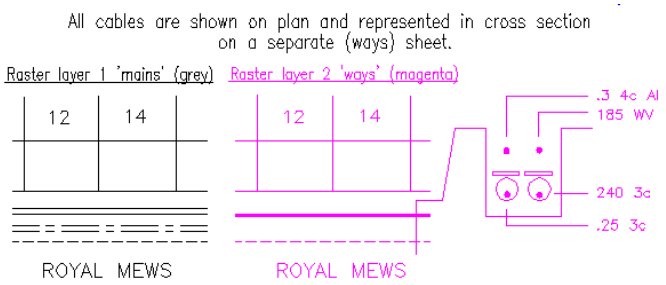
All areas



Applies to all composite raster records within the unshaded areas of the anomalies map.
Can also be found in some shaded areas – in particular the ex–North Eastern shaded areas 3 (b) and 3 (c)

Main and ways representation – dual layer raster

Ex Western area Holborn and parts of Ex-South Eastern Area only



Applies to area 1(a) of the anomalies map.

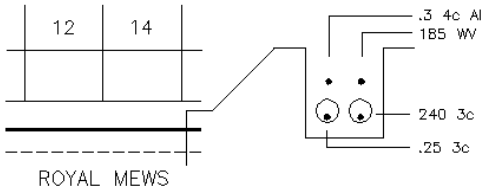
Applies to area 2(a) of the anomalies map.

Typical plan and cross section representations

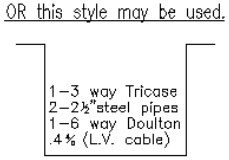
Single line representation - raster or vector data

The City of London only

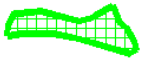
All cables are shown as a single line in plan.
Sections may be written and not drawn.



OR this style may be used.



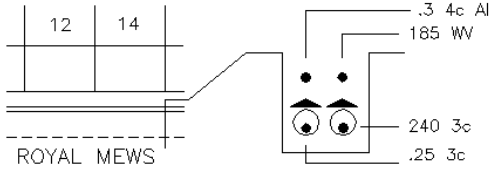
Applies to area 2(b) on the anomalies map.



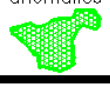
Multi-single line representation general (style 1)

Finsbury and Shoreditch only

Only the top cables in a vertical cable run are shown in the plan view. See the example below.
Note that the two lower cables that are in ducts (in this instance), are not shown in plan.
Therefore cross sections are particularly important, as each line represents one or more cables.



Applies to area 2 (c) of the anomalies map.

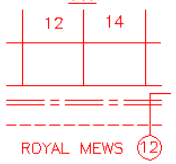


HV and LV map representation – dual layer raster

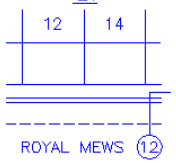
Ex-North Eastern area only

HV and LV cables are shown on separate raster layers. These layers MUST be read in conjunction with each other. Sections are shown on a combined supplementary section sheet in numerical sequence.

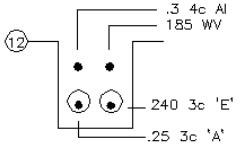
Raster layer 1 HV (red)



Raster layer 2 LV (blue)



Separate raster section sheet



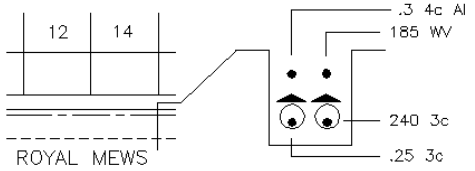
Applies to area 3(a) of the anomalies map.

Typical plan and cross section representations

Multi-single line representation general (style 2)

Ex-North Eastern area only

In this area each voltage (HV and LV) is represented as an individual line. For example, three HV cables and four LV cables in the same run will be indicated by a single HV line and a single LV line. Therefore cross sections are particularly important, as each line represents one or more cables of that voltage.

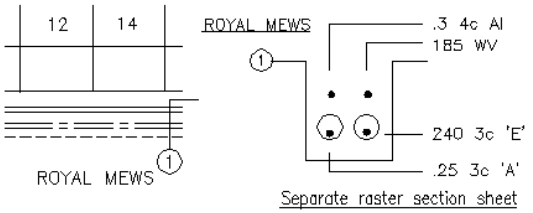


Applies to area 3 (b) of the anomalies map.

Multi-line representation - composite raster (style 2)

Ex North Eastern area only

All cables are individually shown in plan.
Sections are shown on a supplementary section sheet and recorded under the relevant road name.



Applies to area 3(c) of the anomalies map.

Important note regarding sections:

It does not follow that if the number of cables shown in the cross section have been located, that all live cables have been found. You may have found an unrecorded cable, or a cable belonging to another authority.

Regional NetMAP Anomalies - general overview:

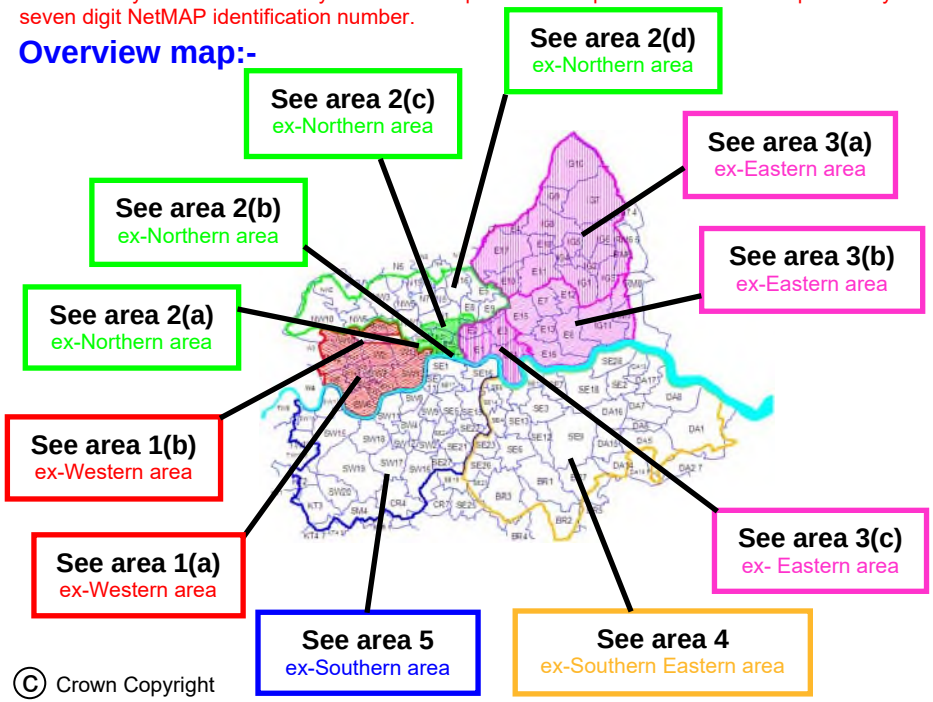
The following pages explain the various major map style anomalies found within the London area. These styles are a legacy from the five individual London Electricity areas which were again formed from seventeen separately organised LEB districts. Areas with significant anomalies are shown in the following pages as cross-hatched areas. Areas with standard composite vector and raster layer information are shown as un-hatched areas.

Cautionary note: - any region or sub-region, either shaded or un-shaded, may contain some local anomalies not mentioned in the following pages – if in doubt, please contact the UK Power Networks Plan Provision team on telephone number 08701 963797.

All regions (1-5) will contain recently created composite vector (NetMAP/AutoCAD) data.

Recent work created using the NetMAP system and previously created using the AutoCAD system (as opposed to raster/scanned data) are recorded in the composite vector style shown on the UK Power Networks London area symbol sheet - see the first example on page 18 of this document. Recent data will be indicated by the existence of multi-coloured cables on the NetMAP system, but this may not be reflected on printed matter produced with a black and white printer. AutoCAD data looks similar to the coloured NetMAP data, but does not hold any cable 'attributes' when selected using the NetMAP system. These cables will be represented individually (multi-line representation). New NetMAP cross sections may be accessed electronically on the NetMAP system and are presented in printed format accompanied by a seven digit NetMAP identification number.

Overview map:-



See following pages for further details.

Region 1 ex-Western area

This region includes Westminster, Kensington, Chelsea, Hammersmith and Fulham. The region is covered by two map layer systems – **region 1(a)** mains and ways dual layer raster, and **region 1(b)** composite raster. The following explains this in greater detail.

Region 1(a) (hatched)

Mains and ways representation:

This system consists of two maps layers for the same area.

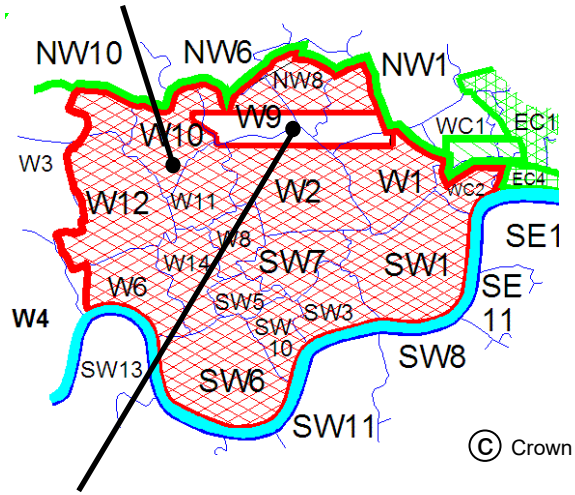
i) The mains map shows all cable routes.

ii) The ways map shows pipe and duct routes with cross sections.

There are some enlargement sheets, cross sections and jointing details. EHV routes are shown on either the mains or the ways map.

It is important that all these maps are read in conjunction with each other.

Caution: - It is also important to note that the kerb line detail on these maps is a dash/dot line, which on the majority of UK Power Networks Central (London) records would refer to an HV cable route. HV cables are shown as a solid line when laid direct and a dashed line when in a duct.



Region 1(b) (un-hatched)

Composite single layer (style 1) maps:

Whenever possible, all the information is on one map layer. There are some enlargement sheets in the Aberdeen Place area. Please note that the kerb line is shown as a dotted line and HV cables are shown as dash/dot lines.

Region 2 ex-Northern area

This region includes Islington, Hackney, the City of London and parts of Brent, Camden and Ealing. The region is covered by four map layer systems - **Region 2(a) -** mains and ways dual layer raster (Holborn area), **Region 2(b)** - single line representation (City of London), **Region 2(c) -** multi-single line representation (Finsbury and Shoreditch) and **Region 2(d)** - composite multi-line maps (all other areas). This following explains this in greater detail.

Region 2(a) (hatched)

Covers part of WC1 and WC2 (Holborn).

Mains and ways representation:

This system consists of two maps layers for the same area.

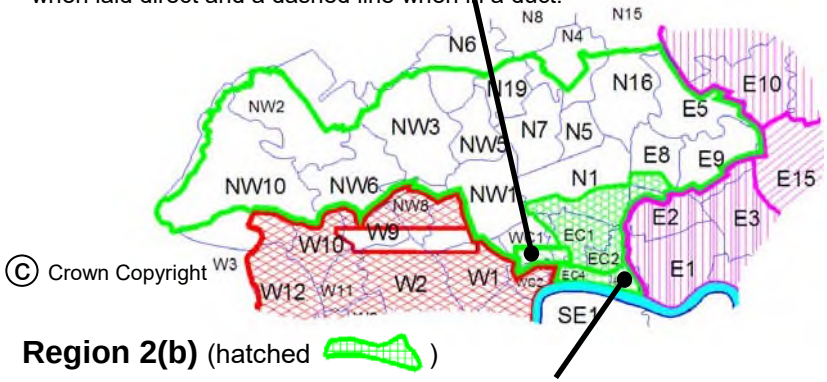
i) The mains map shows all cable routes.

ii) The ways map shows pipe and duct routes with cross sections.

Where needed, extra sheets have been added for enlargements, cross sections and jointing details. EHV routes are shown on the mains map layer.

It is important that all these maps are read in conjunction with each other.

Caution: - It is also important to note that the kerb line detail on these maps is a dash/dot line, which on the majority of UK Power Networks Central (London) records would refer to an HV cable route. HV cables are shown as a solid line when laid direct and a dashed line when in a duct.



Region 2(b) (hatched)

Covers parts of postal areas EC1, EC2 and all of postal areas EC3 and EC4.

Single line representation maps:

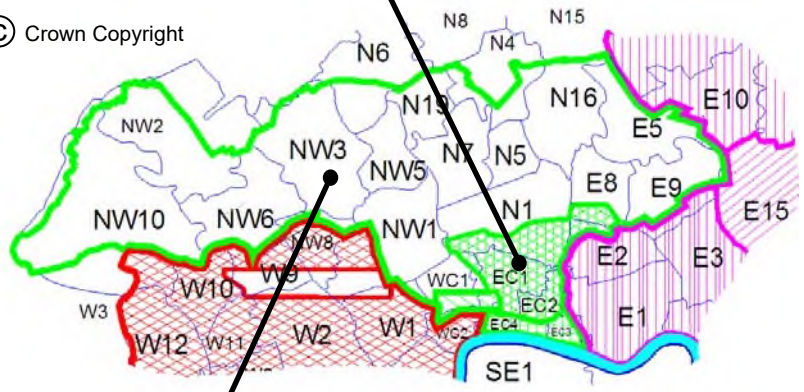
Whenever possible, all the information is on one map layer .One line can represent any number of cables or ducts. It is therefore very important to use cross sections. In some cross sections details may be written and not drawn. In complex and redrawn areas, some detail may be drawn using multi-line representation. There are some enlargement sheets.

Region 2(c) (hatched)

Covers parts of postal areas EC1, EC2, N1, E1, E2 and E8.

Multi-single line representation (style 1) maps:

Whenever possible, all the information is on one map layer. When cables lay immediately above/below each other, it is shown as a single line. For example if six cables lay three on three, only three lines would indicate the six cables. If the cables were laid flat, six separate lines would be shown. It is therefore important not to assume that the lines drawn indicate the number of cables, at any point. **Cross sections must be used.**



Region 2(d) (un-hatched)

Covers all other postal areas in this region

Composite single layer (style 1) maps:

Whenever possible, all the information is on one map layer. There are some enlargement sheets.

Region 3 ex-North Eastern area

This region includes Tower Hamlets, Newham, Redbridge, Waltham Forest, Loughton (Epping) and Barking and Dagenham. This region is covered by three mapping systems.

Region 3(a) (hatched)

Separate HV and LV representation maps:

This system consists of two maps layers for the same area.

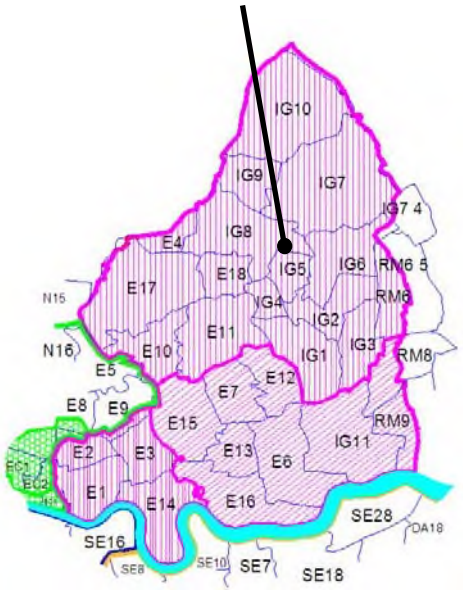
i) The HV map layer showing HV cables and duct routes.

ii) The LV map layer showing LV cables and duct routes.

Cross sections for both HV and LV cable routes are shown on a separate sheet.

EHV cable routes are shown on the HV map layer.

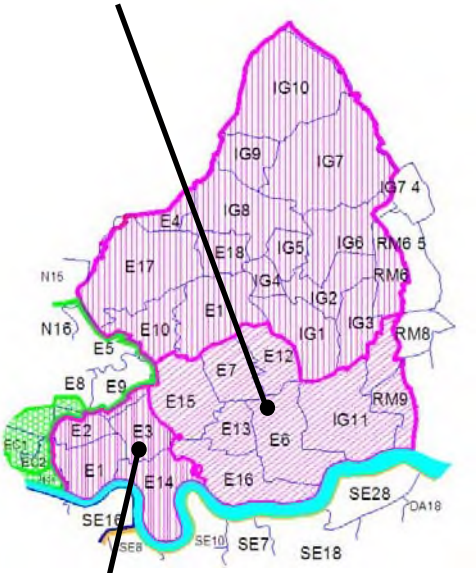
It is important that all these maps are read in conjunction with each other.



Region 3(b) (hatched)

A combination of composite single layer (style 1) and multi-single line (style 2):

Whenever possible, all the information is on one map layer. There are some enlargement sheets. There is a combination of map styles used in this area. Some areas may be conventional multi-line line representation with many areas of multi-single line representation. In the multi-line areas each (live) cable is shown individually in plan. In the multi-single line map areas, there is a single line for each voltage type, with a single HV line and a single LV line representing more than one cable run of each voltage (when applicable). Therefore a cable run containing three HV cable and four LV cables will be represented by one HV line and one LV line.



Region 3(c) (hatched)

A combination of composite single layer (style 2) and multi-single line (style 2):

Whenever possible, all the information is on one map layer. There are some enlargement sheets. In this area (postal code areas E1, E2, E3, E14 and part of E9), the cross sections are listed under each road name. It is therefore extremely important that you have the correct cross sections for the road you are working in.

There is a combination of map styles used in this area. Most areas are composite single layer (style 2) with some areas of multi-single line representation, as described in region 3(b).

Region 4 ex-South Eastern area

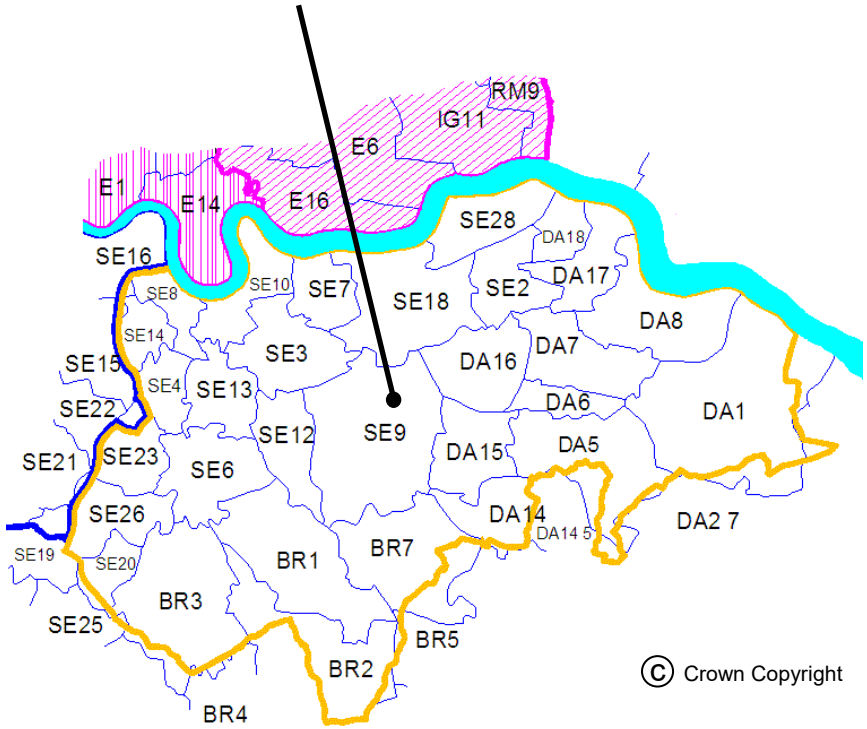
This region includes Lewisham, Greenwich, Bromley, Bexley and Dartford.

Nearly all maps are drawn in one style – single layer composite raster/vector.

Region 4 (un-hatched)

Composite single layer (style 1) with a small number of mains and ways representation maps :

Mainly composite maps - whenever possible, all the information is on one map layer. There are some enlargement and cross section sheets. Some maps do not show single phase services unless they are long and deviating. There are however some maps drawn using the mains and ways style. These are rare, but please be aware that they exist.



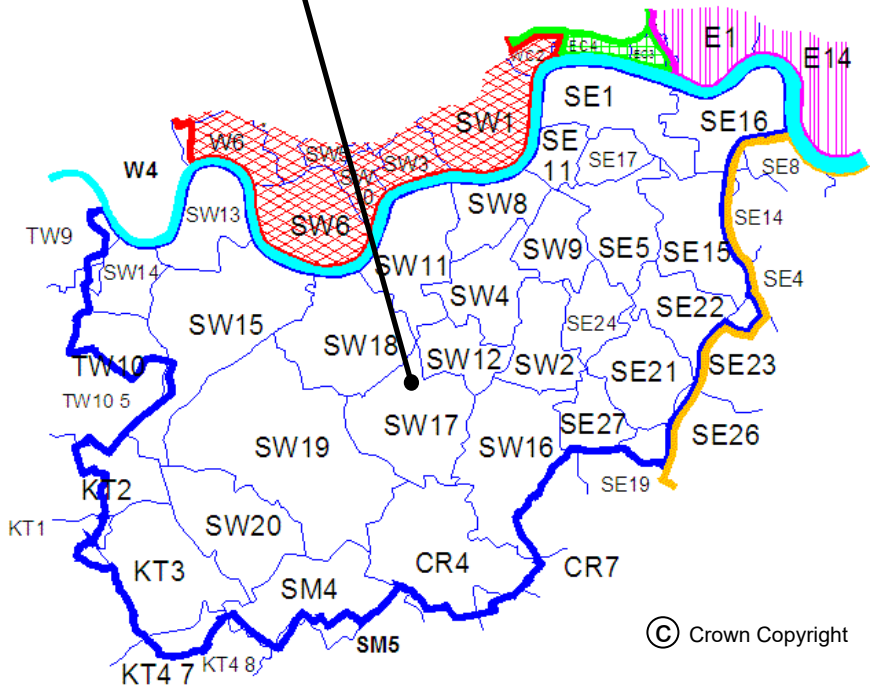
Region 5 ex-Southern area

This region includes Southwark, Lambeth, Wandsworth, Merton, Kingston upon Thames and Richmond upon Thames. All maps are drawn to one style - single layer composite raster/vector.

Region 5 (un-hatched)

Composite single layer (style 1) maps:

Composite maps - whenever possible, all the information is on one map layer. There are some enlargement and cross section sheets. A small number of maps may not show services.



Enquiry Confirmation

LSBUD Ref: 21719459

Date of enquiry: 30/03/2021
Time of enquiry: 17:03

Enquirer

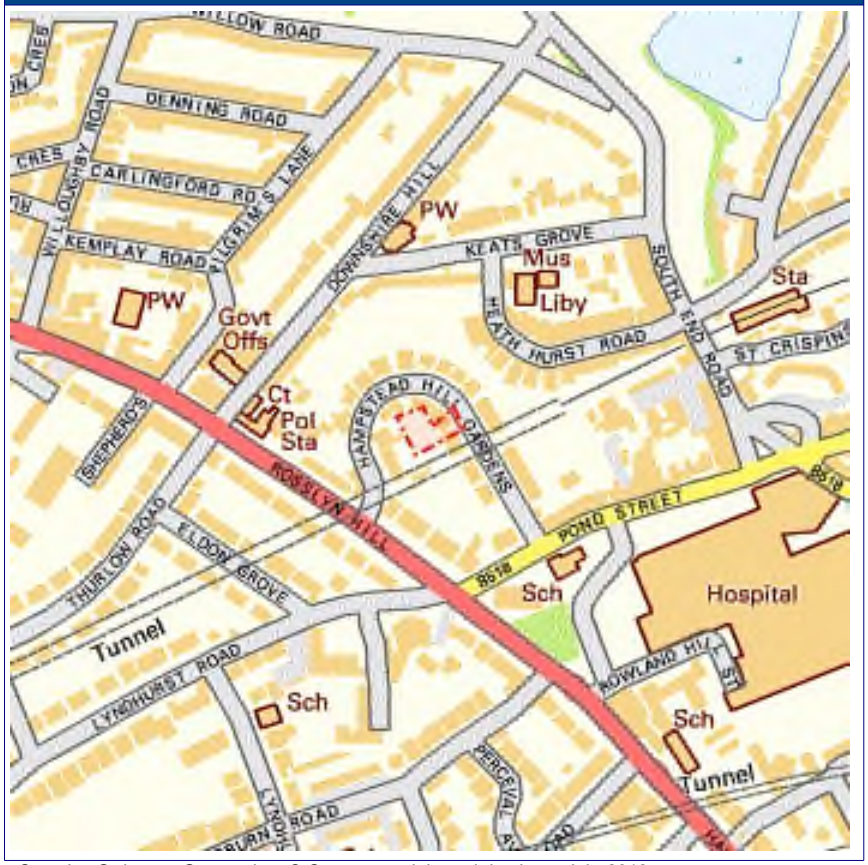
Name	Miss Alexa Band	Phone	01604 781877
Company	Soiltechnics	Mobile	Not Supplied
Address	Cedar Barn White Lodge Walgrave Northamptonshire NN6 9PY		
Email	Alexa.Band@soiltechnics.net		

Enquiry Details

Scheme/Reference	STT5321		
Enquiry type	Initial Enquiry	Work category	Development Projects
Start date	31/03/2021	Work type	Commercial/industrial
End date	31/03/2021	Site size	1219 metres square
Searched location	XY= 527016, 185537	Work type buffer*	25 metres
Confirmed location	527006 185529		
Site Contact Name	Not Supplied	Site Phone No	Not Supplied
Description of Works			

* The WORK TYPE BUFFER is a distance added to your search area based on the Work type you have chosen.

Site Map



Enquiry Confirmation

LSBUD Ref: 21719459

Date of enquiry: 30/03/2021
Time of enquiry: 17:03

Asset Owners

Terms and Conditions. Please note that this enquiry is subject always to our standard terms and conditions available at www.linesearchbeforeudig.co.uk ("Terms of Use") and the disclaimer at the end of this document. Please note that in the event of any conflict or ambiguity between the terms of this Enquiry Confirmation and the Terms of Use, the Terms of Use shall take precedence.

Notes. Please ensure your contact details are correct and up to date on the system in case the LSBUD Members need to contact you.

Validity and search criteria. The results of this enquiry are based on the confirmed information you entered and are valid only as at the date of the enquiry. It is your responsibility to ensure that the Enquiry Details are correct, and LinesearchbeforeUdig accepts no responsibility for any errors or omissions in the Enquiry Details or any consequences thereof. LSBUD Members update their asset information on a regular basis so you are advised to consider this when undertaking any works. It is your responsibility to choose the period of time after which you need to resubmit any enquiry but the maximum time (after which your enquiry will no longer be dealt with by the LSBUD Helpdesk and LSBUD Members) is 28 days. If any details of the enquiry change, particularly including, but not limited to, the location of the work, then a further enquiry must be made.

Asset Owners & Responses. Please note the enquiry results include the following:

1. "LSBUD Members" who are asset owners who have registered their assets on the LSBUD service.
2. "Non LSBUD Members" are asset owners who have not registered their assets on the LSBUD service but LSBUD is aware of their existence. Please note that there could be other asset owners within your search area.

Below are three lists of asset owners:

1. LSBUD Members who have assets registered within your search area. ("Affected")
   a. These LSBUD Members will either:
      i. Ask for further information ("Email Additional Info" noted in status). The additional information includes: Site contact name and number, Location plan, Detailed plan (minimum scale 1:2500), Cross sectional drawings (if available), Work Specification.

      ii. Respond directly to you ("Await Response"). In this response they may either send plans directly to you or ask for further information before being able to do so, particularly if any payments or authorisations are required.

2. LSBUD Members who do not have assets registered within your search area. ("Not Affected")

3. Non LSBUD Members who may have assets within your search area. Please note that this list is not exhaustive and all details are provided as a guide only. It is your responsibility to identify and consult with all asset owners before proceeding.

National Grid. Please note that the LSBUD service only contains information on National Grid's Gas above 7 bar asset, all National Grid Electricity Transmission assets and National Grid's Gas Distribution Limited above 2 bar asset.

For National Grid Gas Distribution Ltd below 2 bar asset information please go to www.beforeyoudig.nationalgrid.com

Enquiry Confirmation

LSBUD Ref: 21719459

Date of enquiry: 30/03/2021
Time of enquiry: 17:03

LSBUD Members who have assets registered on the LSBUD service within the vicinity of your search area.

List of affected LSBUD members			
Asset Owner	**Phone/Email**	**Emergency Only**	**Status**
UK Power Networks	08000565866	08000565866	Await response

LSBUD Members who do not have assets registered on the LSBUD service within the vicinity of your search area. Please be aware that LSBUD Members make regular changes to their assets and this list may vary for new enquiries in the same area.

List of not affected LSBUD members		
AWE Pipeline	Balfour Beatty Investments Limited	BOC Limited (A Member of the Linde Group)
Box Broadband	BP Exploration Operating Company Limited	BPA
Carrington Gas Pipeline	CATS Pipeline c/o Wood Group PSN	Cemex
Centrica Storage Ltd	Chrysaor Production (UK) Limited	CNG Services Ltd
Concept Solutions People Ltd	ConocoPhillips (UK) Teesside Operator Ltd	Diamond Transmission Corporation
DIO (MOD Abandoned Pipelines)	DIO (MOD Live Pipelines)	E.ON UK CHP Limited
EirGrid	Electricity North West Limited	ENI & Himor c/o Penspen Ltd
EnQuest NNS Limited	EP Langage Limited	ESP Utilities Group
ESSAR	Esso Petroleum Company Limited	Exolum Pipeline System
Fulcrum Pipelines Limited	Gamma	Gas Networks Ireland (UK)
Gateshead Energy Company	Gigaclear Ltd	Gtt
Heathrow Airport LTD	Humbly Grove Energy	IGas Energy
INEOS FPS Pipelines	INEOS Manufacturing (Scotland and TSEP)	INOVYN ChlorVinyls Limited
INOVYN Enterprises Limited	Intergen (Coryton Energy or Spalding Energy)	Jurassic Fibre Ltd
Mainline Pipelines Limited	Manchester Jetline Limited	Manx Cable Company
Marchwood Power Ltd (Gas Pipeline)	Melbourn Solar Limited	Murphy Utility Assets
National Grid Gas (Above 7 bar), National Grid Gas Distribution Limited (Above 2 bar) and National Grid Electricity Transmission	Northumbrian Water Group	NPower CHP Pipelines
NYnet Ltd	Oikos Storage Limited	Ørsted
Perenco UK Limited (Purbeck Southampton Pipeline)	Petroineos	Phillips 66
Portsmouth Water	Premier Transmission Ltd (SNIP)	Redundant Pipelines - LPDA
RWE - Great Yarmouth Pipeline (Bacton to Great Yarmouth Power Station)	RWEnpower (Little Barford and South Haven)	SABIC UK Petrochemicals
Scottish and Southern Electricity Networks	Scottish Power Generation	Seabank Power Ltd
SES Water	SGN	Shell
Shell NOP	SSE Enterprise Telecoms	SSE Generation Ltd
SSE Utility Solutions Limited	Tata Communications (c/o JSM Construction Ltd)	Total (Colnbrook & Colwick Pipelines)
Total Finaline Pipelines	Transmission Capital	Uniper UK Ltd
University of Cambridge Granta Backbone	Vattenfall	Veolia ES SELCHP Limited

Network		
Veolia ES Sheffield Ltd	VPI Power Limited	Wales and West Utilities
West of Duddon Sands Transmission Ltd	Western Power Distribution	Westminster City Council
Zayo Group UK Ltd c/o JSM Group Ltd		

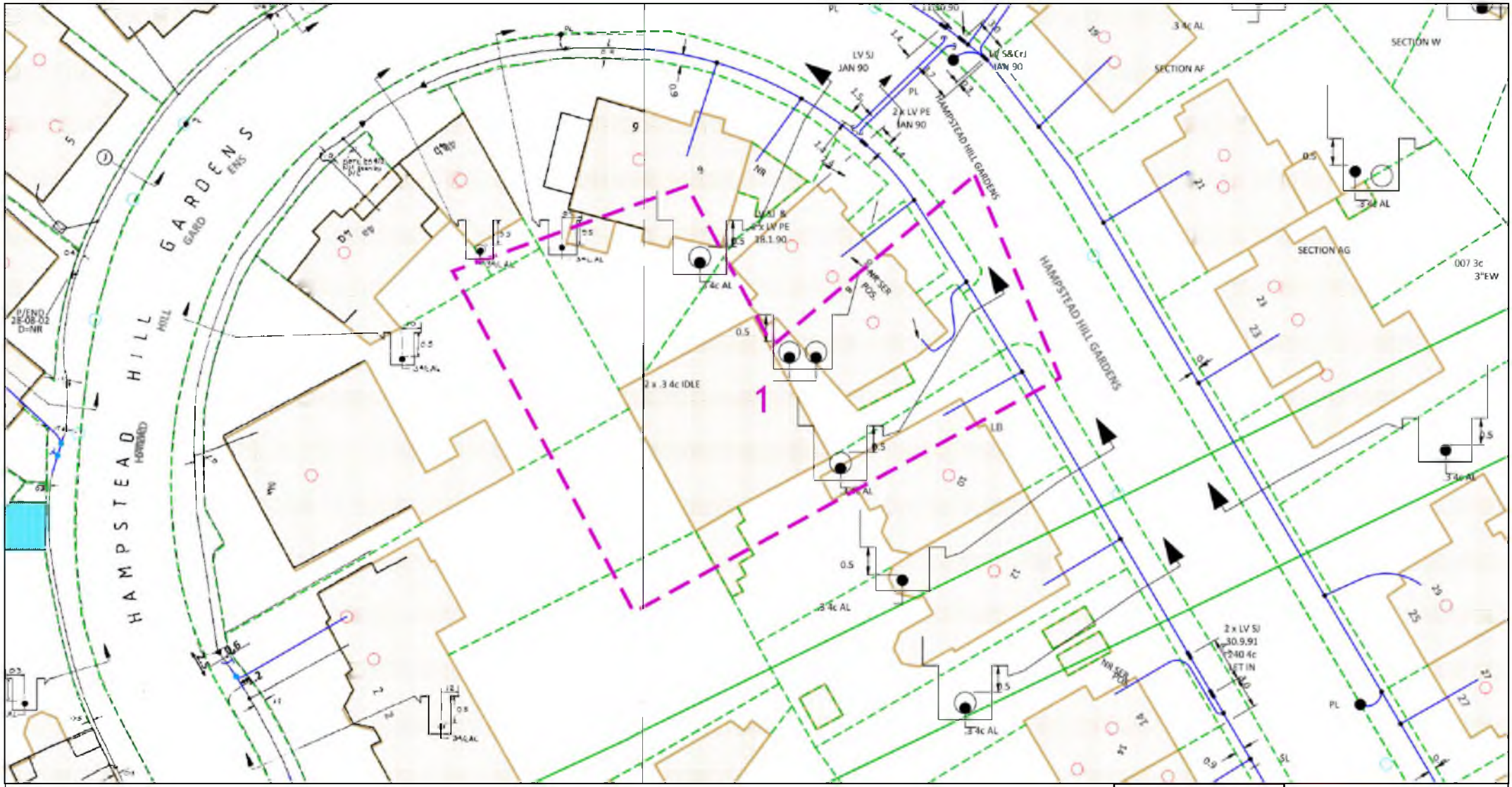
Enquiry Confirmation

LSBUD Ref: 21719459

Date of enquiry: 30/03/2021
Time of enquiry: 17:03

The following Non-LSBUD Members may have assets in your search area. It is YOUR RESPONSIBILITY to contact them before proceeding. Please be aware this list is not exhaustive and it is your responsibility to identify and contact all asset owners within your search area.

Non-LSBUD members (Asset owners not registered on LSBUD)			
Asset Owner	**Preferred contact method**	**Phone**	**Status**
BT	https://www.swns.bt.com/pls/mbe/welcome.home	08000232023	Not Notified
Cadent Gas	plantprotection@cadentgas.com	0800688588	Not Notified
CenturyLink Communications UK Limited	plantenquiries@instalcom.co.uk	02087314613	Not Notified
CityFibre	asset.team@cityfibre.com	033 3150 7282	Not Notified
Colt	plantenquiries@catelecomuk.com	01227768427	Not Notified
ENGIE	nrswa.uk@engie.com	01293 549944	Not Notified
GTC	https://pe.gtc-uk.co.uk/PlantEnqMembership	01359240363	Not Notified
Last Mile	plantenquiries@lastmile-uk.com	plantenquiries@lastmile-uk.com	Not Notified
Mobile Broadband Network Limited	mbnl.plant.enquiries@turntown.com	01212 621 100	Not Notified
Sky UK Limited	nrswa@sky.uk	02070323234	Not Notified
Sota	SOTA.plantenquiries@instalcom.co.uk		Not Notified
Teliasonera	check-network@teliacompany.com	0800526015	Not Notified
Thames Water	http://www.digdat.co.uk	08450709145	Not Notified
Utility assets Ltd	enquiries@utilityassets.co.uk		Not Notified
Verizon Business	osp-team@uk.verizonbusiness.com	01293611736	Not Notified
Virgin Media	http://www.digdat.co.uk	08708883116	Not Notified
Vodafone	osm.enquiries@atkinsglobal.com	01454662881	Not Notified



0 12.5 25
metres

Dig Sites Area: Line:

The quality and accuracy of any print will depend on your printer, your computer and its print settings. Measurements scaled from this plan may not match measurements between the same points on the ground.

This plan must be used with the attached 'Symbols' document.

Date Requested: 30/03/2021
Job Reference: 21719459
Site Location: 526968 185507
Requested by: Miss Alexa Band

Your Scheme/Reference: STT5321
Scale: 1:500 (When plotted at A4)

1. The position of the apparatus shown on this drawing is believed to be correct but the original landmarks may have been altered since the apparatus was installed.
2. The exact position of the apparatus should be verified - use approved cable avoidance tools prior to excavation using suitable hand tools.
3. It is essential that trial holes are carefully made avoiding the use of mechanical tools or picks until the exact location of all the cables have been determined.
4. It must be assumed that there is a service cable into each property, lamp column and street sign, etc.
5. All cables must be treated as being live unless proved otherwise by UK Power Networks.
6. The information proved must be given to all people working near UK Power Networks plant and equipment. Do not use plans more than 3 months after the issue date for excavation purposes.
7. Please be aware that electric cables/lines belonging to other owners of licensed electricity distribution systems may be present and it is your responsibility to identify their location.
8. Please be aware the Low Voltage Overhead power lines are not currently displayed for the Eastern Region via this service, if you require records on the location of these please contact our Plan Provision team directly via plans@ukpowernetworks.co.uk.

1. UK Power Networks does not warrant that the information provided to you is correct. You rely upon it at your own risk.
2. UK Power Networks does not exclude or limit its liability if it causes the death of any persons or causes personal injury to a person.
3. Subject to paragraph 2 UK Power Networks has no liability to you in contract, in tort (including negligence), for breach of statutory duty or otherwise for any loss, damage, cost, claims, demands, or expenses that you or any third party may suffer or incur as a result of using the information provided whether for physical damage to property or for any economic loss (including without limitation loss of profit, loss of opportunity, loss of savings, loss of goodwill, loss of business, loss of use) or any special or consequential loss or damage whatsoever.
4. This plan has been provided to you on the basis of the terms of use set out in the covering letter that accompanies this plan. If you do not accept and/or do not understand the terms of use set out in the covering letter you must not use the plan and must return it to the sender of the letter.
5. You are responsible for the security of the information provided to you. It must not be given, sold or made available upon payment of a fee to a third party.
6. Please Note: The Overview map does not display UK Power Networks electricity network and should not be used for the location of UK Power Networks assets. For detail of the electricity network please view the relevant page as highlighted in the Overview map.

N W E S

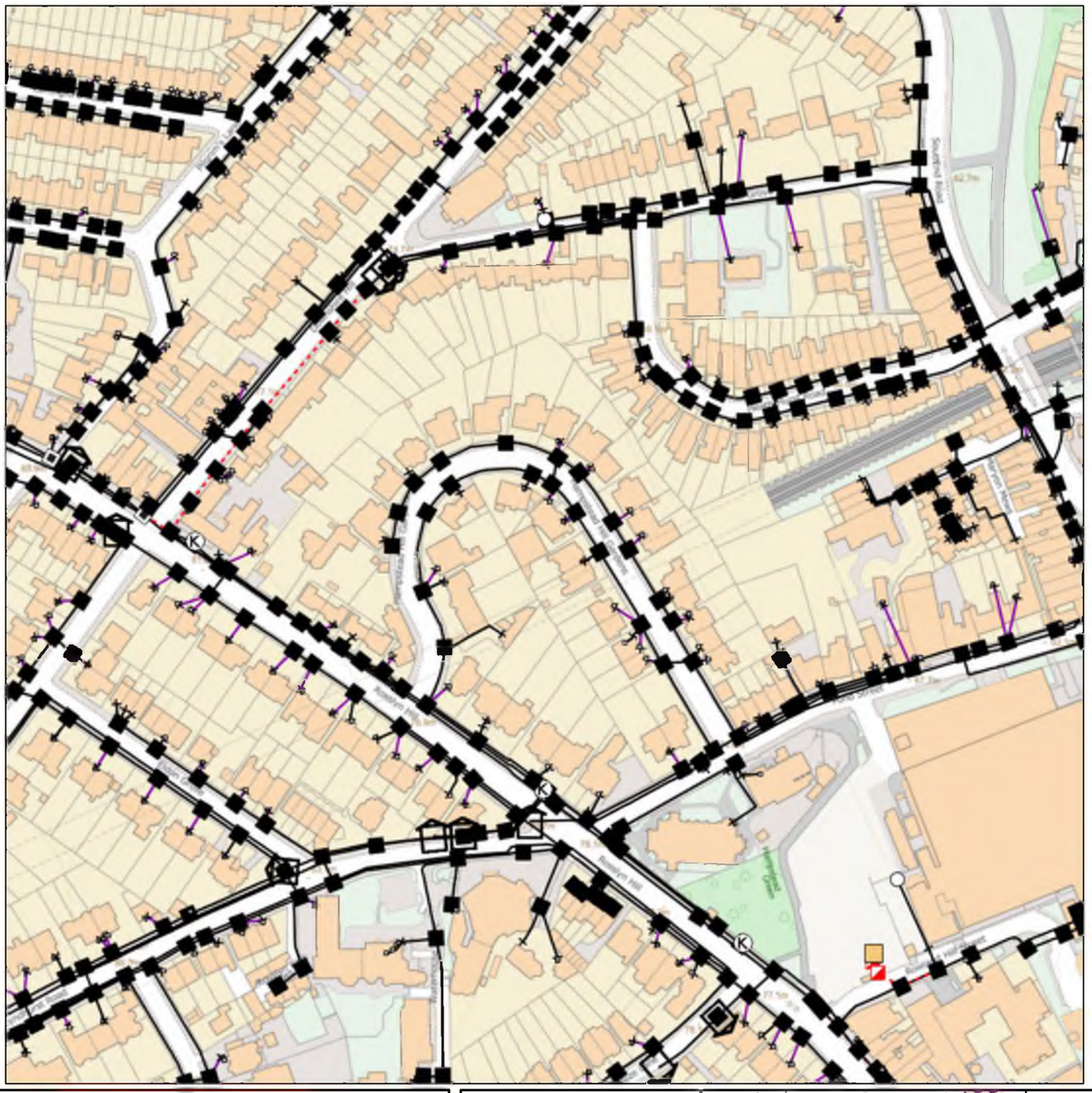
UK Power Networks

IF IN DOUBT - ASK! PHONE
0800 056 5866
EMERGENCY - If you damage a cable or line
Phone 0800 783 8838 (24hrs)
URGENTLY

ALWAYS LOOK UP BEFORE YOU START WORK
Refer to HSE Guidance note GS6

Maps produced at 1:2500 scale are Geo-Schematics which show LV mains cables and overhead lines (in some cases all voltages). Prior to carrying out excavations you must refer to the 1:500 records to determine the location of all known underground plant and equipment.

Maps by email Plant Information Reply



IMPORTANT WARNING

Information regarding the location of BT apparatus is given for your assistance and is intended for general guidance only. No guarantee is given of its accuracy. It should not be relied upon in the event of excavations or other works being made near to BT apparatus which may exist at various depths and may deviate from the marked route.

openreach

CLICK BEFORE YOU DIG

FOR PROFESSIONAL FREE ON SITE ASSISTANCE PRIOR TO COMMENCEMENT OF EXCAVATION WORKS INCLUDING LOCATE AND MARKING SERVICE

email cbyd@openreach.co.uk

ADVANCE NOTICE REQUIRED
(Office hours: Monday - Friday 08.00 to 17.00)
www.openreach.co.uk/cbyd

Accidents happen

If you do damage any Openreach equipment please let us know by calling 0800 023 2023 (opt 1 + opt 1) and we can get it fixed ASAP

KEY TO BT SYMBOLS

	Planned	Live
PCP		
Pole		
Box		
Manhole		
Cabinet		

Change Of State	+	Hatchings	
Split Coupling	×	Built	
Duct Tee	▲	Planned	
Building		Inferred	
Kiosk	K	Duct	

Other proposed plant is shown using dashed lines.
BT Symbols not listed above may be disregarded.
Existing BT Plant may not be recorded.
Information valid at time of preparation. Maps are only valid for 90 days after the date of publication.

	Pending Add	In Place	Pending Remove	Not In Use
Power Cable				
Power Duct				N/A

BT Ref : VHF05026V
Map Reference : (centre) TQ2701685537
Easting/Northing : (centre) 527016,185537
Issued : 30/03/2021 17:02:54

WARNING: IF PLANNED WORKS FALL INSIDE HATCHED AREA IT IS ESSENTIAL BEFORE PROCEEDING THAT YOU CONTACT THE NATIONAL NOTICE HANDLING CENTRE. PLEASE SEND E-MAIL TO: nnhc@openreach.co.uk

Appendix E Ground Movement Analyses

Titles

Job No.: STT5321
Job Title: 8A Hampstead Hill Gardens
Sub-title:
Calculation Heading:
Initials: AKW
Checker:
Date Saved:
Date Checked:
Notes:
File Name: Underpins.pdd
File Path: \\st-dc01\Soiltechnics\ST PROJECTS\Schemes 2021 (T)\STT5321 - 8A Hampstead Hill Gardens\Geotechnical

History

Date	Time	By	Notes
15-Jun-2021	13:41	AngusW	New
15-Jun-2021	14:53	AngusW	
17-Jun-2021	11:47	AngusW	
17-Jun-2021	12:25	AngusW	
17-Jun-2021	14:25	AngusW	
17-Jun-2021	16:07	AngusW	
17-Jun-2021	17:10	AngusW	
17-Jun-2021	17:12	AngusW	
17-Jun-2021	21:04	AngusW	
18-Jun-2021	14:30	AngusW	
01-Nov-2021	11:01	AngusW	
02-Nov-2021	10:02	AngusW	
02-Nov-2021	12:18	AngusW	
02-Nov-2021	17:25	AngusW	Open

Analysis Options

General
Global Poisson's ratio: 0.20
Maximum allowable ratio between values of E: 1.5
Horizontal rigid boundary level: 90.00 [m OD]
Displacements at load centroids: Yes
GSA piled raft data : No

Elastic
Elastic : Yes
Analysis: Boussinesq
Stiffness for horizontal displacement calculations: Weighted average
Using legacy heave correction factor: Yes

Consolidation
Consolidation : Yes
Time Period : 60.000000 years.
Time Step : 0.020000 years.
Cv or k : Cv
Rigid Boundary : Impermeable

Water
Level : 97.500000 [m].
Unit Weight : 9810.000000 [kN/m³].

Soil ProfilesSoil Profile 1

Layer ref.	Name	Level at top [mOD]	Number of intermediate displacement levels	Youngs Modulus : Top [kN/m²]	Youngs Modulus : Btm. [kN/m²]	Poissons ratio	Cons. : Method	Cons. : m_v [m²/kN]	Cons. : e_0	Cons. : C_c	Cons. : C_r	Cons. : Over Cons. Calc.	Cons. : Pre Cons. Press. [kN/m²]	Cons. : OCR	Cons. : OCM [kN/m²]	C_v [m²/year]	Bulk unit weight [kN/m³]	C_a	C_{ae}	Non-linear curve
1	Head	99.000	2	20000.	20000.	0.20000	mv	300.00E-6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10.000	19.000	N/A	100.00E-9	None
2	London Clay	97.000	5	29750.	47600.	0.20000	mv	180.00E-6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10.000	20.000	N/A	100.00E-9	None

Soil Zones

Zone	Name	X min [m]	X max [m]	Y min [m]	Y max [m]	Profile
1	Soil Zone 1	-16.000	31.000	-16.000	21.000	Soil Profile 1

Polygonal Load Data

Load ref.	Name	Position : Level [m]	Position : Polygon : Coords. [m]	Position : Polygon : Rect. tolerance [%]	No. of Rectangles	Value : Normal (local z) [kN/m²]
1	Poly Load 1	95.00000	(-4.35,1.22) (-3.48,1.72) (3.22,-9.38) (2.35,-9.88)	10.000	1	90.000
2	Poly Load 2	95.00000	(2.72,-8.51) (16.8,0.486) (17.3,-0.38) (3.22,-9.38)	10.000	1	90.000
3	Poly Load 3	95.00000	(12.4,4.92) (13.3,5.42) (16.1,2.32) (15.1,1.73)	10.000	7	90.000
4	Poly Load 4	95.00000	(12.4,4.92) (13,4.15) (10.8,2.75) (5.28,11.5) (6.15,12) (11.2,4.12)	10.000	2	90.000
5	Poly Load 5	95.00000	(-4.35,1.22) (-3.48,1.72) (-3.23,1.29) (0.75,7.55) (5.78,10.7) (5.28,11.5) (0.25,8.42)	10.000	23	90.000
6	Excavation	95.00000	(-3.23,1.29) (0.75,7.55) (5.78,10.7) (10.8,2.75) (13,4.15) (15.1,1.73) (14.6,1.52) (15.8,-0.11) (2.72,-8.51)	10.000	9	-80.000
7	Poly Load 7	95.00000	(16.8,0.486) (15.8,-0.11) (14.6,1.52) (15.7,2.12)	10.000	2	90.000

Polygonal Loads' Rectangles

No.	Centre : x [m]	Centre : y [m]	Angle of local x from global X [Degrees]	Width x [m]	Depth y [m]
Load 1 : Poly Load 1					
(Edge 1 optimal)					
1	-0.56700	-4.08000	121.12	12.946	0.99979
Load 2 : Poly Load 2					
(Edge 2 optimal)					
1	9.98300	-4.44700	32.672	16.625	0.99889
Load 3 : Poly Load 3					
(Edge 3 optimal)					
1	15.59895	2.12792	-49.756	0.057913	0.92743
2	15.77937	2.20475	-49.756	0.057913	0.55646
3	15.95979	2.28158	-49.756	0.057913	0.18549
4	12.46574	4.95036	-49.756	0.059277	0.16401
5	12.62922	5.01107	-49.756	0.059277	0.49202
6	12.79270	5.07178	-49.756	0.059277	0.82003
7	14.19159	3.59582	-49.756	4.0014	1.0485

No.	Centre : Centre : Angle of local x from global X		Width x	Depth y	
	x	y			
Load 4 : Poly Load 4					
(Edge 2 optimal)					
1	8.22004	7.79788	122.33	9.3493	1.0177
2	11.60828	3.84667	122.33	0.95209	2.5579
Load 5 : Poly Load 5					
(Edge 1 optimal)					
1	-4.27637	1.29247	30.001	0.20000	0.051890
2	-4.12912	1.43741	30.001	0.20000	0.15567
3	-3.98186	1.58234	30.001	0.20000	0.25945
4	-3.83461	1.72728	30.001	0.20000	0.36323
5	-3.68735	1.87222	30.001	0.20000	0.46701
6	-3.37141	1.91227	30.001	0.38728	1.0183
7	-3.13678	2.28044	30.001	0.38728	1.0172
8	-2.90215	2.64860	30.001	0.38728	1.0161
9	-2.66752	3.01677	30.001	0.38728	1.0150
10	-2.43289	3.38493	30.001	0.38728	1.0139
11	-2.19826	3.75310	30.001	0.38728	1.0128
12	-1.96363	4.12126	30.001	0.38728	1.0117
13	-1.72899	4.48943	30.001	0.38728	1.0105
14	-1.49436	4.85759	30.001	0.38728	1.0094
15	-1.25973	5.22576	30.001	0.38728	1.0083
16	-1.02510	5.59392	30.001	0.38728	1.0072
17	-0.79047	5.96209	30.001	0.38728	1.0061
18	-0.55584	6.33026	30.001	0.38728	1.0050
19	-0.32121	6.69842	30.001	0.38728	1.0039
20	-0.08658	7.06659	30.001	0.38728	1.0028
21	0.14805	7.43475	30.001	0.38728	1.0016
22	0.38268	7.80292	30.001	0.38728	1.0005
23	3.01700	9.53700	30.001	5.9096	0.99998
Load 6 : Excavation					
(Edge 6 optimal)					
1	4.34220	-7.45148	122.33	0.056239	3.8836
2	7.59461	-5.32644	122.33	0.056239	11.651
3	8.67671	-3.43126	122.33	1.9891	15.469
4	14.96307	1.68897	122.33	0.060004	0.23922
5	7.41785	-1.21373	122.33	3.1049	15.618
6	3.75033	2.00489	122.33	6.2572	12.688
7	2.38168	5.75608	122.33	1.5461	10.989
8	2.94137	7.94002	122.33	1.5461	7.7068
9	1.98561	8.29299	122.33	0.072732	3.0329
Load 7 : Poly Load 7					
(Edge 3 optimal)					
1	14.90202	1.65643	123.95	0.066302	0.58581
2	15.70923	0.99977	123.95	1.9247	1.1529

Displacement Lines

Name	X1 [m]	Y1 [m]	Z1 [m]	X2 [m]	Y2 [m]	Z2 [m]	Intervals [No.]	Calculate	Detailed Results
Displacement Line 1	13.70000	-4.10000	99.00000	16.20000	-2.80000	99.00000	3	Yes	Yes
Displacement Line 2	16.20000	-2.80000	99.00000	27.00000	3.70000	99.00000	10	Yes	Yes
Displacement Line 3	13.70000	-4.10000	99.00000	14.90000	-6.10000	99.00000	3	Yes	Yes
Displacement Line 4	17.10000	-4.85000	99.00000	14.90000	-6.10000	99.00000	3	Yes	Yes
Displacement Line 5	5.50000	15.48000	99.00000	8.11000	12.53000	99.00000	5	Yes	Yes
Displacement Line 6	8.11000	12.53000	99.00000	7.15000	11.65000	99.00000	2	Yes	Yes
Displacement Line 7	7.15000	11.65000	99.00000	9.18000	9.37000	99.00000	4	Yes	Yes
Displacement Line 8	9.18000	9.37000	99.00000	10.14000	10.22000	99.00000	2	Yes	Yes
Displacement Line 9	10.14000	10.22000	99.00000	16.60000	2.90000	99.00000	10	Yes	Yes

Displacement Grids

Name	Extrusion: Direction	X1 [m]	Y1 [m]	Z1 [m]	X2 [m]	Y2 [m]	Z2 [m]	Intervals Along Line [No.]	Extrusion: Distance [m]	Extrusion: Intervals Along [No.]	Calculate	Detailed Results
Displacement Grid 1	Global X	-15.00000	-15.00000	99.00000	-	20.00000	99.00000	35	45.00000	30	No	Yes

Warnings

(1)Soil Profile 1 : Stratum 2 : The time step should preferbaly be in the range 0.0454 to 0.272 (see Pore Pressures section of the help file) to avoid large discretisation errors and numerical disturbances. Please adjust the timestep and/or no.of intermediate displacement levels for this layer.

Res Its Total Displacement Data Lines

Ref.	Name	TimeStep No	TimeStep Value	x	y	z	Sett. Immediate	Sett. Primary	Sett. Secondary	Sett. Total
			[m]	[m]	[m]	[mm]	[mm]	[mm]	[mm]	
1	Displacement Line 1	0	0.00000	13.70000	-4.10000	.00000	0.2 644	0.00000	0.00000	0.2 644
		2000	40.00000	13.70000	-4.10000	.00000	0.2 644	0.55612	0.0006	0. 5325
		3000	60.00000	13.70000	-4.10000	.00000	0.2 644	0.55612	0.000 2	0. 533
1	Displacement Line 1	0	0.00000	14.53333	-3.66667	.00000	0.310	0.00000	0.00000	0.310
		2000	40.00000	14.53333	-3.66667	.00000	0.310	0. 1 71	0.00062	1.23031
		3000	60.00000	14.53333	-3.66667	.00000	0.310	0. 1 71	0.00075	1.23044
1	Displacement Line 1	0	0.00000	15.36667	-3.23333	.00000	0.3352	0.00000	0.00000	0.3352
		2000	40.00000	15.36667	-3.23333	.00000	0.3352	1.363 7	0.00060	1.6 75
		3000	60.00000	15.36667	-3.23333	.00000	0.3352	1.363 7	0.00073	1.6
1	Displacement Line 1	0	0.00000	16.20000	-2. 0000	.00000	0.35 70	0.00000	0.00000	0.35 70
		2000	40.00000	16.20000	-2. 0000	.00000	0.35 70	1.7 1	0.0005	2.1511
		3000	60.00000	16.20000	-2. 0000	.00000	0.35 70	1.7 1	0.00072	2.15131
2	Displacement Line 2	0	0.00000	16.20000	-2. 0000	.00000	0.35 70	0.00000	0.00000	0.35 70
		2000	40.00000	16.20000	-2. 0000	.00000	0.35 70	1.7 1	0.0005	2.1511
		3000	60.00000	16.20000	-2. 0000	.00000	0.35 70	1.7 1	0.00072	2.15131
2	Displacement Line 2	0	0.00000	17.2 000	-2.15000	.00000	0.36404	0.00000	0.00000	0.36404
		2000	40.00000	17.2 000	-2.15000	.00000	0.36404	2.0 41	0.0005	2.46403
		3000	60.00000	17.2 000	-2.15000	.00000	0.36404	2.0 41	0.00072	2.46416
2	Displacement Line 2	0	0.00000	1 .36000	-1.50000	.00000	0.26615	0.00000	0.00000	0.26615
		2000	40.00000	1 .36000	-1.50000	.00000	0.26615	1.535	0.0005	1. 0271
		3000	60.00000	1 .36000	-1.50000	.00000	0.26615	1.535	0.00071	1. 02 4
2	Displacement Line 2	0	0.00000	1 .44000	-0. 5000	.00000	0.15134	0.00000	0.00000	0.15134
		2000	40.00000	1 .44000	-0. 5000	.00000	0.15134	0.76405	0.0005	0. 15 7
		3000	60.00000	1 .44000	-0. 5000	.00000	0.15134	0.76405	0.00071	0. 1610
2	Displacement Line 2	0	0.00000	20.52000	-0.20000	.00000	0.0 471	0.00000	0.00000	0.0 471
		2000	40.00000	20.52000	-0.20000	.00000	0.0 471	0.31 17	0.0005	0.40346
		3000	60.00000	20.52000	-0.20000	.00000	0.0 471	0.31 17	0.00071	0.4035
2	Displacement Line 2	0	0.00000	21.60000	0.45000	.00000	0.05223	0.00000	0.00000	0.05223
		2000	40.00000	21.60000	0.45000	.00000	0.05223	0.11561	0.0005	0.16 42
		3000	60.00000	21.60000	0.45000	.00000	0.05223	0.11561	0.00071	0.16 55
2	Displacement Line 2	0	0.00000	22.6 000	1.10000	.00000	0.03620	0.00000	0.00000	0.03620
		2000	40.00000	22.6 000	1.10000	.00000	0.03620	0.030 1	0.0005	0.0676
		3000	60.00000	22.6 000	1.10000	.00000	0.03620	0.030 1	0.00071	0.067 2
2	Displacement Line 2	0	0.00000	23.76000	1.75000	.00000	0.02755	0.00000	0.00000	0.02755
		2000	40.00000	23.76000	1.75000	.00000	0.02755	-0.00236	0.00054	0.02574
		3000	60.00000	23.76000	1.75000	.00000	0.02755	-0.00236	0.00067	0.025 7
2	Displacement Line 2	0	0.00000	24. 4000	2.40000	.00000	0.0222	0.00000	0.00000	0.0222
		2000	40.00000	24. 4000	2.40000	.00000	0.0222	-0.013 6	0.00057	0.00
		3000	60.00000	24. 4000	2.40000	.00000	0.0222	-0.013 6	0.00070	0.00 03
2	Displacement Line 2	0	0.00000	25. 2000	3.05000	.00000	0.01 6	0.00000	0.00000	0.01 6
		2000	40.00000	25. 2000	3.05000	.00000	0.01 6	-0.0166	0.00057	0.00257
		3000	60.00000	25. 2000	3.05000	.00000	0.01 6	-0.0166	0.00070	0.00270
2	Displacement Line 2	0	0.00000	27.00000	3.70000	.00000	0.01601	0.00000	0.00000	0.01601
		2000	40.00000	27.00000	3.70000	.00000	0.01601	-0.015 7	0.00057	0.00061
		3000	60.00000	27.00000	3.70000	.00000	0.01601	-0.015 7	0.00070	0.00074
3	Displacement Line 3	0	0.00000	13.70000	-4.10000	.00000	0.2 644	0.00000	0.00000	0.2 644
		2000	40.00000	13.70000	-4.10000	.00000	0.2 644	0.55612	0.0006	0. 5325
		3000	60.00000	13.70000	-4.10000	.00000	0.2 644	0.55612	0.000 2	0. 533
3	Displacement Line 3	0	0.00000	14.10000	-4.76667	.00000	0.1 10	0.00000	0.00000	0.1 10
		2000	40.00000	14.10000	-4.76667	.00000	0.1 10	0.04644	0.0015	0.22 12
		3000	60.00000	14.10000	-4.76667	.00000	0.1 10	0.04644	0.00173	0.22 25
3	Displacement Line 3	0	0.00000	14.50000	-5.43333	.00000	0.123	0.00000	0.00000	0.123
		2000	40.00000	14.50000	-5.43333	.00000	0.123	-0.13 06	0.00054	-0.01363
		3000	60.00000	14.50000	-5.43333	.00000	0.123	-0.13 06	0.00067	-0.01350
3	Displacement Line 3	0	0.00000	14. 0000	-6.10000	.00000	0.0 141	0.00000	0.00000	0.0 141
		2000	40.00000	14. 0000	-6.10000	.00000	0.0 141	-0.1 700	0.00056	-0.10504
		3000	60.00000	14. 0000	-6.10000	.00000	0.0 141	-0.1 700	0.0006	-0.104 0
4	Displacement Line 4	0	0.00000	17.10000	-4. 5000	.00000	0.0 476	0.00000	0.00000	0.0 476
		2000	40.00000	17.10000	-4. 5000	.00000	0.0 476	0.0 305	0.00060	0.1 40
		3000	60.00000	17.10000	-4. 5000	.00000	0.0 476	0.0 305	0.00073	0.1 53
4	Displacement Line 4	0	0.00000	16.36667	-5.26667	.00000	0.0 440	0.00000	0.00000	0.0 440
		2000	40.00000	16.36667	-5.26667	.00000	0.0 440	0.00123	0.001 4	0.0 747
		3000	60.00000	16.36667	-5.26667	.00000	0.0 440	0.00123	0.001 7	0.0 761
4	Displacement Line 4	0	0.00000	15.63333	-5.6 333	.00000	0.0 2 2	0.00000	0.00000	0.0 2 2
		2000	40.00000	15.63333	-5.6 333	.00000	0.0 2 2	-0.0 6	0.00055	-0.0063
		3000	60.00000	15.63333	-5.6 333	.00000	0.0 2 2	-0.0 6	0.0006	-0.00626
4	Displacement Line 4	0	0.00000	14. 0000	-6.10000	.00000	0.0 141	0.00000	0.00000	0.0 141
		2000	40.00000	14. 0000	-6.10000	.00000	0.0 141	-0.1 700	0.00056	-0.10504
		3000	60.00000	14. 0000	-6.10000	.00000	0.0 141	-0.1 700	0.0006	-0.104 0
5	Displacement Line 5	0	0.00000	5.50000	15.4 000	.00000	0.076 0	0.00000	0.00000	0.076 0
		2000	40.00000	5.50000	15.4 000	.00000	0.076 0	0.13510	0.0005	0.2124
		3000	60.00000	5.50000	15.4 000	.00000	0.076 0	0.13510	0.00071	0.21262
5	Displacement Line 5	0	0.00000	6.02200	14. 000	.00000	0.1024	0.00000	0.00000	0.1024
		2000	40.00000	6.02200	14. 000	.00000	0.1024	0.2 23	0.0005	0.3 12
		3000	60.00000	6.02200	14. 000	.00000	0.1024	0.2 23	0.00071	0.3 142
5	Displacement Line 5	0	0.00000	6.54400	14.30000	.00000	0.13 7	0.00000	0.00000	0.13 7
		2000	40.00000	6.54400	14.30000	.00000	0.13 7	0.517 2	0.0005	0.65746
		3000	60.00000	6.54400	14.30000	.00000	0.13 7	0.517 2	0.00071	0.65760
5	Displacement Line 5	0	0.00000	7.06600	13.71000	.00000	0.1 421	0.00000	0.00000	0.1 421
		2000	40.00000	7.06600	13.71000	.00000	0.1 421	0. 04 5	0.0005	0. 74
		3000	60.00000	7.06600	13.71000	.00000	0.1 421	0. 04 5	0.00071	0.
5	Displacement Line 5	0	0.00000	7.5 00	13.12000	.00000	0.225 6	0.00000	0.00000	0.225 6
		2000	40.00000	7.5 00	13.12000	.00000	0.225 6	1.050 3	0.0005	1.27727
		3000	60.00000	7.5 00	13.12000	.00000	0.225 6	1.050 3	0.00072	1.27741
5	Displacement Line 5	0	0.00000	.11000	12.53000	.00000	0.24570	0.00000	0.00000	0.24570
		2000	40.00000	.11000	12.53000	.00000	0.24570	1.114 1	0.0005	1.3611
		3000	60.00000	.11000	12.53000	.00000	0.24570	1.114 1	0.00072	1.36132
6	Displacement Line 6	0	0.00000	.11000	12.53000	.00000	0.24570	0.00000	0.00000	0.24570
		2000	40.00000	.11000	12.53000	.00000	0.24570	1.114 1	0.0005	1.3611
		3000	60.00000	.11000	12.53000	.00000	0.24570	1.114 1	0.00072	1.36132
6	Displacement Line 6	0	0.00000	7.63000	12.0 000	.00000	0.4115	0.00000	0.00000	0.4115
		2000	40.00000	7.63000	12.0 000	.00000	0.4115	2.24371	0.0005	2.655
		3000	60.00000	7.63000	12.0 000	.00000	0.4115	2.24371	0.00072	2.65601
6	Displacement Line 6	0	0.00000	7.15000	11.65000	.00000	0. 04 4	0.00000	0.00000	0. 04 4
		2000	40.00000	7.15000	11.65000	.00000	0. 04 4	4.5 4 6	0.0005	5.3 02
		3000	60.00000	7.15000	11.65000	.00000	0. 04 4	4.5 4 6	0.00072	5.3 042
7	Displacement Line 7	0	0.00000	7.15000	11.65000	.00000	0. 04 4	0.00000	0.00000	0. 04 4
		2000	40.00000	7.15000	11.65000	.00000	0. 04 4	4.5 4 6	0.0005	5.3 02
		3000	60.00000	7.15000	11.65000	.00000	0. 04 4	4.5 4 6	0.00072	5.3 042
7	Displacement Line 7	0	0.00000	7.65750	11.0 000	.00000	0.6 217	0.00000	0.00000	0.6 217
		2000	40.00000	7.65750	11.0 000	.00000	0.6 217	3.773 6	0.0005	4.46663
		3000	60.00000	7.65750	11.0 000	.00000	0.6 217	3.773 6	0.00073	4.46676
7	Displacement Line 7	0	0.00000	.16500	10.51000	.00000	0.55 10	0.00000	0.00000	0.55 10
		2000	40.00000	.16500	10.51000	.00000	0.55 10	2.71411	0.00060	3.272 0
		3000	60.00000	.16500	10.51000	.00000	0.55 10	2.71411	0.00073	3.272 3
7	Displacement Line 7	0	0.00000	.67250	. 4000	.00000	0.44 2	0.00000	0.00000	0.44 2
		2000	40.00000	.67250	. 4000	.00000	0.44 2	1. 0004	0.00061	2.24 56
		3000	60.00000	.67250	. 4000	.00000	0.44 2	1. 0004	0.00074	2.24 70
7	Displacement Line 7	0	0.00000	.1 000	.37000	.00000	0.36 6	0.00000	0.00000	0.36 6
		2000	40.00000	.1 000	.37000	.00000	0.36 6	1.1073	0.00062	1.477 6
		3000	60.00000	.1 000	.37000	.00000	0.36 6	1.1073	0.00075	1.477
	Displacement Line	0	0.00000	.1 000	.37000	.00000	0.36 6	0.00000	0.00000	0.36 6
		2000	40.00000	.1 000	.37000	.00000	0.36 6	1.1073	0.00062	1.477 6
		3000	60.00000	.1 000	.37000	.00000	0.36 6	1.1073	0.00075	1.477
	Displacement Line	0	0.00000	.66000	.7 500	.00000	0.24440	0.00000	0.00000	0.24440
		2000	40.00000	.66000	.7 500	.00000	0.24440	0.4 2 4	0.00062	0.737 5
		3000	60.00000	.66000	.7 500	.00000	0.24440	0.4 2 4	0.00075	0.737
	Displacement Line	0	0.00000	10.14000	10.22000	.00000	0.173 4	0.00000	0.00000	0.173 4
		2000	40.00000	10.14000	10.22000	.00000	0.173 4	0.1 4 1	0.00064	0.35 2
		3000	60.00000	10.14000	10.22000	.00000	0.173 4	0.1 4 1	0.00077	0.35 41
	Displacement Line	0	0.00000	10.14000	10.22000	.00000	0.173 4	0.00000	0.00000	0.173 4
		2000	40.00000	10.14000	10.22000	.00000	0.173 4	0.1 4 1	0.00064	0.35 2
		3000	60.00000	10.14000	10.22000	.00000	0.173 4	0.1 4 1	0.00077	0.35 41
	Displacement Line	0	0.00000	10.7 600	.4 00	.00000	0.15611	0.00000	0.00000	0.15611
		2000	40.00000	10.7 600	.4 00	.00000	0.15611	-0.0337	0.0004	0.122 0
		3000	60.00000	10.7 600	.4 00	.00000	0.15611	-0.0337	0.00061	0.122 4
	Displacement Line	0	0.00000	11.43200	.75600	.00000	0.15146	0.00000	0.00000	0.15146
		2000	40.00000	11.43200	.75600	.00000	0.15146	-0.121 4	0.00053	0.03016
		3000	60.00000	11.43200	.75600	.00000	0.15146	-0.121 4	0.00066	0.0302
	Displacement Line	0	0.00000	12.07 00	.02400	.00000	0.166 0	0.00000	0.00000	0.166 0
		2000	40.00000	12.07 00	.02400	.00000	0.166 0	-0.02552	0.00046	0.141 5
		3000	60.00000	12.07 00	.02400	.00000	0.166 0	-0.02552	0.0005	0.141
	Displacement Line	0	0.00000	12.72400	7.2 200	.00000	0.220 2	0.00000	0.00000	0.220 2
		2000	40.00000	12.72400	7.2 200	.00000	0.220 2	0.3 363	0.00061	0.61506

Ref.	Name	TimeStep No	TimeStep Value [m]	x [m]	y [m]	z [mm]	Sett. Immediate [mm]	Sett. Primary [mm]	Sett. Secondary [mm]	Sett. Total
		3000	60.00000	12.72400	7.2 200	.00000	0.220 2	0.3 363	0.00074	0.6151
	Displacement Line	0	0.00000	13.37000	6.56000	.00000	0.35057	0.00000	0.00000	0.35057
		2000	40.00000	13.37000	6.56000	.00000	0.35057	1.40063	0.0005	1.751 0
		3000	60.00000	13.37000	6.56000	.00000	0.35057	1.40063	0.00072	1.751 3
	Displacement Line	0	0.00000	14.01600	5. 2 00	.00000	0.56601	0.00000	0.00000	0.56601
		2000	40.00000	14.01600	5. 2 00	.00000	0.56601	2. 175	0.0005	3.4 41
		3000	60.00000	14.01600	5. 2 00	.00000	0.56601	2. 175	0.00072	3.4 432
	Displacement Line	0	0.00000	14.66200	5.0 600	.00000	0.661	0.00000	0.00000	0.661
		2000	40.00000	14.66200	5.0 600	.00000	0.661	3.63 73	0.0005	4.30131
		3000	60.00000	14.66200	5.0 600	.00000	0.661	3.63 73	0.00073	4.30144
	Displacement Line	0	0.00000	15.30 00	4.36400	.00000	0.65144	0.00000	0.00000	0.65144
		2000	40.00000	15.30 00	4.36400	.00000	0.65144	3.64 3	0.0005	4.301 7
		3000	60.00000	15.30 00	4.36400	.00000	0.65144	3.64 3	0.00072	4.30200
	Displacement Line	0	0.00000	15. 5400	3.63200	.00000	0.6334	0.00000	0.00000	0.6334
		2000	40.00000	15. 5400	3.63200	.00000	0.6334	3.64257	0.0005	4.27665
		3000	60.00000	15. 5400	3.63200	.00000	0.6334	3.64257	0.00072	4.2767
	Displacement Line	0	0.00000	16.60000	2. 0000	.00000	0.57750	0.00000	0.00000	0.57750
		2000	40.00000	16.60000	2. 0000	.00000	0.57750	3.43467	0.0005	4.01275
		3000	60.00000	16.60000	2. 0000	.00000	0.57750	3.43467	0.00072	4.012

Titles

Job No.: STT5321
Job Title: 8A Hampstead Hill Gardens
Sub-title: Ground movement assessment
Calculation Heading:
Initials: AKW
Checker:
Date Saved: 02-Nov-2021
Date Checked:
Notes:
File Name: GMA Rev 2.xdd
File Path: \\st-dc01\Soiltechnics\ST PROJECTS\Schemes 2021 (T)\STT5321 - 8A Hampstead Hill Gardens\Geotechnical

History

Date	Time	By	Notes
17-Jun-2021	16:21	AngusW	New
17-Jun-2021	16:56	AngusW	
18-Jun-2021	11:00	AngusW	
18-Jun-2021	14:45	AngusW	
01-Oct-2021	11:53	AngusW	
02-Nov-2021	13:24	AngusW	

Displacement Lines

Ref.	Name	x1 [m]	y1 [m]	z1 [m]	x2 [m]	y2 [m]	z2 [m]	Intervals [No.]	Surface type for tunnels	Interpolate imported displacements	Calculate
1	Displacement Line 1	13.70000	-4.10000	99.00000	16.20000	-2.80000	99.00000	1	Surface	Yes	Yes
2	Displacement Line 2	16.20000	-2.80000	99.00000	27.00000	3.70000	99.00000	3	Surface	Yes	Yes
3	Displacement Line 3	13.70000	-4.10000	99.00000	14.90000	-6.10000	99.00000	1	Surface	Yes	Yes
4	Displacement Line 4	17.10000	-4.85000	99.00000	14.90000	-6.10000	99.00000	1	Surface	Yes	Yes
5	Displacement Line 5	5.50000	15.48000	99.00000	8.11000	12.53000	99.00000	1	Surface	Yes	Yes
6	Displacement Line 6	8.11000	12.53000	99.00000	7.15000	11.65000	99.00000	1	Surface	Yes	Yes
7	Displacement Line 7	7.15000	11.65000	99.00000	9.18000	9.37000	99.00000	1	Surface	Yes	Yes
8	Displacement Line 8	9.18000	9.37000	99.00000	10.14000	10.22000	99.00000	1	Surface	Yes	Yes
9	Displacement Line 9	10.14000	10.22000	99.00000	16.60000	2.90000	99.00000	2	Surface	Yes	Yes

Displacement Grids

Ref.	Name	Extrusion: Direction	Base line start: X [m]	Base line start: Y [m]	Base line start: Z(level) [m]	Base line end: X [m]	Base line end: Y [m]	Base line end: Z(level) [m]	Base line: Intervals [No.]	Extrusion: Distance [m]	Extrusion: Intervals [No.]	Surface type for tunnels	Calculate
1	Displacement Grid 1	Global X	-15.00000	-15.00000	99.00000	-	25.00000	99.00000	400	45.00000	450	Surface	Yes

Imported Displacements

Set: Ref.	Set: Name	Result: Ref.	Coordinates: x [m]	Coordinates: y [m]	Coordinates: z [m]	Displacements: x [mm]	Displacements: y [mm]	Displacements: z [mm]	
1	Underpins - Consolidation	1	13.70000	-4.10000	99.00000	0.00000	0.00000	0.85338	1,2,6
		2	14.53333	-3.66667	99.00000	0.00000	0.00000	1.23044	
		3	15.36667	-3.23333	99.00000	0.00000	0.00000	1.69988	
		4	16.20000	-2.80000	99.00000	0.00000	0.00000	2.15131	1,2,6
		5	17.28000	-2.15000	99.00000	0.00000	0.00000	2.46416	
		6	18.36000	-1.50000	99.00000	0.00000	0.00000	1.80284	
		7	19.44000	-0.85000	99.00000	0.00000	0.00000	0.91610	
		8	20.52000	-0.20000	99.00000	0.00000	0.00000	0.40359	
		9	21.60000	0.45000	99.00000	0.00000	0.00000	0.16855	
		10	22.68000	1.10000	99.00000	0.00000	0.00000	0.06782	
		11	23.76000	1.75000	99.00000	0.00000	0.00000	0.02587	
		12	24.84000	2.40000	99.00000	0.00000	0.00000	0.00903	
		13	25.92000	3.05000	99.00000	0.00000	0.00000	0.00270	
		14	27.00000	3.70000	99.00000	0.00000	0.00000	0.00074	1,2,6
		15	14.10000	-4.76667	99.00000	0.00000	0.00000	0.22925	
		16	14.50000	-5.43333	99.00000	0.00000	0.00000	-0.01350	
		17	14.90000	-6.10000	99.00000	0.00000	0.00000	-0.10490	1,2,6
		18	17.10000	-4.85000	99.00000	0.00000	0.00000	0.18853	2,6
		19	16.36667	-5.26667	99.00000	0.00000	0.00000	0.09761	
		20	15.63333	-5.68333	99.00000	0.00000	0.00000	-0.00626	
		21	5.50000	15.48000	99.00000	0.00000	0.00000	0.21262	2,6
		22	6.02200	14.89000	99.00000	0.00000	0.00000	0.39142	
		23	6.54400	14.30000	99.00000	0.00000	0.00000	0.65760	
		24	7.06600	13.71000	99.00000	0.00000	0.00000	0.98988	
		25	7.58800	13.12000	99.00000	0.00000	0.00000	1.27741	
		26	8.11000	12.53000	99.00000	0.00000	0.00000	1.36132	2,6
		27	7.63000	12.09000	99.00000	0.00000	0.00000	2.65601	
		28	7.15000	11.65000	99.00000	0.00000	0.00000	5.39042	2,6
		29	7.65750	11.08000	99.00000	0.00000	0.00000	4.46676	
		30	8.16500	10.51000	99.00000	0.00000	0.00000	3.27293	
		31	8.67250	9.94000	99.00000	0.00000	0.00000	2.24970	
		32	9.18000	9.37000	99.00000	0.00000	0.00000	1.47799	2,6
		33	9.66000	9.79500	99.00000	0.00000	0.00000	0.73799	
		34	10.14000	10.22000	99.00000	0.00000	0.00000	0.35941	2,6
		35	10.78600	9.48800	99.00000	0.00000	0.00000	0.12294	
		36	11.43200	8.75600	99.00000	0.00000	0.00000	0.03029	
		37	12.07800	8.02400	99.00000	0.00000	0.00000	0.14198	
		38	12.72400	7.29200	99.00000	0.00000	0.00000	0.61519	
		39	13.37000	6.56000	99.00000	0.00000	0.00000	1.75193	2,6
		40	14.01600	5.82800	99.00000	0.00000	0.00000	3.48432	
		41	14.66200	5.09600	99.00000	0.00000	0.00000	4.30144	
		42	15.30800	4.36400	99.00000	0.00000	0.00000	4.30200	
		43	15.95400	3.63200	99.00000	0.00000	0.00000	4.27678	
		44	16.60000	2.90000	99.00000	0.00000	0.00000	4.01288	1,2,6

1 - Data point coincident with displacement location. Its displacement has been added to those calculated by Xdisp.
2 - Data point coincident with horizontal movement calculation point for a specific building. Its displacement has been added before performing building damage calculations.
6 - Data point coincident with vertical movement calculation point for a specific building. Its displacement has been added before performing building damage calculations.

Poly onal ca ations

Ref. 1
Excavation Name: nderpins
Surface level [m]: 99.000
Contribution: Positive

Corner	x [m]	y [m]	Base Level [m]	Arc Enabled	Stiffened	Prev. Side: d [m]	Prev. Side: p1 [%]	Prev. Side: p2 [%]	Next Side: d [m]	Next Side: p1 [%]	Next Side: p2 [%]
1	-4.3500	1.2200	95.000	Yes	No	-	-	-	-	-	-
2	0.25000	8.4200	95.000	Yes	No	-	-	-	-	-	-
3	6.1500	12.020	95.000	Yes	No	-	-	-	-	-	-
4	11.150	4.1200	95.000	Yes	No	-	-	-	-	-	-
5	13.250	5.4200	95.000	Yes	No	-	-	-	-	-	-
6	16.050	2.3200	95.000	Yes	No	-	-	-	-	-	-
7	15.650	2.1200	95.000	Yes	No	-	-	-	-	-	-

Corner	x [m]	y [m]	Base Level [m]	Arc Enabled	Stiffened	Prev. Side: d [m]	Prev. Side: p1 [%]	Prev. Side: p2 [%]	Next Side: d [m]	Next Side: p1 [%]	Next Side: p2 [%]
8	17.250	-0.38000	95.000	Yes	No	-	-	-	-	-	-
9	2.3500	-9.8800	95.000	Yes	No	-	-	-	-	-	-

Side	x1 [m]	y1 [m]	x2 [m]	y2 [m]	.M. Curve: Vertical	.M. Curve: Horizontal
1	-4.3500	1.2200	0.25000	8.4200	Underpin excavation	Underpin excavation
2	0.25000	8.4200	6.1500	12.020	Underpin excavation	Underpin excavation
3	6.1500	12.020	11.150	4.1200	Underpin excavation	Underpin excavation
4	11.150	4.1200	13.250	5.4200	Underpin excavation	Underpin excavation
5	13.250	5.4200	16.050	2.3200	Underpin excavation	Underpin excavation
6	16.050	2.3200	15.650	2.1200	Underpin excavation	Underpin excavation
7	15.650	2.1200	17.250	-0.38000	Underpin excavation	Underpin excavation
8	17.250	-0.38000	2.3500	-9.8800	Underpin excavation	Underpin excavation
9	2.3500	-9.8800	-4.3500	1.2200	Underpin excavation	Underpin excavation

Circ lar ca ations

ertical Gro nd Mo ement C r es

Curve Name: nderpin excavation
Coordinates: [Distance from wall / wall depth or max. excavation depth (x), Depth / wall depth or max. excavation depth (y), Settlement / wall depth or max. excavation depth (z)( )]

[1.000,0.000,0.000][0.000,0.000,0.125]

Curve itting Method: Linear

Hori ontal Gro nd Mo ement C r es

Curve Name: nderpin excavation
Coordinates: [Distance from wall / wall depth or max. excavation depth (x), Depth / wall depth or max. excavation depth (z)( )]
[1.000,0.000,0.000][0.000,0.000,0.125]
Curve itting Method: Linear

Dama e Cate ory Strains

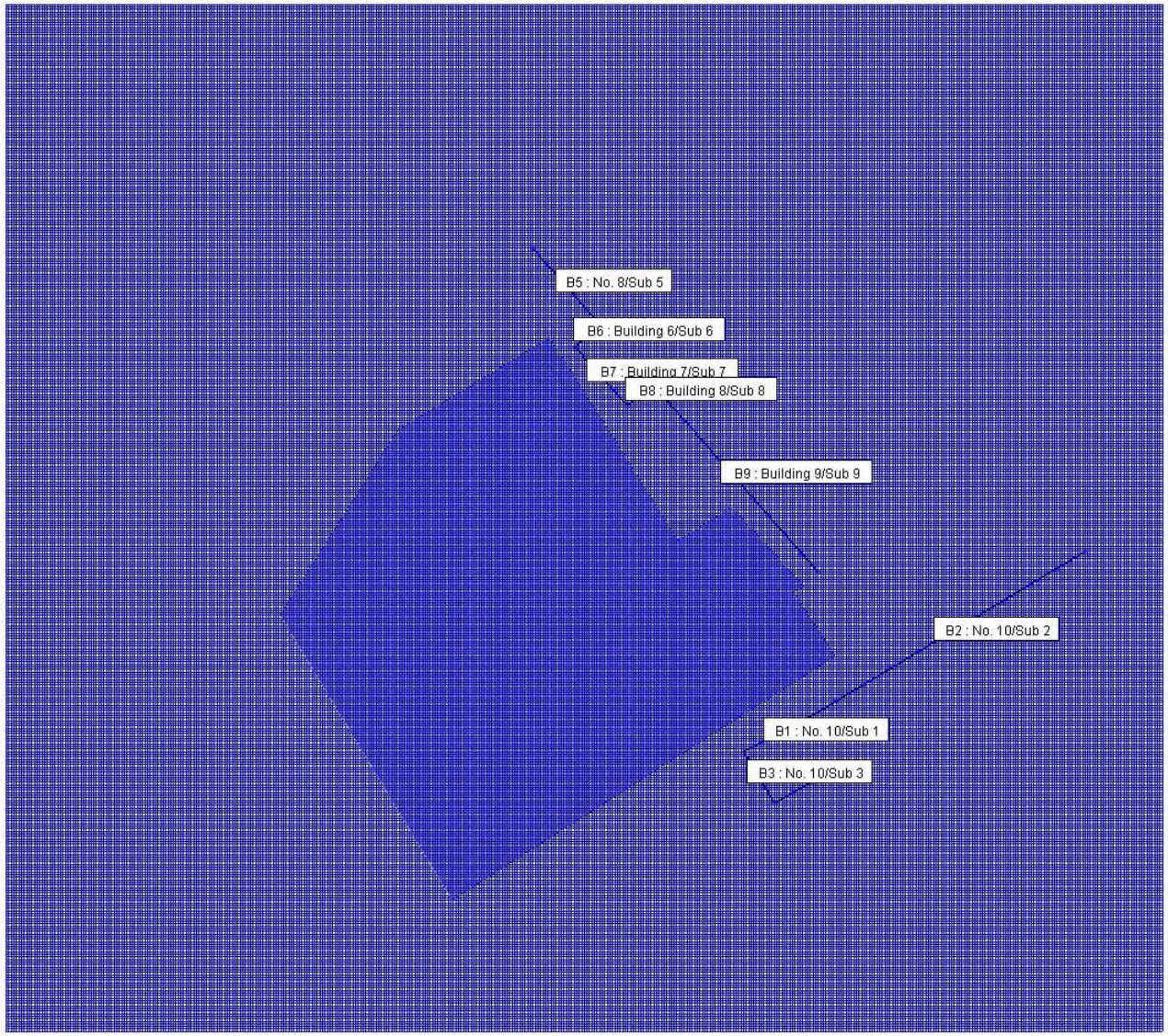
Ref.	Name	0 (Negligible) to 1 (Very Slight)	1 (Very Slight) to 2 (Slight)	2 (Slight) to 3 (Moderate)	3 (Moderate) to 4 (Severe)
1	Burland Strain Limits	0.0	500.00E-6	750.00E-6	0.0015000

Speci ic ildin s Geometry

Ref.	Building Name	Sub-Building Name	Displacement Line	Distance Along Line: Start [m]	Distance Along Line: End [m]	Vertical Offsets from Line for Vertical Movement Calculations [m]	Vertical Displacement Limit Sensitivity [mm]	Damage Category Strains	Poisson s	E/ Ratio
1	No. 10	Sub 1	Displacement Line 1	0.00000	2.81700	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
2	No. 10	Sub 2	Displacement Line 2	0.00000	12.60500	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
3	No. 10	Sub 3	Displacement Line 3	0.00000	2.33200	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
4	No. 10	Sub 4	Displacement Line 4	0.00000	2.53000	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
5	No. 8	Sub 5	Displacement Line 5	0.00000	3.93800	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
6	Building 6	Sub 6	Displacement Line 6	0.00000	1.30200	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
7	Building 7	Sub 7	Displacement Line 7	0.00000	3.05200	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
8	Building 8	Sub 8	Displacement Line 8	0.00000	1.28200	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
9	Building 9	Sub 9	Displacement Line 9	0.00000	9.76200	0.0	0.10000	Burland Strain Limits	0.20000	2.6000

Speci ic ildin s endin Parameters

Ref.	Building Name	Sub-Building Name	Height [m]	Default	Hogging: 2nd Mom. of Area (per unit width) [m³]	Hogging: Dist. of Bending Strain from N.A. [m]	Hogging: Dist. of N.A. from Edge of Beam in Tension [m]	Sagging: 2nd Mom. of Area (per unit width) [m³]	Sagging: Dist. of Bending Strain from N.A. [m]	Sagging: Dist. of N.A. from Edge of Beam in Tension [m]
1	No. 10	Sub 1	9.0000	Yes	243.00	9.0000	9.0000	60.750	4.5000	4.5000
2	No. 10	Sub 2	9.0000	Yes	243.00	9.0000	9.0000	60.750	4.5000	4.5000
3	No. 10	Sub 3	9.0000	Yes	243.00	9.0000	9.0000	60.750	4.5000	4.5000
4	No. 10	Sub 4	9.0000	Yes	243.00	9.0000	9.0000	60.750	4.5000	4.5000
5	No. 8	Sub 5	13.560	Yes	831.11	13.560	13.560	207.78	6.7800	6.7800
6	Building 6	Sub 6	13.560	Yes	831.11	13.560	13.560	207.78	6.7800	6.7800
7	Building 7	Sub 7	13.560	Yes	831.11	13.560	13.560	207.78	6.7800	6.7800
8	Building 8	Sub 8	13.560	Yes	831.11	13.560	13.560	207.78	6.7800	6.7800
9	Building 9	Sub 9	13.560	Yes	831.11	13.560	13.560	207.78	6.7800	6.7800



RAW RESULTS

Legend

Excavation

Building Results
< Sensitivity
Cat. 0 (Negligible)
Cat. 1 (Very Slight)
Cat. 2 (Slight)
Cat. 3 (Moderate)
Cat. 4 (Severe)

Displacement Grids
Displacement Lines
Imp. Displacements

Oasys

SOILTECHNICS LIMITED

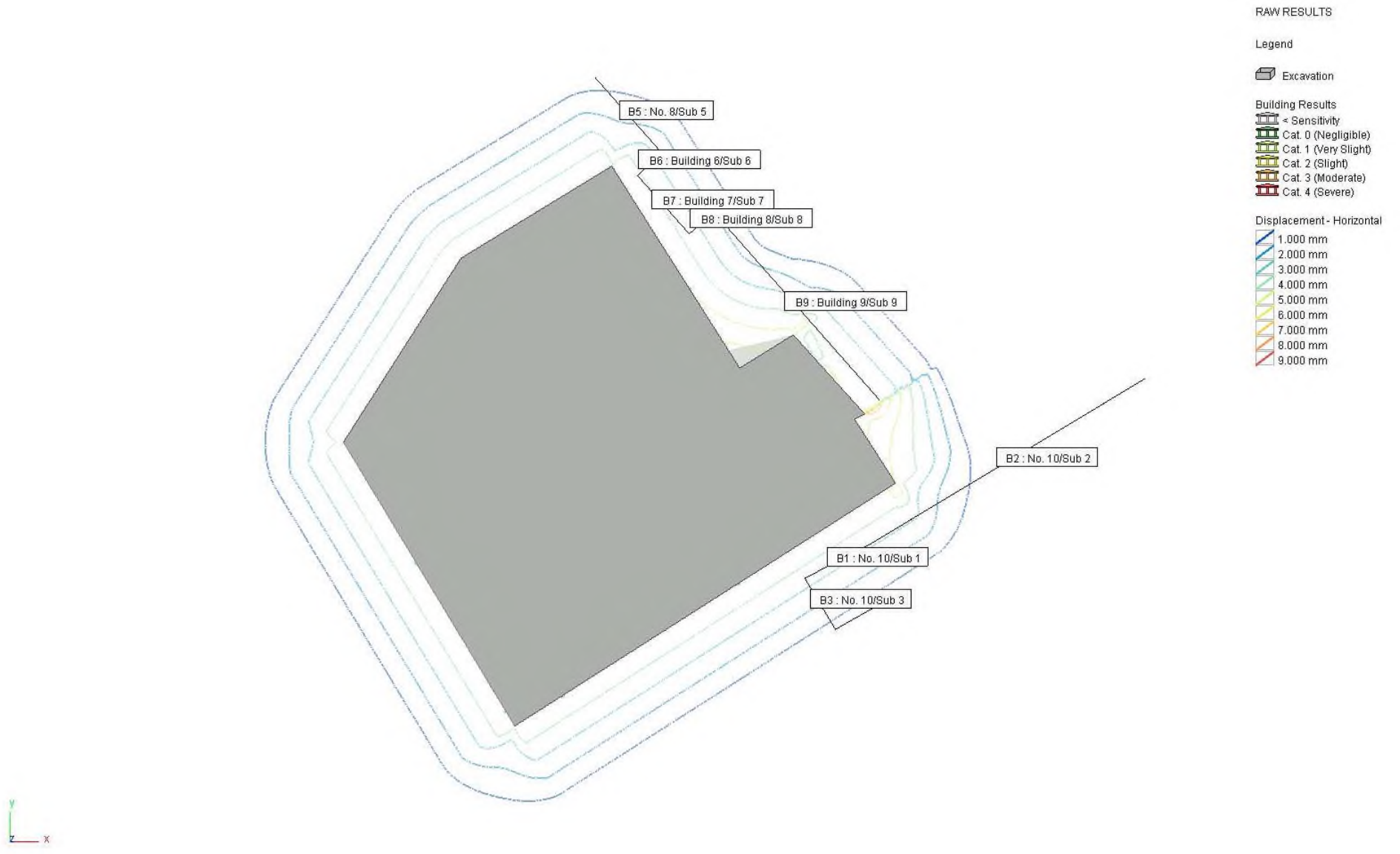
8A Hampstead Hill Gardens

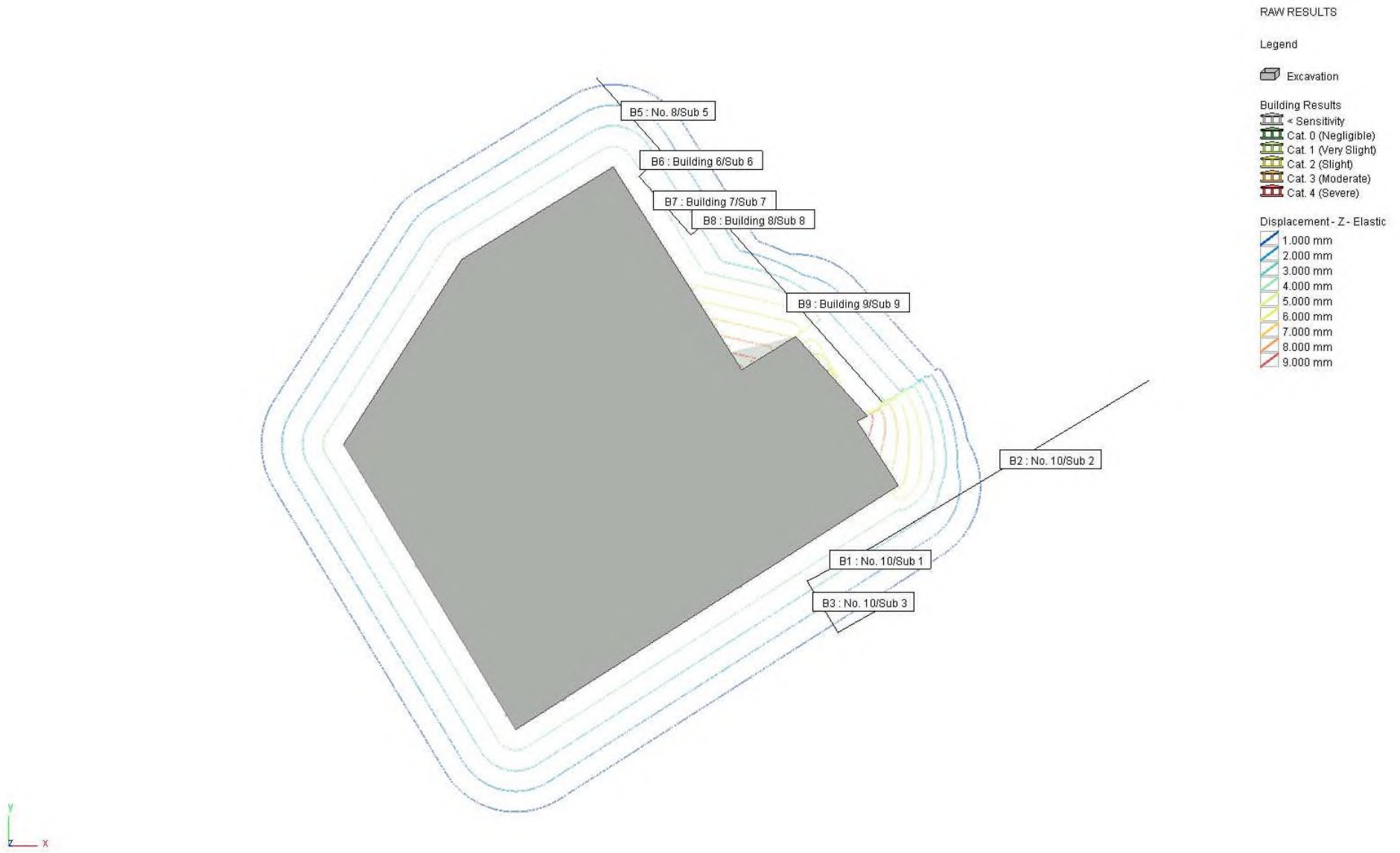
Gro nd movement assessment

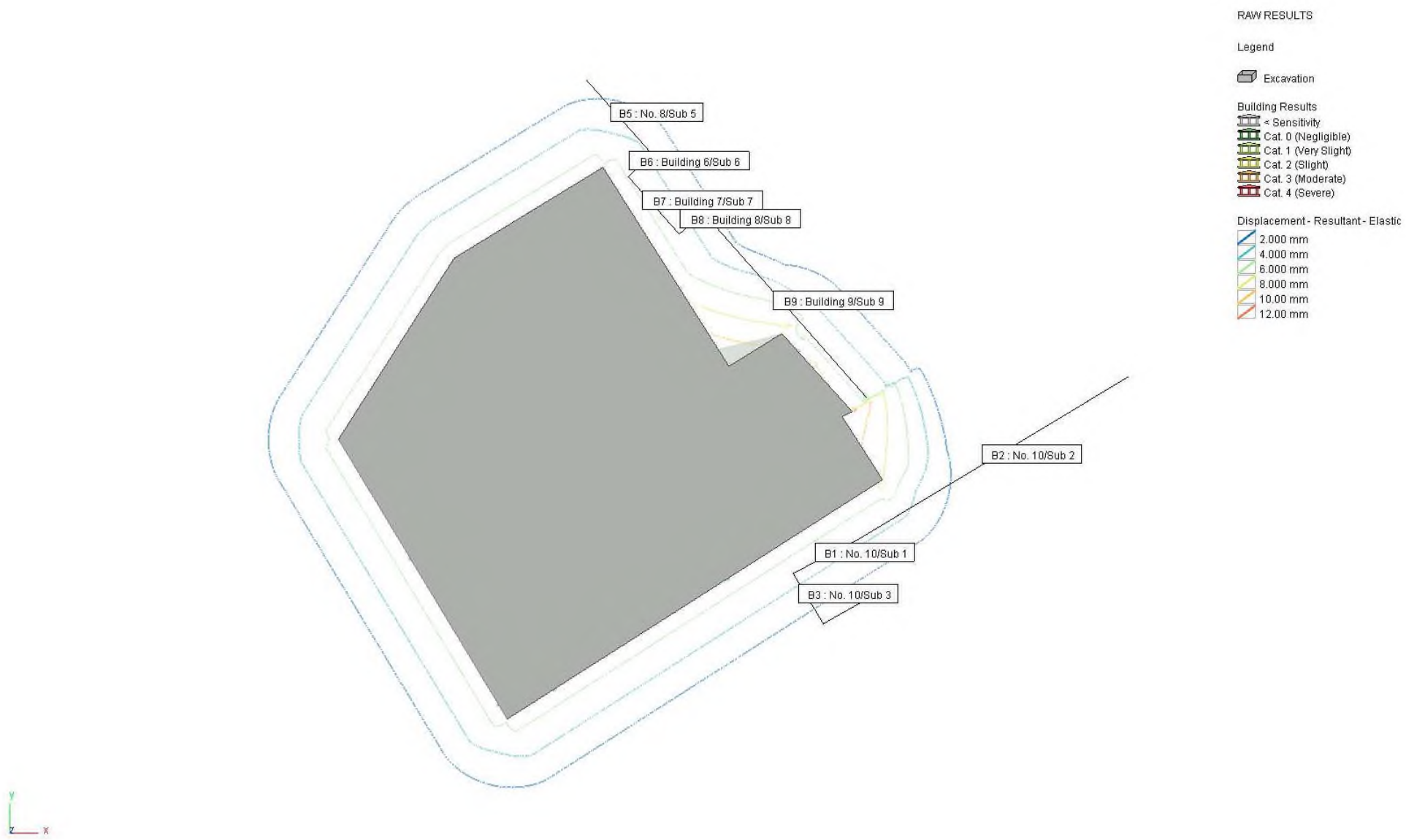
Job No.	Sheet No.	Rev.
STT5321		

Drg. Ref.

Made by	Date	Checked	Date
AKW	02-Nov-2021		

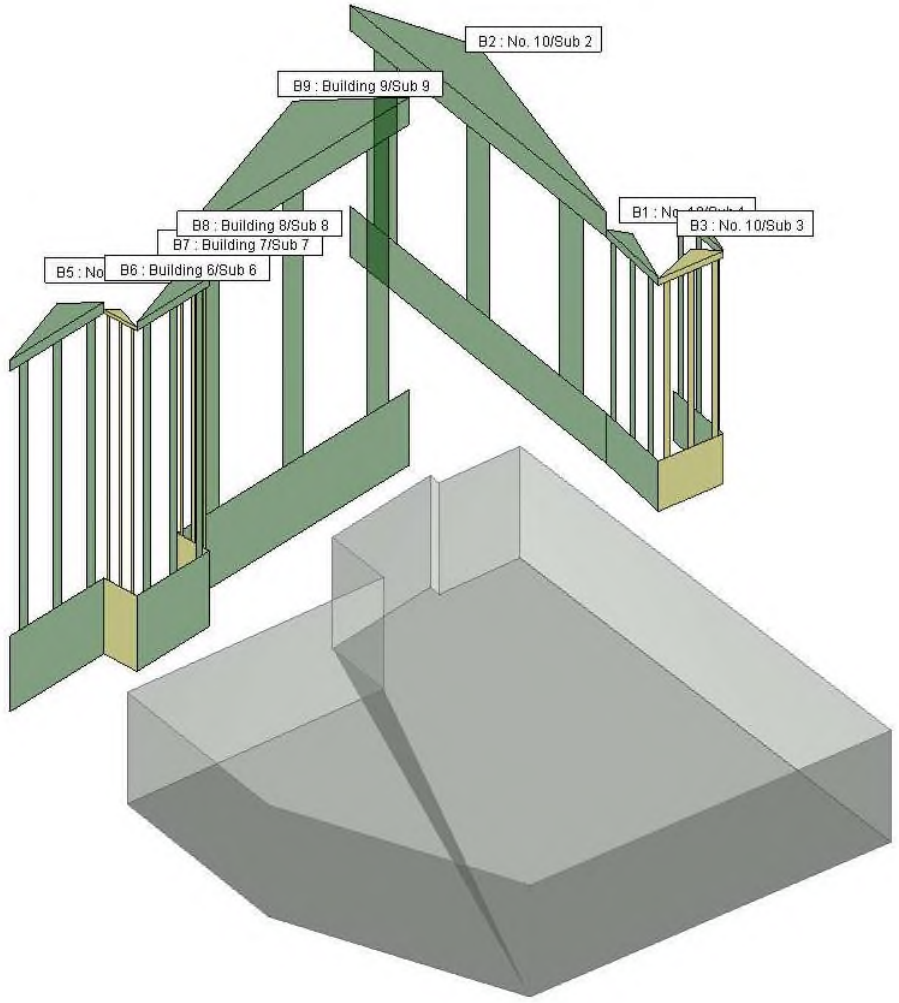



RAW RESULTS
Legend
Excavation
Building Results
< Sensitivity
Cat. 0 (Negligible)
Cat. 1 (Very Slight)
Cat. 2 (Slight)
Cat. 3 (Moderate)
Cat. 4 (Severe)
Displacement - Z - Elastic
1.000 mm
2.000 mm
3.000 mm
4.000 mm
5.000 mm
6.000 mm
7.000 mm
8.000 mm
9.000 mm
B5 : No. 8/Sub 5
B6 : Building 6/Sub 6
B7 : Building 7/Sub 7
B8 : Building 8/Sub 8
B9 : Building 9/Sub 9
B2 : No. 10/Sub 2
B1 : No. 10/Sub 1
B3 : No. 10/Sub 3
Y
Z
X


RAW RESULTS
Legend
Excavation
Building Results
< Sensitivity
Cat. 0 (Negligible)
Cat. 1 (Very Slight)
Cat. 2 (Slight)
Cat. 3 (Moderate)
Cat. 4 (Severe)
Displacement - Resultant - Elastic
2.000 mm
4.000 mm
6.000 mm
8.000 mm
10.00 mm
12.00 mm
B5 : No. 8/Sub 5
B6 : Building 6/Sub 6
B7 : Building 7/Sub 7
B8 : Building 8/Sub 8
B9 : Building 9/Sub 9
B2 : No. 10/Sub 2
B1 : No. 10/Sub 1
B3 : No. 10/Sub 3
Y
Z
X

Speci ic ildin Dama e Res lts Critical al es or ll Se ments it in ac S ildin

Stage: Ref.	Stage: Name	Specific Building: Ref.	Specific Building: Name	Sub-building Name	Vertical Offset from Line for Vertical Movement Calculations [m]	Deflection Ratio [%]	Average Horizontal Strain [%]	Max Slope	Max Settlement [mm]	Max Tensile Strain [%]	Max radient of Horizontal Displacement Curve	Max radient of Vertical Displacement Curve	Min Radius of Curvature (Hogging) [m]	Min Radius of Curvature (Sagging) [m]	Damage Category
0	Base Model	1	No. 10	Sub 1	0.0	0.0	967.21E-6	-350.66E-6	5.3060	967.20E-6	-9.6720E-6	-350.66E-6	-	-	0 (Negligible)
		2	No. 10	Sub 2	0.0	0.0	-0.023110	835.43E-6	5.3063	0.0046220	-250.42E-6	835.43E-6	-	-	0 (Negligible)
		3	No. 10	Sub 3	0.0	0.0	0.12491	0.0016583	4.3182	0.12491	-0.0012475	0.0016583	-	-	2 (Slight)
		4	No. 10	Sub 4	0.0	0.0	323.60E-6	52.369E-6	0.57798	323.62E-6	-3.2360E-6	52.369E-6	-	-	0 (Negligible)
		5	No. 8	Sub 5	0.0	0.0	-0.021400	-796.91E-6	3.9495	0.0042799	214.04E-6	-796.91E-6	-	-	0 (Negligible)
		6	Building 6	Sub 6	0.0	0.0	0.12110	-0.0043189	9.5802	0.12110	-0.0012095	-0.0043189	-	-	2 (Slight)
		7	Building 7	Sub 7	0.0	0.0	0.0032994	0.0014846	9.5815	0.0032994	-32.993E-6	0.0014846	-	-	0 (Negligible)
		8	Building 8	Sub 8	0.0	0.0	0.12181	0.0021038	5.0491	0.12181	-0.0012166	0.0021038	-	-	2 (Slight)
		9	Building 9	Sub 9	0.0	0.011762	0.0036977	-818.01E-6	8.0164	0.015196	-413.95E-6	-818.01E-6	-	10275.	0 (Negligible)



RAW RESULTS

Legend

Excavation

Building Results
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