



Basement Impact Assessment

Site

119 Coppetts Rd
Haringey
London
N10 1JL

Client

Jay Karawadra
London Basement

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Basement Impact Assessment for Site Address

1. Non-technical Summary

1.1. Existing Property & Proposed Development

The proposed development involves the construction of a new basement below the existing building and the rear garden.

1.2. Land Stability, Hydro-geology and Surface-water Assessment

The new basement will increase the differential depth with the neighbouring property. The anticipated ground movement and related damage during construction can be suitably mitigated with adequate temporary supports during excavation.

The basement will not obstruct groundwater conveyance. Any ground-water present during construction can be suitably controlled; the permanent basement structure should be designed to resist hydrostatic pressures.

The BIA has identified that the construction of the basement will not have any significant impacts on surface water. The risk of flooding from excess surface water is not considered significant. There is a risk of flooding due to the failure of the pumping system but this can be reduced to acceptable levels with appropriate design and installation measures.

The basement can be safely constructed without having any significant adverse effects on the existing structure, the surrounding buildings or the hydrogeology of the surrounding area.

2. Introduction

A new basement is proposed at 119 Coppetts Road. In accordance with Policy DM18 for Haringey Council's DPD (2017), it must be demonstrated that a new basement *will not adversely affect the structural stability of the application building, neighbouring buildings and other infrastructure, including the adjoining highway, having regard to local geological conditions*. This document is produced to demonstrate that this, along with other requirements within Policy DM18, are met. The assessment contained within this document is produced to support the planning application and to advise others that necessary technical considerations have been adopted.

The assessment is a systematic check on the technical features that should be considered at Planning Stage. It is carried out in multiple stages and has been produced and revised by suitably qualified assessors.

2.1. Report Authors and Qualifications

2.1.1. Geology, Land stability and Hydrogeology

The features and impacts relating to Land Stability and Groundwater have been reviewed by:

Phil Henry
MEng CEng MICE

Phil Henry is a Chartered Civil Engineer with over 15 years of professional experience in structural design of basements. This experience has involved applying his in-depth knowledge of engineering geology and ground engineering.

2.1.2. Surface Water and Flooding.

The features and impacts relating to Surface Water and Flooding have been reviewed by:

Phil Henry
MEng CEng MICE

Phil Henry is a Chartered Civil Engineer with over 15 years of professional experience in building and drainage design. This includes flood risk assessments and the design of SUDS proposals for numerous properties in both urban and rural locations.

2.2. Sources of Information

The following material has been used to complete the BIA in relation to the proposed development:

- Site walkover / photo inspection (December 2022);
- Haringey Council - Development Management DPD (July 2017)
- LB Camden, Camden Geological, Hydrogeological and Hydrological Study – *Guidance for Subterranean Development* (produced by Arup, 2010);
- CIRIA C760: *Embedded Retaining Walls: Guidance for Economic Design*
- ASUC – *Guidelines on save and efficient basement construction directly below or near to existing structures* (2013)

Additional sources of information are referred to within the report

Note that while much of the *Guidance for sub-terranean development* listed above is specific to the London Borough of Camden, there are many concepts that are applicable to the design of basements generally. Where relevant, these have been noted for this assessment.

This BIA is produced to meet the technical requirements of Policy DM18: Residential Basement Development and Light-Wells of Haringey Council's Development Management DPD (July 2017). Clause 3.45 of this policy requires BIAs to be set out 'in full detail in the Council's guidance note on Basement Impact Assessments'; however, this guidance has not yet been produced. In the absence of this guidance, Croft will produce a BIA similar in content and layout to those produced for Camden Council, the neighbouring borough.

2.3. Existing and Proposed Development

2.3.1. Existing Site

The is site is located at 119 Coppetts Road in the London Borough of Haringey. The property comprises a mid-terrace building in a densely built-up area. The site forms a boundary with Nos. 117&121 Coppetts Road.

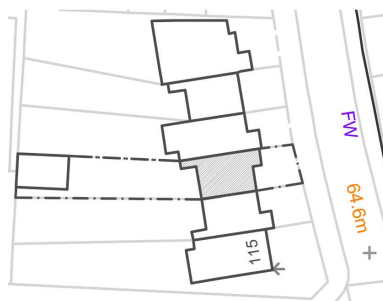


Figure 1 - site location plan

2.3.2. Proposed works

The proposed works involve a single storey basement. This will be below the existing building and below a new extension that is proposed at the rear of the property. The basement will also extend into the rear garden. The top slab of the garden basement will be beneath one-meter-deep soil. Details showing the extent of the alterations are shown in architectural drawings by DS SQUARED architects [Drawing series 22041S]. Drawings by Croft, showing a proposed structural arrangement are appended. Only the works regarding the basement structure are described in detail within this document. Temporary works construction proposals are also described within the appended drawing sheet.

3. Desk Study & Walk over Survey

3.1. Site History

From inspection of historical maps, the site and the vicinity have been occupied for residential use for over 100 years. Before being occupied by residential buildings, the local area was occupied by fields.

South of Bounds Green Brook there was only Coppetts Farm between 1783 and 1846.

By 1754 the modern Coppetts Road ran from Crouch End north towards Colney Hatch.

By 1846 it was linked by a track south of Bounds Green brook to Colney Hatch Lane. At the northern end Coppetts Road met a route running westward from Colney Hatch shortly before it forked into two tracks crossing Finchley Common, later Woodhouse Road and Summers Lane. In the late 15th and early 16th centuries many copyhold lanes apparently led to individual holdings.



Figure 2 - Extract from National Library of Scotland map, surveyed in 1863

3.1.1. Listed buildings

The existing building is not listed. Data from Historic England shows that there are no listed buildings close by.



Figure 3 - Extract from Historic England map

The site is not in a conservation area.

3.2. Existing Assets/Infrastructure

3.2.1. London Under Ground and Network Rail Infrastructures

The site is more than 1000m away from the nearest national rail line and the nearest subterranean train line. These are unlikely to be affected by the new basement.

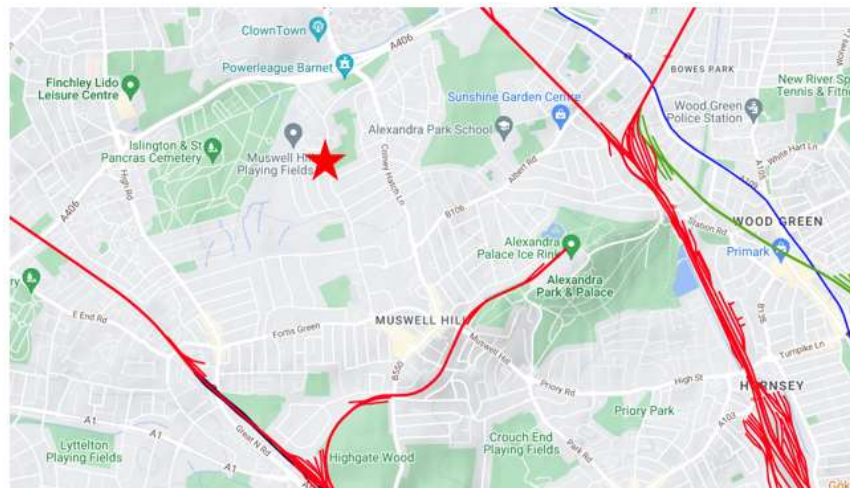


Figure 4 - Extract from rail map online

3.2.2. Highways

The site is not within 5m of the public highway.

3.2.3. UK Power Network

There are no significant items of electrical infrastructure (such as pylons, substations or tunnels) in the immediate vicinity.

3.2.4. Utility Search

A utility search has been completed and is attached in the Appendices.

3.3. Walk-over Survey & Further Desk Study

A structural engineer from Croft Structural Engineers visited the site on 6th December 2022.

3.3.1. Site and Existing Property

The existing building is understood to have been constructed in the early half of the 20th century. The structure is believed to be constructed from traditional building materials, i.e. brickwork, Timber and concrete. The property is a mid-terrace house. From inspection of street view photos, there are no obvious signs of cracking that would be related to subsidence.



Figure 5 - view of front elevation

There is a rear garden.



Figure 6 - view of rear elevation

3.3.2. Proximity of Trees

There are trees close by, in the neighbouring land. These do not have tree preservation orders. The closest tree appears to be more than 4m away from the outline of the proposed basement.



Figure 7 - view of tree at the rear of adjacent property

BS 5837: 2012 *Trees in relation to design, demolition and construction – Recommendations* estimates the root protection area (RPA) equivalent to a circle with a radius 12 times the stem diameter. Based on the diameter of the tree as being 400mm, the diameter of this circle would be 4.8m. The roots concerned would therefore be within 2.4m from the trunk. These would not be affected by a basement that is 4m away.

The clearance of the site for a basement would involve removal of trees/bushes in the rear garden of the subject property.



Figure 8 - tree/bushes view in rear garden



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3.3.3. Adjacent Properties

Nos 117 Coppetts Road

Property age : 1920's (~100 years old)

Property use : Residential

Number of storeys : two-storey

Current Basement: The neighbouring property does not have a basement. The planning portal indicates that there are no plans for a basement.



Figure 9 – No.117 Coppetts Rd - front view

Nos 121 Coppetts Road

Property age : 1920's (~100 years old)

Property use : Residential

Number of storeys : two-storey

Current Basement: The neighbouring property does not have a basement. The planning portal indicates that there are no plans for a basement.



Figure 10 - No.121 Coppetts Rd - front view

3.4. Geology and Land Stability

The British Geology Survey (BGS) map of the area indicates that the site is underlain by London Clay. This is a combination of clay, silt and sand.

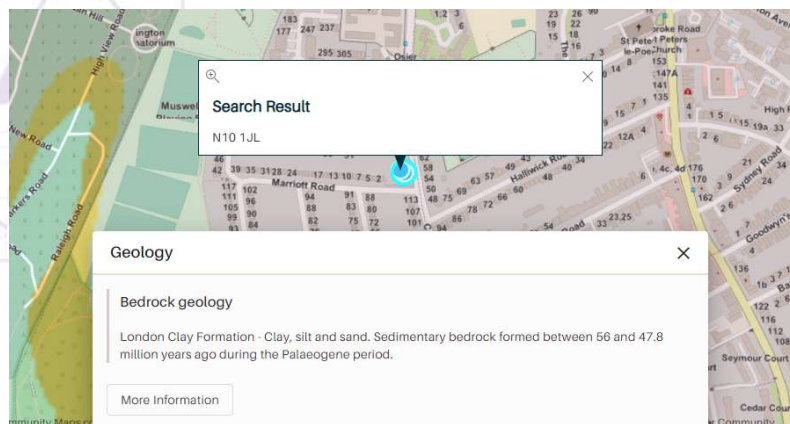


Figure 11 - Extract from BGS map

A site-specific borehole investigation has confirmed that the property is sitting on made ground down to 1.2m below ground level and London Clay Formation is found below that. The formation level of the basement will be within the layer of London Clay Formation. A summary of the results is shown below.

GEOTECHNICAL INVESTIGATION

Ground Conditions Encountered The boreholes and trial pits revealed ground conditions that were generally consistent with the geological records and known history of the area and comprised Made Ground up to 1.20m in thickness resting on the London Clay Formation at depth.

Groundwater Groundwater was encountered at a depth of 4.30m below ground level in Borehole 1 after a period of approximately three weeks.

Engineering Observations & Recommendations Based on the ground and groundwater conditions encountered in the boreholes, it could, in theory, be possible to support the proposed new development on conventional strip foundations taken down below the Made Ground and any weak superficial soils and placed in the natural stiff silty sandy clay deposits which occur at a depth of 1.20m across the site.

Using theory from Terzaghi (1943), strip foundations placed within natural soils may be designed to allowable net bearing pressures of approximately 90kN/m^2 at 3.00m depth below ground level increasing to 110kN/m^2 at 3.00m depth below ground level in order to allow for a factor of safety of 2.5 against general shear failure. The actual allowable bearing pressure applicable will depend on the form of foundation, its geometry and depth in accordance with classical analytical methods, details of which can be obtained from "Foundation Design and Construction", Seventh Edition, 2001 by M J Tomlinson (see references) or similar texts.

Figure 12 - Extract from SI by Site Analytical Services Ltd

Site Analytical Services Ltd.						Site	Borehole Number	
Boring Method ROTARY PERCUSSIVE		Casing Diameter 128mm cased to 0.00m		Ground Level (mOD)	Client	119 COPPETTS ROAD, LONDON N10 1JL	BH1	
		Location TQ278908		Dates 23/11/2022	Engineer	LONDON BASEMENT	Job Number 2236132	
							Sheet 1/1	
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend
0.25	D1		DRY	1.1/1.1, 1.2		0.07	MADE GROUND: Concrete	
0.50	D2					0.30	MADE GROUND: Hardcore containing brick and tile	
0.75	D3					0.44	MADE GROUND: Brown orange silty clay containing occasional brick and tile fragments	
1.00-1.45	SPT N=5 D4					0.70	Soft, brown orange silty CLAY	
1.50	D5					0.90		
2.00-2.45	SPT N=9 D6		DRY	1.2/2.2, 2.3		1.60	Firm becoming stiff, brown orange silty CLAY	
2.50	D7							
3.00	U1			65 blows				
3.50	D8							
4.00-4.45	SPT N=12 D9		DRY	2.2/3.3, 3.3				
4.50	D10							
5.00-5.45	SPT N=15 D11		DRY	3.2/3.4, 4.4		(7.10)		
6.00	U2			80 blows				
7.00	D12							
7.50-7.95	SPT N=25 D13		DRY	3.3/5.6, 7.7				
8.00	D14							
9.00	U3			115 blows		8.70	Grey silty CLAY containing shell fragments	
10.00	D15					(1.30)		
						10.00		

Figure 13 - Extract from SI by Site Analytical Services Ltd

Site Analytical Services Ltd.						Site	Borehole Number	
Boring Method CONTINUOUS FLIGHT AUGER		Casing Diameter		Ground Level (mOD)		Client	Job Number	
		100mm cased to 0.09m				LONDON BASEMENT	2236132	
		Location		Dates		Engineer	Sheet	
		TQ278908		23/11/2022			1/1	
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend
0.25	D1					(0.10)	MADE GROUND: Grass over dark brown sandy topsoil	
0.50	D2					(0.50)	MADE GROUND: Dark brown silty sandy clay containing brick and concrete fragments	
0.75	D3					0.65	MADE GROUND: Brown orange silty clay containing occasional brick fragments	
1.00	D4					(0.25)		
1.00	V1 70					0.90	Stiff, brown orange silty CLAY	
1.50	D5							
1.50	V2 91							
2.00	D6							
2.00	V3 122							
2.50	D7							
2.50	V4 134							
3.00	D8							
3.00	V5 140+							
3.50	D9							
3.50	V6 140+							
4.00	D10							
4.00	V7 140+							
4.50	D11							
4.50	V8 140+							
5.00	D12							
5.00	V9 140+					(9.10)		
6.00	D13							
6.00	V10 140+							
7.00	D14							
7.00	V11 140+							
8.00	D15							
8.00	V12 140+							
9.00	D16							
9.00	V13 140+							
10.00	D17							
10.00	V14 140+					10.00		

Figure 14 - Extract from SI by Site Analytical Services Ltd

3.5. Hydro-geology (Groundwater)

A Ground investigation has been undertaken to better determine the ground conditions.

The geology underlying the site is classified as clay. The ground investigation by *Site Analytical Services Ltd* states that groundwater was encountered at a depth of 4.30m below ground level in Borehole 1 after a period of approximately three weeks.

The ground investigation revealed the presence of water during the excavation of the trial pits. Any water subsequently found to be present during excavations within the site are likely to be due to perched water. This is water that has not had sufficient time to discharge into the ground due to the low permeability of the underlying clay.

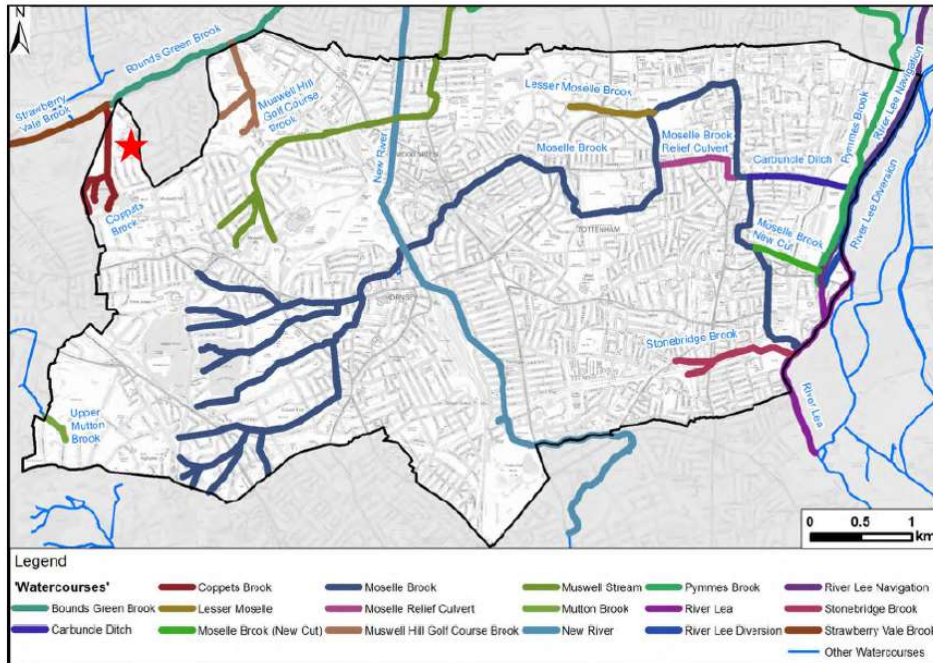
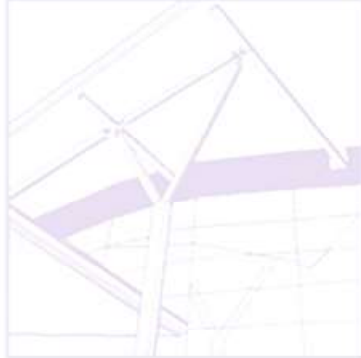


Figure 15: Extract from Figure 2.1 of Haringey SFRA showing watercourses



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3.6. Surface Water and Drainage

3.6.1. Site Drainage and Hardstanding

The proposed basement will be below the existing building and below a new extension that is proposed at the rear of the property. The basement will also extend into the rear garden. The top slab of the garden basement will be beneath one-meter-deep soil.

The proposed basement development will not result in a change to the hard surfaced /paved external areas, as the new extension will occupy an area that is currently paved.

The proposed basement will not result in changes to the inflows, instantaneous and long term of surface water being received by adjacent properties or downstream watercourses. The proposed development will enter the current drainage system.



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3.6.2. Surface Water Features

No areas of surface water in the form of ponds lakes, streams or rivers were noted on the site.

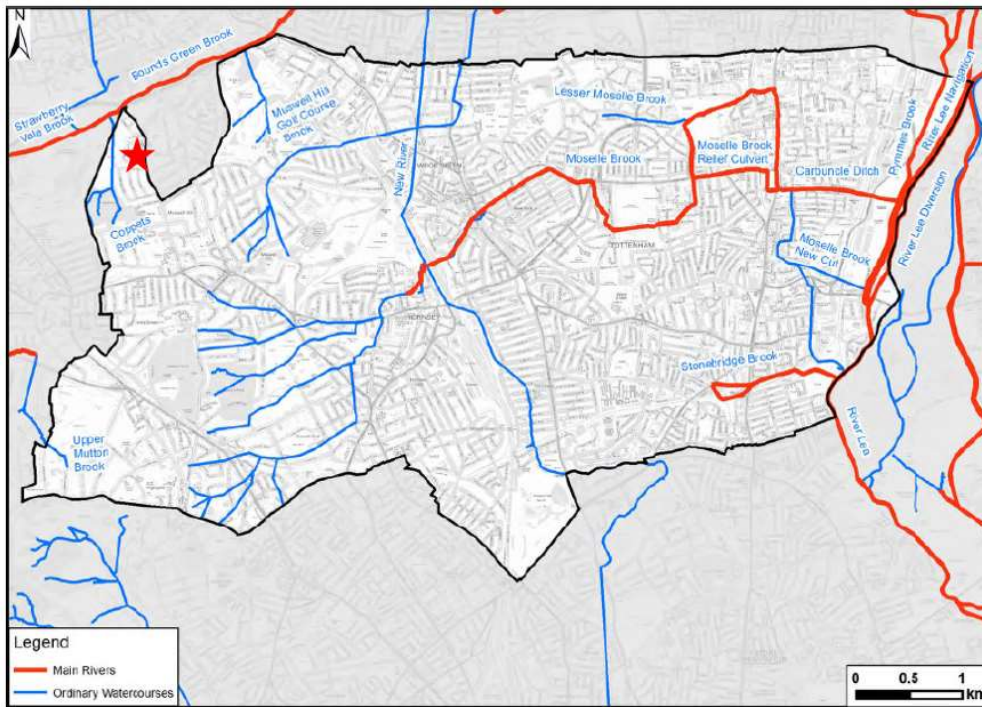


Figure 16: Extract from Figure 2-3 of SFRA for Haringey showing responsible party of 'watercourses'

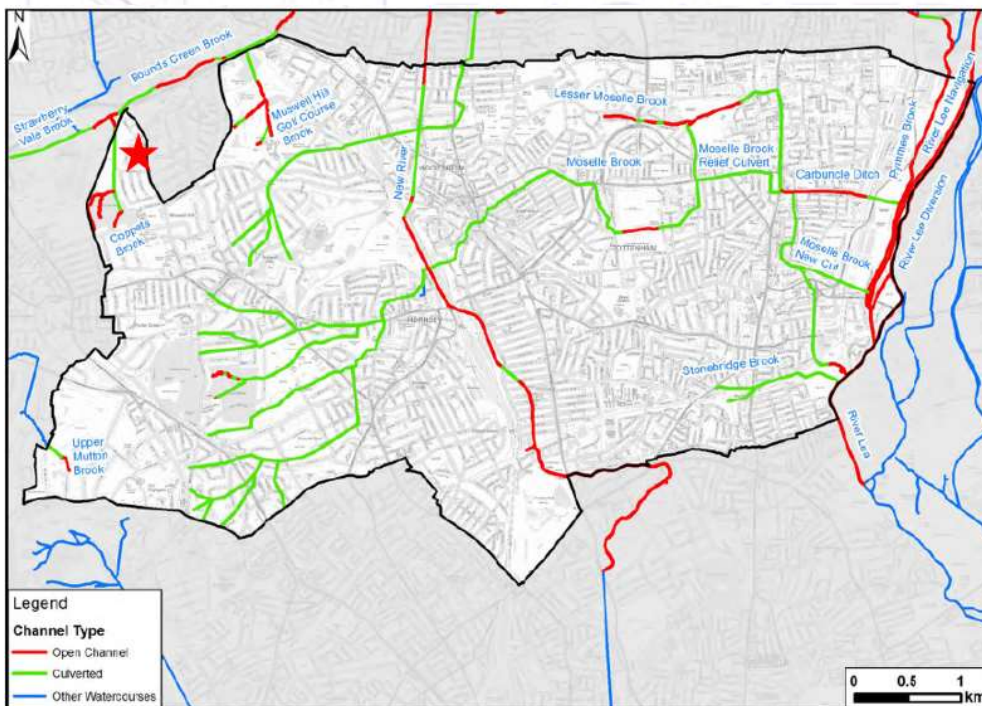


Figure 17: Extract from Figure 2-2 of SFRA for Haringey showing Channel Type

The site is not in a CDA area.

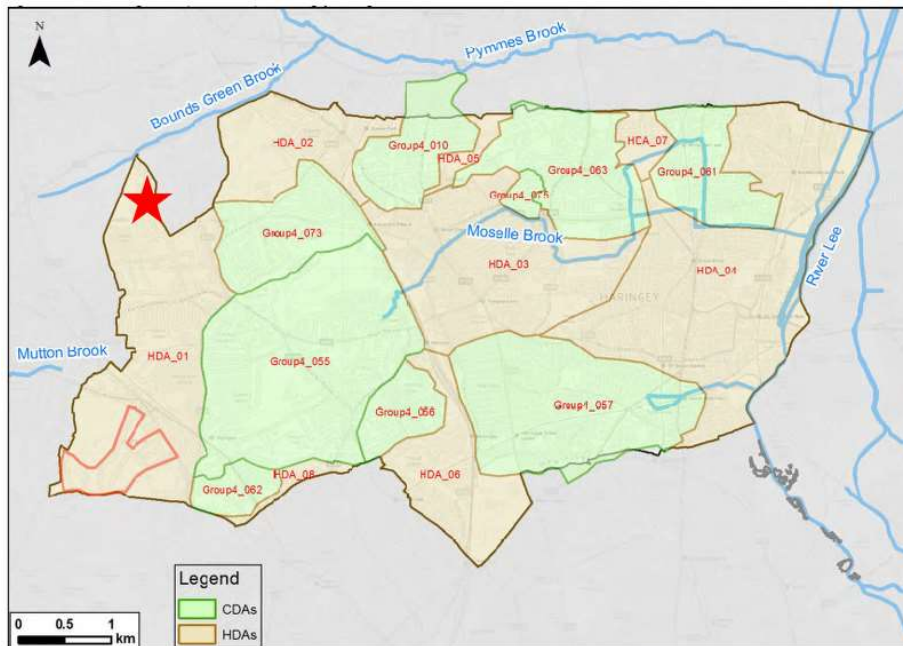


Figure 18: Extract from Figure 2-6 of SFRA for Haringey showing Critical Drainage Areas (SWMP 2012) and Haringey Drainage areas

3.6.3. Flooding

A search on the Environment Agency website shows that the site is not at a significant risk of flooding from rivers or surface water.

119, COPPETTS ROAD, LONDON, N10 1JL

Surface water

Low risk

[What this information means](#)

Surface water flooding, sometimes known as flash flooding:

- happens when heavy rain cannot drain away
- is difficult to predict as it depends on rainfall volume and location
- can happen up hills and away from rivers and other bodies of water
- is more widespread in areas with harder surfaces like concrete

Lead local flood authorities (LLFA) are responsible for managing the flood risk from surface water and may hold more detailed information.

Your LLFA is **Haringey council**.

[View a map of the risk of flooding from surface water](#)

Rivers and the sea

Very low risk

[What this information means](#)

The Environment Agency is responsible for managing the flood risk from rivers and the sea.

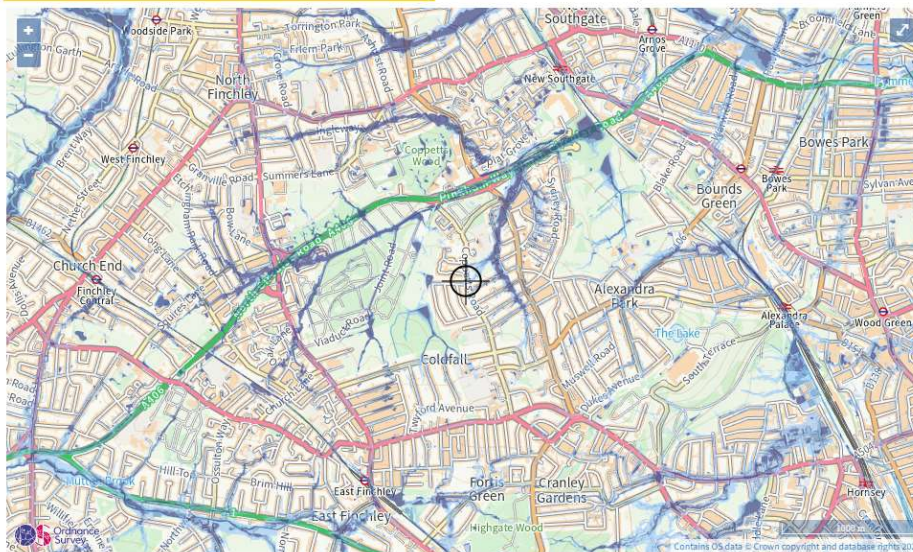
Figure 19 - Extract of EA data

Flood risk

Extent of flooding

Location

N10 1JL



Extent of flooding from surface water

● High
 ● Medium
 ● Low
 ● Very low
 ⊕ Location you selected

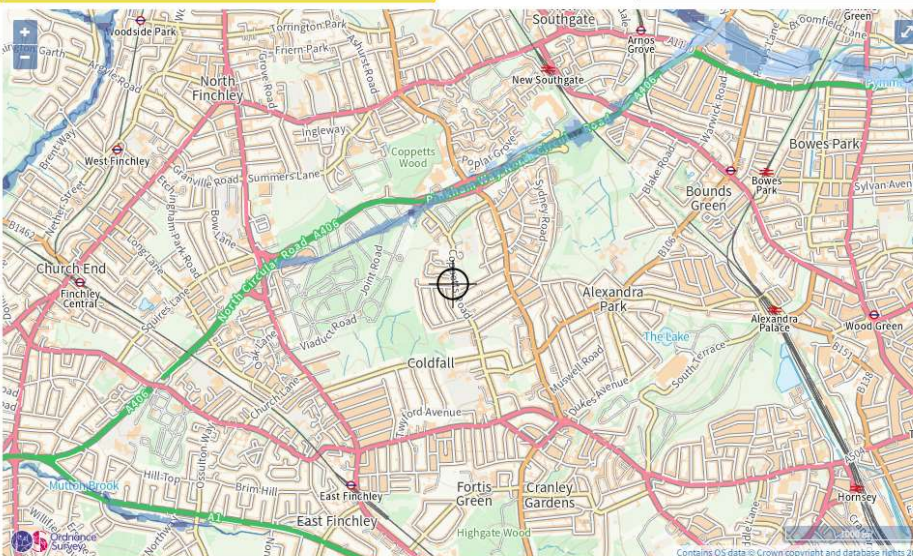
Figure 20 - Extent of flooding from surface water

Flood risk

Extent of flooding

Location

N10 1JL



Extent of flooding from rivers or the sea

● High
 ● Medium
 ● Low
 ● Very low
 ⊕ Location you selected

Figure 21 - Extent of flooding from rivers or the sea

4. Screening Stage

This stage identifies any areas for concern that should be investigated further.

4.1. Geology and Land Stability

1. **Does the existing site include slopes, natural or man-made greater than 7 degrees (approximately 1 in 8)?**
No. There are no slopes greater than 7 degrees withing the site.
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. There will be no re-profiling of the land within the site.
3. **Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7 degrees (approximately 1 in 8)?**
No. There are no significant slopes or cuttings in the immediate vicinity.
4. **Is the site within a wider hillside setting in which the general slope is greater than 7 degrees (approximately 1 in 8)?**
No. The slope of the surrounding land is as per the site: approximately flat.
5. **Is the London Clay the shallowest strata at the site?**
Yes.
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?**
Yes. There are existing trees/bushes in the rear garden that need to be felled for the basement development.
7. **Is there a history of seasonal shrink-swell subsidence in the local area and/or evidence of such effects at the site?**
No. From inspection of the subject property and on the exterior of neighbouring buildings, there are no obvious signs of cracking relating to subsidence.
8. **Is the site within 100m of a watercourse or a potential spring line?**
No. The nearest watercourse is Coppetts Brook, which is more than 100mm away.
9. **Is the site within an area of previously worked ground?**
No.
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. Clay is present below the site and water table was found 4.3m below ground level.

11. Is the site within 5m of a highway or pedestrian right of way?

No.

12. Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?

Yes. The property is a terrace house, therefore the party walls with No.119 will be underpinned, but the front and rear walls of No.117 and No.121 will be kept at their original depth.

13. Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?

No.

4.2. Hydro-geology

1. Is the site located directly above an aquifer?

No. The site is underlain by clay, an 'unproductive strata'

2. Will the proposed basement extend beneath the water table surface?

No. ground water may be present but, as revealed by the trial pits investigation, this would be perched water, not related to the water table.

3. Is the site within 100m of a watercourse, well (used / disused) or potential spring line?

No. The nearest watercourse is Coppetts Brook. This is more than 100m away from the site.

4. Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?

No. Part of the basement will be completely below areas that are already covered with hard surfaces. Part of the basement will extend into the rear garden and have one meter of soil on top of the slab; this area will maintain a soft landscape/surface.

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. there will be no additional discharge of surface water into the ground

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 or spring line?

No

4.3. Surface Flow and Flooding

1. Is the site within the catchment of the open bodies of water designated for recreational use?

No. The nearest ponds known for significant recreational use are in Hampstead Heath. The site lies outside of the catchment area of these 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 surface water that flows from the proposed development will be routed the same way as before: water is and will be collected from hard surfaced areas and enter the existing drainage system.

3. Will the proposed basement development result in a change to the hard surfaced /paved external areas?

No. The amount of hard standing will remain unchanged.

4. Will the proposed basement result in changes to the inflows (instantaneous and long term) of surface water being received by adjacent properties or downstream watercourses?

No. Surface water that is received by adjacent properties and downstream watercourses is not from the site. This will remain the case with the proposed development.

5. Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?

No. Collected surface water will be from building roofs and paving, as before. The quality of the water received downstream will therefore not change.

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 not in a CDA.

4.4. Screening Summary

The screening process identifies the following issues to be carried forward to scoping for further assessment:

- The basement will be constructed in clay
- The proposed development will increase differential foundation depth with neighbours
- Local trees/bushes in the rear garden will be felled
- The basement is close to the road/pavement.

Other potential concerns identified in the Screening process were demonstrated to be not applicable or not significant when applied to the proposed development.



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5. Scoping Stage

5.1. Geology and Land Stability

Local trees/bushes in the rear garden will be felled. There will be change in the moisture content in the soil that will cause volumetric changes to occur. The new basement will form a foundation that will be beyond the influence of such changes, resulting in a more stable structure.

Due to the basement, there will be an increase differential depth between the new foundations and the existing foundations of the neighbouring properties. This may have implications on the ground movement during construction. Potential ground movement should be considered further.

The basement is close to the road/pavement. This should be accounted for in when considering the surcharge in the design of the basement retaining walls.

5.2. Hydro-geology

No potential issues have been identified.

5.3. Surface Flow and Flooding

No further study is required in the context of the initial screening questions.

6. Site Investigation / Additional Assessments

As mentioned previously, within the context of the initial screening, no further assessments are required for Geology and Land-stability.

As mentioned previously, within the context of the initial screening, no further assessments are required for Groundwater.

As mentioned previously, within the context of the initial screening, no further assessments are required for Surface Water and Flooding.

A site-specific borehole investigation has confirmed that the property is sitting on made ground down to 1.2m below ground level and London Clay Formation is found below that.

The formation level of the basement will be within the layer of London Clay Formation

The ground investigation by *Site Analytical Services Ltd* states that groundwater was encountered at a depth of 4.30m below ground level.

No further assessments are considered necessary at Planning Stage. The information referred to within this report is sufficient to proceed with anticipated design and construction proposals. These are presented in the following sections.

7. Engineering Design and Construction Considerations

7.1. Outline Geotechnical Design Parameters

From the geological data described previously, the following are advised to be carried forward to detailed design stage:

Angle of shearing resistance, $\phi = 23$ degrees

Water level at $\frac{3}{4}$ basement wall height (allowing for unexpected water ie burst mains etc)

Allowable ground bearing pressure = 110 kN/m^2 (from soil investigation for depth greater than 3.0m).

7.2. Outline Permanent Design Proposals

Design Concept

Reinforced concrete cantilevered retaining walls will form the perimeter of the new basement. The base of these walls will form the foundation of the new structure and will also part of the existing building.

A design of one of the retaining walls, which is appended, is calculated using software by TEDDS. This software is specifically designed for retaining walls. This helps to design the walls to ensure that the construction is kept to a limit to prevent damage to the nearby existing properties. This is achieved by designing the walls to be stiff enough to provide adequate resistance against lateral earth pressures and hydrostatic forces.

The overall stability of the walls is designed using K_a & K_p values, while the design of the wall structure uses K_0 values. This approach minimises the level of movement from the concrete affecting the adjacent properties.

The walls are designed to resist the hydrostatic pressure. The water table was believed to be low. The design of the walls considers long-term scenarios. It is possible that a water main may break causing a localised high water table. To account for this, the wall is will be designed with hydrostatic forces applied to up to $\frac{3}{4}$ of its height.

Below ground level, the reinforced concrete retaining walls would be designed to resist the lateral loading applied from above. The lateral earth pressure exerts a horizontal force on the retaining walls. The retaining walls will be checked for resistance to the overturning force this produces.

Lateral forces will be applied from:

- Soil loads
- Hydrostatic pressures
- Surcharge loading from behind the wall

These produce retaining wall thrust. This will be restrained by the opposing retaining wall.

Particular attention should be paid to areas of the basement where there is no structure above ground level (towards the rear). This part of the structure may need to be designed to resist uplift. The Design stage engineer should consider the highest possible levels for the water table and, if necessary, include extra design measures to resist uplift. This should be advised at detailed design stage.

Appendix A shows the calculations of one of the most heavily loaded retaining walls. The most critical parameters have been used for this.

Intended Use & Loadings

	UDL kN/m ²	Concentrated Load kN
Domestic Single Dwellings	1.5	2.0

Surcharge Loading

The following will be applied as surcharge loads to the front/ front lightwell retaining walls:

- 10kN/m² if within 45° of road
- 100kN point loads if under road or within 1.5m
- 5kN/m² if within 45° of Pavement
- Garden Surcharge 2.5kN/m² + 1 m of soil (if present above basement ceiling) 20kN/m²
- Surcharge for adjacent property 1.5kN/m² + 4kN/m² for concrete ground bearing slab

Adjacent Properties:

All adjacent property footings within 45° to have additional geotechnical engineers input. A line at 45° from the base of the neighbours' wall footing would be intersected by the basement retaining wall. This should be accounted for in the design.

Waterproofing

The design of the basement should ensure that the structure is adequately water-proofed. Due the segmental construction of the concrete that will form the basement shell, it will not be possible to make the structure completely water-tight. This can be mitigated by applying suitable waterproofing substances to the joints in the concrete during construction.

A common and anticipated detailed design stage approach is to also use internal membranes (Delta or similar).



Figure 22: Example of dimpled membrane used for waterproofing basements

These will be integral to the waterproofing design of the basement. Any water from this will enter a drainage channel below the slab. This will be pumped and discharged into the existing sewer system.

The design of drainage and damp-proofing is not within the scope of this assessment and would normally be expected to be part of the structural water-proofers remit at detailed design stage.

It is recommended that a waterproofing specialist is employed to ensure all the water proofing requirements are met. The waterproofing specialist must name their structural water-proofer. The structural water-proofer must inspect the structural details and confirm that he is happy with the robustness.

Due to the segmental construction nature of the basement, it is not possible to water proof the joints. All waterproofing must be made by the waterproofing specialist. They should review the structural engineer's design stage details and advise if water bars and stops are necessary.

The waterproofing designer must not assume that the structure is watertight. To help reduce water flow through the joints in the segmental pins, the following measures should be applied:

- All faces should be cleaned of all debris and detritus
- Faces between pins should be needle hammered to improve key for bonding
- All pipe work and other penetrations should have puddle flanges or hydrophilic strips

7.3. Ground Movement Assessment

All excavations induce minor movement in the surrounding ground. The degree of movement is partly dependent on depth of the excavation and the control of the construction procedures. The

amount of ground movement that may occur due to these works is not anticipated to be significant.

The basement will be constructed using standard underpinning procedures. This will involve segmental underpins below the existing building. The main part of the basement, in the garden area will be constructed following bulk removal of soil. The main area of the basement will not be immediately adjacent to the listed building. However, the behaviour of the ground nearby, and the impact that this may have on the existing building, has been considered.

There is limited guidance on the behaviour of ground near excavations of this type and scale. In the absence of suitably matching guidance CIRIA C760 (formerly C580) *Embedded Retaining Walls: Guidance for Economic Design* is referred to for the analysis of the ground movement during construction.

It is pertinent to note that this guidance is conservative for the following reasons:

- Sheet walls are assumed, which involves inserting a wall into the ground before excavation. This would involve an additional amount of disturbance that would not be replicated with the construction method proposed at this development
- The empirical data that the guidance in C580/C760 is based on draws on case-studies of developments of a much greater scale (eg British Library, train stations)

The guidance in C760 shows that ground movements in clay may occur near excavations, as illustrated in the diagram below.

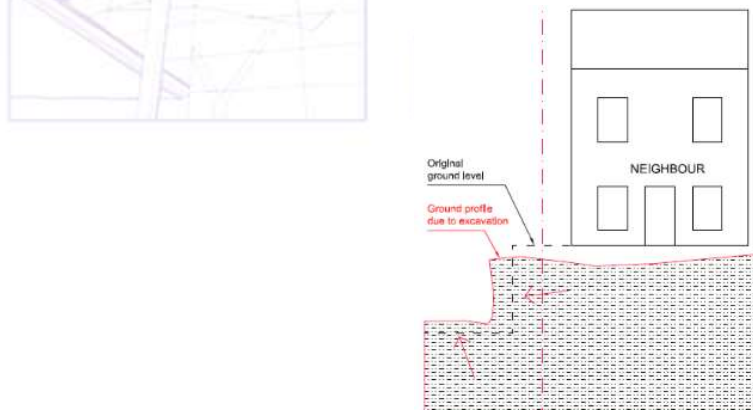


Figure 23: example of ground movement during excavation; movements are exaggerated and not to scale

The guidance on C760 has drawn on empirical evidence to show that the movement of the ground can be reduced with the use of propping in excavated soil. The greater the degree of propping, the smaller that ground movements.

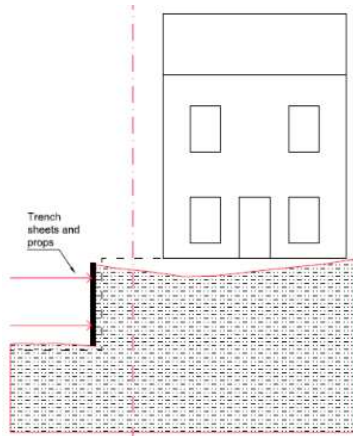


Figure 24: example of ground movement limited by propping; movements are exaggerated and not to scale

Ground movements and related building damage can also be reduced by ensuring that good workmanship is maintained on site and that suitable construction sequences are observed. The proposed construction method (appended) is such that it minimises the risk of movement to the above structure and any properties close by. The method statement should be followed carefully to limit any possible movement. A ground movement assessment is appended. This shows that the predicted damage category will be no greater than Category 1 (Very Slight) on the Burland Scale.

7.4. Temporary Works Proposals and Control of Construction Works

7.4.1. Temporary works

To control ground movement, and to maintain the safety of the operatives on site, lateral propping during the excavations for the basement is advised. Croft would propose propping the sides of the excavations as they progress downwards from ground level. Examples of propping are shown below:



Figure 25: Examples of propping (relevant to excavations close to and below existing building)



Figure 26: Example of propping (relevant to main basement)

Temporary propping details will be required to be provided by the contractor and must be completed by a suitably qualified professional.

Any groundwater present is likely to be perched water. This can be removed during the works. The contractor may wish to consider monitoring the groundwater prior to the start of works. A specialist dewatering contractor should be appointed if the water table is found to be consistently higher than expected. The temporary works designer may consider omitting hydrostatic loads in the design of lateral props, if water can be adequately discharged during construction.

To demonstrate the feasibility of the works, a proposed basement construction sequence is appended

7.4.2. Control of Construction Works

Pre-construction Arrangements

A construction sequence has been formulated with Croft's experience of over 500 basements. The procedures described in this statement will mitigate the impacts that the construction of the basement will have on nearby properties.

To reduce the risk to the development:

- Employ a reputable firm that has extensive knowledge of basement works.
- Employ suitably qualified consultants Croft Structural Engineers has completed over 500 basements in the last five years.
- Provide method statements for the contractors to follow

- Investigate the ground this has now been done.
- Record and monitor the properties close by. This is completed by a condition survey under the Party Wall Act, before and after the works are completed.

With the measures listed above, the maximum level of cracking anticipated Damage Category is not expected to be greater than 'Very Slight' (Category 1)

7.4.3. Construction Management Plan

For the Construction Phase Management Plan it may be beneficial to compile a Construction Management Plan (CMP). A suitably qualified person, typically the contractor, would provide the CMP. The items that should be considered are

- Delivers routes and times
- Expected working hours
- Times when local roads may become bust: school times, other construction sites.
- Volume of muck away, how this is managed and when.
- Required plant
- Noise dust and Vibration
- Waste Management

This is outside the brief of the Basement Impact Assessment and is not covered within Croft's brief.

7.4.4. Monitoring

In order to safeguard the existing structures during underpinning and new basement construction, movement monitoring using total stations or similar is to be undertaken.

Before the works begin, a detailed monitoring report is required to confirm the implementation of the monitoring. The items that this should cover are:

- Risk Assessment to determine level of monitoring
- Scope of Works
- Applicable standards
- Frequency of Monitoring
- Specification for Instrumentation
- Monitoring of Existing cracks
- Monitoring of movement
- Reporting

We would recommend that the monitoring frequency should follow:

Pre-construction: Monitored once.

During construction: Monitored after every pin is cast for first 4 no. pins to gauge effect of underpinning. If all is well, monitor after every other pin.

Post construction works: Monitored once.

This statement describes the procedures for the Principal Contractor to follow to observe movement that may occur to the existing properties, and also describes mitigation measures to apply if necessary.

This risk assessment considers the impact of the proposed works and how they impact the party wall. There are varying levels of inspection that can be undertaken and not all works, soil conditions and properties require the same level of protection.

Monitoring Level Proposed	Type of Works.
Monitoring Level 4 - Visual inspection and production of condition survey by Party Wall Surveyors at the beginning of the works and also at the end of the works. - Visual inspection of existing party wall during the works. - Inspection of the footing to ensure that the footings are stable and adequate. - Vertical monitoring movement by standard optical equipment • - Lateral movement between walls by laser measurements	New basements greater than 2.0m and shallower than 3.5m deep in gravels or clays Underpinning works to Grade I listed building Piled retaining walls to 2m deep

Scope of Works

The works comprise:

- Visual Monitoring of the party wall
- Attachment of Tell Tales or Demec studs to accurately record movement of significant cracks.
- Attachment of levelling targets to monitor settlement.
- The monitoring of the above instrumentation is in accordance with Appendix A. The number and precise locations of instrumentation may change during the works; this shall be subject to agreement with the Principal Contractor (PC).
- All instruments are to be adequately protected against any damage from construction plant or private vehicles using clearly visible markings and suitable head protection e.g. manhole rings or similar. Any damaged instruments are to be immediately replaced or repaired at the contractor's own cost.
- Reporting of all data in a manner easily understood by all interested parties.
- Co-ordination of these monitoring works with other site operations to ensure that all instruments can be read and can be reviewed against specified trigger values both during and post construction.
- Regular site meetings by the Principal Contractor (PC) and the Monitoring Surveyor (MS) to review the data and their implications.
- Review of data by Croft Structural Engineers

In addition, the PC will have responsibility for the following:

- Review of methods of working/operations to limit movements, and
- Implementation of any emergency remedial measures if deemed necessary by the results of the monitoring.

The Monitoring Surveyor shall allow for settlement and crack monitoring measures to be installed and monitored on various parts of the structure described in Table 1 as directed by the PC and Party Wall Surveyor (PWS) for the Client.

Item	Instrumentation Type
Party Wall Brickwork	
Settlement monitoring	Levelling equipment & targets
Crack monitoring	Visual inspection of cracking, Demec studs where necessary

Table 1: Instrumentation

Trigger values and contingency actions are noted in the table below.

MOVEMENT		CATEGORY	ACTION
Vertical	Horizontal		
0mm-4mm	0-3mm	Green	No action required
4mm-6mm	3-6mm	AMBER	Detailed review of Monitoring: Check studs are OK and have not moved. Ensure site staff have not moved studs. If studs have moved reposition. Relevel to ensure results are correct and tolerance is not a concern. Inform Party Wall surveyors of amber readings. Double the monitoring for 2 further readings. If stable revert back. Carry out a local structural review and inspection. Preparation for the implementation of remedial measures should be required. Double number of lateral props
6mm-10mm	6-8mm		Implement remedial measures review method of working and ground conditions
>10mm	>8mm	RED	Implement structural support as required; Cease works with the exception of necessary works for the safety and stability of the structure and personnel; Review monitoring data and implement revised method of works

8. Basement Impact Assessment

8.1. Geology and Land stability

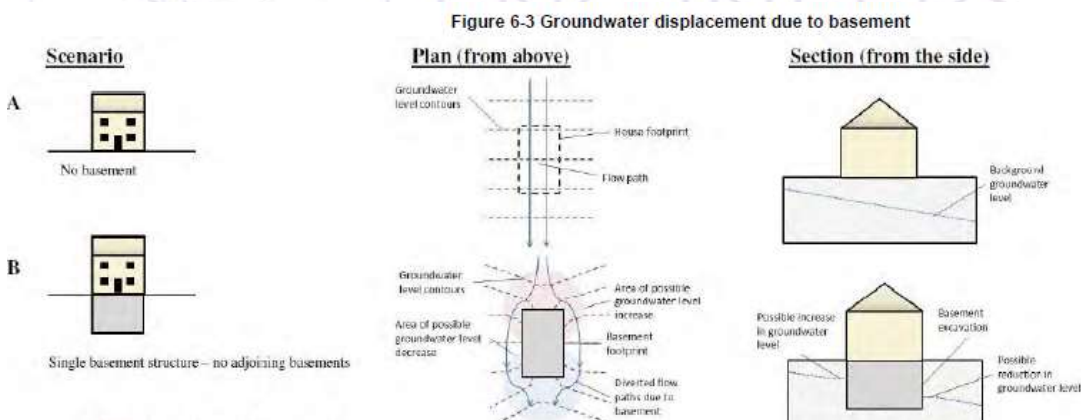
As described previously, ground movement during construction is likely to result in a Damage Category no greater than 'Very Slight' (Category 1). The ground movement can be controlled and suitable mitigated by adequate propping.

There will be an increase in differential depth between the adjacent properties and the existing building. However, the ground movement has been considered (in Section 7) and has concluded that the movement can be controlled.

8.2. Hydrogeology

As mentioned previously, the basement will be within clay. This has a low level of permeability. The inclusion of the basement is therefore unlikely to have any significant impacts on groundwater conveyance.

There is a possibility that there may be localised gravel bands or pockets within the clay. If any groundwater is found to be present within these and these are obstructed by the basement then water will be able to flow around the new structure, as illustrated below.



The new basement will not act as a dam and groundwater conveyance will not be obstructed significantly.

8.3. Surface Water & Flooding Assessment

SUDS aims to mimic the route that rainwater would take in a natural environment. In this development, this is achieved by ensuring that there is a soil cover above the basement ceiling, where it extends into the garden. Considerations for SUDS are described in the next section.

There is a risk of flooding is from failure of infrastructure, such as flooding due to unexpected failure of the drainage, water mains and the internal pumping system. This risk is inherent in the construction of all subterranean structures. Measures to mitigate this risk are described later.

8.3.1. Flood Risk Assessment

The site is less than 1 hectare so a detailed FRA is not considered necessary.

From site-specific borehole investigations, the building is understood to be founded on clay.

The existing hard landscaping is described in the Walk over survey section.

The proposal is to form a basement below the footprint of the existing property. This will also extend into the garden. The top of the basement that extends into the garden will be covered with 1m of permeable soil.

8.3.2. Flood Hazards

The potential hazards related to flooding are as follows:

Tidal and Fluvial Flooding

Given that the site lies in Flood Risk Zone 1 (defined by the Environment Agency as having low risk of flooding from rivers and seas), the risk of flooding from fluvial and tidal sources is not significant.

Surface Water and Pluvial Flooding

The site is adequately drained, as are the surrounding roads (which are drained by gullies maintained by Thames Water). The new basement will not involve a significant removal of permeable surfaces (the walk-on roof-light will occupy less than 1m²). Rainwater will be able to infiltrate into the ground as before and will not migrate to alternative locations above ground level.

Groundwater Flooding

The presence of the new basement has the potential to affect groundwater flow. The risk of groundwater flooding is concluded as being low, both on-site and off-site

Infrastructure Flooding

There are no reservoirs nearby which could cause flooding in the event of failure. Further more these items are assumed to have a high level of maintenance thus the risk of flooding from these is considered very low.

There are no known cases of flooding from sewers in the local area. There is always a risk that incoming water mains may break, causing significant flood risk to the occupants of the basement. This risk is inherent with all basement structures. Mitigation measures are proposed in the following section.

8.3.3. Flooding Mitigation Measures

To mitigate the risks associated with flooding, Croft would recommend the following mitigation measures:

- A pumping mechanism should be installed for the proposed basement. There is a likelihood that this may fail and allow excess water to accumulate. If this were to occur, the build-up of water would be gradual and noticeable before it becomes a significant life-threatening hazard.
- The pumping system should be a dual mechanism to maintain operation in the event of a failure. This should include a battery backup and a suitable alarm system for warning purposes. After the planning application is concluded, the design team should seek consent from Thames Water to pump and discharge water into the sewer.
- Route all electrical wiring at high level
- Ensure that the basement structure is adequately waterproofed during construction.

8.3.4. Surface Water and Flood Risk Assessment Summary

The risk of flooding from excess surface water is not considered significant. There is a risk of flooding due to the failure of the pumping system but this can be reduced to acceptable levels with appropriate design and installation measures.

Appendix A : Structural Calculations

Building Regulations will be required after planning. As part of the Building Control package, full calculations must be undertaken and provided at detailed design stage once planning permission is granted. The calculations must be completed to a recognised Standard (BS or Euro Codes). The calculations must take into account the findings of this report and any recommendations from the auditors.

The design must resist:

- Vertical loads from the proposed works and adjacent properties
- Lateral loads from wind, soil water and adjacent properties
- Loadings in the temporary condition
- All other applied loads on the building
- Uplift forces from hydrostatic effects and soil heave if basement is founded on clay

The final proposed scheme must:

- Provide stability in the temporary condition to all forces
- Provide stability to all forces in the permanent condition

To support the Planning application, Croft Structural Engineers has considered some of the pertinent parts of the basement structure to ensure that it can be constructed. The following calculations are not a full set of calculations for the final design, they are to demonstrate feasibility at the Planning stage only.



**W1 - RC WALL – INCLUDING LOADS NEXT DOOR**

W1 - RC Wall (PARTY WALL)										
pitched roofx2	2.85	2	5.7	g_k		1.15	6.5			
				q_k		0.60			3.4	
Timber floors x2	2.85	4	11.4	g_k		0.88	10.0			
				q_k		1.50			17.1	
concrete slab x2	2.85	2	5.7	g_k		4.80	27.4			
				q_k		1.50			8.6	
masonry wall	6	1	6	g_k		5.00	30.0			
							73.9	kN/m	29.1	kN/m

Surcharge DL = 4kN/m²Surcharge LL = 1.5kN/m²**RETAINING WALL ANALYSIS**

In accordance with EN1997-1:2004 incorporating Corrigendum dated February 2009 and the UK National Annex incorporating Corrigendum No.1

Teds calculation version 2.9.14

Retaining wall details

Stem type	Cantilever
Stem height	$h_{\text{stem}} = 3200$ mm
Stem thickness	$t_{\text{stem}} = 350$ mm
Angle to rear face of stem	$\alpha = 90$ deg
Stem density	$\gamma_{\text{stem}} = 25$ kN/m ³
Toe length	$l_{\text{toe}} = 1600$ mm
Base thickness	$t_{\text{base}} = 350$ mm
Base density	$\gamma_{\text{base}} = 25$ kN/m ³
Height of retained soil	$h_{\text{ref}} = 3200$ mm
Angle of soil surface	$\beta = 0$ deg
Depth of cover	$d_{\text{cover}} = 0$ mm
Height of water	$h_{\text{water}} = 2400$ mm
Water density	$\gamma_w = 9.8$ kN/m ³

Retained soil properties

Soil type	Organic clay
Moist density	$\gamma_{\text{mr}} = 15$ kN/m ³
Saturated density	$\gamma_{\text{sr}} = 15$ kN/m ³
Characteristic effective shear resistance angle	$\phi'_{r,k} = 23$ deg
Characteristic wall friction angle	$\delta_{r,k} = 9$ deg

Base soil properties

Soil type	Organic clay
-----------	--------------



Soil density

$$\gamma_b = 15 \text{ kN/m}^3$$

Characteristic effective shear resistance angle $\phi'_{b,k} = 23 \text{ deg}$

Characteristic wall friction angle

$$\delta_{b,k} = 9 \text{ deg}$$

Characteristic base friction angle

$$\delta_{bb,k} = 12 \text{ deg}$$

Presumed bearing capacity

$$P_{\text{bearing}} = 110 \text{ kN/m}^2$$

Loading details

Permanent surcharge load

$$\text{Surcharge}_G = 4 \text{ kN/m}^2$$

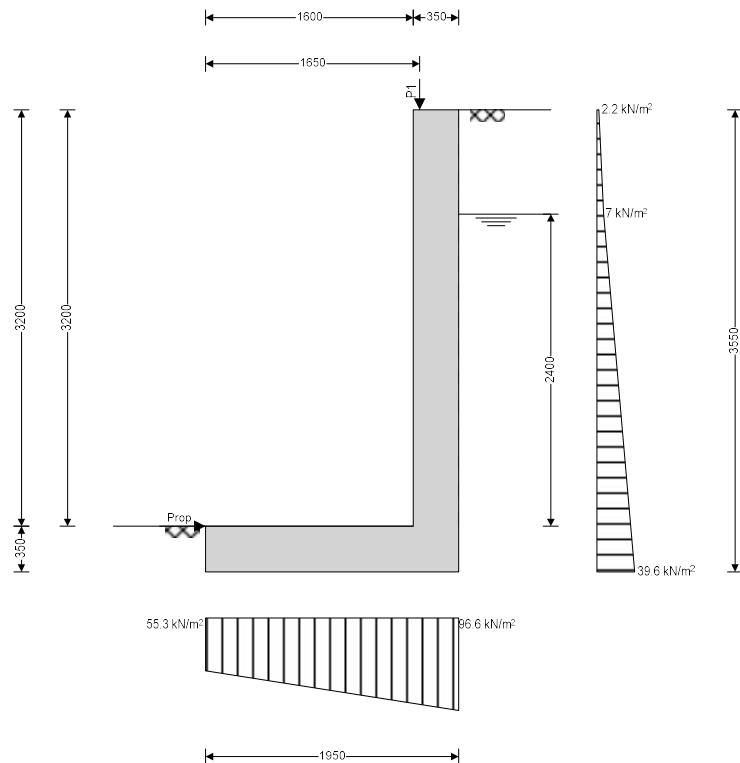
Variable surcharge load

$$\text{Surcharge}_Q = 1.5 \text{ kN/m}^2$$

Vertical line load at 1650 mm

$$P_{G1} = 73.9 \text{ kN/m}$$

$$P_{Q1} = 29.1 \text{ kN/m}$$



General arrangement

Calculate retaining wall geometry

Base length

$$l_{\text{base}} = l_{\text{toe}} + t_{\text{stem}} = 1950 \text{ mm}$$

Saturated soil height

$$h_{\text{sat}} = h_{\text{water}} + d_{\text{cover}} = 2400 \text{ mm}$$

Moist soil height

$$h_{\text{moist}} = h_{\text{ret}} - h_{\text{water}} = 800 \text{ mm}$$

Length of surcharge load

$$l_{\text{sur}} = l_{\text{heel}} = 0 \text{ mm}$$

- Distance to vertical component

$$x_{\text{sur}_v} = l_{\text{base}} - l_{\text{heel}} / 2 = 1950 \text{ mm}$$



Effective height of wall

$$h_{\text{eff}} = h_{\text{base}} + d_{\text{cover}} + h_{\text{ret}} = \mathbf{3550 \text{ mm}}$$

- Distance to horizontal component

$$x_{\text{sur}_h} = h_{\text{eff}} / 2 = \mathbf{1775 \text{ mm}}$$

Area of wall stem

$$A_{\text{stem}} = h_{\text{stem}} \times t_{\text{stem}} = \mathbf{1.12 \text{ m}^2}$$

- Distance to vertical component

$$x_{\text{stem}} = l_{\text{toe}} + t_{\text{stem}} / 2 = \mathbf{1775 \text{ mm}}$$

Area of wall base

$$A_{\text{base}} = l_{\text{base}} \times t_{\text{base}} = \mathbf{0.683 \text{ m}^2}$$

- Distance to vertical component

$$x_{\text{base}} = l_{\text{base}} / 2 = \mathbf{975 \text{ mm}}$$

Using Coulomb theory

Active pressure coefficient

$$K_A = \sin(\alpha + \phi'_{r,k})^2 / (\sin(\alpha)^2 \times \sin(\alpha - \delta_{r,k}) \times [1 + \sqrt{[\sin(\phi'_{r,k} + \delta_{r,k}) \times \sin(\phi'_{r,k} - \beta) / (\sin(\alpha - \delta_{r,k}) \times \sin(\alpha + \beta))]}])^2 = \mathbf{0.404}$$

Passive pressure coefficient

$$K_P = \sin(90 - \phi'_{b,k})^2 / (\sin(90 + \delta_{b,k}) \times [1 - \sqrt{[\sin(\phi'_{b,k} + \delta_{b,k}) \times \sin(\phi'_{b,k}) / (\sin(90 + \delta_{b,k}))]}])^2 = \mathbf{2.919}$$

Bearing pressure check**Vertical forces on wall**

Wall stem

$$F_{\text{stem}} = A_{\text{stem}} \times \gamma_{\text{stem}} = \mathbf{28 \text{ kN/m}}$$

Wall base

$$F_{\text{base}} = A_{\text{base}} \times \gamma_{\text{base}} = \mathbf{17.1 \text{ kN/m}}$$

Line loads

$$F_{P_v} = P_{G1} + P_{Q1} = \mathbf{103 \text{ kN/m}}$$

Total

$$F_{\text{total}_v} = F_{\text{stem}} + F_{\text{base}} + F_{P_v} + F_{\text{water}_v} = \mathbf{148.1 \text{ kN/m}}$$

Horizontal forces on wall

Surcharge load

$$F_{\text{sur}_h} = K_A \times \cos(\delta_{r,k}) \times (\text{Surcharge}_G + \text{Surcharge}_Q) \times h_{\text{eff}} = \mathbf{7.8 \text{ kN/m}}$$

Saturated retained soil

$$F_{\text{sat}_h} = K_A \times \cos(\delta_{r,k}) \times (\gamma_{\text{sr}} - \gamma_w) \times (h_{\text{sat}} + h_{\text{base}})^2 / 2 = \mathbf{7.8 \text{ kN/m}}$$

Water

$$F_{\text{water}_h} = \gamma_w \times (h_{\text{water}} + d_{\text{cover}} + h_{\text{base}})^2 / 2 = \mathbf{37.1 \text{ kN/m}}$$

Moist retained soil

$$F_{\text{moist}_h} = K_A \times \cos(\delta_{r,k}) \times \gamma_{\text{mr}} \times ((h_{\text{eff}} - h_{\text{sat}} - h_{\text{base}})^2 / 2 + (h_{\text{eff}} - h_{\text{sat}} - h_{\text{base}}) \times (h_{\text{sat}} + h_{\text{base}})) = \mathbf{15.1 \text{ kN/m}}$$

Base soil

$$F_{\text{pass}_h} = -K_P \times \cos(\delta_{b,k}) \times \gamma_b \times (d_{\text{cover}} + h_{\text{base}})^2 / 2 = \mathbf{-2.6 \text{ kN/m}}$$

Total

$$F_{\text{total}_h} = F_{\text{sur}_h} + F_{\text{sat}_h} + F_{\text{water}_h} + F_{\text{moist}_h} + F_{\text{pass}_h} = \mathbf{65.1 \text{ kN/m}}$$

Moments on wall

Wall stem

$$M_{\text{stem}} = F_{\text{stem}} \times x_{\text{stem}} = \mathbf{49.7 \text{ kNm/m}}$$

Wall base

$$M_{\text{base}} = F_{\text{base}} \times x_{\text{base}} = \mathbf{16.6 \text{ kNm/m}}$$

Surcharge load

$$M_{\text{sur}} = -F_{\text{sur}_h} \times x_{\text{sur}_h} = \mathbf{-13.8 \text{ kNm/m}}$$

Line loads

$$M_P = (P_{G1} + P_{Q1}) \times p_1 = \mathbf{170 \text{ kNm/m}}$$

Saturated retained soil

$$M_{\text{sat}} = -F_{\text{sat}_h} \times x_{\text{sat}_h} = \mathbf{-7.2 \text{ kNm/m}}$$

Water

$$M_{\text{water}} = -F_{\text{water}_h} \times x_{\text{water}_h} = \mathbf{-34 \text{ kNm/m}}$$

Moist retained soil

$$M_{\text{moist}} = -F_{\text{moist}_h} \times x_{\text{moist}_h} = \mathbf{-23.9 \text{ kNm/m}}$$

Total

$$M_{\text{total}} = M_{\text{stem}} + M_{\text{base}} + M_{\text{sur}} + M_P + M_{\text{sat}} + M_{\text{water}} + M_{\text{moist}} = \mathbf{157.4 \text{ kNm/m}}$$

**Check bearing pressure**

Propping force

$$F_{prop_base} = F_{total_h} = \mathbf{65.1 \text{ kN/m}}$$

Distance to reaction

$$\bar{x} = M_{total} / F_{total_v} = \mathbf{1063 \text{ mm}}$$

Eccentricity of reaction

$$e = \bar{x} - l_{base} / 2 = \mathbf{88 \text{ mm}}$$

Loaded length of base

$$l_{load} = l_{base} = \mathbf{1950 \text{ mm}}$$

Bearing pressure at toe

$$q_{toe} = F_{total_v} / l_{base} \times (1 - 6 \times e / l_{base}) = \mathbf{55.3 \text{ kN/m}^2}$$

Bearing pressure at heel

$$q_{heel} = F_{total_v} / l_{base} \times (1 + 6 \times e / l_{base}) = \mathbf{96.6 \text{ kN/m}^2}$$

Factor of safety

$$FoS_{bp} = P_{bearing} / \max(q_{toe}, q_{heel}) = \mathbf{1.139}$$

PASS - Allowable bearing pressure exceeds maximum applied bearing pressure

RETAINING WALL DESIGN

In accordance with EN1992-1-1:2004 incorporating Corrigendum dated January 2008 and the UK National Annex incorporating National Amendment No.1

Teds calculation version 2.9.14

Concrete details - Table 3.1 - Strength and deformation characteristics for concrete

Concrete strength class

C32/40

Characteristic compressive cylinder strength

$$f_{ck} = \mathbf{32 \text{ N/mm}^2}$$

Characteristic compressive cube strength $f_{ck,cube} = \mathbf{40 \text{ N/mm}^2}$

Mean value of compressive cylinder strength

$$f_{cm} = f_{ck} + 8 \text{ N/mm}^2 = \mathbf{40 \text{ N/mm}^2}$$

N/mm²

Mean value of axial tensile strength

$$f_{ctm} = 0.3 \text{ N/mm}^2 \times (f_{ck} / 1 \text{ N/mm}^2)^{2/3} = \mathbf{3.0 \text{ N/mm}^2}$$

5% fractile of axial tensile strength

$$f_{ctk,0.05} = 0.7 \times f_{ctm} = \mathbf{2.1 \text{ N/mm}^2}$$

Secant modulus of elasticity of concrete

$$E_{cm} = 22 \text{ kN/mm}^2 \times (f_{cm} / 10 \text{ N/mm}^2)^{0.3} = \mathbf{33346 \text{ N/mm}^2}$$

Partial factor for concrete - Table 2.1N

$$\gamma_c = \mathbf{1.50}$$

Compressive strength coefficient - cl.3.1.6(1)

$$\alpha_{cc} = \mathbf{0.85}$$

Design compressive concrete strength - exp.3.15

$$f_{cd} = \alpha_{cc} \times f_{ck} / \gamma_c = \mathbf{18.1 \text{ N/mm}^2}$$

N/mm²

Maximum aggregate size

$$h_{agg} = \mathbf{20 \text{ mm}}$$

Ultimate strain - Table 3.1

$$\epsilon_{cu2} = \mathbf{0.0035}$$

Shortening strain - Table 3.1

$$\epsilon_{cu3} = \mathbf{0.0035}$$

Effective compression zone height factor

$$\lambda = \mathbf{0.80}$$

Effective strength factor

$$\eta = \mathbf{1.00}$$

Bending coefficient k_1

$$K_1 = \mathbf{0.40}$$

Bending coefficient k_2

$$K_2 = 1.00 \times (0.6 + 0.0014 / \epsilon_{cu2}) = \mathbf{1.00}$$

Bending coefficient k_3

$$K_3 = \mathbf{0.40}$$

Bending coefficient k_4

$$K_4 = 1.00 \times (0.6 + 0.0014 / \epsilon_{cu2}) = \mathbf{1.00}$$

Reinforcement details

Characteristic yield strength of reinforcement

$$f_{yk} = \mathbf{500 \text{ N/mm}^2}$$

Modulus of elasticity of reinforcement

$$E_s = \mathbf{200000 \text{ N/mm}^2}$$



Partial factor for reinforcing steel - Table 2.1N

$$\gamma_s = 1.15$$

Design yield strength of reinforcement $f_{yd} = f_{yk} / \gamma_s = 435 \text{ N/mm}^2$

Cover to reinforcement

Front face of stem

$$C_{sf} = 40 \text{ mm}$$

Rear face of stem

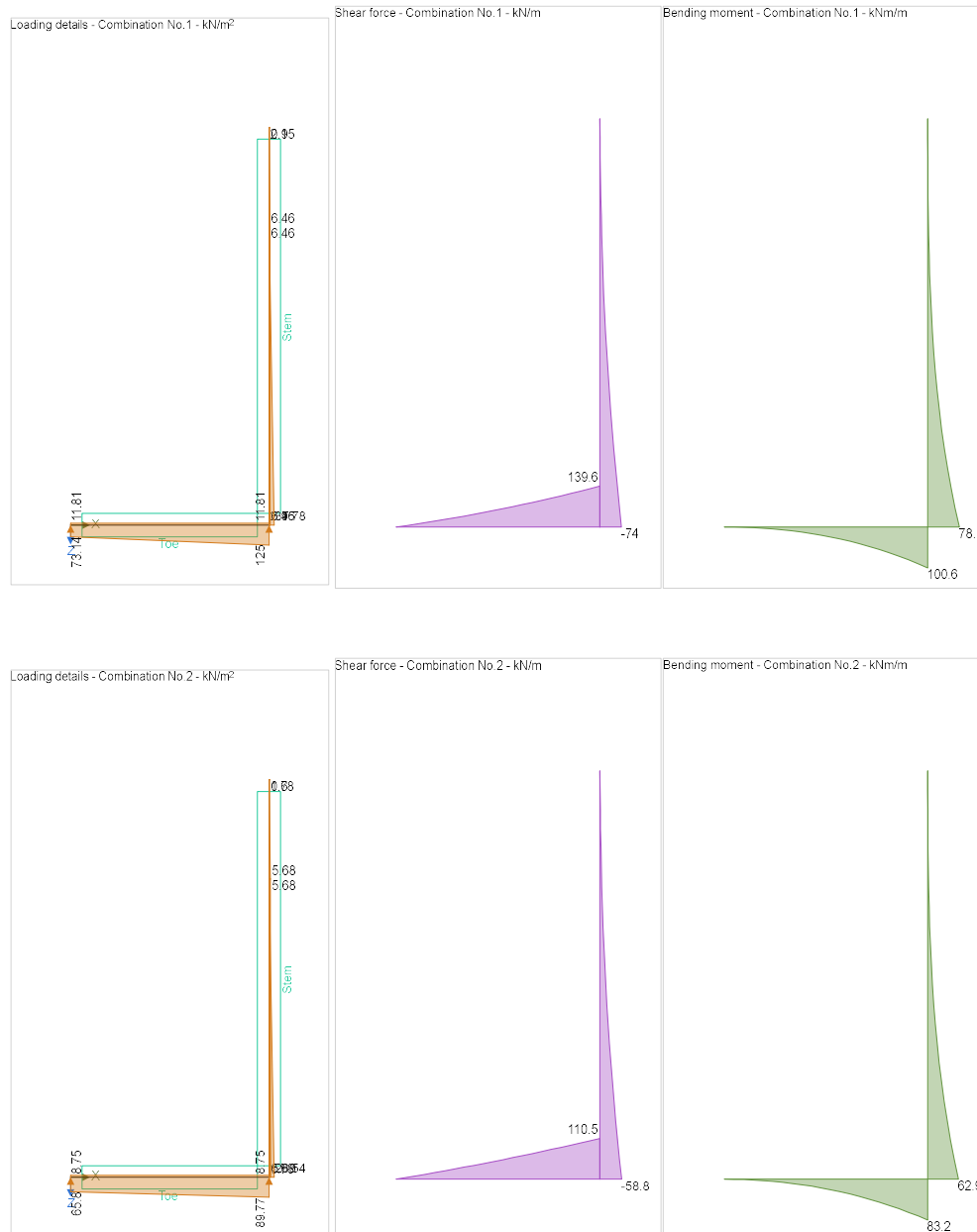
$$C_{sr} = 75 \text{ mm}$$

Top face of base

$$C_{bt} = 40 \text{ mm}$$

Bottom face of base

$$C_{bb} = 75 \text{ mm}$$



**Check stem design at base of stem**

Depth of section

$$h = 350 \text{ mm}$$

Rectangular section in flexure - Section 6.1

Design bending moment combination 1

$$M = 78.1 \text{ kNm/m}$$

Depth to tension reinforcement

$$d = h - c_{sr} - \phi_{sr} / 2 = 267 \text{ mm}$$

$$K = M / (d^2 \times f_{ck}) = 0.034$$

$$K' = (2 \times \eta \times \alpha_{cc} / \gamma_c) \times (1 - \lambda \times (\delta - K_1) / (2 \times K_2)) \times (\lambda \times (\delta - K_1) / (2 \times$$

K₂))

$$K' = 0.207$$

K' > K - No compression reinforcement is required

Lever arm

$$z = \min(0.5 + 0.5 \times (1 - 2 \times K / (\eta \times \alpha_{cc} / \gamma_c))^{0.5}, 0.95) \times d = 254$$

mm

Depth of neutral axis

$$x = 2.5 \times (d - z) = 33 \text{ mm}$$

Area of tension reinforcement required

$$A_{sr,req} = M / (f_{yd} \times z) = 708 \text{ mm}^2/\text{m}$$

Tension reinforcement provided

$$16 \text{ dia. bars @ } 100 \text{ c/c}$$

Area of tension reinforcement provided

$$A_{sr,prov} = \pi \times \phi_{sr}^2 / (4 \times s_{sr}) = 2011 \text{ mm}^2/\text{m}$$

Minimum area of reinforcement - exp.9.1N

$$A_{sr,min} = \max(0.26 \times f_{ctm} / f_{yk}, 0.0013) \times d = 420 \text{ mm}^2/\text{m}$$

Maximum area of reinforcement - cl.9.2.1.1(3)

$$A_{sr,max} = 0.04 \times h = 14000$$

mm²/m

$$\max(A_{sr,req}, A_{sr,min}) / A_{sr,prov} = 0.352$$

PASS - Area of reinforcement provided is greater than area of reinforcement required

Library item: Rectangular single output

Deflection control - Section 7.4

Reference reinforcement ratio

$$\rho_0 = \sqrt{(f_{ck} / 1 \text{ N/mm}^2)} / 1000 = 0.006$$

Required tension reinforcement ratio

$$\rho = A_{sr,req} / d = 0.003$$

Required compression reinforcement ratio

$$\rho' = A_{sr,2,req} / d_2 = 0.000$$

Structural system factor - Table 7.4N

$$K_b = 0.4$$

Reinforcement factor - exp.7.17

$$K_s = \min(500 \text{ N/mm}^2 / (f_{yk} \times A_{sr,req} / A_{sr,prov}), 1.5) = 1.5$$

Limiting span to depth ratio - exp.7.16.a

$$\min(K_s \times K_b \times [11 + 1.5 \times \sqrt{(f_{ck} / 1 \text{ N/mm}^2)} \times \rho_0 / \rho + 3.2 \times \sqrt{(f_{ck} / 1 \text{ N/mm}^2)} \times (\rho_0 / \rho - 1)^{3/2}], 40 \times K_b) = 16$$

Actual span to depth ratio

$$h_{stem} / d = 12$$

PASS - Span to depth ratio is less than deflection control limit**Crack control - Section 7.3**

Limiting crack width

$$w_{max} = 0.3 \text{ mm}$$

Variable load factor - EN1990 – Table A1.1

$$\psi_2 = 0.6$$

Serviceability bending moment

$$M_{sls} = 56.3 \text{ kNm/m}$$

Tensile stress in reinforcement

$$\sigma_s = M_{sls} / (A_{sr,prov} \times z) = 110.3 \text{ N/mm}^2$$



Load duration

Long term

Load duration factor

 $k_t = 0.4$

Effective area of concrete in tension

 $A_{c,eff} = \min(2.5 \times (h - d), (h - x) / 3, h / 2)$ $A_{c,eff} = 105542 \text{ mm}^2/\text{m}$

Mean value of concrete tensile strength

 $f_{ct,eff} = f_{ctm} = 3.0 \text{ N/mm}^2$

Reinforcement ratio

 $\rho_{p,eff} = A_{sr,prov} / A_{c,eff} = 0.019$

Modular ratio

 $\alpha_e = E_s / E_{cm} = 5.998$

Bond property coefficient

 $k_1 = 0.8$

Strain distribution coefficient

 $k_2 = 0.5$ $k_3 = 3.4$ $k_4 = 0.425$

Maximum crack spacing - exp.7.11

 $s_{r,max} = k_3 \times C_{sr} + k_1 \times k_2 \times k_4 \times \phi_{sr} / \rho_{p,eff} = 398 \text{ mm}$

Maximum crack width - exp.7.8

 $w_k = s_{r,max} \times \max(\sigma_s - k_t \times (f_{ct,eff} / \rho_{p,eff}) \times (1 + \alpha_e \times \rho_{p,eff}), 0.6 \times \sigma_s) / E_s$ $w_k = 0.132 \text{ mm}$ $w_k / w_{max} = 0.439$ **PASS - Maximum crack width is less than limiting crack width****Rectangular section in shear - Section 6.2**

Design shear force

 $V = 74 \text{ kN/m}$ $C_{Rd,c} = 0.18 / \gamma_C = 0.120$ $k = \min(1 + \sqrt{200 \text{ mm} / d}, 2) = 1.865$

Longitudinal reinforcement ratio

 $\rho_l = \min(A_{sr,prov} / d, 0.02) = 0.008$ $v_{min} = 0.035 \text{ N}^{1/2}/\text{mm} \times k^{3/2} \times f_{ck}^{0.5} = 0.504 \text{ N/mm}^2$

Design shear resistance - exp.6.2a & 6.2b

 $V_{Rd,c} = \max(C_{Rd,c} \times k \times (100 \text{ N}^2/\text{mm}^4 \times \rho_l \times f_{ck})^{1/3}, v_{min}) \times d$ $V_{Rd,c} = 172.6 \text{ kN/m}$ $V / V_{Rd,c} = 0.429$ **PASS - Design shear resistance exceeds design shear force****Check stem design at 1000 mm**

Depth of section

 $h = 350 \text{ mm}$ **Rectangular section in flexure - Section 6.1**

Design bending moment combination 1

 $M = 25.3 \text{ kNm/m}$

Depth to tension reinforcement

 $d = h - C_{sr} - \phi_{sr1} / 2 = 269 \text{ mm}$ $K = M / (d^2 \times f_{ck}) = 0.011$ $K' = (2 \times \eta \times \alpha_{cc} / \gamma_C) \times (1 - \lambda \times (\delta - K_1) / (2 \times K_2)) \times (\lambda \times (\delta - K_1) / (2 \times$ $K_2))$ $K' = 0.207$ **K' > K - No compression reinforcement is required**



Lever arm

$$z = \min(0.5 + 0.5 \times (1 - 2 \times K / (\eta \times \alpha_{cc} / \gamma_c))^{0.5}, 0.95) \times d = \mathbf{256}$$

mm

Depth of neutral axis

$$x = 2.5 \times (d - z) = \mathbf{34} \text{ mm}$$

Area of tension reinforcement required

$$A_{sr1,req} = M / (f_{yd} \times z) = \mathbf{228} \text{ mm}^2/\text{m}$$

Tension reinforcement provided

$$12 \text{ dia.bars @ } 100 \text{ c/c}$$

Area of tension reinforcement provided

$$A_{sr1,prov} = \pi \times \phi_{sr1}^2 / (4 \times s_{sr1}) = \mathbf{1131} \text{ mm}^2/\text{m}$$

Minimum area of reinforcement - exp.9.1N $A_{sr1,min} = \max(0.26 \times f_{ctm} / f_{yk}, 0.0013) \times d = \mathbf{423} \text{ mm}^2/\text{m}$

Maximum area of reinforcement - cl.9.2.1.1(3)

$$A_{sr1,max} = 0.04 \times h = \mathbf{14000}$$

mm²/m

$$\max(A_{sr1,req}, A_{sr1,min}) / A_{sr1,prov} = \mathbf{0.374}$$

PASS - Area of reinforcement provided is greater than area of reinforcement required

Library item: Rectangular single output

Deflection control - Section 7.4

Reference reinforcement ratio

$$\rho_0 = \sqrt[3]{(f_{ck} / 1 \text{ N/mm}^2)} / 1000 = \mathbf{0.006}$$

Required tension reinforcement ratio

$$\rho = A_{sr1,req} / d = \mathbf{0.001}$$

Required compression reinforcement ratio

$$\rho' = A_{sr1,2,req} / d_2 = \mathbf{0.000}$$

Structural system factor - Table 7.4N

$$K_b = \mathbf{0.4}$$

Reinforcement factor - exp.7.17

$$K_s = \min(500 \text{ N/mm}^2 / (f_{yk} \times A_{sr1,req} / A_{sr1,prov}), 1.5) = \mathbf{1.5}$$

Limiting span to depth ratio - exp.7.16.a

$$\min(K_s \times K_b \times [11 + 1.5 \times \sqrt[3]{(f_{ck} / 1 \text{ N/mm}^2)} \times \rho_0 / \rho + 3.2 \times \sqrt[3]{(f_{ck} / 1 \text{ N/mm}^2)} \times (\rho_0 / \rho - 1)^{3/2}], 40 \times K_b) = \mathbf{16}$$

Actual span to depth ratio

$$(h_{stem} - 1000 \text{ mm}) / d = \mathbf{8.2}$$

PASS - Span to depth ratio is less than deflection control limit

Crack control - Section 7.3

Limiting crack width

$$w_{max} = \mathbf{0.3} \text{ mm}$$

Variable load factor - EN1990 – Table A1.1

$$\psi_2 = \mathbf{0.6}$$

Serviceability bending moment

$$M_{sls} = \mathbf{18} \text{ kNm/m}$$

Tensile stress in reinforcement

$$\sigma_s = M_{sls} / (A_{sr1,prov} \times z) = \mathbf{62.4} \text{ N/mm}^2$$

Load duration

Long term

Load duration factor

$$k_1 = \mathbf{0.4}$$

Effective area of concrete in tension

$$A_{c,eff} = \min(2.5 \times (h - d), (h - x) / 3, h / 2)$$

$$A_{c,eff} = \mathbf{105458} \text{ mm}^2/\text{m}$$

Mean value of concrete tensile strength

$$f_{ct,eff} = f_{ctm} = \mathbf{3.0} \text{ N/mm}^2$$

Reinforcement ratio

$$\rho_{p,eff} = A_{sr1,prov} / A_{c,eff} = \mathbf{0.011}$$

Modular ratio

$$\alpha_e = E_s / E_{cm} = \mathbf{5.998}$$

Bond property coefficient

$$k_1 = \mathbf{0.8}$$

Strain distribution coefficient

$$k_2 = \mathbf{0.5}$$

$$k_3 = \mathbf{3.4}$$

$$k_4 = \mathbf{0.425}$$

Maximum crack spacing - exp.7.11

$$s_{r,max} = k_3 \times C_{sr} + k_1 \times k_2 \times k_4 \times \phi_{sr1} / \rho_{p,eff} = \mathbf{445} \text{ mm}$$



Maximum crack width - exp.7.8

$$w_k = s_{r,max} \times \max(\sigma_s - k_t \times (f_{ct,eff} / \rho_{p,eff}) \times (1 + \alpha_e \times \rho_{p,eff}), 0.6 \times \sigma_s) / E_s$$

$$w_k = \mathbf{0.083 \text{ mm}}$$

$$w_k / w_{max} = \mathbf{0.278}$$

PASS - Maximum crack width is less than limiting crack width**Rectangular section in shear - Section 6.2**

Design shear force

$$V = \mathbf{34.1 \text{ kN/m}}$$

$$C_{Rd,c} = 0.18 / \gamma_C = \mathbf{0.120}$$

$$k = \min(1 + \sqrt{(200 \text{ mm} / d)}, 2) = \mathbf{1.862}$$

Longitudinal reinforcement ratio

$$\rho_l = \min(A_{srl,prov} / d, 0.02) = \mathbf{0.004}$$

$$v_{min} = 0.035 \text{ N}^{1/2}/\text{mm} \times k^{3/2} \times f_{ck}^{0.5} = \mathbf{0.503 \text{ N/mm}^2}$$

Design shear resistance - exp.6.2a & 6.2b

$$V_{Rd,c} = \max(C_{Rd,c} \times k \times (100 \text{ N}^2/\text{mm}^4 \times \rho_l \times f_{ck})^{1/3}, v_{min}) \times d$$

$$V_{Rd,c} = \mathbf{143 \text{ kN/m}}$$

$$V / V_{Rd,c} = \mathbf{0.238}$$

PASS - Design shear resistance exceeds design shear force**Horizontal reinforcement parallel to face of stem - Section 9.6**

Minimum area of reinforcement - cl.9.6.3(1)

$$A_{sx,req} = \max(0.25 \times A_{sr,prov},$$

$$0.001 \times t_{stem}) = \mathbf{503 \text{ mm}^2/\text{m}}$$

Maximum spacing of reinforcement - cl.9.6.3(2)

$$s_{sx,max} = \mathbf{400 \text{ mm}}$$

Transverse reinforcement provided

$$8 \text{ dia.bars @ } 100 \text{ c/c}$$

Area of transverse reinforcement provided $A_{sx,prov} = \pi \times \phi_{sx}^2 / (4 \times s_{sx}) = \mathbf{503 \text{ mm}^2/\text{m}}$ **PASS - Area of reinforcement provided is greater than area of reinforcement required****Check base design at toe**

Depth of section

$$h = \mathbf{350 \text{ mm}}$$

Rectangular section in flexure - Section 6.1

Design bending moment combination 1

$$M = \mathbf{100.6 \text{ kNm/m}}$$

Depth to tension reinforcement

$$d = h - c_{bb} - \phi_{bb} / 2 = \mathbf{267 \text{ mm}}$$

$$K = M / (d^2 \times f_{ck}) = \mathbf{0.044}$$

$$K' = (2 \times \eta \times \alpha_{cc} / \gamma_C) \times (1 - \lambda \times (\delta - K_1) / (2 \times K_2)) \times (\lambda \times (\delta - K_1) / (2 \times$$

K₂))

$$K' = \mathbf{0.207}$$

K' > K - No compression reinforcement is required

Lever arm

$$z = \min(0.5 + 0.5 \times (1 - 2 \times K / (\eta \times \alpha_{cc} / \gamma_C))^{0.5}, 0.95) \times d = \mathbf{254}$$

mm

Depth of neutral axis

$$x = 2.5 \times (d - z) = \mathbf{33 \text{ mm}}$$

Area of tension reinforcement required

$$A_{bb,req} = M / (f_{yd} \times z) = \mathbf{912 \text{ mm}^2/\text{m}}$$

Tension reinforcement provided

$$16 \text{ dia.bars @ } 100 \text{ c/c}$$

Area of tension reinforcement provided

$$A_{bb,prov} = \pi \times \phi_{bb}^2 / (4 \times s_{bb}) = \mathbf{2011 \text{ mm}^2/\text{m}}$$



Minimum area of reinforcement - exp.9.1N $A_{bb,min} = \max(0.26 \times f_{ctm} / f_{yk}, 0.0013) \times d = 420 \text{ mm}^2/\text{m}$

Maximum area of reinforcement - cl.9.2.1.1(3)

$A_{bb,max} = 0.04 \times h = 14000$

mm^2/m

$\max(A_{bb,req}, A_{bb,min}) / A_{bb,prov} = 0.454$

PASS - Area of reinforcement provided is greater than area of reinforcement required

Library item: Rectangular single output

Crack control - Section 7.3

Limiting crack width

$w_{max} = 0.3 \text{ mm}$

Variable load factor - EN1990 – Table A1.1

$\psi_2 = 0.6$

Serviceability bending moment

$M_{sls} = 74 \text{ kNm/m}$

Tensile stress in reinforcement

$\sigma_s = M_{sls} / (A_{bb,prov} \times z) = 145.2 \text{ N/mm}^2$

Load duration

Long term

Load duration factor

$k_1 = 0.4$

Effective area of concrete in tension

$A_{c,eff} = \min(2.5 \times (h - d), (h - x) / 3, h / 2)$

$A_{c,eff} = 105542 \text{ mm}^2/\text{m}$

Mean value of concrete tensile strength

$f_{ct,eff} = f_{ctm} = 3.0 \text{ N/mm}^2$

Reinforcement ratio

$\rho_{p,eff} = A_{bb,prov} / A_{c,eff} = 0.019$

Modular ratio

$\alpha_e = E_s / E_{cm} = 5.998$

Bond property coefficient

$k_1 = 0.8$

Strain distribution coefficient

$k_2 = 0.5$

$k_3 = 3.4$

$k_4 = 0.425$

Maximum crack spacing - exp.7.11

$s_{r,max} = k_3 \times C_{bb} + k_1 \times k_2 \times k_4 \times \phi_{bb} / \rho_{p,eff} = 398 \text{ mm}$

Maximum crack width - exp.7.8

$w_k = s_{r,max} \times \max(\sigma_s - k_t \times (f_{ct,eff} / \rho_{p,eff}) \times (1 + \alpha_e \times \rho_{p,eff}), 0.6 \times \sigma_s) / E_s$

$w_k = 0.173 \text{ mm}$

$w_k / w_{max} = 0.577$

PASS - Maximum crack width is less than limiting crack width

Rectangular section in shear - Section 6.2

Design shear force

$V = 139.6 \text{ kN/m}$

$C_{Rd,c} = 0.18 / \gamma_c = 0.120$

$k = \min(1 + \sqrt{200 \text{ mm} / d}, 2) = 1.865$

Longitudinal reinforcement ratio

$\rho_l = \min(A_{bb,prov} / d, 0.02) = 0.008$

$v_{min} = 0.035 \text{ N}^{1/2}/\text{mm} \times k^{3/2} \times f_{ck}^{0.5} = 0.504 \text{ N/mm}^2$

Design shear resistance - exp.6.2a & 6.2b

$V_{Rd,c} = \max(C_{Rd,c} \times k \times (100 \text{ N}^2/\text{mm}^4 \times \rho_l \times f_{ck})^{1/3}, v_{min}) \times d$

$V_{Rd,c} = 172.6 \text{ kN/m}$

$V / V_{Rd,c} = 0.809$

PASS - Design shear resistance exceeds design shear force

Secondary transverse reinforcement to base - Section 9.3



Minimum area of reinforcement – cl.9.3.1.1(2)

$$A_{bx,req} = 0.2 \times A_{bb,prov} = \mathbf{402}$$

mm²/m

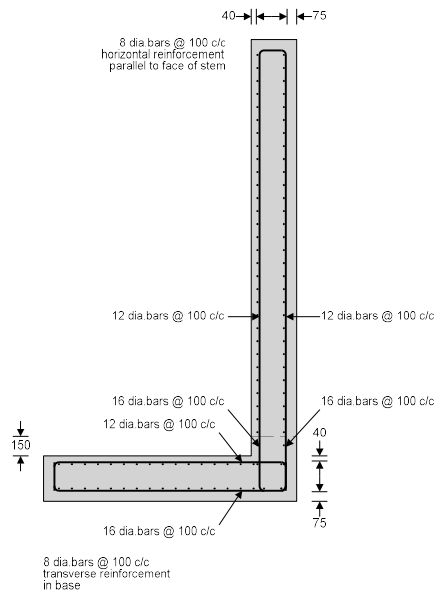
Maximum spacing of reinforcement – cl.9.3.1.1(3)

$$s_{bx,max} = \mathbf{450 \text{ mm}}$$

Transverse reinforcement provided 8 dia.bars @ 100 c/c

Area of transverse reinforcement provided $A_{bx,prov} = \pi \times \phi_{bx}^2 / (4 \times s_{bx}) = \mathbf{503 \text{ mm}^2/\text{m}}$

PASS - Area of reinforcement provided is greater than area of reinforcement required



Reinforcement details

Appendix B: Construction Programme

The following is intended as a guide to inform the Planning application only. The Contractor is responsible for the final construction programme

Outline Construction Programme (For planning purposes only)																
	Months															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Planning approval																
Detailed Design																
Tender																
Party Walls																
Monitoring of Adjacent structures																
Enabling works																
Basement Construction																
Superstructure construction																

Appendix C : Utilities Searches



CROFT
STRUCTURAL
ENGINEERS



Network Records NetMAP Symbols Booklet - East of England

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:-

Page no:	Contents:
1	Guidance notes.
2	The area covered by this guide.
3	<u>1:500 view</u>
4	Scenery.
7	Scenery (UK Power Networks use only).
8	Primary distribution cables (EHV).
9	Secondary distribution cables (HV/LV).
10	Service cables/terminations.
11	Cable ducts.
13	EHV/HV/LV sites.
14	Mains joints.
15	Service joints.
17	Cross sections.
17	Common abbreviations/terminology (all views).
19	<u>1:2500 (LV) & 1:10000 (HV) network views</u> (UK Power Networks use only).
20	General.
22	1:2500 scale LV network.
22	1:10000 scale HV network.
23	<u>LV network diagram view</u> (UK Power Networks use only).
24	Overhead lines.
25	Underground cables.
26	Joints.
26	Substations/pole transformers.

Guidance notes.

Important notice:

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

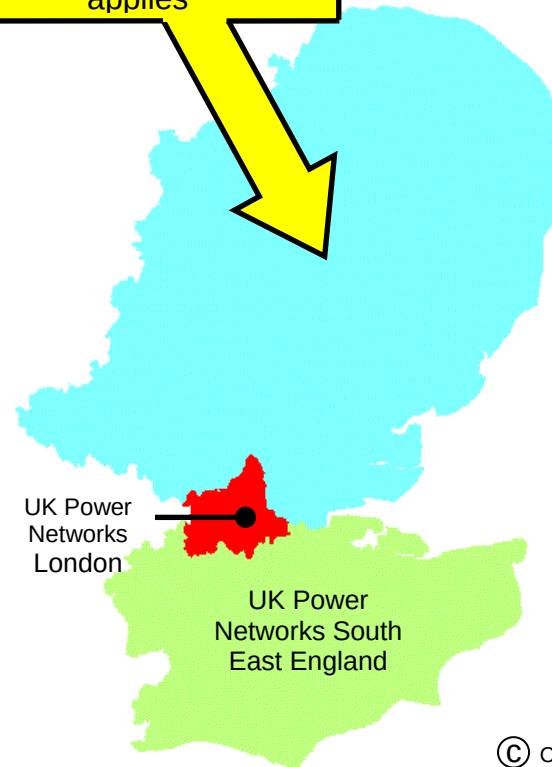
- The position of apparatus shown on NetMAP is believed to be correct, but the original landmarks may have altered since the apparatus was installed.
- It must be assumed that there is at least one service to each property, lamp column, street sign etc.
- All cables must be treated as live, unless proven otherwise by an authorised UK Power Networks representative.
- Third party cables are not usually shown. In cases of doubt, please telephone 08000 565866.
- 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 document.
- All LV cables are assumed to be 4 core, and all HV cables assumed to be 3 core unless otherwise stated.



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

The area covered by this guide:

**UK Power Networks
East of England.**
This is the only area
where this document
applies



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1:500 view - underground network

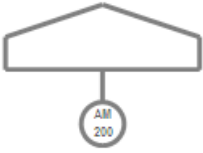
Scenery

NetMAP system	Scanned image	Description
		100 metre Ordnance Survey grid line (on O/S based maps only.)
		Property fence line
		Building line
		Kerb line
		Electrical Boundary

Scenery - for UK Power Networks use only - boxed in red

NetMAP system	Scanned image	Description
	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 UK Power Networks and their immediate contractors)
	Not applicable	High pressure pipelines in the general vicinity (only visible to 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 excavation 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

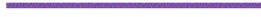
Scenery for UK Power Networks use only - boxed in red		
NetMAP system	Scanned image	Description
	Not applicable	Historical - Scheduled Monuments (only visible to UK Power Networks and their immediate contractors)
	Not applicable	Historical - Parks and Gardens (only visible to UK Power Networks and their immediate contractors)
	Not applicable	Historical - Areas of Archaeological Potential (AAP) (only visible to E 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 to UK Power Networks and their immediate contractors)
		Nature - Site of Special and Scientific Interest (SSSI) (only visible to UK Power Networks and their immediate contractors)
section continued on next page		

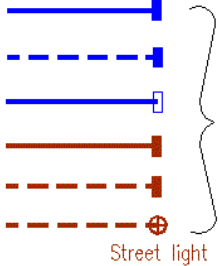
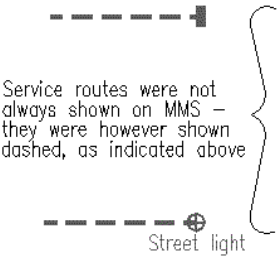
Scenery for UK Power Networks use only - boxed in red		
NetMAP system	Scanned image	Description
	Not applicable	Nature - Local Nature Reserve (only visible to UK Power Networks and their immediate contractors)
	Not applicable	Nature - National Nature Reserve (only visible to UK Power Networks and their 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)

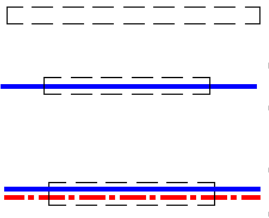
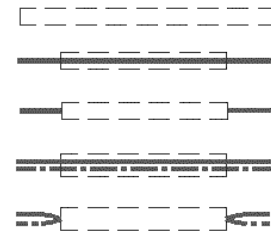
Primary distribution cables (1:500 view)

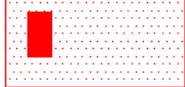
NetMAP system	Scanned image	Description
		Over 33kV and up to 132kV
		Over 11kV and up to 33kV

Secondary distribution cables (1:500 view)

NetMAP system	Scanned image	Description
		Over 230/400V and up to 11kV (HV) cable route
		230/400V (LV) cable route
		Pilot cable route
(Only shown this way if independent from HV cable route)		
Abandoned cables are shown and labelled as such when applicable		

Service cables and terminations (1:500 view)		
NetMAP system	Scanned image	Description
		3 phase service with termination 3 phase service with termination (unknown route) 3 phase service with multi-head termination Single phase service with termination Single phase service with termination (route unknown) Street lighting cable and termination

Cable ducts (1:500 view)		
NetMAP system	Scanned image	Description
		Empty duct Cable(s) in duct(s) Cable(s) in duct(s) (on some raster maps) Multiple cables in ducts Multiple cables in ducts (on some raster maps)

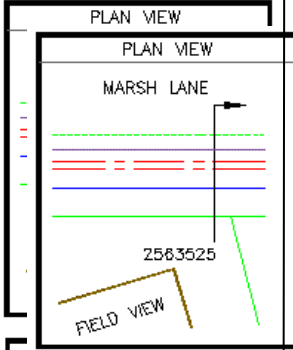
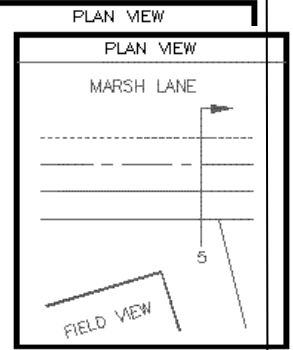
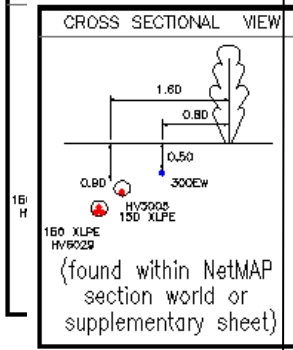
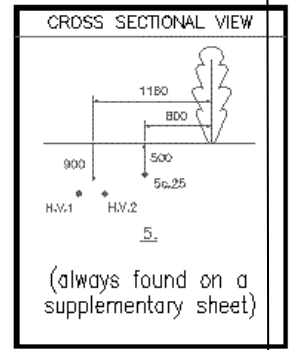
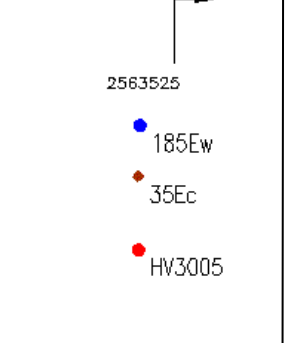
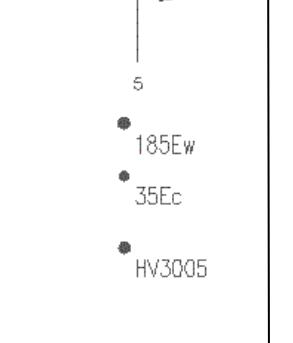
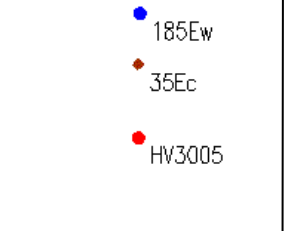
EHV, HV and LV sites (1:500 view)		
NetMAP system	Scanned image	Description
COLCHESTER GRID 	COLCHESTER GRID 	Primary substation
HIGH STREET 	 HIGH STREET  HIGH STREET	Secondary substation
		Pad mounted substation
		Link box – 2 way
		Link box – 4 way (6 way etc shown similarly)
		Feeder pillar – 4 way (6 way etc shown similarly)
CHURCH RD 	CHURCH RD 	Pole transformer
 3	 3	Poles on underground records
		
		H pole, any voltage
		Service turret (solid type)
section continued on next page		

EHV, HV and LV sites continued (1:500 view)		
NetMAP system	Scanned image	Description
No NetMAP equivalent  CAUTION Missing Information	 No equivalent	Service turret (with link facility on LV main) Missing data in or near this location
 Contaminated Land refer to SHE 01 016	Not applicable	Contaminated land reference

Mains joints (1:500 view)		
NetMAP system	Scanned image	Description
(voltage indicated by colour/line-style)		
		Straight joint
		Crutch joint
		Straight crutch joint
		Pot end
		Pot end – on one of several cables – single line representation
		Branch joint/pot end – (humpty back joint, back to back joint, bull nose joint or stub joint)
		Sleeve repair or repair joint
		Cut end
		Capped end
		Tee joint
	NetMAP/vector only	Sicame joint box

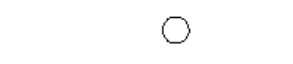
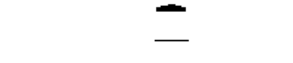
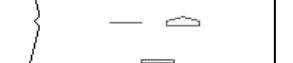
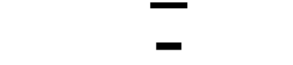
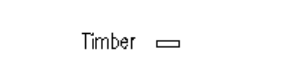
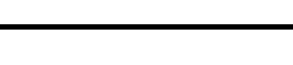
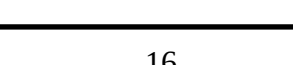
Service joints (1:500 view)		
NetMAP system	Scanned image	Description
Please note that 3 phase services are shown blue, and single phase services are shown brown		
		Straight joint
		Service joint to main
		Pot end

Cross sections (1:500 view)

NetMAP system	Scanned image	Description
		Single line representational plan view with NetMAP equivalent (please note the use of separate line for each voltage on the raster/MMS data)
 (found within NetMAP section world or supplementary sheet)	 (always found on a supplementary sheet)	Cross sectional view of above
		Section arrow with old/new numbering system – points in direction section is viewed
		LV/3 phase service cable Single phase service cable with size annotation HV cable – 3 core with route number annotation

section continued on next page

Cross sections continued (1:500 view)

NetMAP system	Scanned image	Description
		HV cable – modern EPR, Plam and Triplex with route number annotation
		Pilot cable
		33kV cable
		132kV cable
		Single duct
		6 way duct formation – irrespective of duct type and material, all are displayed similarly
		Protective slab
		Tiles
		Concrete slabs
		33kV fibre warning board
		Steel plate
		Plastic tile tape
		Timber

Common abbreviations and terminology (all views)

Abbrev.	Description	Abbrev.	Description
1c	Single core	Cut out or C/O	Meter/main fuse position
1ph	Single phase	cx	Triplex (copper)
2c	Two core	DE	Direct earth
3c	Three core	DSTA	Double steel tape armoured
3ph	Three phase	Ea	Alpex cable
ABC	Aerial bunched (bundled) conductor (modern LV overhead line)	EFI	Earth fault passage indicator
ABI	Air break isolator (no fuses)	EHV	Extra high voltage (11,001 Volts and over)
ABSD	Air break switch disconnect	ELCB	Earth leakage circuit breaker
ACCS	Aluminium concentric copper sheathed	ELT	Earth leakage trip
Al	Aluminium	EPR	Ethylene propylene rubber
AR	Auto recloser	Ew	Waveform cable
ASL	Automatic sectionalising links	E/W	Earthenware duct or earth wire
ax	Triplex (aluminium) 2 x 22mm AL PVC (example) Duplex 3 x 22mm AL PVC (example) Triplex	Fdr or Feeder	LV or HV cable fed by or feeding a substation
CB	Circuit breaker	F/G	Fuse gear
c/c	Concentric cores	F/P	Feeder pillar
ccc	Compact covered conductor	GRP	Fibreglass substation
CCT	Circuit	GVR	Gas vacuum recloser or pole mounted circuit breaker
CNE	Combined neutral and earth	HV	High voltage (1,001 – 11,000 Volts incl)
Cross phased	The core colour may be different to originating transformer phasing	HYBRID	Modern plastic cable with mixed conductor material (Al/Cu)
CS	Consac	Insulation	Electrically protective material surrounding a conductor
CSE	Cable sheath earth	Insulator	Porcelain or glass overhead line support (on poles)
Cu	Copper	ITC	Instrument traced cable or ITC - cable traced electronically using Cable Avoidance Tool (CAT) or similar

section continued on next page

Common abbreviations and terminology continued (all views)

Abbrev.	Description	Abbrev.	Description
Jumper	Connecting lead between open points, section points and overhead plant	PICAS	Paper insulated corrugated aluminium sheath armoured
kV	Kilovolt (or 1,000 Volts) – unit of electrical pressure	PILC	Paper insulated lead covered
kW	Kilowatt (1,000 Watts) – unit of electrical power	PILSTA	Paper insulated lead covered steel tape armoured cable
kVA	Kilovolt Amps or power	PL	Plain lead or public lighting
Link box or LB	Means of connecting LV feeders together using links or fuses	PME	Protected multiple earth or CNE
LSF	Low smoke & fume	PMT	Pole mounted transformer
LV	Low voltage (up to 1,000 Volts incl)	PMR	Pole mounted recloser (generic term for OYT/GVR)
LV Pillar	Low voltage fuse distribution board	PT	Pole transformer
Neutral	Return path of live cable	PVC	Polyvinyl chloride
O/H or OHL	Overhead line	RMU	Ring main unit
OYS	Oil filled pole mounted sectionaliser	RN	Reduced neutral
OYT	Oil filled pole mounted recloser	s/c	Split concentric or single core
PC400	Pole mounted LV fuse unit	S/L	Street light
PE	Pot end or potential end – joint on cable end	S/S	Substation
Phase	Usually the core colour of a cable (caution – may be cross phased) – Red, Yellow, Blue on old cables, or L1, L2, L3 on new cables, for example	STA	Steel tape armoured
		SWA	Steel wire armoured
		T1 or T2 etc	Substation TX setup where more than one TX exists
		T/F or TX	Transformer
		Volts	Unit of electrical pressure
		Watts	Unit of electrical power
		XLPE	Cross linked polyethylene

1:2500 & 1:10000 view - overhead networks - for UK Power Networks use only - boxed in red

General

NetMAP system	Scanned image	Description
		H pole
		Pole

1:2500 scale LV network

NetMAP system	Scanned image	Description
No NetMAP equivalent		132kV cable route
No NetMAP equivalent		33/22kV cable route
No NetMAP equivalent		11kV underground cable
		132kV overhead line
		33kV overhead line dots mark pole position
		11kV overhead line – dots mark pole position
		Dual construction – dots mark pole position
		LV overhead line – dots mark pole position
No NetMAP equivalent		LV underground cable
		Pole and stay
		Pole and strut
		Voltage regulator
		Static balancer
		Example of struts and stays
		Flying stay
		Earthed pole in PME system
261	261	Pole number
		Ground type substation
S.P.	S.P.	Section pole
S.L.	S.L.	Street light

section continued on next page

1:2500 scale LV network continued

NetMAP system	Scanned image	Description
O.R. Stay	O.R. Stay	Outrigger stay
Ext. Brkt	Ext. Brkt	Extension bracket
P. Box	P. Box	Pole box
N.E.	N.E.	Neutral and earth
O.R. Brkt	O.R. Brkt	Outrigger bracket

1:10000 scale HV network

NetMAP system	Scanned image	Description
		132kV overhead line
		33kV overhead line dots mark pole position
		11kV overhead line – dots mark pole position
		11kV overhead line – dual circuit – dots mark pole position
		11kV underground cable and EHV
		Pylon HV or EHV
		Grid line tower
		Stay
		Ground type substation
		Pole type transformer
		Live line taps
		Switchgear – all types
		Fuse gear
		Auto recloser – live line connected

The above circular substation/switchgear symbols may be found that contain different combinations of apparatus (see last example)

LV network diagram view-for UK Power Networks use only-boxed in red

Overhead lines

NetMAP system	Description
	Unknown
	Al
	Cu
	ABC
	Pole link

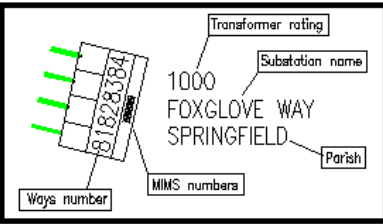
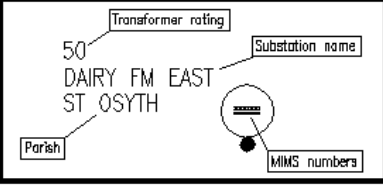
Underground cables (LV network diagram view)

NetMAP system	Description
	Unknown
	Al
	Cu
	CC
	TCC
	Ea
	Ec
	Ecx
	Ew
	LSF
	Other

Joints (LV network diagram view)

NetMAP system	Description
	Pot end or Sicame Box
	Straight joint
	Crutch joint
	3 phase termination

Substations/pole transformers (LV network diagram view)

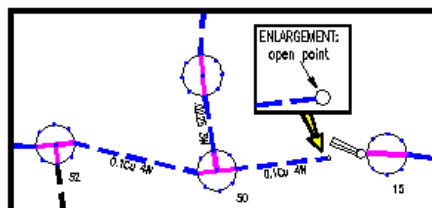
NetMAP system	Description
There are many substation combinations – these are merely a sample of configurations that can be found.            	2 way substation 4 way substation 4 way twin busbar substation 10 way back to back substation Pole transformer (normal) Pole transformer 2 way Pole transformer 3 way Substation with rating, name, Parish and MIMS identifying number Pole transformer with rating, name, Parish and MIMS identifying number Intermediate pole Section pole Overhead fuse

section continued on next page

Substations/pole transformers cont'd (LV network diagram view)

NetMAP system

Description



Overview – the purple lines through the section poles are pole links – these indicate how the network is linked together



2 way link box



3 way link box



4 way link box



4 way double busbar link box



4 way BICC link box



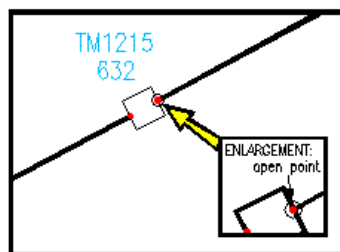
5 way link box



6 way link box



6 way double busbar link box

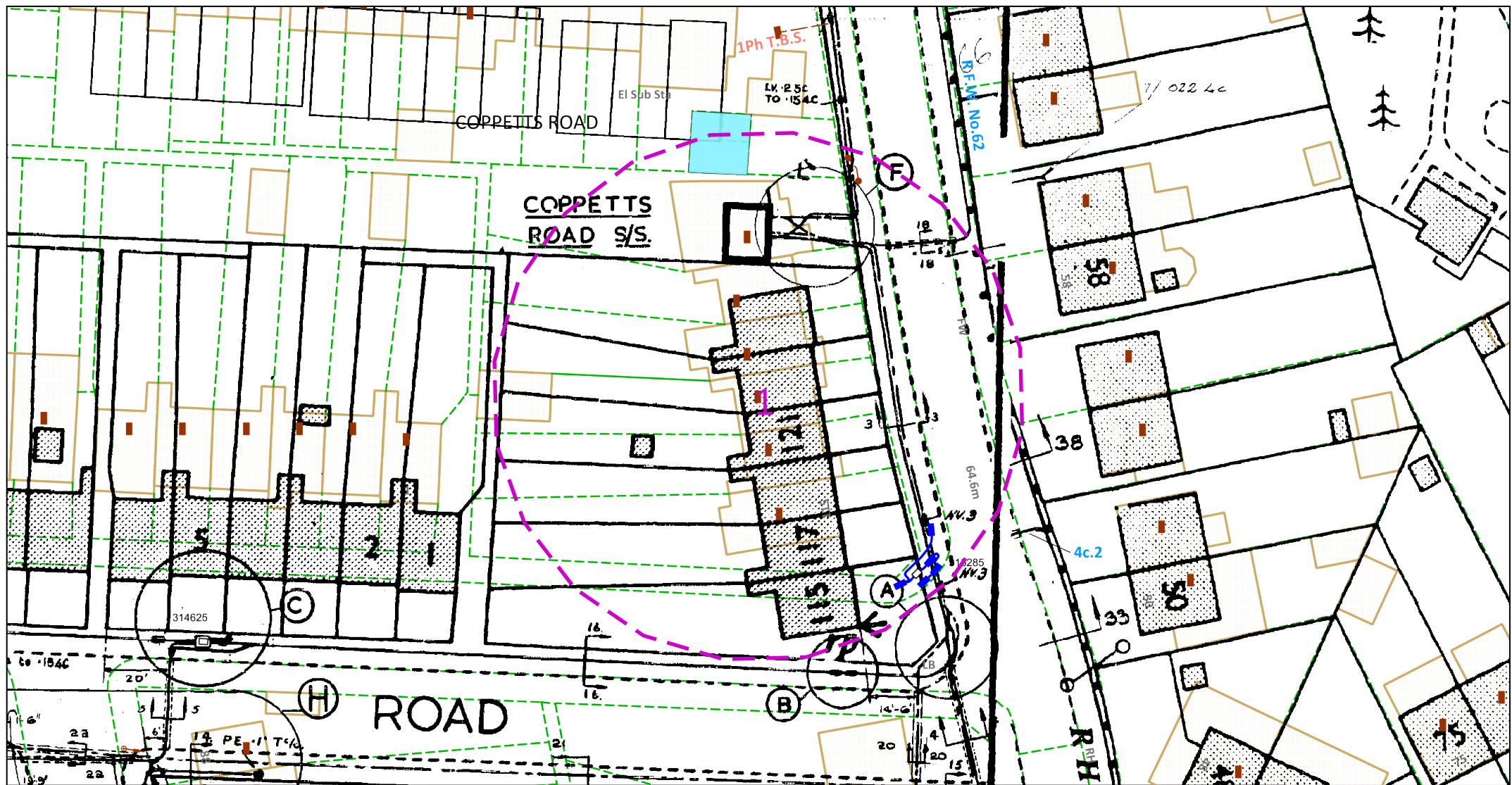


A two way link box with identification number, connected to a cable with an open point



Feeder pillars – these range from 2 ways through to 9 ways – a 9 way and a 2 way are shown as examples





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.

Dig Sites Area: Line:

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

Date Requested: 04/01/2023

Job Reference: 28060460

Site Location: 527952 190631

Requested by: Mr Pawel Rogalewicz

Your Scheme/Reference:

220923

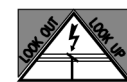
Scale: 1:500 (When plotted at A4)

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.



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.

See Supplemental Diagram TQ2790NEB for Cross-Section 2 details

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.	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.	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

UK Power Networks Feedback Tool

Please help UK Power Networks improve the accuracy of their network records and help make it safer for all those working around them in future.

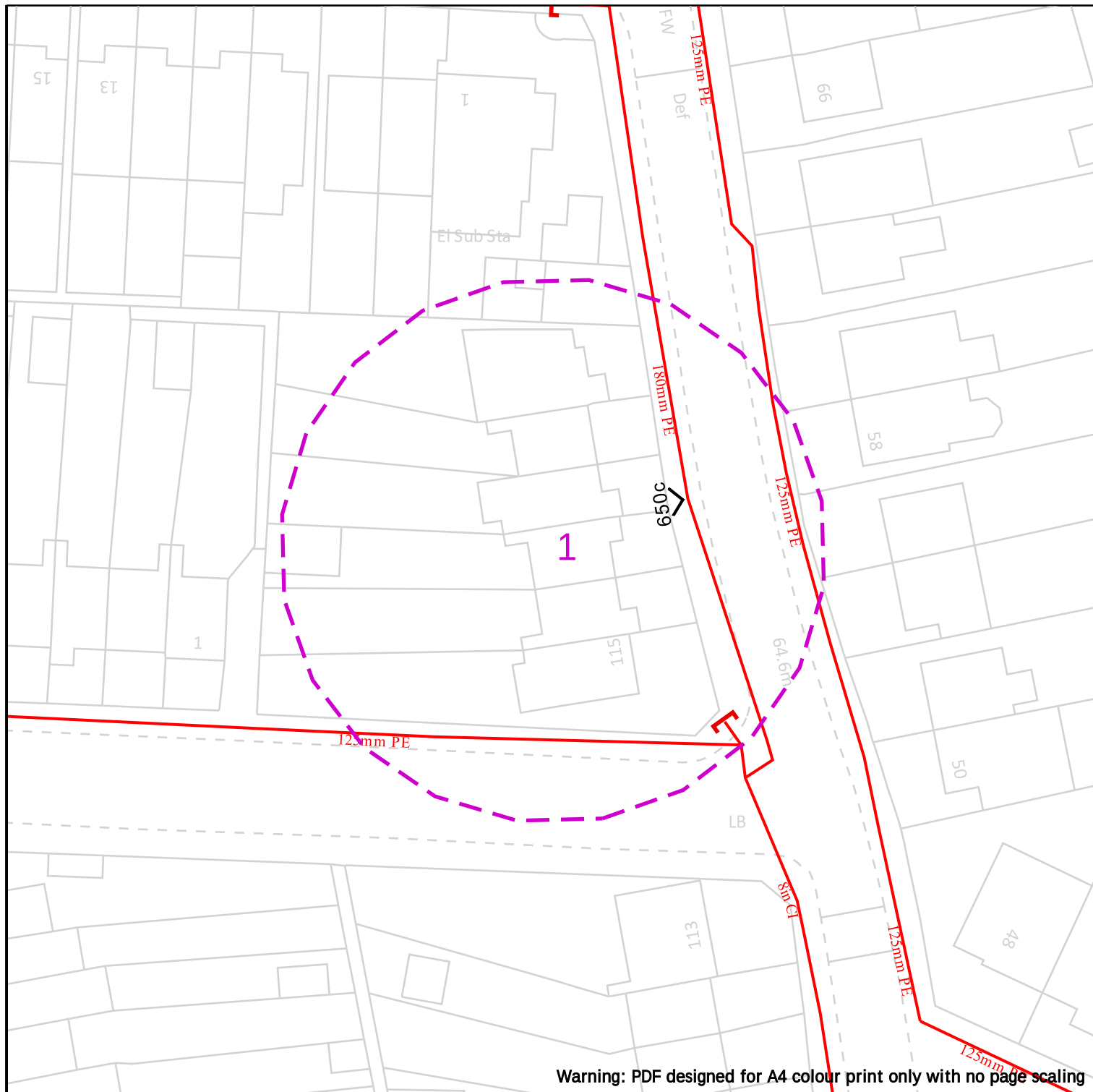
All you need to do is:

1. Use your phone camera to scan the QR code:
2. Provide feedback on what you have found on site (good or bad)
3. Upload a photo if needed

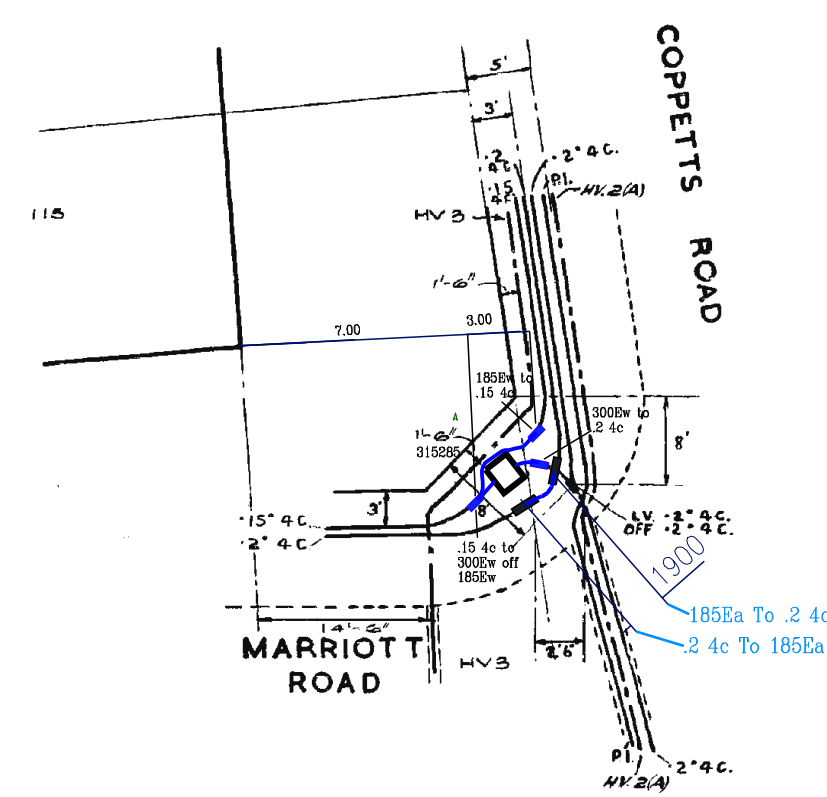


Thank you for making the area a safer place to dig.

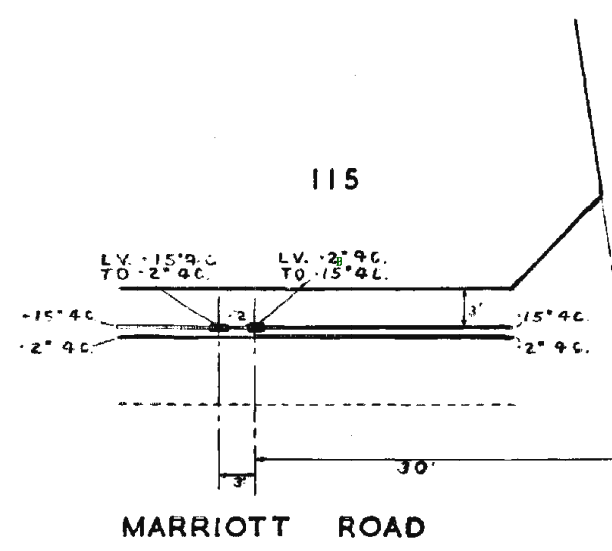
UK Power Networks, working with LSBUD



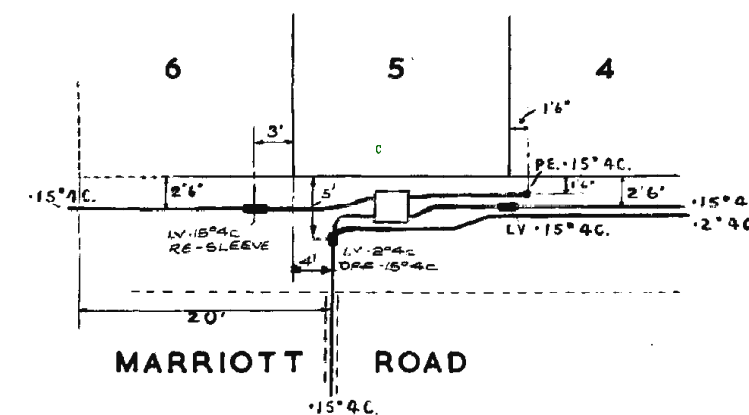
	25m
Cadent Your Gas Network	Dig Sites Area: Line: LP Mains MP Mains IP Mains LHP Mains Valve Depth of cover Syphon Diameter Change Material Change Out of Standard Service
Date Requested: 04/01/2023 Job Reference: 28060460 Site Location: 527977 190656 Requested by: Mr Pawel Rogalewicz Your Scheme/Reference: 220923 View extent: 100m, 100m	IMPORTANT NOTICES This plan shows these pipes owned by Cadent Gas Limited in its role as a Licensed Gas Transporter (GT). Gas pipes owned by other GT's or otherwise privately owned may be present in this area. Information with regards 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 Limited or their agents, servants or contractors for any errors 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.
Scale: 1:500 (When plotted at A4)	In case of emergency call - 0800 111 999 Crown Copyright © - This plan is reproduced from or based on the OS map by Cadent Gas Limited, with the sanction of the controller of HM Stationary Office. Crown Copyright Reserved. Ordnance Survey Licence number 100024886



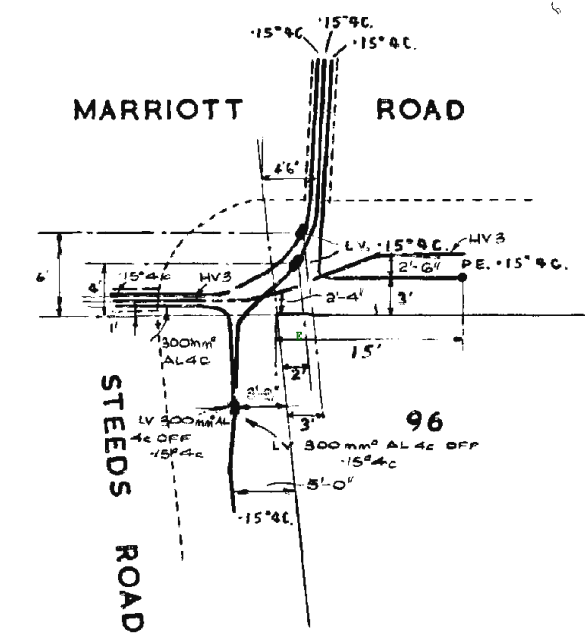
A



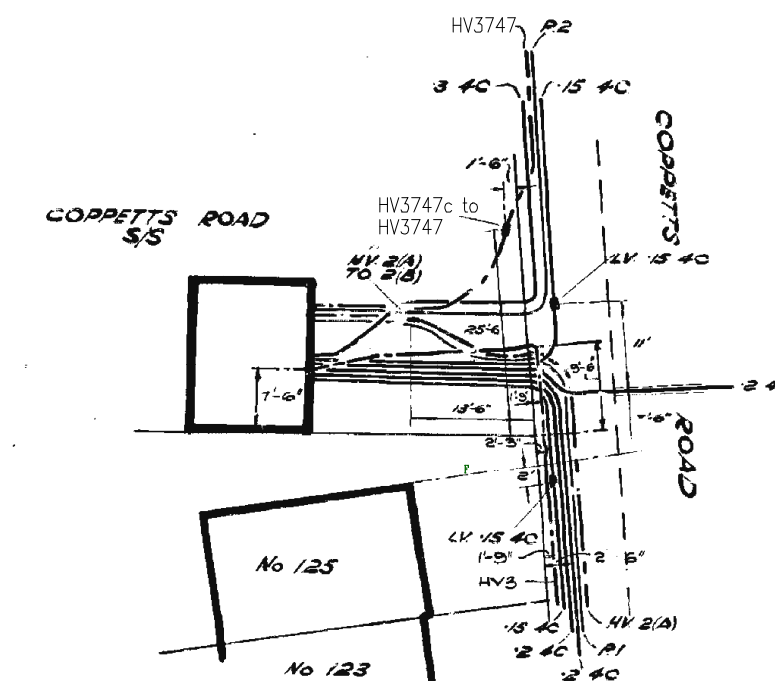
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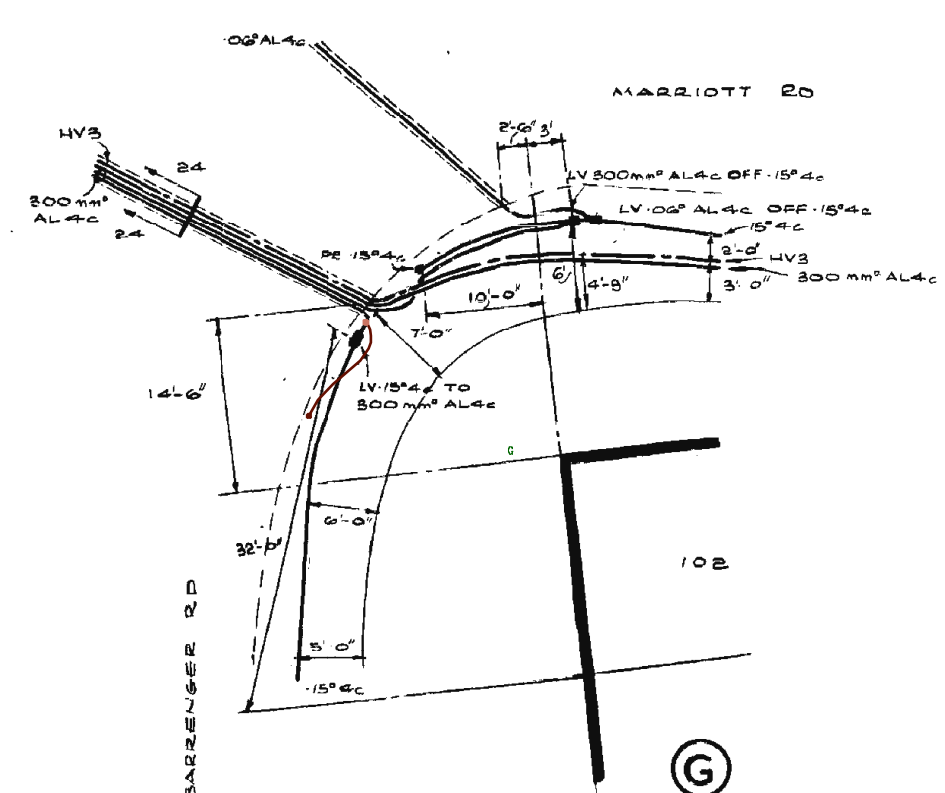
C



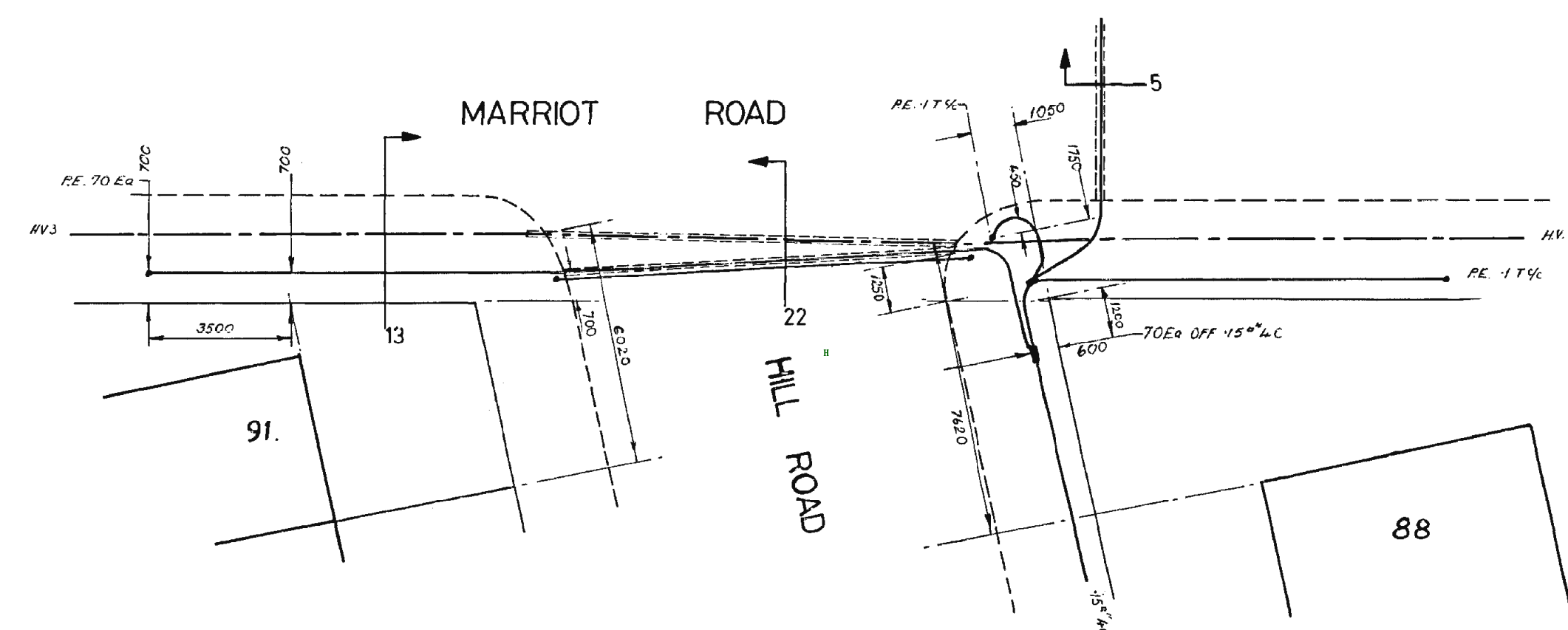
E



F



G



H

Scale 1/125



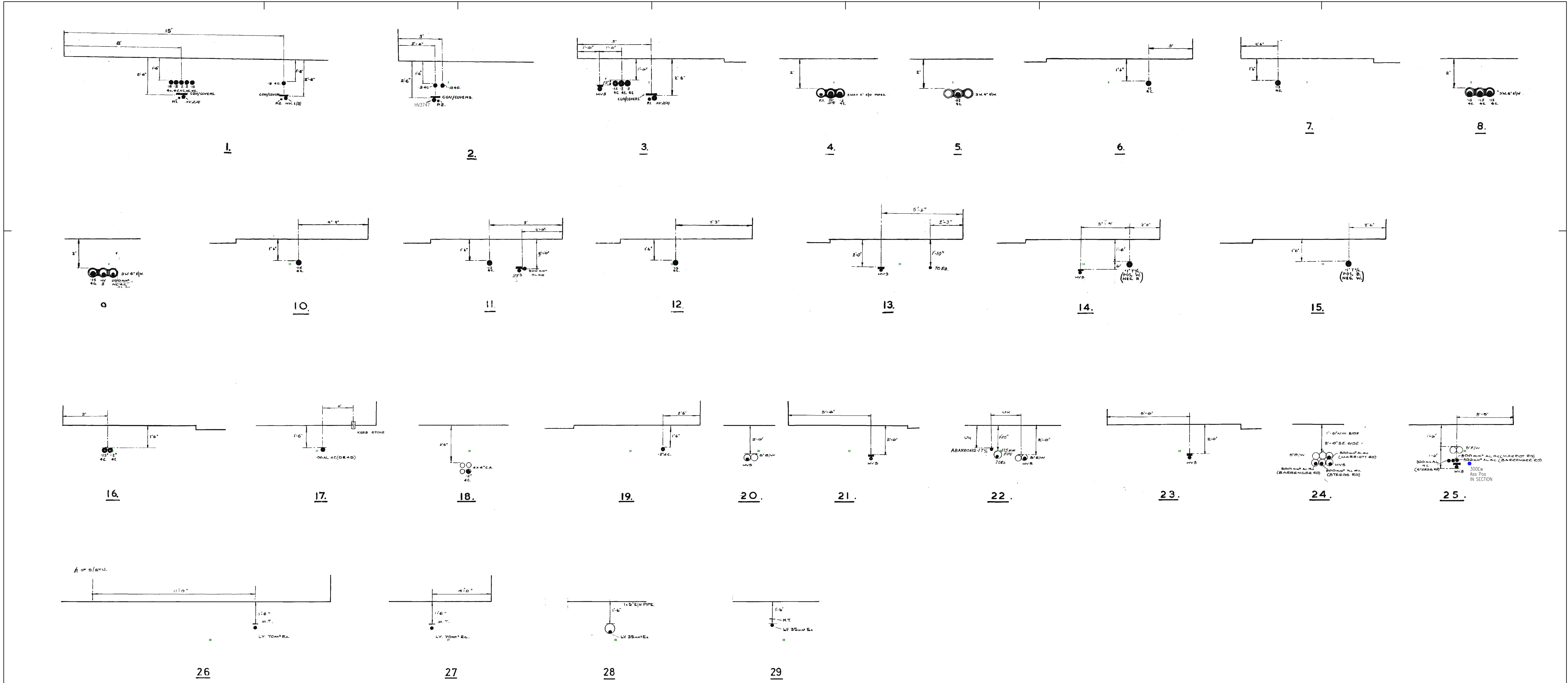
LOCATION
HORNSEY

SHEET No.
TQ2790NEB.s1
SUPPLEMENTARY SHEET No.

ISSUE
B
DATE
06-07-00

REPRODUCED FROM AND BASED UPON THE GRANTANCE
SURVEY MAP WITH PERMISSION OF THE
CONTROLLER OF H.M. STATIONERY OFFICE
DRAWN BY: P. WRIGHT

SERVICES
FOR DETAILS OF SERVICE CABLE
REFERENCE SHOULD BE MADE TO
THE SERVICE CABLES IN THE
LOCAL OFFICE



PILOT CABLES			HIGH VOLTAGE CABLES		
SERIAL NUMBERS REFER TO THIS SHEET ONLY			SERIAL NUMBERS REFER TO THIS SHEET ONLY		
No.	CORES	SIZE	No.	CORES	SIZE
1.	3	1/2"	1.	3	1/2"
2.	3	1/2"	2.	3	1/2"
3.	3	1/2"	3.	3	1/2"
4.	3	1/2"	4.	3	1/2"
5.	3	1/2"	5.	3	1/2"
6.	3	1/2"	6.	3	1/2"
7.	3	1/2"	7.	3	1/2"
8.	3	1/2"	8.	3	1/2"
9.	3	1/2"	9.	3	1/2"
10.	3	1/2"	10.	3	1/2"
11.	3	1/2"	11.	3	1/2"
12.	3	1/2"	12.	3	1/2"
13.	3	1/2"	13.	3	1/2"
14.	3	1/2"	14.	3	1/2"
15.	3	1/2"	15.	3	1/2"
16.	3	1/2"	16.	3	1/2"
17.	3	1/2"	17.	3	1/2"
18.	3	1/2"	18.	3	1/2"
19.	3	1/2"	19.	3	1/2"
20.	3	1/2"	20.	3	1/2"
21.	3	1/2"	21.	3	1/2"
22.	3	1/2"	22.	3	1/2"
23.	3	1/2"	23.	3	1/2"
24.	3	1/2"	24.	3	1/2"
25.	3	1/2"	25.	3	1/2"
26.	3	1/2"	26.	3	1/2"
27.	3	1/2"	27.	3	1/2"
28.	3	1/2"	28.	3	1/2"
29.	3	1/2"	29.	3	1/2"

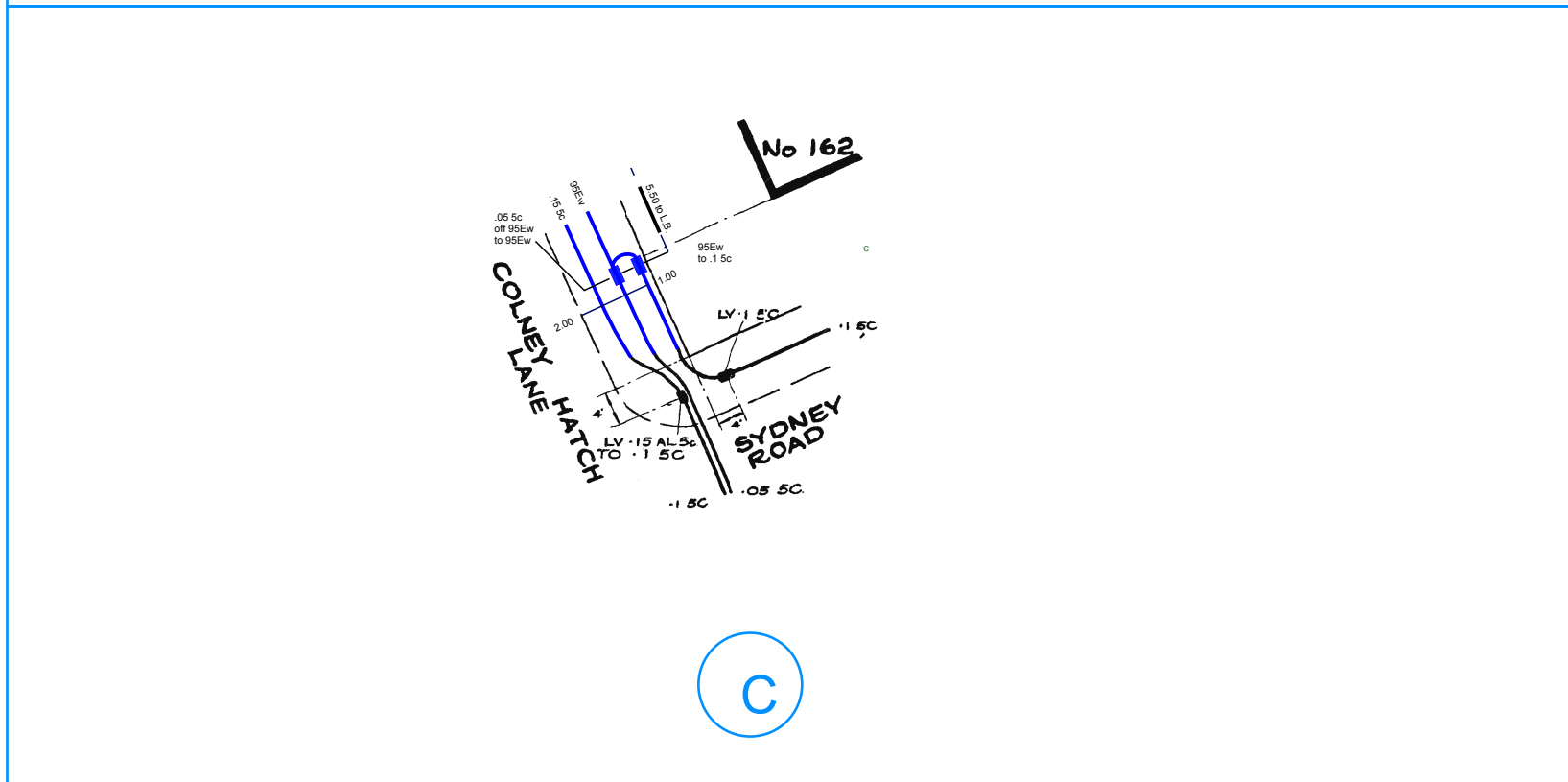
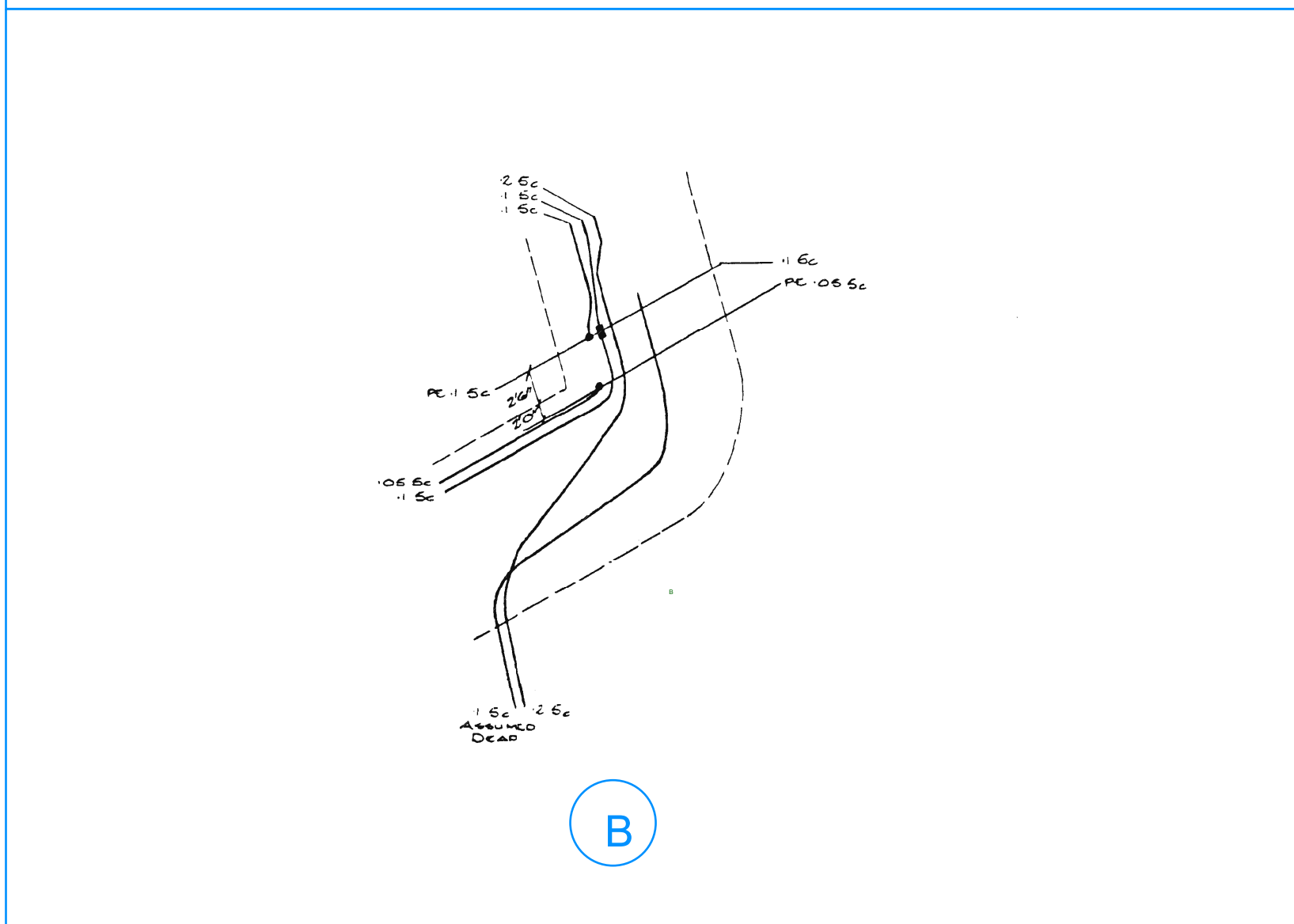
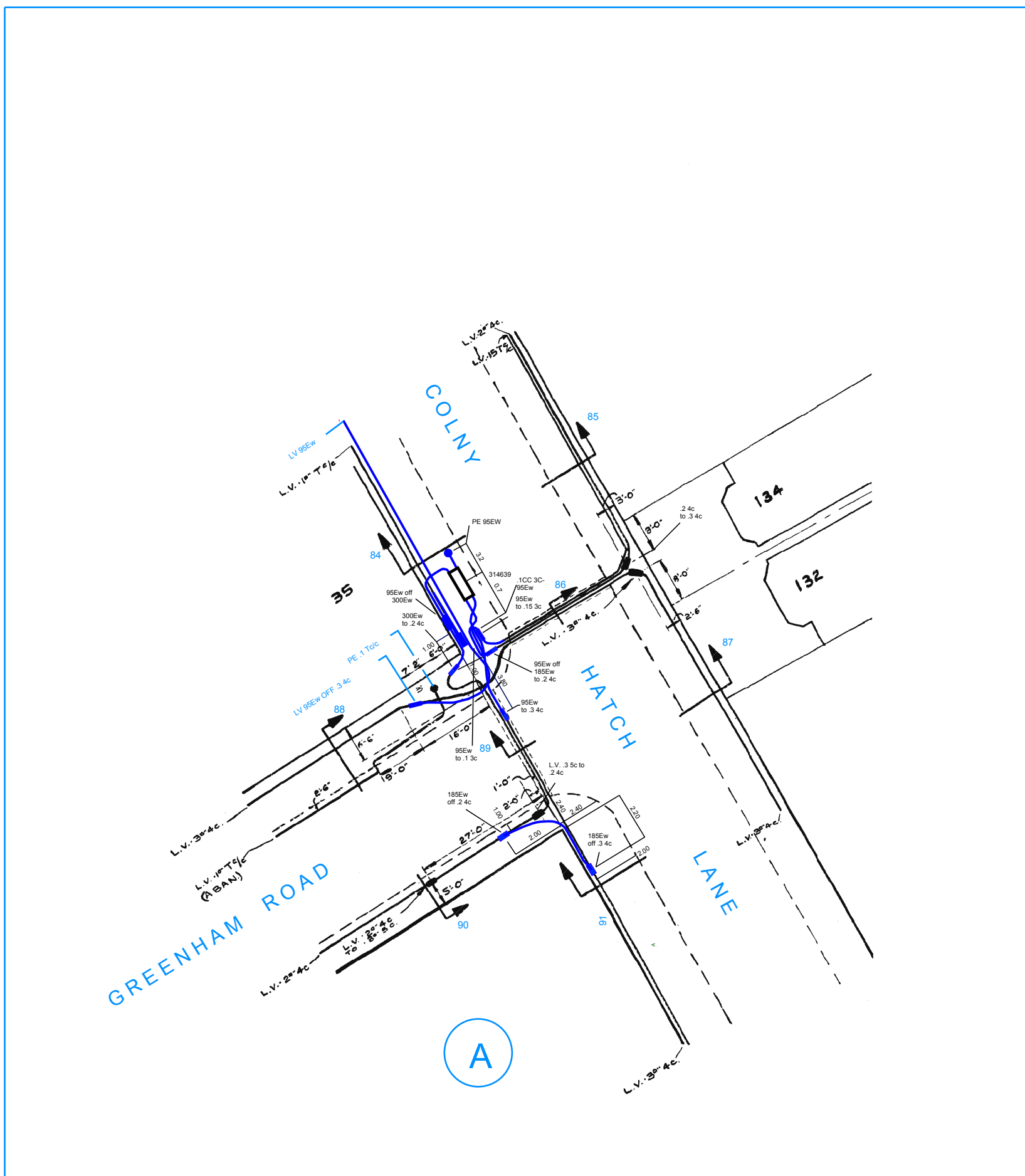
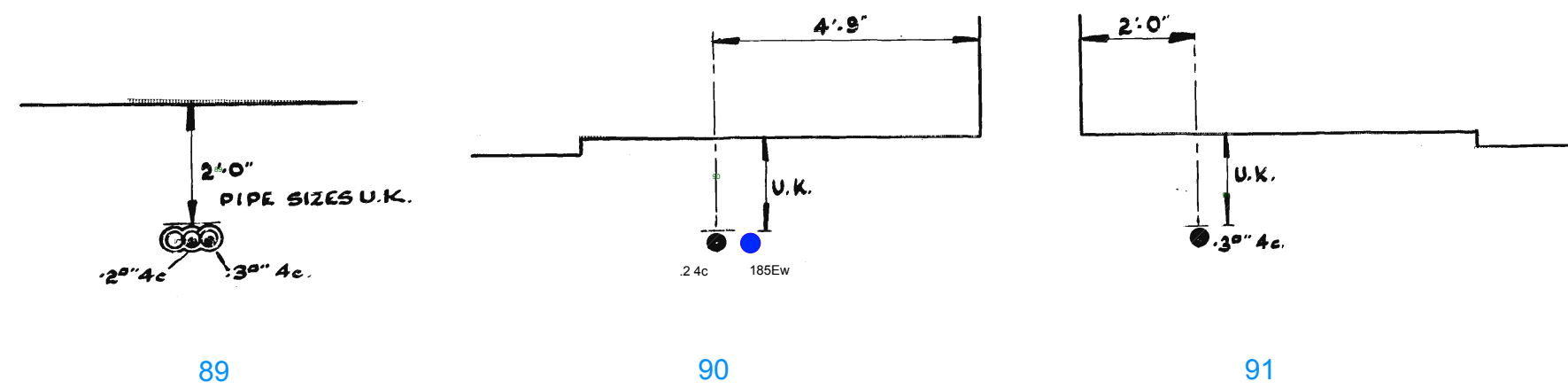
NOTES:
1. FOR FULL DETAILS OF 33KV CABLES REFERENCE SHOULD BE MADE TO THE PLUMMET RECORDS.
2. DC PILOTS ARE NOT SERIAL NUMBERED.
3. IN AREAS WHERE ROAD WIDENING & REDEVELOPMENT HAVE TAKEN PLACE, ABANDONED CABLES MAY BE FOUND.
4. M.T. DERIVED P.V.C. MARKER TAPES
5. E. DERIVED C.R.E. CABLE, A. DERIVED ALP TYPE.



LOCATION
HORNSEY

REPRODUCED FROM AND BASED UPON THE GRANTANCE SURVEY MAP WITH PERMISSION OF THE CONTROLLER OF N.M. STATIONARY OFFICE	SHEET No. TQ2790NEB s0	ISSUE D	DATE 15-08-01
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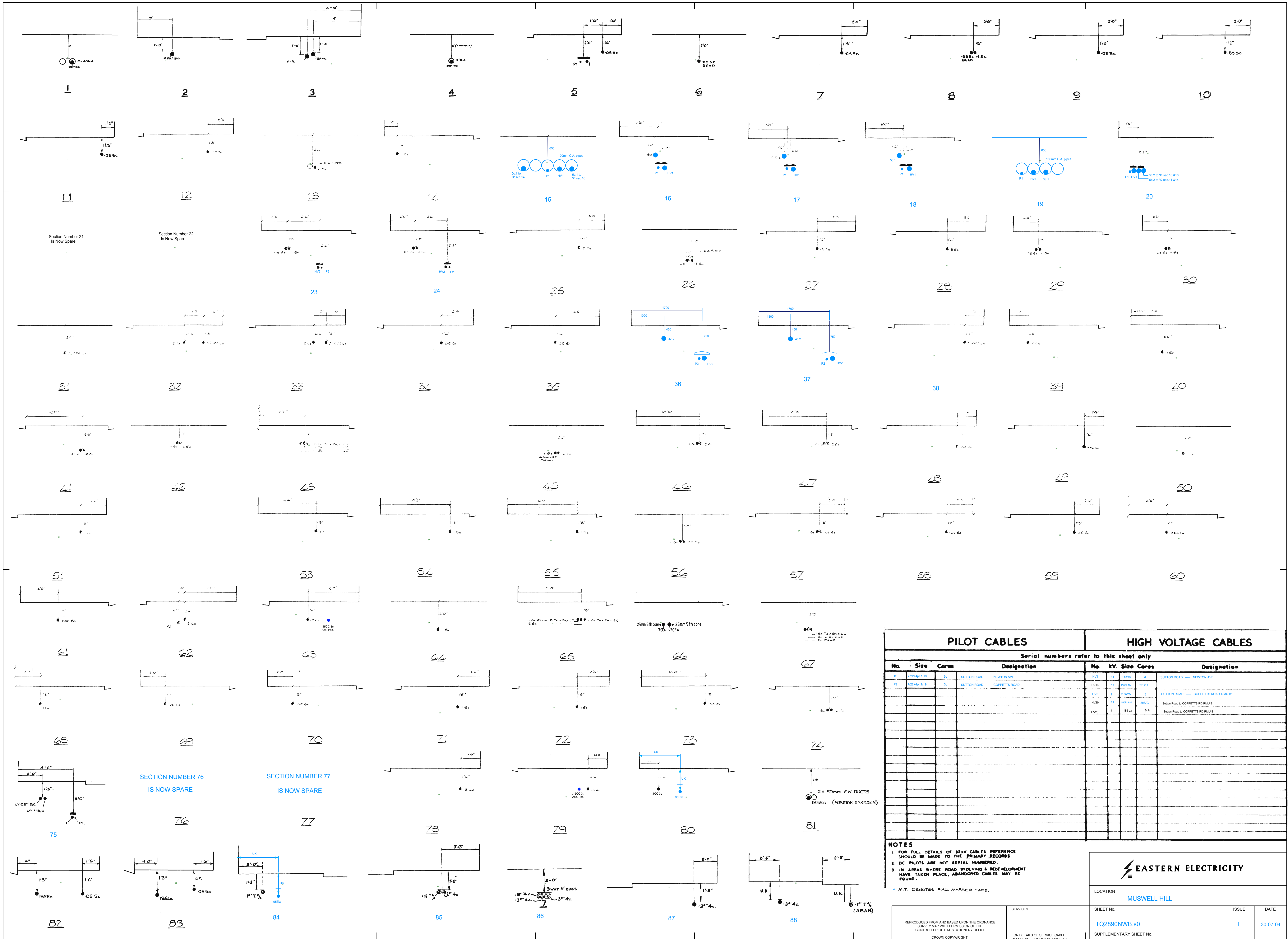
FOR DETAILS OF SERVICE CABLE REFERENCE SHOULD BE MADE TO THE SERVICE CABLES IN THE LOCAL OFFICE



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SURVEY MAP WITH PERMISSION OF THE
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FOR DETAILS OF SERVICE CABLE
REFER TO THE SERVICE CABLES IN THE
LOCAL OFFICE

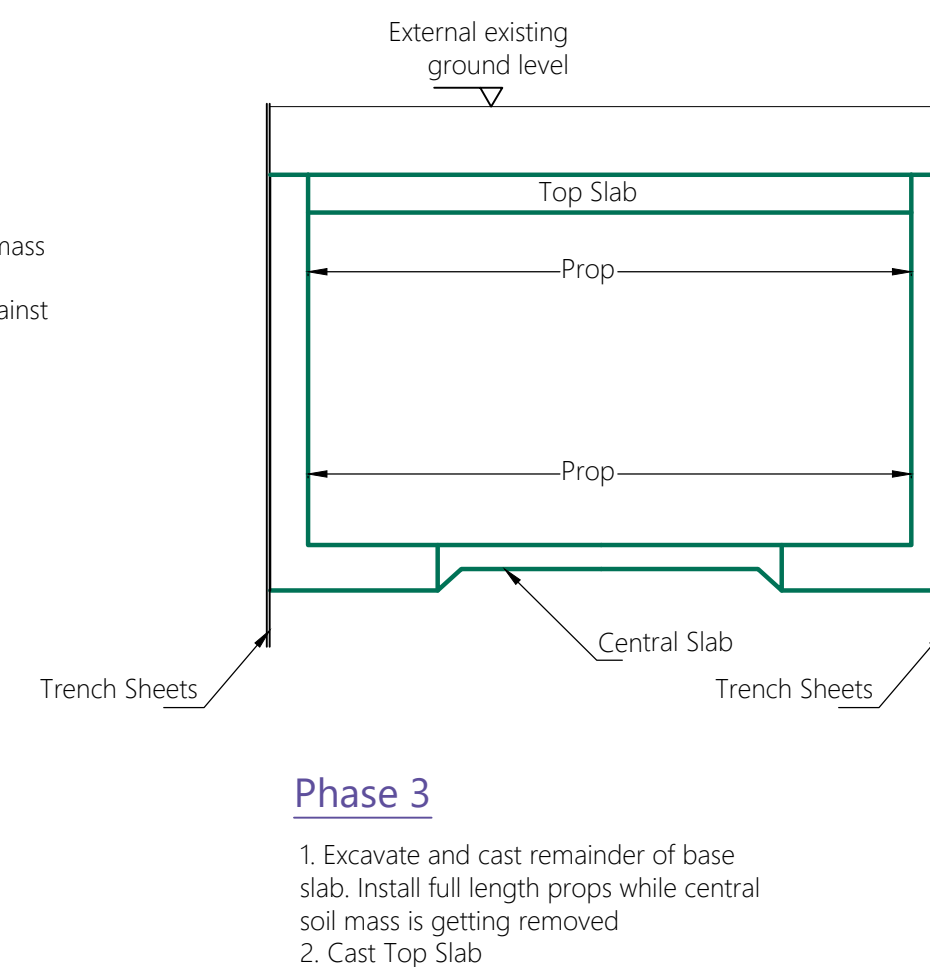
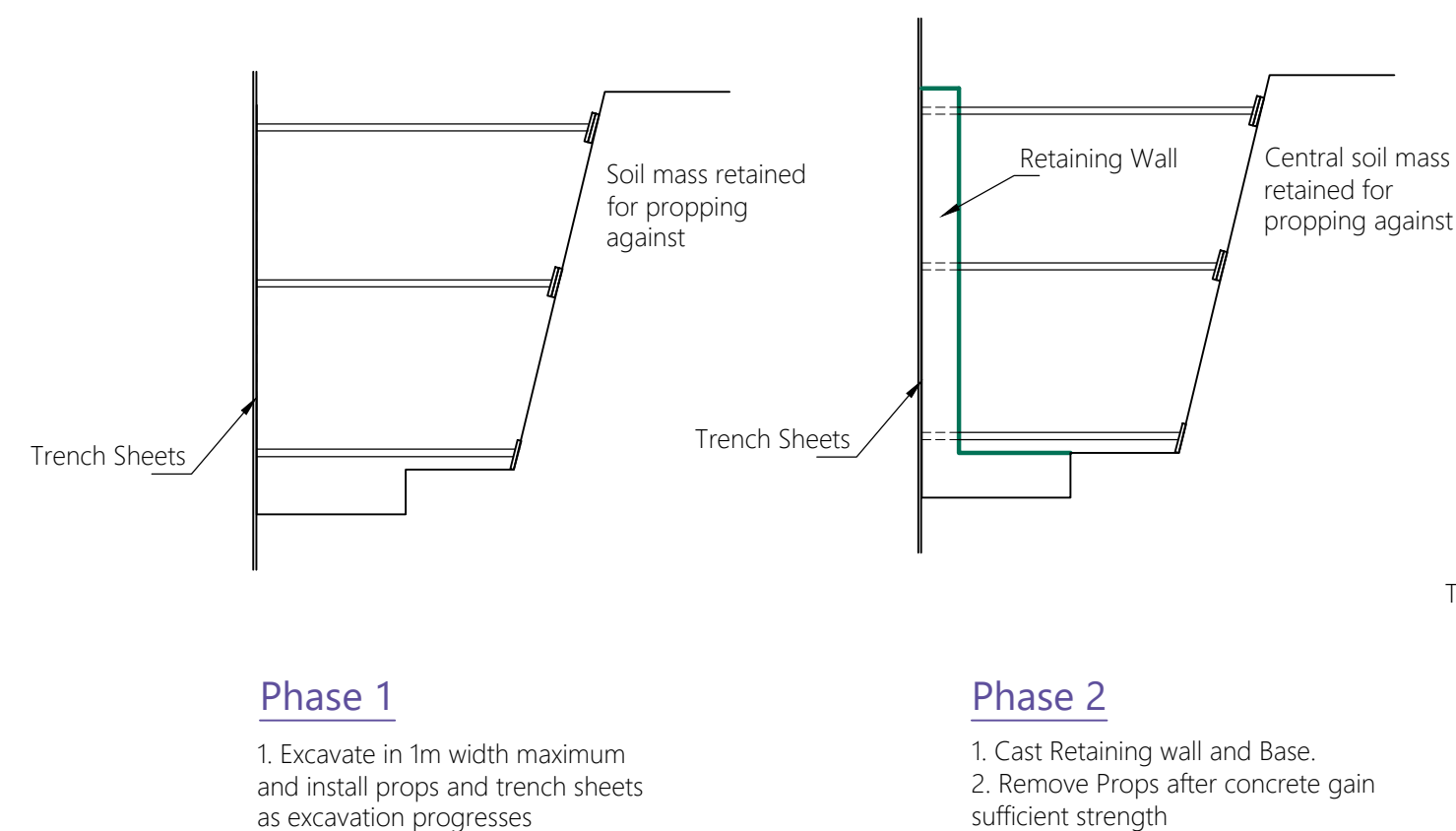
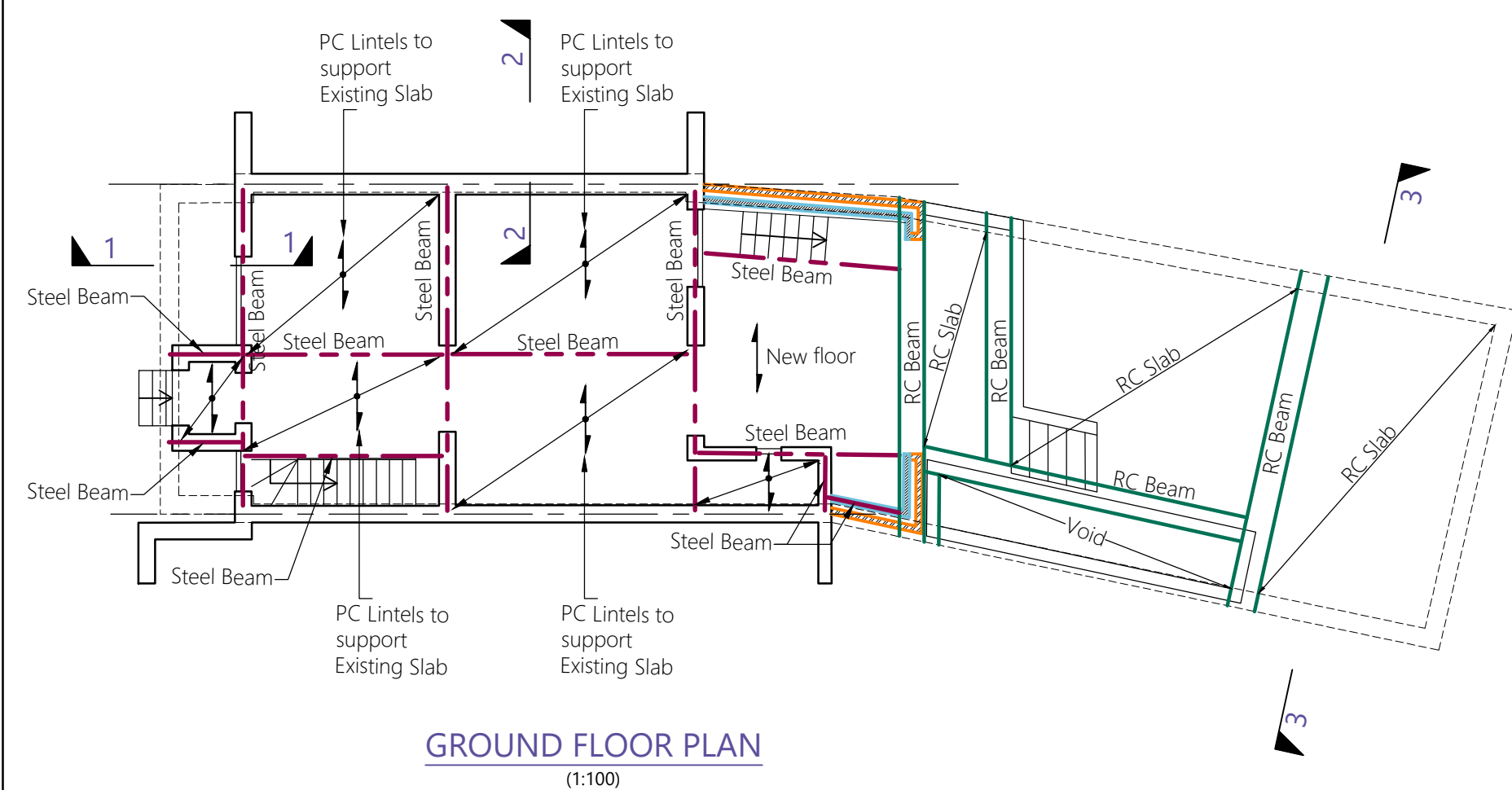
 EASTERN ELECTRICITY			
LOCATION			
MUSWELL HILL			
SHEET No.		ISSUE	DATE
TQ2890NWB.s1		F	30-07-04
SUPPLEMENTARY SHEET No.			



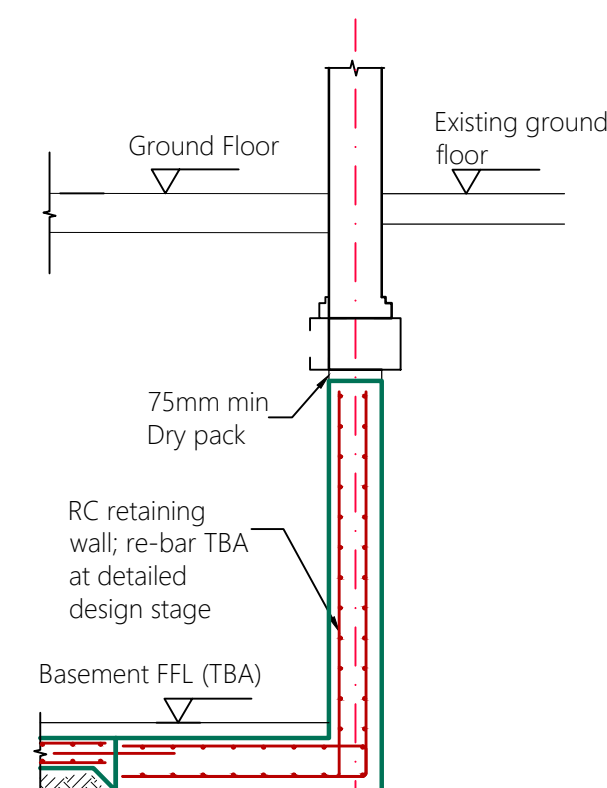
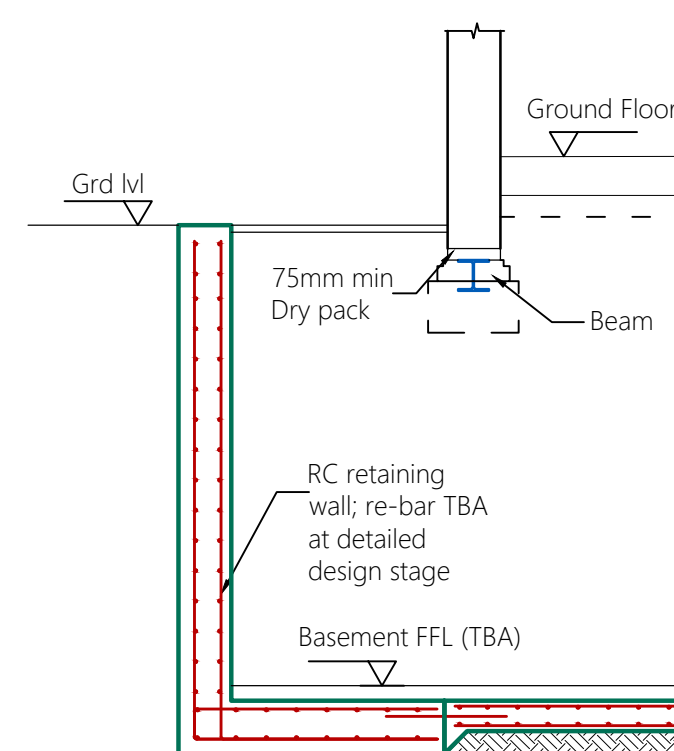
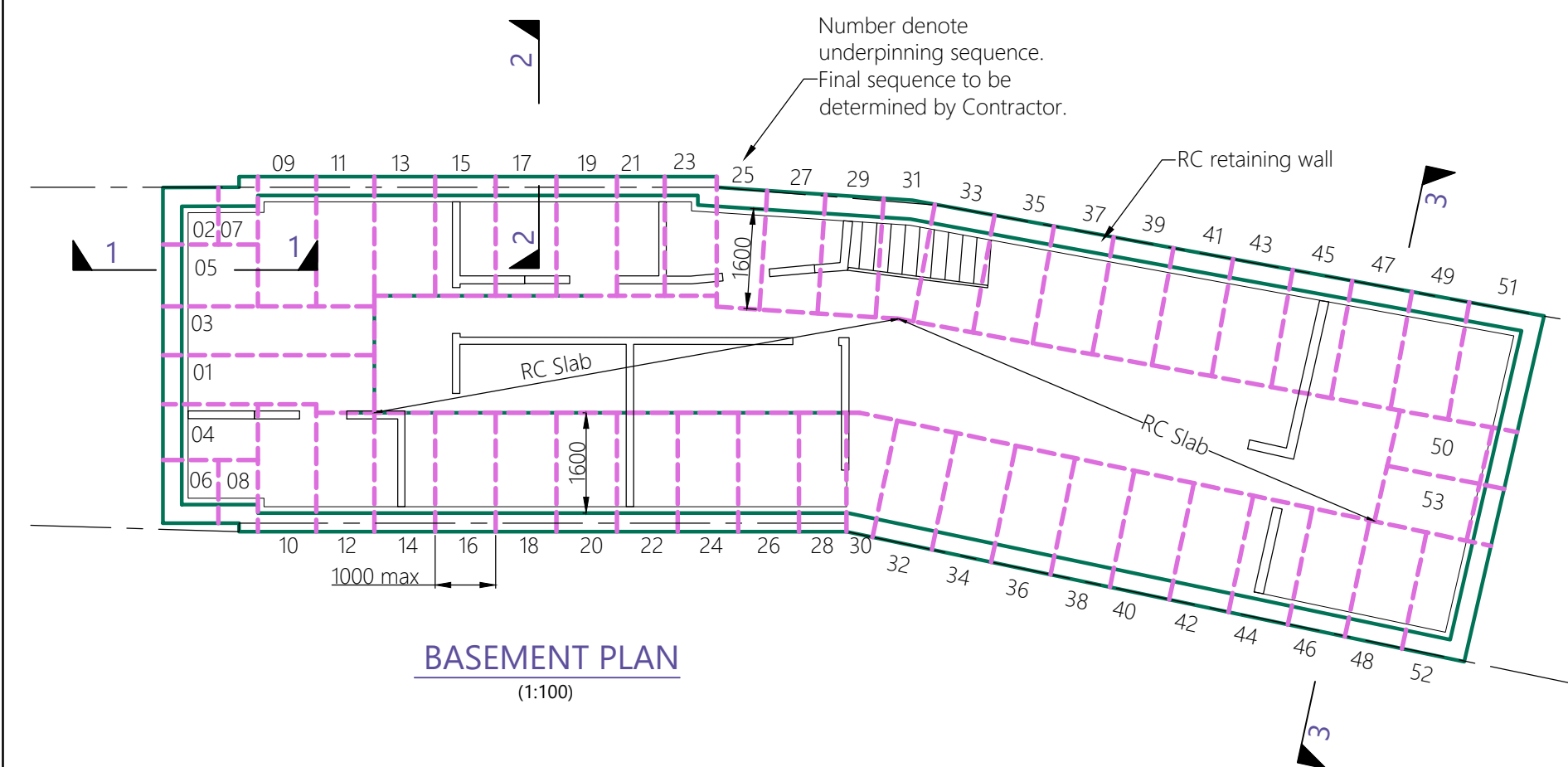
Appendix D : Structural Drawings & Temporary Works Proposals



CROFT
STRUCTURAL
ENGINEERS



Section 3-3
(Proposed Construction Sequence)
Scale 1:50



-	05/01/2022	CC	First Issue
Rev	Date	By	Amendments

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Jay Karawadra - London Basement

119 Coppetts Road
London N10 1JL

Structural Scheme Design &
Proposed Construction Sequence
Issued for **PLANNING ONLY**

Job Number 220923	Dwg Number PL-01	Rev -
By CC	Approved by -	Scale 1:100 @A2