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152 Royal College Street
London, NW1 0TA

Basement Impact Assessment
Audit

For

London Borough of Camden

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Revision: F1

May 2016

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1.0 NON-TECHNICAL SUMMARY

1.1. CampbellReith was instructed by London Borough of Camden, (LBC) to carry out an audit on the Basement Impact Assessment submitted as part of the Planning Submission documentation for 152 Royal College Street (planning reference 2015/4396/P). On the basis of the BIA, the basement was considered to fall within Category A as defined by the Terms of Reference, however, a review of the proposals identified potential impacts on surrounding structures and infrastructure.

1.2. The Audit reviewed the Basement Impact Assessment for potential impact on land stability and local ground and surface water conditions arising from basement development in accordance with LBC's policies and technical procedures.

1.3. CampbellReith was able to access LBC's Planning Portal and gain access to the latest revision of submitted documentation and reviewed it against an agreed audit check list.

1.4. The Basement impact Assessment (BIA) was undertaken by Michael Hadl Associates and the individuals involved are all Chartered Structural Engineers. Whilst there was no input from a Chartered Geologist with respect to the appraisal of groundwater flow as required by CPG4, hydrogeological issues are considered to be addressed appropriately.

1.5. A separate Ground Investigation, Geotechnical Analysis and Contamination Assessment Report was prepared by Soil Consultants and the individuals involved have suitable credentials.

1.6. The BIA has confirmed that the proposed basement will be founded in the London Clay and that the surrounding slopes are stable.

1.7. The basement is to be constructed by underpinning the party wall with no 154 Royal College Street with a bored pile wall indicated in the BIA addendum forming the remainder of the site perimeter following a clarification request in the initial audit report.

1.8. It is accepted that the development will not impact on the wider hydrogeology of the area and is not in an area subject to flooding. It is accepted that the BIA has shown that the development will have little detrimental effect on surface water discharges to the network drainage system.

1.9. It is accepted that any groundwater encountered is likely to be perched and pumping is anticipated to be sufficient to deal with this.

1.10. The BIA did not identify the presence of a semi-mature tree close to the north western corner although this was indicated on the site plans and the Soil Consultants report. Clarification was

requested and the BIA addendum considers the presence of the tree and concludes it is unlikely to be affected by the development.

1.11. The BIA did not identify the presence nor consider the impact of the development on a sewer in the north eastern area. It is understood that consultations with Thames Water have been undertaken with the extent of the basement now revised and it is stated the development will not load the sewer. Confirmation should be presented.

1.12. Stiffness parameters were not given as part of the retaining wall parameters in the BIA and this has now been provided for the London Clay in the BIA addendum.

1.13. Supporting analysis has now been provided for the ground movement assessment as requested and Category 0 damage is predicted for both No 154 and the nearby canal wall. It is recommended that details on how further damage to No 154 ,which is already in poor condition with visible cracks noted, is to be limited should be agreed as part of the Party Wall awards.

1.14. The BIA addendum indicates the predicted heave as a result of excavation was analysed using Boussinesq's elastic theory.

1.15. A preliminary construction management plan (CMP) and an outline programme of works is provided as requested in the appendices to the BIA addendum and it is stated that the final CMP and detailed programme will be provided by the appointed Contractor.

1.16. An outline monitoring proposal has been provided following a request in the initial audit report and it is further stated a fully detailed monitoring regime with trigger levels will be agreed as part of the party wall awards and this is recommended.

1.17. It is accepted that the BIA has adequately identified the potential impacts such as the effect to the neighbouring structures from basement construction and proposes sufficient mitigation, however, further details on limiting damage to No. 154 should be agreed as part of the Party Wall awards.

2.0 INTRODUCTION

2.1. CampbellReith was instructed by London Borough of Camden (LBC) carry out a Category B Audit on the Basement Impact Assessment (BIA) submitted as part of the Planning Submission documentation for 152 Royal College Street, London NW1 0TA, Camden Reference 2015/4396/P.

2.2. The Audit was carried out in accordance with the Terms of Reference set by LBC. It reviewed the Basement Impact Assessment for potential impact on land stability and local ground and surface water conditions arising from basement development.

2.3. A BIA is required for all planning applications with basements in Camden in general accordance with policies and technical procedures contained within

- Guidance for Subterranean Development (GSD). Issue 01. November 2010. Ove Arup & Partners.
- Camden Planning Guidance (CPG) 4: Basements and Lightwells.
- Camden Development Policy (DP) 27: Basements and Lightwells.
- Camden Development Policy (DP) 23: Water

2.4. The BIA should demonstrate that schemes:

a) maintain the structural stability of the building and neighbouring properties;

b) avoid adversely affecting drainage and run off or causing other damage to the water environment; and,

c) avoid cumulative impacts upon structural stability or the water environment in the local area.

and evaluate the impacts of the proposed basement considering the issues of hydrology, hydrogeology and land stability via the process described by the GSD and to make recommendations for the detailed design.

2.5. LBC's Audit Instruction described the planning proposal as *"Erection of five-storey building including excavation of basement to provide 1 x 4 bed maisonette (Class C3) and retail and office at ground and basement level. Demolish two storey building and erection of 2 x 3 bedroom, four storey dwellings including a new basement floor."* It should be noted that the description on the BIA states three above ground floors and a single storey basement.

2.6. The Audit Instruction also confirmed the proposal does not involve a listed building nor is it neighbour to a listed building.

2.7. CampbellReith accessed LBC's Planning Portal on 16 February 2016 and gained access to the following relevant documents for audit purposes:

- Basement Impact Assessment (BIA) - Michael Hadl Associates (MHA), dated July 2015 which includes as part of the appendices an interpretative Ground Investigation, Geotechnical Analysis and Contamination Assessment Report by Soil Consultants dated July 2015
- Design and Access Statement – Henning Stummel Architects Ltd
- Architects – Henning Stummel Architects Ltd drawings:

  Location Plan (101_PA_010)

  Existing Plans (101_PA_020)

  Existing Elevations (101_EX_200)

  Proposed Floor Plans (101_PA_100)

  Proposed Elevations (101_PA_200)

  Proposed Front Elevation (101_PA_210)

  Window and Roof detail (101_PA_310)

  South West Corner Detail (101_PA_410
- 17 No Consultation Responses

2.8. Additional information was received on 8 April 2016 in response to queries raised in the initial BIA audit report. The documentation is as follows:

- Basement Impact Assessment Addendum Information, Michael Hadl Associates (MHA), dated April 2016 (included in Appendix 3)

3.0 BASEMENT IMPACT ASSESSMENT AUDIT CHECK LIST

Item	Yes/No/NA	Comment
Are BIA Author(s) credentials satisfactory?	No	See Audit paragraph 4.1.
Is data required by Cl.233 of the GSD presented?	Yes	Michael Hadl Associates (MHA) Basement Impact Assessment (BIA) report and BIA addendum information.
Does the description of the proposed development include all aspects of temporary and permanent works which might impact upon geology, hydrogeology and hydrology?	Yes	MHA BIA report and BIA addendum information.
Are suitable plan/maps included?	Yes	MHA report appendices and Henning Stummel Architects Ltd drawings.
Do the plans/maps show the whole of the relevant area of study and do they show it in sufficient detail?	Yes	
Land Stability Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	No	Discrepancy in the trees identified and an incorrect response to Q14 which relates to whether or not the site is within the exclusion zone of a tunnel, however, both issues have now been appropriately addressed in the BIA addendum (see Audit paragraphs 4.8 and 4.9).
Hydrogeology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	MHA report Section 7.
Hydrology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	MHA report Section 7.

Item	Yes/No/NA	Comment
Is a conceptual model presented?	Yes	Soil Consultants Ground Investigation, Geotechnical Analysis and Contamination Assessment Report and MHA report Section 3.
Land Stability Scoping Provided? Is scoping consistent with screening outcome?	No	Soil Consultants Report indicates the presence of a sewer in the north eastern area of the site which was not considered in the BIA, however, this issue is now appropriately addressed in the BIA addendum (see Audit paragraph 4.9).
Hydrogeology Scoping Provided? Is scoping consistent with screening outcome?	N/A	MHA report Section 7.1 states scoping not required as no concerns were raised in the screening.
Hydrology Scoping Provided? Is scoping consistent with screening outcome?	N/A	MHA report Section 7.1 states scoping not required as no concerns were raised in the screening.
Is factual ground investigation data provided?	Yes	Soil Consultants report.
Is monitoring data presented?	Yes	Soil Consultants report Section 5.3 and MHA report Sections 2.0 to 4.0.
Is the ground investigation informed by a desk study?	Yes	Included in Soil Consultants report and MHA report Section 2.0.
Has a site walkover been undertaken?	Yes	Soil Consultants report Section 3.2.
Is the presence/absence of adjacent or nearby basements confirmed?	Yes	154 Royal College Street, the immediate neighbouring property is indicated to contain a single storey basement.
Is a geotechnical interpretation presented?	Yes	Soil Consultants Report Section 6.0.
Does the geotechnical interpretation include information on retaining wall design?	Yes	MHA BIA and addendum information.

Item	Yes/No/NA	Comment
Are reports on other investigations required by screening and scoping presented?	Yes	
Are baseline conditions described, based on the GSD?	Yes	MHA and Soil Consultants reports.
Do the base line conditions consider adjacent or nearby basements?	Yes	
Is an Impact Assessment provided?	Yes	Provided in MHA report Section 10, however, this was considered inadequate. MHA BIA addendum appropriately addresses outstanding issues (see Audit paragraphs 4.11 to 4.14).
Are estimates of ground movement and structural impact presented?	Yes	MHA BIA addendum information.
Is the Impact Assessment appropriate to the matters identified by screen and scoping?	Yes	This was considered inadequate in the BIA (see Audit paragraphs 4.11 to 4.14) however outstanding issues addressed in BIA addendum.
Has the need for mitigation been considered and are appropriate mitigation methods incorporated in the scheme?	Yes	MHA report Section 6.0.
Has the need for monitoring during construction been considered?	Yes	Outline proposals in MHA BIA addendum.
Have the residual (after mitigation) impacts been clearly identified?	N/A	
Has the scheme demonstrated that the structural stability of the building and neighbouring properties and infrastructure will be maintained?	Yes	MHA BIA addendum.
Has the scheme avoided adversely affecting drainage and run-off or causing other damage to the water environment?	Yes	MHA BIA and addendum.

Item	Yes/No/NA	Comment
Has the scheme avoided cumulative impacts upon structural stability or the water environment in the local area?	Yes	MHA BIA and addendum.
Does report state that damage to surrounding buildings will be no worse than Burland Category 2?	Yes	BIA addendum predicts Category 0 (Negligible) damage for No 154.
Are non-technical summaries provided?	Yes	MHA report Section 7.1, 8.1, 9.0 and 10.1.

4.0 DISCUSSION

4.1. The Basement Impact Assessment (BIA) was prepared by Michael Hadl Associates (MHA) Ltd and the individuals concerned in its production are all Chartered Structural Engineers with one of the reviewers also a Fellow of the Institution of Civil Engineers (FICE). The preparation of a BIA also requires the involvement of a Chartered Geologist (C.Geol) with respect to appraisal of groundwater flow and whilst this does not appear to be the case, it is considered that groundwater issues have been appropriately appraised.

4.2. A separate Ground Investigation, Geotechnical Analysis and Contamination Assessment Report was prepared by Soil Consultants Ltd and the individuals involved have suitable qualifications.

4.3. The basement, with a formation level of c.3m below ground level (bgl) is to be constructed by underpinning the party wall with No. 154 Royal College Street with a bored pile wall forming the remainder of the site perimeter. Section 2 of the BIA addendum indicates a contiguous wall. An indicative construction sequence is presented in Appendix C of the MHA report.

4.4. The BIA indicates the neighbouring property, No. 154 Royal College Street comprises a basement with relatively low headroom. A trial pit excavated against this property indicates a foundation level of 2.10m bgl.

4.5. The ground investigation encountered Made Ground noted to be infill from a historic basement to between 1.90 and 2.30m bgl over London Clay with groundwater monitored at c.2.90m bgl. It is stated in the MHA report that any perched water should be removed by sump pumping during construction and it is accepted that should be sufficient. Section 6.0 of the BIA states the basement slab and walls are to be designed for a maximum a water level of 1m bgl.

4.6. Whilst Regents Canal is indicated to be within 20m of the site, the BIA states that as this is a manmade 'tanked' structure in a non-aquifer therefore has little influence on groundwater. It is accepted that the BIA has shown that the development will have no significant effect on the hydrogeology of the surrounding area.

4.7. It is stated in the BIA that the site is not in a flood risk area and this is accepted.

4.8. The BIA noted the presence of trees along the Canal across Baynes Street, however, there was no mention of the semi-mature deciduous tree identified close to the southwestern corner in Section 2.0 of the Soil Consultants Report and indicated on the site plans. Clarification was requested and the BIA addendum considers the presence of the tree and concludes it is unlikely to be affected by the development.

4.9. A 'No' response was given to Q14 of the slope stability screening which relates to whether or not the site is over or within the exclusion zone of a tunnel. This was considered incorrect because a sewer running through the north eastern area of the site was noted in the Soil Consultants Report and indicated on the site plans and it was requested in the initial audit report that the impact of the proposed development on the sewer be considered. It is stated in the BIA addendum that the extent of the basement has been revised following liaison with Thames Water and that the '*proposals will not load the sewer*'. Confirmation should be provided.

4.10. Retaining wall parameters were given on Section 6.1 of the Soil Consultants Report, however, this was considered incomplete in the initial audit report as stiffness parameters were not given for the London Clay and Made Ground. A recommended undrained shear strength (Cu)/Young's Modulus (E) relationship is now given in the BIA addendum.

4.11. The BIA stated subsidence of soil behind the basement retaining walls, particularly to neighbouring highways and structures is to be kept within acceptable limits by the formation of a rigid basement box stiffened by lateral supports. It was further stated that subsidence/heave from the basement construction will not be onerous and will not influence the neighbouring buildings, however, no supporting analysis, predicted vertical and horizontal movements from the construction activities or an anticipated damage category for No. 154 which was noted to be in poor condition was provided.

4.12. Supporting analysis has now been provided in the BIA addendum and Category 0 (Negligible) damage is predicted for No 154 as a result of the underpinning of the party wall. For the piled wall the anticipated combined long term horizontal and vertical movements of the ground behind the wall due to installation, excavation and pile deflection are 5.7mm and 10.9mm respectively. For the underpinning to the Party Wall with No 154, the anticipated combined vertical long term movement of the ground due to the construction of the underpins, basement excavation and underpin deflection is 3.3mm. No indication of horizontal movement is given in the text.

4.13. Movement resulting from underpinning is almost entirely due to workmanship and damage to a neighbouring property may be limited to Category 1 provided the works are properly controlled and the building is in sound condition. However, in this case given No 154 is already in poor condition, it is difficult to predict anticipated damage or determine the reliability of the assessment. It is recommended that details on how further damage to No 154, which is already in poor condition with visible cracks note, is to be limited should be agreed as part of the Party Wall award. Negligible damage is also predicted for the nearby canal wall as a result of piling and excavation.

4.14. Section 6.2 of the Soil Consultants report stated that long term heave is expected to be in the order of 10 to 15mm although it was unclear how this was determined. The BIA addendum states this was based on '*traditional elastic theory by Boussinesq'* and the supporting analysis has now been provided.

4.15. A preliminary construction management plan (CMP) is provided in the appendices to the BIA addendum and it is stated that the final CMP will be provided by the appointed Contractor.

4.16. An outline monitoring proposal has been provided following a request in the initial audit report and it is indicated that movement monitoring of the party wall during the later stages of the structural works will not be possible due to the monitoring locations being obscured by the new structure. It is further stated that condition surveys should be undertaken prior to site works commencing and that a fully detailed monitoring regime with trigger levels will be agreed as part of the party wall awards. This is accepted.

4.17. An outline works programme has now been provided in the appendices to the BIA addendum and it is accepted a detailed programme may be provided by the appointed Contractor.

4.18. It is accepted that the BIA has adequately identified the potential impacts such as the effect on the neighbouring structures from basement construction and, subject to the agreement of the Party Wall award, proposes sufficient mitigation.

5.0 CONCLUSIONS

5.1. The BIA report authors and reviewers are Chartered Structural Engineers and whilst CPG4 requires the input of a Chartered Geologist with respect to the appraisal of groundwater flow, it is considered the BIA appropriately addressed this issue.

5.2. The individuals involved in the preparation of the Soil Consultants Ground Investigation, Geotechnical Analysis and Contamination Assessment Report have suitable qualifications.

5.3. The basement is to be constructed by underpinning the party wall with no 154 Royal College Street with a bored pile forming the remainder of the site perimeter. It is indicated in the BIA addendum that is contiguous wall following a clarification request in the initial audit report.

5.4. The BIA has confirmed that the proposed basement will be founded in the London Clay and that the surrounding slopes are stable.

5.5. It is accepted that the development will not impact on the wider hydrogeology of the area and is not in an area subject to flooding. It is accepted that the BIA has shown that the development will have little detrimental effect on surface water discharges to the network drainage system.

5.6. It is accepted that any groundwater encountered is likely to be perched and pumping is likely to be sufficient to deal with this.

5.7. The BIA did not identify the presence of a semi-mature tree close to the north western corner although this is indicated on the site plans and the Soil Consultants report. Clarification was requested and the BIA addendum considers the presence of the tree and concludes it is unlikely to be affected by the development.

5.8. The BIA did not identify the presence nor consider the impact of the development on a sewer in the north eastern area. It is understood that consultations with Thames Water have been undertaken with the extent of the basement now revised and that the development will not load the sewer. Confirmation should be provided.

5.9. Stiffness parameters were not given as part of the retaining wall parameters in the BIA and this has now been provided for the London Clay in the BIA addendum.

5.10. Supporting analysis for the ground movement assessment has now been provided for the ground movement analysis as requested and Category 0 damage is predicted for both No 154 and the nearby canal wall. It is recommended that details on how further damage to No

154 ,which is already in poor condition with visible cracks noted is to be limited should be agreed as part of the Party Wall awards.

5.11. The BIA addendum indicates the predicted heave as a result of excavation was analysed using Boussinesq's elastic theory.

5.12. A preliminary Construction Management Plan (CMP) and an outline programme of works is provided as requested in the appendices to the BIA addendum and it is stated that the final CMP and detailed programme will be provided by the appointed Contractor.

5.13. An outline monitoring proposal has been provided following a request in the initial audit report and it is further stated a fully detailed monitoring regime with trigger levels will be agreed as part of the party wall awards and this is recommended.

5.14. It is accepted that the BIA has adequately identified the potential impacts such as the impact to the neighbouring structures from basement construction and proposes sufficient mitigation, however, further details on limiting damage to No 154 should be agreed as part of the Party Wall award.

Appendix 1: Residents' Consultation Comments

Residents' Consultation Comments

Surname	Address	Date	Issue raised	Response
Nedin (Nathaniel Lichfield and Partners)	On behalf of the owner of Bruges Place, Baynes Street	30th September 2015	Failure to provide a construction management plan Limited ground movement assessment, no indication of anticipated damage category and impacts not appropriately considered	see Audit paragraph 4.15 see Audit paragraphs 4.9 to 4.13 and 4.18

Appendix 2: Audit Query Tracker

Audit Query Tracker

Query No	Subject	Query	Status	Date closed out
1	BIA format	A works programme has not been submitted as required by cl.233 of the GSD	Closed – Outline programme provided in appendices to BIA addendum with detailed programme to be provided by appointed Contractor.	10/05/16
2	Stability	Clarification is requested on whether a contiguous or secant wall is proposed	Closed – BIA addendum confirms this is a contiguous wall	10/05/16
3	Stability	Clarification is requested on the presence of a semi-mature tree on the northwestern corner	Closed – Tree considered in BIA addendum which concludes development will not impact tree	10/05/16
4	Stability	Stiffness parameters not provided for retaining wall design	Closed – Stiffness parameters for London Clay provided in BIA addendum	10/05/16
5	Stability	Unclear how predicted heave movements were determined	Closed – Clarification provided in BIA addendum together with supporting analysis	10/05/16
6	Stability	Supporting analysis for ground movement assessment and predicted damage category not provided	Closed – Provided in BIA addendum. Predicted damage to No 154 assumes property is in sound condition however this building is indicated to have visible cracking already. Details on how further damage to building is limited to be agreed as part of Party Wall award.	10/05/16 N/A
7	Stability	Presence of a sewer in north eastern area not considered	Closed – Considered in BIA addendum with Thames Water liaison understood to have been undertaken	10/05/16
8	Stability	Movement monitoring details not provided	Closed – Outline proposals provided in BIA addendum. Detailed monitoring regime and trigger levels to be agreed as part of Party Wall	N/A

			Awards.	
9	BIA format	Construction Management Plan not provided	Closed – Preliminary proposals provided in BIA addendum. Detailed plan to be provided by appointed Contractor and agreed with the owners of the roadways and the Council	N/A

Appendix 3: Supplementary Supporting Documents

Michael Hadl Associates BIA addendum information dated April 2016

15055 / 152 Royal College Street, NW1 0TA

April 2016 / Basement Impact Assessment – Addendum Information

Rev	Date	Description
-	08 April 2016	Submission for inclusion in planning application

Prepared by: Robert Dean *BEng (Hons) CEng MIStructE*

Authorised by: *Sarah Miley MA MEng (Cantab) CEng MIStructE*

Issued by: Robert Dean *BEng (Hons) CEng MIStructE*

Summary

This note forms part of a Basement Impact Assessment (BIA), as set out by Camden's Planning Guidance 4 (CPG4) for the proposed basement at 152 Royal College Street, NW1 0TA.

This note should be read in conjunction with Michael Hadi Associates BIA submission dated July 2015.

It provides additional information to meet the revised requirements of CPG4 (revision dated July 2015) as requested by the BIA audit undertaken by Campbell Reith dated February 2016, including a works programme, a Construction Management Plan (CMP), ground movement analysis and associated predicted damage category assessment and proposed movement monitoring.

The extent of the basement has been revised following liaison with Thames Water with regards to an underground sewer across the site. The proposed works will not load the sewer.

The construction of the basement will not have an adverse impact on adjacent structures and the Thames Water sewer. The construction of the property is feasible, without significantly disturbing local residents and local traffic flows.

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Appendix A – Revised Basement Drawings

Appendix B – Basement Heave Analysis

Appendix C – Retaining Wall Movement Analysis

Appendix D – Thames Water Sewer Plan Extract

Appendix E – Construction Management Plan (CMP)

1.0 Introduction

This addendum note forms part of a Basement Impact Assessment (BIA), as set out by Camden's Planning Guidance 4 (CPG4) for the proposed basement at 152 Royal College Street, NW1 0TA.

This note should be read in conjunction with Michael Hadi Associates BIA submission dated July 2015. It provides additional information to meet the revised requirements of CPG4 (revision dated July 2015) and as requested by the BIA audit undertaken by Campbell Reith dated February 2016.

Since the July 2015 BIA submission the extent of the basement has been revised following liaison with Thames Water with regards to their underground sewer across the site. The proposed works will not load the sewer. The approximate route of the sewer is shown on our general arrangement drawings in Appendix A and on the Thames Water sewer plan contained in Appendix D.

The below is a list of the additional information requested by the BIA audit:

i. A works programme has not been submitted as required by cl.233 of the GSD (Guidance for Subterranean development)

ii. Clarification is requested on whether a contiguous or secant wall is proposed

iii. Clarification is requested on the presence of a semi-mature tree on the northwestern corner

iv. Stiffness parameters not provided for retaining wall design

v. Unclear how predicted heave movements were determined

vi. Supporting analysis for ground movement assessment and predicted damage category not provided

vii. Presence of a sewer in north eastern area not considered

viii. Movement monitoring details not provided

ix. Constructed management plan not provided

All of the above queries are address in section 2.0 of this addendum.

2.0 Response to Audit Queries

(i) *– Works Programme*
An outline works programme is provided in the Construction Management Plan contained in Appendix E.

(ii) *– Piled Wall Construction*
A contiguous pile wall is proposed along the Royal College Street and Baynes Street sides of the proposed reduced basement. Please refer to SK10 contained in Appendix A.

(iii) *– Tree in northwestern corner*
The adjacent tree present on Royal College Street is located in a council tree pit and has presumably been planted only within the last 10 years. Refer to the photo below taken in November 2015.

The construction of the proposed basement will not compromise the stability of the tree as its root zone is unlikely to extend across to the site as the tree is young, its truck diameter is small and the soil under the pavement will be highly compacted. NHBC guidance suggests a minimum foundation formation depth of 1.85m, assuming the tree could reach a mature height of 10m (as typical Council planted fruit species), the tree has a moderate water demand and the clay has a high volume change potential. The 1.85m minimum formation depth is therefore much shallower than the proposed basement formation depth of around 3m.

The location of the large deciduous trees on the other side of Baynes Street (visible in the background in the above image) has been addressed in section 5.0 of the original BIA.

(iv) *Stiffness parameters for Retaining Wall Design*

The borehole undertaken by Soil Consultants (logs included in appendix A in the original BIA) passed through a backfilled basement. When the retaining walls are constructed on site the soil they will retain will be outside of the original basement line and therefore the depth of made ground will vary from that shown in the borehole log. A conservative approach for the retaining wall design will be adopted using the long-term strength parameters for the London Clay. With reference to the calculation sheet in Appendix B, the Youngs Modulus of the London Clay has been taken as varying from 33.5MN/m^2 to 96.5MN/m^2 (500 times C_u) between 3.7m and 16.3m deep.

(v) *Heave Movements*

The quoted heave movements within Soil Consultant's report 9819/KOG/SCW (extracts in Appendix A of our original July 2015 BIA) are based on traditional elastic theory by Boussinesq. The calculation sheet in Appendix B provides the inputs and outputs of this analysis.

The calculated heave values are conservative as a basement was historically present on this site, which was presumably constructed at the same time as the basement to #154. Any heave may therefore return the clay to its near historic state. The heave analysis does not consider the applied reloading due to the proposed superstructure (~57KN/m^2, considering only 30% of Live Load), which will be similar to the load relief due to the temporary excavation (~60KN/m^2). The calculated long-term heave values (Appendix B) should therefore be discounted and the immediate values considered as the more relevant as the short-term heave values, which will reduce as the clay is reloaded by the building construction.

(vi) *Ground Movement and Damage Assessment due to Retaining Walls*
With reference to the calculations contained in Appendix C the anticipated ground movements have been assessed at two locations; behind the bored contiguous piled wall and behind the RC underpinning to the party wall with #154 Royal College Street. Assessments have been carried out in accordance with the guidance outlined in CIRIA report C580.

For the piled retaining wall the anticipated combined long term horizontal and vertical movements of the ground due to the bored pile installation, basement excavation and pile deflection are 5.7mm and 10.9mm respectively. These movements occur behind the piled wall within a zone of 1.8m and reduce to a negligible value within 14m of the excavation. The closest existing structure to the new wall is the canal wall, over 9m from the excavation. It can be judged that at this distance the anticipated ground movement will be minimal and as the canal wall runs parallel to the excavation the differential movements, which are critical, across the wall will be negligible. Therefore the risk of cracking and damage to the wall is negligible.

For the underpinning to the #154 Party Wall the anticipated combined vertical long term movement of the ground due to the construction of the underpins, basement excavation and underpin deflection is 3.3mm. These predicted movements occur directly behind the underpinning and reduce to a negligible value within 11m of the excavation. Undertaking a damage assessment for the adjacent terrace construction in accordance with Burland et al (1977) suggests that the interaction of the horizontal strains and vertical settlements would result in Category 0 - 'Negligible' cracking.

It should be noted that both assessments summarised above make conservative assumptions regarding the ground water and do not take into account the stiffening effect of the proposed RC lining wall to the piles. Additionally with reference to the September 2014 report by Ball et al considering the ground movements associated with bored pile installation the CIRIA guidance figure of 0.04% of the pile length being equivalent to the horizontal movement behind the wall can reasonably be reduced to 0.02% with good workmanship and monitoring regimes. All of which would further reduce the anticipated level of ground movement.

The predicted immediate heave movements (Appendix B) are vertical upwards and this will obviously counter the predicted vertical settlements to CIRIA C580 quoted above.

(vii) *Thames Water Sewer*
A plan showing the Thames Water record of the route of the sewer is contained in Appendix D. The proposed extent of the basement has been much reduced as shown on the drawings contained in Appendix A, when compared to the original BIA submission. All of the structure over the sewer has been designed to be suspended and Cellcore by Cordek void former will be provided underneath to prevent the sewer being loaded. The bored piled contiguous wall is to be at least 1.5m clear of the sewer and all underpins and trench-fill foundations are to be at least 1m clear of the sewer as stipulated by Thames Water's Developer Services.

(viii) *Movement Monitoring*
The full and detailed movement-monitoring regime will be agreed as part of the Party Wall Awards. Outlined below are preliminary proposals for movement monitoring of the adjacent structures, specifically #154 Royal College Street.

Prior to any works taking place and as part of the Party Wall Awards a photographic condition survey should be undertaken of the internal and external faces of the party wall.

It is proposed that a number of prism reflector targets be installed at key locations on the party wall, typically at high level where lines of sight can be more easily maintained during the basement construction works. The prisms will allow movements to be measured in all three directions to an accuracy of ±1mm. Tell-tales will be installed on any significant historic cracks in the masonry party wall to #154 and will be monitored throughout the basement construction works, typically these can achieve an accuracy of around ±0.2mm.

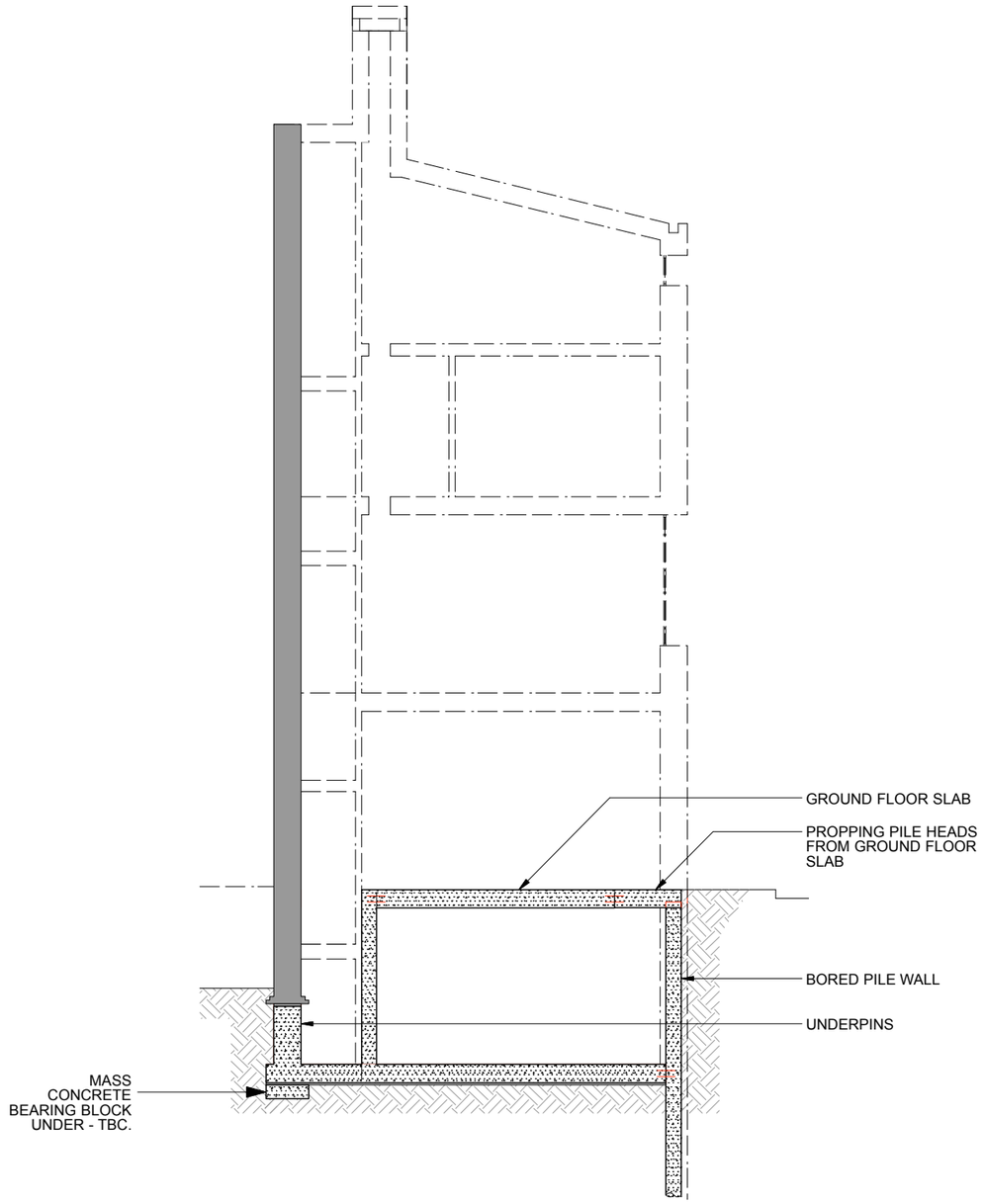
Initial readings would be taken several weeks before construction work commences and then undertaken weekly during the basement construction. Due to the nature of the superstructure construction it will not be possible to continue movement monitoring of the party wall during the later phases of the structural works as the monitoring locations would quickly become obscured by the new structure.

Movements will be logged and trigger and action levels agreed as party of the Party Wall Awards.

(ix) Construction Management Plan

A preliminary Construction Management Plan (CMP) is contained in Appendix E. As is normal the CMP will be developed by the contractor appointed to carry out the works and will be subject to review and amendment during the course of the works. The CMP will be reformatted by the main contractor to be in accordance with Camden Council's CMP pro-forma (v2.0) and will be submitted to Camden Council for their acceptance at a later date along with all other associated approvals (e.g. parking, skips, scaffold).

Appendix A – Revised Basement Drawings



Section A-A
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SK10

NOTES

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B	23.03.16	GM	ISSUED FOR INFORMATION

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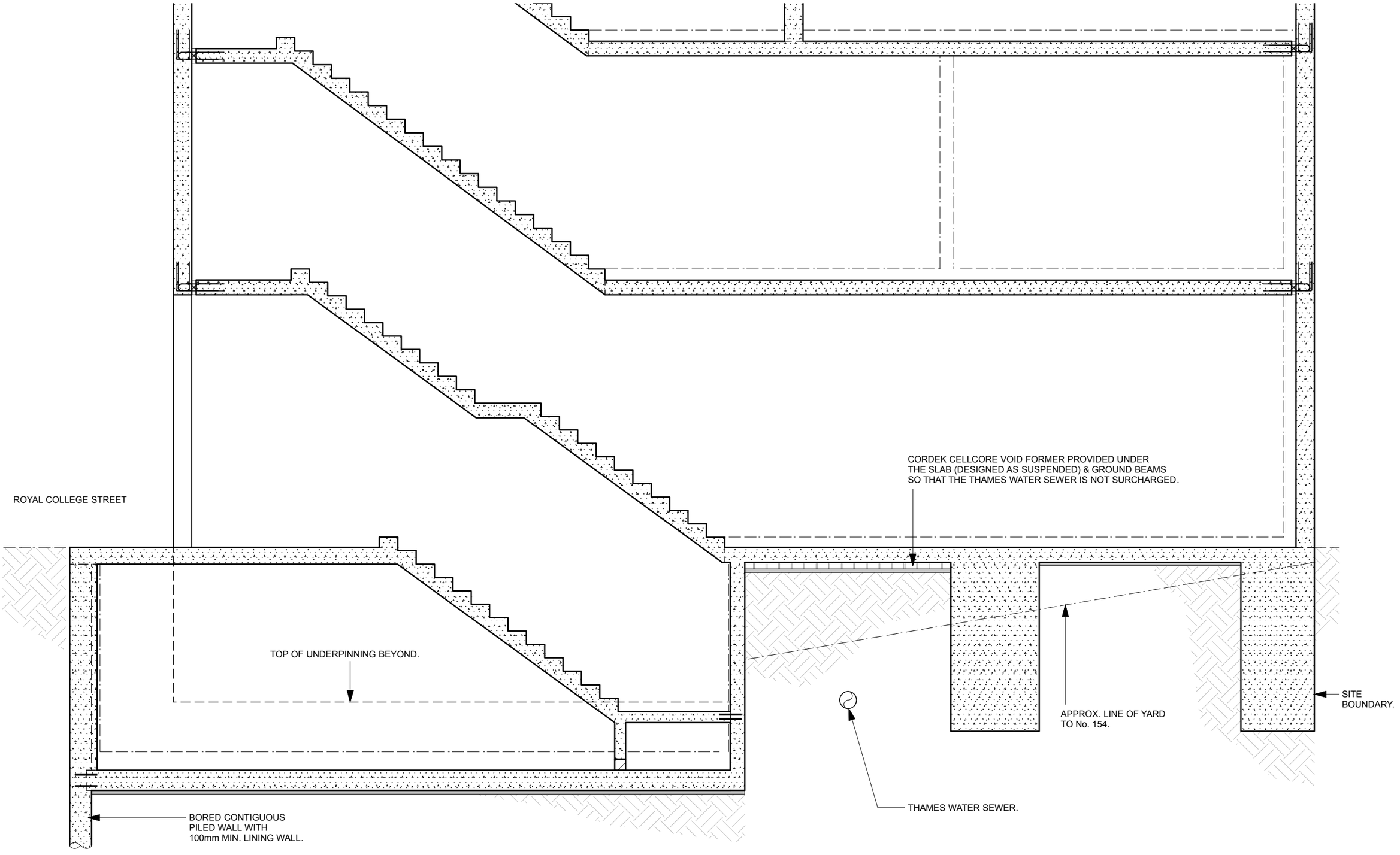
Job Title: 152 ROYAL COLLEGE STREET, NW1				Job No.: 15055
Drawing Title: BASEMENT INDICATIVE SECTION				Drg. No.: SK01
Scale @ A3: 1:100	Date: JULY 2015	Drawn: SC	Checked: RD	Rev.: B



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Drawing Title: Section B-B				Drg. No.: SK03
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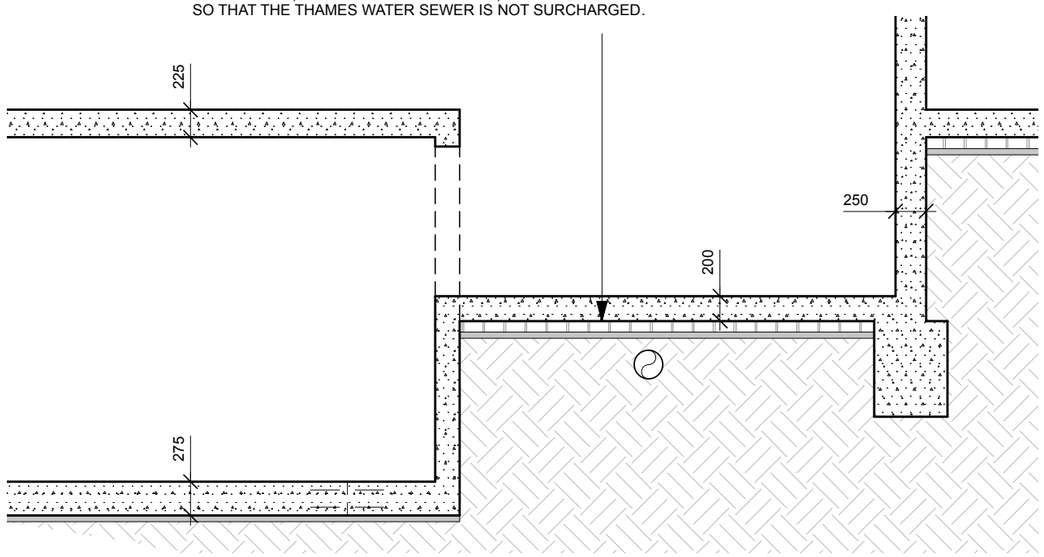
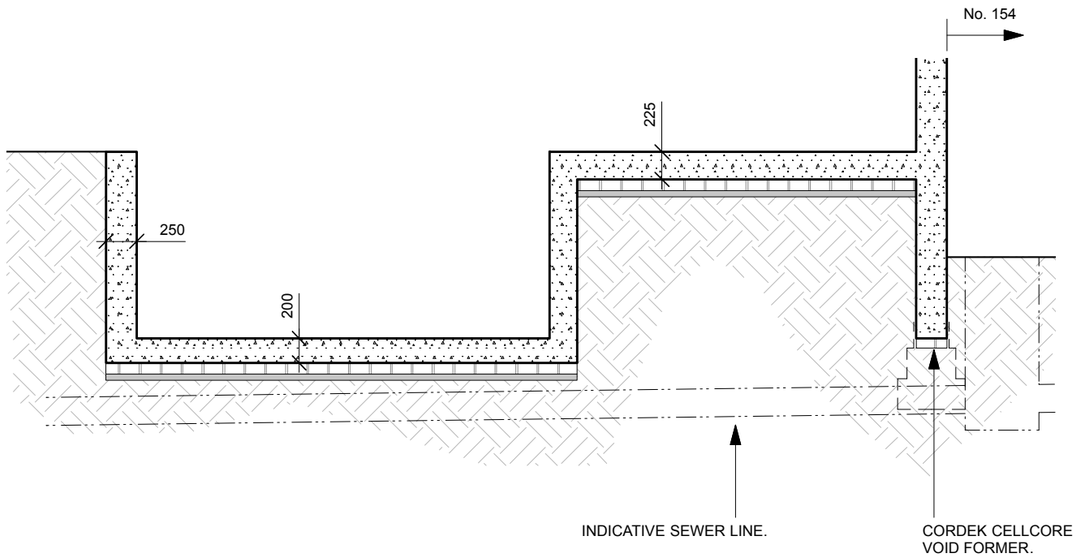


Section C-C
Scale: 1:50
SK10



Section D-D
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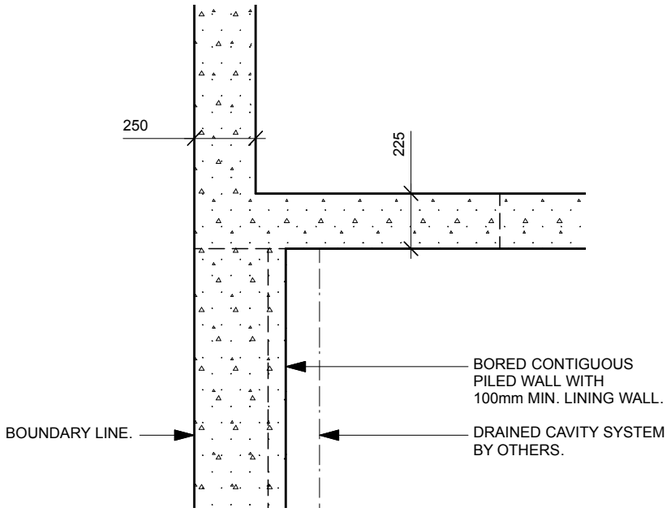

Section E-E
Scale: 1:25
SK10

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-	05.02.16	GM	ISSUED FOR INFORMATION

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Job Title	Job No.
152 Royal College Street , NW1 0TA.	15055
Drawing Title	**Drg. No.**
Section C-C, D-D & E-E	SK04

Scale @ A3	Date	Drawn	Checked	Rev.
1:50	MARCH 2016	GM	RD	-

UNDERPINNING WORKS

1. BEFORE STARTING THE WORK, THE CONTRACTOR IS TO CHECK FOR ANY SERVICES THAT COULD BE DAMAGED BY THE UNDERPINNING WORK.
2. UNDERPINNING IS TO BE CARRIED OUT IN SHORT SECTIONS OF ABOUT 1M IN LENGTH. THE BOTTOMS OF THE FOUNDATIONS SHALL BE INSPECTED AND APPROVED BY THE BUILDING INSPECTOR BEFORE CONCRETE IS POURED. THE UNDERSIDES OF EXISTING FOOTINGS ARE TO BE CLEAN AND FREE OF DIRT, SOIL OR LOOSE MATERIAL BEFORE UNDERPINNING. REINFORCEMENT BARS ARE TO BE PUSHED INTO THE SOIL ON BOTH FACES & BOTH SIDES OF THE RC SECTION.
3. THE EXCAVATION AND CONCRETING OF ANY SECTION OF UNDERPINNING SHALL BE CARRIED OUT ON THE SAME DAY.
4. THE MAIN CONCRETE IS TO BE STOPPED OFF 75MM BELOW THE UNDERSIDE OF THE EXISTING FOOTINGS, AND FINAL PINNING UP OVER THE WHOLE FOOTING IS TO BE CARRIED OUT WITH A 1:3 CEMENT TO SHARP SAND DRY PACKED MORTAR, WELL RAMMED IN, 36 HOURS AFTER THE MAIN CONCRETE HAS BEEN POURED.
5. THERE SHALL BE AT LEAST FIVE COMPLETED OR UNEXCAVATED BAYS BETWEEN SIMULTANEOUS EXCAVATIONS. A BAY SHALL BE REGARDED AS COMPLETE 24 HOURS AFTER DRY PACKING.
6. THE SIDE OF PREVIOUS UNDERPINNING BAYS ARE TO BE ROUGHENED OR KEYED TO THE SATISFACTION OF THE BUILDING INSPECTOR & PROTRUDING DOWEL BARS CLEANED.

TEMPORARY STEEL COLUMN INSTALLED WITH UNDERPIN. COLUMN TO SUPPORT PART OF SLAB OVER DUE TO TOP-DOWN SEQUENCE.

MANHOLE TO No.154.

D SK04

> 1000 CLEAR

INDICATIVE LINE OF SEWER.

1000 BETWEEN SEWER & RETAINING WALL

B SK04

300ø CONTIGUOUS BORED PILE WALL.

275 RC SLAB

C SK04

STEP

200 RC SLAB

> 1500 CLEAR

B

C

D

MIN. 100 RC LINING WALL, DOWELLED TO PILES.

SUMP SIZE & LOCATION TBC.

CORDEK CELLCORE VOID FORMER PROVIDED UNDER SLAB & WALLS BETWEEN BASEMENT & GRID 6.

ALL FOUNDATIONS TO BE FOUNDED AT A MIN. OF 2.5m BELOW EXISTING GROUND LEVEL.

NOTES

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-	23.03.16	GM	ISSUED FOR INFORMATION

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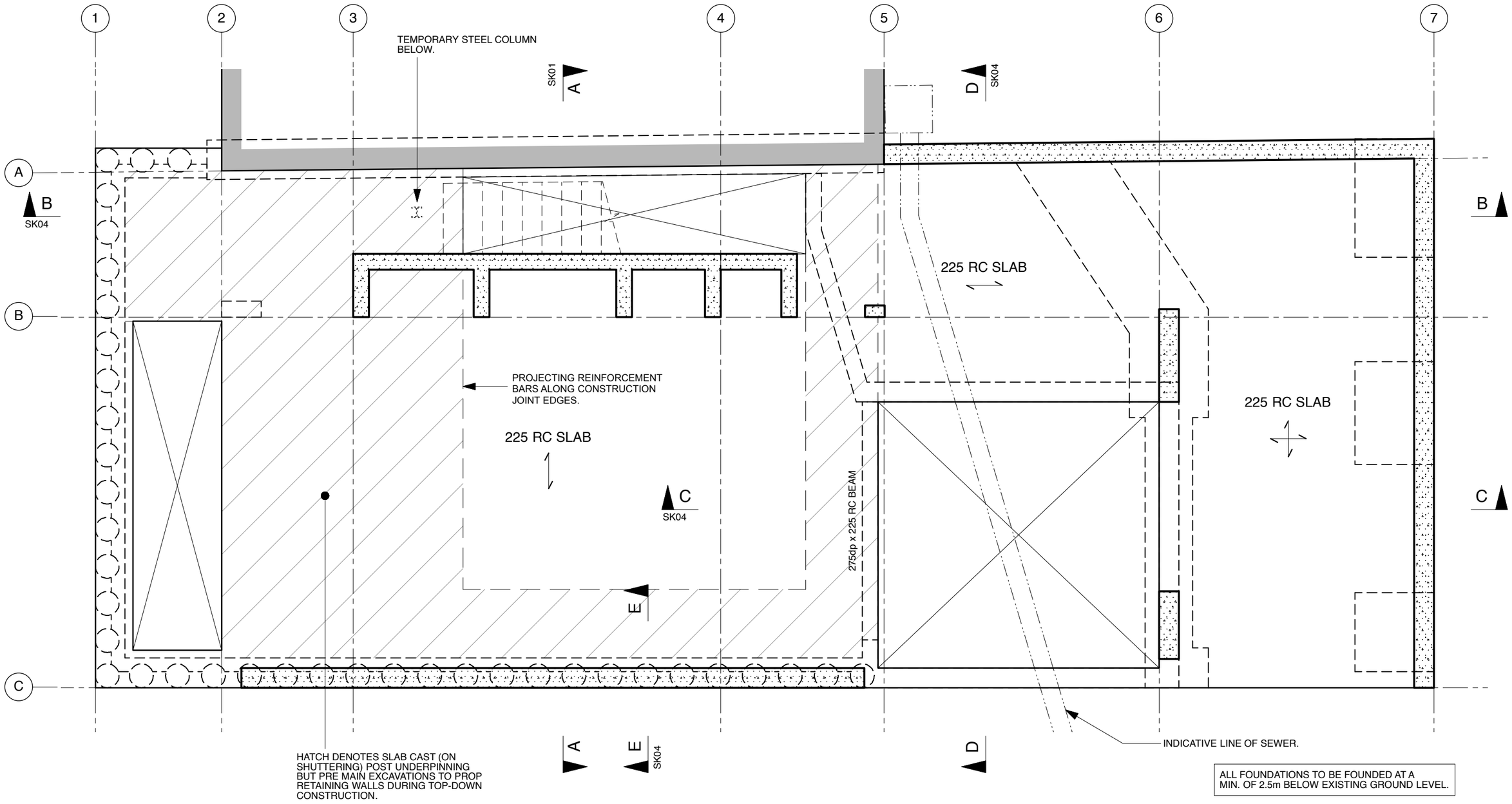
Job Title: 152 Royal College Street , NW1 0TA.				Job No.: 15055
Drawing Title: Basement GA				Drg. No.: SK10
Scale @ A3: 1:50	Date: MARCH 2016	Drawn: GM	Checked: RD	Rev.: -



NOTES

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Job Title	Job No.
152 Royal College Street , NW1 0TA.	15055
Drawing Title	**Drg. No.**
Ground Floor GA	SK11

Scale @ A3	Date	Drawn	Checked	Rev.
1:50	MARCH 2016	GM	RD	-

Appendix B – Basement Heave Analysis

ROYAL COLLEGE STREET

CALCULATION OF HEAVE AT CENTRE OF SIMPLE RECTANGULAR AREA

1 Calculation of Stress Relief

Reduction of stress = 60 kN/m^2 (or use the following calculation)

Soil Type	Density	H (m)	Unload
	20.0	3.0	60
Totals =		3	60

Units
Density = kN/m^3
H = Thickness
kN/m^2

The stress relief used in calculation of heave = **60** kN/m^2

Excavation width = 7 length = 17 m

2 Soil Data

Strength relationship	Depth/OD	Cohesion	Strength increase
Top of zone	3	60	Increasing at
Base of zone	17	200	10.00 per m

kN/m^2

Factor to calculate Eu from Cu value 500
Factor to calculate E' from Cu value 250

Poisson's Ratio (undrained) 0.5
Poisson's Ratio (drained) 0.15

3 Calculation of Heave

Based on 10 layers 1.4 thickness

Layer	DEPTH	Cu	E	E'	I factor	VS	Incremental immediate	Cumulative immediate	Incremental Long term	Cumulative Long term	Cumulative Total Heave
1	3.7	67	33.5	16.8	0.997	59.8	1.9	**7.1**	3.0	**11.4**	**18**
2	5.1	81	40.5	20.3	0.934	56.1	1.5	5.2	2.3	8.4	14
3	6.5	95	47.5	23.8	0.808	48.5	1.1	3.8	1.7	6.0	10
4	7.9	109	54.5	27.3	0.674	40.4	0.8	2.7	1.3	4.3	7
5	9.3	123	61.5	30.8	0.557	33.4	0.6	1.9	0.9	3.1	5
6	10.7	137	68.5	34.3	0.461	27.6	0.4	1.3	0.7	2.1	3
7	12.1	151	75.5	37.8	0.384	23.0	0.3	0.9	0.5	1.5	2
8	13.5	165	82.5	41.3	0.322	19.3	0.2	0.6	0.4	0.9	2
9	14.9	179	89.5	44.8	0.272	16.3	0.2	0.3	0.3	0.6	1
10	16.3	193	96.5	48.3	0.232	13.9	0.2	0.2	0.2	0.2	0
	m	kN/m^2	MN/m^2	MN/m^2		kN/m^2	mm	mm	mm	mm	mm

Note, the above analysis (Boussinesq) is conservative as a basement was historically present on the site before being infilled.

The above long-term values do not consider the re-loading of the soil due to the building construction. The proposed superstructure loading is similar to the initial load relief due to the soil excavation and therefore the long-term heave movement values can be discounted.

Appendix C – Retaining Wall Movement Analysis

JOB 15055/152 Royal College Street DATE March '16 PAGE 1

TITLE Basement Movement & Damage. BY SM CHECKED

Two locations are to be assessed:

i) Bored contiguous pile retaining wall.
ii) RC underpinning to party wall with No. 154 Royal College St.

All movement assessments undertaken with reference to Figure 2.14 of CIRIA C580 & damage assessment to Figure 2.17.

i) Bored Contiguous Pile Wall

To 3No. sides of basement excavation (NE, SE & SW). Excavation to be part of top-down construction ∴ piles propped by high stiffness prop @ high level. Assumed pile length = 7m & excavation depth = 3.2m.

a) Anticipated ground movement - bored pile installation (Table 2.2)

Horizontal

@ wall: 0.04% Length = 2.8mm
negligible @: 1.5 Length = 10.5m

Vertical

@ wall: 0.04% Length = 2.8mm
negligible @: 2 Length = 14m.

b) Anticipated ground movement - from excavation (Table 2.4)

Horizontal

@ wall: 0.15% ex. = 4.8mm
negligible @: 4 ex = 12.8m

Vertical

@ wall: 0.1% ex. = 3.2mm
negligible @: 3.5 ex. = 11.2m

c) Anticipated ground movement - from pile deflection.

Take $\gamma_b = 20 kN/m^2$, $K_o = 0.5$ (at rest to minimise ground movements), $10 kN/m^2$ surcharge from highway

Peak pressures are as follows:

At rest earth	=	(20−10)	× 0.5 (Ko) ×	3.2m (h)	= 16.0 kN/m²
Surcharge	=	10	× 0.5		5.0 kN/m²
					21.0 kN/m²

With reference to Soil Consultant's report, beyond seepage from Made Ground, no ground water encountered on site ∴ pressures neglected for pile design.

[simplifying surcharge to ∆ distribution]

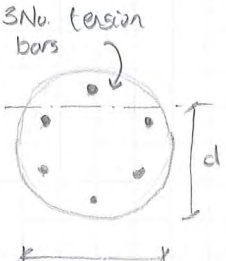
Considering piles @ 0.5m c/c:

Resultant load per pile:

$F = 0.5 \times (21 \times 3.2 \times 0.5 + 24 \times 2.4 \times 0.5) = 31.2\,kN$.

$M = 16.8 \times 1.067 + 14.4 \times 0.8 = 29.4\,kN$.

Considering 300 ϕ piles, $f_{cu} = 40\,N/mm^2$



$$K = \frac{1.2 \times 29.4 \times 10^6}{300 \times 225^2 \times 40} = 0.06 < 0.043$$

(b, d, f_{cu})

$\therefore z = 0.95d = 214mm$.

$$A_{s\,req'd} = \frac{1.2 \times 29.4 \times 10^6}{0.87 \times 500 \times 214} = 379\,mm^2$$

Prov. 6No. B16 to pile ($A_s = 603\,mm^2$)

By inspection shear ok.

Consider deflection with props at ground & basement level. Using uncracked short term stiffness in the first instance.

$$\delta_{inst,h} = \frac{31.2 \times 10^3 \times 2266 \times 934 (3200 + 934) \sqrt{3 \times 2266 (3200 + 934)}}{27 \times 28000 \times \frac{\pi \times 300^4}{64} \times 3200}$$

31.2x10³

$= 1.5\,mm$ @ $\sqrt{\frac{2.266(3.210.934)}{3}} = 1.77m$ from ground.

conservative as continuity could be achieved in practice

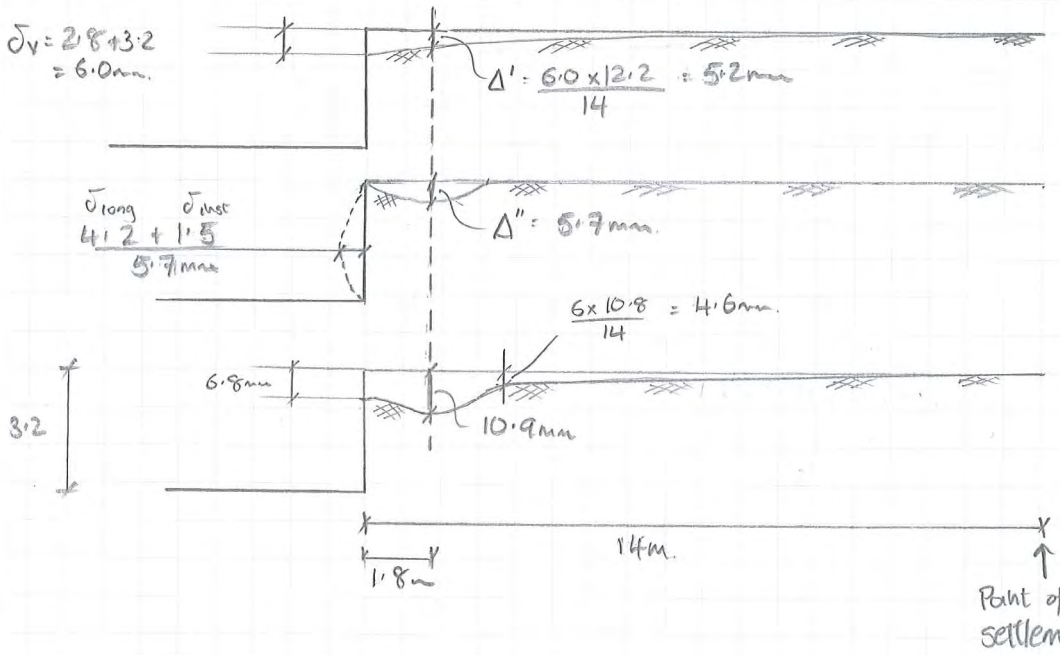
It is normal to increase this by a factor of 2.8 to account for cracked section stiffness reductions & long term creep effects ∴

$\delta_{long\,term,h} = 4.2mm$.

Overall Movement

From IStructE's "Soil-Structure Interaction" the settlement profile of the soil will be approximately equal to deflected shape of the wall. It can therefore be assumed that the maximum long term settlement of retained soil due to piled retaining wall will be of the order of 4.2mm

Adding conservative allowances for movement during construction & excavation processes, the critical case for damage assessment will be as overleaf.



Constr.

Pile δ's

Combined.

ii) RC Underpinning No. 154 Party wall.

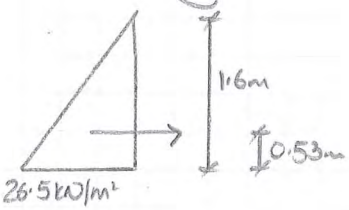
Taking soil parameters as ic), 5kN/m² surcharge from existing buildings & conservatively take ground water acting at top of retaining wall.

Retained height = 1.6m (due to existing adjacent basement).

Peak pressures are as follows:

At rest earth:	=	(20−10) x	K_o 0.5 x	h 1.6m	= 8 kN/m²
Hydrostatic	=	10 x		1.6m	= 16 kN/m²
Surcharge	=	5 x	0.5		= 2.5 kN/m²
					26.5 kN/m²

Simplify to Δ distribution.



Considering 1m length of wall, resultant load:

F = 0.5 x 26.5 x 1.6 = 21.2 kN
M = 21.2 x 0.53 = 11.2 kNm.

Considering 350thk wall (to match existing)

$$K = \frac{M}{b d^2 f_{cu}} = \frac{1.2 \times 11.2 \times 10^6}{1000 \times 288^2 \times 40} = 0.004$$

$\therefore z = 0.95d = 274mm$

$$A_{s\,req'd} = \frac{1.2 \times 11.2 \times 10^6}{0.87 \times 500 \times 274} = 113\ mm^2/m$$

Provide H12's @ 200 $A_s = 565 mm^2/m$

By inspection shear ok.

Consider deflection of wall acting as a cantilever, using uncracked short term stiffness in the first instance.

$$\delta_{inst,h} = \frac{21.2\times10^3 \times 530^2}{3\times 28000 \times \frac{1000\times350^3}{12}} \times \left(1600 + \frac{1070}{2}\right) = 0.04\text{mm}$$

Increase by factor of 2.8 to account for cracked section stiffness reductions & long term creep effects

$\therefore \delta_{long\ term,h} = 0.1$ mm.

Overall Movement

From IStructE's "Soil-Structure Interaction" the settlement profile of the soil will be approximately equal to the deflected shape of the wall. It can therefore be assumed that the maximum long term settlement of retained soil due to piled retaining wall will be less than 1mm.

Damage Assessment

With reference to marked up site plan, showing zone of maximum movement (blue hatch) & line at which movement negligible (dashed line).

i) Bored Continuous Piled Wall.

With reference to pg 3. maximum settlement of ground = 10.9mm within 1.8m of excavation, reducing to 4.2mm within 3.2m of excavation. Settlements negligible within 14m of excavation.

Closest structure is canal retaining wall, 9m from excavation & positioned parallel to excavation.

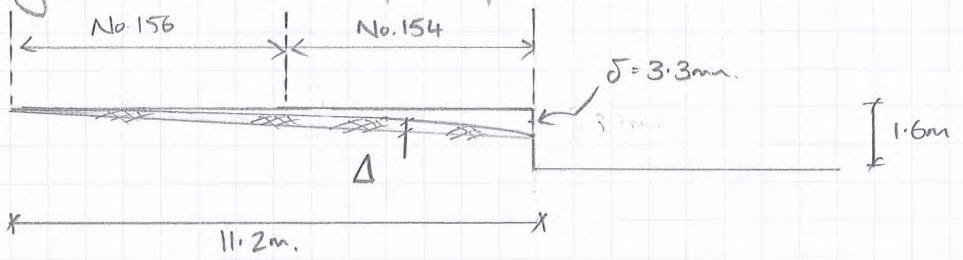
By inspection the anticipated ground movement at the canal retaining wall will be minimal & due to orientation of wall relative to excavation, differential movements (which result in cracking) will be even less.

Therefore it can be judged that risk of cracking to canal wall is negligible.

Further with reference to the Report by Ball et al September 2014 regarding ground movements due to installation of bored piled walls 0.04% of pile length, with good movement control & monitoring, can be reduced to a more reasonable value of 0.02%.

ii) Underpinning to No. 154 Party wall.

Conservatively assuming settlements become negligible cotthun 11.2m of excavation (ref pg 1 (ib)). Maximum ground movement at face of excavation = 0.04 + 0.1 + 3.2 = 3.3mm.



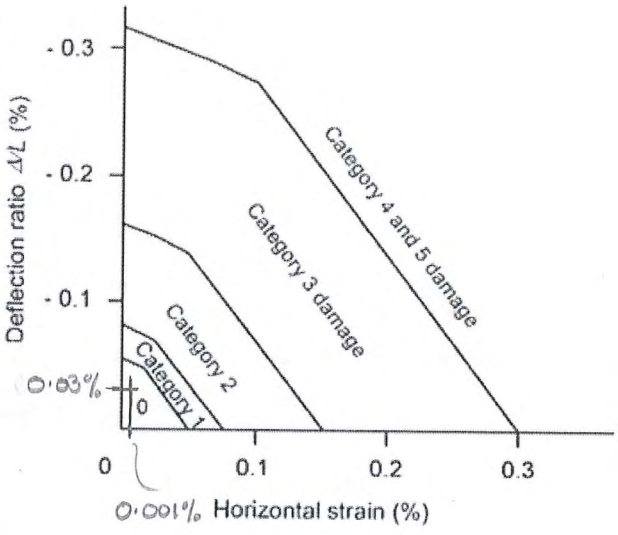
Damage Category assessment, ref. Fig. 2.18 & Box 2.5 CIRIA C580.

L = 11.2m, H = 11m ⇒ L/H = 1.0

Δ ≈ 0.85δ = 2.8mm. ⇒ Δ/L = 0.03%

ε_h = (0.04 + 0.1)/11200 = 0.001%.

Predicted damage = Cat 0



(c) Relationship between damage category and deflection ratio and horizontal tensile strain for hogging for (*L*/*H*) = 1.0 (after Burland, 2001)

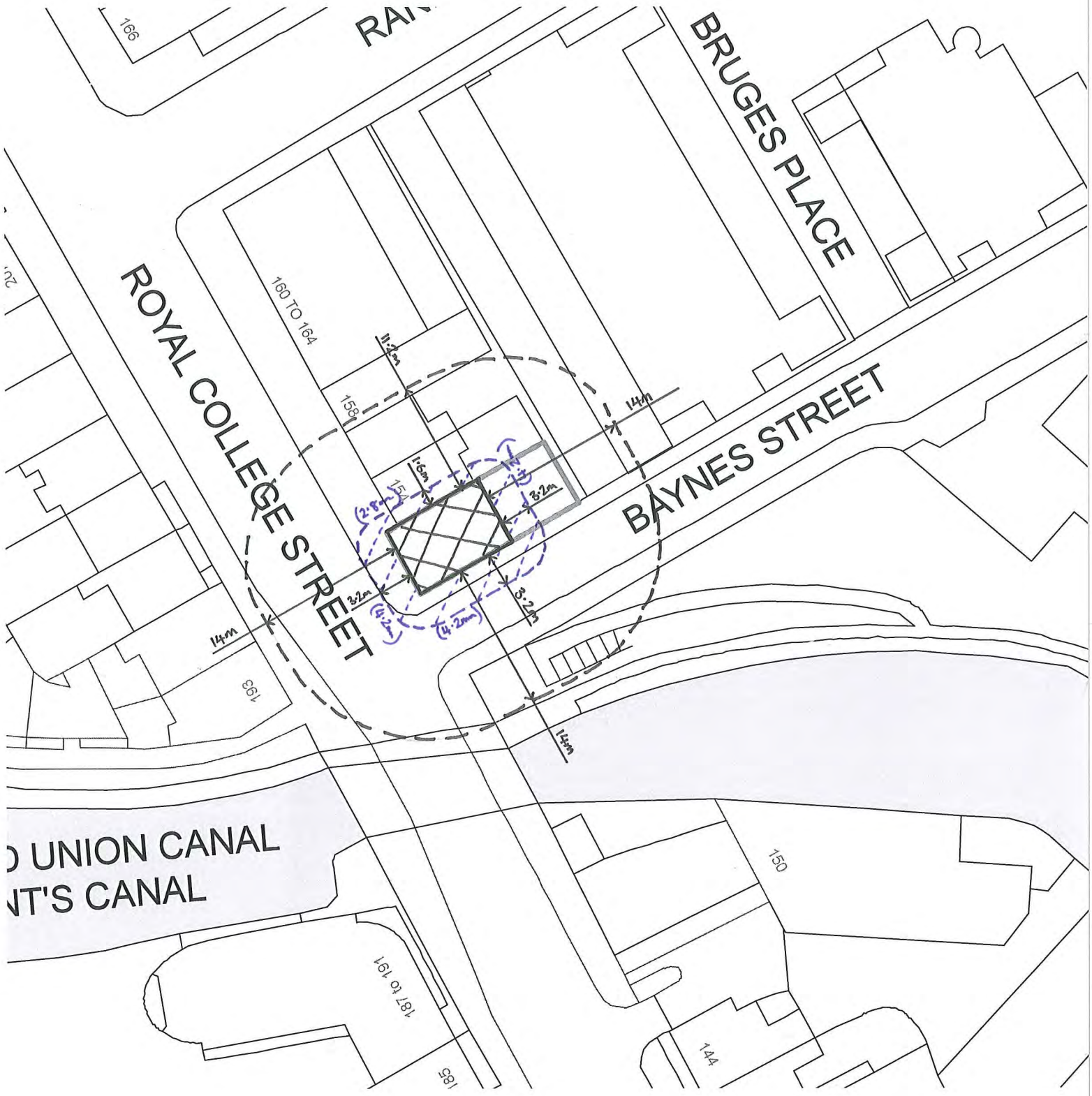
It should be noted that the assessments made for i) & ii) the assumptions regarding ground water levels are onerous, coher ground water applied at level encountered during SI, movements will further decrease.

The magnitude of movements depends on the quality of workmanship as noted in CIRIA C580. If the eventual contractor is able to exert greater over movements during pile installation & underpinning, the movements will reduce further.

The stiffening effect of RC lining walls to the piles has also not been considered in the analysis.

15055/152 Royal College Street

Site Plan 1:500 @ A4

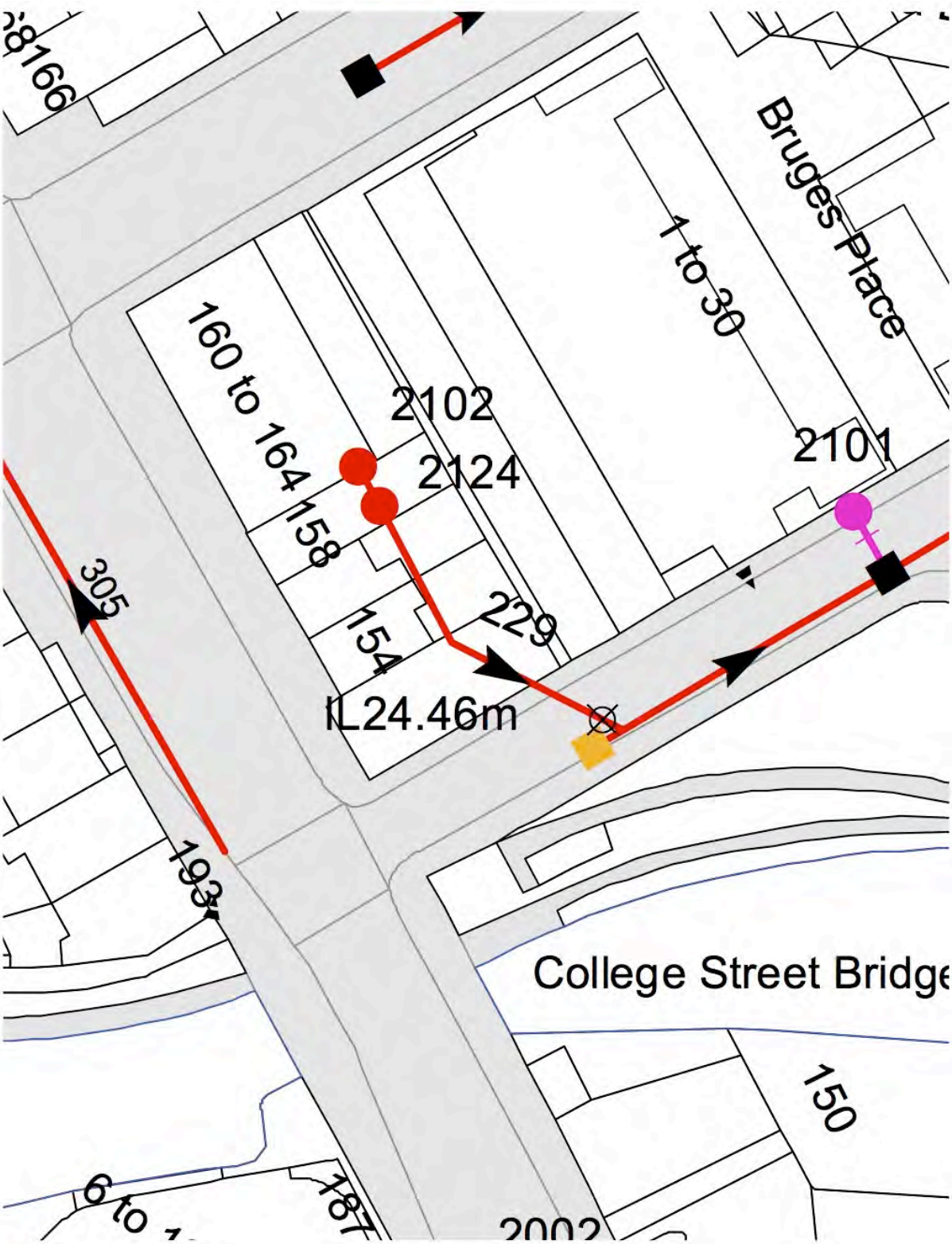


Basement excavation

(Xmm) Zone of max. movement, boundary values in brackets

Line of negligible movements

Appendix D – Thames Water Sewer Plan Extract



Appendix E – Construction Management Plan (CMP)

15055 / 152 Royal College Street, NW1 0TA

April 2016 / Outline Construction Management Plan (CMP)

Rev	Date	Description
-	08 April 2016	Submission for inclusion in planning application

Prepared by: Robert Dean *BEng (Hons) CEng MIStructE*

Authorised by: *Sarah Miley MA MEng (Cantab) CEng MIStructE*

Issued by: Robert Dean *BEng (Hons) CEng MIStructE*

Summary

This note provides an outline Construction Management Plan (CMP) for the proposed basement at 152 Royal College Street to assist with the planning submission.

As is normal the CMP will be developed by the contractor appointed to carry out the works and will be subject to review and amendment during the course of the works. The CMP will be reformatted by the main contractor to be in accordance with Camden Council's CMP pro-forma (v2.0).

The construction of the property is feasible, without significantly disturbing local residents or local traffic flows.

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Registered in England & Wales
Company No. 04718155

Contents

	Summary
A	Management Arrangements
B	Party Wall Awards & Best Practice
C	Timetable and Programming of Works
D	Working Hours
E	Storage of Materials and Equipment and Use of the Highway
F	Access, Parking, Traffic Management and Deliveries
G	Handling Materials and Waste
H	Managing Environmental Impacts, Noise, Vibration and Dust
Appendices	Proposed Construction Sequencing (SK02, SK05 & SK06)
	Preliminary Construction Programme

A Management Arrangements, Communication and Neighbour Liaison

The key contact will be the Site Manager: their name and address will be provided. 24 hour emergency contact details will be displayed at the site.

Adjoining occupiers likely to be affected by proposals and any local amenity society or residents group will be kept informed about the programme of works and any significant changes to the programme or changes to the key contact details.

A complaints process and log will be in place on site.

The Site Manager will be made aware of and take all reasonable measures to comply with any conditions attached to the planning permission and notify the relevant council officers of any changes during the course of works. The Site Manager will be made aware of the relevant contacts in the council's Building Control, Environmental Health and Highways teams.

B Party Wall Awards & Best Practice

Party Wall Awards will be agreed with all neighbours who are required to be notified under the act.

Under the construction contract the site manager will take responsibility for managing the site according to best practice, the contract documents and Camden guidelines.

In the tender appraisal process priority will be given to contractors who are members of the Considerate Constructors Scheme. The works will be appointed to a specialist contractor, experienced in basement works in central London sites.

C Timetable and Programming of Works

The target start for construction is in the summer of 2016 and the works are estimated to take around 13 months to complete. An outline construction programme is appended to this CMP.

The formation of the basement will be the first activity after site set up and is anticipated to take around 18 weeks.

The appointed contractor will develop their detailed programme for the works and before commencement will communicate the programme with the neighbours. Prior to this the contractor will liaise with any nearby construction sites to establish their proposed construction programmes and to see how works maybe coordinated to minimise/mitigate disruption to neighbours.

D Working Hours

Working hours will comply with Camden Council's standard requirements, i.e. Monday to Friday 8am – 6pm and Saturdays 8am – 1pm.

The site manager will maintain a dialogue with adjoining occupiers in relation to working hours and where practicable seek to avoid any particularly noisy operations at any sensitive times.

E Storage of Materials and Equipment and Use of the Highway

The proposed new #152 Royal College Street building will occupy the full perimeter of the site. Space will therefore be limited and the appended outline construction sequence (primarily SK05 & SK06) has been prepared considering the site restraints and provides outline details for the potential locations of site facilities, site deliveries and site skips. This outline proposal will be developed by the chosen main contractor and will be submitted to Camden Council prior to the commencement of the works.

Due to the limited space on site the chosen main contractor may deem it necessary to apply to erect a temporary scaffold and gantry to the Royal College Street side of the site to provide additional storage. This would be undertaken in accordance with Camden Council's requirements and a license would be obtained before erection.

F Access, Parking, Traffic Management

Local parking is limited and therefore site operatives will be encouraged to use the many nearby public transport connections and access the site on foot. Metered on street car parking bays are located nearby and site visitors not utilising public transport can use these facilities.

Vehicular access to the site is from Baynes Street or from Royal College Street. Both are one-way streets and the access route from Baynes Street has a 15ft (4.57m) height restriction and Royal College Street 15' 9" (4.8m), due to railway bridges. Most deliveries will be made to Royal College Street, as it is the wider of the two access roads, and vehicles will park beyond the zig-zag road markings (see below). The approach to a pedestrian crossing, on Royal College Street just to the South of the site, is made from the South and therefore a parked construction vehicle on Royal College Street will not hinder views and safety.

In conjunction with the main contractor a suitable risk assessed vehicle route to the site will be determined and will be communicated to all contractors and drivers prior to the commencement of deliveries. Barring any unavoidable diversions this vehicle route is to be adhered to.

All deliveries will be made on a just-in-time basis with calls made to the site foreman with an expected time of arrival so the parking can be made clear ahead of arrival. The stacking of vehicles or parking within residents' parking bays will not be allowed. Vehicles will mainly be skip lorries and concrete trucks during the basement works, concrete trucks for the superstructure works and then reducing to smaller vehicles for the later construction phases.

A traffic marshal or banksman will be positioned in the street to ensure the safe and timely passage of pedestrians, cyclists and other traffic.

For the basement spoil removal approximately 26 number of '12-yard skip' ($9.2m^3$) removals will be necessary, considering a basement volume of approximately $173m^3$ and clay bulking factor of say 1.35. Skip drops and removal can be safety undertaken, in conjunction with the traffic marshal, in a matter of a few minutes.

All efforts will be made for construction contracts to be award to companies with delivery vehicles complying with CLOCS (Construction Logistics and Cyclist Safety) standards to minimise road risk, especially to vulnerable road users.

Deliveries and collections from the site will be limited to between 9.30am and 3.30pm. Where possible vehicle dwell time will be limited to 15 minutes.

G Handling Materials and Waste

All waste substances from the site will be disposed of offsite, under the appropriate Duty of Care and subject to approvals or consents from the relevant statutory bodies

Recycling is to be undertaken wherever appropriate.

H Managing Environmental Impacts, Noise, Vibration and Dust

The Contractor will adhere to, and respect any restrictions on working hours or the enforcement of silent periods throughout the day, which may be imposed by the Local Authority, Contract Documents or the Party Wall requirements.

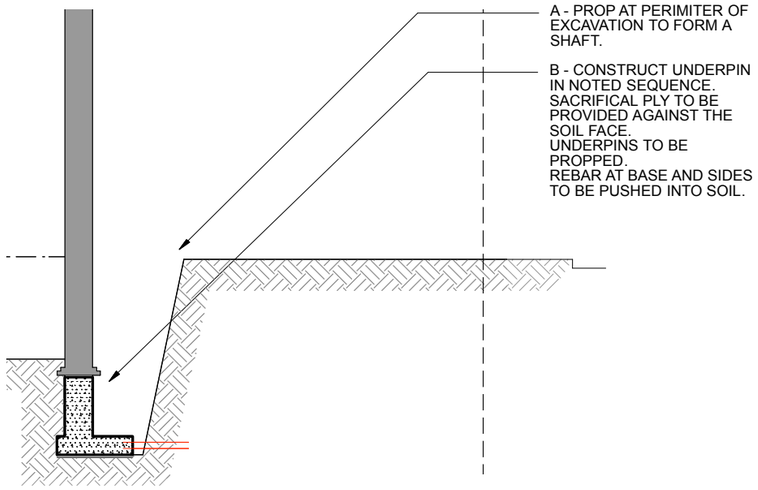
All site activities will be placed behind hoarding to limit the effect of the works on the public.

Wheel washing and the like should not be required as vehicles making deliveries to site and removing spoil will be parked on the street and not be driving onto a muddy site. Due to the nature of construction traffic the roads adjacent to the site will be monitored and washed periodically should dust and spoil build up.

Demolition and excavation dust on site will be controlled by watering. Inlets to the drainage system will be protected with filters bunded with sandbags to prevent slurry runoff entering the system.

All vehicles leaving site carrying potentially dust-generating demolition or construction waste will be completely sheeted with tarpaulin or netting. The sheeting will be in good condition.

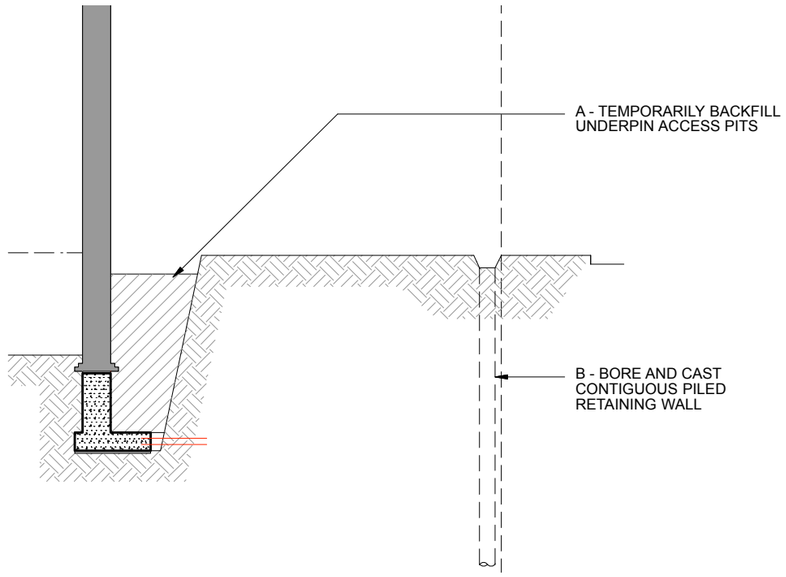
Appendices to CMP



[Works include temporary slab support column]

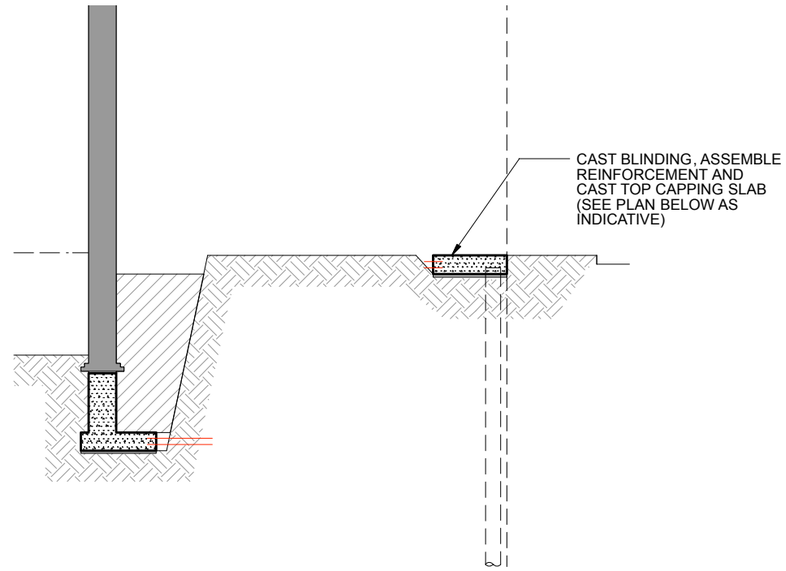
Stage 1 - Underpin wall to #154+ Rear of basement

Scale: 1:100



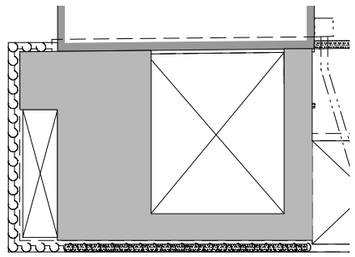
Stage 2 - Bored piles wall casting

Scale: 1:100

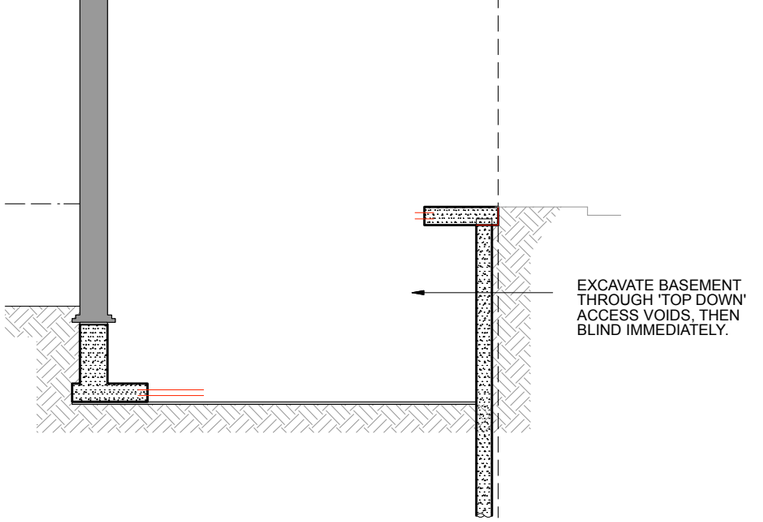


Stage 3 - Cast capping slab

Scale: 1:100



TOP CAPPING SLAB LAYOUT



Stage 4 - Excavate basement

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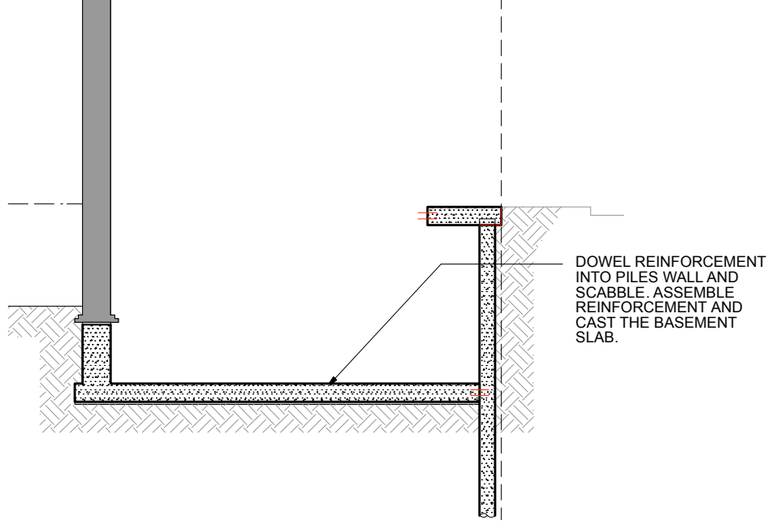
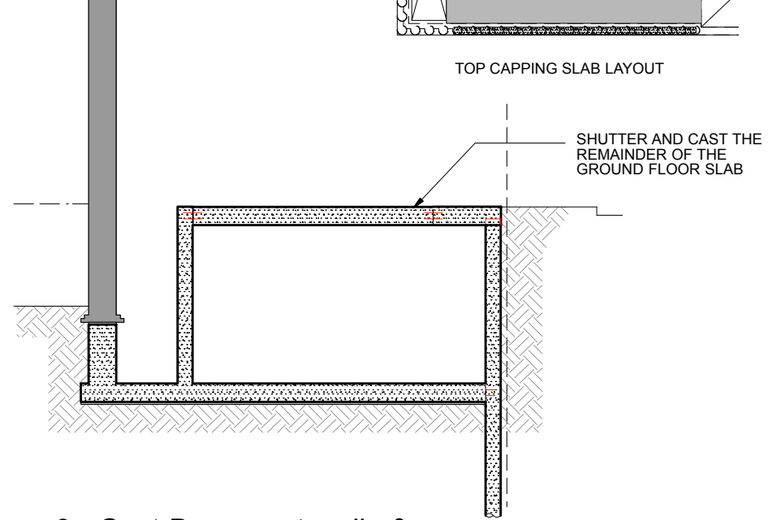


Stage 5 - Cast basement slab

Scale: 1:100



Stage 6 - Cast Basement walls & remainder of ground floor slab

Scale: 1:100

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS
2. DO NOT SCALE THIS DRAWING. ALL DIMENSIONS AND LEVELS TO BE CONFIRMED ON SITE.

Rev.	Date	Made by	Amendments
B	23.03.16	GM	ISSUED FOR INFORMATION

Status: PRELIMINARY

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Job Title: 152 ROYAL COLLEGE STREET, NW1				Job No.: 15055
Drawing Title: INDICATIVE BASEMENT CONSTRUCTION SEQUENCE				Drg. No.: SK02
Scale @ A3: 1:100	Date: JULY 2015	Drawn: SC	Checked: RD	Rev.: B

Outline Sequence and Method of Construction

As is normal, the sequence of construction will be developed by the contractor appointed to carry out the works and will be subject to review during the course of the works.

This is to be read in conjunction with the construction sequence shown on SK02 and all other drawings. This document provides additional information (not conflicting) with regards to site set-up as part of the proposed Construction Management Plan (CMP).

Deliveries will be made during off-peak hours (between 9.30am and 3.30pm) on a just-in-time basis with calls made to the site foreman with an expected time of arrival so the parking can be made clear in advance.

Stage 1 – Setup and Underpinning

1a - Existing site hut is to be used as the temporary site office and existing steel fencing to secure the site perimeter. Portable WC provided near site office.

Sewer route is to be clearly sprayed and pegged on site and heavy plant will be prevented from crossing over the route.

1b – Subject to Party Wall agreement, install Helifix Bow-Ties externally through the Party Wall to #154 and into the mid-depth of the floor joists at 1m centres at all main floor levels. Confirmation of floor levels and service location checks to be carried out beforehand.

Remove and cart-away steelwork used for advertising signboard.

1c – Underpinning works to be carefully undertaken along grid A and between grids 4 & 5 strictly in accordance with the sequence indicated on SK10 and in accordance with good practice. Underpins are to have projecting reinforcement bars pushed into the soil to provide full-continuity with later pins and slabs. Upon completion of an underpin the access pits are to be back-filled with compacted spoil.

Ready-mix concrete trucks delivering for the underpins are to park briefly outside the site on Royal College Street and the concrete moved into place using wheel barrows. Deliveries are to be made during off-peak hours (see definition above) and a banks-person is to be present to oversee the wheelbarrows crossing the pavement.

The underpin #3 on grid A is to have a temporary steel column installed as indicated on SK10, to facilitate the top-down construction. Access pit is to be backfilled as elsewhere.

Stage 2 – CFA Piling

2a – All piling locations to be accurately set-out and centrelines securely pegged. The existing site steel fencing is to be carefully removed and carted away from site. At the same time a robust Heras fence with connecting clips is to be provided along the Royal College Street and Baynes Street perimeters, located just far enough out from the site boundary so that the piles can be installed.

2b – The Continuous Flight Auger (CFA) piles along the boundary to Royal College Street and Baynes Street are to be carefully installed. The piling rig is to be a mini (Klemm) type and the rig and its power pack are to be at all times greater than 1.5m away from the sewer route.

Stage 3 – Demolition and Casting Ground Floor Slab

3a – The existing ground-bearing slab between grids 1 & 5 is to be broken out. Material is to be placed in a licensed skip immediately outside the site on Royal College Street.

3b – Install 50mm of levelled sand blinding (with small cement content) and position plywood shuttering on top. Cast indicated parts of ground floor slab (ref SK11) to facilitate top-down construction.

3c – Upon sufficient curing of slab a lightweight temporary timber site office at ground floor level near grid 2 A is to be installed (within the capacity of the slab when suspended).

3d – Demolish and remove existing site office hut located between grids 6 & 7.

3e – Using the existing pavement crossover, skips are to be located on site between grids 6 & 7.

3f – The garden boundary walls along grid A/5-7 and along grid 7 are to be demolished and robust Heras fencing with clips provided to secure the site. Bricks from the demolition that cannot be salvaged for onward sale are to be placed in the skip and carted away.

3g – Robust self-supporting OSB painted hoarding is to be provided along the perimeter of the site boundary to Royal College Street and along Baynes Street. The hoarding posts are to be set in cast concrete blocks, located above ground.

Stage 4 – Excavate for Basement

The basement is to be excavated using a mini-digger (via the access holes in the slab). Site spoil is to be placed in skips onsite between grids 6 & 7. Material is not to be heaped or stored between grids 5 & 6. A conveyor is to carry the spoil from the basement and into the skips. Skips to be removed via the existing pavement crossovers, but only during off-peak hours.

Secure proprietary guardrails (e.g. J-SAFE Connect Base) are to be resin fixed to the slab top-surface are to be provided around all ground floor slab openings.

Stage 5 – Cast Basement Slab

5a – The final 100mm of clay is to be removed to reach formation level and then the surface is to be immediately blinded using a 50mm sand/cement mix.

5b – Sump pit reinforced and cast. If any water penetrates then it can be pumped out via appropriate filters.

5b – The reinforcement for the basement slab is to either to be lowered straight into basement void via a delivery truck with a crane on Baynes Street (off-peak, deliver and go) or be delivered to the immediate roadside on Royal College Street, in a suspended parking area (subject to Camden's agreement).

5c – Reinforcement positioned and slab cast. Mobile concrete pump to be located on Royal College Street and to reach over the pavement and into the basement. Concrete trucks to deliver to Royal College Street and place concrete straight into the hopper for the pump.

Stage 6 – Cast Basement Walls and Remainder of Ground Floor Slab

6a – Dowels to be installed into the faces of the contiguous piled walls, mesh positioned and lining wall shuttered and cast.

6b – Internal basement walls and columns to be shuttered and cast.

6c – The remainder of the ground floor slab over the basement is shuttered, reinforced then cast.

6d – The stair flight between basement and ground floor is to be shuttered and cast.

6e – Site office and welfare facilities are to be provided in the basement

Stage 7 – Pad Foundations and Courtyard

7a – Pad and trench fill footings beyond the basement are to be excavated and immediately concreted. Plant is not to cross over the sewer line. Spoil to be placed into licensed skips on Royal College Street via mini dumper trucks driving along the road.

7b – Reinforced concrete retaining wall along grid 6 to be constructed.

7c – Undertake drain survey to confirm that the existing sewer does not require any repairs to be made. Agree with Thames Water any repairs if necessary.

7d – Construct retaining wall along Northern face of courtyard.

7e – Construct retaining wall along Baynes Street side of courtyard in 1m long lengths, horizontally propping against the retaining wall on the Northern side of the courtyard site via type 4 acrows. Propping to remain in place until the wall between grids 5 & 6 is cast and cured.

7f –Cordek Cellcore void former on blinding to be installed under all structure from basement retaining wall approximately along grid 5 to foundation line approximately along grid 6.

7g – The remainder of the ground floor slab is to be reinforced and cast remainder of ground floor slab. Again concrete trucks and pump are to be located adjacent to the site on Royal College Street.

Stage 8 - Superstructure

8a – Firstly construct the single storey part of the building between grids 6 & 7 and between grids B & C. The roof of this can then be used for the storage of (not excessively heavy) materials.

8b – Construct the remainder of the superstructure frame in a traditional manner. Again concrete deliveries and pumps to be located adjacent to the site on Royal College Street.

Status: PRELIMINARY

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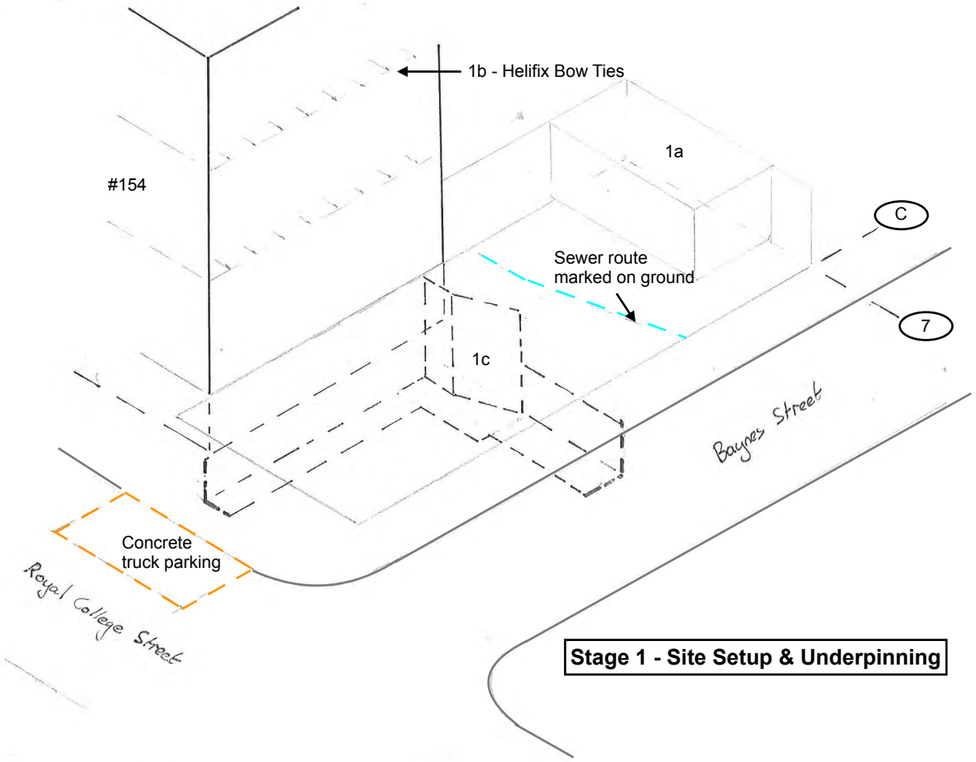
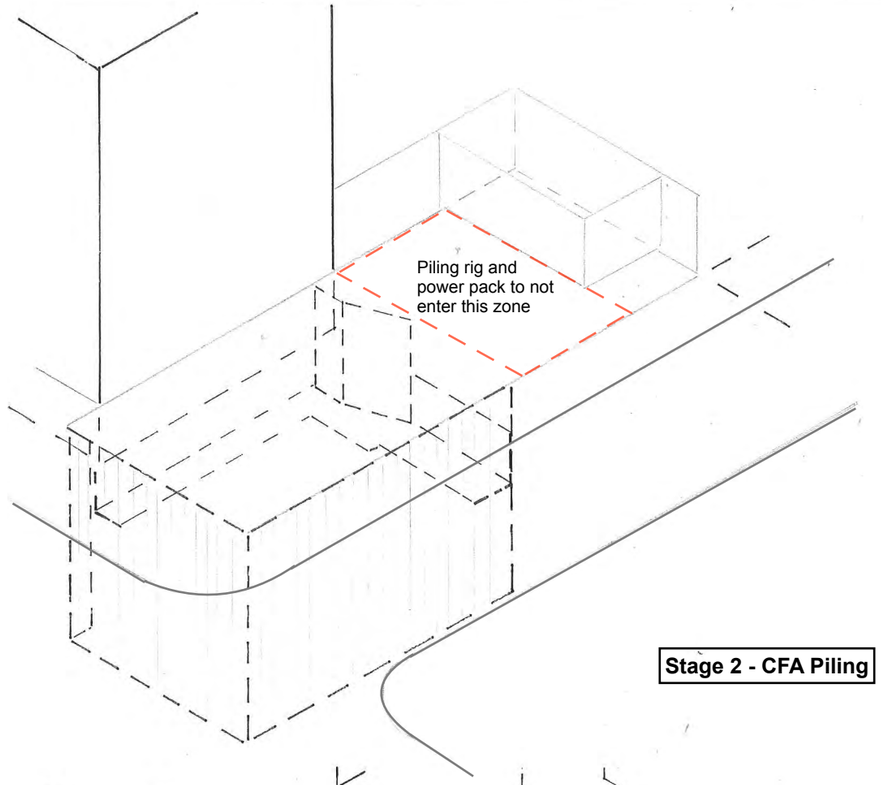
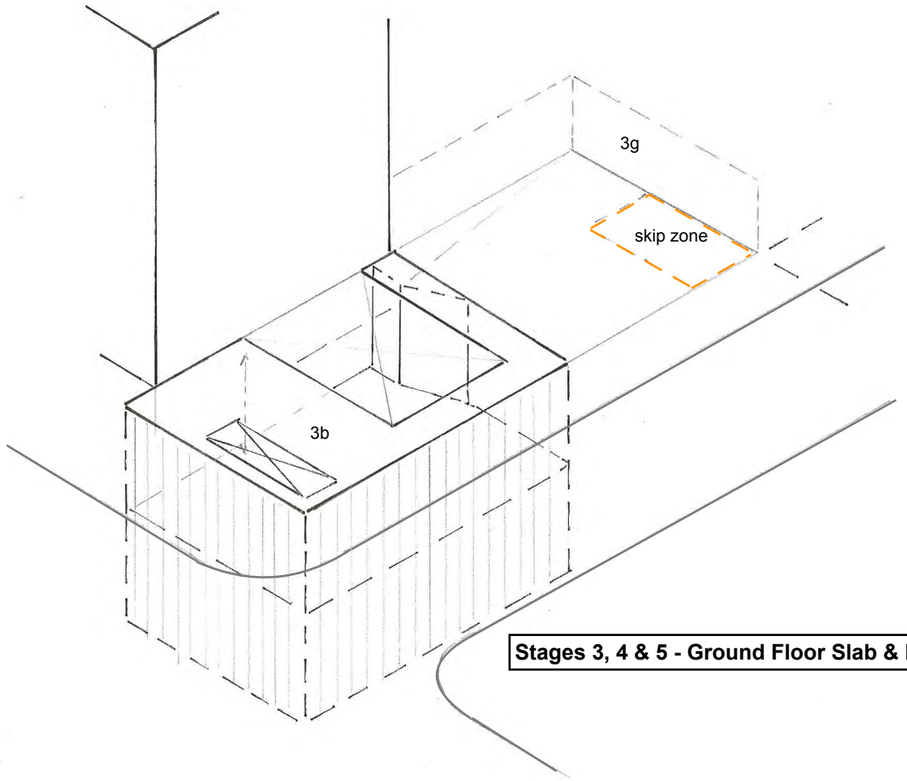
Job Title: 152 Royal College Street, NW1 0TA				Job No.: 15055
Drawing Title: Additional Sequencing Information for CMP - Sheet 1 of 2				Drg. No.: SK05
Scale @ A3: NTS	Date: March 2016	Drawn: RD	Checked: SM	Rev.: -



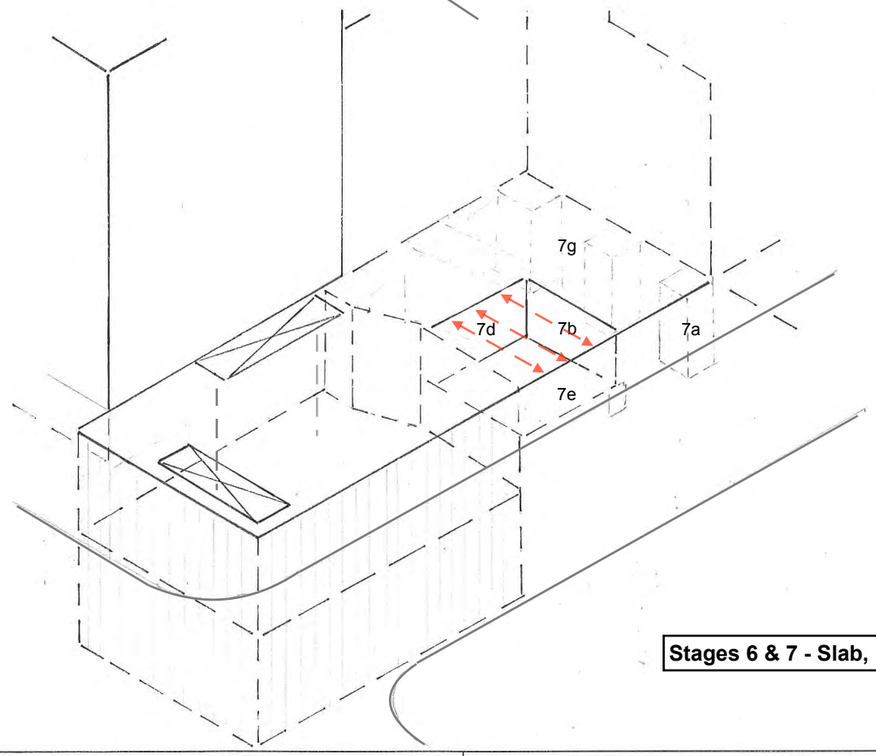
Stage 1 - Site Setup & Underpinning



Stage 2 - CFA Piling



Stages 3, 4 & 5 - Ground Floor Slab & Basement



Stages 6 & 7 - Slab, Pads & Courtyard

Status: PRELIMINARY

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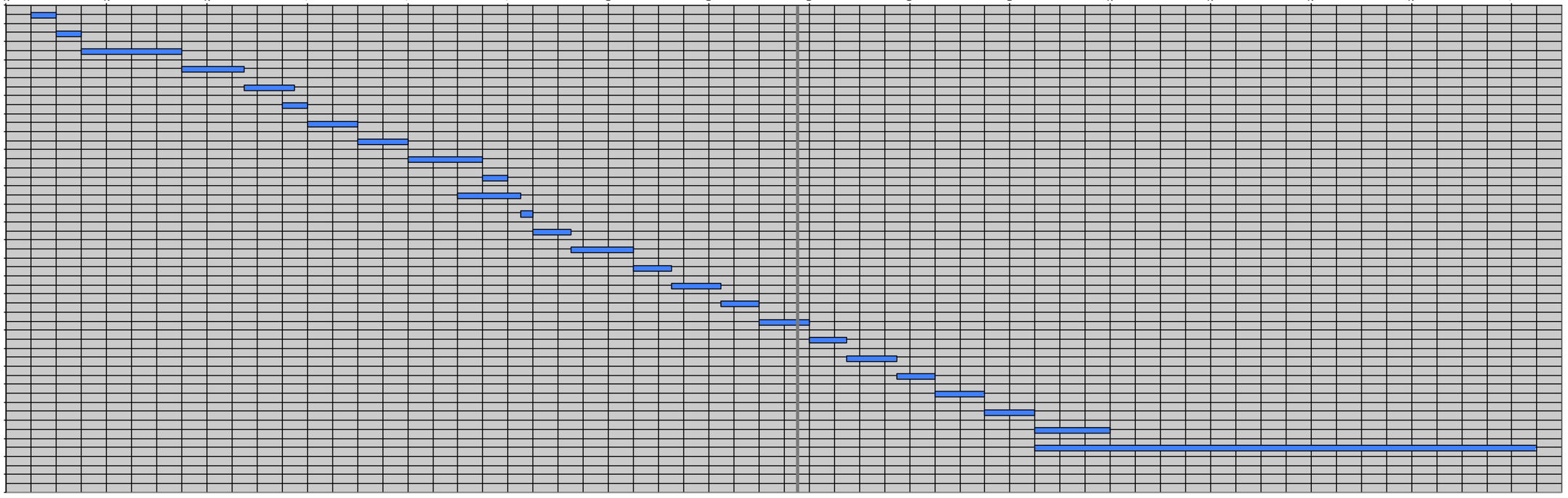
Job Title: 152 Royal College Street, NW1 0TA				Job No.: 15055
Drawing Title: Additional Sequencing Information for CMP - Sheet 2 of 2				Drg. No.: SK06
Scale @ A3: NTS	Date: March 2016	Drawn: RD	Checked: SM	Rev.: -

15055 - 152 Royal College Street, NW1 0TA - Preliminary Construction Programme - April 2016

Works

25/05/16 | 22/06/16 | 20/07/16 | 17/08/16 | 14/09/16 | 12/10/16 | 09/11/16 | 07/12/16 | 04/01/17 | 01/02/17 | 01/03/17 | 29/03/17 | 26/04/17 | 24/05/17 | 21/06/17 | 19/07/17



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