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6 Nutley Terrace

London, NW3 5BX

Structural Engineering Report and Subterranean Construction Method Statement

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Document Control

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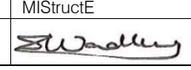
date:	13.04.15	signature:	SSt	signature:		signature:	

Contents

Appendices

Non-Technical Summary

If the above measures and sequence of works are taken into account in the eventual design and construction of the proposed works and are properly undertaken by suitability qualified contractor, these works will pose no significant threat to the structural stability of the adjoining properties or surrounding grounds.

The attached reports state that the proposed basement will have no significant adverse effect on the local hydrogeology. They also state that both ground water and surface water will not be affected or cause significant adverse effects to the surrounding properties.

To this end, EW 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.

1.0 Introduction

1.1 Elliott Wood (EW) is a firm of consulting structural engineers approximately 110 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 EW 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 EW were appointed by the building's owner to advise on the structural implications of the proposed construction of a new four storey multi-unit dwelling with a double storey basement on the site of 6 Nutley Terrace. 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. A Basement Impact Assessment has been carried out, consisting of two reports. The Land Stability and Surface Flow assessments have been carried out in a single report by Geotechnical and Environmental Associates (GEA). The Subterranean Groundwater Assessment has been carried out by Chord Environmental Ltd.

1.3 The Contractor will provide a detailed method statement including all temporary works 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. The Contractor 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.

2.0 Description of Existing Building and Site Conditions

2.1 The existing building at 6 Nutley Terrace is a detached two-storey house without a basement. The existing building is of traditional construction with timber floors and roofs, and with load-bearing masonry walls.

2.2 The existing building and neighbouring properties are not registered on the Camden Borough listed building register but they are situated in the Fitzjohns Netherhall conservation area.

2.3 A site investigation was carried out at the property by GEA. The investigation comprised of three boreholes of 20m depth with standard penetration tests at regular intervals. Disturbed and undisturbed samples were collected for laboratory testing, including soil contamination testing.

2.4 The site investigation indicated that the underlying ground is London Clay overlaid by up to 0.3m-1.0m of made ground. This is in line with geological records for this area. Groundwater was not encountered during the boring operations but was found to have stabilised at a depths between 1.0m-1.7m below ground level in the monitoring standpipes installed in Boreholes 2 & 3. Sample testing indicated the soil underlying clay to be of high swelling and shrinkage potential. Refer to GEA's report for details.

2.5 There are a number of mature trees both in the garden of No. 6 and in adjacent gardens, resulting in a number of root protection zones to some areas of the rear garden. No works are proposed within the tree protection zones.

2.6 The Belsize Network Rail Tunnel runs under the road at Nutley Terrace, at around 23m below ground level in the direction of the road. This has been taken into account in the design of the proposed basement. However final confirmation will be required from Network Rail. Refer to Appendix B for network rail asset information.

2.7 The historic river Tyburn runs approximately 50m to the east of the property beneath the eastern edge of Fitzjohns Avenue. The tributary is entirely covered and culverted. The site is not located within the flood plain or within a Groundwater Source Protection Zone as defined by the Environment Agency Flood Maps.

2.8 Nutley Terrace is located within the Critical Drainage Area number GROUP3-005 as identified in Camden SWMP, but is not in Camden's list of streets at risk of surface water flooding.

2.9 The results of our desk study can be summarised as follows;

- The building appears to be near the historic river Tyburn (reference Lost Rivers of London, Nicholas Barton – refer to Appendix C).
- The site is located in flood zone 1 and is not within a Groundwater Source Protection Zone as shown on the latest Environment Agency Flood Maps (reference; www.environment-agency.gov.uk).
- The site is in the vicinity of the Belsize Network Rail Tunnel (refer to Appendix B for Asset Information).
- There is no record of historical blast bomb damage to the property (reference, The LCC London Bomb Damage Maps 1939-1945, LTS, map 37).

3.0 Proposed Alterations

3.1 The proposed works involve the demolition of the existing property and construction of a new four storey multi-unit dwelling with a double storey basement. Refer to appendix A for proposed structural drawings and sections.

3.2 The new double storey basement will extend approximately 7.6m below ground level with the perimeter walls formed from a secant piled wall and reinforced concrete (RC) liner wall.

3.3 To minimise any impact that the proposed building may have on the Belsize Tunnel, an exclusion zone of 10m from the tunnel extrados will be formed whereby vertically-loaded piles will not encroach. Piles outside of the exclusion zone will take vertical and lateral loads. Piles that lie within the exclusion zone will only take lateral loads to reduce the required depth of pile and minimise any impact this may have on the tunnel. At the higher basement level the cantilevering RC slab to the front of the property will pick up vertical loads from above and transfer these loads to the perimeter wall at the basement level.

3.4 The secant piled wall will enable the double basement to be excavated and constructed in a safe manner for both the Contractor and adjacent properties and gardens. The piled wall will also be used to prevent the ingress of ground water into the excavation during construction. It will support all the ground, water and surcharge loads applied to it in the temporary condition.

3.5 The lower basement slab will be a RC raft supported on a series of concrete piles and suspended over a compressible void former. The piles will be designed to support the vertical loads from the new basement and also act to prevent hydrostatic and clay heave uplift.

3.6 The higher basement slab will be a RC flat slab supported on the basement perimeter walls, internal stair core, lift shaft and RC columns. The slab will provide permanent propping to the perimeter RC lining walls and surrounding secant piled wall. The RC lining walls will act in the permanent condition to resist lateral loads from earth, water and surcharge loads from the adjacent ground.

3.7 At higher levels the RC flat slab construction will continue at each floor level, with the slab supported on the RC perimeter walls and internal core structure.

3.8 The roof structure and third floor level will be formed from a steel frame and timber infill to reduce overall load of the building.

3.9 The overall stability of the building will be achieved through the cellular layout of the RC shear walls and rigid diaphragm action of the RC floor slabs.

4.0 Proposed Below Ground Drainage

4.1 It is proposed that the existing connection to the combined 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. Refer to Appendix D for Thames Asset search.

4.2 It is proposed that all drainage from the ground floor and above is drained via gravity. The proposed basement level will 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.

4.3 It is proposed that SuDS are incorporated within the scheme, to reduce the surface water run-off from the site. The site investigation has confirmed that the underlying subsoils consist of impermeable clay, therefore infiltration into the ground via soakaways will not be feasible. To limit the run-off from the site to that of the existing situation, underground attenuation tanks will be incorporated into the design. The exact details of this attenuation tank, including size and flow control device will be confirmed as part of the detailed design phase, although it is likely that the tank will be constructed from cellular storage crates. We note that it has been suggested that the surface water run-off is restricted to Greenfield rates if possible – unfortunately due to the small size of the site, this will not be practical and will potentially increase the risk of the site flooding, due to a very small flow restrictor.

5.0 Party Wall Matters

5.1 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.

5.2 The structural design for 6 Nutley Terrace will be developed so as not to preclude or inhibit similar, or indeed any, works on the adjoining properties. This will be verified by the Surveyors as part of the process under the Act.

6.0 Basement Impact Assessment Summary

6.1 The Land Stability and Surface Flow assessments been carried by GEA, the assessments conclude that the proposed development is unlikely to result in any specific land/slope stability issues or surface flooding issues.

6.2 The Groundwater Impact Assessment has been carried out by Chord Environmental Ltd. The assessment concluded the proposed development is unlikely to affect the groundwater regime beneath, or adjacent to the site.

6.3 A ground movement analysis will be carried out and reported by GEA prior to the works starting on site. However, the structure will be designed to ensure movement is not worse than Category 2 on the Burland Assessment.

7.0 Hydrogeological Statement Summary

7.1 Groundwater was not encountered during the boring operations carried out by GEA in August 2011 however recent standpipe monitoring has found the water level stabilised at depths between 1.0m and 1.7m below ground level in Boreholes 1 and 2.

7.2 The groundwater found in the standpipes is more than likely perched water from discrete pockets of water rather than a continuous layer. It is likely that the rate of inflow will be relatively slow within the London Clay.

7.2 The structural slab level of the lower basement slab is approximately 7.6m bgl. It is therefore more than likely that perched water will be encountered during the construction of the double basement. The piled secant wall will inhibit the ingress of groundwater during construction and the basement walls will be constructed with a waterproof reinforced concrete designed to withstand the surcharge loading from groundwater. Localised pumping will be implemented to deal with the perched water during the construction of the basement. As the ground has a low permeability it was advised that this would be a suitable method of controlling the water. The relevant filters will be installed on the pumps to ensure that the migration of fines is limited. Alternatively permeation grouting could be adopted subject to the relevant party wall agreements.

.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 Conclusions

8.1 It is intended that the above measures and sequence of works are adopted for the eventual design and construction of the proposed works.

8.2 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 ensure that adequate supervision and monitoring is provided throughout the works particularly during the excavation and demolition stages. A specification and indication of monitoring requirements is given in section 9.0.

9.0 Monitoring during Excavation and Construction

9.1 The Contractor shall provide monitoring to all structures and infrastructure adjacent to the basement excavation at the time of excavation and construction.

9.2 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.

9.3 Cumulative movement of survey points must not exceed:

a. *Settlement and Lateral displacement*
   Code amber trigger values: +/-4mm
   Code red trigger values: +/-8mm

9.4 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 / 7 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.

10.0 Subterranean Construction Method Statement

10.1 Construction generally

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

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 will need to ensure that adequate supervision and monitoring is provided throughout the works particularly during the excavation and demolition stages.

To this end, EW 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.

Access onto the site will be from Nutley Terrace and must be coordinated in a sensible manner to minimise disruption to the adjoining residents; and provide a safe working environment.

10.2 Assumed Sequence of Construction

Stage 1: Site set-up

- Erect a fully enclosed painted plywood site hoarding along the front boundary wall, 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 shall be agreed. Given the scope of the works it is likely that conveyors will be used to move the spoil from within the building to a holding skip located in the front garden/driveway. Grab lorries will be used to remove the material from the skip.
- Tree Protection methods to be agreed and installed to all retained trees.
- Monitoring points should be installed to all neighbouring structures and infrastructure and a base reading should be taken prior to any construction works starting on the site.

Stage 2: Internal soft strip & demolition

- Complete soft strip of internal finishes within the building.
- Carefully demolish the existing building down to ground floor level in a staged sequence (tbc by the Contractor).

Stage 3: Install piles

- Complete the secant piling from ground floor level around the perimeter of the proposed basement leaving the upper section unreinforced in the areas where the higher basement level extends beyond the extent of lower basement level. The unreinforced section will allow the piles to be broken down later in the sequence of works.
- The secant wall will resist vertical loads and lateral forces from soil and surcharge pressures in the temporary and permanent states.
- Install tension piles within the basement perimeter leaving the upper section unreinforced (allowing them to be broken down at a later date). These will resist uplift forces from any residual overburden and hydrostatic pressures acting on the base slab.
- Complete the secant piling in the areas where the perimeter of the higher basement level extends beyond the extent of the lower basement level. These secant piles will resist lateral forces from soil and surcharge pressures in the temporary and permanent states.

Stage 4: Bulk excavation

- Reduce level dig down to approx. 1m below ground level.
- Install steel waling beams around the perimeter of the excavation.
- Install horizontal props spanning across the width of the basement between the waling beams.
- Continue excavating down to formation level in stages installing further waling beams and horizontal propping as the excavation progresses. The levels at which propping is required is to be determined by the temporary works Engineer. The propping levels will take into account the permanent works design such that the RC slabs can be cast above/below the props whilst the props remain in place.
- As excavation progress the un-reinforced tension piles are broken down to formation level.

Stage 5: Cast RC base slab

- At formation level cast blinding layer and install the below ground drainage as required.
- Install compressible void former under the RC raft slab.
- Install and tie reinforcement for the basement slab including starter bars for RC walls.
- Cast RC base slab and kickers.
- Once the base slab has cured it will provide a permanent low level prop to the basement retaining walls/piles and hence, the lowest level of horizontal propping and waling beams can be removed.

Stage 6: Construct up to lower ground level

- Once the base slab has cured, the lower basement walls and RC columns can be constructed.
- Cast the RC lining walls and RC columns up to the higher basement slab level.
- Once the RC lining walls have cured, cast the higher basement level slab. Once the higher basement level slab has cured it will provide a mid-level prop to the secant piled walls and hence, the mid-level horizontal propping and waling beams can be removed.

Stage 7: Construct up to ground level

- Once the higher basement level slab has cured, the RC lining walls and RC columns up to ground floor level can be constructed.
- Cast RC walls and build up load-bearing block walls up to proposed ground floor slab level.
- Once the walls have cured cast the ground floor slab supported on the walls. Once the ground floor slab has cured it will provide a permanent high level prop to the basement retaining walls and hence, the remaining horizontal propping and waling beams can be removed.

Stage 8: Construct superstructure

- Once the ground floor slab has cured, the superstructure works can commence.

13.0 Noise, Vibration and Dust

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Below we have described the mitigation measures that are proposed to keep noise, dust and vibration to acceptable levels during construction.

13.1 Mitigation Measures for Demolition of Existing Building

The breaking out of existing structures shall be carried out by diamond saw cutting and hydraulic bursting where possible to minimise noise and vibration to the adjacent properties. All demolition and excavation work will be undertaken in a carefully controlled sequence, taking into account the requirement to minimise vibration and noise. The contractor will need to utilise non-percussive breaking techniques where practicable.

As the property is detached there is less of an issue with noise and vibration transference via connections to the neighbouring building. However, the contractor should ensure that where any slab is adjacent to the boundary the concrete slab should be diamond saw cut first along the boundary to isolate the slab from any adjoining structures.

Dust suppression equipment should be used during the demolition process to ensure that any airborne dust is kept to a minimum.

13.3 Mitigation Measures for Piling

The secant piled wall will be formed using a continuous flight auger rig – this is a non-percussive technique and therefore produces significantly less noise and vibration than the alternative driven piles. Some of the temporary piles will require breaking down to slab level once the basement works are complete. The contractor should ensure that they use non-percussive pile reduction techniques which are much quieter than traditional breakers.

13.4 Mitigation Measures for Bulk Excavation

Due to the size of the basement it is likely that mechanical plant will be required to complete the bulk excavation. The contractor should ensure that any mechanical plant is switched off when not in use and is subject to regular maintenance checks and servicing. An electrically powered conveyor will be used as detailed above.

13.5 Mitigation Measures for the Construction of the concrete shell

The contractor should ensure that any concrete pours are completed within the permitted hours for noise generating works. The contractor should allow for a contingency period to ensure that concrete pours can be completed within these hours regardless of unforeseen circumstances such as batching plant delays and traffic congestion.

The fabrication and cutting of steelwork for the reinforced concrete walls and underpins shall take place off site. If any rebar needs to be trimmed on site this should be completed using hydraulic or pneumatic tools instead of angle grinders.

13.6 Dust Control

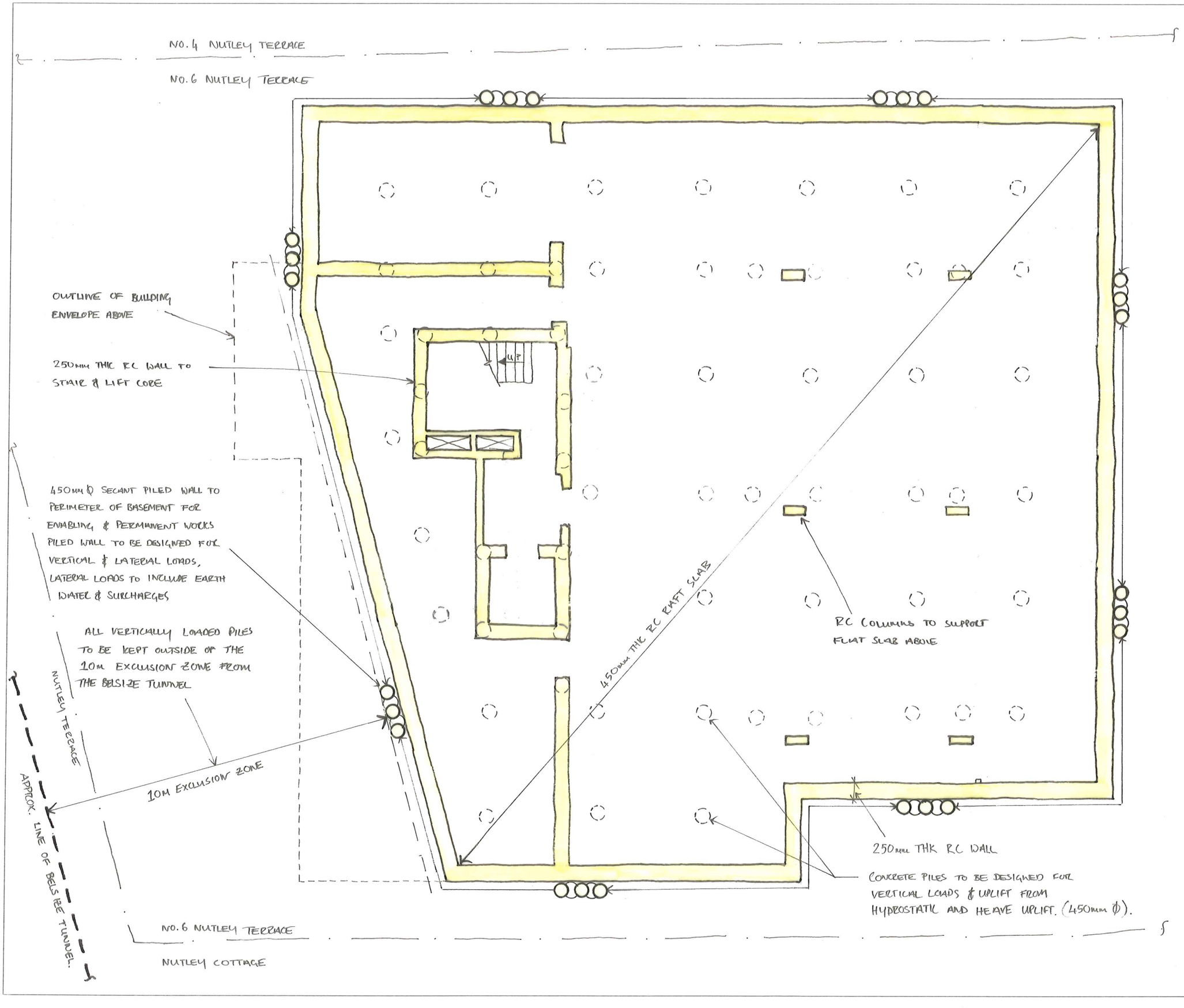
In order to reduce the amount of dust generated from the site, the contractor should ensure that any cutting, grinding and sawing should be completed off site where practicable. Any equipment used on site should be fitted with dust suppression or a dust collection facility.

The contractor will be responsible for ensuring good practice with regards to dust and should adopt regular sweeping, cleaning and washing down of the hoardings and scaffolding to ensure that the site is kept within good order. The contractor selected will be a member of the Considerate Contractors Scheme. Contact details of the contractor who will be responsible for containing dust and emissions within the site will be displayed on the site boundary so that the local residents can contact the contractor to raise any concerns regarding noise and dust.

The building will be enclosed within suitable scaffold sheeting and any stockpiles of sand or dust-generating materials will be covered. Cement, fine aggregates, sand and other fine powders should be sealed after use.

APPENDICES

A Proposed Structural Layouts and Sections



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job title
NO. 6 NUTLEY TERRACE, LONDON, NW3 5BX

drawing title
PROPOSED BASEMENT PLAN. (LOWER)

scale(s)	date	drawn
1:100@A3	DEC'14	SS

drawing status
PRELIMINARY

job no	drawing no	revision
2140657	S.01	P2

NO.4 NUTLEY TERRACE

NO.6 NUTLEY TERRACE

LOWER GROUND SLAB DESIGNED TO CANTILEVER OVER PILED WALL UNDER AND TO PICK UP LOADING FROM FLOORS ABOVE AND FRONT FACADE. SLAB SUPPORTED BY CANTILEVING BEAMS WITHIN RC WALLS

LINE OF PILED WALL AT RC WALL UNDER

250mm THK RC WALLS TO STAIR & LIFT CORE

450mm ⌀ SECANT PILED WALL TO EDGE OF CANTILEVING PORTION OF LOWER GROUND LEVEL FOR ENABLING & PERMANENT WORKS

PILED WALL TO BE DESIGNED FOR LATERAL LOADS FROM WATER, EARTH AND SURCHARGES. PILED WALL NOT TO TAKE VERTICAL LOADING. TEMPORARY PROPPING OF PILED WALL MAY BE REQUIRED.

CANTILEVING RC BEAMS WITH RC WALLS TO SUPPORT CANTILEVING SLAB

RC COLUMNS TO SUPPORT SLAB OVER.

STRUCTURE UNDER

CAR LIFT.

UP

UP

UP

450mm THK RC SLAB

RC COLUMN UNDER

RC COLUMN UNDER.

250mm THK RC WALL

LINE OF SECANT PILED WALL.

REFER TO DRG S.11 FOR REAR GARDEN DETAILS

NUTLEY TERRACE

NO.6 NUTLEY TERRACE

NUTLEY COTTAGE

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job title

NO. 6 NUTLEY TERRACE LONDON, NW3 5BX

drawing title

PROPOSED HIGHER BASEMENT PLAN.

scale(s)	date	drawn
1:100 @ A3	DEC'14	SSt

drawing status

PRELIMINARY

job no	drawing no	revision
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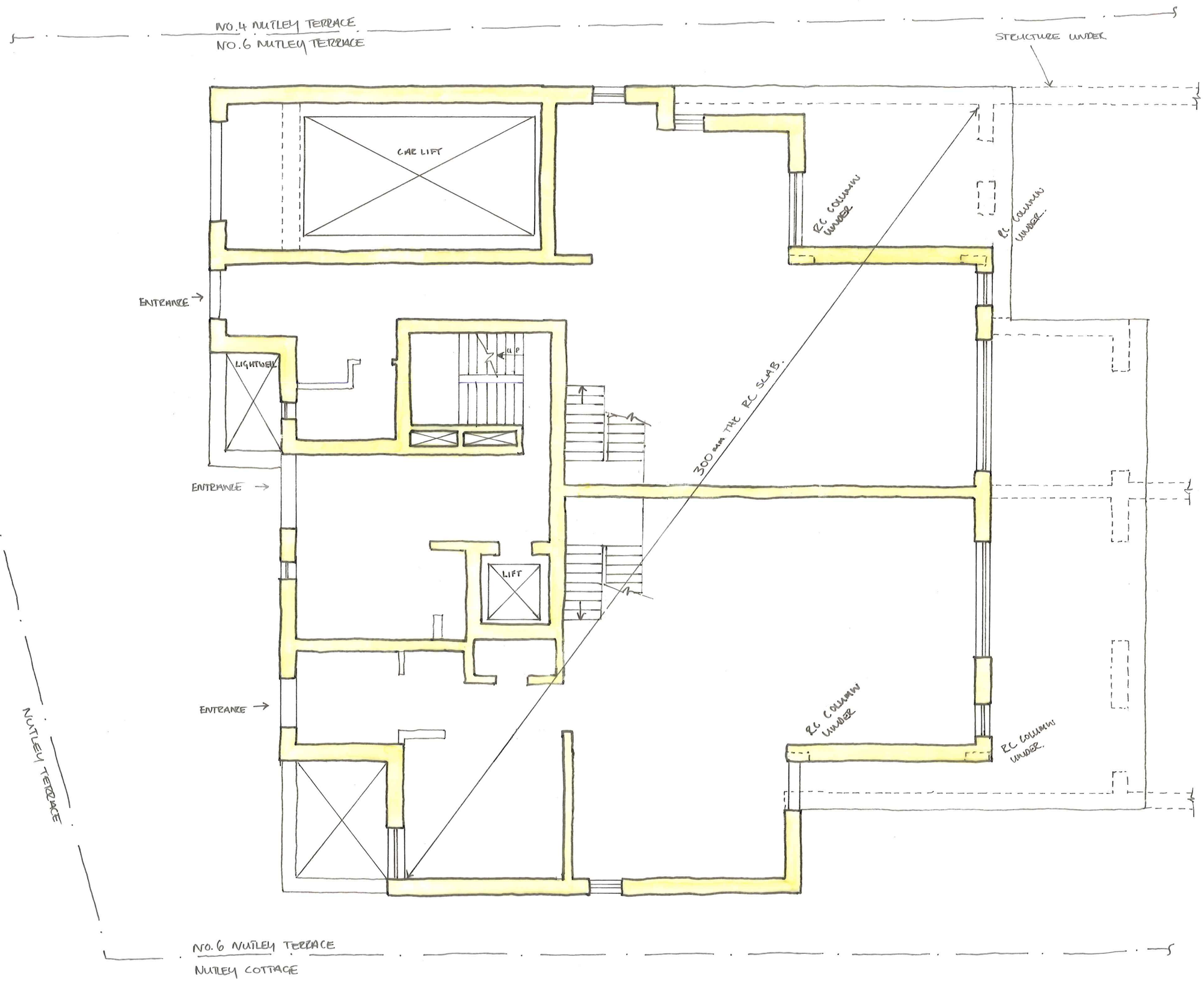

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job title

NO.6 NUTLEY TERRACE, LONDON, NW3 5BX

drawing title

PROPOSED GROUND FLOOR PLAN.

scale(s)	date	drawn
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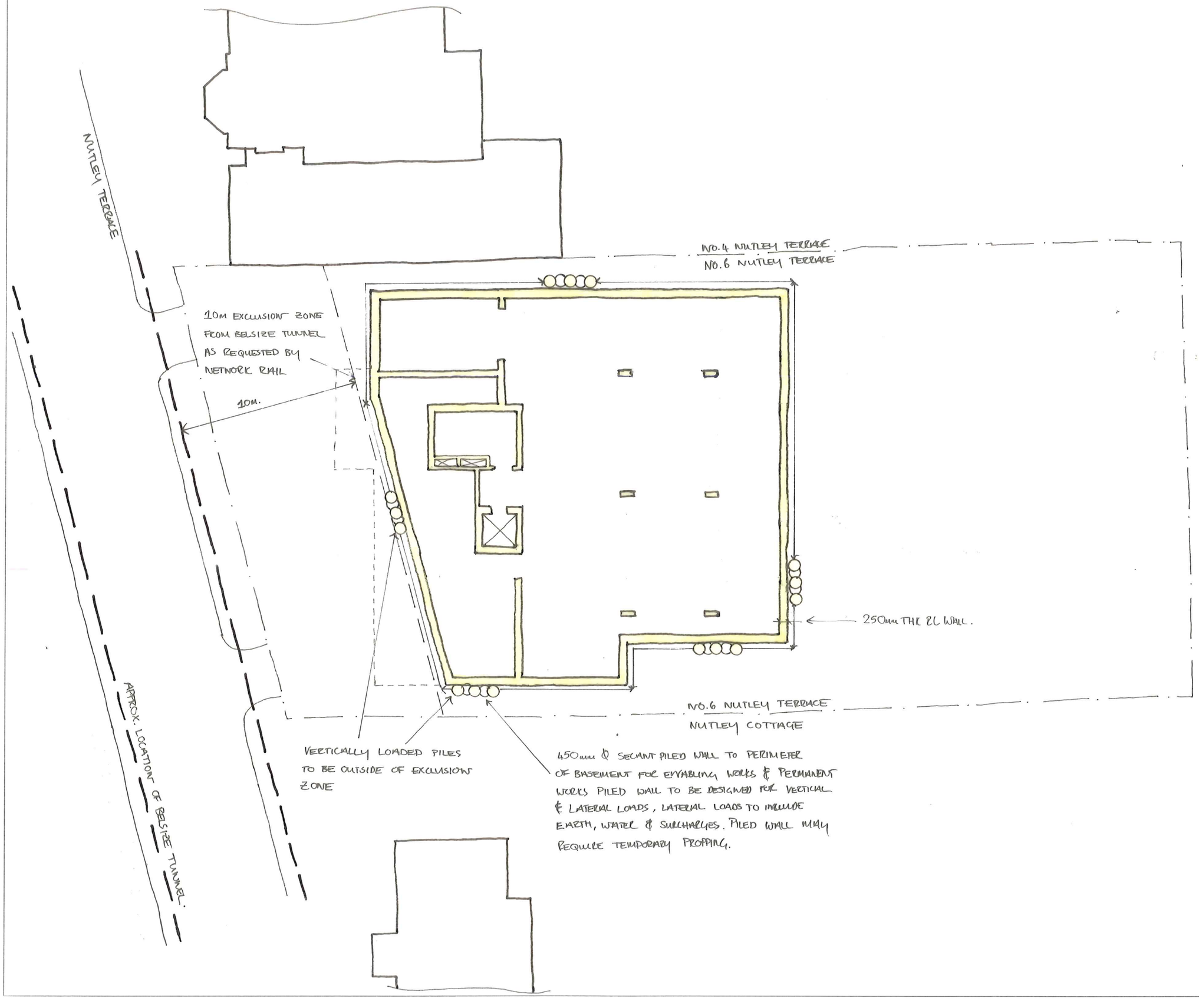
drawing status

PRELIMINARY

job no	drawing no	revision
2140657	S.03	P2



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job title

NO. 6 NUTLEY TERRACE LONDON NW3 5BX

drawing title

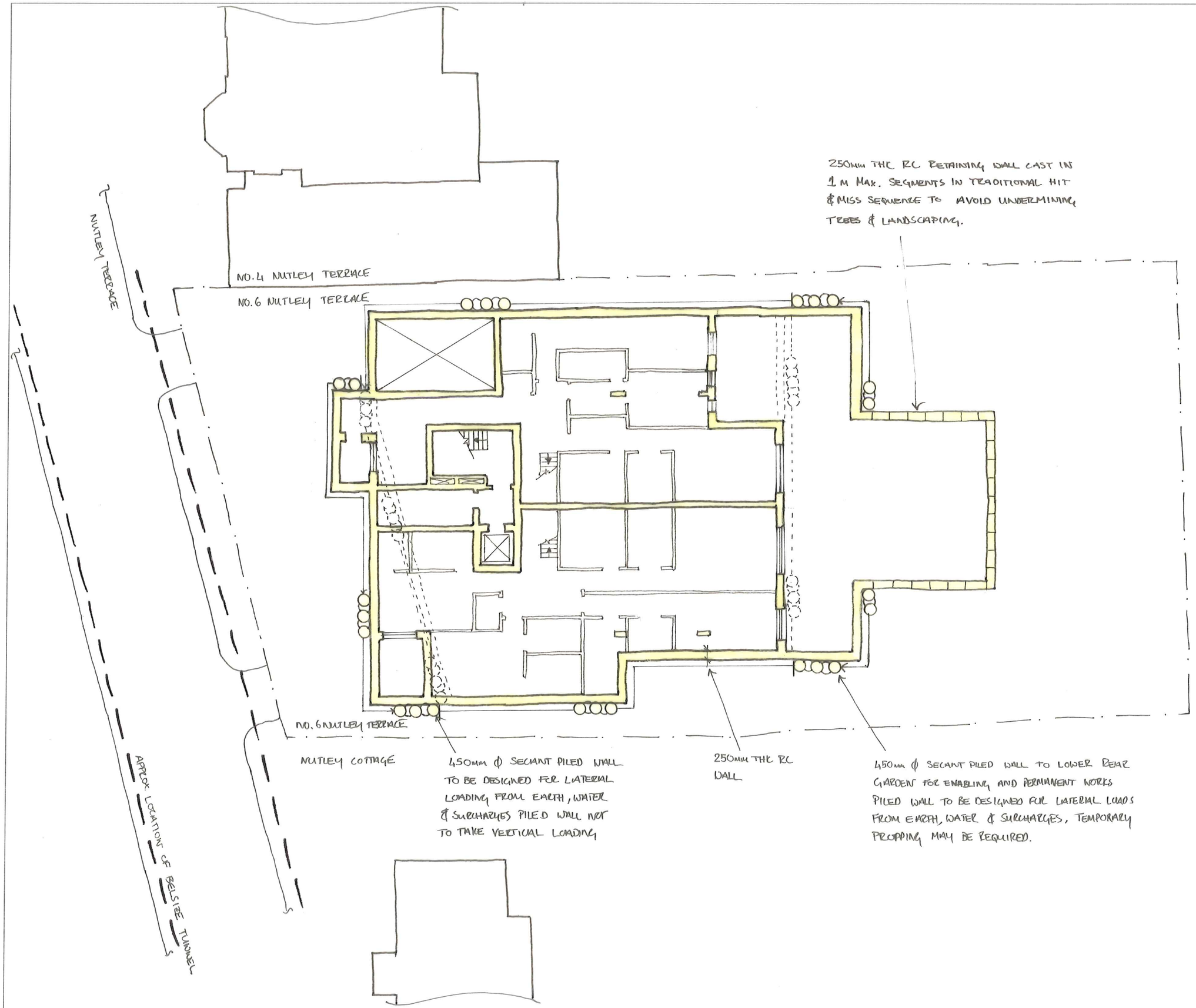
BASEMENT PLAN WITH BELSIZE TUNNEL

scale(s)	date	drawn
1:200@A3	DEC'14	SSt

drawing status

PRELIMINARY

job no	drawing no	revision
2140657	S.10	P2



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job title

NO.6 NUTLEY TERRACE LONDON NW3 5BX

drawing title

HIGHER BASEMENT LEVEL SITE PLAN.

scale(s)	date	drawn
1:200@A3	DEC'14	SSt

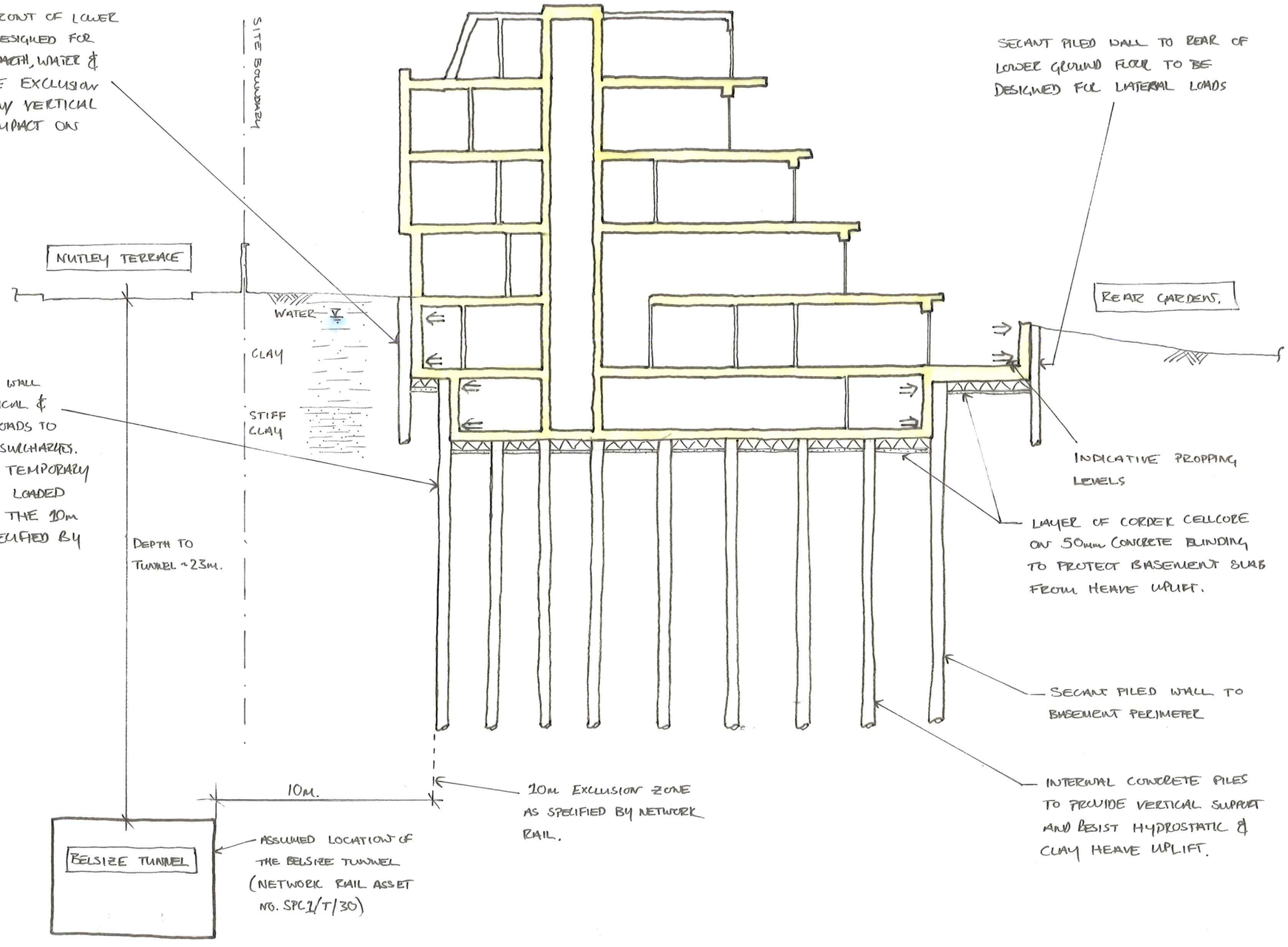
drawing status

PRELIMINARY

job no	drawing no	revision
2140657	S.11	P2

CONCRETE PILES TO FRONT OF LOWER GROUND FLOOR TO BE DESIGNED FOR LATERAL LOADS FROM EARTH, WATER & SURCHARGE. PILES INSIDE EXCLUSION ZONE NOT TO TAKE ANY VERTICAL LOADING TO MINIMISE IMPACT ON TUNNEL BELOW.

450mm Ø SECANT PILED WALL TO BE DESIGNED FOR VERTICAL & LATERAL LOADS. LATERAL LOADS TO INCLUDE EARTH, WATER & SURCHARGES. PILED WALL MAY REQUIRE TEMPORARY PROPPING. ALL VERTICALLY LOADED PILES TO BE OUTSIDE OF THE 10m EXCLUSION ZONE, AS SPECIFIED BY NETWORK RAIL.



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job title

NO.6 NUTLEY TERRACE LONDON NW3 5BX

drawing title

LONG SECTION INCL. BELSIZE TUNNEL (SECTION A-A)

scale(s)	date	drawn
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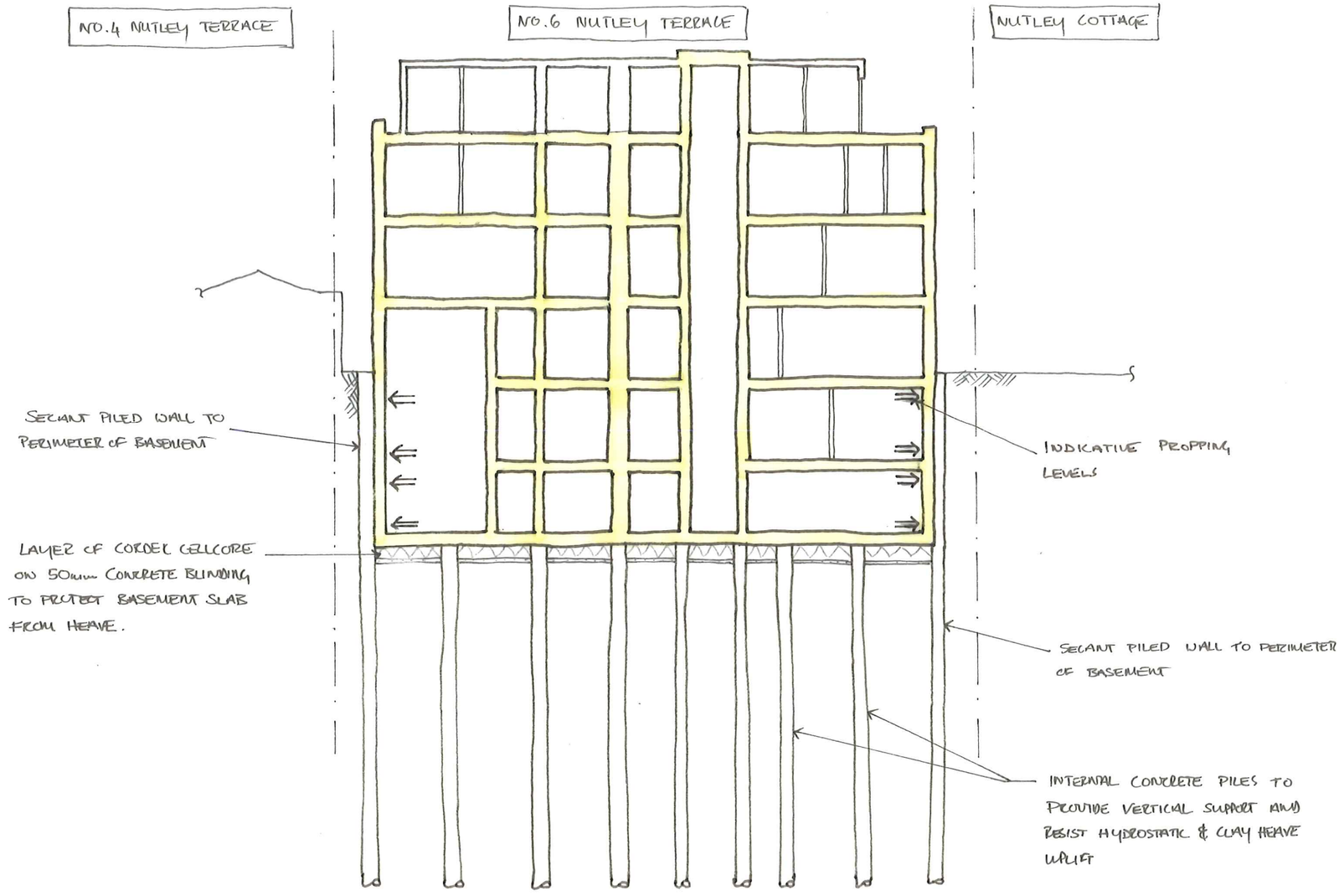
drawing status

PRELIMINARY

job no	drawing no	revision
2140657	S.20	P2



This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.

Do not scale from this drawing.

rev	date	by	chk	description

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job title

NO.6 NUTLEY TERRACE, LONDON, NW3 5BX

drawing title

SHORT SECTION (SECTION B-B)

scale(s)	date	drawn
1:200@A3	DEC'14	SSt

drawing status

PRELIMINARY

job no	drawing no	revision
2140657	S.21	P1