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Consulting Structural Engineers

CA6700.01

JAN 2022

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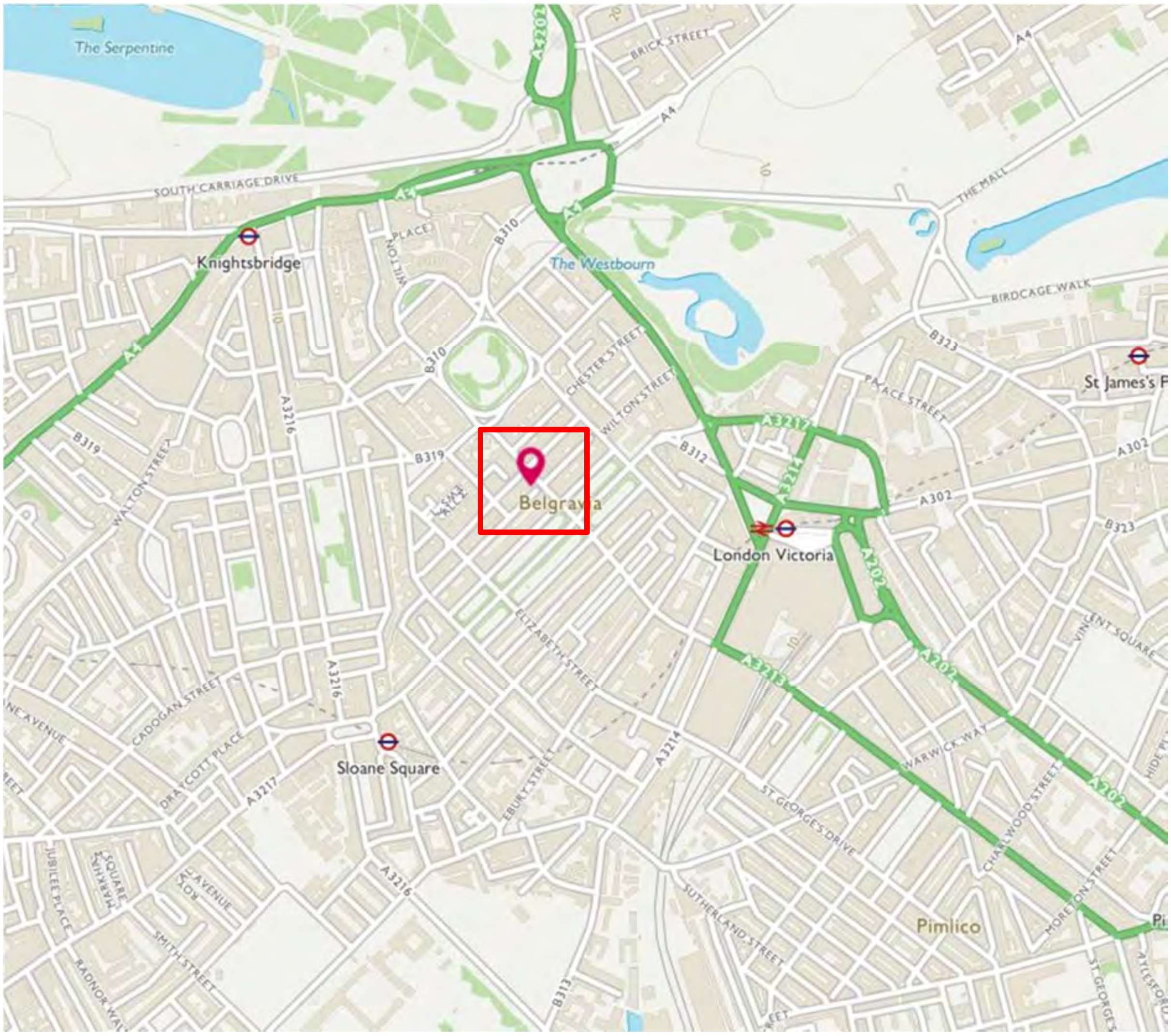
Structural Method Statement (SMS)



8 Belgrave Place, London SW1X 8AJ

CONTENTS

1 Introduction

1.1 The following Structural Method Statement has been prepared by Cooper Associates to be included in the pre-planning application, for the proposed subterranean development at 8 Belgrave Place, London SW1X 8AJ

1.2 This application intends to construct a basement by excavating below the footprint of the main property. Any internal alterations to the upper floors that require structural input will be scheduled and addressed as part of the planning application.

1.3 This structural report describes the investigation for and construction method of the proposed basement.

1.4 This Structural Method Statement has been prepared by Marcus Marinos Beng MSc and checked by Martin Cooper Eur Ing Bsc Ceng MICE MIStructE, Director at Cooper Associates.

COOPER ASSOCIATES

Cooper Associates are a practise of Structural Engineers who have been operating in excess of 30 years. Over the past 20 years we have gained considerable experience in designing basement extensions, by underpinning existing properties. We have prepared many Basement Impact Statements and Construction Method Statements as part of planning applications, within the various London Boroughs.

2 Existing Structure

2.1 Eight Belgrave Place is an existing two story semi-detached property that has only ever been used for residential accommodation.

2.2 Cooper Associates inspection of the property revealed that this existing building comprises loadbearing external and party solid brick walls and suspended floors and roof structure.

2.3 Where required the existing floor joists and existing lintels will be exposed and inspected as part of this project.

3 Site and Ground Conditions

3.1 The site address is 8 Belgrave Place, London SW1X 8AJ and has the following grid reference "TQ 28370 79181".

3.2 Access to the building is provided directly off the pavement of Belgrave Place.

3.3 The property is located approximately 600 metres from Victoria Station. The property is also located more than 450m from the nearest underground tunnel, District Line (See Appendix C). The proposed works will not affect these.

3.4 The site is not in a known area affected by Radon (See Appendix B).

3.5 There is no known significant infrastructure below or within 100m of this site.

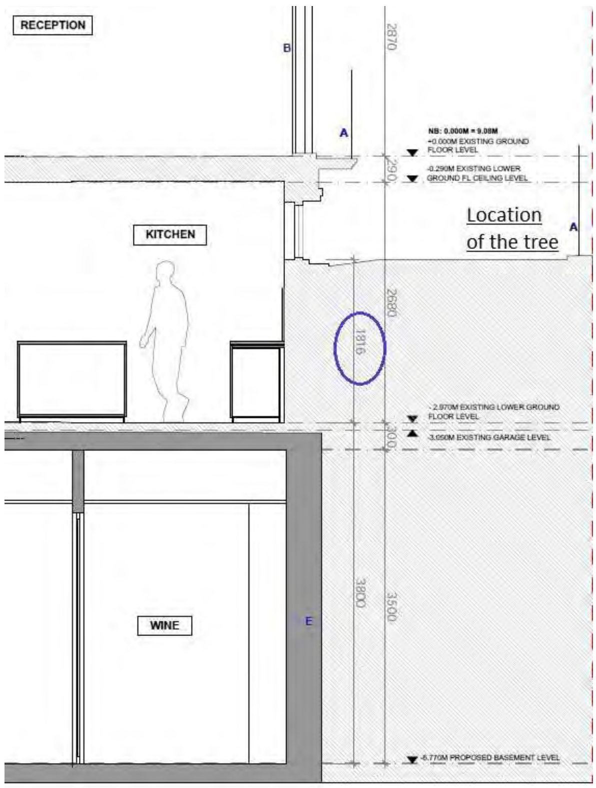
3.6 The property is in flood zone 1, an area with a low probability of flooding.(See Appendix F).

3.7 This project will not impede access to existing flood defences, as there aren't any nearby.

3.8 Bore holes in the area (provided by the British Geological Survey) show that the first 1.5 metres include made up ground before firm brown sandy clay is found. Medium dense flint gravel with sand is found from 3.75m below ground level. The new foundations will be cast on this layer. The Borehole logs can be seen in Appendix A. A geotechnical report including site specific boreholes and trial pits will be undertaken for the planning application.

3.9 A substantial London Plane tree is located at the front of the property as can be seen in the photo on sheet 2. This is however growing adjacent to the existing semi basement – the internal ground level is almost 2 metres deeper than the external garden level. It is generally considered that the majority of tree roots are located in the top 1.0 m – 1.5 m of ground.

3.10 In our case, the excavation is to commence 2 metres below the external ground level and so we anticipate that we will encounter a negligible number of roots. It is intended to excavate two internal trial holes at the existing lower ground level, against the wall close to the tree, in order to confirm that we will not disturb roots larger than 25 mm's in diameter.



4 Proposed works

4.1 A preliminary structural design has been carried out for the superstructure and the basement construction. The proposed works include underpinning part of the existing PW and perimeter foundations.

The full scope of the proposed alterations can be seen in the Architectural drawings.

4.2 There is no risk to the stability of the existing or the adjacent buildings during or as a result of these works, as the working procedures that are to be adopted have been established and used successfully over the last decade or more.

4.3 The underpinning works are undertaken by excavating and concreting one 1000mm long strip of basement wall at a time and after curing, drypacking tightly, with an expanding drypack (Conbex 100 or similar). Further curing time is allowed before an adjacent bay is constructed – as will be described in more detail in this report. Hence the risk of long term differential movement between the basement and the neighbour’s foundations is negligible.

4.4 We are satisfied that the temporary and permanent works will have no significant impact on the structural integrity and natural ability for movement of the existing and surrounding structures, utilities, infrastructure and any man-made cavities, such as tunnels.

4.5 We are not able to state that the neighbours will have no damage however the existing properties are in good order and we consider (based on previous projects of this nature) that any cracking would be within Category 1 of the Burland Scale. This is defined as fine cracks which are easily treated during normal decoration and forms part of the BRE Digest 251. A Party Wall Award will be in place before the works commence. This will record any existing damage and will identify any fresh damage, in the event that any did occur.

BRE Digest 251 – Table 1: Classification of visible damage to walls with particular reference to ease of repair of plaster and brickwork or masonry. Crack width is one factor in assessing category of damage and should not be used on its own as a direct measure of it.	
Category of damage	Description of typical damage
0	Hairline cracks of less than about 0.1 mm which are classed as negligible. No action required.
1	**Fine cracks which can be treated easily using normal decoration. Damage generally restricted to internal wall finishes; cracks rarely visible in external brickwork. Typical crack widths up to 1 mm.**
2	Cracks easily filled. Recurrent cracks can be masked by suitable linings. Cracks not necessarily visible externally; some external repointing may be required to ensure weather-tightness. Doors and windows may stick slightly and require easing and adjusting. Typical crack widths up to 5 mm.
3	Cracks which require some opening up and can be patched by a mason. Repointing of external brickwork and possibly a small amount of brickwork to be replaced. Doors and windows sticking. Service pipes may fracture. Weather-tightness often impaired. Typical crack widths are 5 to 15 mm, or several of, say, 3 mm.
4	Extensive damage which requires breaking-out and replacing sections of walls, especially over doors and windows. Windows and door frames distorted, floor sloping noticeably*. Walls leaning or bulging noticeably*, some loss of bearing in beams. Service pipes disrupted. Typical crack widths are 15 to 25 mm, but also depends on number of cracks.
5	Structural damage which requires a major repair job, involving partial or complete rebuilding. Beams lose bearing, walls lean badly and require shoring. Windows broken with distortion. Danger of instability. Typical crack widths are greater than 25 mm, but depends on number of cracks.

4.6 A monitoring company will be appointed and their reflective targets will be established on site, prior to the works commencing. Independent readings (every month) will be taken over the following months to establish a set of base readings. Readings will be taken weekly during the underpinning phase and on a monthly basis thereafter till the completion of the structural works at the basement. Amber and red triggers deflection allowances will be agreed prior to the works commencing:

- Amber Trigger: Review works on site and propose ways to mitigate the movement (check / improve drypacking – add additional horizontal props – or as appropriate)

- Red Trigger: As above, in conjunction with the neighbours Engineers / Party wall surveyors. Consider stopping works in the immediate area subject to positively identify and rectify the cause of the movement.

4.7 The ground in the area is predominantly level and thus there is no risk of slope instability beyond the site. The proposed method of construction avoids any risk of slope instability within the site.

4.8 Any utilities and other infrastructure immediately adjacent to or through the construction will be exposed, adequately supported and be reinstated (using appropriate specialist subcontractors where necessary) as part of the works. The construction of each underpin is done in short sections which avoids damage or movement of the adjacent structures.

4.9 The reinforced concrete walls and bases will be constructed using concrete classed as grade C35A (according to BS8007). This is accepted as a watertight concrete mix. Used in conjunction with the internal drainage system, they will be two lines of waterproofing which is in accordance with BS8102.

4.10 Water flow only exists because of rainwater. Surface water is already being collected by an existing drainage system. Whilst the new basement will be deeper than the existing lower ground floor, the amount of roof area and hardstanding will not increase in the amount of surface water that has to be collected, by the new drainage system.

4.11 Flood resilient building materials and fittings will be used. All service ducts / gaps etc., to accommodate utilities such as gas, electricity and telephone cables to the lower ground floor level, will be sealed with silicone.

4.12 According to BCA Technical Guidance Note 21: The Building Regulations 2010 – England & Wales Requirement A3 – Disproportionate Collapse the new building is part of consequence class 2A. As such, 5 x 30 steel galvanised restraint straps will be installed at 1200c/c's to provide horizontal restraint, in addition to the joist hangers, to better restrain the external walls. The straps will be screwfixed over a minimum of 3 parallel timber floor or rafters and timber noggins. All steel connection details will be designed to have a minimum horizontal tying force of 75KN as per (BS5950-1). The new structure will thus be designed robustly and will comply with the disproportionate collapse requirements.

5 Construction method

5.1 A Chartered Structural Engineer has been appointed to supervise the construction throughout its duration.

5.2 It is intended that the basement will be constructed by a specialist contractor who is experienced in this form of construction and is capable of successfully dealing with the issues that a basement construction presents. At all times during the construction, works are to be supervised by a competent supervisor that will be appointed by the main contractor. They will be a member of the Considerate Constructors Scheme.

5.3 Party wall agreements will be prepared for the adjacent neighbours on all sides, in order to protect their interests.

5.4 Detailed temporary works drawings (and construction sequence documents/drawings) will be designed by a Charted Structural Engineer.

5.5 Hoarding will be erected at the front of the site to accommodate a working space and a skip.

5.6 Conveyor belts will be located to transfer spoil from the front of the property, into the skip, all of which will be enclosed by the hoarding at all times except when the skip is being removed and replaced with an empty skip.

5.7 A method will be agreed with the Contractor – based on a 1:3:5:2:4 hit and miss construction sequence for the construction of the new wall lengths. See Appendix F

5.8 Sump pumps will be available during the excavations to remove any water due to ponding.

5.9 Individually, a void for a section of wall will be excavated; a maximum of 1000 wide and reinforcement (to our design) will be installed. Reinforcing starter bars will be driven into the ground on each side. Shutters will be constructed to retain the wet concrete. Once the concrete is cast, leaving a 50 mm gap between the top of the concrete and the underside of the cleaned brick footing, the gap will be drypacked, but only after a minimum of 24 hours has been allowed for the concrete to cure. A further 48 hours must elapse before any further excavation can be carried out, within two bays of this new footing. A limit of 20% of the building can be undermined at any one time.

5.10 During the underpinning works, the structure above will be propped as necessary to maintain support, using heavy duty props off either the new concrete slab or cast concrete bases, to carry the main structure and any local areas of timber floor, etc.

6 Summary

6.1 A chartered Civil and Structural Engineer has been appointed to the design team.

6.2 The property has been inspected and a desk study has been carried out by the Structural Engineer; reports have been prepared.

6.3 A site investigation including trial holes, to expose the existing foundations will be undertaken.

6.4 A design has been prepared and a construction sequence has been produced, to show that the basement can be constructed in a safe manner.

6.5 Detailed drawings that show how the basement can be constructed safely, will be prepared before any basement works commence.

6.6 Ground movement and potential damage has been considered and categorised based on the Burland Scale.

6.7 The subterranean development has no adverse impact on surface water, ground water flows and site levels.

Checked by:

Eur Ing Martin Cooper Bsc Ceng MICE MIStructE

Cooper Associates.

7 Appendix

7.1 Appendix A -Borehole Log

TQ27NE/1679

Contract Name	GROSVENOR PLACE NGR 28517 79511	Borehole No. 1 Sheet 1 of 3

Method of boring	Shell and Auger	Ground level	6.744 m O.D.
Diameter	200 mm nom	Start	14.9.74
		Finish	21.9.74

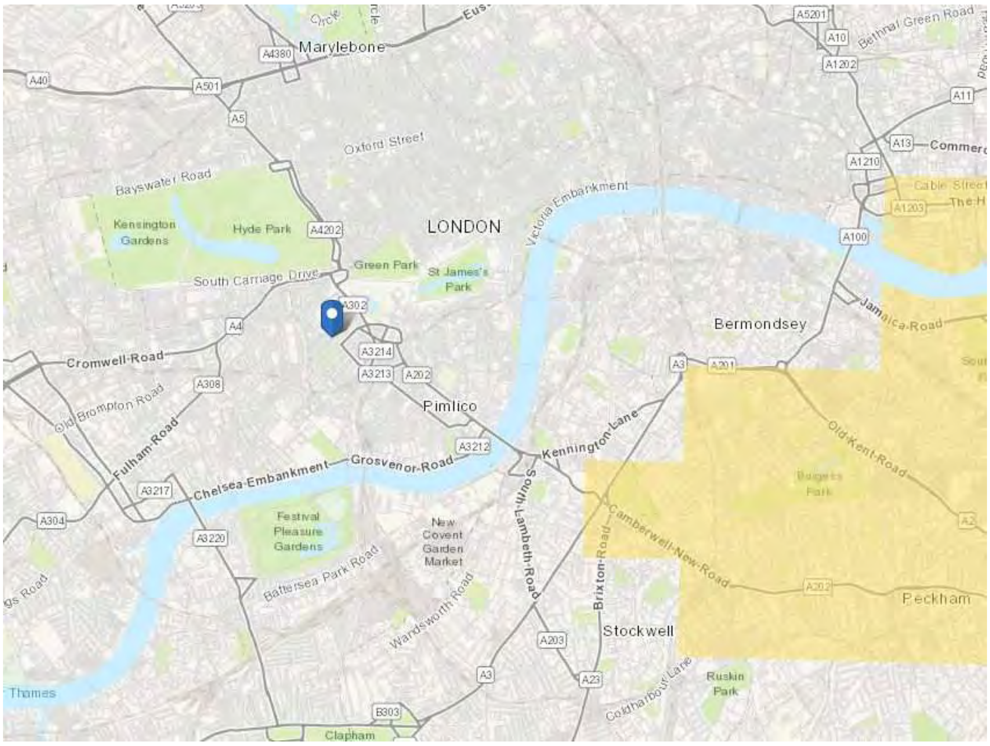
Daily progress	Water levels	In-situ tests	Samples	Depth (m)	Reduced level (m O.D.)	Thickness (m)	Description of Strata
			J			1.50	Made Ground(Paving stones,concrete, brick and morter.
			JU	1.50	5.25		
			J			1.50	Firm brown sandy clay with a little gravel and brown sand
		N=40	B	3.00	3.75		
			J				
	▽ 14/9	N=32	B			4.25	Medium dense to dense medium to coarse flint gravel with sand and some bands of brown clay in places
			J				
	▽ 21/9	N=27	B				
14/9 14/9			J				
	▽ 15/9		W				
			U	7.25	-0.50		
15/9							
			J				Stiff to very stiff grey silty clay with partings of grey silt and thin bands of claystone in places
			U				
			J				Contd/..

Notes

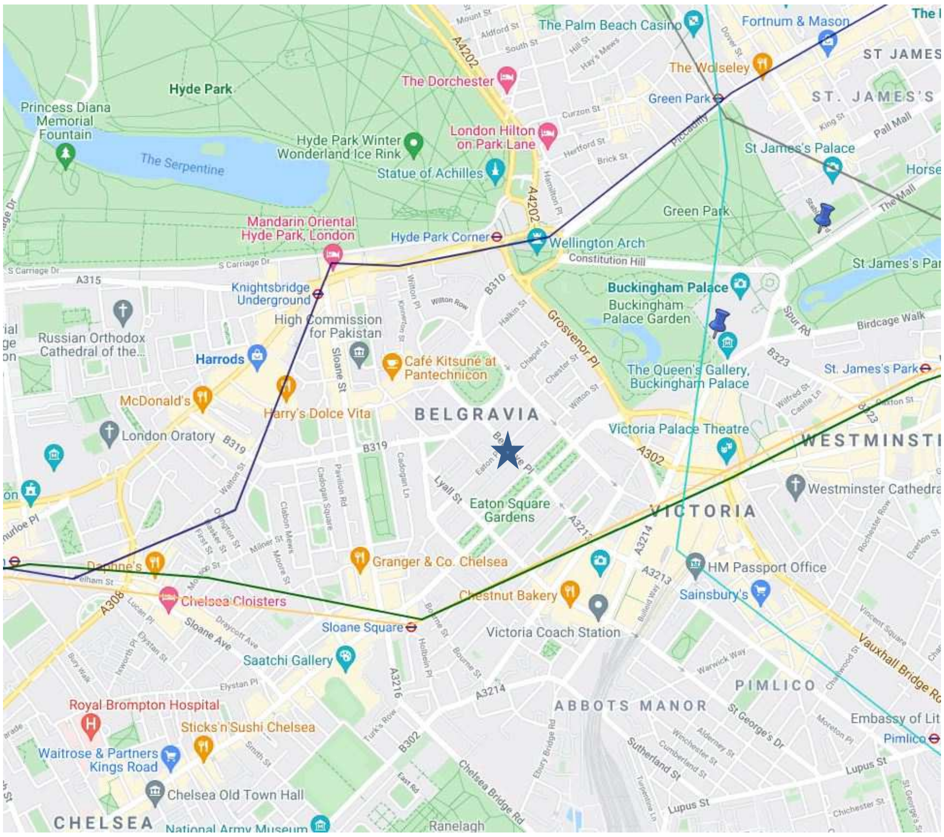
Starting pit excavated to 1.50m,

Terresearch Limited	Report No. S.24/788	Appendix 1 Sheet 1

7.2 Appendix B - Radon affected sites map



7.3 Appendix C - London Underground lines nearby.



7.4 Appendix F – Flood map for planning

Environment Agency

Flood map for planning

Your reference	Location (easting/northing)	Created
<Unspecified>	**528370/179181**	**13 Jan 2022 16:19**

Your selected location is in flood zone 1, an area with a low probability of flooding.

This means:

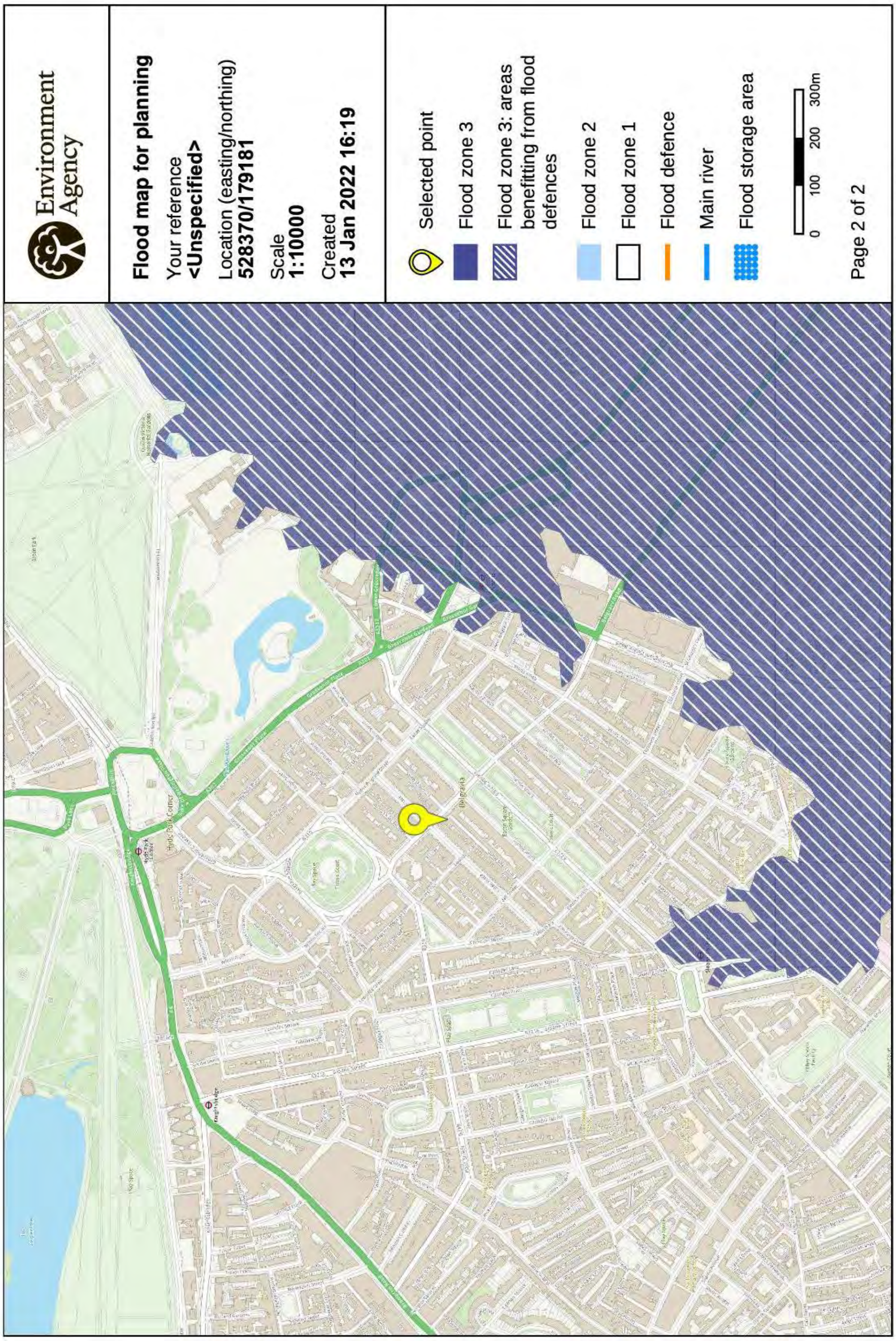
- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage problems

Notes

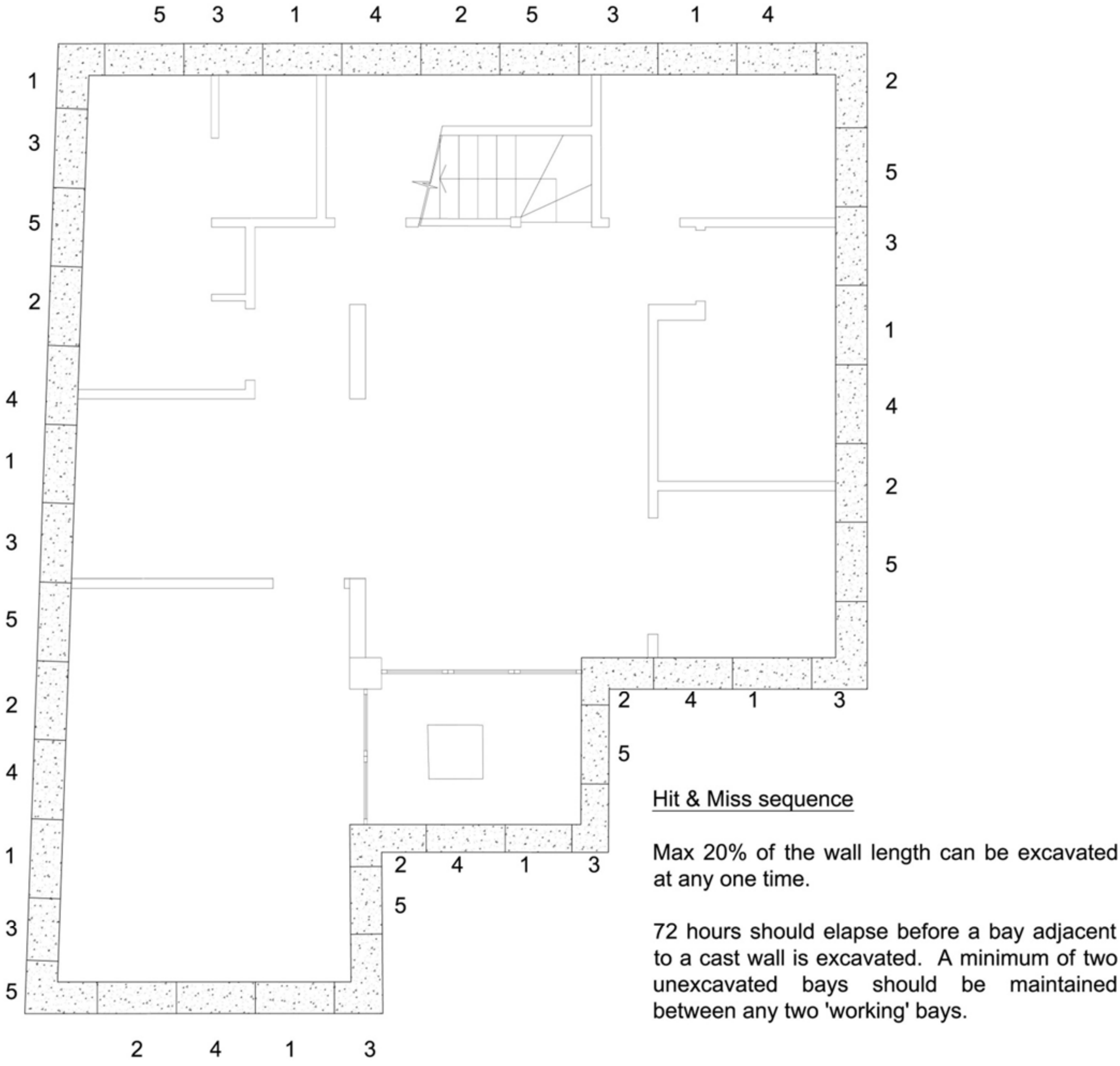
The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

Page 1 of 2


Environment Agency
Flood map for planning
Your reference
<Unspecified>
Location (easting/northing)
528370/179181
Scale
1:10000
Created
13 Jan 2022 16:19
Selected point
Flood zone 3
Flood zone 3: areas benefitting from flood defences
Flood zone 2
Flood zone 1
Flood defence
Main river
Flood storage area
0 100 200 300m
Page 2 of 2

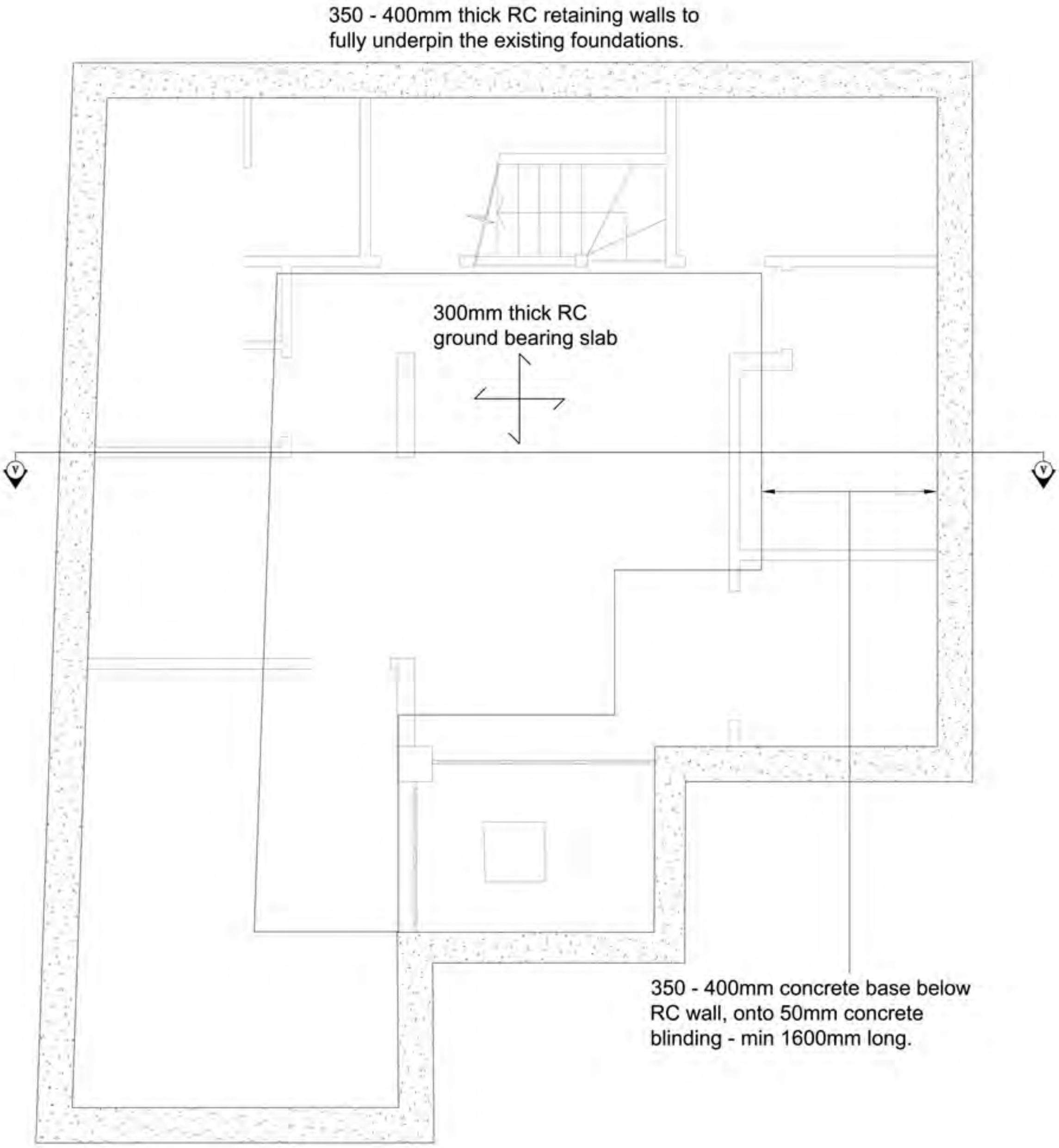
7.5 Appendix F – Hit and miss sequence



Typical Hit and miss sequence

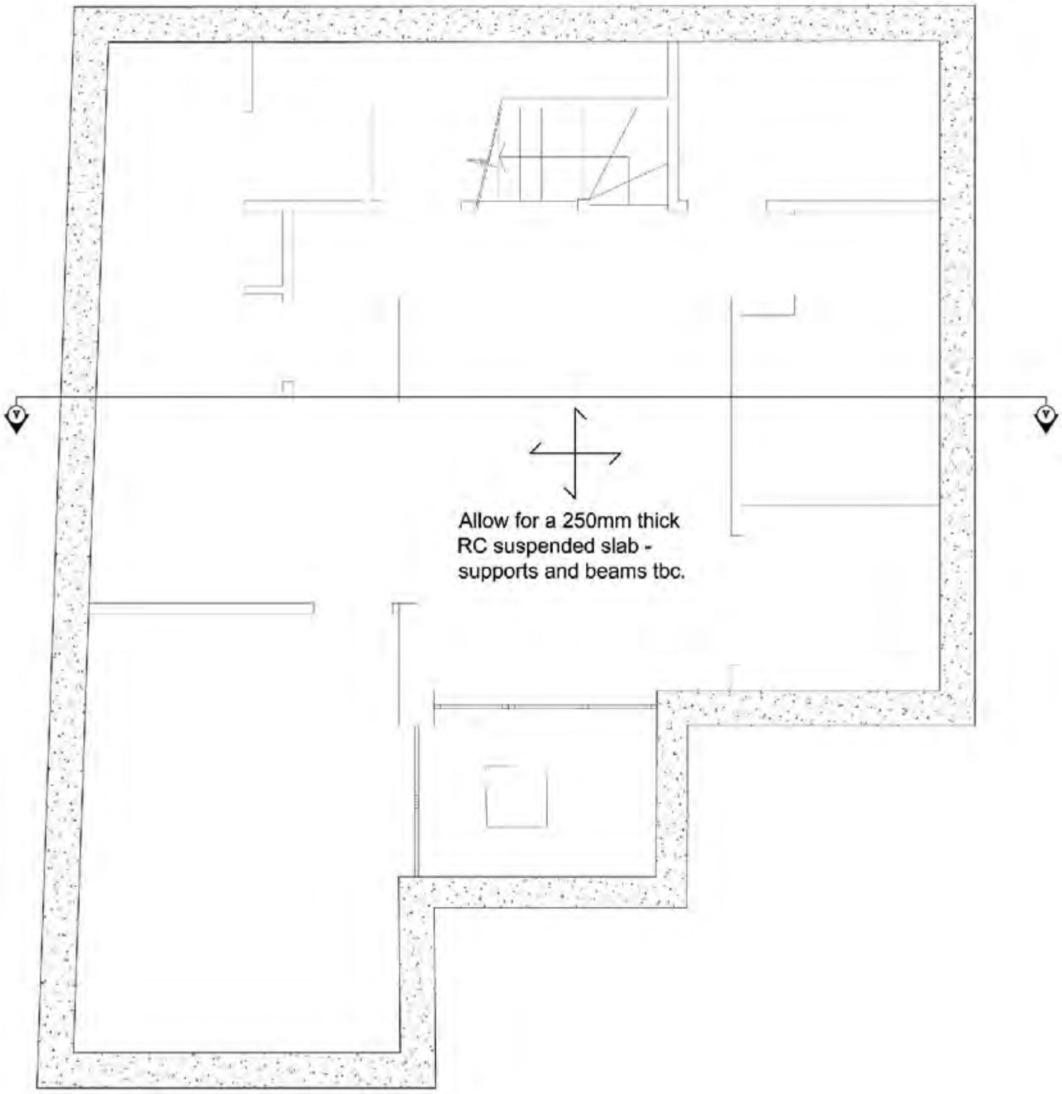
7.6 Appendix H – Permanent works: Indicative drawings

Indicative drawings

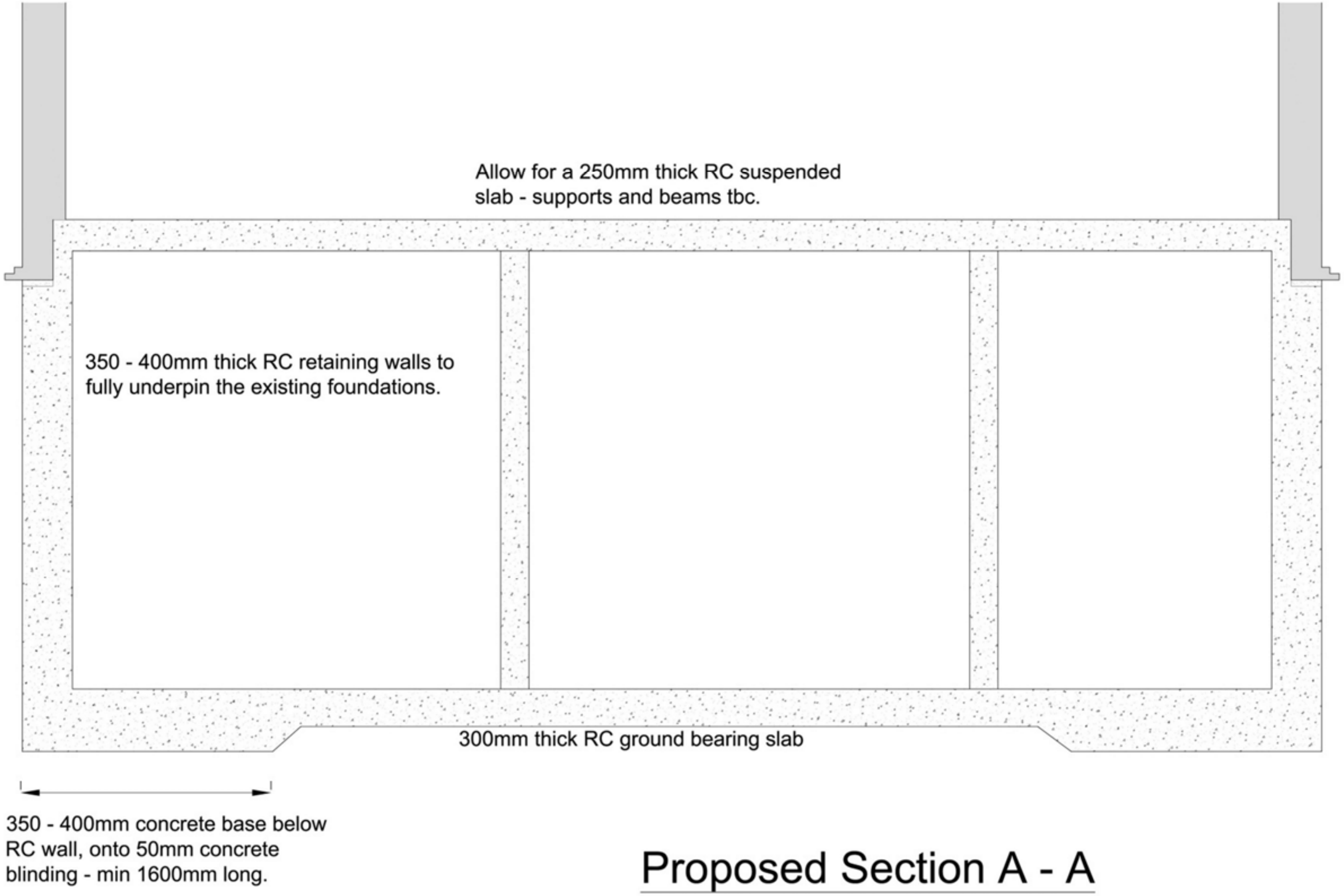


Proposed Basement (Foundations)

Indicative drawings

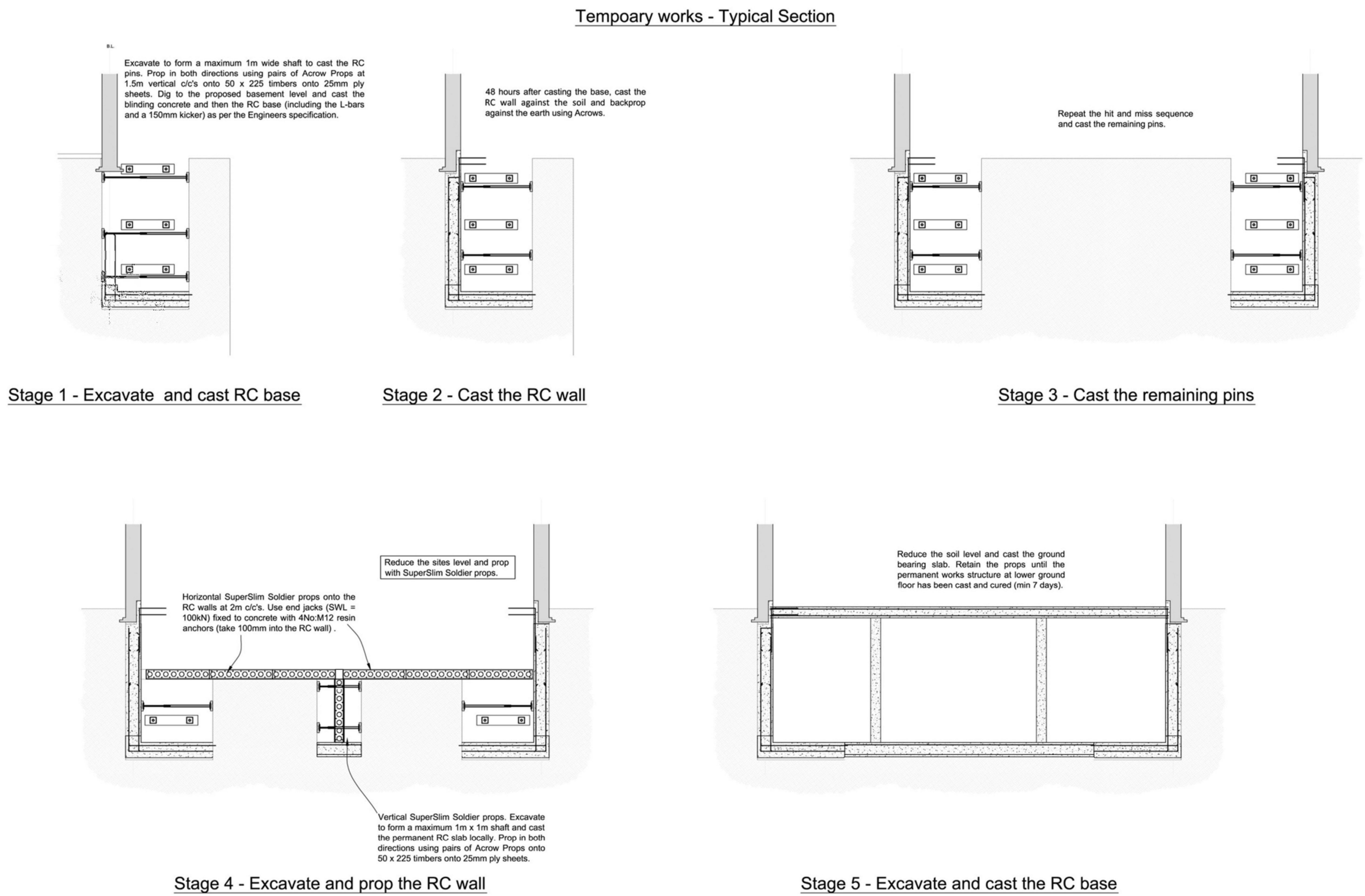


Proposed Basement (Structure Over)



Proposed Section A - A

7.7 Appendix I – Indicative Basement construction sequence



7.8 Appendix J – RC retaining wall/underpin calculation

RETAINING WALL ANALYSIS

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

Description	Unit	Capacity	Applied	F o S	Result
Bearing pressure	kN/m^2	100	64.2	1.558	PASS

Design summary

Description	Unit	Provided	Required	Utilisation	Result
Stem max front face - Flexural reinforcement	mm^2/m	565.5	442.8	0.78	PASS
Stem p0 rear face - Flexural reinforcement	mm^2/m	1570.8	526.6	0.34	PASS
Stem p0 - Shear resistance	kN/m	161.3	103.7	0.64	PASS
Stem p1 front face - Flexural reinforcement	mm^2/m	565.5	442.8	0.78	PASS
Stem p1 - Shear resistance	kN/m	161.3	33.8	0.21	PASS
Base top face - Flexural reinforcement	mm^2/m	1570.8	512.1	0.33	PASS
Base bottom face - Flexural reinforcement	mm^2/m	1570.8	719.4	0.46	PASS
Base - Shear resistance	kN/m	167.4	117.0	0.70	PASS
Transverse stem reinforcement	mm^2/m	392.7	392.7	1.00	PASS
Transverse base reinforcement	mm^2/m	392.7	314.2	0.80	PASS

Retaining wall details

Stem type; Propped cantilever
Stem thickness; t_{stem} = **350** mm
Angle to rear face of stem; α = **90** deg
Stem density; γ_{stem} = **25** kN/m^3
Toe length; l_{toe} = **1600** mm
Base thickness; t_{base} = **400** mm
Base density; γ_{base} = **25** kN/m^3
Angle of soil surface; β = **0** deg
Depth of cover; d_{cover} = **0** mm

Retained soil properties

Soil type; Firm clay
Moist density; γ_{mr} = **18** kN/m^3
Saturated density; γ_{sr} = **18** kN/m^3
Characteristic effective shear resistance angle; $\phi'_{r.k}$ = **18** deg
Characteristic wall friction angle; $\delta_{r.k}$ = **9** deg

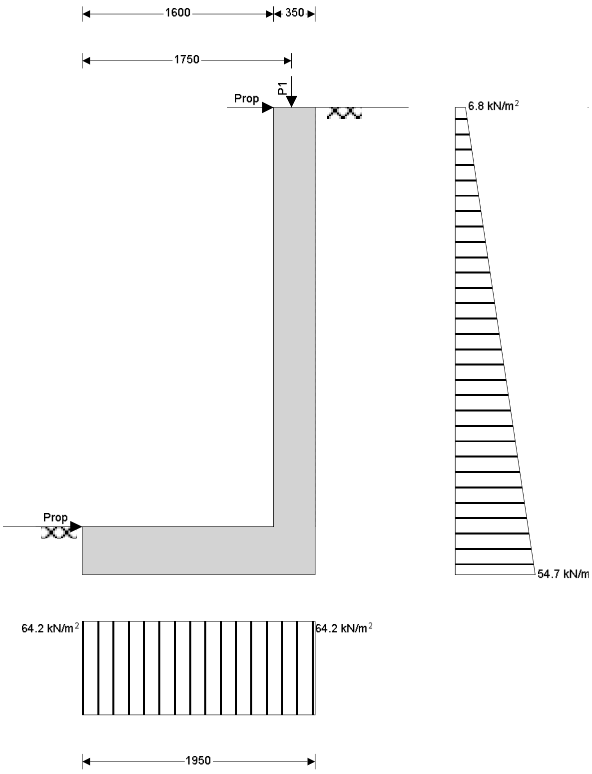
Base soil properties

Soil type; Medium dense gravel
Soil density; γ_b = **17** kN/m^3
Characteristic effective shear resistance angle; $\phi'_{b.k}$ = **30** deg

Characteristic wall friction angle; $\delta_{b.k}$ = **15** deg
Characteristic base friction angle; $\delta_{bb.k}$ = **20** deg
Presumed bearing capacity; $P_{bearing}$ = **100** kN/m^2

Loading details

Variable surcharge load; $Surcharge_Q$ = **10** kN/m^2
Vertical line load at 1750 mm; P_{G1} = **75** kN/m



General arrangement

Calculate retaining wall geometry

Base length; l_{base} = **1950** mm
Length of surcharge load; l_{sur} = **0** mm
Vertical distance; x_{sur_v} = **1950** mm
Horizontal distance; x_{sur_h} = **1950** mm
Area of wall stem; A_{stem} = **1.225** m^2; Vertical distance; x_{stem} = **1775** mm
Area of wall base; A_{base} = **0.78** m^2; Vertical distance; x_{base} = **975** mm

Using Coulomb theory

At rest pressure coefficient; K_0 = **0.691**; Passive pressure coefficient; K_P = **4.977**

Bearing pressure check

Vertical forces on wall

Total; $F_{total\_v} = F_{stem} + F_{base} + F_{P\_v}$ = **125.1** kN/m

Horizontal forces on wall

Total; $F_{total\_h} = F_{sur\_h} + F_{moist\_h} + F_{pass\_h}$ = **113.5** kN/m

Moments on wall

Total; $M_{total} = M_{stem} + M_{base} + M_{sur} + M_P + M_{moist}$ = **31.3** kNm/m

Check bearing pressure
Propping force to stem; F_{prop_stem} = **23.3** kN/m; Propping force to base; F_{prop_base} = **90.2** kN/m
Bearing pressure at toe; q_{toe} = **64.2** kN/m^2; Bearing pressure at heel; q_{heel} = **64.2** kN/m^2
Factor of safety; FoS_{bp} = **1.558**
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

Concrete details - Table 3.1 - Strength and deformation characteristics for concrete
Concrete strength class; C35/45
Char.comp.cylinder strength; f_{ck} = **35** N/mm^2; Mean axial tensile strength; f_{ctm} = **3.2** N/mm^2
Secant modulus of elasticity; E_{cm} = **34077** N/mm^2; Maximum aggregate size; h_{agg} = **20** mm
Design comp.concrete strength; f_{cd} = **19.8** N/mm^2; Partial factor; γ_C = **1.50**

Reinforcement details
Characteristic yield strength; f_{yk} = **500** N/mm^2; Modulus of elasticity; E_s = **200000** N/mm^2
Design yield strength; f_{yd} = **435** N/mm^2; Partial factor; γ_S = **1.15**

Cover to reinforcement
Front face of stem; c_{sf} = **40** mm; Rear face of stem; c_{sr} = **50** mm
Top face of base; c_{bt} = **50** mm; Bottom face of base; c_{bb} = **75** mm

Check stem design at 2007 mm
Depth of section; h = **350** mm

Rectangular section in flexure - Section 6.1
Design bending moment; M = **29.8** kNm/m; K = **0.010**; K' = **0.207**
K' > K - No compression reinforcement is required
Tens.reinforcement required; $A_{sfM.req}$ = **245** mm^2/m
Tens.reinforcement provided; 12 dia.bars @ 200 c/c; Tens.reinforcement provided; $A_{sfM.prov}$ = **565** mm^2/m
Min.area of reinforcement; $A_{sfM.min}$ = **491** mm^2/m; Max.area of reinforcement; $A_{sfM.max}$ = **14000** mm^2/m
PASS - Area of reinforcement provided is greater than area of reinforcement required
Library item: Rectangular single summary

Deflection control - Section 7.4
Limiting span to depth ratio; 40 Actual span to depth ratio; 11.9
PASS - Span to depth ratio is less than deflection control limit

Crack control - Section 7.3
Limiting crack width; w_{max} = **0.3** mm; Maximum crack width; w_k = **0.186** mm
PASS - Maximum crack width is less than limiting crack width**Check stem design at base of stem**
Depth of section; h = **350** mm

Rectangular section in flexure - Section 6.1
Design bending moment; M = **63.1** kNm/m; K = **0.021**; K' = **0.207**
K' > K - No compression reinforcement is required
Tens.reinforcement required; $A_{sr.req}$ = **527** mm^2/m
Tens.reinforcement provided; 20 dia.bars @ 200 c/c; Tens.reinforcement provided; $A_{sr.prov}$ = **1571** mm^2/m
Min.area of reinforcement; $A_{sr.min}$ = **484** mm^2/m; Max.area of reinforcement; $A_{sr.max}$ = **14000** mm^2/m

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

Library item: Rectangular single summary

Deflection control - Section 7.4

Limiting span to depth ratio; 40 Actual span to depth ratio; 12.1

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

Crack control - Section 7.3

Limiting crack width; w_{max} = **0.3** mm; Maximum crack width; w_k = **0.114** mm

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

Design shear force; V = **103.7** kN/m; Design shear resistance; $V_{Rd.c}$ = **169.9** kN/m

PASS - Design shear resistance exceeds design shear force

Check stem design at prop

Depth of section; h = **350** mm

Rectangular section in shear - Section 6.2

Design shear force; V = **33.8** kN/m; Design shear resistance; $V_{Rd.c}$ = **169.9** kN/m

PASS - Design shear resistance exceeds design shear force

Horizontal reinforcement parallel to face of stem - Section 9.6

Min.area of reinforcement; $A_{sx.req}$ = **393** mm^2/m; Max.spacing of reinforcement; s_{sx_max} = **400** mm

Trans.reinforcement provided; 10 dia.bars @ 200 c/c; Trans.reinforcement provided; $A_{sx.prov}$ = **393** mm^2/m

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

Check base design at toe

Depth of section; h = **400** mm

Rectangular section in flexure - Section 6.1

Design bending moment; M = **93.6** kNm/m; K = **0.027**; K' = **0.207**

K' > K - No compression reinforcement is required

Tens.reinforcement required; $A_{bb.req}$ = **719** mm^2/m

Tens.reinforcement provided; 20 dia.bars @ 200 c/c; Tens.reinforcement provided; $A_{bb.prov}$ = **1571** mm^2/m

Min.area of reinforcement; $A_{bb.min}$ = **526** mm^2/m; Max.area of reinforcement; $A_{bb.max}$ = **16000** mm^2/m

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

Library item: Rectangular single summary

Crack control - Section 7.3

Limiting crack width; w_{max} = **0.3** mm; Maximum crack width; w_k = **0.228** mm

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

Design shear force; V = **117** kN/m; Design shear resistance; $V_{Rd.c}$ = **176.2** kN/m

PASS - Design shear resistance exceeds design shear force

Secondary transverse reinforcement to base - Section 9.3

Min.area of reinforcement; $A_{bx.req}$ = **314** mm^2/m; Max.spacing of reinforcement; s_{bx_max} = **450** mm

Trans.reinforcement provided; 10 dia.bars @ 200 c/c; Trans.reinforcement provided; $A_{bx.prov}$ = **393** mm^2/m

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