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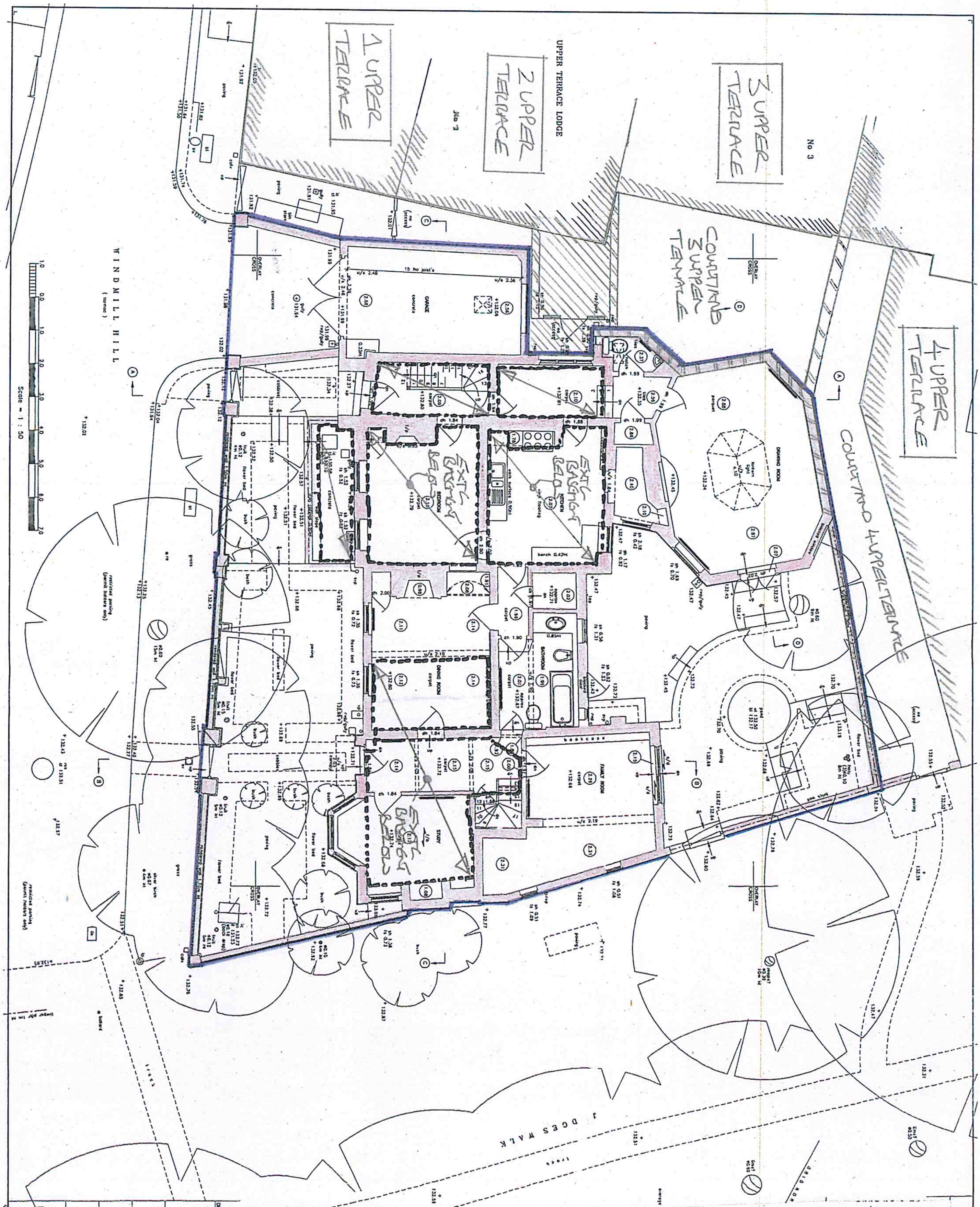
Appendix C – Structural Drawings



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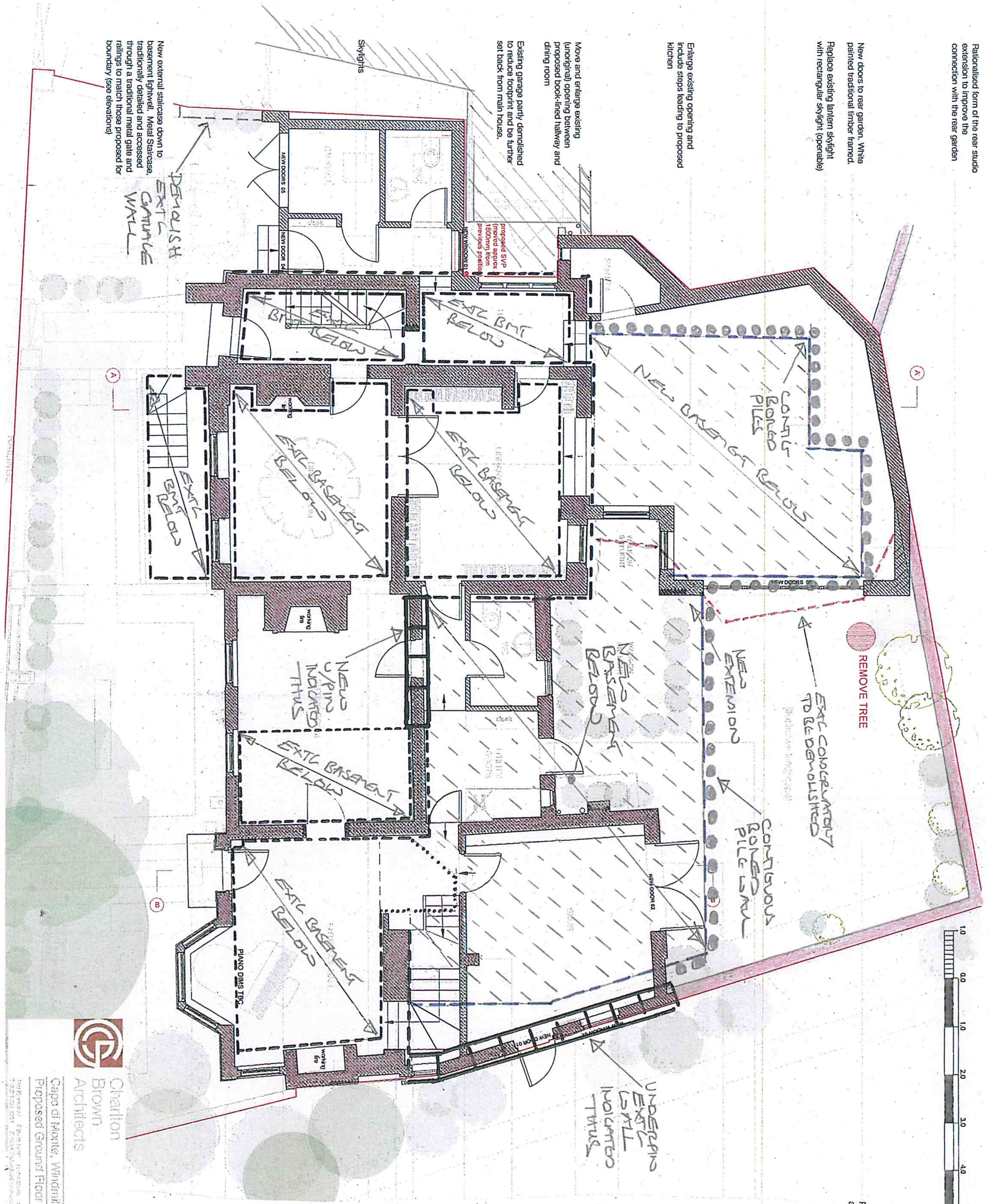
Job Title	Job Number	Sheet Number	Revision
CAPO DI MONTE	6036	300	P
Calculation/sketch Title	**Date**	**Author**	**Checked**
EXISTING G.F PLAN SHOWING EXTG BASEMENT	OCT 14	AJB	



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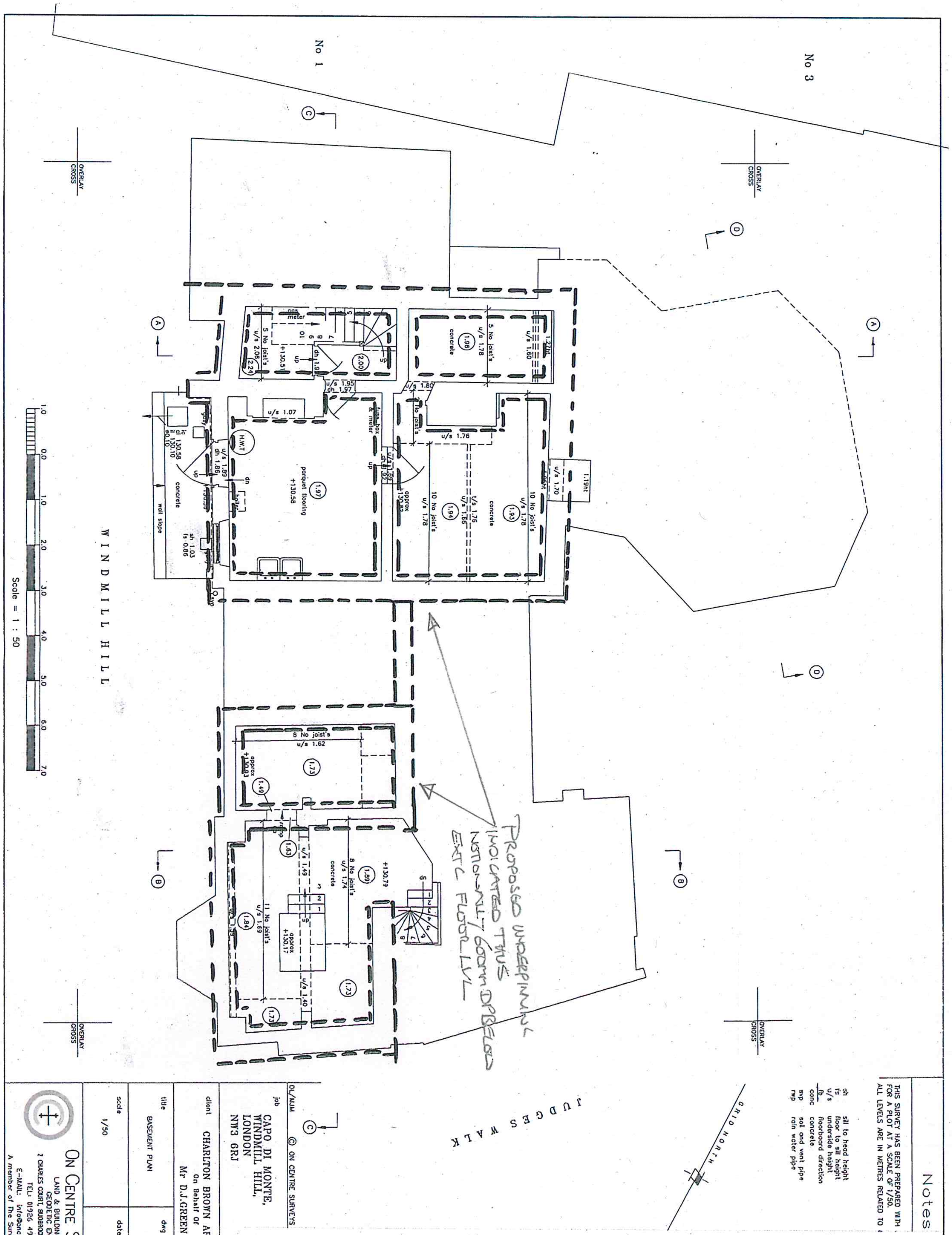
Job Title	Job Number	Sheet Number	Revision
CAPO DI MONTE	6036	301	P
Calculation/sketch Title	**Date**	**Author**	**Checked**
PROPOSED GF PLAN SHOWING EXT'G/NEW BASEMENT	OCT 14	AJB	



MBP Michael Barclay Partnership consulting engineers	Job Title	Job Number	Sheet Number	Revision
105-109 Strand London WC2R 0AA	CAPO DI MONTE	6036	302	P
T 020 7240 1191 F 020 7240 2241	Calculation/sketch Title	Date	Author	Checked
E london@mbp-uk.com	EXISTING BASEMENT PROPOSED UNDERPINNING	OCT 14	AJB	

CONCRETE BEAM ANALYSIS

Concrete beam dimensions:-

Beam width b = **1000** mm

Beam depth h = **250** mm

Cross-section area A = b × h = **250000** mm^2

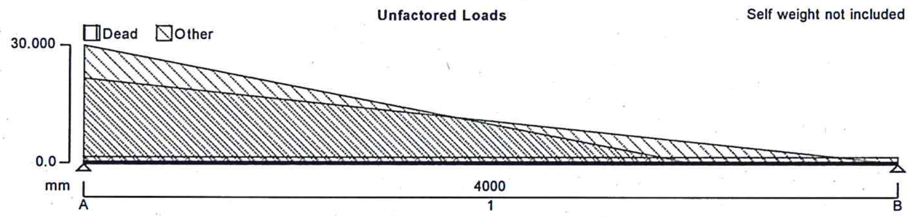
Major axis second moment of area I_{xx} = b × h^3 / 12 = **1.30×10^9** mm^4

f_{cu} = **35** N/mm^2

E = 20 kN/mm^2 + 200 × f_{cu} = **27.0** kN/mm^2

Ref BS8110:1985:Pt 2 - Eq 17

ρ = $\rho_{C.norm}$ = **2400** kg/m^3



CONTINUOUS BEAM ANALYSIS - INPUT

BEAM DETAILS

Number of spans = **1**

Material Properties:

Modulus of elasticity = **27** kN/mm^2 Material density = **2400** kg/m^3

Support Conditions:

Support A   Vertically **"Restrained"**   Rotationally **"Free"**

Support B   Vertically **"Restrained"**   Rotationally **"Free"**

Span Definitions:

Span 1   Length = **4000** mm   Cross-sectional area = **250000** mm^2 Moment of inertia = **1.30×10^9** mm^4

LOADING DETAILS

Beam Loads:

Load 1   UDL Dead load **0.0** kN/m

Load 2   VDL Other load **21.6** kN/m to **0.0** kN/m

Load 3   UDL Other load **1.5** kN/m

Load 4   Partial VDL Other load **30.0** kN/m at **0.000** m to **0.0** kN/m at **3.000** m

LOAD COMBINATIONS

Load combination 1 - ULS

Span 1   1.4×Dead + 1.6×Other

Load combination 2 - SLS

Span 1   1×Dead + 1×Other

CONTINUOUS BEAM ANALYSIS - RESULTS

Support Reactions - Combination Summary

Support A   Max react = **-65.5** kN   Min react = **-104.9** kN   Max mom = **0.0** kNm   Min mom = **0.0** kNm

Support B   Max react = **-28.6** kN   Min react = **-45.8** kN   Max mom = **0.0** kNm   Min mom = **0.0** kNm

Beam Max/Min results - Combination Summary

Maximum shear = **104.9** kN

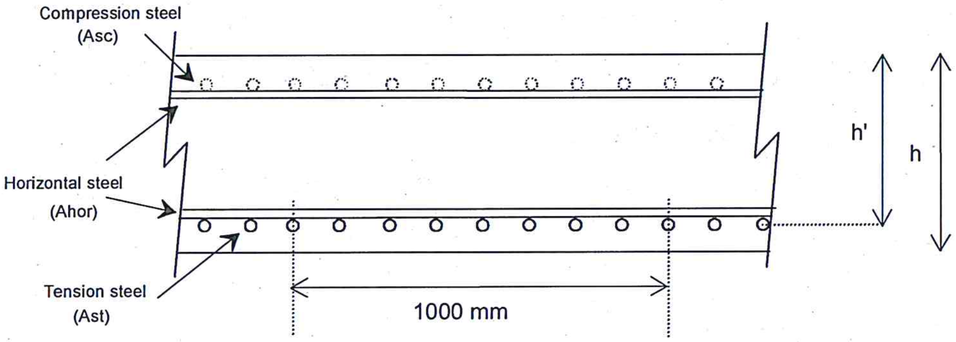
Minimum shear F_{min} = **-45.8** kN

Maximum moment = **75.9** kNm

Minimum moment = **0.0** kNm

Maximum deflection = **3.5** mm

Minimum deflection = **0.0** mm



Wall
(assumed symmetric)

RC WALL DESIGN (BS8110) WALL DESIGN TO CL 3.9.3

TEDDS calculation version 1.0.04

WALL DEFINITION

Wall thickness h = **250** mm

Cover to tension reinforcement c_w = **35** mm

Trial bar diameter D_{try} = **16** mm

Depth to tension steel

$h' = h - c_w - D_{try}/2$ = **207** mm

Materials

Characteristic strength of reinforcement f_y = **500** N/mm^2

Characteristic strength of concrete f_{cu} = **35** N/mm^2

Braced Wall Design to cl 3.9.3 (Simply supported construction)

Stocky check for braced walls

Wall clear height l_o = **4000** mm

Effective height factor for simply supported braced walls (assessed for a plain wall)

β = **1.00**

$l_e = \beta \times l_o$ = **4.000** m l_e/h = **16.00**

The braced wall is slender

Braced wall slenderness check

Effective wall height l_e = **4000** mm

Slenderness limit $l_{limit} = 40 \times h$ = **10000** mm

Slenderness limit $l_{limit1} = 45 \times h$ = **11250** mm

Wall slenderness limit OK

Define wall reinforcement

Main reinforcement in wall

Provide 16 dia bars @ 150 centres in each face

Area of "tension" steel $A_{st} = A_{svert} =$ **1340** mm^2/m

Area of compression steel $A_{sc} = A_{st} =$ **1340** mm^2/m

Total area of steel $A_{wall} = A_{st} + A_{sc} =$ **2680.0** mm^2/m

Percentage of steel $(A_{st} + A_{sc}) / h =$ **1.07** %

HORIZONTAL WALL STEEL

Wall thickness $h =$ **250** mm

Area of vertical steel provided $A_{wall} =$ **2680** mm^2/m

Percentage of vertical steel $p_{vwall} = A_{wall} / h =$ **1.07** %

Minimum diameter of horizontal steel $D_{min} = \max(D_{vert}/4, 6\text{ mm}) =$ **6** mm

Minimum area of horizontal steel

$A_{Hmin} = \text{If}(f_y>=(460\text{ N/mm}^2),\text{if}(p_{vwall}>2\ \%,0.13\ \%,0.25\%),\text{if}(p_{vwall}>2\ \%,0.24\ \%, 0.30\ \%)) \times h/2$

$A_{Hmin} =$ **313** mm^2/m

No containment links required

Define horizontal wall steel in one face

Provide 16 dia bars @ 150 centres in each face

Braced slender wall - simple construction - transverse bending and axial load

Design ultimate loading

Design ultimate axial load per m of wall $n_w =$ **10** kN/m

Larger initial transverse end moment per m of wall $m_2 =$ **5** kNm/m

Smaller initial transverse end moment per m of wall $m_1 =$ **5** kNm /m

Initial moment (approx)

$m_i = \max(\text{abs}(0.4\times m_1 + 0.6\times m_2), \text{abs}(0.4\times m_2)) =$ **5.0** kNm/m

Additional moment

$\beta_a = l_e^2 / (2000 \times h^2) =$ **0.128**

Reduction factor to correct deflection for axial load

$n_{uz} = 0.45 \times f_{cu} \times h + 1/\gamma_{ms} \times f_y \times A_{wall} =$ **5102.7** kN/m

$n_{bal} = 0.25 \times f_{cu} \times h' =$ **1811.3** kN/m

$K = \min((n_{uz} - n_w)/(n_{uz} - n_{bal}), 1.0) =$ **1.00**

$a_u = \beta_a \times K \times h =$ **32.0** mm

$m_{add} = n_w \times a_u = \mathbf{0.3}$ kNm/m

Minimum design moments

$m_{min} = \min(0.05 \times h, 20 \text{ mm}) \times n_w = \mathbf{0.1}$ kNm/m

Design moments

$m_{design} = \max(\text{abs}(m_2), \text{abs}(m_i) + m_{add}, \text{abs}(m_1) + m_{add}/2, m_{min}) = \mathbf{5.3}$ kNm/m

CHECK OF DESIGN FORCES - SYMMETRICALLY REINFORCED WALL SECTION

NOTES

h is the wall thickness

h' is the depth from the more highly compressed face to the "tension" steel.

Tension steel yields

Determine correct moment of resistance

$n_R = \text{if}(x_{calc} < h/0.9, n_{R1}, n_{R2}) = \mathbf{26.9}$ kN/m

$m_R = \text{if}(x_{calc} < h/0.9, m_{R1}, m_{R2}) = \mathbf{112.2}$ kNm/m

Applied axial load

$n_w = \mathbf{10.0}$ kN/m

Check for moment

$m_{design} = \mathbf{5.3}$ kNm/m

Moment check satisfied

The wall vertical reinforcement defined in each face is H16 dia bars @ 150 centres

CHECK MIN AND MAX AREAS OF STEEL

Overall thickness of wall $h = \mathbf{250}$ mm

Vertical steel

Total area of concrete per m run of wall $A_c = h = \mathbf{250000}$ mm²/m

$A_{st\_min} = 0.4\% \times A_c = \mathbf{1000}$ mm²/m

$A_{st\_max} = 4\ \% \times A_c = \mathbf{10000}$ mm²/m

Total vertical steel in wall $A_{wall} = \mathbf{2680}$ mm²/m

Area of vertical steel in wall provided OK

Horizontal steel

Percentage of vertical steel $p_{vwall} = A_{wall} / h = \mathbf{1.07}$ %

Diameter of horizontal steel $D_{hor} = \mathbf{16}$ mm

Minimum diameter of horizontal steel D_{min} = max(D_{vert}/4,6 mm) = **6** mm

Diameter of horizontal steel in wall OK

Area of horizontal steel in one face A_{shor} = **1340** mm^2/m

Minimum area of horizontal steel

A_{Hmin} = If(f_y>=(460 N/mm^2),if(p_{vwall}>2 %,0.13 %,0.25%),if(p_{vwall}>2 %,0.24,0.30 %)) × h/2

A_{Hmin} =**313** mm^2/m

Area of horizontal steel in wall provided OK

Shear Resistance of Concrete Walls - (cl 3.8.4.6)

Wall thickness h = **250** mm

Effective depth to steel h' = **207** mm

Area of concrete A_{conc} = h = **250000** mm^2/m

Design ultimate shear force through thickness per m of wall v_w = **105** kN/m

Characteristic strength of concrete f_{cu} = **35** N/mm^2

Is a check required? (3.8.4.6)

Axial load per m of wall n_w = **10.0** kN/m

Major axis moment per m of wall m_w = **75.9** kNm/m

e = m_w / n_w = **7590.0** mm

e_{limit} = 0.6 × h = **150.0** mm

Actual shear stress v_x = v_w / h' = **0.5** N/mm^2

Allowable stress $v_{allowable}$ = min ((0.8 N$^{1/2}$/mm) × √(f_{cu}), 5 N/mm^2) = **4.733** N/mm^2

Shear check required

Design shear stress to clause 3.4.5.12

f_{cu_ratio} = if (f_{cu} > 40 N/mm^2 , 40/25 , f_{cu}/(25 N/mm^2)) = **1.400**

Design concrete shear stress

v_c = 0.79 N/mm^2 × min(3,100 × A_{st} / h')$^{1/3}$ × max(1,(400 mm) / h')$^{1/4}$ / 1.25 * $f_{cu\_ratio}^{1/3}$

v_c = **0.721** N/mm^2

v_c' = v_c + 0.6 × n_w / h × min(abs(v_w) × h / m_w, 1.0) = **0.7** N/mm^2

$v_{allowable}$ = min ((0.8 N$^{1/2}$/mm) × √(f_{cu}), v_c' , 5 N/mm^2) = **0.729** N/mm^2

Actual shear stress

v_x = **0.5** N/mm^2

Shear reinforcement not necessarily required in wall

Shear stress - OK

Appendix D – Basement Impact Assessment (Summary Only)
Refer separate report byHR Wallingford for full BIA)

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Introduction

The construction of basements is increasingly popular and the London Borough of Camden (LBC) requires the preparation of a Basement Impact Assessment (BIA) as part of the planning documentation.

The following BIA has been prepared in consideration of the following Camden planning documents:

Development Policy DP27 "Basements and Light-wells"

Core Strategy 14 (CS14) "Promoting high quality places and conserving our heritage"

Planning Guidance Note CPG4 "Basements and Light-wells" Sept 2013

"Camden Geological, Hydrogeological and Hydrological Study" Arup 2010

The following report demonstrates that the proposed underground development will not cause harm to the built and natural environment or to the local amenity.

This report addresses subterranean flow (groundwater), land stability and surface flow and flooding.

The format of this document addresses all potential impacts identified by CPG 4 under each of these key headings.

Each of the individual screening issues covered in CPG 4 has been considered and commentated on to an appropriate level in a combined approach

Subterranean (Groundwater) Issues

	Consideration	Comments
1a	Is the site located directly above an aquifer?	**Yes**, Camden considers all sites which do not outcrop with London Clay to be above an aquifer. Surface outcrop of Bagshot Beds depth Approx 20m EAA mapping confirms this site to be an area of minor aquifer. There are no groundwater protection issues. No impacts on Bagshot Beds aquifer are expected.
1b	Will the proposed basement extend below the water table?	**No:** Ground Investigation data indicates groundwater at a depth of 5.2m, which is substantially greater than the proposed basement depth. The highest recorded depth at the nearest bore-hole at the adjacent site 4 Upper Terrace (over a protracted period was 7.7m). Therefore basement will not act as a barrier to groundwater flows and there are discernible impacts ground water.
2	Is the site within 100m of a watercourse or potential spring line	**No.** No watercourses are marked on the geological maps in the vicinity of the site.
3	Is the site within the catchment of the pond chains of Hampstead Heath	**No.** The site drains to the south and west and is not within any pond catchments. This is clear from Fig 14 of the Camden Geological, Hydrogeological and Hydrological study (Arup)
4	Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?	**No.** The small existing courtyard garden is predominantly paved. There will be no material changes – contributing areas to be kept largely as existing
5	As part of the site drainage, will more surface water (eg rainfall and run-off) than at present be discharged to the ground (eg via soakaways and or SUDS?	**No.** The existing drainage systems are to be reinstated as existing with no changes to flows discharged to the ground.
6	Is the lowest part of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to /lower than, the mean	**No.** There are no relevant local ponds and the spring line is significantly downhill from the site: Based on the BGS Geological Sheet N1 S E (1:10,560) the natural spring line is at or near to the interface of the Claygate Beds and Bagshot Sands - nearest outcrop being some 200m away

Land Stability Issues

	Consideration	Action
1	Does the existing site include slopes, natural or man-made, greater than 7deg?	**No**. There are no significant slopes at the site.
2	Will the proposed re-profiling of landscaping at site change slopes at the property boundary to more than 7deg?	**No**. There is no re-profiling of ground levels around the site proposed.
3	Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7deg.	**Yes.** There are local areas below the site that have slopes slightly greater than 7deg. However, the basement is sufficiently remote from those areas for them not to cause any slope stability problems in those areas
4	Is the site within a wider hillside setting in which the general slope is greater than 7deg	**No.** The average slope to the SW is approximately 1 in 10. A slope of less than 7 deg is confirmed on Fig 16 of the Camden Geological, Hydrogeological and Hydrological study
5	Is the London clay the shallowest strata at the site	**No.** Site-specific investigation has confirmed that the Bagshot sand formation is the shallowest strata. Refer Ground Engineering Report C13361
6	Will any tree/s be felled as part of the proposed development and/or are any works proposed within any tree protection zones where trees are to be retained?	**Yes.** A tree is to be felled as described in the Arboricultural Report by Tree-Tec that accompanies this planning application. Additionally there may be minor incursions into the RPA of less than 1% as similarly described.
7	Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site?	**No.** Site-specific investigation has confirmed that the Bagshot sand formation is the shallowest strata. Refer Ground Engineering Report C13361
8	Is the site within 100m of a watercourse or potential spring line?	**No.** Refer response to question 2 under subterranean (groundwater) issues.

9	Is the site within an area of previously worked ground?	**No.** There is no evidence of worked ground at the site. BGS Geological sheet N1 S E (1:10,560) illustrates old sand pits and worked ground lie far beyond the site.
10	Is the site within an aquifer? If so, will the proposed basement extend beneath the water table such that de-watering may be required during construction?	**Yes:** Based on the EA's aquifer designations the site is considered to be a Secondary A Aquifer. This consists of *"permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flows to rivers. These are generally aquifers formerly classified as minor aquifers"* Water level information from the bore-holes around the site suggests very slight possibility of perched water and therefore de-watering is very unlikely to be required.
11	Is the site within 50m of Hampstead Heath Ponds?	**No.** See Figure 14 Camden Geological, Hydrogeological and Hydrological Study
12	Is the site within 5m of a highway or pedestrian right of way?	**Yes.** Details of infrastructure in the area have been obtained and reviewed and nothing critical has been identified. The basement excavation is located sufficiently far from the highway for it not to be impacted.
13	Will the proposed development significantly increase the differential depth of foundations relative to neighbouring properties?	**No.** Several of the nearby properties have existing basements – probably single storey and 2.5-3.0m in depth: The basement extension at 4 Upper Terrace is significantly deeper. The new basement at Capo di Monte will not be significantly deeper than its immediate neighbours.
14	Is the site over (or within the exclusion zone of) any tunnels, eg railway lines?	**No.** Enquiries made with all statutory authorities including London Underground and Network Rail. Refer letters contained in Landmark Search Reports

Surface flow and flooding Issues

	Consideration	Action
1	Is the site within the catchment of the pond chains on Hmpstead Heath?	**No.** See Figure 14 Camden Geological, Hydrogeological and Hydrological Study
2	As part of the proposed site drainage, will surface water flows (eg volume of rainfall and peak run-off) be materially changed from the existing route?	**No.** The existing drainage systems are to be reinstated as existing with no changes to flows discharged to the ground
3	Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	**No.** Refer comments to question 2 above
4	Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface water being received by adjacent properties or downstream watercourses?	**No.** Refer comments to question 2 above
5	Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	**No.** There are no proposed changes to surface flows that discharge to the ground or to the local drainage system
6	Is the site in an area identified to have surface water food risk according to either rthe Local floor risk Management strategy or the Strategic flood risk Assessment or is it at risk of flooding for example because the proposed basement is below the static water level of a nearby surface water feature?	**No.** Whilst an area of risk of surface flooding is shown for Windmill Hill Fig 15 on Camden Geological, Hydrogeological and Hydrological study (flooded 1975) it is to the south of the property. The local topography means it does not affect the property and there will be no changes to flood risk elsewhere. All sources of flood map show no anticipated risk of groundwater or fluvial flooding. There is no history of such flooding.

Conclusion

- The proposed works will not affect ground water flows and levels
- It is proposed that the existing surfaces and drainage systems will be reinstated with no changes to the volumes of run-off or discharge rate
- There will be no changes to flood risk at the site or elsewhere
- There are no issues anticipated with underground services running close to the site
- There are no slope stability issues of concern
- There are no significant issues associated with the trees

It is therefore concluded that the proposed basement development meets the relevant requirements of DP27 and that it can be approved with respect to CPG 4