



41 Frognaal
London, NW3 6YD

Structural Engineering Report
and Subterranean
Construction Method
Statement

Job number: 2140825

Revision: P2

Status: Planning Application

Date: March 2015

Document Control

issue no.	01	remarks:	Issued for Planning				
revision:	P1	prepared by:	Richard Woodroffe Engineer MSc (Hons)	checked by:	Gary Povey Associate Director BSc CEng MIStructE	approved by:	Gary Povey Associate Director BSc CEng MIStructE
date:	December 2014	signature:		signature:		signature:	

issue no.	02	remarks:	Issued for Planning				
revision:	P2	prepared by:	Richard Woodroffe Engineer MSc (Hons)	checked by:	Gary Povey Associate Director BSc CEng MIStructE	approved by:	Gary Povey Associate Director BSc CEng MIStructE
date:	March 2015	signature:		signature:		signature:	

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Non-Technical Summary

If the recommended measures and sequence of works outlined in this report are properly undertaken by a suitability qualified contractor, the proposed works will pose no significant threat to the structural stability of the adjoining properties, the remaining house and surrounding grounds.

The 'Deskstudy and Ground Investigation Report' prepared by GEA suggests that it is unlikely that the proposed basement will pose a risk to the hydrogeological or hydrological setting.

To this end, EWP will have an on-going role during the works on site to monitor that the said works are being carried out generally in accordance with our design and specification. This role will typically involve weekly site visits at the beginning of the project and fortnightly thereafter.

1.0 Introduction

- 1.1 Elliott Wood Partnership LLP (EWP) is a firm of consulting structural engineers approximately 100 strong operating from their head office in South West London. Residential developments of all scales have been central to the workload of the practice with many in the Greater London area. In particular EWP have been producing designs for basements to both existing and new buildings. To date, this numbers approximately 500 sites many of which have been in the Borough of Camden. Our general understanding of the development of London, its geology and unique features together with direct experience on many sites puts us in a strong position to advise clients on works to their buildings and in particular the design and construction of their basement.
- 1.2 EWP were appointed by the building's owner to advise on the structural implications of the proposed construction of a new single-storey basement on the site of 41 Frogna1. The following report has been prepared to ensure that the property and neighbouring properties are safeguarded during the works. This report follows the guidance given in the Camden Planning Guidance on Basements and Lightwells CPG4. This assessment has been prepared in accordance with the guidance given in CPG4, DP23 and DP27. The Basement Impact Assessment is being carried out by persons holding the required qualifications relevant to each stage.
- 1.3 The Contractor will provide a detailed method statement including all temporary works required before the works can commence on site. The Contractor is to accept full responsibility for the stability and structural integrity of the works during the Contract and provide temporary support as necessary. He shall also prevent overloading of any completed or partially completed elements.
- 1.4 This statement focuses on the proposed subterranean works as opposed to the superstructure works and should be read in conjunction with all relevant Architects and Specialists supporting documents, some of which appear in the Appendices of this documents.

2.0 Description of Existing Building and Desk Study Summary

- 2.1 No. 41 Frogna1 is a two-storey detached house located on the south-west side of Frogna1. The site is predominately occupied by a front and rear garden whereby the house is situated approximately in the centre of the site.
- 2.2 The existing building consists of load bearing masonry walls which support reinforced concrete (RC) floors at first floor. The concrete floors bear onto the masonry walls via RC downstand beams which cantilever to form the existing balconies to the front and rear elevations. The existing roof structure consists of timber joists spanning between the masonry walls while the ground floor slab appears to be a RC ground bearing slab. Stability of the overall structure is assumed to be provided by cellular action of the masonry walls and diaphragm action of the floors and roof. The building is not listed but is considered to contribute to the Redington and Frogna1 Conservation Area.
- 2.3 Examination of the Environment Agency Flood Map indicates that the site lies within Zone 1 (low flood risk). As the site is less than 1 hectare, a Flood Risk Assessment should not be required. Also, Frogna1 is not a street at risk of surface water flooding (as listed by Camden Planning Guidance CPG 4).
- 2.4 There are a number of trees located around the periphery of the existing building. The proximity of the existing trees will need to be considered in the final design of the basement and its foundations. An arboriculturalist has been appointed to ensure that the works do not have an adverse impact on the retained trees.
- 2.5 The results of our desk study can be summarised as follows;
 - The building appears to be in the vicinity of a tributary from the historic river Westbourne (reference Lost Rivers of London, Nicholas Barton – refer to Appendix B).
 - The site is not located within a flood plain as shown on the latest Environment Agency Flood Maps (reference; www.environment-agency.gov.uk).
 - The site is not in the vicinity of any London Underground Ltd infrastructure (refer to confirmation letter in Appendix C).
 - There is a record of minor historical bomb damage to the property according to the Bomb Damage Maps, however, it is believed that the current structure was not present at that time (reference, The LCC London Bomb Damage Maps 1939-1945, LTS, map 37). It is believed that the building currently occupying the site was constructed some time between 1955 and 1970 to replace the previous building. The previous building occupying the site is assumed to be pre 1871 and was associated with a property to the northwest, annotated as the Priory.

3.0 Ground Conditions

- 3.1 Detailed information of the site and ground conditions have been provided in the 'Desk Study and Ground Investigation Report' prepared by Geotechnical & Environmental Associates (GEA).
- 3.2 Reference to British Geological Survey Maps (Sheet 256) suggests that the underlying ground is likely to be underlain by the Claygate Member of the London Clay Formation.

- 3.3 The ground conditions have been confirmed by a site investigation carried out by GEA in January 2015. The site investigation comprised of 2No 20m deep boreholes, 1No 10m deep borehole and four trial pits.
- 3.4 Three groundwater monitoring standpipes were installed to a depth of 6.0m to assess the ground water levels across the site.
- 3.5 The investigations imply that the underlying ground is London Clay overlaid by approximately 2.3m of made ground, which is in line with geological records for this area. Groundwater was not encountered within the depth of the boreholes, however, perched water was observed in the trial pit excavations. Sample testing indicated the underlying clay layer to be of expansive nature.
- 3.6 The desk study carried out by GEA suggests that the site has not had a contaminative history, having been occupied by residential properties throughout its development history. However, contamination testing has identified an elevated concentration of lead within a sample of made ground. The exact source of the contamination is unknown, however, the made ground was noted as containing variable amounts of extraneous material. It is recommended to carry out further testing once the proposals have been finalised.

4.0 Proposed Alterations

- 4.1 The proposed works involve the construction of a new storey on top of the existing structure, a rear extension, and the construction of a new single-storey basement. It is also proposed to construct a single storey garage with a green roof to the front of the property over the proposed basement. The proposed basement construction encompasses the proposed rear extension, the footprint of the existing structure, and extends under the existing driveway to the front of the property.
- 4.2 The existing front and rear facade will be retained in addition to retaining the main internal structural walls and RC slab at first floor. The existing roof of the garage and the main house is to be removed and replaced with an RC slab to accommodate the proposed additional storey. The existing ground floor slab will be removed to allow for a new RC suspended slab over the proposed basement.
- 4.3 The majority of the basement will extend approximately 4.5m below ground level with a portion extending approximately 6.5m below ground level to form the pool area.
- 4.4 No water was observed at basement formation level, therefore, the basement perimeter walls will be formed using contiguous piles to enable a safe excavation. The piles will be required to resist lateral forces from soil and surcharge loads in the temporary and permanent state. A reinforced concrete liner wall cast with waterproof concrete will be used to form the primary barrier to prevent water ingress. A cavity drain system will provide a secondary barrier.
- 4.5 The existing Main House will follow a 'bottom-up' approach whereby the existing front wall and the retained internal loadbearing walls, will be underpinned with reinforced concrete underpins using a traditional 5-stage sequence. The slabs and load bearing walls within the basement will be formed with reinforced concrete. The founding slab will be a suspended slab spanning over a compressible void former, and will be designed to

resist any residual uplift forces from heave, due to the release of the overburden and hydrostatic pressures. Reinforced concrete thickenings will be formed inside the pile line to support the vertical loads of the basement slabs.

- 4.6 The retained walls of the existing house, will be underpinned to allow excavation to the basement under the house. This underpinning will be permanent where it can be kept and temporary where it is only needed at enabling works for excavation. An explanation of the proposed works is contained on the drawings attached.
- 4.7 The basement works under the existing driveway, will follow a 'top-down' approach whereby the ground floor slab can be cast and supported on temporary piles prior to the excavation of the basement. The ground floor slab will contain sufficient voids for access, excavation and ventilation.

5.0 Proposed Below Ground Drainage

- 5.1 It is proposed that the existing connection to the public sewer is retained and re-used. This will be subject to location and condition, which will be confirmed by a CCTV survey prior to works.
- 5.2 It is proposed that all drainage from the ground floor and above is drained via gravity. The proposed basement level may be lower than the level of the existing public sewer connection as such the foul effluent generated at basement level will need to be pumped to the main private drainage system. This will prevent any flooding from the public sewer in case of backup. However given the topography of the site it is possible that pumping may not be necessary.
- 5.3 The basic waterproofing strategy is informed by the proposed use of the basement and the existing ground conditions. Ground water was not encountered within the proposed depth of the basement, however, it has still been considered in the design and waterproofing of the basement. It is proposed that the reinforced concrete basement walls and slab are constructed from waterproof concrete and will act as the primary barrier to possible water ingress. An internal drained cavity system will be installed to complete the system creating a Category 3 Basement as defined in Table 2 of BS 8102.
- 5.4 The cavity drain system will include a cavity drain sump to collect any water which will then be pumped to the main private drainage system.
- 5.5 It is proposed that SuDS are incorporated within the scheme, to reduce the surface water run-off from the site. The current proposals include both an extensive green and brown roof on the new extension respectively the site investigation confirms that the underlying subsoils consist of impermeable clay, therefore infiltration into the ground via soakaways will not be feasible.

6.0 Party Wall Matters

- 6.1 The proposed works development falls within the scope of the Party Walls Act 1996. Procedures under the Act will be dealt with in full by the Employer's Party Wall Surveyor. The Party Wall Surveyor will prepare and serve necessary Notices under the provisions of the Act and agree Party Wall Awards in the event of disputes.

The Contractor will be required to provide the Party Wall Surveyor with appropriate drawings, method statements and other relevant information covering the works that are notable under the Act. The resolution of matters under the Act and provisions of the Party Wall Awards will protect the interests of all owners.

6.2 The designs for 41 Frognal will be developed so as not to preclude or inhibit similar, or indeed any, works on the neighbouring properties. This will be verified by the Surveyors as part of the process under the Act.

7.0 Hydrogeological Statement Summary

7.1 Groundwater was not encountered below the site although perched ground water is present within the made ground.

7.2 A Basement Impact Assessment has been prepared by GEA to show that the proposed works are unlikely to pose a risk to hydrogeological or hydrological setting particularly as adequate space will remain around the proposed basement structure.

7.3 Arup's Subterranean Development Scoping Study (para 5.1), June 2008, notes that the impact of subterranean development on groundwater flows is negligible as groundwater flows will find an alternative route if blocked by a subterranean structure.

8.0 Monitoring and Ground Movement

8.1 It is anticipated that the Contractor shall provide monitoring to all structures and infrastructure adjacent to the basement excavation at the time of excavation and construction, however, this is to be agreed with the party wall surveyors.

8.2 Monitoring shall be completed as follows:

- 1) One month prior to any works being started to provide a base reading.
- 2) At the start and end of every shift during the excavation and until the basement slab and lining wall has been cast.
- 3) On a monthly basis thereafter for a 6 month period following completion of the notifiable works.

8.3 Cumulative movement of survey points must not exceed:

a. Settlement

Code amber trigger values: +/-4mm

Code red trigger values: +/-8mm

b. Lateral displacement

Code amber trigger values: +/-4mm

Code red trigger values: +/-8mm

8.4 Movement approaching critical values:

Code amber trigger value:

All interested parties, including the Adjoining Owner's Surveyor and his Engineer should be informed and further actions immediately agreed between two of the three Surveyors and implemented by the Building Owner. Notwithstanding the Party Wall requirements, the Contractor is to appoint, and to have permanently on site, a suitably qualified Structural Engineer who will be responsible for the reviewing of the movement monitoring results at the start and end of each day and provide immediate advice, remedial works and design as necessary in the event of movement being noted. The Contractor is to ensure that he has 24 hour/"days a week access" to emergency support provision including but not limited to additional temporary props, needles, waling beams and concrete supply at the start of the excavation and prior to any likelihood of this trigger value being reached. If this value is reached the Contractor, and his Engineer, must without delay provide all interested parties with his plan to implement any emergency remedial and supporting works deemed necessary. The Contractor must be ready to carry out these works without delay if the movement continues and approaches the trigger value below.

Code red trigger value:

All interested parties including Adjoining Owner's Surveyor and Engineer will be informed immediately. Works will stop and be made safe using methods and equipment agreed at the above stage. The Contractor is to ensure that the movement has stopped as a result of the implemented remedial works designed and installed at this stage. The requirements of the Party Wall Act will also ensure that, two of the three Surveyors and their advising Engineers shall then enter into an addendum Award, setting out whether or not the Building Owner's works can re-commence and when, and if so agree additional precautions or modifications to the proposals prior to re-commencement.

9.0 Conclusion

9.1 It is assumed that the above measures and sequence of works are taken into account in the eventual design and construction of the proposed works.

9.2 Detailed method statements and calculations for the enabling and temporary works will need to be prepared by the Contractor for comment by all relevant parties including party wall surveyors and their engineers. Elliott Wood Partnership will need to ensure that adequate supervision and monitoring is provided throughout the works particularly during the excavation and demolition stages.

9.3 In line with the site specific site investigation prepared by GEA, it is unlikely that proposed basement will pose a risk to the hydrogeological or hydrological setting.

9.4 To this end, EWP will have an on-going role during the works on site to monitor that the works are being carried out generally in accordance with our design and specification. This role will typically involve weekly site visits at the beginning of the project and fortnightly thereafter. A written site report is provided to the design team, Contractor and Party Wall Surveyor.

9.5 The undertaking of such projects to existing buildings is specialist work and EWP will be involved in the selection of an appropriate Contractor who will need the relevant expertise and experience for this type of project.

9.6 If the works noted above are properly undertaken by suitably qualified contractors, it is very unlikely that these works will pose any significant threat to the structural stability of the existing house or the neighbouring properties. We consider that if the works are carried out in this manner then the likelihood of damage to the adjacent properties and will be limited to Category 2 as set out in CIRIA report 580.

10.0 Subterranean Construction Method Statement

10.1 Construction generally

All demolitions and excavations will need to be undertaken in a carefully controlled sequence. In our structural design we have assumed the following Subterranean Construction Method Statement. The Contractor will, however, have to provide a detailed method statement including all temporary works design before the works commence on site. These proposals will be issued to EWP and the design team for comments prior to commencement of the works on site.

Access onto the site will be from Frognaal and must be coordinated in a sensible manner to minimise disruption to the neighbouring residents; and provide a safe working environment. The principles of access to the property during construction have been outlined in the Construction Management Plan (CMP) prepared by Motion.

10.2 Noise & vibration

The Contractor shall undertake the works in such a way as to minimise noise, dust and vibration when working close to adjoining buildings in order to protect the amenities of the nearby occupiers.

The breaking out of existing structure shall be carried out by saw cutting where possible to minimise vibration to the adjacent properties and associated construction noise. All demolition and excavation work will be undertaken in a carefully controlled sequence, taking into account the requirement to minimise vibration and noise.

10.3 Construction Method Statement

Refer to the attached drawings SK.20 to SK.25 for the assumed sequence of construction.

Site Set-up

- Erect a fully enclosed painted plywood site hoarding along the boundaries, this should not impede on the neighbouring properties.
- The services within the site should be identified and isolated as necessary. All below ground obstructions should also be removed to allow the works to progress.

- The principles for the removal of spoil are indicated in the CMP, however, the final construction management plan and overall sequence is to be agreed with the contractor after final proposals have been agreed.
- Tree Protection methods to be agreed and installed to all retained trees where required. Refer to the Arboricultural Impact Assessment Report prepared by Landmark Trees.
- If required, monitoring points will be installed to all neighbouring structures and infrastructure and a base reading should be taken prior to any construction works starting on the site.

The Construction Method Statement is split into two methods where we are constructing the basement under the existing house using a 'bottom-up' construction approach. The basement to the front of the house is proposed to be constructed using a 'top-down' approach.

Basement Under Existing House

Stage 1: Internal soft strip, enabling works

- Complete soft strip of internal finishes within the building.
- Remove the existing swimming pool container and backfill to allow for piling to the rear of the existing house.
- Temporary mass concrete underpins are required to be installed in some areas, in conjunction with the construction of some new walls to enable the demolition of some existing ground floor walls.
- Where required, temporary needle beams, props and mass concrete foundations are to be installed to enable the installation of steel beams to support some of the first floor walls in the temporary case.

Stage 2: Demolition of Ground Floor slab and walls

- After the existing first floor structure is adequately supported, the internal walls can be demolished where required followed by the demolition of the ground floor slab.
- Carry out a reduced level dig to allow props to be installed to restrain the existing foundation walls. Reduced level dig will be above the level of the existing footings to avoid undermining.

Stage 3: Install underpins

- Dig trial underpins for inspection by Elliott Wood Partnership to check how well the existing soil is cemented and in particular its ability to "stand up" whilst the individual underpin is completed. Given our experience on nearby projects we would expect that localised trench sheeting and props will need to be installed within the underpin shaft.
- Carry out the underpinning works to the existing walls using a traditional 5-stage underpinning sequence. The reinforcement will be tied in the toe first followed by the stem. The underpins will be left to cure for 3 days and then dry-packed to the underside of the existing walls with 3:1 sharp sand to cement dry pack well

rammed in. The exact sequence of the underpinning will be advised by the Contractor as it will relate to their sequence of construction. Trench sheets, timber waling beams and Acrow props are to be used to shore up the excavation (1m maximum) and prop off the adjacent earth bund.

- Where required, excavations created during the underpinning sequence are to be backfilled to allow for the perimeter piles to be installed.

Stage 4: Install piles

- Install the contiguous piling from ground floor level around the perimeter of the proposed basement. The piles will be designed to resist the lateral forces from soil and surcharge pressures in the temporary and permanent cases.

Stage 5: Bulk excavation

- Once all the piling and underpinning is complete, undertake the bulk excavation, installing temporary propping to the underpinning across the width of the basement as required. The temporary propping will remain in place until the basement and ground floor structures are in place and have cured sufficiently.

Stage 7: Cast RC base slab

- At formation level cast blinding layer and install below ground drainage as required.
- Install compressible void former under areas of suspended slab (between thickenings in the base).
- Install and tie reinforcement for the basement slab including starter bars for RC walls.
- Cast RC base slab, local thickenings and kickers.
- Cast liner walls and remaining load bearing RC walls where required.
- Once the basement slab has cured sufficiently, the lateral propping directly above the basement slab level can be removed

Stage 8: Cast RC Ground Floor slab

- Cast the RC slab and internal beam strips using the sacrificial stool method or Pynford beam method in the areas that the existing walls are to be retained and resupported on the slab (note that these walls are currently underpinned with temporary piles). The new slab should be adequately tied to the underpins and continuity bars should be installed within the slab under the walls as required for the permanent case.
- After the slab is adequately cured, the temporary underpins and high level props in the basement can be removed.

Stage 9: Commence Superstructure Works

- Carry out works to superstructure as required.

Basement Under Driveway Outside of Existing House Footprint

Stage 1: Install Piles

- Install the contiguous piling from ground floor level around the perimeter of the proposed basement. The piles will be designed to resist the lateral forces from soil and surcharge pressures in the temporary and permanent cases.
- Install the internal CFA temporary piles to support the ground floor slab in the temporary case.

Stage 2: Cast Ground Floor slab

- Complete a reduced level excavation down to formation level of the ground floor slab.
- Cast the RC slab and internal beam strips adequately tying the slab into the temporary internal piles. Voids are to be left in the slab as required to allow access and spoil removal.

Stage 3: Reduced level excavation to basement

- Once ground floor slab is cured, undertake the bulk excavation under the slab to basement formation level.
- Locally carry out a sloped excavation to accommodate construction of the proposed swimming pool.

Stage 4: Construct Swimming Pool container

- At formation level cast blinding layer and install the below ground drainage as required.
- Install compressible void former under areas of suspended slab (between thickenings in the base).
- Install and tie reinforcement for the pool slab including starter bars for RC walls.
- Cast RC base slab, local thickenings and kickers. Voids are to be left in the slab at pile locations with continuity reinforcement installed in the voids.
- Cast RC walls to form pool container.
- Backfill the sloped excavation up to basement slab formation level.

Stage 5: Cast basement slab

- At formation level cast blinding layer and install the below ground drainage as required.
- Install compressible void former under areas of suspended slab (between thickenings in the base).
- Install and tie reinforcement for the basement slab including starter bars for RC walls.

- Cast RC base slab, local thickenings and kickers. Voids are to be left in the slab the pile locations with continuity reinforcement installed in the voids.

Stage 6: Cast perimeter and internal load bearing walls

- Cast liner walls and internal load bearing RC walls where required.
- Once the load bearing walls are in place and have cured sufficiently, the internal temporary piles can be broken down to below the level of the basement and pool slab.
- After the piles are broken down, the voids in the slab can be made good.

Stage 7: Commence Superstructure Works

- Carry out works to superstructure as required.

APPENDICES

A. Proposed Structural Layouts and Sequence of Construction

NOTE:

- UNDERPINS TO BE CAST IN AN AGREED UNDERPINNING SEQUENCE
- ALL UNDERPIN + PILES TO BE TEMPORARILY PROPPED UNTIL GROUND + BASEMENT SLABS HAVE BEEN CAST + CURED.

TEMPORARY UNDERPINS TO BE INSTALLED TO SUPPORT WALL OVER TO ENABLE DEMOLITION OF EXISTING GROUND FLOOR SLAB

SK.07

200MM THK. WATERPROOF RC LINING WALL TO SUPPORT SLAB OVER IN PERMANENT CASE

Φ450MM CONTIGUOUS PILES TO FORM BASEMENT

200MM THK. RC LOAD BEARING WALLS TO SUPPORT STRUCTURE OVER IN PERMANENT CASE

600MM DEEP RC EDGE THICKENING

TEMPORARY MASS CONCRETE UNDERPINS TO SUPPORT EXISTING WALLS OVER. UNDERPINS TO BE REMOVED IN PERMANENT CASE

LEGEND
 ↗ : 300MM THK. RC SLAB ON LAYER OF HEAVE PROTECTION.

BOUNDARY LINE

SK.10

BOUNDARY LINE

ASSUMED LOCATION

SK.10

39 FROGNAL * 41 FROGNAL

SK.08

REFER TO DWG SK.02 FOR CONTINUATION

RC UNDERPINS TO BE CAST IN MAXIMUM 1.0M LONG SECTIONS. WIDTH OF UNDERPINS TO MATCH WIDTH OF WALL OVER.

EXISTING GARAGE

2 FROGNAL CLOSE



This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications. Do not scale from this drawing.

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drawing title
PROPOSED LOWER GROUND PLAN (1 of 2)

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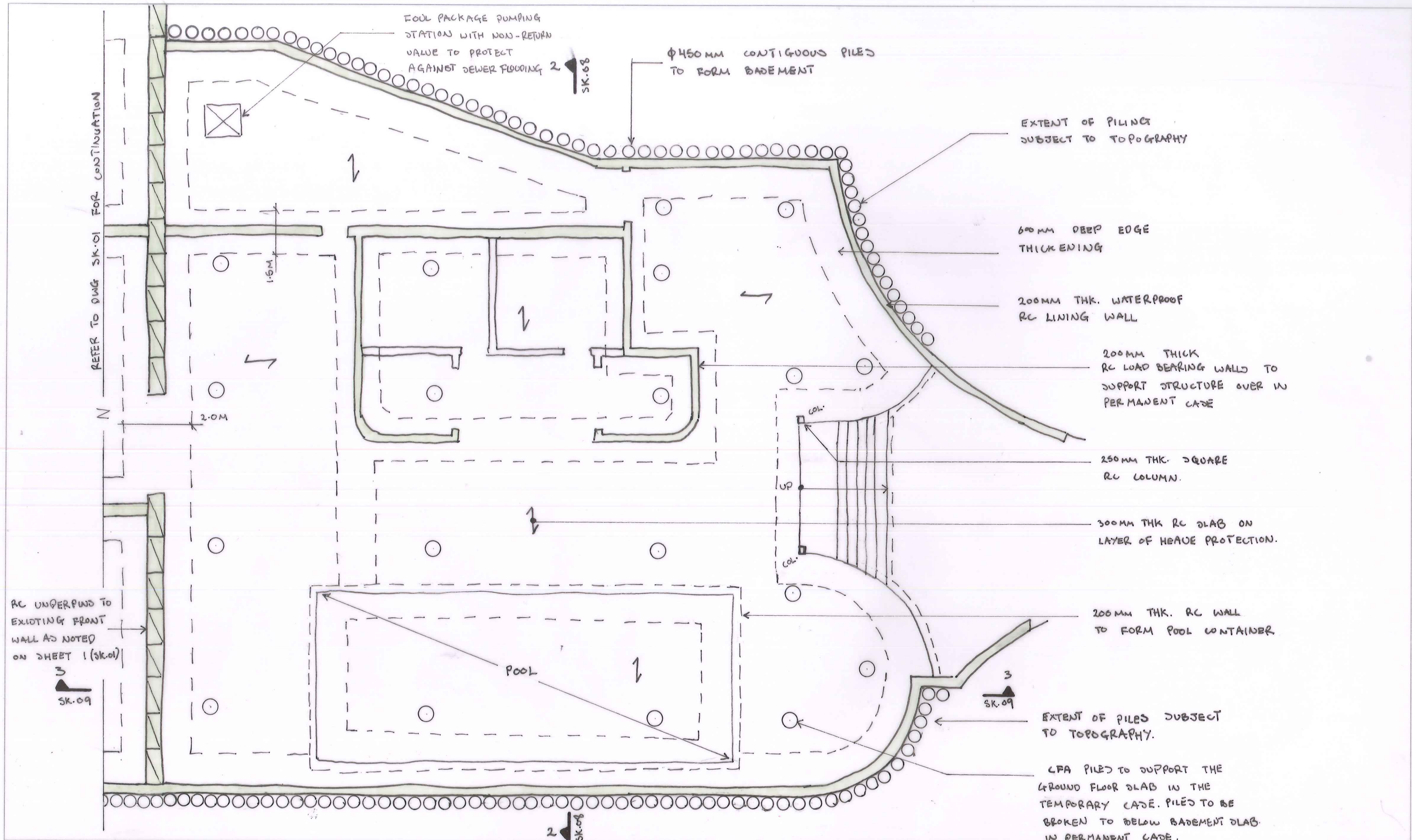
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elliottwood

Elliott Wood Partnership LLP, 241 The Broadway, London SW19 1SD
 Consulting Structural and Civil Engineers. www.elliottwood.co.uk
 tel: (020) 8544 0033 fax: (020) 8544 0066 info@elliottwood.co.uk

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PROPOSED LOWER GROUND PLAN (2 OF 2)

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Elliott Wood Partnership LLP, 241 The Broadway, London SW19 1SD
Consulting Structural and Civil Engineers. www.elliottwood.co.uk
tel: (020) 8544 0033 fax: (020) 8544 0066 info@elliottwood.co.uk

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