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Ilyas Amlani

6A GRANGE ROAD, LONDON

Basement Impact Assessment

Revision K

Volume 2 of 3

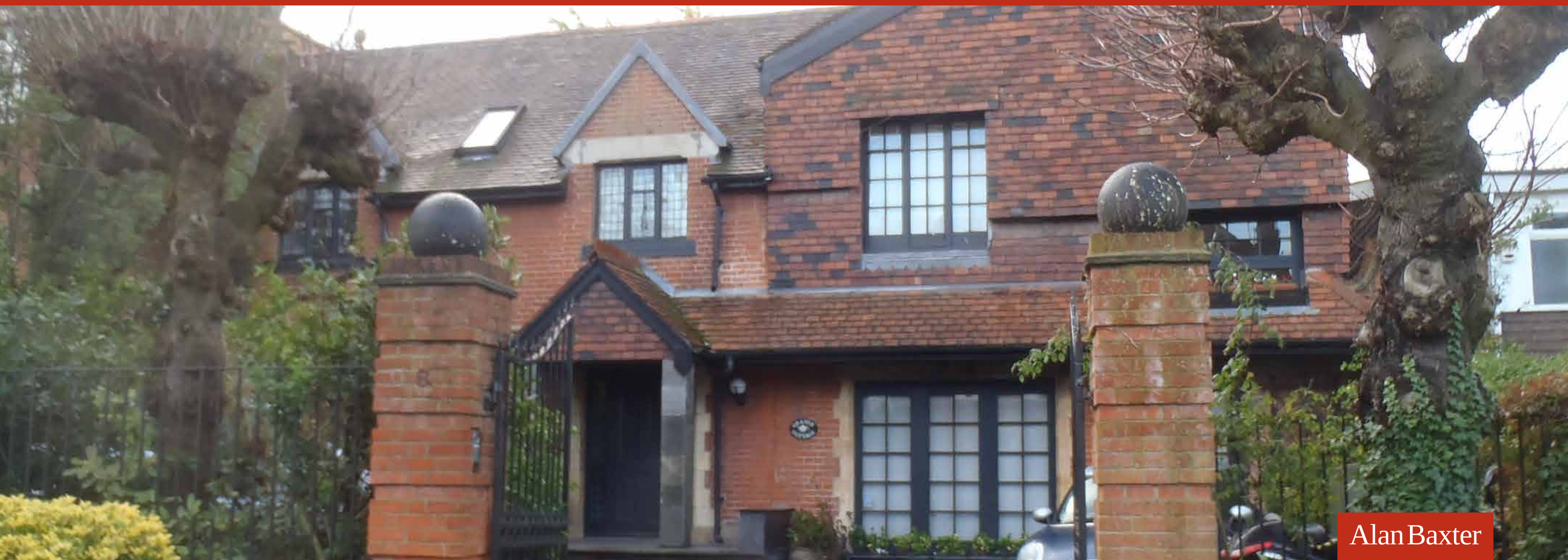
Independent, multidisciplinary engineering
and environmental consultants

APPENDICES

APPENDIX F

No.8 Grange Road BIA

No.8 Grange Road, Highgate, N6 4AP
Structural and Civil Engineering Notes and
Basement Impact Assessment
to Support the Planning Application
Prepared for Mr & Mrs Simon Purves
November 2014



No.8 Grange Road, Highgate, N6 4AP

Structural and Civil Engineering Notes and Basement Impact Assessment to Support the Planning Application

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1.0 Introduction

Alan Baxter & Associates LLP have been appointed as Civil and Structural Engineers to the client to provide design services in relation to the proposed redevelopment of No.8 Grange Road, London N6 4AP, in the London Borough of Haringey. The Client has also appointed HUT Architecture as their Architect and Lead Consultant and Planning Potential as their planning consultant.

1.1 Summary of the proposed redevelopment

The proposed redevelopment comprises the demolition of a single storey rear extension and utility room and the construction of a new basement under the existing footprint of the house and part of the front and rear paved areas. Some alterations to the internal layout at ground and first floor are also proposed.

1.2 Scope and limitations of this report

This report has been prepared by Alan Baxter & Associates (ABA) in support of the Planning Application in order to summarise the engineering issues associated with the construction of the proposed basement and assess the impact of the basement to the local hydrology and adjoining structures. The report includes a formal Basement Impact Assessment as requested by Haringey Council.

This report has been prepared solely for the purpose of supporting the planning application. The civil and structural engineering design of the proposals will have to be further developed before the project proceeds towards construction.

2.0 Context

2.1 The Site

Grange Road is located to the North West of Highgate, North London, running parallel to North Hill between Broadlands Road and View Road. The surrounding area generally slopes down from the South East towards Highgate Golf Club to the North-West. The average slope is in the region of 2-3° (i.e. 3.5% to 5%).

The site is positioned towards the lower end of Grange Road. It is roughly rectangular in shape with an area of approximately 750 m². It is approximately 62m long with a width narrowing from 17m at the front to 8m at the back. The front part of the site is occupied by a two storey house set back 9m from the boundary. The front driveway is generally tarmacked with some small trees and shrubs at the entrance. The long and narrow rear garden is generally covered in grass apart a large paved patio adjacent to the rear extension of the building. Levels gently decrease along the site from approximately 13.0m AOD at the front to approximately 12.5 AOD at the rear. The very end of the rear garden is slightly sunken to a level of approximately 12.0m AOD.

The house is built across the whole width of the site and shares party walls with No.6a to the North West and No.10 to the South East. It generally comprises two storeys, with an additional mezzanine level adjacent to No. 6a. The building does not have a basement level.

The original building has been refurbished and extended a number of times over its lifetime, with significant extension works carried out in the second half of the 1980s. Generally the building appears to be in reasonable structural condition for its age and type, particularly considering the alterations to the original structure.

2.2 Site History

Grange Road was originally formed to provide access to a large house, known as The Grange (see drawing 1675/100/001). The house was built adjacent to the site of No. 10 in the late 19th Century. The estate contained a number of outbuildings (now No.8 and No.10) and it is understood that the older section of No. 8 was originally the gardener's cottage.

The surrounding area was extensively developed for residential use from the start of the 20th century, with the majority of the buildings on Grange Road originally constructed before the 1970's. Following the Second World War, The Grange was divided into smaller properties (No.12, No.14 and No.16). The property at No.6a Grange Road was subsequently built and extended at first floor level, so that it shares a party wall with the side extension of No. 8.

The history of the site, along with the demand for more recent development works, has resulted in a range of age and style of properties along the current streetscape. A number of buildings along Grange Road have recently been rebuilt with basement levels (see drawing 1675/100/04).

2.3 Site geology

The geology of the area consists of Claygate Beds overlying the London Clay. Generally there are also layers of head deposits and made ground at the surface due to natural transportation of material and general development/reworking respectively. Further up the hill, Bagshot Sands generally overlie the Claygate Beds (see drawing 1675/100/002).

Information gathered from site investigation carried out for some of the surrounding developments have confirmed these strata. The Claygate Beds are typically identified as finely interbedded sequences of orange-brown clay, silt and fine grained sands. The Claygate Beds are very variable but the sand lenses contain ground water which can flow where there is continuity of the permeable layers.

Information on the BGS borehole logs available in the area have also been reviewed and are summarised on drawing 1675/100/003. This shows the geological profiles roughly following the topography, with the Claygate Beds thinning as the ground levels decrease to the North. The Bagshot Sand formation is generally found at higher elevations (to the South) and not present near the site.

As part of the site investigation carried out on site in May 2013 (see section 3.3), two boreholes, respectively 12.0 and 13.0m deep, have been drilled in the front and rear garden of the property. These have confirmed the presence of Claygate Beds underlying a layer of made ground. Drawing 1675/100/05 summarises our understanding of the geology around the site.

2.4 Site Hydrology

The presence of the Claygate Beds is potentially significant with regards to groundwater flows, as they can have a relatively high permeability, whereas the underlying London Clay is generally considered as impermeable. The available borehole records nearest the site all show groundwater present within the Claygate Beds, with the groundwater levels generally following the ground profile (see drawing 1675/100/003). The level of groundwater monitored on site between May 2013 and May 2014 appears to be consistent with the hydrology of the area (see drawing 1675/100/008).

This would suggest that there is groundwater flow within the Claygate Beds, running in the general direction towards the lower site topography (North West). This is to be expected and it is consistent with hydrology reports available for surrounding developments. However, it should be noted that groundwater flows in the Claygate Beds are very unpredictable due to the various inter-bedded layers of clays, silts and sands.

It is likely that the groundwater flow identified above forms part of the supply to a historic tributary of the River Brent, which runs to the far North of the site. Documents available in relation to adjacent planning applications show a surface stream that was previously located to the South West of The Grange.

There is some evidence that the local groundwater regime and groundwater flows are significant and can be impacted on by the construction of a basement.

2.5 Existing Structure

Our current understanding of the existing structure of the building is summarised on drawing 1675/100/011. This is based on a number of trial pits excavated on site during the site investigation and observations made on site.

The structure of the building generally comprises loadbearing masonry walls and timber floors, with a double pitched roof and dormers at first floor.

The original building has been refurbished over its lifetime, with significant extension works carried out in the second half of the 1980s. It appears that, as part of this, some of the loadbearing walls at ground floor were removed and replaced with steel beams and columns.

2.6 Existing Utilities

An initial 'in-house' search carried out suggests that the site has the usual array of utilities serving individual properties on Grange Road. The site itself appears to be clear of major services and tunnelled obstructions in the ground.

Surface water runoff and foul water are discharged separately via private drains under the front garden into a public combined sewer under Grange Road.

2.7 Existing Trees

There are no major trees on site. There are a number of small trees in planters at the front of the site and in the rear garden. A larger tree is present on No.10 Grange Road along the boundary with the site, approximately 9.0 away from the frontage of the building. For further details refer to the arboricultural report submitted as part of the planning application.

3.0 Surveys and Investigations

3.1 Measured Surveys

A measured survey of the site and the existing building was carried out by Arena Property Services in November 2013.

3.2 Boreholes and soil investigation

Two boreholes, respectively 12.0m and 13.0m, were carried out by Harrison Group in May 2013. In-situ samples were taken for geotechnical and chemical testing. Harrison's factual report on the ground condition at No.8 Grange road is given as Appendix C to this report.

3.3 Trial Pits

As part of the site investigation carried out in May 2013, 4 trial pits have also been excavated to expose the foundations to the original building and to the 1980's extension. These were recorded by Harrison Group and included in their site investigation report.

3.4 Groundwater level monitoring

Levels of groundwater on site were monitored by Harrison at the location of the two boreholes from May 2013 to May 2014. The results, given as Appendix C to this report, have been summarised on drawing 1675/100/008 and appear to be consistent with the hydrology of the area and with the expected seasonal variation in rainfall pattern.

The level of groundwater generally decreased from May 2013 to October 2013 to an average minimum of 109.00m AOD. Groundwater rose in winter reaching an average peak of 109.6m AOD in February 2014. It then decreased again from March 2014 to May 2014 to a similar level as the previous year.

4.0 Basement Impact Assessment

A Basement Impact Assessment (BIA) for the proposed development of the site has been carried out and structured in accordance with section 9.3 of the Haringey's Basement Development Guidance Note- June 2012 to cover the following stages:

Stage 1: Screening

Stage 2: Scoping

Stage 3: Site investigation and study

Stage 4: Impact assessment

Stage 5: Review and decision making

4.1 Screening

The purpose of the screening process is to identify the matters of concern related to the geology and hydrology of the area, neighbouring properties and other risks which the proposed development may have an impact on and which therefore require a more detailed assessment to be undertaken.

4.1.1 Groundwater flow

A new basement at No.8 Grange Road is likely to require excavations to a similar depth of the groundwater measured on site. The piled wall required for the construction of the basement is also likely to extend below the groundwater level.

The study of the geology and hydrology of the site summarised in section 2.3 and 2.4 of this report indicates that groundwater is likely to flow down the hill, within the Claygate Beds. Nearby developments show that the local groundwater regime and groundwater flows are significant and, if altered, have the potential to affect surrounding properties. A more detailed assessment of the potential impact of the proposed development on the natural flow of ground water has therefore been undertaken (see sections 4.2.1 and 4.4.1).

4.1.2 Land stability

The overall site slope is of 2-3° (i.e. 3.5% to 5%) which is considered to be stable. No large trees are to be felled and the new basement will be outside the root penetration zone of any significant tree.

The proposed basement is also set back more than 5m from the front boundary. The new basement will not cause any overall land stability issue.

4.1.3 Surface flow and flooding

The Environmental Agency Flood Risk Map for sea and rivers shows the site is located in an area not at risk of flooding from sea and rivers. The Flooding from surface water map classifies the site as to be at very low/low risk of flooding from surface water. (Refer to Appendix 4: Map 3.1 Indicative Flood Zones of the Haringey's Basement Development Guidance Note- June 2012).

In the proposed scheme, the new basement at the front will be under an area of the driveway which is currently tarmacked. At the rear, the basement will be mainly under the existing patio area, which is already paved. Therefore, the increase in surface water runoff from the impermeable areas of the proposed development will be negligible.

No further assessment of the potential impact of the proposed scheme is deemed to be required.

4.1.4 Cumulative Development

A number of properties along Grange Road have recently been rebuilt with the addition of new basements (see drawing 1675/100/004). In some cases, these may have caused obstruction to the natural flow of groundwater resulting in the level of water to rise locally.

No.10 Grange Road on the S-E side has been recently redeveloped including a shallow lower ground floor. No.6a Grange Road on the N-W side does not currently have a basement. However, planning permission has been granted for its demolition and reconstruction with the addition of a basement. A further assessment of the impact of the cumulative development of No8 and No6a Grange Road on the local hydrology has therefore been undertaken (see sections 4.2.2 and 4.4.1).

4.1.5 Construction Management Plan

There is a good road access to the site, with a wide frontage to the road. There is also enough space on site for the storage of materials. A detailed construction management plan will be prepared and agreed with Haringey Council prior to any works commencing on site. No further assessment is required at this stage.

4.2 Scoping

The purpose of the scoping stage is to identify the potential impact of the proposed development for the following matters of concern identified in the screening stage:

- Hydrology and groundwater level
- Cumulative development

4.2.1 Potential Impact of the proposals on the hydrology:

In order to identify the potential impact of the proposed development on the local hydrology and groundwater level, a conceptual ground model of the area has been prepared, as described in section 2.3 and section 2.4 of this report. Groundwater flows can be significant and, if altered, they have the potential to affect surrounding properties.

The new basement at No.8 Grange Road is likely to require excavations to a depth very close to and in some areas possibly slightly below the groundwater level measured on site. The piled wall required to support the excavation during the construction of the basement is also likely to extend below the groundwater level.

As the new basement can potentially alter the existing groundwater flows, an assessment of the impact of the proposals on the local hydrology has been undertaken (see section 4.4.1).

4.2.2 Potential Impact of the Cumulative Development on the hydrology:

It is recognised that Cumulative Development can be a matter of concern in relation to the effects on the local hydrology. An assessment of its impact of the local hydrology has therefore been undertaken in section 4.4.2.

4.3 Site investigation and study

In order to develop a specific understanding of the site and its immediate surroundings, an initial desk top study has been undertaken, which has included a review of planning applications for basements in the surrounding area.

A site walkover was also carried out in December 2012 to look at the property at No.8 Grange Road. No access was made available to No.6a Grange Road at the time of the visit and the boundary with No.8 Grange Road was only viewed externally.

A site investigation at No.8 Grange Road was commissioned by Alan Baxter & Associates and carried out by Harrison Geotechnical Engineering in May 2013. This comprised the excavation of two boreholes and 4 trial pits as described in section 3.2 and 3.3. Harrison’s factual report on the ground condition at No.8 Grange road is given as Appendix C to this report.

Monitoring of groundwater level was carried out at the two boreholes from May 2013 to May 2014. The results, summarised on drawing 1675/100/004, appear to be consistent with the hydrology of the area and with the expected seasonal variation. See section 3.4 for further details.

4.4 Impact Assessment

The effects of the proposed development on those features of the geological and hydrological environment identified in the scoping stage as being potentially affected are described in this section.

4.4.1 Impact of the Proposals on the local Hydrology

The design of the proposed basement has been informed by the intent of maintaining the natural flow of ground water so as to mitigate the impact of the proposed structure on the local hydrology and surrounding buildings, in according with good practice.

The following levels have been used for setting out the structure at basement:

Underside of basement slab	=	109.30m AOD
Pads foundations	=	109.00m AOD.
Underside of the pool structure	=	108.00m AOD

Based on the monitoring carried out to date, the basement slab will generally be above the groundwater level and just below it during winter.

The basement will therefore be generally above the existing groundwater level and should not obstruct the natural flow of groundwater. The pad foundations will be just below the groundwater table, generally approximately 200mm. However, their number and size is limited, and will therefore have minimal impact on the flow of the groundwater. As the pool will be below the groundwater level, its area, depth and orientation has been considered in order to mitigate the local damming effect this may have on the natural flow of groundwater.

Consideration has also been given to the presence of the secant piled wall and its impact on the local hydrology. The secant piled wall is needed as temporary works to enable the basement box to be built in the dry. The proposed basement will not cover the entire width available between the piles and a gap will be left between the piled wall and the reinforced concrete walls of the basement. The purpose of this gap is to allow a section of each of the ‘soft’ piles to be removed, once the structure is completed, so that groundwater can flow through the gaps in the piled wall around and beneath the basement.

A drainage layer will be provided around and under the pool to maintain a drainage path. As an additional measure, it is also proposed to provide a drainage system with perforated pipes set at the existing

ground water level. In the event that the ground water level increases, this drainage system will divert water around the new basement so that there is no damming effect. Access manholes will be provided in order to maintain the system.

4.4.2 Impact of Cumulative Development on the local Hydrology

The impact of Cumulative Development on the local hydrology has also been assessed.

The construction of the basement structure and the secant piled wall will not obstruct the natural flow of groundwater in the permanent condition, as explained in section 4.4.1.

Therefore there will not be a direct impact of Cumulative Development on the local Hydrology from the construction of the basement at No.8 Grange Road.

Basement Impact Assessments will have to be prepared for adjacent developments, such as the one at No.6a Grange Road, in order to address the impact their proposals may have on the local hydrology.

5.0 Structural Engineering Proposals

5.1 Summary of the proposed alterations

The proposed redevelopment of No.8 Grange Road comprises:

- Demolition and reconstruction of the single storey rear extension.
- A new single storey basement below the existing building. This will cover the main footprint of the building and will extend under part of the front and rear paved area.
- A new slab at Ground Floor with new staircases to access the basement and first floor.
- Some minor alterations to the ground and first floor to suit the proposed layout.

For further information on the proposed structure see drawings in Appendix B.

5.2 Design overview of the Basement

The Basement Impact Assessment (BIA) carried out for the proposed development (see section 4.0) has identified the following key items to be considered when determining the approach to the design of the basement:

- The structure of the existing building and the extent and nature of the proposed alterations.
- The effect on adjacent and adjoining properties
- The ground conditions
- The ground water levels

The basement slab, ground floor slab and walls will be built in insitu reinforced concrete. From the information provided by the Architect, it is envisaged that a combination of external waterproofing membrane and internal cavity drain system will be used for the tanking of the structures below ground.

In the temporary case, it is envisaged that the front elevation and the internal walls will be supported by a grillage of steel needles and columns spanning between temporary piles.

Underpinning of the boundary walls with the adjoining properties will be required in order to allow the excavation for the new basement under the existing building. Due to the depth of the proposed basement, the underpinning will probably need to be cast in two lifts. It is possible that the excavation for the second lift of underpinning will be just below the perched water table. It is therefore envisaged that the Contractor will use a dewatering system or permeation grouting to help control the flow of ground water into the excavations.

A piled wall will be built to the front and rear of the building to support the excavation in these areas. Because of the presence of ground water, it is likely that secant piles will be used in order to control the flow of water into the excavation during construction. Additional dewatering may be required to control the flow of water from the bottom of the excavation during construction.

In order to address the issue of the stability of the surrounding ground, horizontal temporary propping will be provided to the underpins and the secant piled wall at various levels to resist the lateral loads from the surrounding ground in advance of the construction of the permanent structure.

Within the perimeter of the underpinning and secant piled walls, a ground bearing RC slab and RC retaining walls will be constructed, along with an RC slab at lower ground. The permanent reinforced concrete structure will be designed to provide lateral restraint and resist hydrostatic pressure assuming ground water level of 1m below existing lower ground level, in line with current good practice. The structure will also be designed to support the vertical loads from the superstructure.

The foundations will be designed to limit the bearing pressure and deflections to within safe limits based on the result of the SI report.

5.3 Construction Methodology and Sequence of Construction of the proposed basement

The sequence of construction assumed when formulating the structural design is a typical method of forming a basement such as this under a building of this nature.

However, there are some complexities due to the basement construction extending below the perched water table. Therefore, the engineering design must be developed with a thorough and detailed understanding, following the principles set out in this report and the construction carried out by a skilled contractor, experienced in such works.

A summary of the sequence of construction for the basement is broadly described below (see drawings 1675/100/50-52).

Stage A:

- Demolish the rear extension area of property, including removal of the foundations.
- Construct a Pynford beam under the front façade's masonry wall.

Stage B:

Construct a secant piled wall from ground level around the front and rear perimeter of the basement.

- Install temporary piles for supporting temporary steel frames.
- Locally, cut pocket through the brick walls and install needles at ground floor level to form a steel grillage supporting the masonry walls.
- Install steel grillage to support beams and joists at 1st floor level.
- Once all the structures to be retained are temporarily supported on the steel frames, remove the remaining walls and floors no longer required.

6.0 Conclusion

Stage C:

- Carry out the first lift of underpinning to the boundary walls.
- Construct the infill wall between underpins and secant piled wall.
- Complete the demolition of the ground slab and gradually reduce the levels across the footprint of the proposed basement.
- Install the horizontal temporary props to the underpinning and secant piled wall.
- Complete excavation, installing horizontal props as the excavation progresses.
- Carry out the second stage of underpinning, using a dewatering system as required.
- Excavate to the base of the second lift of underpinning, reviewing the dewatering strategy as the works progress.
- Provide temporary propping to the underpinning and secant piled wall.
- Cast blinding to the base of the excavation.

Stage D:

- Install the underground drainage and cast the new RC sumps.
- Install perforated pipe in trench and construct access manholes.
- Construct the new RC ground bearing basement slab and the RC retaining walls.
- A trench will be left between the secant piled wall and the new RC basement wall. The dewatering must therefore continue until the construction of the lower ground floor slab is complete.
- Install the external tanking of the basement.

Stage E:

- Break out sections of the 'soft' piles of the contiguous piled wall to allow the ground water to re-flow around and under the new basement.
- Backfill the trenches between the secant piled wall and the basement RC walls

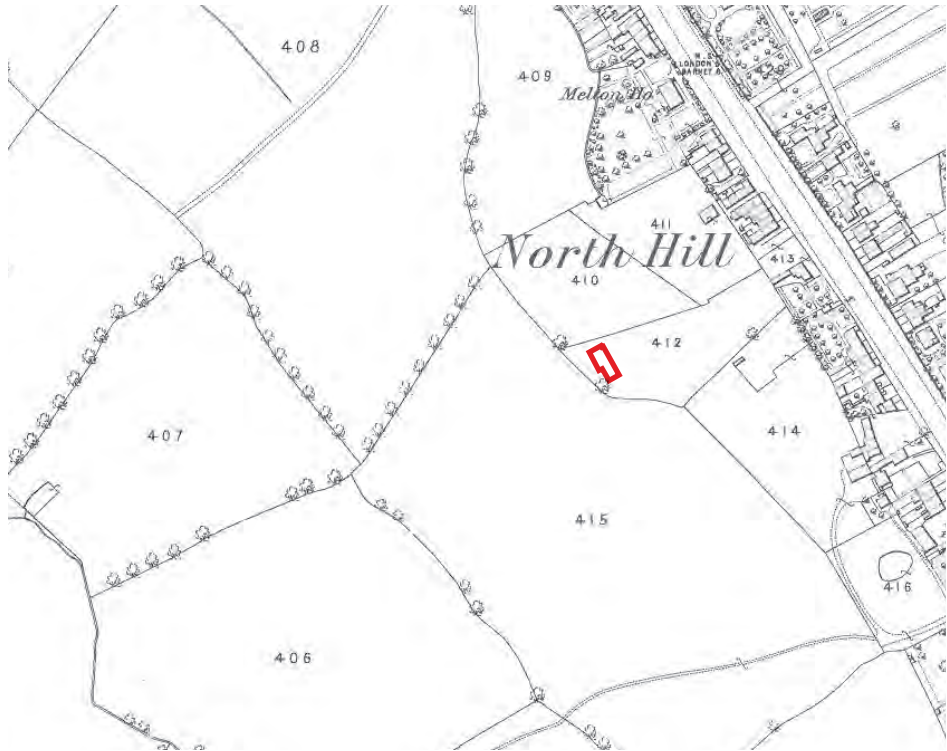
Stage F:

- Construct new structures above ground.
- Remove temporary steel frames and piles once the permanent structure is in place, making good basement and ground floor slabs and brick walls.

The engineering and construction issues associated with forming a basement below No.8 Grange Road have been explored and summarised in this report. A structural scheme has been prepared by Alan Baxter & Associates along with a construction methodology and a basement impact assessment in order to demonstrate that the proposals can be built safely by a contractor with the right skill and care without significant detrimental effect on the adjacent properties and the local hydrology.

Appendix A

Geology and Hydrology Drawings



1869
The site sits within the vicinity of North Hill, located West of North Road which is already relatively established with small-medium scale residential developments. Generally larger houses are situated away from North Hill and Archway Road, within the fields that make up the majority of the surrounding area. The site is undeveloped.



1894
There has been some medium density development to the area around the site, including the formation of Grange Road. A notable house, The Grange, has been constructed to the West of the road, reportedly under the direction of architect John Groom. The original section of 8 Grange Road is understood to have comprised the gardeners cottage of this estate.



1913
Widespread development of the surrounding area has taken place, notably the formation of Derewood Road and View Road to the West and North of the site respectively. The Grange appears to remain in place as a single property although it is likely that remodelling works were carried out with the development of other houses along Grange Road.



2010
The Grange is no longer a single property and appears to have been divided into separate residences between No. 8 to No. 16. No. 8 has been extended to the North and West and now shares a party wall with No. 6a. Extensive refurbishment works are also taking place at No. 10, including front and rear extensions. A number of buildings along Grange Road are understood to have basement levels.

- Notes**
1. This drawing is to be read in conjunction with all other relevant architects and engineers drawings
 2. This drawing shows extracts from historical maps from the dates shown
 3. **Key**
 Site

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8 GRANGE ROAD, HIGHGATE	
SUMMARY OF HISTORICAL DEVELOPMENT IN THE AREA	
1675/100/001	
NOVEMBER 2014	Alan Baxter



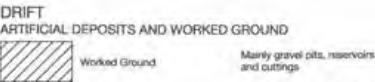
Notes

1. This drawing is to be read in conjunction with all other relevant architects and engineers drawings
2. The information on this drawing is taken from the 1890 British Geological Survey map TQ28NE. Reproduced by permission of the British Geological Survey.

3. Key



Site



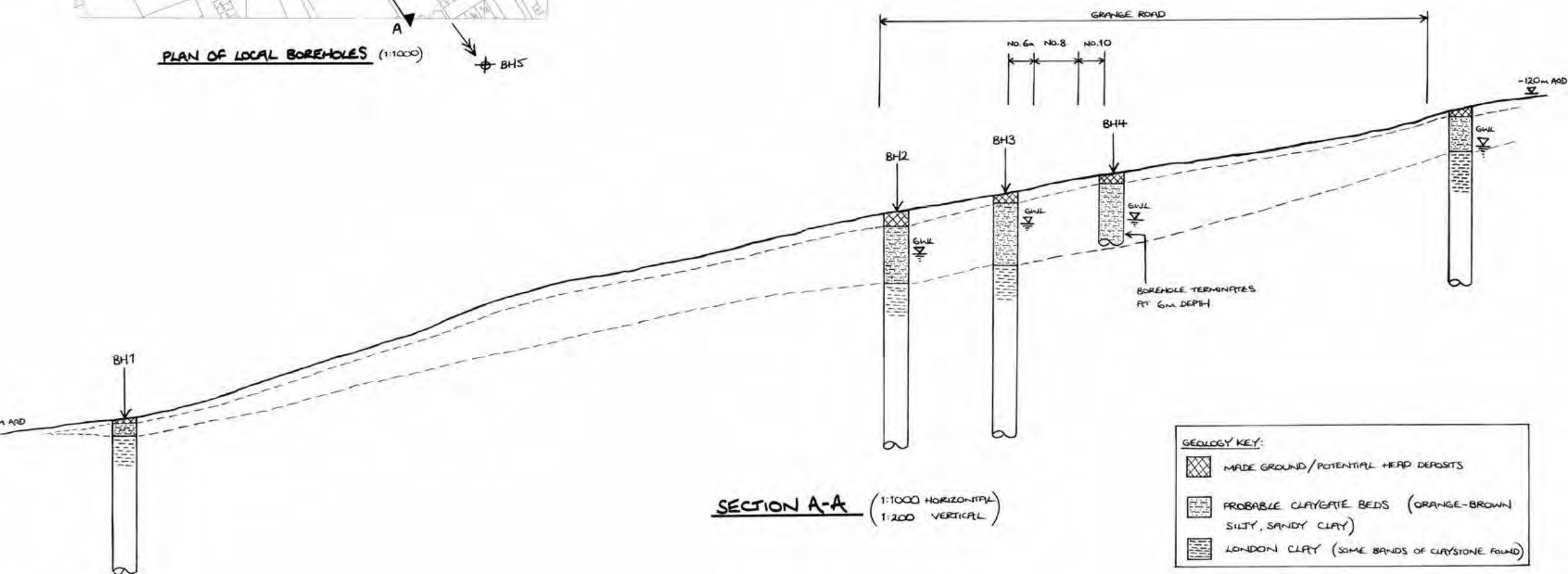
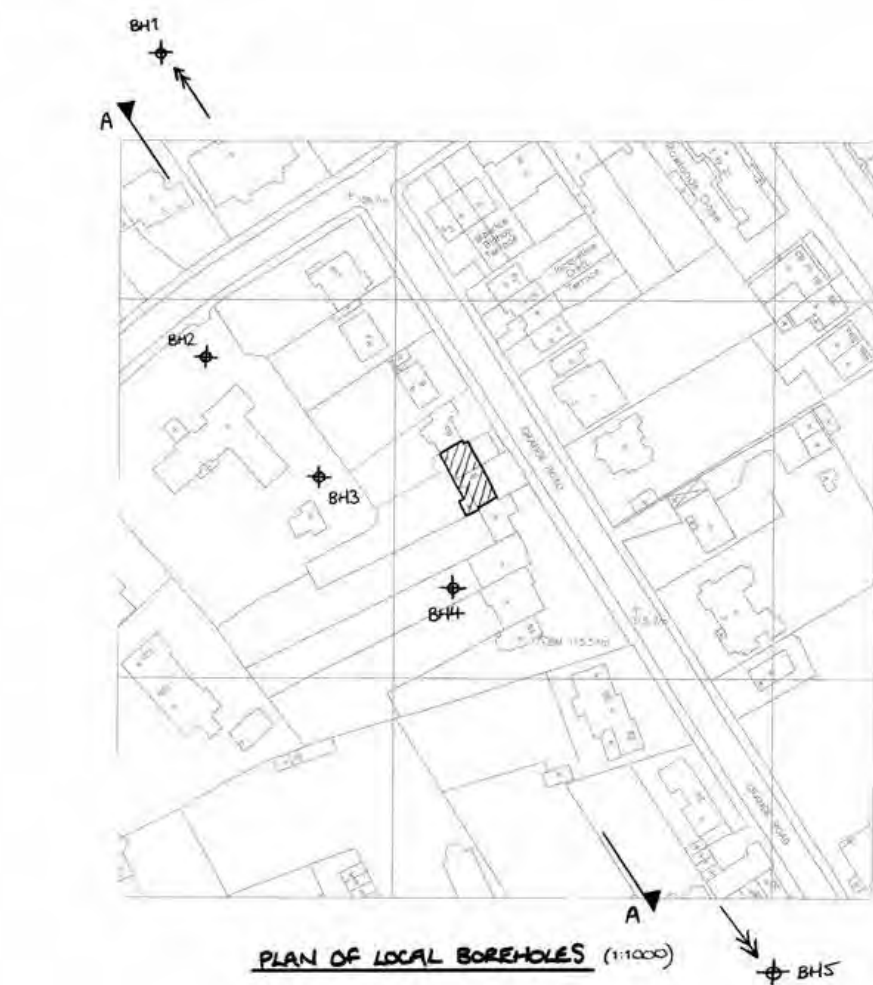
8 GRANGE ROAD, HIGHGATE

LOCAL GEOLOGY AND GROUND CONDITIONS

1675/100/002

NOVEMBER 2014

Alan Baxter



Notes

1. This drawing is to be read in conjunction with all other relevant architect's and engineer's drawings

2. The information indicated on this drawing is based on the following sources:

BH1 - BGS Borehole log TQ28NE426

BH2 - Site Analytical Services

BH3 - LTD report for 10 View Road dated August 2006

BH4 - Soils Ltd report for 10 Grange Road dated February 2008

BH5 - GEA Ltd report for 21 Broadlands Road dated March 2012

3. Where unknown, levels of boreholes have been estimated based on local topography/adjacent spot levels. Plan locations of boreholes have been translated to section line

8 GRANGE ROAD, HIGHGATE

LOCAL AREA BOREHOLE
SUMMARY

1675/100/003

NOVEMBER 2014

Alan Baxter



Notes

1. This drawing is to be read in conjunction with all other relevant architect's and engineer's drawings
2. Building profiles and contours indicated are indicative only for information purposes. Do not scale from this drawing

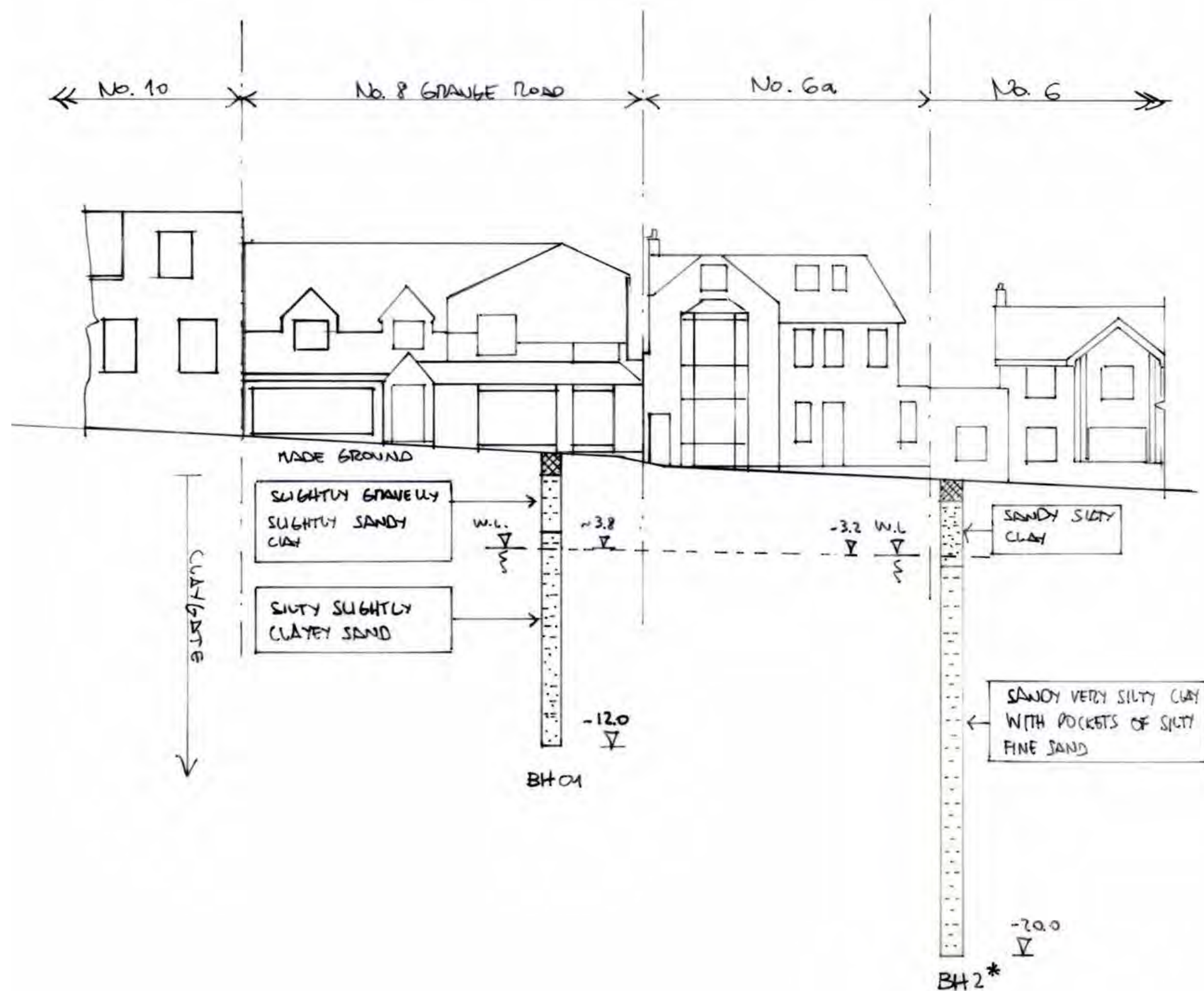
8 GRANGE ROAD, HIGHGATE

LOCAL AREA PLAN
SHOWING UNDERSTANDING
OF PROPOSED/RECENT
DEVELOPMENTS

1675/100/004

NOVEMBER 2014

Alan Baxter



Notes

1. Borehole BH01 log from Harrison Group's report for No. 8 Grange Road of June '13
2. Borehole BH2* log from Site Analytical Services' report for 10 View Road of August 2006.

8 GRANGE ROAD, HIGHGATE

SUMMARY OF GEOLOGY
AROUND NO. 8 GRANGE ROAD

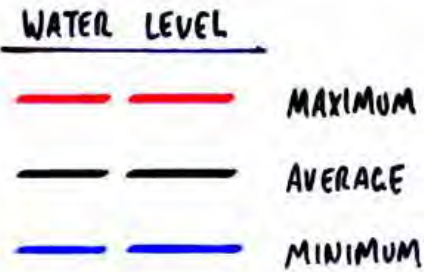
1675/100/005

NOVEMBER 2014

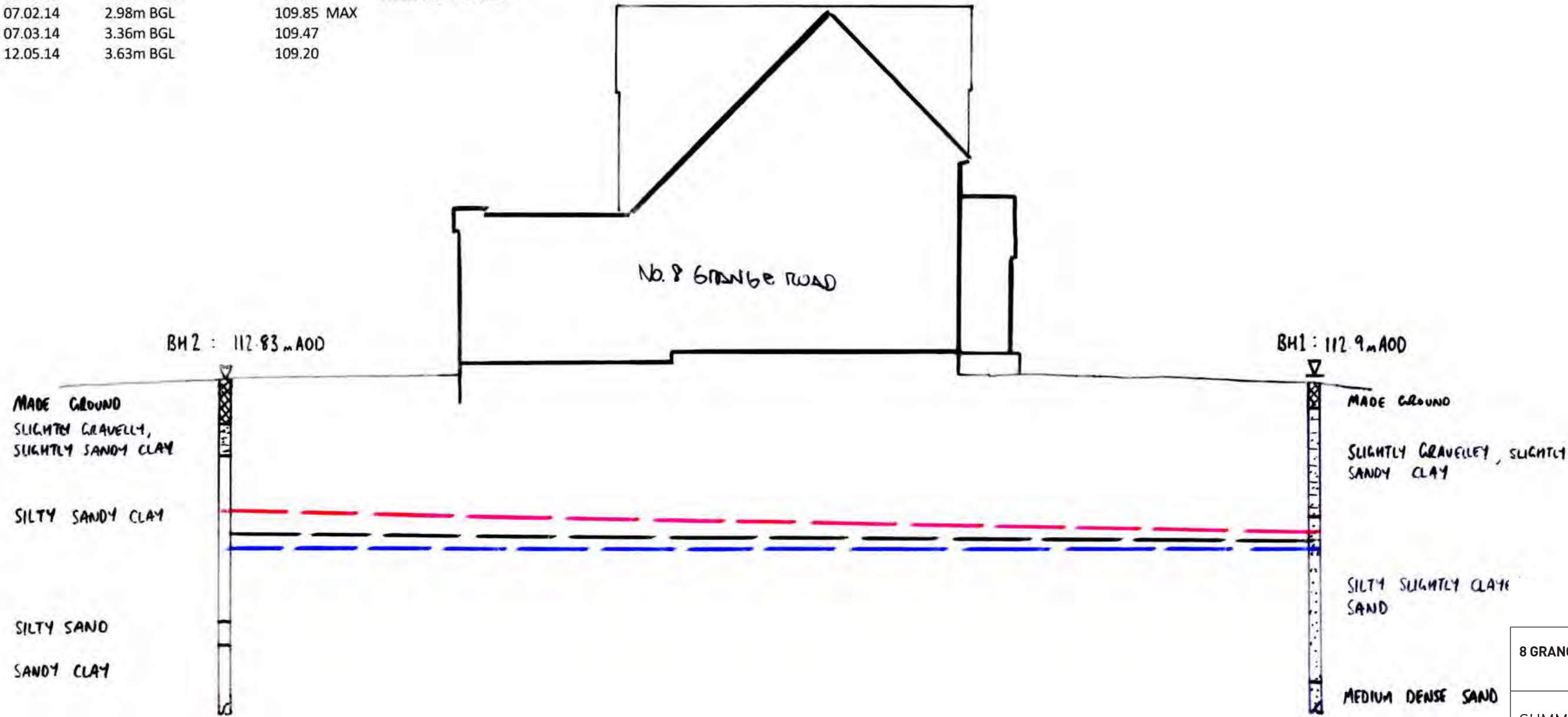
Alan Baxter

BH1 (+112.90m AOD)		
09.05.13	3.81m BGL	109.09
16.05.13	3.80m BGL	109.10
23.05.13	3.84m BGL	109.06
11.10.13	3.91m BGL	108.99 MIN
06.12.13	3.83m BGL	109.07
07.02.14	3.54m BGL	109.36 MAX
07.03.14	3.65m BGL	109.25
12.05.14	3.79m BGL	109.11
		AVERAGE = 109.13

BH2 (+112.83m AOD)		
09.05.13	3.62m BGL	109.21
16.05.13	3.61m BGL	109.22
23.05.13	3.64m BGL	109.19
11.10.13	3.83m BGL	109.00 MIN
06.12.13	3.66m BGL	109.17
07.02.14	2.98m BGL	109.85 MAX
07.03.14	3.36m BGL	109.47
12.05.14	3.63m BGL	109.20
		AVERAGE = 109.29



- Notes
1. This drawing is to be read in conjunction with all other relevant architect's and engineer's drawings
 2. The drawing summarises the measurements of groundwater levels carried out by Harrison between May 2013 and May 2014 at No.8 Grange Road

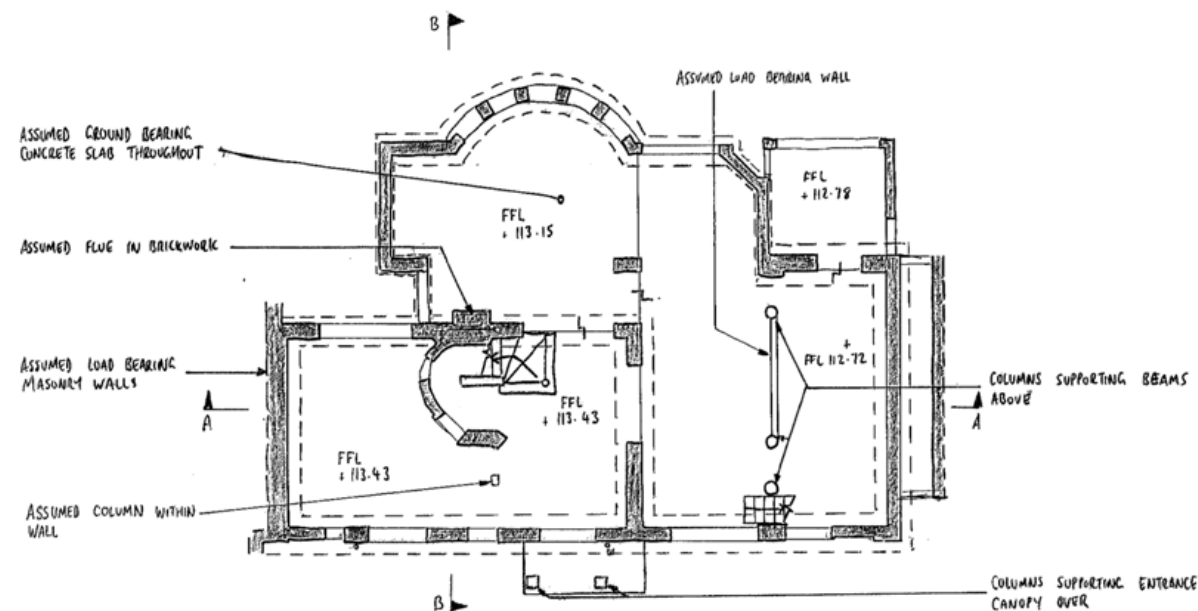


8 GRANGE ROAD, HIGHGATE	
SUMMARY OF GROUNDWATER LEVELS MEASURED ON SITE BY HARRISON GROUP	
1675/100/008	
NOVEMBER 2014	Alan Baxter

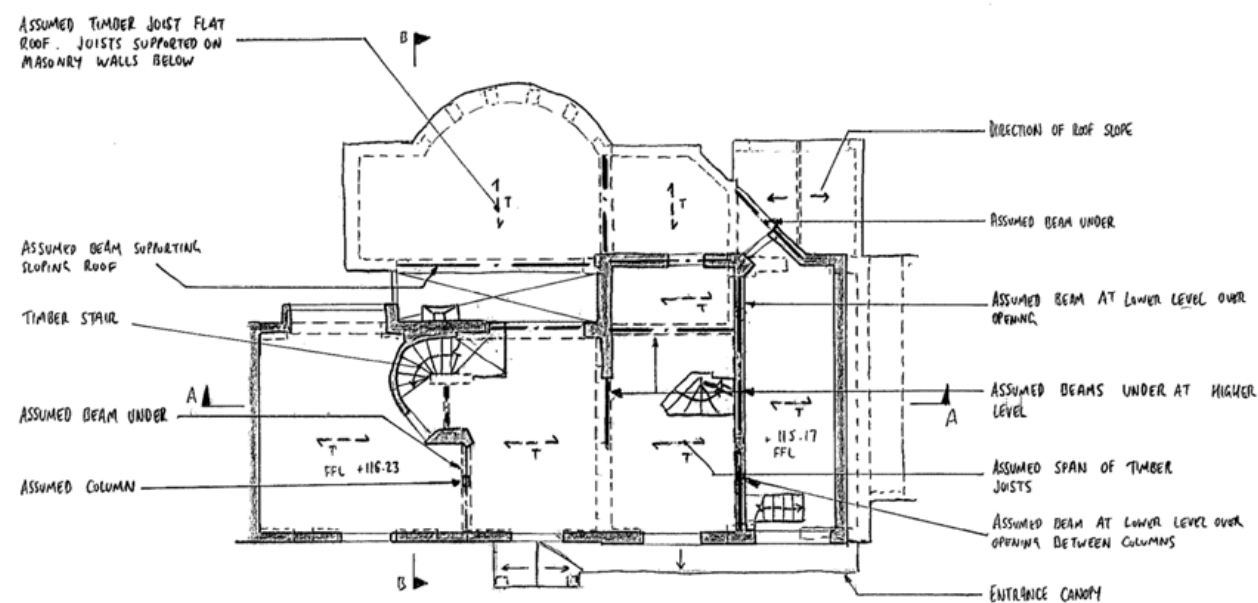
Appendix B

Existing Structural Drawings

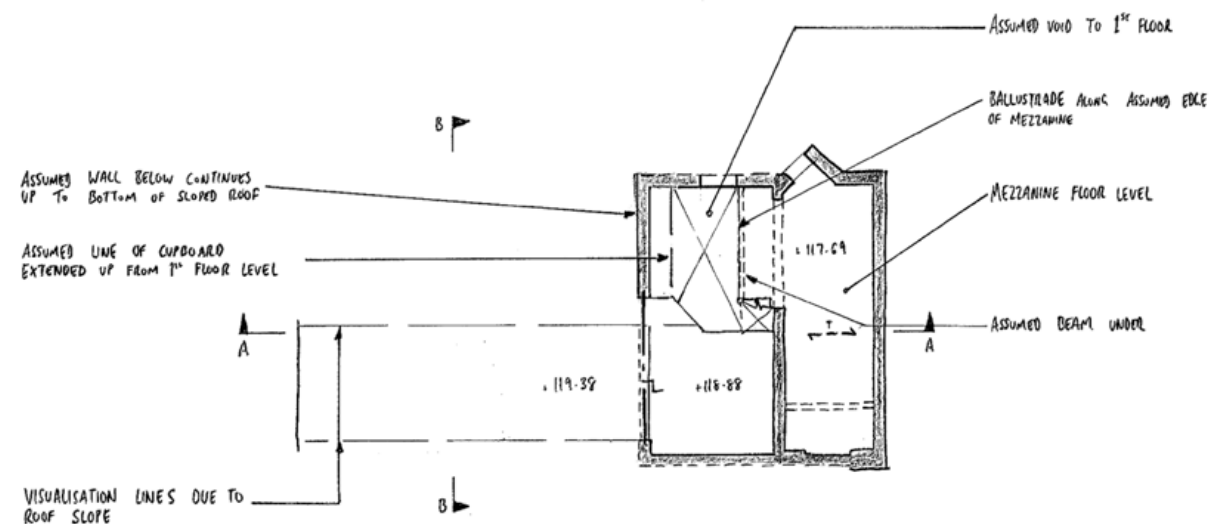
NOTE: ALL EXISTING STRUCTURE SHOWN IS ASSUMED & BASED ON SURVEY DRAWINGS. IT WILL BE CONFIRMED AT A LATER STAGE WITH INVESTIGATION WORKS



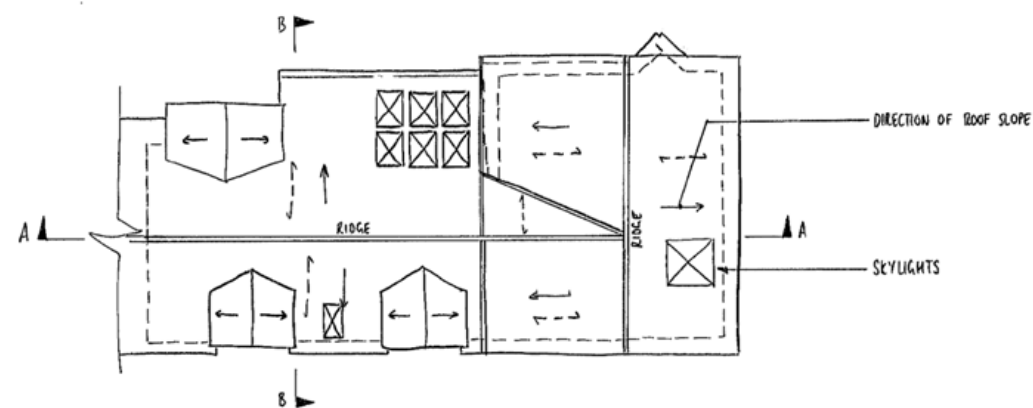
GROUND FLOOR PLAN



FIRST FLOOR PLAN



UPPER FIRST FLOOR PLAN



ROOF PLAN

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8 GRANGE ROAD,
HIGHGATE, N6

EXISTING STRUCTURE: PLANS

drawn JHI
date MAY '14
checked
scale (original - A1)
1:100

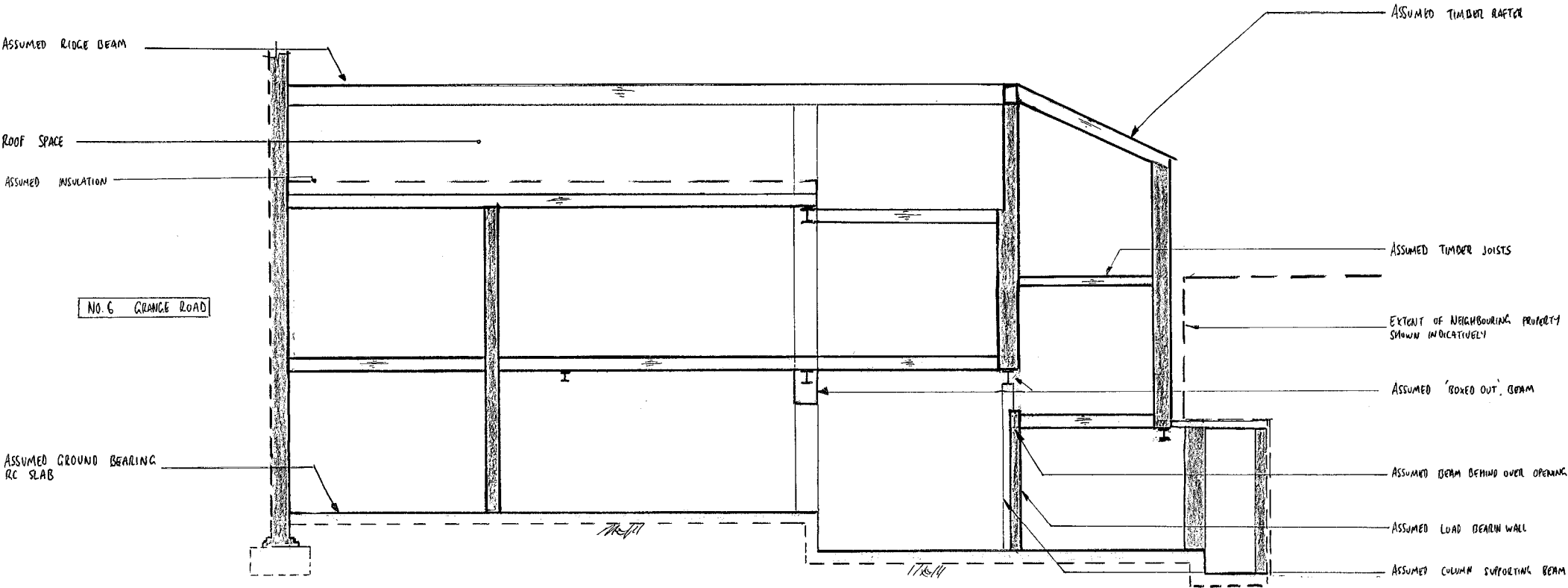
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email aba@alanbaxter.co.uk

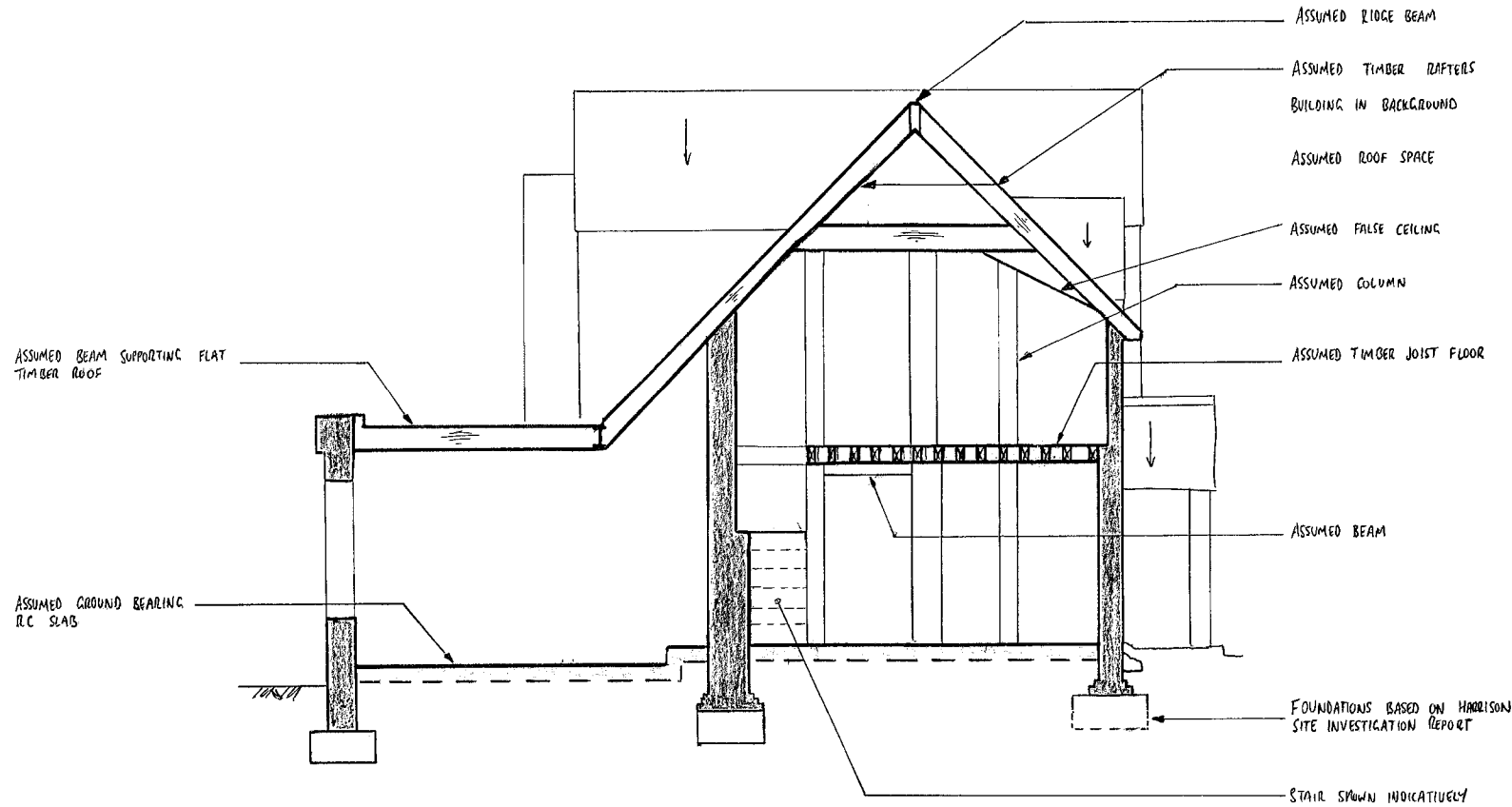
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SECTION A-A



SECTION B-B

notes

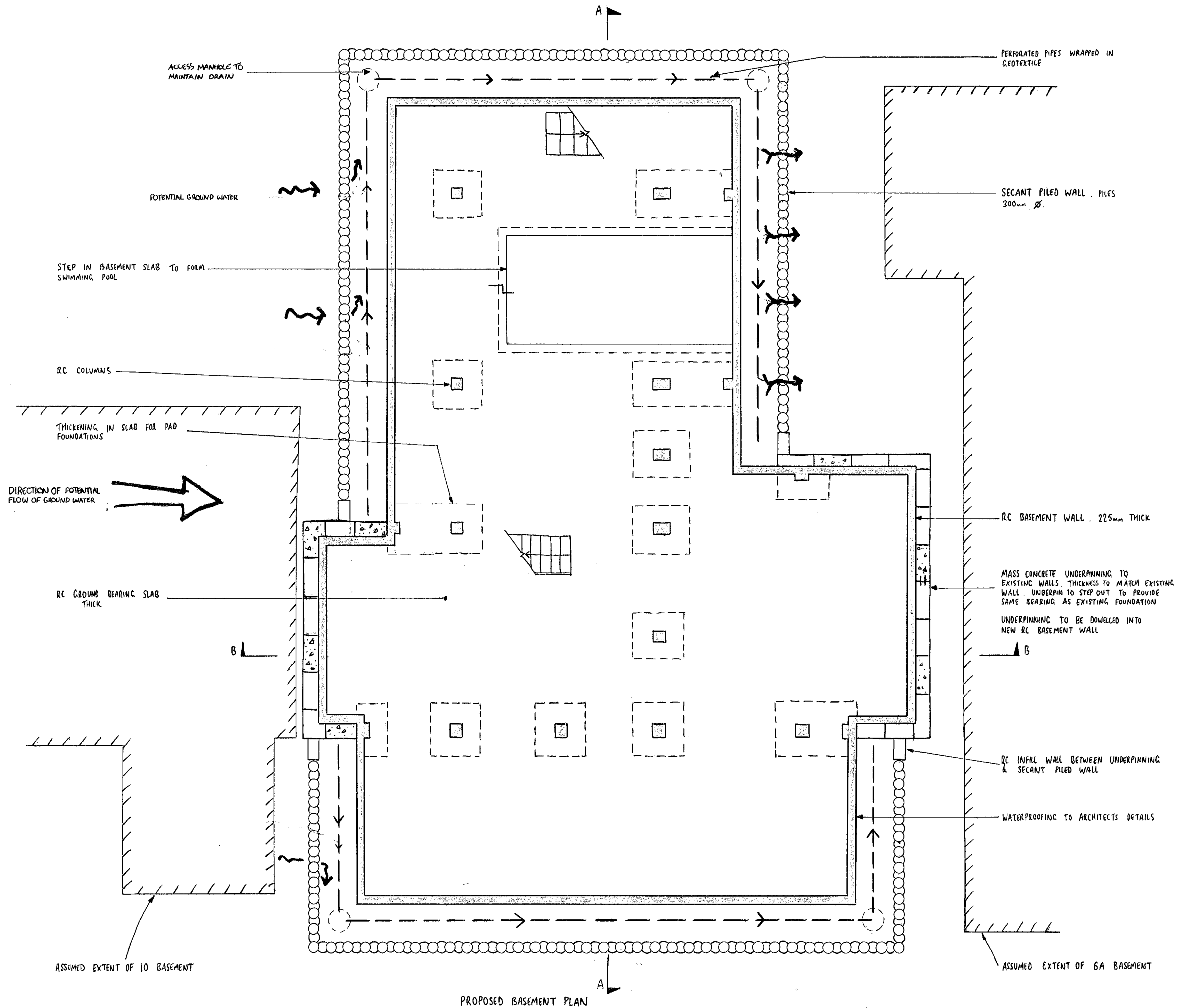
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Job 8 GRANGE ROAD , N6		
Site EXISTING STRUCTURE : SECTIONS		
Drawn JH:	checked	scale (original - A1) 1:50
date MAY '14		
Alan Baxter 75 Cowcross Street London EC1M 6EL tel 020 7250 1555 email aba@alanbaxter.co.uk www.alanbaxter.co.uk		
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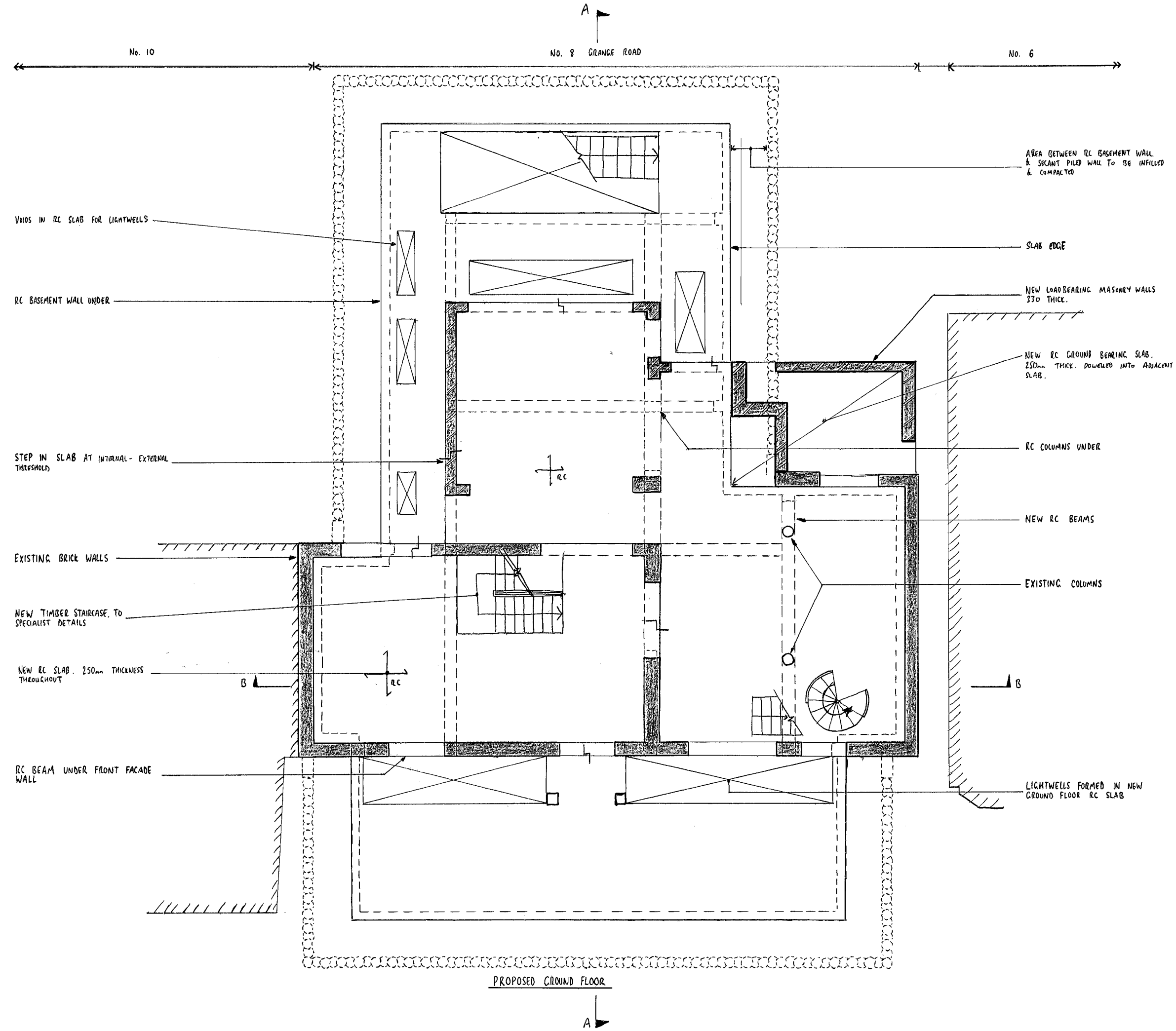
Appendix C

Proposed Structural Drawings



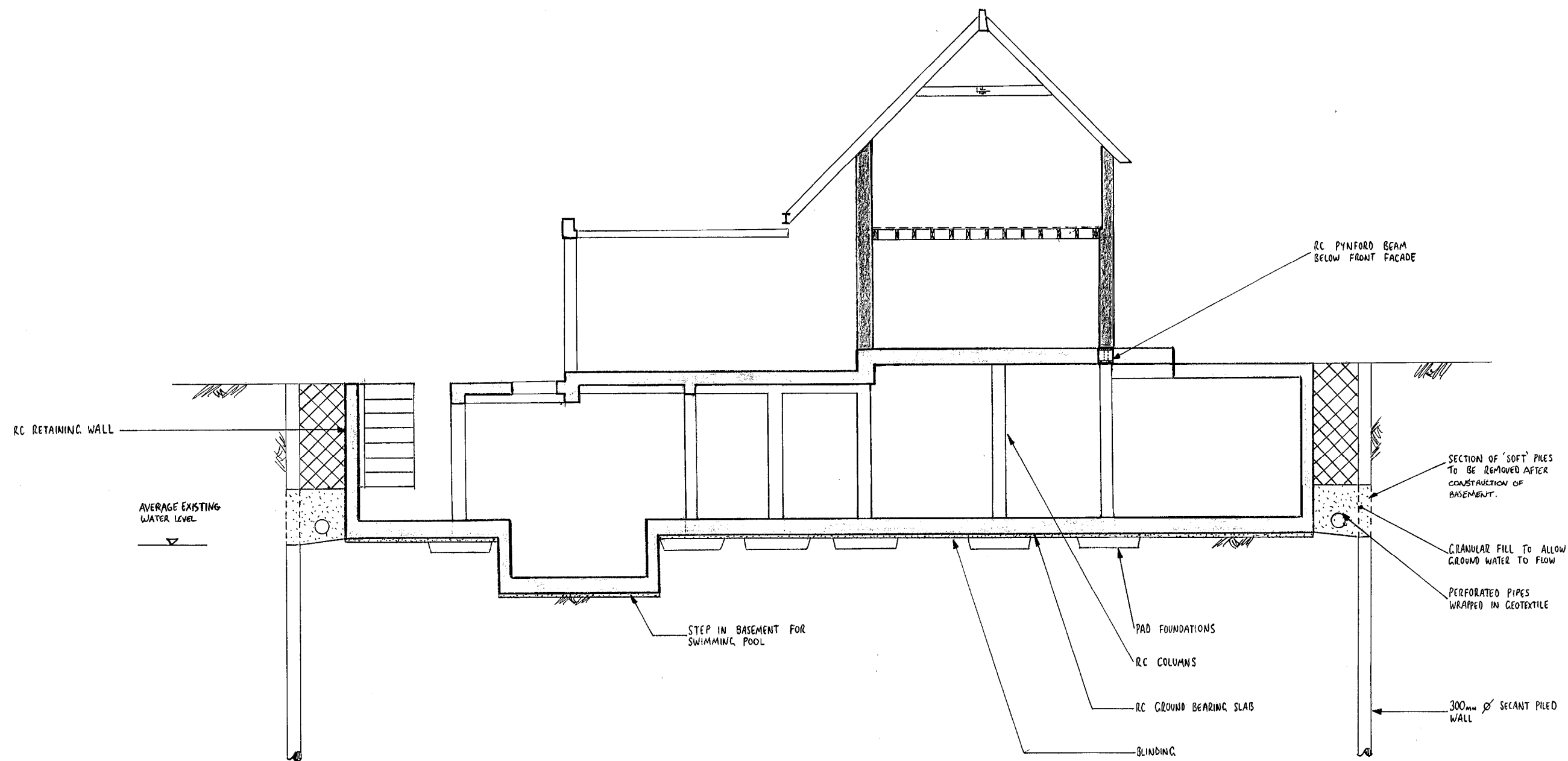
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ISSUED AS PART OF PLANNING REPORT		LF
Job 8 GRANGE ROAD, HIGHGATE, N6		
Title PROPOSED BASEMENT PLAN		
drawn JHi	checked LF	
date SEP '14	scale (original - A1) 1:50	
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site PROPOSED GROUND FLOOR PLAN			
drawn JHI		checked LF	
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job
**8 GRANGE ROAD,
HIGHGATE, N6**

drawn
JHI
date
SEP '14

checked
LF
scale (only if not A1)
1:50

PROPOSED SECTION A-A

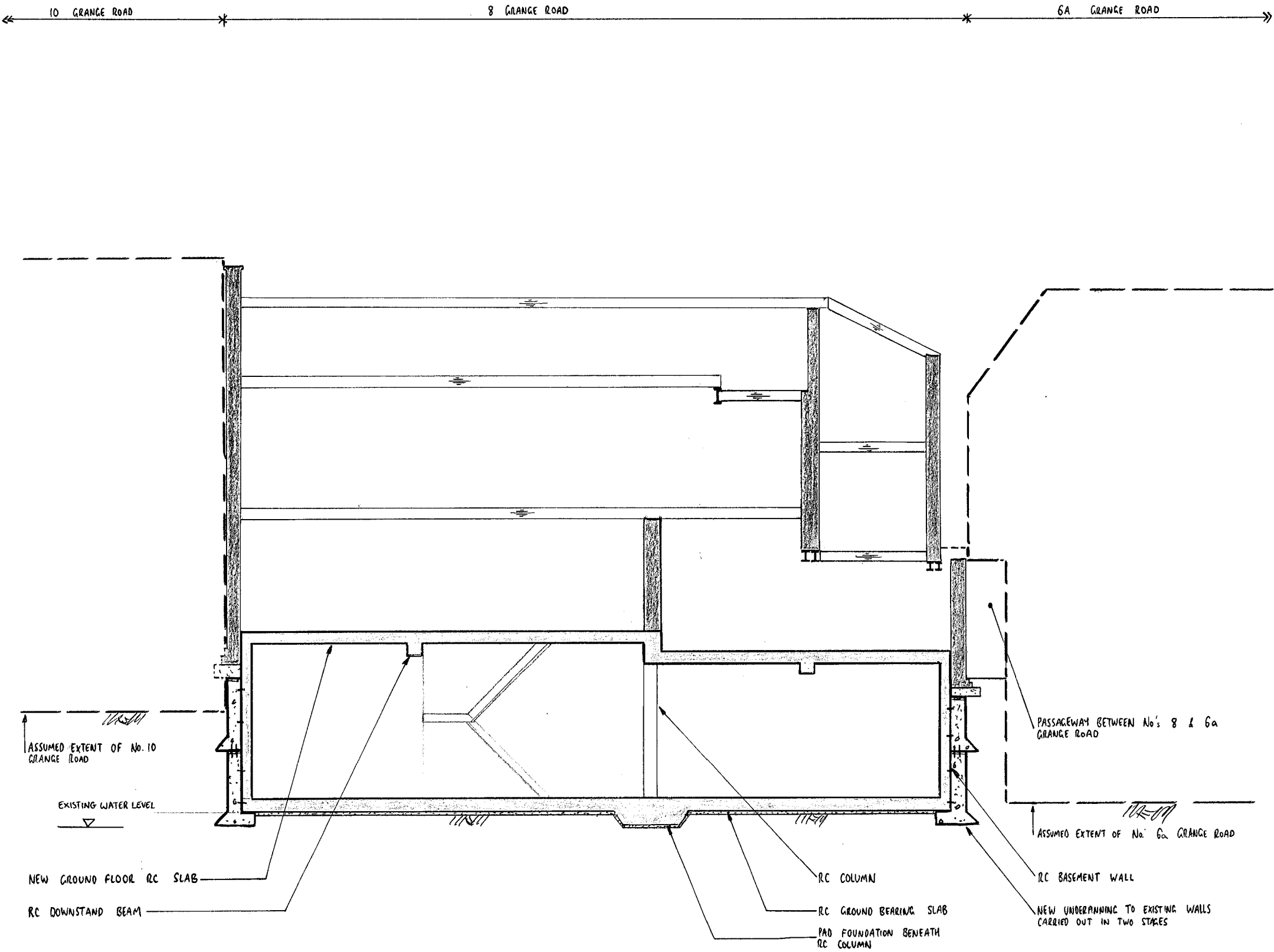
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diag. no.
1675/100/30

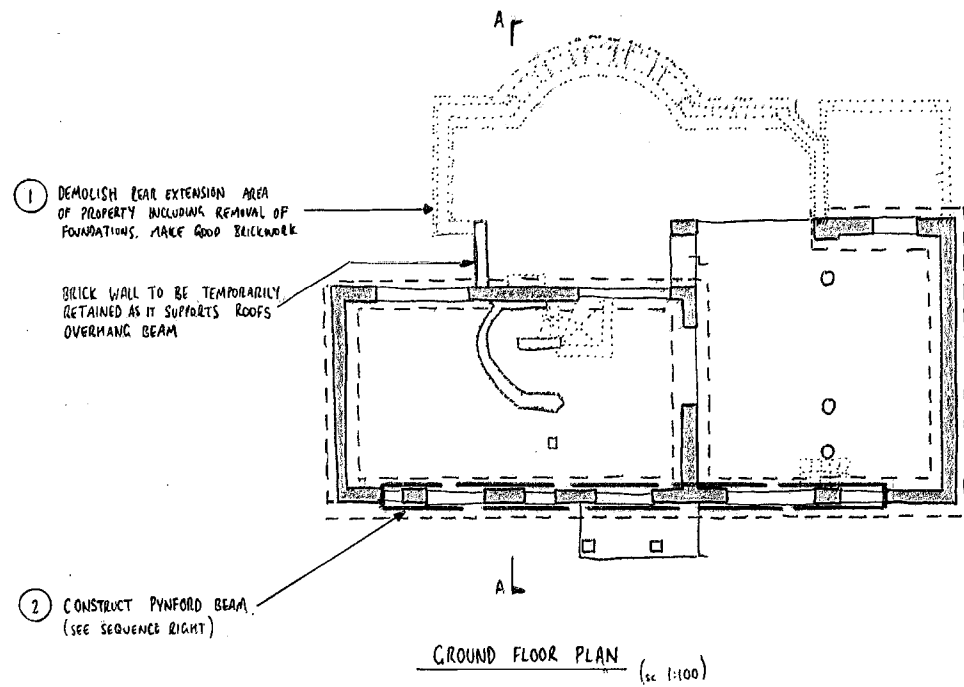
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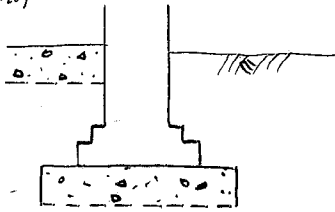


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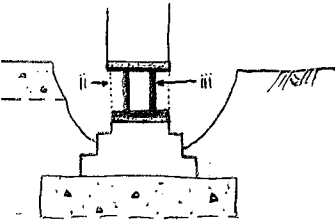
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JOB 8 GRANGE ROAD, HIGHGATE, N6		
JOB PROPOSED SECTION B-B		
drawn JHI	checked LE	
date SEP '14	scale (original - A1) 1:50	
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dig. no. 1675/100/31	rev.	

STAGE A : DEMOLITION**PYNFORD BEAM SEQUENCE (sc 1:20)**

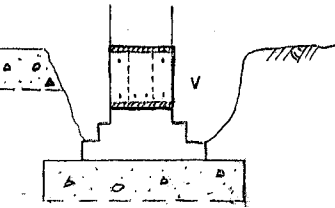
2i) EXISTING FRONT FACADE



ii) DEMOLISH SECTION OF WALL

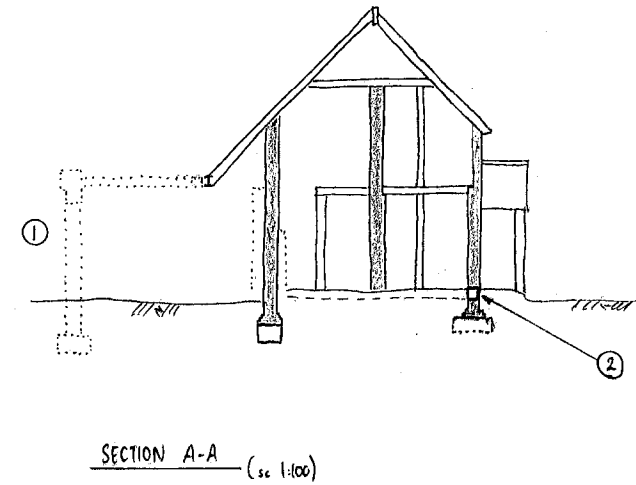


iii) INSERT PYNFORD STUOL & RAM DRYPACK TIGHT BENEATH STUOL & WALL

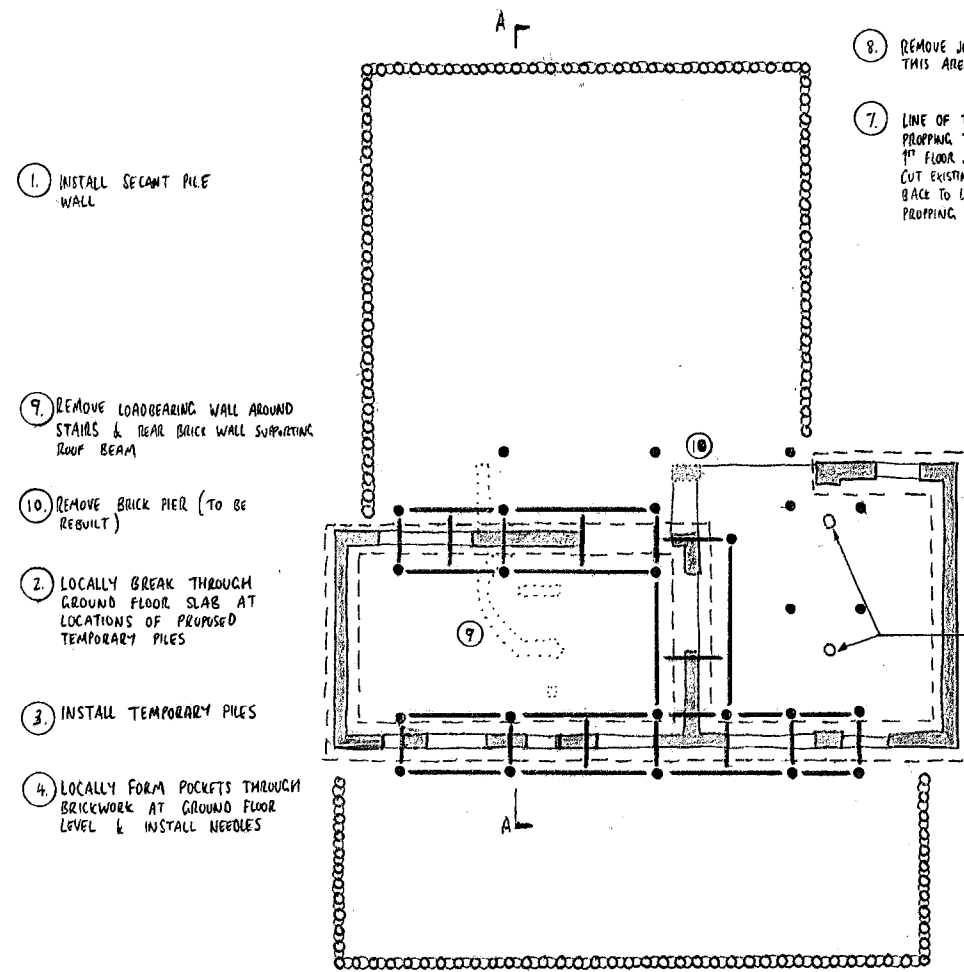


iv) REPEAT ii & iii ALONG LENGTH OF WALL

v) PLACE REINFORCEMENT IN STUOLS & CAST CONCRETE FULL LENGTH

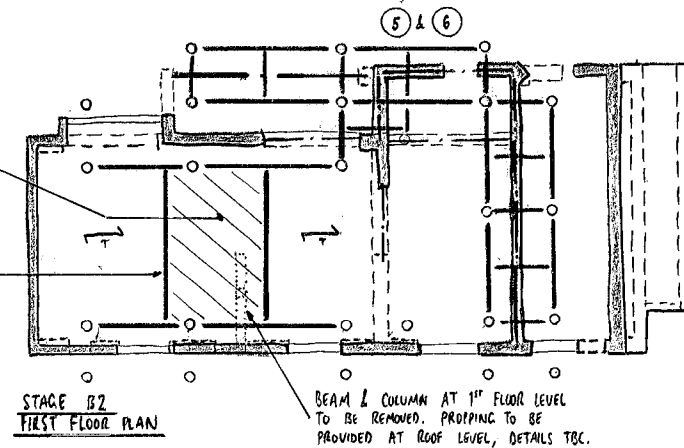
**STAGE B : B1-GROUNDWORKS**

B2- FIRST FLOOR SUPPORT



8. REMOVE JOISTS WITHIN THIS AREA

7. LINE OF TEMPORARY PROPPING TO SUPPORT 1ST FLOOR JOISTS. CUT EXISTING JOISTS BACK TO LINE OF PROPPING.

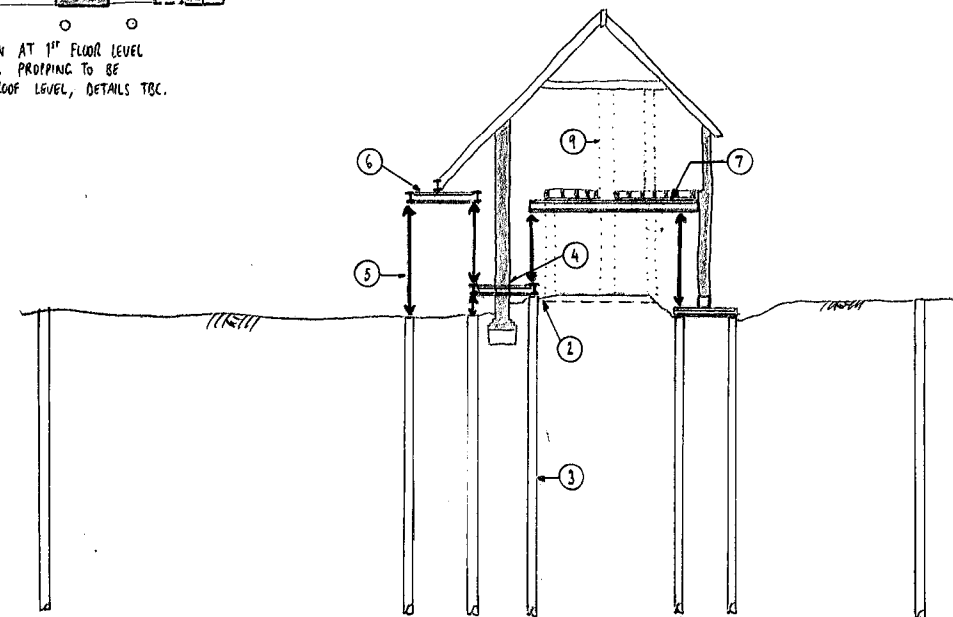


5. INSTALL TEMPORARY STEEL FRAME BUILT OFF OF TEMPORARY PILES

6. SUPPORT BEAMS AT 1ST FLOOR LEVEL

EXISTING COLUMNS TO BE REMOVED & REPLACED LATER

NOTE: ARRANGEMENT OF PILES & NEEDLES TEMPORARILY SUPPORTING EXISTING WALLS IS SHOWN INDICATIVELY ONLY. TO BE CONFIRMED BY CONTRACTOR



notes

- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND THE SPECIFICATION.
- THIS DRAWING SHOWS THE ASSUMED SEQUENCE OF CONSTRUCTION ASSUMED BY ALAN BAXTER & ASSOCIATES FOR THE DESIGN OF THE WORKS AND IS FOR INFORMATION ONLY. THE CONTRACTOR SHALL PREPARE HIS OWN PROPOSALS FOR S.O.C FOR WHICH HE SHALL REMAIN RESPONSIBLE. THE CONTRACTOR IS SOLELY RESPONSIBLE FOR MAINTAINING THE STABILITY OF THE BUILDING & STRUCTURES WITHIN & ADJACENT TO THE WORKS.
- THE PURPOSE OF THIS DRAWING IS TO HIGHLIGHT KEY CONSTRUCTION ASPECTS ASSOCIATED WITH THE WORKS. THE TEMPORARY WORKS ARE NOT 'MEASURABLE' BUT WILL FORM A SIGNIFICANT PROPORTION OF THE COST OF THE WORKS. THE CONTRACTOR IS TO CONSIDER THESE ISSUES CAREFULLY AND MAKE ALL NECESSARY COST & PROGRAMME ALLOWANCES.

ISSUED AS PART OF PLANNING REPORT

8 GRANGE ROAD, HIGHGATE, N6

ASSUMED SEQUENCE OF CONSTRUCTION SHEET 1 OF 3

drawn JHI checked LF
date SEP '14 scale (original - A1) AS SHOWN

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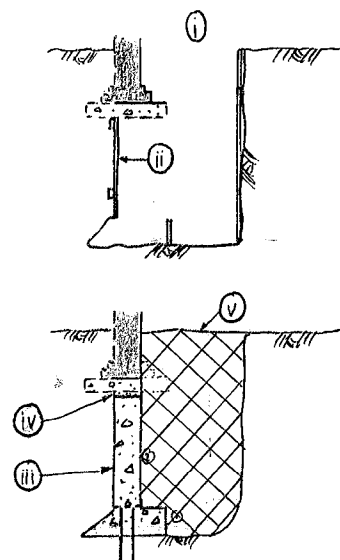
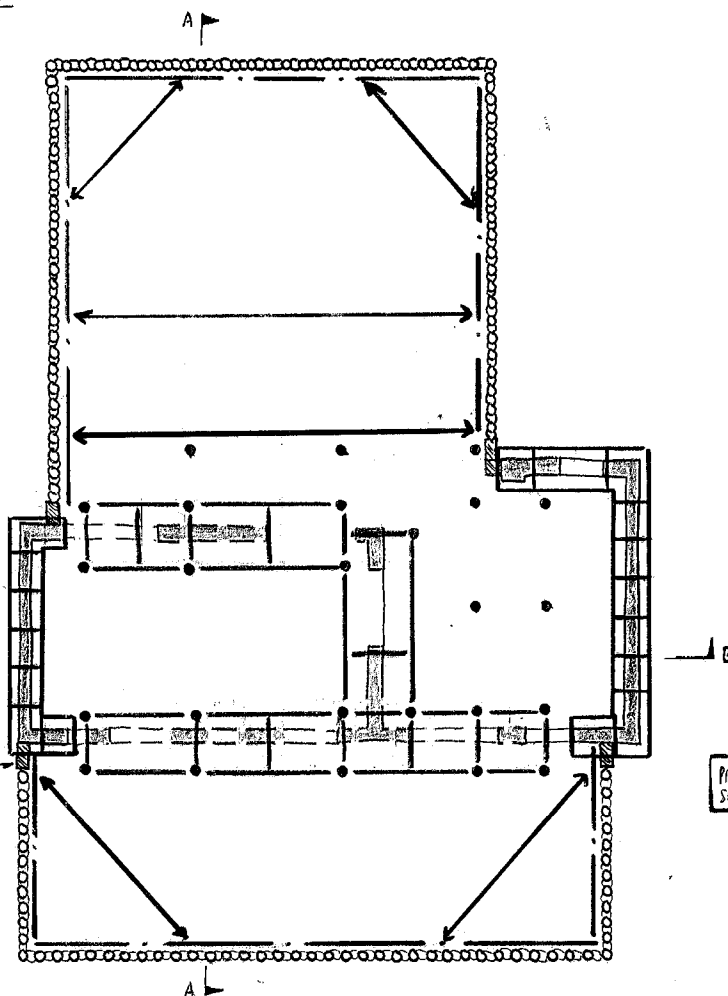
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STAGE C : UNDERPINNING

1. CARRY OUT FIRST LIFT OF UNDERPINNING

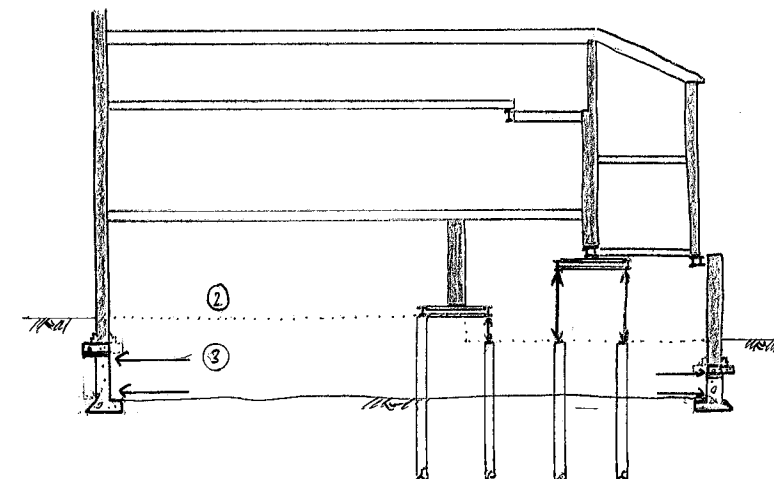
1m MAX
B
CONSTRUCT INFILL WALL BETWEEN PILED WALL & UNDERPINNING



UNDERPINNING SEQUENCE

PROPPING TO UNDERPINNING NOT SHOWN FOR CLARITY

- i) EXCAVATE LOCALLY BENEATH WALL OVER 1m MAX WIDTH. BREAK OUT EXISTING FOOTING AS REQUIRED. PROPPING & SHORING WHERE REQUIRED
- ii) INSTALL FORMWORK & DOWELS (HORIZONTAL & VERTICAL)
- iii) POUR MASS CONCRETE UNDERPINS IN 2 STAGES
- iv) INSTALL ORYPACK TO UNDERSIDE OF WALL 24-48 HOURS AFTER POURING CONCRETE
- v) BACKFILL IN LAYERS & COMPACT
- vi) REPEAT i-v FOR NEXT UNDERPIN



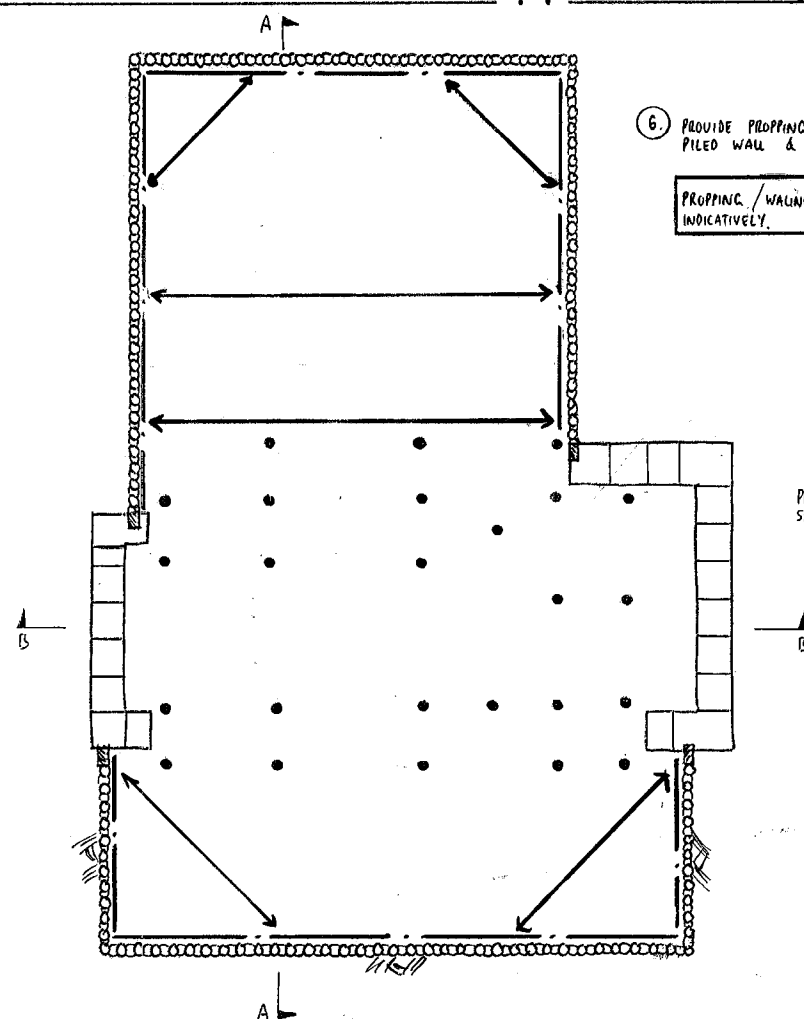
2. DEMOLISH REMAINING GROUND FLOOR SLAB & EXCAVATE FOOTPRINT OF BASEMENT TO ALLOW INSTALLATION OF TEMPORARY PROPS

3. INSTALL HORIZONTAL PROPPING

4. REMOVE BRICKWORK BENEATH NEEDLES & COMPLETE EXCAVATION

SECTION B-B (sc 1:100)

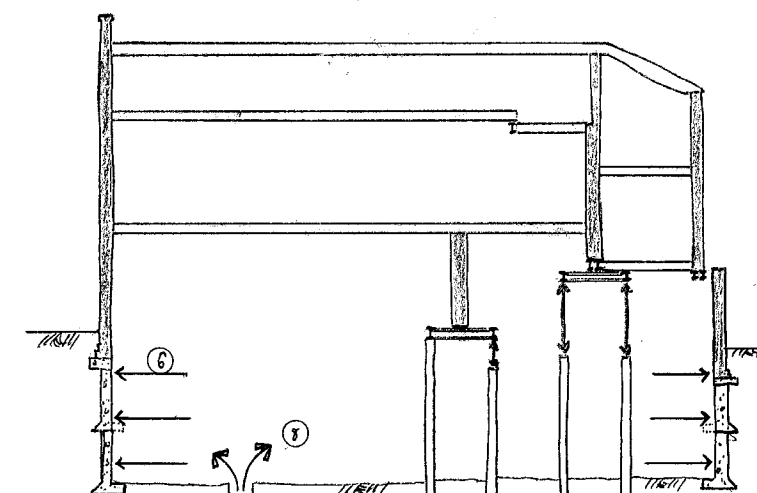
5. CARRY OUT 2ND LIFT OF UNDERPINNING
(SEQUENCE SIMILAR TO 1ST LIFT OF UNDERPINNING)



6. PROVIDE PROPPING TO SECANT PILED WALL & UNDERPINNING

PROPPING/WALING BEAMS SHOWN INDICATIVELY

PROPPING TO UNDERPINNING NOT SHOWN FOR CLARITY



7. EXCAVATE TO BASE OF SECOND LIFT OF UNDERPINNING. ALLOW FOR DEMOLITION OF EXCAVATION BY SPECIALISTS.

8. DEWATERING AS NECESSARY BY SPECIALISTS. REVIEW AS EXCAVATION PROGRESSES

6. PROVIDE TEMPORARY PROPS TO PERIMETER WALLS AS NECESSARY, SHOWN INDICATIVELY

9. CAST BINDING TO BASE OF EXCAVATION

SECTION B-B (sc 1:100)

NOTE: ARRANGEMENT OF PILES & NEEDLES TEMPORARILY SUPPORTING EXISTING WALLS IS SHOWN INDICATIVELY ONLY. TO BE CONFIRMED BY CONTRACTOR

m1005

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2. FOR GENERAL NOTES REFER TO DRAWING 1675/100/50.

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job

8 GRANGE ROAD,
HIGHGATE, N6

site

ASSUMED SEQUENCE OF
CONSTRUCTION SHEET 2 OF 3

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LFdate
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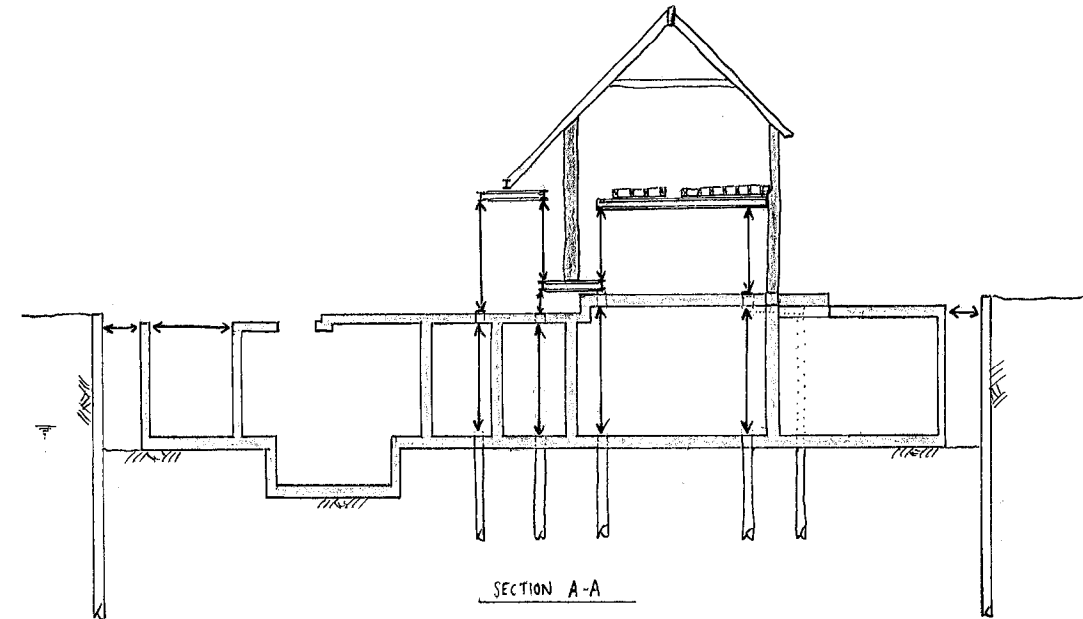
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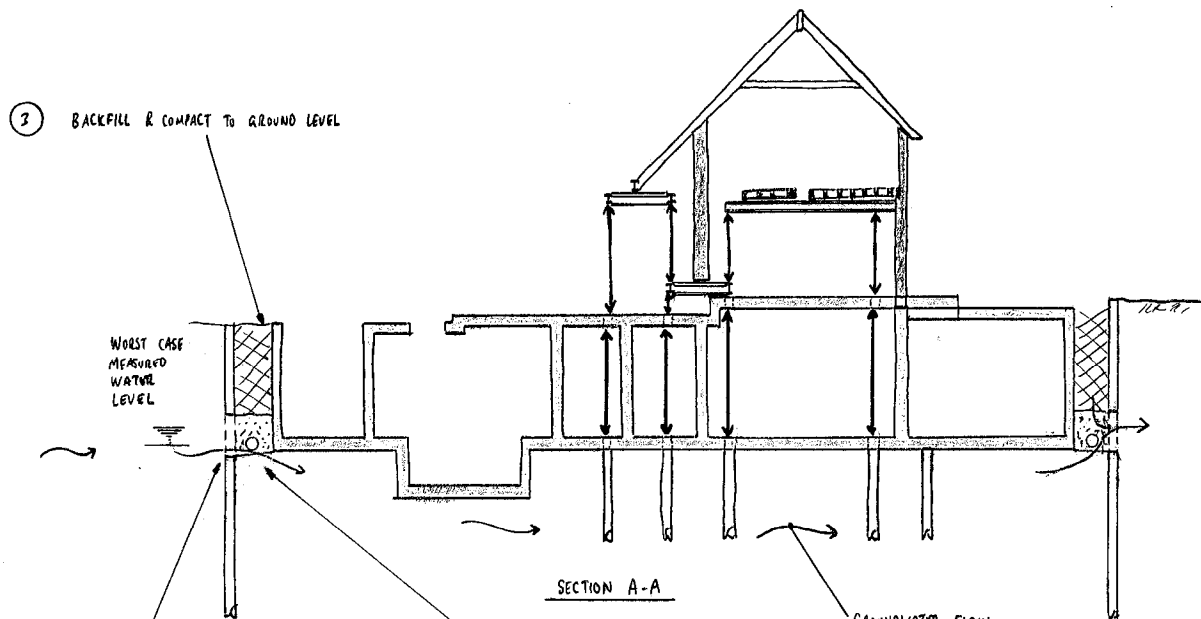
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STAGE D : CONSTRUCT DRAINAGE & RC BASEMENT BOX



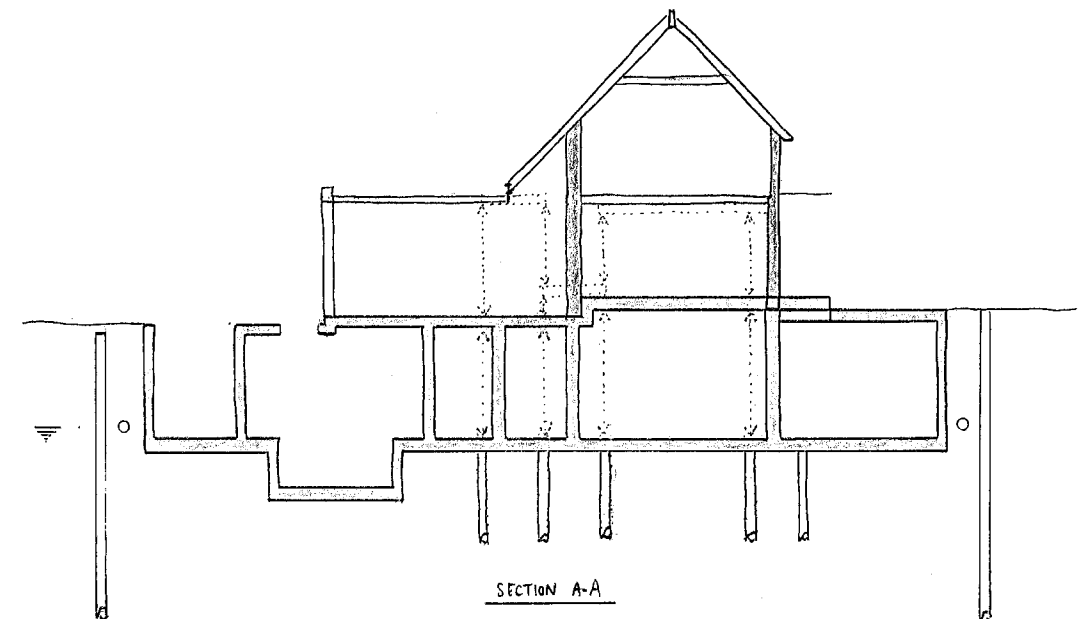
- 1 INSTALL NEW UNDERGROUND DRAINAGE
- 2 CONSTRUCT NEW RC BASEMENT BOX & COLUMNS. ALTER PROPS TO SLANT PILED WALL AS REQUIRED AS CONSTRUCTION PROGRESSES.
- 3 WATERPROOF & TANK BASEMENT

STAGE E : BREAK OUT SOFT PILES



- 1 BREAK OUT SOFT 'INFILL' PILES TO ALLOW GROUND WATER TO 'FLOW' AROUND AND UNDER THE BASEMENT
- 2 USE A GRANULAR FILL WHERE PILES BROKEN OUT TO ALLOW FOR FLOW OF WATER
3. INSTALL PERFORATED PIPE & CONSTRUCT ACCESS MANHOLE

STAGE F : CONSTRUCT GROUND & FIRST FLOOR STRUCTURE



- 1 CONSTRUCT NEW ABOVE GROUND STRUCTURE
- 2 REMOVE TEMPORARY STEEL FRAME & PILES. MAKE GOOD BASEMENT & GROUND FLOOR SLABS & BRICK WALLS

- notes
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 2. FOR GENERAL NOTES REFER TO DRAWING 1675/100/50.

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Job		
8 GRANGE ROAD, HIGHGATE, N6		
Title		
ASSUMED SEQUENCE OF CONSTRUCTION SHEET 3 OF 3		
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Alan Baxter

Prepared by Luca Frasca MEng MStructE level

Reviewed by Jim Gardiner BSc, MICS, MStructE

Draft issued November 2014

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APPENDIX G

Risk Assessment Classification

Classification	Definition
High Likelihood	There is a pollution linkage and an event that either appears very likely in the short-term and almost inevitable over the long-term, or there is evidence at the receptor of harm or pollution.
Likely	There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short-term and likely over the long-term.
Low Likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the short-term.
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long-term.

Table 1: Classification of Probability

Classification	Definition	Examples
Severe	Short-term (acute) risk to human health likely to result in “significant harm” as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resource. (Note: Water Resources Act contains no scope for considering significance of pollution). Catastrophic damage to buildings/property. A short-term risk to a particular ecosystem, or organisation forming part of such ecosystem (note: the definitions of ecological systems within the draft circular on Contaminated Land, DETR, 2000).	High concentrations of cyanide on the surface of an informal recreation area. Major spillage of contaminants from Site into controlled water. Explosion, causing building collapse (can also equate to a short-term human health risk if buildings are occupied).
Medium	Chronic damage to human health (“significant harm” as defined in DETR, 2000). Pollution of sensitive water resources. (Note: Water Resources Act contains no scope for considering significance of pollution). A significant change in a particular ecosystem, or organism forming part of such ecosystem, (note: the definitions of ecological systems within draft circular on Contaminated Land, DETR, 2000).	Concentration of a contaminant from Site exceed the generic, or Site-specific assessment criteria. Leaching of contaminants from a Site to a major or minor aquifer. Death of a species within a designated nature reserve.
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services (“significant harm” as defined in the draft circular on Contaminated Land, DETR, 2000). Damage to sensitive buildings/structures/services or the environment.	Pollution of non-classified groundwater. Damage to building rendering it unsafe to occupy (for example foundation damage resulting in instability).
Minor	Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as personal protective clothing etc.), easily repairable effects of damage to buildings, structures and services.	The presence of contaminants at such concentrations that protective equipment is required during Site works. The loss of plants in a landscaping scheme. Discolouration of concrete.

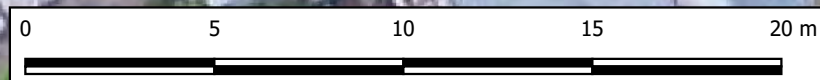
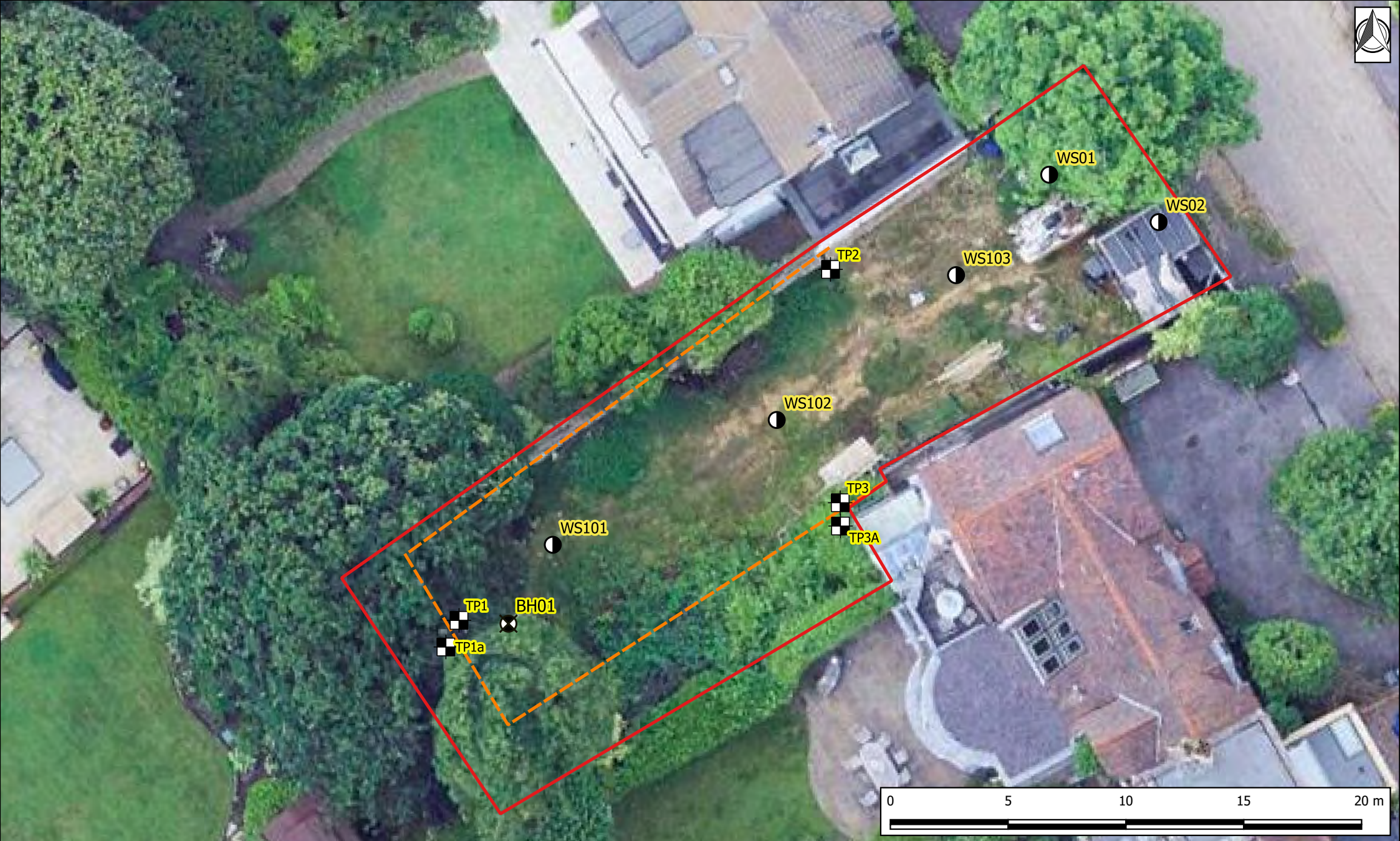
Table 2: Classification of Consequence

		Consequence			
		Severe	Medium	Mild	Minor
Risk	High Likelihood	Very high risk	High risk	Moderate risk	Moderate/low risk
	Likely	High risk	Moderate risk	Moderate/low risk	Low risk
	Low Likelihood	Moderate risk	Moderate/low risk	Low Risk	Very low risk
	Unlikely	Moderate/low risk	Low risk	Very low risk	Very low risk

Table 3: Combination of Consequence with Probability

APPENDIX H1

Exploratory Hole Location Plan



Project: 6a Grange Road
Drawing Title: Exploratory Hole Location Plan
Drawing No.: P22-2546-10
Date: May 2025

Legend

- | | |
|-------------------------|-------------|
| Site Boundary | WS Borehole |
| Existing Retaining Wall | Hand Pit |
| CP Borehole | |

APPENDIX H2

Ground Investigation Report

A REPORT ON A GROUND INVESTIGATION AT 6A GRANGE ROAD, LONDON, N6 4AB

CLIENT: Lawrence Bent

ENGINEER: Create Consulting Engineers Limited

Date: 8 July 2016

Reference: GNB/AFH/16.185

A F Howland Associates
The Old Exchange
Newmarket Road
Cringleford
Norwich
NR4 6UF

Tel: 01603 250754

Fax: 01603 250749



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1. INTRODUCTION	1
2. FIELDWORK	2
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APPENDICES

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APPENDIX B: CABLE PERCUSSIVE BOREHOLE RECORDS

APPENDIX C: WINDOW SAMPLE HOLE RECORDS

APPENDIX D: TRIAL PIT RECORDS

APPENDIX E: LABORATORY TESTING

APPENDIX F: DRAWINGS



CLIENT: Lawrence Bent

ENGINEER: Create Consulting Engineers Limited

A REPORT ON A GROUND INVESTIGATION AT 6A GRANGE ROAD, LONDON, N6 4AB

Reference: GNB/AFH/16.185

Date: 8 July 2016

1. INTRODUCTION

It is proposed to undertake modifications to the existing two storey property at 6A Grange Road, London (Drawing 16.185/1) to include a third storey extension and provision of basement below much of the footprint of the building.

At the instruction of Lawrence Bent, an investigation was carried out to provide information on the subsoil conditions and relevant geotechnical parameters for foundation design.

This report provides details of the fieldwork and laboratory testing undertaken and discusses the findings of the investigation with respect to the proposed development.



A F Howland Associates
Geotechnical Engineers

2. FIELDWORK

Fieldwork was carried out from 30 May to 7 June 2016 and comprised a cable percussive borehole, referenced BH01, two window sample holes, referenced WS01 and WS02, and trial pit inspections of the existing foundations at TP01 and TP01A. BH01A was the original intended location for the borehole but this was terminated at 1.10 m depth due to the encounter of construction rubble, corrugated metal sheets and pipe fragments, thought to represent remains of a former air raid shelter.

The exploratory hole positions were selected and set out in general accordance with the requirements of the Engineer, as shown approximately on Drawing 16.185/2. The National Grid references and, the elevation of the positions relative to Ordnance Datum, were measured using a Hemisphere S320 VRS GPS (RTK) system by A F Howland Associates.

A cable avoidance tool (CAT) was used to sweep the locations and the immediate surrounding areas to locate any potential underground services and the position adjusted as necessary. A starter pit was also excavated by hand to a depth of 1.20 m at the borehole and window sample holes to provide direct inspection for services or obstructions.

Details of the strata encountered, the sampling, *in situ* and laboratory testing, are shown on records appended to this report.

The **borehole**, referenced BH01A, was taken to a depth of 13.2 m using a demountable cable percussive rig in 150 mm diameter casing. Sampling and *in situ* testing were carried out in general accordance with the recommendations of BS EN1997-2:2007 Eurocode 7 and its UK National Annex supported by BS 5930:2015.

Disturbed samples were taken for possible laboratory testing and to allow later inspection of the materials encountered and facilitate accurate logging. Open drive samples (U100) were taken in cohesive material to allow laboratory testing of undisturbed material. Standard penetration tests (SPT) were carried out using a split barrel sampler at intervals in granular materials and within cohesive deposits to obtain additional information about



the condition of clay strata. The N-value was taken as the number of blows for 300 mm of penetration, following a seating drive of 150 mm or 25 blows.

The **window sample holes** were carried out with a tracked window sampling rig to a depth of 10.00 m at WS01 and 9.45 m at WS02. The sampling system utilises a 63.5 kg weight falling a distance of 750 mm to drive rods and sampling tubes into the ground, these are then extracted and the continuous samples described and then sub-sampled for possible laboratory testing. Open tube samples (U70) were taken where possible in cohesive material to allow laboratory testing of undisturbed material. Standard penetration tests (SPT) were also carried out using a split barrel sampler or a solid cone. The SPT N value was taken as the number of blows for 300 mm of penetration, following a seating drive of 150 mm or 25 blows.

The exploratory holes were monitored for **groundwater** ingress during advance. Upon encountering water, operations were temporarily stopped to allow the level to stabilise, recording the water level every five minutes for a period of twenty minutes.

The **trial pits** were excavated by hand in order to inspect the existing foundations and shallow ground conditions. TP01 positioned at the front of the property was terminated at 0.62 m when concrete was encountered which suggested the possibility of a service. The position was moved to the rear of the building (TP01A) to establish the foundation details for both the house and its extension. The pit was taken to a depth of 1.25 m. Following completion, the encountered conditions and foundation details were recorded and the trial pits were backfilled with arisings.

Details of the strata encountered, the sampling, *in situ* and laboratory testing are shown on records appended to this report.



3. LABORATORY TESTING

3.1 GENERAL

Subsequent to the fieldwork, a programme of laboratory testing was carried out to provide additional quantitative data on the materials encountered. The tests were completed in accordance with the procedures laid down in BS1377: 1990 unless stated otherwise and consisted of:

- Natural moisture content
- Atterberg limit determinations
- Particle size distribution
- Undrained shear strength in triaxial compression without measurement of pore pressure
- Sulphate content and pH value
- Total sulphur content

3.2 TEST PROCEDURES

3.2.1 Natural Moisture Content

The natural moisture content is determined according to BS1377: Part 2: 1990: clause 3.2. This represents the mass of moisture content retained by the soil in its natural state as a percentage of its dry mass. For organic soils and peats care should be taken to avoid heating the sample above 50°C to prevent irreversible physical changes to the material.

3.2.2 Atterberg Limits

The Atterberg limits are determined in the laboratory by the procedures given in BS1377: Part 2: 1990. The liquid limit (LL) is the moisture content of the soil at the point that its behaviour passes from that of a plastic solid to that of a liquid. The test procedure given as clause 4.4 was used based on the cone penetrometer in which the penetration of a free-fall cone into moistened and cured samples of the soil is measured. The plastic limit (PL) is the moisture content of the soil at the point that its behaviour passes from a plastic solid to a brittle solid. This point is measured according to clause 5.3 and is the point at which a thread of the soil rolled to 3 mm diameter begins to crumble.



Together the Atterberg limits can be used to define the plastic range of the soil. The plasticity index (PI) is the difference between the liquid and plastic limit and is broadly correlated to the engineering behaviour of the soil. When used with the natural moisture content of the soil they can also give an indication of its in situ condition.

3.2.3 Particle Size Distribution

A quantitative assessment of the particle size distribution of the soil down to the fine grained sand size is made according to BS 1377: Part 2: 1990: clause 9. In this the percentage of certain sized fractions of the soil are found by determining the weight retained on a variety of sieve sizes through which the material is allowed to pass. The combined silt and clay fraction is determined by the difference between the sum of the retained weights and the original sample weight. Variations of the test procedure allow the silt and clay fraction to be removed from the coarser fraction by wet sieving during which the fine material is washed from the surface of the coarser material.

The quantitative determination of the particle size distribution for fine soils, from coarse silt to clay size, is made according to BS 1377: Part 2: 1990: clause 9.4 or 9.5, using either the sedimentation by pipette method or hydrometer method. These tests are generally carried out if greater than 10% of the material passes the BS test sieve size of 63 μm , but in this instance only one test was performed on the sample with the highest fines content. The percentages of the constituents of the fine soil can be linked to the curve obtained by sieving to provide a single curve for the whole material.

3.2.4 Determination Of The Undrained Shear Strength In Triaxial Compression Without Measurement Of Pore

The undrained shear strength of the soil was measured, as stated in BS 1377: Part 7: 1990: clause 8, by axial compression of 70 mm or 100 mm diameter cylindrical specimens cut from the U70 or U100 undisturbed samples. The nature of the test is such that no change in moisture content of the specimen is allowed during shear.

The theory of behaviour of saturated clay materials in undrained shear failure gives that the strength will not be influenced by the confining pressure such that the measured angle of internal friction for the material will apparently be equal to zero. Experience has shown that this is true only for samples of unweathered heavily overconsolidated pure



clays. Where the material is weathered or it contains a significant granular content a plastic rather than a brittle failure develops which produces a strain hardening during shear. In this situation measurable apparent undrained angle of internal friction is produced. A similar situation develops in partially saturated materials. The test results are also influenced by sample variation, and in particular the presence of natural fissures or inclusions within the sample.

The use of large diameter specimens is preferred as this compensates for the scale effects of random features in smaller specimens. One of two tests are carried out according to the soil characteristic. Unweathered specimens of heavily overconsolidated clays which have a brittle failure in shear are tested in a single stage. The confining pressure is taken as the total overburden pressure of the sample in situ. It is then failed by axial compression and the measured deviator stress reported as the apparent undrained cohesion. Specimens of weathered clay or the clays with granular contents are tested in a multistage manner according to BS 1377: Part 7: 1990: clause 9.

The test procedure is similar to the single stage but at the point that failure begins the confining pressure is increased and the specimen compressed for a further 2% of vertical strain at which point the confining pressure is again increased and held for a further 2% strain. The deviator stresses at each of the confining pressures are used to plot the Mohr envelope and the apparent undrained cohesion and if appropriate the undrained angle of internal friction.

3.2.5 Sulphate Content and pH Value

In order to aid the evaluation of any aggressive tendency of the subsoil or groundwater to buried concrete the pH and soluble sulphate of a number of samples were determined using in-house procedures based on British Standard methods. The pH of a groundwater sample, or a soil suspension was determined electrometrically according to BS 1377: Part 3: 1990: clause 9.5. For the sulphate analysis, soil and groundwater samples were prepared in general accordance with BS 1377: Part 3: 1990: clause 5.3. The soil extract was analysed by optical emission spectrometry (ICP-OES), with the prepared water sample analysed by photometric analysis following precipitation with barium chloride. The total sulphate of a soil was measured on a filtrate following digestion of the soil by 10% hydrochloric acid, and tested according to clause 5.5.



3.2.6 Total Sulphur Content

To aid the evaluation of aggressive tendency of the subsoil to buried concrete as a result of its pyritic potential, the total potential sulphate content can be determined from the relationship between the total (acid soluble) sulphate content and the amount of total sulphur present. The total sulphur content is determined by a laboratory in-house method based on BS 1377: Part 3: 1990 and Methods for the Examination of Waters and Associated Materials (MEWAM) (Environment Agency, 2006).

A dried portion of the soil is extracted at 115 °C for 75 minutes using 100% aqua regia and potassium bromate/bromide oxidizing mixture. The principle of this digest is to oxidize all sulphur to sulphate, and use the aqua regia acid mixture to digest the sample. The resultant digest solution is then filtered and analysed by ICP-OES. The results are expressed as % S, and include water soluble and acid soluble sulphates and total reduced sulphur, as well as insoluble sulphates and organic sulphur.



4. DISCUSSION

4.1 SITE DESCRIPTION

The site is located on Grange Road within a residential area close to Highgate, North London. The site comprises a two story residential building with a recent single story, flat roofed, garage conversion to the front of the property, and a single story flat roofed extension to the rear of the property with an adjoining patio area.

The site afforded a modest front garden and a larger rear garden. Access to the rear garden was through a narrow alleyway shared with the neighbouring property, along the northern boundary of the site with a concrete path leading out to Grange Road. The rear garden was bound by wooden fencing on all sides approximately 1.80 m high with mature shrubs and trees. The front garden was bound by a brick wall along the northern boundary and a hedgerow along the southern boundary. The eastern boundary was bound by a sparse Loral hedge with a central opening to allow access to a path leading to building. The south eastern section of the boundary was open to Grange Road where the remnants of a driveway lead from the road to the converted garage. Both front and rear gardens are generally level and at grade with the surrounds. The general area beyond the site boundaries to the south and the east gently sloped to the south east.

A brief review of historical Ordnance Survey mapping of the area¹ showed the site had been occupied by buildings of varying sizes since the 1890s. At that time a large building occupied a large area of the site labelled 'The Grange' until the 1970's where it was replaced by several residential dwellings.

4.2 GENERAL GEOLOGY

The regional geology is mapped for the area by the British Geological Survey (BGS, 2016) to show a solid geology of the Claygate Member underlain by the London Clay Formation. No superficial deposits were indicated to be present in the immediate area of the site, although Head deposits sometimes exist at a scale that is too small to map.

¹ <https://www.old-maps.co.uk/#/Map/>



The **Claygate Member** is the youngest part of the London Clay Formation and comprises dark grey clays with sand laminae, passing up into thin alternations of clays, silts and fine-grained sand, with beds of bioturbated silt. Ferruginous concretions and septarian nodules occur in places. In this area it is found to be up to 16 m in thickness with the lower beds dominantly clay and sandy clay but also include some discrete sand bodies. The upper beds are laminated sands and clays, but at some locations these are replaced by silts and fine sands.

The **London Clay Formation** in its entirety mainly comprises bioturbated or poorly laminated, blue-grey or grey-brown, slightly calcareous, silty to very silty clay, clayey silt and sometimes silt, with some layers of sandy clay. It commonly contains thin courses of carbonate concretions ('cementstone nodules') and disseminated pyrite. It also includes a few thin beds of shells and fine sand partings or pockets of sand, which commonly increase towards the base and towards the top of the formation. At the base, and at some other levels, thin beds of black rounded flint gravel occurs in places. Glauconite is present in some of the sands and in some clay beds, and white mica occurs at some levels.

Head deposits are materials of varying lithology, formed by mass movement processes which include hillwash, soil creep and solifluction (a process active only under periglacial conditions). The deposit may blanket wide areas or infill former hollows or valleys and is poorly sorted and poorly stratified. It is of varying lithology, with the relative proportions of clay and sand dependent on the local source material upslope, which in this area is predominantly the London Clay and the Claygate unit. Therefore any Head material is likely to be variable and could include granular and cohesive deposits.

4.3 SITE GEOLOGY AND GEOTECHNICAL CONDITION

4.3.1 Geological Findings

The exploratory hole findings are in general accord with the expectations of the BGS, with most of the deposits most likely representing the Claygate Member. The Nominal Section (Figure 16.185/3) summarises the findings of the investigation.

An initial layer of topsoil was found to be underlain by a varying thickness of made ground at BH01, WS01 and WS02. The made ground was generally recorded to contain



concrete, brick and flint fragments to a maximum depth of 0.70 m where it was underlain by a series of clays, silts and fine sands.

The probable **Claygate Member** was represented by a series of soft to firm orange brown occasionally gravelly clays, loose to medium dense grey silty fine sands and grey sandy silts, with occasional pockets of clay, in all exploratory holes at 0.4 to 1.10 m and was proved to a maximum depth of 13.20 m.

Laboratory testing showed the cohesive deposits to be of intermediate to high plasticity on the basis of laboratory Atterberg limits testing which gave plasticity index values between 23 and 37% (Figure 16.185/4). Triaxial testing of undisturbed samples of the clay produced results ranging from 48 to 88 kNm⁻² while standard penetration test N-values were between 8 and 14. The strength assessment was supported generally by the N-values whereby the strength can be correlated using a relationship between undrained shear strength, Cu, and N-value (after Stroud, 1989). A multiplication factor of 5.0 has been incorporated into Figures 16.185/5a and 5b, with values equating to undrained shear strengths between 40 and 70 kNm⁻².

The granular strata were generally dominated by fine grained sands with a silt and/or clay content that varied from 17 to 32%. The particle size distribution was demonstrated by grading analyses in the laboratory and as summarised on the particle size distribution plot (Figure 16.185/6). *In situ* SPT N-values typically varied from 10 to 16 and indicated a loose to medium dense condition, although values of 3 and 5 were recorded below 4.0 m depth at WS01 which show the local potential for very loose to loose material. This is included on Figure 16.185/5a.

4.3.2 Chemical Considerations

Risks to construction materials can be assessed primarily using the sulphate and pH results according to the recommendations of Building Research Establishment Special Digest 1 (BRE, 2005). These analyses were undertaken in order to evaluate any aggressive tendency of the soil to buried concrete. The results from samples of granular and cohesive strata, and also groundwater can be summarised as follows:

- pH values in soil between 5.0 and 5.9, while pH value of 6.0 was recorded in groundwater



- sulphate (SO_3) concentration of 0.27 gl^{-1} in groundwater
- water soluble sulphate (SO_3) concentration in soil of 0.01 to 0.06 gl^{-1}
- acid soluble sulphate (SO_4) value of 0.03%
- total sulphur concentration of 0.01%

The sulphur determination was made to complement the sulphate testing according to the recommendations of Building Research Special Digest 1 (BRE, 2005). This establishes if a material is pyritic and uses a relationship between total sulphur, acid soluble and water soluble sulphate, and Total Potential Sulphate (TPS), to determine whether it is necessary to increase the Design Sulphate (DS) class. The sample analysed in this manner produced an oxidisable sulphide (OS) value that were below the 0.3% trigger concentration, demonstrating that the material does not contain pyrites.

4.4 GROUNDWATER

Groundwater was struck in the granular deposits at both window sample hole positions and at BH01 towards the base of the upper clay stratum. Following a short cessation in fieldwork operations the water level rose to depths ranging from 3.7 to 4.3 m .

However, observations reported during fieldwork will have been affected by the permeability of the ground, the rate of progress of the hole and the techniques used. The general procedures in operation do not allow precise measurements of the groundwater conditions, but give only a general guide to the overall situation. Fluctuations in any water table will occur as a result of seasonal or climatic effects, as well as other outside influences, while the groundwater level in a small diameter hole can also underplay its importance in larger scale excavation.

To allow a longer term assessment of groundwater conditions piezometers were installed in BH01, WS01 and WS02. During the fieldwork period, AFHA recorded the water level at the window sample hole positions at depths of 3.2 and 3.3 m . Subsequent monitoring by the Engineer on 22 June 2016 confirmed the water levels to be at 3.0 to 3.2 mbgl (Figure 16.185/3).



5. ENGINEERING INTERPRETATION

5.1 GENERAL

The purpose of the investigation was to allow the determination of appropriate design parameters to assist the Engineer with the structural design of the scheme to include the excavation of a basement. These have been deemed to include:

- Stratum thicknesses;
- Bulk weight of each stratum;
- Stratum type :
 - Cohesive/Cohesionless;
 - Normal/Over consolidated;
 - Drained/Undrained;
- Coefficient of earth pressure at rest, K_0 ;
- Soil friction angle;
- Cohesion :
 - Drained;
 - Undrained;
- Young's modulus;
- Poisson ratio; and
- Water table elevation.

It is presumed that the design concept for the basement would be to form a watertight retaining wall box in which the basement could be excavated whilst keeping water out (assuming that the basement excavation level was within or very close to the ground water table level, as has been established to be the case).

The comments and recommendations contained in the report address the design requirements as understood, and are based on the data obtained from the site investigation. Extrapolation between and to other parts of the site is considered within the light of the geological setting as interpreted, but no responsibility can be accepted for varying geological and geotechnical conditions from those on which the report is based. It should be noted that the solutions discussed reflect the design proposals and information supplied at the time of reporting and must be subject to re-assessment if changes are made at a later date.



5.2 EXISTING FOUNDATIONS

The character of the building and the evidence from the foundation inspection pit suggest that the existing foundations are traditional strip foundations at about 1.25 m depth for the main house and about a metre depth for the extension. However, this information is based on a single trial pit which straddled the main house and extension.

The existing foundation levels act onto the upper cohesive soils, the allowable bearing capacity, q_a , of which can be determined by:

$$q_a = \frac{1}{F} (N_c \times C_u)$$

where;

N_c is a bearing capacity factor related to footing geometry

C_u is the undrained shear strength of the stressed soil, and

F is a factor of safety against bearing capacity failure

If an undrained shear strength of 40 kNm^{-2} is taken for near surface soils, (Figure 16.185/5b), the allowable bearing stress increase, q_a , for a factor of safety of 3 is:

$$\begin{aligned} q_a &= \frac{1}{3} (6.1 \times 40) \\ &= 81.33 \text{ kNm}^{-2} \end{aligned}$$

5.3 PROPOSED SUBSTRUCTURE WORKS

5.3.1 Excavations

The excavation for the new basement is anticipated to be taken to a depth that varies from approximately 3.0 to 4.0 m. This suggests the structure will cross from the cohesive strata into the granular deposits at the front of the property, but may be contained within the cohesive material strata at the rear of the property (Figure 16.185/3).

The soil with the excavation depth is heterogeneous and in view of the consequences of sidewall failure, it should be regarded as being incapable of self-support and the construction system should be devised accordingly. In particular, the concept for a proposed watertight retaining wall box would need to ensure that it is adequate to prevent



any lateral displacement of the retained soil in both the permanent and temporary conditions.

Excavations that remain above the groundwater will, in essence, remain dry and would not be expected to affect the groundwater, or be affected by it. However, as the water level is approached it is generally the case that the soils become more soft or loose. As the excavation is likely extend to below the water table it will encounter more adverse conditions that would need additional consideration.

5.3.2 Retaining Structures

The walls of the basement excavation will need to be capable of accommodating the stresses induced by the full depth of excavation plus that of the water pressure.

As the water pressure acting on a retaining structure requires only the presence of water on the back wall, and in the absence of drainage measures in the wall, this can develop irrespective of the regional groundwater table, the system should assume water loading over the full depth from ground level.

5.3.3 Characteristic Soil Parameters

The soil parameters pertinent to the assessment of the temporary and permanent works aspect of the construction proposal are listed in Section 4.1 above and values for each are given in Table 1, below.



Parameter	Natural cohesive soils	Natural granular soils
Stratum thickness ¹	Variable (has the potential to be present to the full depth of influence)	Variable (has the potential to be present to the full depth influence)
Stratum Type ¹	Cohesive	Cohesionless
State of Consolidation ²	Over-consolidated, unless fully softened by disturbance	Not applicable
Bulk weight, γ_k (weight density) ³	19.0 to 20.0	17.0 to 20.0
Undrained strength, kNm^{-2} , ⁴	40.0	Not applicable
Drained strength, c' kNm^{-2} / ϕ' degrees ³	0 / 25	0 / 30
Coefficient of earth pressure at rest, K_o ⁵	0.75	0.40 (loose or medium dense) 0.80 (dense)
Poisson's ratio ⁵	0.4 to 0.5	0.20
Young's Modulus, MNm^{-2} , ^{2,6}	5 (soft soils) 5 to 8 (firm soils)	30 to 80 (loose) 80 to 160 (medium dense) 160 to 320 (dense)
Water table elevation, mOD ¹	109	109

Table 1 : Soil Parameters

NB. Data source:

1 – Borehole records;

3 – BS 8002 (BSI, 2015b);

5 - Tomlinson (1996);

2 – Geological provenance derived from geological setting;

4 – Derived from SI data;

6 - www.geotechdata.info/parameter/soil-young's-modulus.html.

Natural materials are variable in character and condition. This is notably the case at the site as a result of the particular geological processes that have been active in the area. Thus, the parameters provided in Table 1 should not be taken to represent an innate property of the soil and the values will vary not only as result of the variability of the soils but also by the context in which the parameter will apply. Any analysis would be enhanced by a sensitivity analysis for the parameters as a means to determine the impact of the uncertainty of each.



5.3.4 Underpin piled foundations

It is presumed that a system such as secant piles will be used to support the basement excavation. If so, these could also be used to underpin and accommodate the structural loads of the existing building. Unless individual piles are extended below the level that is required to support the sidewalls of the basement extension, the pile group will act as a deep strip foundation, with the benefit of the friction developed along the internal and external faces of the pile group.

Although the soils have been found to have significant variability, the structural integrity of the construction system in such loads will be distributed to some degree within the group. However, the potential exists for differing behaviour as some of the variability in the soils is at a large scale. For example, a pile system acting into the cohesive soils would have a differing response to that where the granular soils are present. It would seem prudent therefore that the design approach focussed on the settlement response of the system acting into each soil type in order to ensure that differential movements were of an acceptable level, rather than the load capacity alone.

5.3.5 Buried Concrete

Specific chemical analyses were undertaken in order to evaluate the aggressive tendency of the ground to buried concrete. The pH results indicated moderately acidic conditions, while the soluble sulphate results correspond with a design sulphate class of **DS-1** (BRE, 2005).

The digest identifies a number of different site categories, which include those with natural soil conditions, those that have been subject to brownfield development and also those sites that contain pyrite bearing ground that would be subject to future disturbance and could result in pyritic oxidation. Assuming the localised made ground is related to residential construction, and the absence of past industrial activity, natural soil conditions can be adopted. Although the natural deposits may have been vulnerable to pyritic oxidation, the test results have confirmed this is not a risk, so the effect has been ignored.

The BRE Digest also shows it is necessary to take into account other factors related to the environment into which the concrete is placed i.e. the pH of the material and the mobility of the groundwater table. An ACEC (aggressive chemical environment for concrete) class can then be assigned.



Given that the piles will need to be taken below the groundwater and that thicknesses of granular soils are present, a mobile groundwater condition has been adopted. However, as the pH is lower than 5.5 (but higher than 2.5), in a natural ground setting the guidelines indicate that ACEC classification of **AC-2z** would be appropriate for buried concrete in contact with all deposits.

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8 July 2016



APPENDIX A: REFERENCES

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APPENDIX B: CABLE PERCUSSIVE BOREHOLE RECORDS

B	Bulk disturbed sample
D	Small disturbed sample
W	Water sample
U	Undisturbed sample
X blows	The associated figure 'X' is the number of blows to drive the sample tube over the given depth range
XF	Undisturbed sample not recovered after 'X' number of blows to drive the sample tube
SPT	Standard penetration test using a split spoon sampler. N Value is uncorrected, but the hammer energy ratio is given in the remarks.
X,X/X,X,X,X	Blows per increment during the standard penetration test. The initial value relates to the seating drive (150 mm) and the remaining four to the 75 mm increments of the test length
N=X	SPT blow count 'N' given by the summation of the blows 'X' required to drive the full test length (300 mm)
X*/Y	Incomplete standard penetration test where the seating drive could not be completed. The blows 'X' represent the total blows for the given length of seating drive 'Y' (mm)
X/Z	Incomplete standard penetration test where the seating drive was achieved but the full test length was not. The blows 'X' represent the total blows for the given test length 'Z' (mm)
<u>dd/mm/yy: 1.0</u>	Date, water level at the borehole depth at the end of shift
<u>dd/mm/yy: dry</u>	and the start of the following shift

Each sample type is numbered sequentially with depth and relates to the depth range quoted

All depths and measurements are given in metres, except as noted

Strata descriptions complied by visual examination of samples obtained during boring, after BS 5930:2015 and modified in accordance with laboratory test results where applicable



 A F Howland Associates Geotechnical Engineers					Site 6A Grange Road, London N6 4AP			Borehole Number BH01	
Boring Method Demountable Cable Percussive Drilling Rig		Casing Diameter 150mm cased to 12.00m		Ground Level (mOD) 112.08		Client Lawrence Bent		Job Number 16.185	
		Location 527997 E 188054 N		Dates 31/05/2016-07/06/2016		Engineer Create Consulting Engineers Limited		Sheet 1/2	
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.30 0.30-0.80	D1 B1				111.88 111.68	(0.20) 0.20 (0.20) 0.40	TOPSOIL (Grass over dark brown slightly clayey gravelly fine to coarse sand. Gravel is subangular to subrounded fine to coarse brick, flint, concrete. Occasional rootlets) MADE GROUND (Dark brown slightly clayey gravelly fine to coarse sand. Gravel is subangular to subrounded fine to coarse flint and brick) Soft orange brown and occasional grey sandy CLAY		
1.00	D2								
1.50 1.50-1.95	D3 U1	1.50		55 blows			 becoming firm		
2.00	D4								
2.50-2.95 2.50-3.00	SPT N=8 D5	2.50	DRY	1,1/2,2,2,2		(4.10)			
3.00	D6								
3.50-3.95	U2	3.50		65 blows					
4.00	D7								
4.50-5.00 4.50-4.95 4.50-5.00	B2 SPT N=11 D8	4.50	3.90	Slow(1) at 4.30m, rose to 3.90m in 20 mins, not sealed. 1,2/2,3,3,3	107.58	4.50	Loose to medium dense yellowish brown silty fine SAND		
5.50-5.95 5.50-6.00 5.80-6.00	SPT N=10 D9 B3	5.50	4.10	1,1/2,2,2,4					
7.00-7.45 7.00-7.50 7.00-7.50	SPT N=13 B4 D10	7.00	5.20	1,2/2,3,3,5		(4.90)	 partings and small pockets of orange brown and grey slightly sandy clay from 7.00		
					31/05/2016:5.20m 01/06/2016:5.20m				
Remarks 1. Location CAT scanned prior to excavation. 2. Hand dug inspection pit to 1.20 m. 3. Groundwater struck at 4.30 m and rose to 4.30 m in 5 mins., 4.10 m in 10 mins., 3.90 m in 15 mins. and 20 mins. 4. Slotted Standpipe installed to 13.00 m. 5. SPT Hammer Energy Ratio = 75.48% 6. Water sample taken from piezometer 08/06/2016.								Scale (approx) 1:40	Logged By JK/KPB
								Figure No. 16.185.BH101A	

		A F Howland Associates Geotechnical Engineers				Site 6A Grange Road, London N6 4AP		Borehole Number BH01	
Boring Method Demountable Cable Percussive Drilling Rig		Casing Diameter 150mm cased to 12.00m		Ground Level (mOD) 112.08		Client Lawrence Bent		Job Number 16.185	
		Location 527997 E 188054 N		Dates 31/05/2016- 07/06/2016		Engineer Create Consulting Engineers Limited		Sheet 2/2	
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
8.50-8.95 8.50-9.00 8.50-9.00	SPT N=10 B5 D11	8.50	6.90	1,1/2,2,3,3			Loose to medium dense yellowish brown silty fine SAND, with partings and small pockets of orange brown and grey slightly sandy clay from 7.00 m		
				01/06/2016: 07/06/2016:7.40m			 occasional subangular sandstone fragments		
9.40	D12				102.68	9.40	Firm grey silty CLAY with partings of fine to medium grey silt and sand		
						(1.00)			
10.00-10.45 10.00-10.50	SPT N=11 D13	10.00	7.40	1,2/2,3,3,3					
					101.68	10.40	Firm grey silty CLAY with pockets of orange brown silty fine sand <20 mm ³ with grey silt and silty fine sand layers <5 mm		
10.60	B6				101.48	(0.20) 10.60	Grey sandy SILT with thin layers of soft to firm grey silty CLAY < 50 mm		
11.50-11.95 11.50-12.00	SPT N=9 D14	11.50	DRY	1,1/2,2,2,3					
						(2.60)			
13.00-13.45 13.00-13.50 13.00-13.50	SPT N=6 B7 D15	12.00	DRY	0,0/0,0,3,3	98.88	13.20	Complete at 13.20m		
Remarks								Scale (approx) 1:40	Logged By JK/KPB
								Figure No. 16.185.BH101A	

 A F Howland Associates Geotechnical Engineers						Site 6A Grange Road, London N6 4AP		Borehole Number BH01A	
Boring Method Cable Percussion		Casing Diameter		Ground Level (mOD) 111.98		Client Lawrence Bent		Job Number 16.185	
		Location 528002 E 188056 N		Dates 31/05/2016		Engineer Create Consulting Engineers Limited		Sheet 1/1	
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					111.68	0.30	TOPSOIL (Grass over dark brown slightly clayey gravelly fine to coarse sand. Gravel is subangular to subrounded fine to coarse brick, flint, concrete. Occasional rootlets)		
						(0.80)	MADE GROUND (Possible Air raid shelter) (Sandy gravelly subangular cobbles. Gravel and cobbles are subangular fine to coarse concrete and brick. Occasional metal bare and pipe fragments)		
					110.88	1.10	Complete at 1.10m		
Remarks									
								Scale (approx) 1:25	Logged By
								Figure No. 16.185.BH01A	

APPENDIX C: WINDOW SAMPLE HOLE RECORDS

U	Nominal 70 mm diameter undisturbed open tube sample
X blows	The associated figure 'X' is the number of blows to drive the sample tube over the given depth range
XF	Undisturbed sample not recovered after 'X' number of blows to drive the sample tube
B	Bulk disturbed sample
D	Small disturbed sample (suffix 'P' denotes inspection pit sample)
SPT	Standard penetration test using a split spoon sampler
SPT (C)	Standard penetration test using 60 degree solid cone
X,X/X,X,X,X	Blows per increment during the standard penetration test. The initial value relates to the seating drive (150 mm) and the remaining four to the 75 mm increments of the test length
N=X	SPT blow count 'N' given by the summation of the blows 'X' required to drive the full test length (300 mm)
X*/Y	Incomplete standard penetration test where the seating drive could not be completed. The blows 'X' represent the total blows for the given length of seating drive 'Y' (mm)
X/Z	Incomplete standard penetration test where the seating drive was achieved but the full test length was not. The blows 'X' represent the total blows for the given test length 'Z' (mm)
<u>dd/mm/yy: 1.0</u>	Date, water level at the borehole depth at the end of shift
<u>dd/mm/yy: dry</u>	and the start of the following shift

Each sample type is numbered sequentially with depth and relates to the depth range quoted

All depths and measurements are given in metres, except as noted

Strata descriptions complied by visual examination of samples obtained during boring, after BS 5930:2015 and modified in accordance with laboratory test results where applicable



 A F Howland Associates Geotechnical Engineers				Site 6A Grange Road, London N6 4AP			Number WS01			
Excavation Method Tracked Window Sampling Rig, Dando Terrier 2002. 102 mm to 4.00 m 87 mm to 7.00 m 75 mm to 10.00 m		Dimensions		Ground Level (mOD) 112.12		Client Lawrence Bent		Job Number 16.185		
		Location 528017 E 188070 N		Dates 31/05/2016		Engineer Create Consulting Engineers Limited		Sheet 1/2		
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water		
0.30-0.50	D1	DRY	17 blows	111.97	(0.15)	TOPSOIL (Grass over dark brown slightly clayey gravelly fine to coarse sand. Gravel is subangular to subrounded fine to coarse brick, flint, concrete. Occasional rootlets)				
				111.87	0.15	MADE GROUND (Brown and grey slightly sandy gravel. Gravel is subangular concrete and brick)				
				111.82	0.25					
					0.30					
						(0.40)	MADE GROUND (Concrete)			
0.70-1.20	B1			111.42	0.70	MADE GROUND (Dark brown slightly clayey gravelly fine to coarse sand. Gravel is subangular to subrounded fine to coarse flint and brick)				
							Firm mottled brown, grey and orange brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium flint. Occasional rootlets			
										
1.20-1.65	U1						(1.10)			
1.40-1.60	D2									
1.80-2.00	D3			110.32	1.80	Firm mottled grey and yellow brown sandy CLAY				
2.00-2.45	SPT N=16	IP 0/S 3,3 T 3,5,4,4			(0.40)					
2.00-2.45	D4									
2.20-3.00	B2			109.92	2.20	Medium dense yellowish brown with occasional grey silty fine SAND				
										
										
										
										
										
										
										
3.00-3.47	SPT	IP 20/S 2,2 T 2,2,2,4								
3.00-3.45	D5									
3.00-4.00	B3									
	N=10									
4.00-4.50	SPT	IP 50/S 2,1 T 1,2,1,1								
4.00-4.45	D6									
4.00-4.75	B4									
	N=5									
4.75-5.00	D7	Moderate(1) at 4.70m, rose to 4.30m in 20 mins.		107.37	4.75	Very loose yellowish brown with occasional grey clayey silty fine SAND				
5.00-5.47	SPT			4.29	IP 20/S 1,0					
Remarks 1. Location CAT scanned prior to excavation. 2. Hand dug inspection pit to 1.20 m. 3. Piezometer installed to 7.00 m. 4. Poor sample recovery from 7.00m to 10.00m							Scale (approx) 1:25	Logged By JK	Figure No. 16.185.WS01	

 A F Howland Associates Geotechnical Engineers					Site 6A Grange Road, London N6 4AP			Number WS01	
Excavation Method Tracked Window Sampling Rig, Dando Terrier 2002. 102 mm to 4.00 m 87 mm to 7.00 m 75 mm to 10.00 m		Dimensions		Ground Level (mOD) 112.12		Client Lawrence Bent		Job Number 16.185	
		Location 528017 E 188070 N		Dates 31/05/2016		Engineer Create Consulting Engineers Limited		Sheet 2/2	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
5.00-5.45 5.00-6.00	D8 B5 N=3	4.31	T 1,0,1,1	105.52	(1.85)	 grey partings increasing with depth			
6.00-6.51 6.00-6.45 6.00-6.60	SPT D9 B6 N=8		IP 60/S 1,1 T 2,2,2,2			... becoming loose			
6.70-7.00	D10					Firm orange brown and grey sandy CLAY			
7.00-7.47 7.00-7.45 7.00-8.00	SPT D11 D12 N=12	4.29	IP 20/S 1,2 T 3,2,3,4	104.92	7.20	Medium dense greyish green silty fine SAND			
8.00-8.45 8.00-9.00	U2 D13	4.29	40 blows		(2.60)				
9.00-9.47 9.00-9.45	SPT D14 N=13		IP 20/S 4,2 T 3,3,3,4						
9.80-10.00	D15			102.32 102.12	9.80 (0.20) 10.00	Firm grey slightly sandy CLAY			
Remarks								Scale (approx) 1:25	Logged By JK
								Figure No. 16.185.WS01	



A F Howland Associates
Geotechnical Engineers

Site

6A Grange Road, London N6 4AP

Borehole Number

WS01

Installation Type

Single Installation

Dimensions

Internal Diameter of Tube [A] = 19 mm

Client

Lawrence Bent

Job Number

16.185

Location

528017 E 188070 N

Ground Level (mOD)

112.12

Engineer

Create Consulting Engineers Limited

Sheet

1/1

Legend	Water	Instr (A)	Level (mOD)	Depth (m)	Description	Groundwater Strikes During Drilling									
						Date	Time	Depth Struck (m)	Casing Depth (m)	Inflow Rate	Readings				Depth Sealed (m)
			111.92	0.20	Concrete	31/05/16		4.70		Moderate	4.63	4.50	4.35	4.30	
			111.12	1.00	Bentonite Seal										
Groundwater Observations During Drilling															
						Start of Shift					End of Shift				
		Date	Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)	Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)			
Instrument Groundwater Observations															
Inst. [A] Type : Slotted Standpipe															
						Instrument [A]			Remarks						
		Date	Time	Depth (m)	Level (mOD)										
		22/06/16		3.20	108.92	Reading provided by Create Consulting on 6 July 2016									
		06/07/16		3.20	108.92										
				105.12	7.00	Slotted Standpipe									
				102.12	10.00	General Backfill									

Remarks

Reading taken by Client.

				A F Howland Associates Geotechnical Engineers		Site 6A Grange Road, London N6 4AP		Number WS02		
Excavation Method Tracked Window Sampling Rig, Dando Terrier 2002. 87 mm to 6.00 m 75 mm to 9.45 m		Dimensions		Ground Level (mOD) 112.15		Client Lawrence Bent		Job Number 16.185		
		Location 528024 E 188067 N		Dates 01/06/2016		Engineer Create Consulting Engineers Limited		Sheet 1/2		
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water	
0.60-1.20	B1					TOPSOIL (Grass over dark brown slightly clayey gravelly fine to coarse sand. Gravel is subangular to subrounded fine to coarse brick, flint, concrete. Occasional rootlets)				
					111.85	0.30	MADE GROUND (Dark brown slightly clayey gravelly fine to coarse sand. Gravel is subangular to subrounded fine to coarse flint and brick)			
					111.55	0.60	Firm orange brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium flint. Occasional rootlets			
1.20-1.71 1.20-1.65	SPT D1 N=13		IP 60/S 1,1 T 3,3,3,4							
					110.85	1.30	Firm mottled orange brown and grey slightly sandy CLAY. Occasional rootlets			
1.70-1.90	D2					(0.90)	 with rare fine to medium gravel #			
2.20-2.45	U1		42 blows		109.95	2.20	Medium dense orange brown with occasional grey silty fine SAND			
2.50-3.00	B2									
3.00-3.50 3.00-3.45 3.00-4.00	SPT D3 B3 N=11		IP 50/S 2,1 T 2,3,3,3							
4.00-4.49 4.00-4.45 4.00-5.00	SPT D4 B4 N=12	3.78	IP 40/S 2,2 T 2,2,3,5 Slow(1) at 4.30m, rose to 3.72m in 20 mins, sealed at 5.00m.			(3.70)			▽1	
5.00-5.46	SPT		IP 10/S 3,2							
Remarks 1. Location CAT scanned prior to excavation. 2. Hand dug inspection pit to 1.20 m. 3. No groundwater encountered. 4. Poor sample recovery from 8.00m to 9.00m 5. # Laboratory observation.								Scale (approx) 1:25	Logged By JK	
								Figure No. 16.185.WS02		

 A F Howland Associates Geotechnical Engineers					Site 6A Grange Road, London N6 4AP			Number WS02	
Excavation Method Tracked Window Sampling Rig, Dando Terrier 2002. 87 mm to 6.00 m 75 mm to 9.45 m		Dimensions		Ground Level (mOD) 112.15		Client Lawrence Bent		Job Number 16.185	
		Location 528024 E 188067 N		Dates 01/06/2016		Engineer Create Consulting Engineers Limited		Sheet 2/2	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
5.00-5.45 5.00-5.90	D5 B5 N=16		T 4,4,4,4			Medium dense orange brown with occasional grey silty fine SAND, becoming clayey in places			
5.90-6.00 6.00-6.45	D6 U2		23 blows	106.25 106.05	5.90 (0.20) 6.10	Firm orange brown with grey partings sandy CLAY			
6.45-7.00	B6					Medium dense orange brown with occasional grey silty fine SAND			
7.00-7.45 7.00-7.45 7.00-7.50	SPT N=13 D7 B7		4.50	IP 0/S 1,1 T 3,3,3,4		(1.80)			
8.00-8.45 8.00-8.45 8.00-9.00	SPT N=12 D8 D9	4.30	IP 0/S 3,2 T 3,3,3,3	104.25	7.90 (1.10)	Firm greyish green slightly sandy CLAY with occasional silt partings			
9.00-9.45	SPT(C) N=14	4.29	IP 0/S 3,3 T 3,4,3,4	103.15	9.00	Complete at 9.45m			
Remarks							Scale (approx)	Logged By	
							1:25	JK	
							Figure No. 16.185.WS02		

Installation Type Single Installation	Dimensions Internal Diameter of Tube [A] = 19 mm		Client Lawrence Bent	Job Number 16.185
	Location 528024 E 188067 N	Ground Level (mOD) 112.15	Engineer Create Consulting Engineers Limited	Sheet 1/1

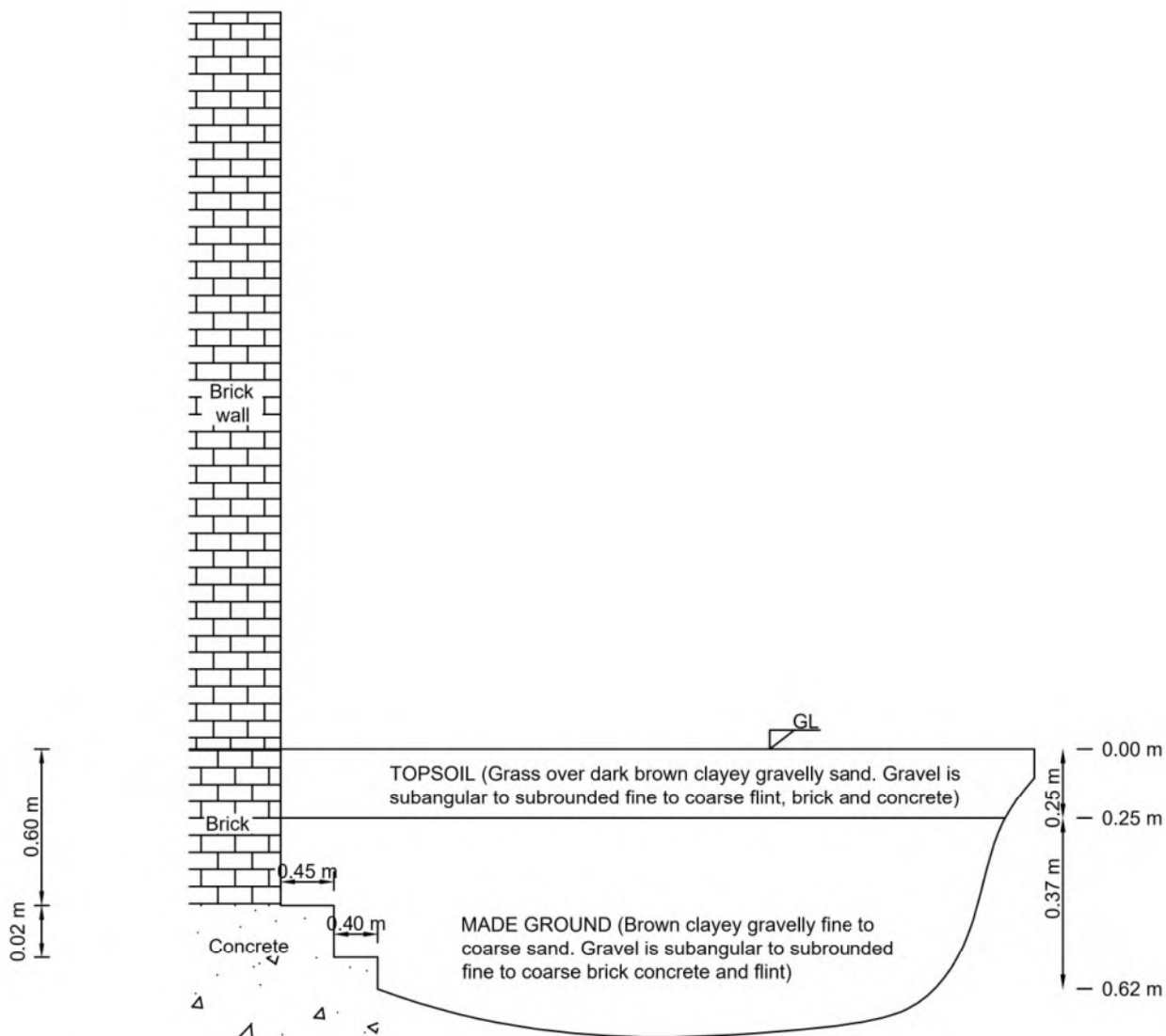
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Remarks
Reading taken by Client.

APPENDIX D: TRIAL PIT RECORDS



				A F Howland Associates Geotechnical Engineers		Site 6A Grange Road, London N6 4AP		Trial Pit Number TP01	
Excavation Method Hand Dug Inspection Pit		Dimensions 0.70 m x 0.85 m x 0.62 m		Ground Level (mOD) 112.82		Client Lawrence Bent		Job Number 16.185	
		Location 528017 E 188064 N		Dates 31/05/2016		Engineer Create Consulting Engineers Limited		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
				112.57	(0.25)	TOPSOIL (Grass over dark brown clayey gravelly sand. Gravel is subangular to subrounded fine to coarse flint, brick and concrete)			
					0.25	MADE GROUND (Brown clayey gravelly fine to coarse sand. Gravel is subangular to subrounded fine to coarse brick concrete and flint)			
					(0.37)				
				112.20	0.62	Complete at 0.62m			
No image available						Remarks			
						1. Concrete obstruction encountered in pit, service suspected, therefore position changed to TP01A.			
Scale (approx)						Logged By		Figure No.	
1:20						JK		16.185.TP01	



Not to Scale



A F Howland Associates
Geotechnical Engineers

Site: 6A Grange Road, London N6 4AP

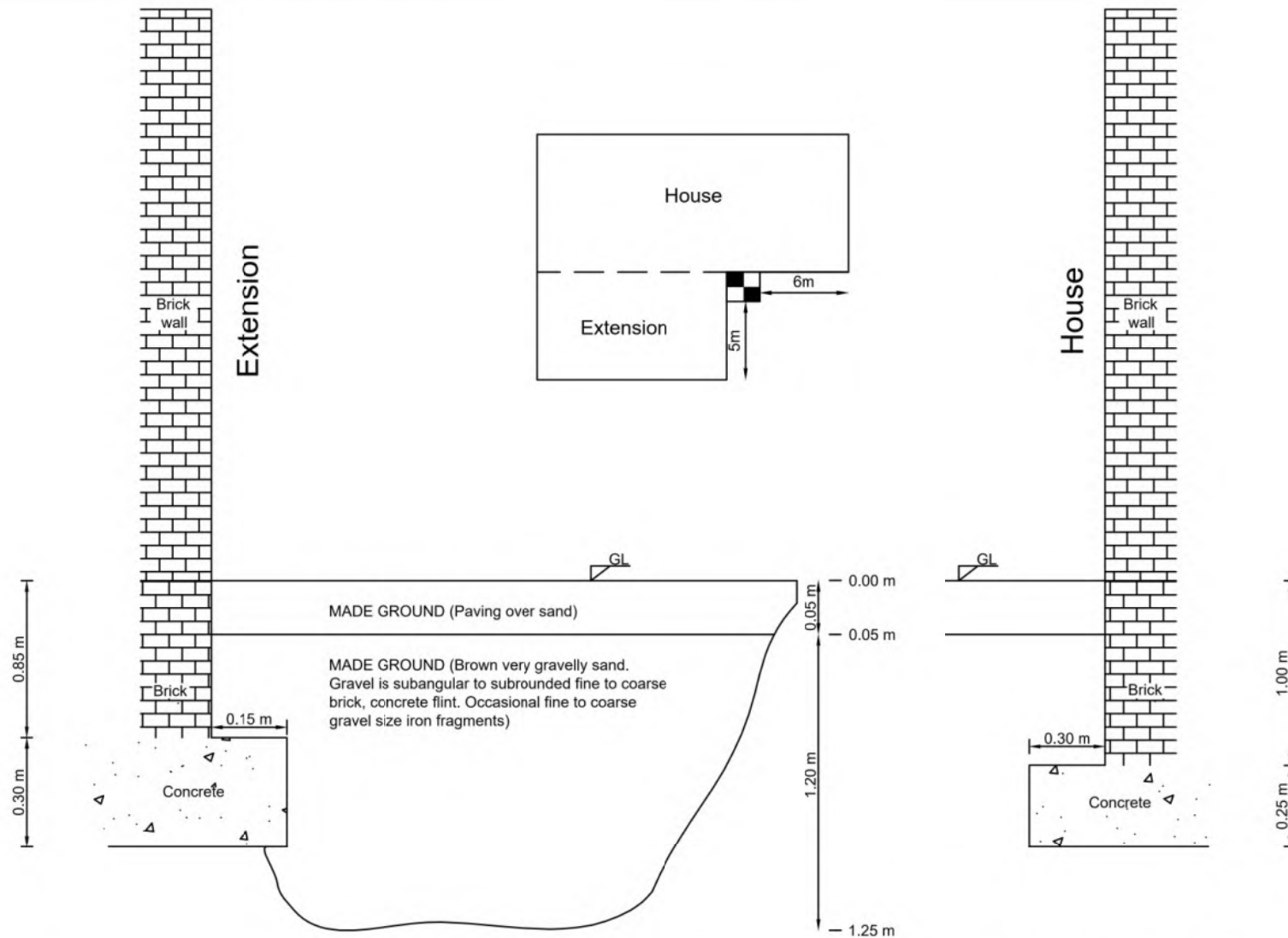
Diagrammatic Cross Section of Trial Pit (TP01)

Client : Lawrence Bent

Date : July 2016

Dwg : 16.185/TP01

				A F Howland Associates Geotechnical Engineers		Site 6A Grange Road, London N6 4AP		Trial Pit Number TP01A	
Excavation Method Hand Dug Inspection Pit		Dimensions 0.60 m x 0.60 x 1.25 m		Ground Level (mOD) 112.10		Client Lawrence Bent		Job Number 16.185	
		Location 528010 E 188062 N		Dates 01/06/2016		Engineer Create Consulting Engineers Limited		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
				112.05	0.05	MADE GROUND (Paving over sand)			
					(0.95)	MADE GROUND (Brown very gravelly sand. Gravel is subangular to subrounded fine to coarse brick, concrete flint. Occasional fine to coarse gravel size iron fragments)			
				111.10	1.00	Made GROUND (Firm orange brown and brown slightly sandy slightly gravelly clay. Gravel is subangular to subrounded fine to coarse flint and brick)			
				110.90	1.20	Complete at 1.25m			
No image available						Remarks			
						Scale (approx)	Logged By	Figure No.	
						1:20	JK	16.185.TP01A	



A F Howland Associates
Geotechnical Engineers

Site: 6A Grange Road, London N6 4AP

Diagrammatic Cross Section of Trial Pit (TP01A)

Client : Lawrence Bent

Date : July 2016

Dwg : 16.185/TP01A