Basement Impact Assessment

38 Frognal Lane

Introduction

A Basement Impact Assessment (BIA) is required for all planning applications with basements in Camden.

Basement Impact Assessments must be prepared in general accordance with policies and technical procedures contained within the documents listed below.

- Guidance for Subterranean Development (GSD). Issue 01. November 2010. Ove Arup & Partners.
- Camden Planning Guidance (CPG): Basements (March 2018).
- Camden Local Plan 2017[1] (: Policy A5 Basements and Policy CC3 Water and flooding.

[1] https://www.camden.gov.uk/localplan

38 Frognal Lane NW3 6PP

Basement Impact Assessment

Planning reference no [if known]

For

MRPP

Project Number: T&K 14604

7th October 2020

Revisions & additional material

Document History and Status

Revision	Date	Purpose/Status	File Ref	Author	Check	Review

Document Details

Last saved	5th October 2020
Path	Document1
Author	Norman Train, Train and Kemp
Reviewer	Chris Swainston, Soils Ltd
Project Name	38 Frognal Lane
Planning Reference No.	

Additional supporting documents

Please note – the review process will be quicker if these are submitted as Word documents or searchable PDFs.

D	Version	Produced by
Flood Risk Assessment	2	Norman Train
Ground Movement and Building Damage Assessment	0	Norman Train
Surface Water Strategy	Drg 1611-100 P2	Simon Dent Associates

Please list all revisions here: 1

D a t e	Version	Produced by
None		

Contents

Appendices

Appendix 4: Ground Movement and Damage Impact Assessment

Appendix 5: Structural Engineer's Statement

Appendix 6: Arboricultural Report/Surface Water Drainage Strategy

1. Non-Technical Summary

1. The site location is 38 Frognal Lane, NW3 6PP. See Location Plan on drawing -PL-010.

2. The current site arrangement is a two storey detached house. See the following drawings:

3. The proposed development comprises a two storey detached house with a basement. See referenced drawings above.

4. The following assessments are presented:

    - Desk Study
    - Screening
    - Scoping
    - Additional evidence/assessments (as required)
        - *Site investigation*
        - *Arboricultural report*
        - *Ground movement assessment*
        - *Consultation with adjacent infrastructure/asset owners*
        - *Flood risk assessments*
        - *Surface water drainage strategy/SUDS assessment*
        - *Others*
    - *Impact Assessment*

5. The authors of the assessments are:

    The lead author is Norman Train, BSc, CEng, FICE, FIStructE, consultant to Train and Kemp with over 40 years' experience in foundation design and structures

    The BIA has been reviewed and approved by Chris Swainston, BSc (Hons) Geology PGCE FGS CGeol

6. The ground and groundwater conditions beneath the site are Claygate Members overlying London Clay with a perched water table to the base of the Claygate Members

7. The construction methods proposed are a contiguous piled wall and reinforced concrete box construction to the basement with traditional masonry and concrete floors over. The contiguous piled wall will be propped during the construction with the lid to the box propping it permanently

8. A structural monitoring strategy to control the works and impacts to neighbouring structures will comprise Tell tail crack gauges, as agreed with the adjoining owners party wall surveyor, installed on existing cracks within adjoining properties.

9. The BIA has assessed land stability and the impacts of the proposed development on neighbouring structures will be to no greater that Burland Category 1

10. The BIA has identified that there are no potential slope stability impacts.

11. The BIA has identified that there are no potential hydrological impacts

12. The BIA has identified that the basement perimeter piles will intercept the perched water table in the Claygate Members. To mitigate this, a pea shingle layer will be installed around the outside of the basement to intercept the groundwater on the upper side and replenish the water table on the low side.

13. As in the FRA, there is a very low flood risk with the proposed development.

2. Introduction

The purpose of this assessment is to consider the effects of a proposed basement development at 38 Frognal Lane, NW3 6PP on the local hydrology, geology and hydrogeology and potential impacts to neighbours and the wider environment. The site location is presented in drawing PL-010.

The BIA approach follows current planning procedure for basements and lightwells adopted by LB Camden and comprises the following elements (CPG Basements):

- Desk Study;
- Screening;
- Scoping;
- Site Investigation, monitoring, interpretation and ground movement assessment;
- Impact Assessment

2.1. Authors

2.1.1. The BIA has been authored by Norman Train, BSc, CEng, FICE, FIStructE, consultant to Train and Kemp with over 40 years' experience in foundation design and structures

2.1.2. The BIA has been reviewed and approved by Chris Swainston, BSc (Hons) Geology PGCE FGS CGeol

2.2. Sources of Information

The following baseline data have been referenced to complete the BIA in relation to the proposed development:

- In terms of consultation with neighbours, no specific consultation took place prior to the submission of the previous basement application in 2016 (ref. 2014/7752/P). Furthermore, BIA Guidance states that *"the Council will expect consultation with local residents on all basement developments unless the proposed construction work is minimal and will have a negligible effect on the adjoining or nearby properties as evidenced by the applicant to the satisfaction of the Council."* It is considered appropriate therefore that the same approach is taken with respect of this current application noting that the planning application

process enables interested parties to comment on all aspects of the planning application, including the BIA.

- Location Plan (PL-010), Site Plan (PL-011);
- Geological mapping: BGS website base Geological Map or UK;
- Hydrogeological data based on previous and current site investigations AP Geotechnics;
- Current/historical hydrological data with LB Camden Flood Risk Management Strategy, FRMS, 2013*;*
- Flood risk mapping EA Flood Maps
- LB Camden, Strategic Flood Risk Assessment (produced by URS, 2014);
- LB Camden, Floods in Camden, Report of the Floods Scrutiny Panel (2013);
- LB Camden, Planning Guidance (CPG) – Basements (March 2018);
- LB Camden, Camden Geological, Hydrogeological and Hydrological Study – Guidance for Subterranean Development (produced by Arup, 2010);
- LB Camden, Local Plan Policy A5 Basements (2017);
- LB Camden's Audit Process Terms of Reference;

2.3. Existing and Proposed Development

2.3.1. The Application site is located towards the top of the slope on Frognal Lane where the slope angle is less than 6^{o}. The application comprises the demolition of the existing building and the erection of a replacement property incorporating a basement.

2.3.2. The site is located on 38 Frognal Lane. The site is located where Chesterford Gardens terminates on Frognal Lane and is sloped. Refer to PL-010 Location Plan, PL-011 Site Plan & PL-204 Street Elevation.

2.3.3. The site currently holds a 2 storey dwelling.

2.3.4. To the east of the site is 40 Frognal Lane; a Grade II listed private house. 40 Frognal Lane has a live consent for a basement until 1 May 2021. To the West is located 12 Langland Gardens, a multi-residential building with a basement. Please refer to PL-011 Site Plan, PL-204 Street Elevation & PL-300 Sections - AA.

2.3.5. Neighbouring buildings include the following Listed properties: 40 Frognal Lane.

2.3.6. Neighbouring gardens and trees are present at 40 Frognal Lane and 12 Langland Gardens and will be protected in accordance with (A5 Basements (Local Plan 2017).

2.3.7. Existing and Proposed development drawings are presented in the following drawings:

PL-010 Location Plan
PL-011 Site Plan
PL-099 Basement Plan
PL-100 Ground Floor Plan
PL-101 First Floor Plan
PL-102 Second Floor Plan
PL-103 Roof Plan
PL-200 Front Elevation _ North
PL-201 Side Elevation _ East
PL-202 Rear Elevation _ South
PL-203 Side Elevation _ West
PL-204 Street Elevation
PL-300 Sections - AA
PL-305 Sections - BB

2.3.8. The proposed development will be the full demolition of the existing building, salvaging as many bricks as possible, along with termination of all utilities to allow construction of the new building. The new basement will be formed with contiguous piled external wall and an internal waterproof concrete box. The perimeter walls will be propped during construction with the lid to the concrete box providing the permanent propping. The reduced level of the basement and the pool excavations will be +86.2m OD and 84.4m OD respectively. Given that the upper ground floor to No 12 Langland Gardens is at +88.8 OD, its foundations will be at 88.0m OD which is higher than basement excavation. Streets in the surrounding area are wide enough for both goods and plant machinery.

2.3.9. The outline construction programme for the proposed development is outlined within the Construction Management Plan

3. Desk Study

3.1. Site History

3.1.1. The property is located on the south side of Frognal Lane, opposite the junction with Chesterford Gardens. The property is detached, modest in scale and set back from the road. Much of the ground floor is screened by a low brick wall, fence and planting. The property is comprised of brick, under clay tiles, with timer casement windows. The front façade of the original property is highly symmetrical. The property is pleasant in its appearance but does not have any special architectural features.

There have been a number of additions to the property, notably an attached garage to its left side, a side return to the right side and a large conservatory to the rear. Various internal alterations have also been made, though none manifest externally. There is a modest garden to the rear, which includes a number of trees.

There have been numerous applications on the site for various alterations and extensions to the property, including the addition of a basement underneath the existing building. However, to date, none of these applications have been implemented.

3.2. Geology

3.2.1. The British Geology Survey, Map of the Geology of UK, indicates that the site is underlain by Claygate Members overlying London Clay. This has been confirmed by the historical site investigations

3.3. Hydrogeology

3.3.1. The site is founded on Claygate Members which are classified as a Secondary A Aquifer with the underlying London Clay being an Unproductive Stratum.

3.3.2. LB Camden data indicates the site is not within a groundwater source protection zone and there are no recorded water abstractions in the area.

3.4. Hydrology, Drainage and Flood Risk

3.4.1. CGHH Fig 13, Hampstead Heath Map, shows that the nearest water feature is the Whitestone Pond, 0.75km to the north of the site, at a higher elevation, in a different catchment and on overlying strata and hence too remote to affect the site.

3.4.2. CGHH Fig 11, Watercourses, shows that two tributaries of the River Westbourne start in Langland Gardens and Frognal to the south-west, and the east of the site near University

College School; these are at some 100m and 200m from the site respectively and will relate to the outcrop of the London Clay. There are no reported springs in the area.

3.4.3. CGHH Fig 14, Hampstead Heath Surface Water Catchment, shows that the Hampstead Ponds catchment is 0.75km to the north of the site. The site is not within the catchment of the Hampstead Heath Pond Chain.

3.4.4. The total site area is currently some 590 sq.m and is a mixture of roofs, hardstanding driveways and soft areas with approximately 50:50 permeable/impermeable ratio. The current greenfield rates for the sites are very low and are as follows for the 1 year, 30 year & 100 year event respectively; 0.38 lit/sec, 1.02 lit/sec & 1.41 lit/sec. The existing site survey drawing no. 3798-T by MSA refers.

3.4.5. The proposed surface area will comprise a mixture of roofs, hardstandings and soft gardens areas as before however, the external hardstanding areas shall be finished with a drainage cavity board system to both source control flows and provide a treatment train for discharge water. These permeable areas will comprise 280 sq.m with the impermeable roof offering 180 sq.m and the remaining areas to be soft. In addition, all rainwater downpipes shall be provided with water butts to assist in reusing rainwater for irrigation and gardening.

3.4.6. The geology of the site indicates infiltration to the ground is not possible. All storm water discharges from the site will be intercepted by an attenuation geocell below ground structure with the final flow control chamber restricting run off from the site to 2.0 lit/sec.; this being the lowest practicable non mechanical flow control device available and replicating as near to existing greenfield run off rates as possible, with a final connection made to the existing drainage and consequent sewer.

3.4.7. The site is classified as low risk of surface water flooding and is not within a Local Flood Risk Zone.

3.4.8. The site is not within a Critical Drainage Area. The Surface Water Management Plan 2013, Fig 3.1, shows LFRZ 3015, Frognal, is to the east of the site.

4. Screening

4.1.1. A screening process has been undertaken and the findings are described below.

Question	Response	Details
1a. Is the site located directly above an aquifer?	Yes-	CGHH Figs 4 and 8
1b. Will the proposed basement extend beneath the water table surface?	Yes-	See Site Investigation in Appendix 2
2. Is the site within 100mof a watercourse, well (used / disused) or potential spring line?	No-	CGHH Fig 11, Watercourses, show that a tributary to the River Westboure starts over 100m to the south in Langland Gardens
3. Is the site within the catchment of the pond chains on Hampstead Heath?	No-	CGHH Fig 14 , Hampstead Heath Surface Water Catchment Areas shows the site is 0.75km south of these catchments
4. Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?	No-	The proposed basement has no impact on the final surface area of the site.
5. As part of site drainage, will more surface water (e.g. rainfall and run-off) than at present be discharged to the ground (e.g. via soakaways and/or SUDS)?	No-	The proposed attenuation and flow control will restrict the run off from the site from a 1 in 100 year storm with 40% climate change increase
6. Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to, or lower than, the mean water level in any local pond (not just the pond chains on Hampstead Heath) or spring line?	No-	CGHH Fig 12 Camden Surface Water Features shows the site in not close to any local pond or water feature.

4.2. Slope Stability

Question	Response	Details
1. Does the existing site include slopes, natural or man-made greater than 7 degrees (approximately 1 in 8)?	No-	CGHH Fig 16, Slope Angle Map shows the slopes are less than 7°
2. Will the proposed re-profiling of landscaping at the site change slopes at the property boundary to more than 7 degrees (approximately 1 in 8)?	No-	The current levels will be maintained and there will not be any re-profiling of the landscaping

3. Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7 degrees (approximately 1 in 8)?	No-	CGHH Fig 16, Slope Angle Map shows that the site is remote from any railway cuttings or embankements
4. Is the site within a wider hillside setting in which the general slope is greater than 7 degrees (approximately1 in 8)?	No-	CGHH Fig 16 and OS Contour Map
5. Is the London Clay the shallowest strata at the site?	No-	Geological Maps and Site Investigations show the site is founded on Claygate Members
6. Will any trees be felled as part of the development and/or are any works proposed within any tree protection zones where trees are to be retained?	No	See Arboriculturist's Report in Appendix 6
7. Is there a history of seasonal shrink-swell subsidence in the local area and/or evidence of such effects at the site?`	No-	Claygate Members exhibit less seasonal shrink/swell than London Clay and existing house at No 38 is crack free.
8. Is the site within 100m of a watercourse or a potential spring line?	No-	CGHH Fig 11, Watercourses
9. Is the site within an area of previously worked ground?	No-	No historical records
10. Is the site within an aquifer. If so, will the proposed basement extend beneath the water table such that dewatering may be required during construction?	No-	Whilst the basement will extend into the aquifer, the contiguous piled water will form its own barrier to the minor flows and dewatering techniques will not be required.
11. Is the site within 50m of the Hampstead Heath Ponds?	No-	CGHH Fig 13, Hampstead Heath Map shows the ponds are 0.75km to the north
12. Is the site within 5m of a highway or pedestrian right of way?	Yes-	The site has a street frontage along Frognal Lane
13. Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	Yes-	12 Langland Gardens is within 3m of the basement
14. Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?	No-	London Underground Norther Line is 0.5km to east of site

4.3. Surface Water and Flooding

Question	Response	Details
1. Is the site within the catchment of the ponds chains on Hampstead Heath?	No-	CGHH Fig 14 , Hampstead Heath Surface Water Catchment Areas shows the site is 0.75km south of these catchments

2. As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route?	Yes	The proposed attenuation and flow control will restrict the run off from the site from a 1 in 100 year storm with 40% climate change increase
3. Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	No	The proposed basement has no impact on the final surface area of the site.
4. Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface water being received by adjacent properties or downstream watercourses?	No-	Changes in impervious areas are minimal
5. Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	No-	No changes in the quality of the surface water discharge.
6. Is the site in an area identified to have surface water flood risk according to either the Local Flood Risk Management Strategy or the Strategic Flood Risk Assessment or is it at risk from flooding, for example because the proposed basement is below the static water level of nearby surface water feature.	No-	See FRA in Appendix 6

4.4. Non-Technical Summary of Screening Process

4.4.1. The screening process identifies the following issues to be carried forward to scoping for further assessment:

- The site is on a Secondary A Aquifer
- The basement will extend beneath the water table
- The basement will be deeper than the foundations of the neighbouring properties

4.4.2. The other potential concerns considered within the screening process have been demonstrated to be not applicable or not significant when applied to the proposed development.

- The site is within 5m of the highway.

5. Scoping

The following issues have been brought forward from the Screening process for further assessment:

5.1. Surface Water and Flooding

5.1.1 Although the site is in EA Flood Zone 1 and a Site Specific Flood Risk Assessment is not required, a SSFRA has been completed and is included Appendix 6.

5.1.2 The conclusions of the SSFRA are:

- The reconstruction of the house with a basement will not impact on the flood risk of the area.
- SUDS will reduce the impact of the surface water discharge into the adopted sewer.
- The forecourt level should include a mound to a level of +91.0 OD to take cognisance of any backflow onto the site from surface water flowing down Frognal Lane.

5.2. Slope Stability

5.2.1. The natural slope on Frognal Lane and Langland Gardens are 1 in 10, which is less than 7°.

5.2.2. This is correlated by GHHS Figure 16, which also shows the site is remote from any railway cuttings or embankments.

5.2.3. No further assessment is considered necessary. There will be no impacts to slope stability.

5.3. Drainage

5.3.1. The application site is not within a critical drainage area.

5.3.2. The existing impermeable area of 200m^2 will increase to 230m^2 with the proposed development; an increase of 30m^2. However, there will be a reduction of run off flows by the addition of attenuation storage with a restricted discharge of only 2.0 lit/sec from the site; the lowest practicable non mechanical flow control available.

5.3.3. A drainage assessment has been indicated by Simon Dent Associates upon their Drawing 1611 100 in Appendix 6.

5.3.4. The assessment and drainage design improves the existing site conditions and reduces the discharge to the adopted drainage infrastructure.

5.4. Ground Movement and Building Damage

5.4.1. The proposed basement will be lower than the foundations to both No 40 Frognal Lane and 12 Langland Gardens.

5.4.2. The proposed development will increase the differential foundation depth with neighbours. Construction and excavation activities will cause ground movements that have the potential to damage existing, neighbouring structures.

5.4.3. It is considered that the development proposals can be suitably designed to maintain stability. In order to demonstrate this, a site specific ground investigation is presented in Section 6, with structural information and a ground movement assessment presented in Section 7. Conclusions of the impact assessment are provided in Section 8.

5.5. Groundwater and Hydrogeology

5.5.1. The Site Investigation have established that the thickness of the Claygate Members beneath the site is 7m with CGHH, Fig 4 showing the London Clay to outcrop 120m down the slope. The thickness of the Claygate Members decreases to the south and west by 1m in 15m.

5.5.2. Water will collect to the base of the Claygate Members perching above the impervious London Clay. Given the moderately low permeability of the Claygate Members, it is expected that it will contain water all year round.

Catchment & Macro Groundwater Flows

5.5.3. The Claygate Member/London Clay contact is shown on CGHH Fig 4 to pass along Lindfield Gardens, across Langland Gardens and Frognal Lane, at an elevation of approximately 82m AOD. This is coincident with the start of the River Westbourne tributary shown on CGHH Fig 11 as being 100m south-west of the site, within a shallow valley. A second tributary commences beneath University College School, 200m east of the site, again on the Claygate Member/London Clay contact, again at an elevation of approximately 82m AOD, again in a shallow valley feature.

5.5.4. The location of these two tributaries, suggests the site is located near a groundwater divide. Hence the area of the catchment contributing to the tributary commencing on Langland Gardens, and in which the site must be located, is relatively small.

5.5.5. Based upon the location of the three tributaries identified on CGHH Fig 11, and the extent of the Hampstead Pond Catchment Area on CGHH Fig 14, defines the catchment area for

the Langland Gardens tributary as being approximately 10 hectares (200m wide, 500m long). Assuming a typical average recharge into the Claygate Member of no more than 250mm/yr, would yield an average annual groundwater contribution to the tributary of 25,000m^3/yr, which equates on average to 1 litre per second.

5.5.6. Whilst it is unknown whether these tributaries flow year round or just in winter months, clearly a flow of typically 1 litre per second is fairly minimal, especially if dispersed along a wide seepage horizon.

Groundwater Throughflow beneath the site

5.5.7. An estimate of the groundwater throughflow beneath the site can be calculated using Darcy's Law Q = k i a, where:

k = permeability, which is taken as being 1 x 10^{-6} m/s. [See 7.1.1]

i = hydraulic gradient, which is taken from the 2014 Site Investigation as being 5 x 10^{-2}

a = the cross-sectional area comprising a water table depth of 6m and a site and basement widths of 30m and 20m respectively giving cross sectional areas of 180m^2 and 120m^2

This gives a value of 0.009l/s or 0.75m^3/day for the site and 0.006l/s or 0.5m^3/day for the basement. This is very little water and within the capacity of a sump pump during excavations.

Groundwater Flow Obstructions

5.5.8. No 12 Langland Gardens, down the slope from No 38, is 17m wide and its lower ground floor is at +86m OD. This lower ground floor obstructs but does not cut off the groundwater flow

5.5.9. This means that the proposed basement is in the shadow of No 12 Langland Gardens with the latter defining the status quo with regard to groundwater flow below the site

5.5.10. Groundwater flows will eventually move around the impermeable box consequently there is unlikely to be an effect to the catchment of the river tributaries. Even if the site groundwater flows were to be lost, these site groundwater throughflows (estimated at no more than 0.003 l/s) are less than 0.5% of the estimated catchment groundwater baseflow and hence will be immeasurable and negligible.

5.5.11. However, the proposed basement will impact on the water table, raising the free surface on the upstream side and depressing it on the downstream side.

5.5.12. The proposed basement is 14m from the centerline of Frognal Lane. To the rear there are no houses to the south of No 38. No 40 is 19m up the slope to the west of No 38.

5.5.13. The magnitude of the groundwater level changes due to construction of the impermeable basement and pool, without further mitigation are difficult to quantify, given the existing basement disturbance to the Claygate Member at the adjacent houses. However, experience in similar strata suggests these will be of the order of 0.2 -0.8m. This will be in

No 40 Frognal Lane's garden and will not affect the house which is 20m further up the slope

Mitigation Measures

5.5.14. As mitigation measures:

5.5.14.1. a pea shingle blanket will be installed around the basement to intercept the groundwater on the high side, allow it to flow around the basement and replenish the water table on the low side.

5.5.14.1.1. Contiguous piles will be used with 150mm gap between 600mm diameter piles giving a 20% pathways beneath the basement slabs

6. Site Investigation/Additional Assessments

6.1. Site Investigation

Soils Ltd have completed two Site Investigations on 38 Frognal Lane in 2014 and again in 2020. Details of these are given in Appendix 2.

2014
The 2014 site investigation comprised two window samplers to a depth of 6m in the forecourt. This established that the Claygate Members extend to a greater depth than 6m.

Standpipes were installed in both window samplers with the groundwater measured in December 2013 and January 2014. Initially the depth was 2.0m [east] and 2.8m [west] rising after a month to 0.8m [east] and 1.5m [west]. Being on the forecourt, the locations were at the same level,18m apart, so the gradient of the phreatic surface across the site in early 2014 was 1 in 20.

2020
The 2020 site investigation comprised a 20m borehole in the forecourt and two 10m window samplers in the rear garden. The 20m borehole gives strength parameters for the pile design. The 10m window samplers established the depth of the London Clay, which ranges between 5.5m and 7.8m in depth.

Standpipes were installed in all three holes and were monitored over a 3-month period.

6.2. Additional Assessments

6.2.1 A Ground Movement and Building Damage Assessment is presented in Appendix 4

6.2.2 An Arboricultural Report is presented in Appendix 6

7. Construction Methodology/ Engineering Statements

7.1. Outline Geotechnical Design Parameters

7.1.1. The geotechnical parameters are presented in the Site Investigation Reports in Appendix 2. A falling head permeability test in No 40 Frognal Lane established that the permeability, k, was 4 x10^{-7} m/s. Conservatively the throughflow has been based on k =1 x 10^{-6} m/s

7.2. Outline Temporary and Permanent Works Proposals

7.2.1. The works proposals include:

- Demolition of the existing house
- Installation of contiguous piles to perimeter of basement and piles to basement columns
- Construction of capping beam or installation of high level wailer system with propping to hold excavation stiff
- Excavation of basement. This will require the interception of any seepages with a sump and pump, but formal dewatering techniques will not be required. The throughflow in 5.5.7 at less than 0.01l/s is well within the capacity of a single sump pump.
- Casting of basement raft and perimeter walls in waterproof concrete
- Removal of wailer and completion of lid to basement box.
- Drainage strategy/SUDS proposals as SDA Drawing 1611 100

7.3. Ground Movement and Damage Impact Assessment

7.3.1. A Ground Movement Assessment (GMA) has been carried out in accordance with CIRIA Report C580.

7.3.2. The conceptual model follows the principles in C580, Section 2.5.2 assuming the strains are uniformly distributed over the zone of influence. The strains tabulated in C580 are:

7.3.2.1. at the surface, reducing linearly to zero at the base of the excavation or walling element. This means that on a slope, where the adjoining building is at a different level, it is the net difference in level rather than the excavation depth that defines the zone of influence

7.3.2.2. perpendicular to the excavation. Whilst only applicable to the horizontal strains at excavation corners or changes in the depth of the wall, if the orientation is at an angle, it is the perpendicular component horizontal strain that is appropriate.

7.3.3. All structures / properties within the zone of influence have been assessed including No 40 Frognal Lane, 12 Langland Gardens.

7.3.4. The ground movements resulting from the works are presented as horizontal and vertical differential settlement strains and plotted on Burland Scale Figures for four locations.

7.3.5. No 40 Frognal Lane and No 12 Langland Gardens were assessed, having been identified as potentially within that zone of influence of the proposed basement.

7.3.6. In accordance with the Burland Scale, the damage impacts are assessed as Category 1 Very Slight or less

7.3.7. Propping of the contiguous piles in both the temporary and permanent works will be used to mitigate and reduce ground movements and damage impacts.

7.4. Control of Construction Works

7.4.1. The construction works will be controlled in accordance with the contract preliminaries and the engineering specifications

7.4.2. The predicted vertical movements in the adjacent buildings are less than 5mm with the differential vertical movements being even smaller again. The predicted damage is Burland Category 1, Very Slight, and level monitoring is neither justified nor practical since the movements are within the closing errors of such surveys. At a pragmatic level Tell Tail crack gauges will be installed, if required by the adjoining owners party wall surveyor, to monitor the movement at any historical cracks.

8. Basement Impact Assessment

8.1. Conceptual Site Model

8.1.1. The Conceptual Site Model (CSM) is…

- The proven ground conditions are Claygate Members overlying London Clays
- The monitored groundwater level is …..
- The natural slope of the road has been terraced to form the current site.
- The existing building has shallow foundations 0.8m below ground level.
- The proposed development will have piled foundations with contiguous piled walls to the basement
- The depths of neighbouring foundations/basements are typically 0.8m below ground level
- The site has a street frontage
- There are no adjacent tunnels or significant utility infrastructure.

8.2. Land Stability/Slope Stability

8.2.1. The site investigation has identified that both the Claygate Member and London Clay are suitable founding strata.

8.2.2. The risk of movement and damage to this development due to seasonal movements of the ground are minimal.

8.2.3. A Ground Movement Assessment has concluded that the potential Damage to surrounding structures within the zone of influence has been assessed as Burland Scale Category 1.

8.2.4. The BIA has concluded that there will not be risk(s) or stability impact(s) to the development and/or adjacent sites due to slopes.

8.3. Hydrogeology and Groundwater Flooding

8.3.1. The BIA has concluded there is a very low risks of groundwater flooding. The local changes to the water table with the obstruction of the basement will be mitigated with a perimeter pea shingle blanket and the gaps between the contiguous beams beneath the basement.

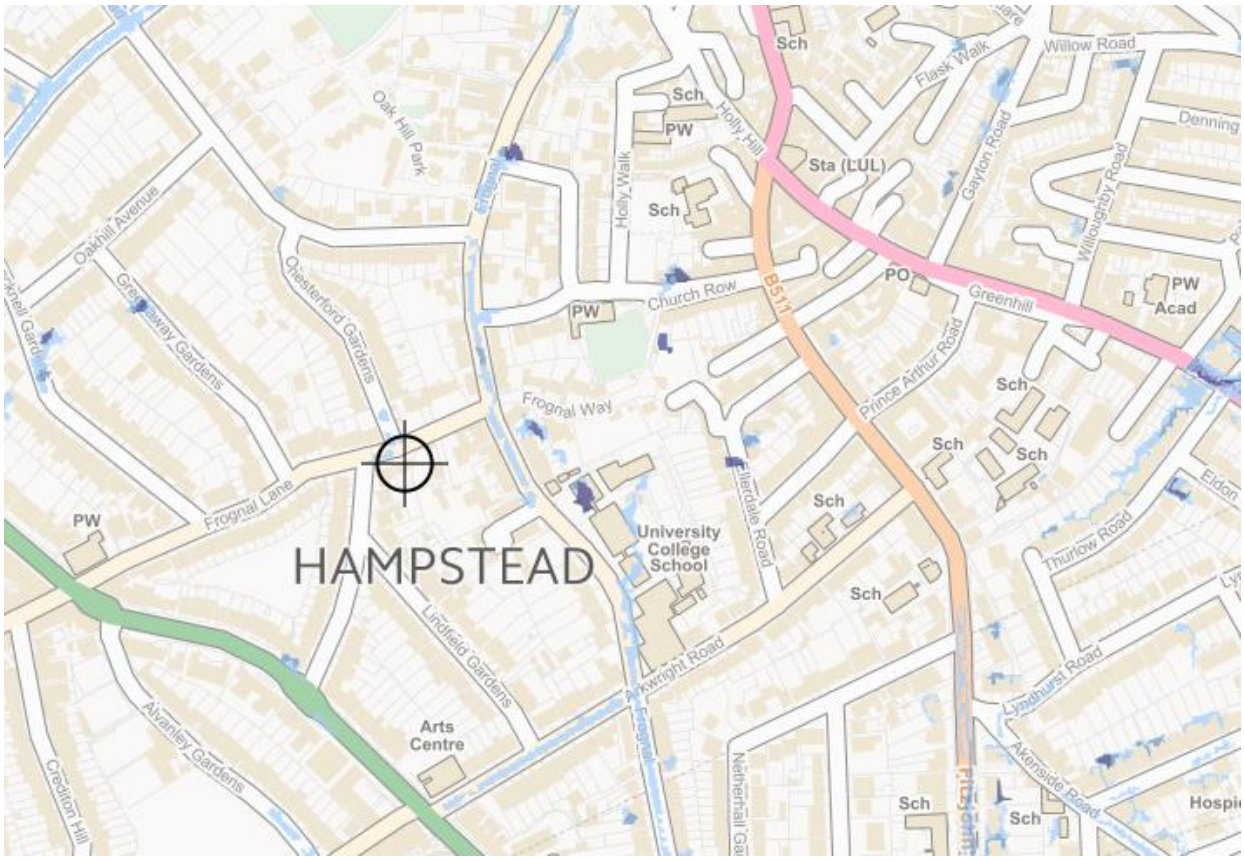
8.3.2. The BIA has concluded there are limited impacts to the wider hydrogeological environment with the construction of the basement are minimal. ……

8.4. Hydrology, Surface Water Flooding and Sewer Flooding

8.4.1. The site specific FRA has concluded there is a low risk of surface water/sewer flooding. Mitigation measures are proposed to reduce the surface water discharge rate with on site storage, as shown on SDA drawing 100, 101, 200 & 201.

8.4.2. The BIA has concluded there are no impacts to the wider hydrological environment.

Appendix 1: Desk Study References



EA Surface Water Flooding Map of NW3 6PP showing some ponding to the southern end of Chesterford Gardens , but not on Frognal Lane.

Appendix 2: Site Investigation Data

Appendix 2 Site Investigation Data

Soils Ltd Site Investigations 2014 and 2020.

soils LIMITED

Geotechnical &
Environmental Consultants

Newton House
Cross Road
Tadworth
Surrey
KT20 5SR

T: 44(0)1737 814221

www.soilslimited.co.uk

Fitzpatrick Construction Ltd

Via Email Only: shelly@fitzp.com

FAO: Brian Fitzpatrick

10 January 2014

Our ref: 14005/FDL/RG

Dear Sir

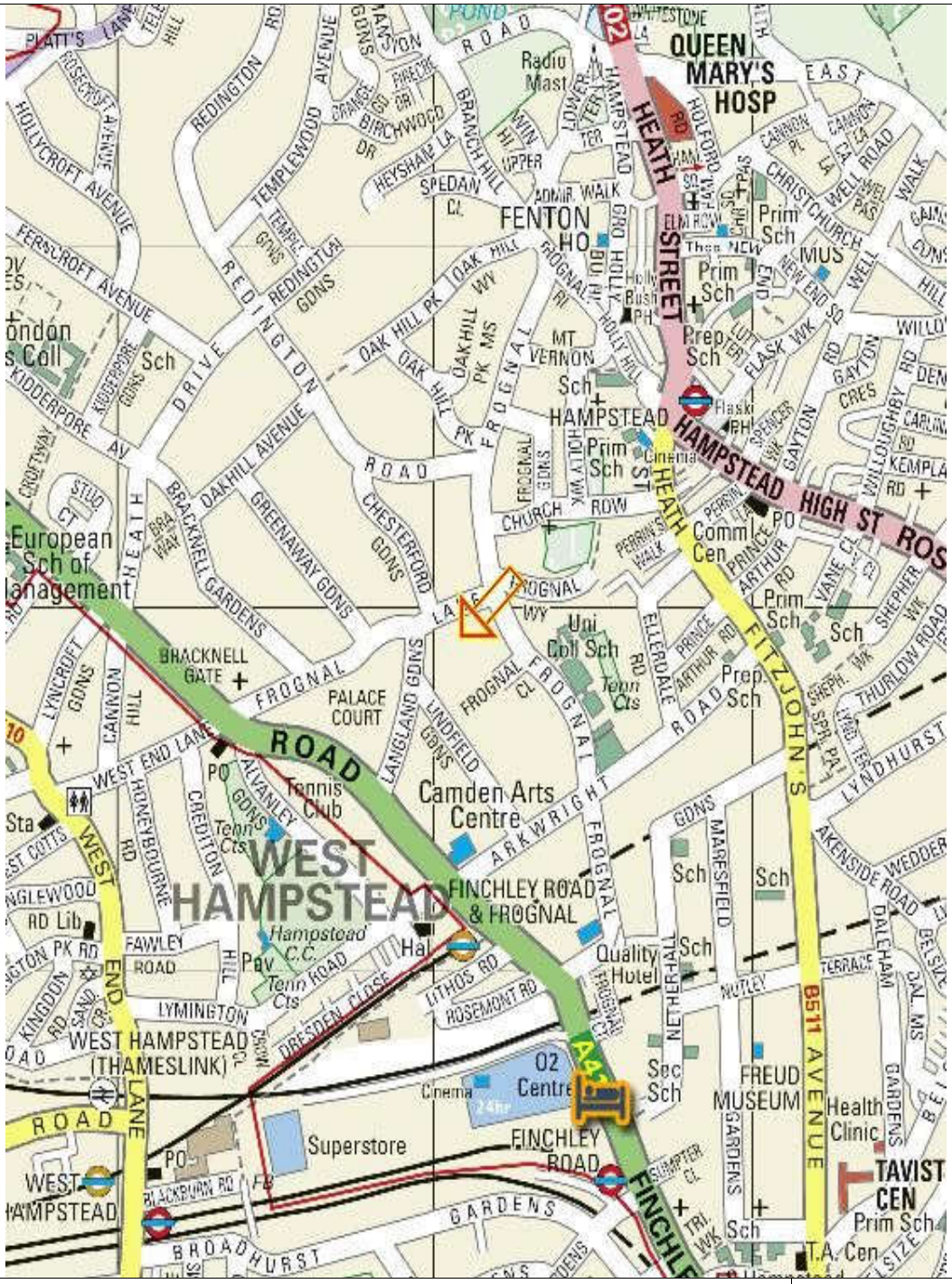
Re: 38 Frognal Lane, Hampstead, London, NW3 6PP

Please find enclosed the field data on the Ground Investigation undertaken on the aforementioned site.

We trust this is the requested data, though should you have any queries please do not hesitate to contact us.

Yours sincerely

Roland Galinski
rg@soilslimited.co.uk
for and on behalf of Soils Limited
enc



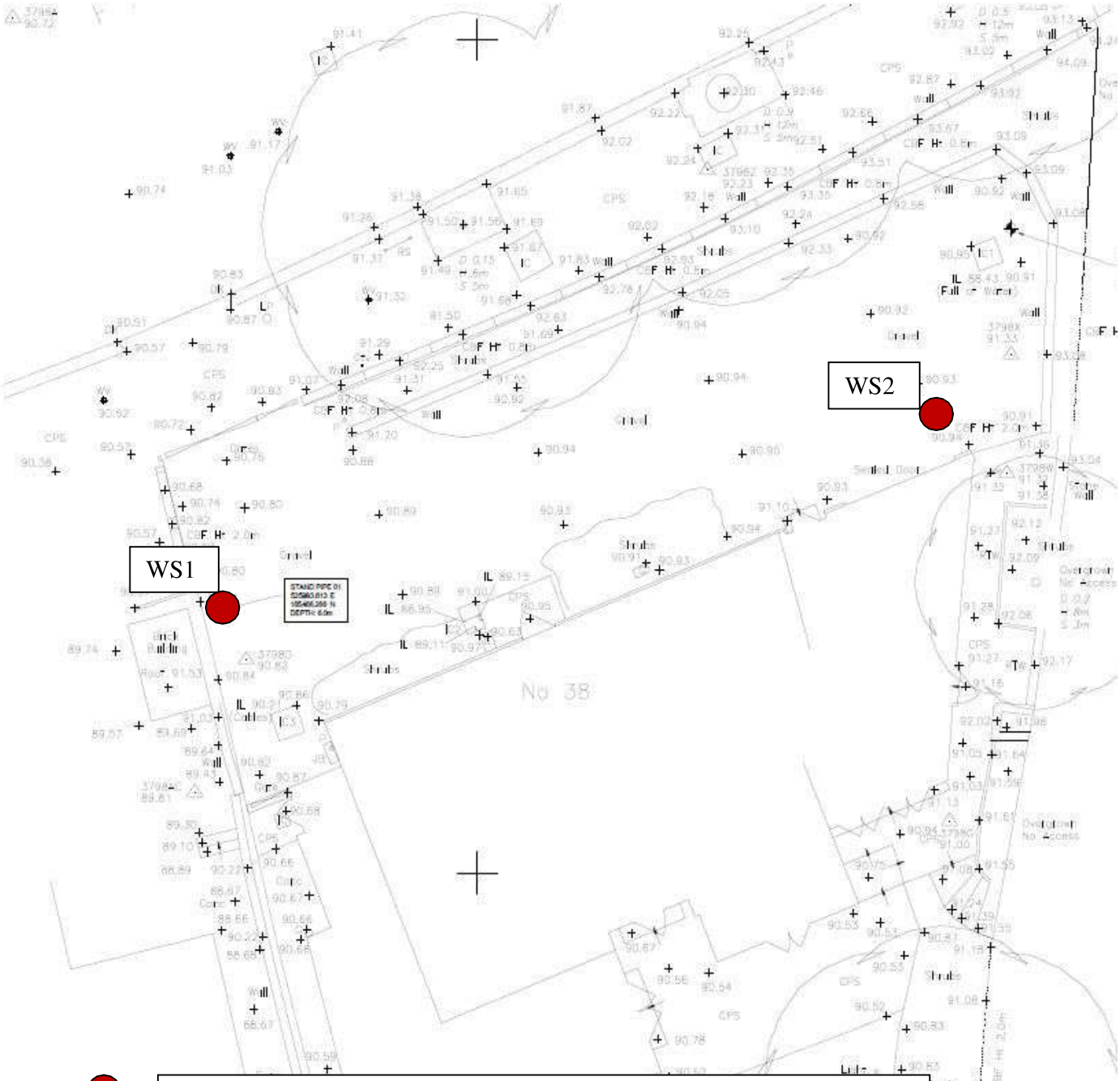
Project: **38 Frognal Lane, Hampstead, London, NW3 6PP**	**Fig No. 1**
Client **Fitzpatrick Construction Ltd**	Date: **January 2014**
Site Location Map	Ref: **14005**

soils LIMITED
Geotechnical & Environmental Consultants

Project: **38 Frognal Lane, Hampstead, London, NW3 6PP**	**Fig No. 2**
Client **Fitzpatrick Construction Ltd**	Date: **January 2014**
Site Location Plan	Ref: **14005**

soils LIMITED

Geotechnical & Environmental Consultants



Windowless sampler borehole with groundwater monitoring well

WS2 location was moved due to a car parked over proposed location

Project: **38 Frognal Lane, Hampstead, London, NW3 6PP**		**Fig No. 3**
Client **Fitzpatrick Construction Ltd**	Date: **January 2014**	soils LIMITED Geotechnical & Environmental Consultants
Trial Hole Location Plan	Ref: **14005**	

Soils Limited
Newton House
Cross Road
Tadworth
Surrey KT20 5SR
Tel: 01737 814221
Fax: 01737 812557

Record of Borehole WS 1

Start Date:	18/12/2014	**Ground Level:**	-
End Date:	18/12/2014	**Easting:**	-
Logged By:	GB	**Northing:**	-

Site: 38 Frognal Lane, Hampstead, London, NW3 6PP
Client: Fitzpatrick Construction Ltd
Project No: 14005

Boring Method: WS
Weather:
Driller: SN

Samples, In-situ Tests & Installations / Strata

Depth	Type	Result	S/Pipe	Elev	Legend	Depth/(Thk)	Description
0.40	D & J					0.13 (0.13)	10mm shingle over block paving, reinforcement grid. MADE GROUND
0.60	D & J					0.35 (0.22)	Pink crushed limestone. MADE GROUND
0.80	D & J					0.55	
1.00	D					0.90	Soft to firm dark orangish red sandy CLAY with brick and ash fragments and occasional rootlets. MADE GROUND
1.50	D						Soft to very soft light orangish brown becoming dark greyish mottled brown CLAY at 2.80m with occasional rootlets. CLAYGATE MEMBER
2.00	D						
2.50	D					3.10	
3.00	D						
3.50	D						
4.00	D					4.00	Soft to firm brown closely fissured CLAY. CLAYGATE MEMBER
4.50	D						
5.00	D					2.00	
5.50	D						
6.00	D					6.00	End of Borehole at 6.00 m

Daily Progress

Date	Time	Hole	Depth	Water Depth

Water Strikes

Strike Depth	Casing Depth	Date	Time	Post Depth	Elapsed Minutes	Depth Sealed
2.80	-	18/12/2014	0000	5.25	10	-

Chiselling

Start Depth	End Depth	Hours

Hole Diameter

Depth	Diam. (mm)

Casing Diameter

Depth	Diam. (mm)

General Remarks:
Roots observed to 2.80m bgl

Soils Limited
Newton House
Cross Road
Tadworth
Surrey KT20 5SR
Tel: 01737 814221
Fax: 01737 812557

Record of Borehole WS 2

Sheet 1 of 1

Start Date:	18/12/2014	**Ground Level:**	-
End Date:	18/12/2014	**Easting:**	-
Logged By:	GB	**Northing:**	-

Site: 38 Frognal Lane, Hampstead, London, NW3 6PP
Client: Fitzpatrick Construction Ltd
Project No: 14005

Boring Method: WS
Weather:
Driller: SN

Samples, In-situ Tests & Installations / Strata

Depth	Type	Result	S/Pipe	Elev	Legend	Depth/(Thk)	Description
						0.13 (0.13)	10mm shingle black plastic reinforcement grid. MADE GROUND
0.45	D & J					0.35 (0.22)	White crushed limestone. MADE GROUND
0.60	D & J						Soft becoming firm light orangish brown slightly silty CLAY with occasional rootlets and occasional sandy partings. Claystone band at 2.30m bgl. CLAYGATE MEMBER
0.80	D & J						
1.00	D						
1.50	D						
2.00	D						
2.50	D						
3.00	D						
						5.65	
3.50	D						
4.00	D						
4.50	D						
5.00	D						
5.50	D						
6.00	D					6.00	End of Borehole at 6.00 m

Daily Progress

Date	Time	Hole	Depth	Water Depth

Water Strikes

Strike Depth	Casing Depth	Date	Time	Post Depth	Elapsed Minutes	Depth Sealed
2.00	-	18/12/2014	0000	1.56	15	-

Chiselling

Start Depth	End Depth	Hours

Hole Diameter

Depth	Diam. (mm)

Casing Diameter

Depth	Diam. (mm)

General Remarks:
Roots observed to 2.00m bgl

IN SITU PERMEABILITY TEST

HVORSLEV'S TIME LAG

Project: 40 FROGNAL LANE, CAMDEN
Client: Arlington Management Services Limited

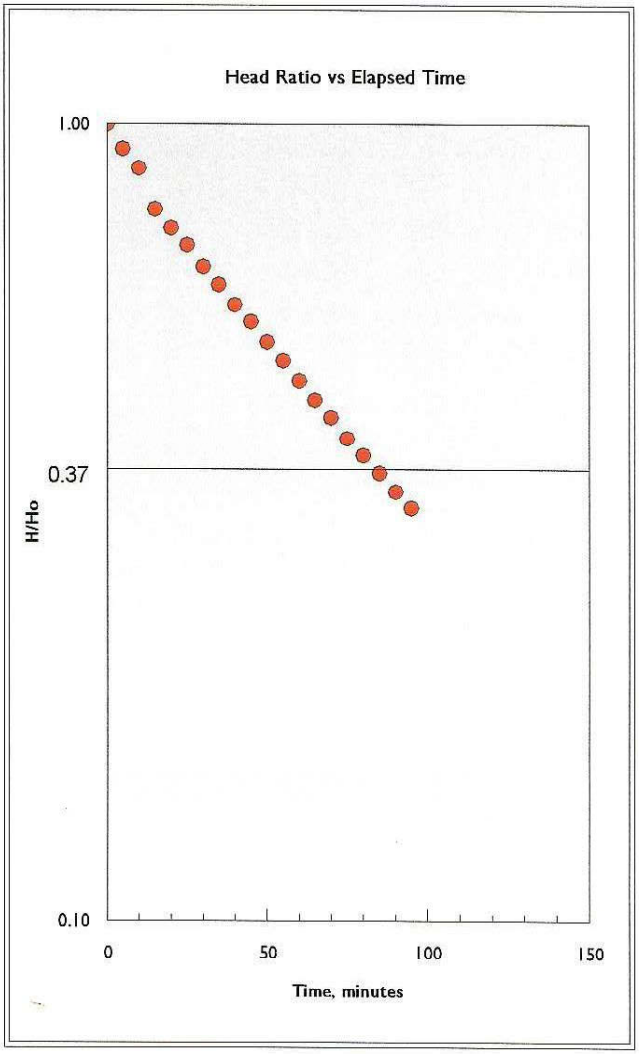
Project No: 3611
Sheet No: 1/1

Location: BH 1
Test depth from 7.00 m
to 1.00 m

Height of casing above g.l., m	0.00
Depth of casing below g.l., m	1.00
Diameter of casing, m	0.15
Depth to water at start of test, m b.g.l.	2.86

Description of stratum under test
Claygate Member to 5.6m then London Clay

Elapsed Time min	Depth to Water, m from Casing	Depth to Water, m from GL	H	H/Ho
0	6.00	6.00	-3.14	1.000
5	5.79	5.79	-2.93	0.933
10	5.63	5.63	-2.77	0.882
15	5.32	5.32	-2.46	0.783
20	5.19	5.19	-2.33	0.742
25	5.08	5.08	-2.22	0.707
30	4.94	4.94	-2.08	0.662
35	4.84	4.84	-1.98	0.631
40	4.73	4.73	-1.87	0.596
45	4.64	4.64	-1.78	0.567
50	4.54	4.54	-1.68	0.535
55	4.45	4.45	-1.59	0.506
60	4.36	4.36	-1.50	0.478
65	4.28	4.28	-1.42	0.452
70	4.21	4.21	-1.35	0.430
75	4.13	4.13	-1.27	0.404
80	4.07	4.07	-1.21	0.385
85	4.01	4.01	-1.15	0.366
90	3.95	3.95	-1.09	0.347
95	3.90	3.90	-1.04	0.331



k = A/FT

A = 0.018 m²
F = 8.603 m
T = 82 min
k = 4.18E-007 m/s

Standpipe Readings

	18.12.13		23.01.14	
Location	Depth BGL	OD	Depth BGL	OD
WS1 [West]	2.8m	+88.0m	1.5m	+89.3m
WS2 [East]	2.0m	+88.9m	0.8m	+90.1m
Difference across site		0.9m		0.8m

Road level at WS2 = +92.8m OD with road gradient at 1 in 10.

WS1 and WS2 spaced 18m apart so water table difference of 0.9m gives gradient of 1 in 20.

Extrapolating gradients:

- with water table in WS2 as +90.1m, water table at surface 55m to the west.
- with water table in WS2 as +88.9m, water table at surface 80m to the west.

soils LIMITED

Contract Name:		Client:			Hole ID:
Frognal Lane					**BH01**
Contract Number:	Start and End Date:	Logged By:	Checked By:	Status:	Hole Type:
18577	25-08-20 - 26-08-20	DW		DRAFT	**CP**
Easting:	Northing:	Ground Level:	Plant Used:	Print Date:	Scale:
526008.8	185472.3	90.96mAOD	Dando 2000	18-09-2020	1:50

Weather: | Termination: | SPT Hammer: N/R, Energy Ratio: N/R | Sheet 1 of 2

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
			90.91	0.05		From driller's logs: GRAVEL. MADE GROUND.		
0.20	D		90.86	0.10		From driller's logs: Plastic matting and foam. MADE GROUND.		
			90.76	0.20		From driller's logs: Compacted type 1 stone. MADE GROUND.		
0.50	D					Firm, black speckled, grey and orangish brown mottled, brown, slightly sandy CLAY. Sand is fine to medium. Occasional rootlets and woody roots.		
				(1.00)				
1.00	D							
1.20	D		89.76	1.20				
1.20 - 1.50	B					Firm to stiff, black speckled, grey and orangish brown mottled, brown, sandy silty CLAY. Sand is fine.		
1.50	SPT	N=8 (1,2/2,2,2,2)						
1.50 - 1.95	D							
2.30	D							
2.50 - 2.95	U	Ublow = 20						
				(2.80)				
3.00	D							
3.50	SPT	N=11 (1,2/2,3,3,3)						
3.50 - 3.95	D							
			86.96	4.00		Stiff, slightly orangish brown mottled, slightly sandy CLAY. Sand is fine. Occasional coarse sand sized selenite crystals. CLAYGATE MEMBER.		
4.30	D							
4.50 - 4.95	U	Ublow = 25						
				(1.50)				
5.00	D							
5.50	D		85.46	5.50		Stiff to very stiff, greyish brown to brownish grey with depth, slightly sandy, slightly silty CLAY. Sand is fine. Rare coarse sand to fine gravel sized selenite crystals. LONDON CLAY FORMATION.		
6.00	SPT	N=16 (2,2/3,4,4,5)						
6.00 - 6.45	D							
7.00	D							
7.50 - 7.95	U	Ublow = 30						
				(9.00)				
8.00	D							
8.50	D							
9.00	SPT	N=22 (2,3/4,6,6,6)						
9.00 - 9.45	D							
10.00	D							

Start & End of Shift Observations					Borehole Diameter		Casing Diameter	
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)
					20.00	150	3.00	150

Remarks:
Rootlets observed to 1.2m bgl.

Chiselling				Installation			
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)
				0.00	1.00	PLAIN	50
				1.00	10.00	SLOTTED	50

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
			0	0.00	No groundwater "strikes" recorded during drilling. Water seepage at 2.8m bgl.

Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.

soils LIMITED

Contract Name:		Client:			Hole ID:
Frognal Lane					**BH01**
Contract Number:	Start and End Date:	Logged By:	Checked By:	Status:	Hole Type:
18577	25-08-20 - 26-08-20	DW		DRAFT	**CP**
Easting:	Northing:	Ground Level:	Plant Used:	Print Date:	Scale:
526008.8	185472.3	90.96mAOD	Dando 2000	18-09-2020	1:50

Weather: | Termination: | SPT Hammer: N/R, Energy Ratio: N/R |

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
						Stiff to very stiff, greyish brown to brownish grey with depth, slightly sandy, slightly silty CLAY. Sand is fine. Rare coarse sand to fine gravel sized selenite crystals. LONDON CLAY FORMATION.		
10.50 - 10.95	U	Ublow = 50						
11.00	D							
11.50	D							
12.00	SPT	N=26 (3,4/6,6,7,7)						
12.00 - 12.45	D							
13.00	D							
13.50 - 13.95	U	Ublow = 45						
14.00	D							
14.50	D		76.46	14.50		Stiff to very stiff dark blackish green mottled, brownish grey slightly sandy, silty CLAY. Sand is fine, and features in occasional laminations and lenses. LONDON CLAY FORMATION.		
15.00	SPT	N=30 (3,4/6,7,8,9)						
15.00 - 15.45	D							
16.00	D							
16.50 - 16.95	U	Ublow = 50						
17.00	D							
				(5.50)				
17.50	D							
18.00	SPT	N=33 (3,4/6,7,10,10)						
18.00 - 18.45	D							
19.00	D							
19.50 - 19.95	U	Ublow = 60						
20.00	D		70.96	20.00		End of Borehole at 20.00m		

Start & End of Shift Observations					Borehole Diameter		Casing Diameter	
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)
					20.00	150	3.00	150

Remarks:
Rootlets observed to 1.2m bgl.

Chiselling				Installation			
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)
				0.00	1.00	PLAIN	50
				1.00	10.00	SLOTTED	50

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
			0	0.00	No groundwater "strikes" recorded during drilling. Water seepage at 2.8m bgl.

Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.

soils LIMITED

Contract Name:		Client:			Hole ID:
Frognal Lane					**WS101**
Contract Number:	Start and End Date:	Logged By:	Checked By:	Status:	Hole Type:
18577	04-09-20	DW		DRAFT	**WS**
Easting:	Northing:	Ground Level:	Plant Used:	Print Date:	Scale:
526008.9	185446.9	90.47mAOD	TERRIER	18-09-2020	1:50

Weather: | Termination: | SPT Hammer: N/R, Energy Ratio: N/R | Sheet 1 of 1

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
0.20	ES			(0.30)		From driller's logs: Dark brown, slightly clayey SAND. Occasional fine to coarse flint and fine brick gravel. Frequent rootlets. MADE GROUND.		
			90.17	0.30				
0.50 - 1.20	WAC			(0.60)		From driller's logs: Recovered as loose brown gravelly SAND. Gravel is angular to sub-angular, fine to coarse brick and occasional fine flint gravel. MADE GROUND.		
			89.57	0.90				
				(0.60)		Firm, slightly black speckled brown CLAY. Occasional angular fine to coarse brick, clinker and rare flint gravel, with a band from 0.1 - 0.2m bgl. Occasional rootlets. MADE GROUND.		
1.40	D		88.97	1.50				
1.60	D					Firm black speckled, grey and yellowish brown mottled, brown, slightly sandy silty CLAY. Sand is fine and features in frequent partings and occasional laminations. Occasional rootlets and woody roots 2mm diameter. Rare coarse to fine gravel sized sand sized selenite crystals from 4.5m bgl. CLAYGATE MEMBER.		
2.10	D					*Fine sandy lenses at 3.6 and 3.9m bgl.*		
2.60	D							
3.10	D			(3.40)				
3.60	D							
4.10	D							
4.60	D							
5.00	SPT	N=25 (16,16/11,6,4,4)	85.57	4.90				
				(0.30)		Brown calcareous MUDSTONE.		
5.10	D		85.27	5.20		Firm, slightly black speckled, grey mottled, brown, slightly sandy, silty CLAY. Sand is fine, and features in occasional laminations. Occasional to rare coarse to fine gravel sized sand sized selenite crystals.		
5.50	D					*Disturbed sample from 6.0 - 6.5, 7.0 - 7.5m bgl.*		
6.50	D			(2.60)				
6.90	D							
7.90	D		82.67	7.80		Firm to stiff, brownish, silty CLAY. Rare fine gravel sized selenite crystals, with an angular medium gravel sized selenite crystal at 8.98m bgl. Very rare fine gravel sized calcareous shells at 8.7, and 9.7m bgl. LONDON CLAY FORMATION.		
						Disturbed sample from 8.0 - 8.5, 9.0 - 9.5m bgl.		
8.50	D							
8.90	D			(2.20)				
9.60	D							
9.90	D		80.47	10.00		End of Borehole at 10.00m		

1 2 3 4 5 6 7 8 9 10

Start & End of Shift Observations

Date	Time	Depth (m)	Casing (m)	Water (m)

Borehole Diameter

Depth (m)	Dia (mm)
10.00	150

Casing Diameter

Depth (m)	Dia (mm)

Chiselling

From (m)	To (m)	Duration	Remarks

Installation

Top (m)	Base (m)	Type	Dia (mm)
0.00	1.00	PLAIN	33
1.00	10.00	SLOTTED	33

Remarks:
Live rootlets observed to 3.9m bgl.

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
6.00			20	6.00	

Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.

soils LIMITED

Contract Name:		Client:				Hole ID:
Frognal Lane						**WS102**
Contract Number:	Start and End Date:	Logged By:	Checked By:	Status:		Hole Type:
18577	04-09-20	DW		DRAFT		**WS**
Easting:	Northing:	Ground Level:	Plant Used:	Print Date:		Scale:
525999.2	185451.2	90.48mAOD	TERRIER	18-09-2020		1:50

Weather: | Termination: | Sheet 1 of 1

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
0.20	ES			(0.30)		From driller's logs: Dark brown, slightly clayey SAND. Occasional fine flint and brick gravel. Occasional rootlets. MADE GROUND.		
			90.18	0.30				
0.50	ES			(0.60)		From driller's logs: Recovered as loose brown gravelly SAND. Gravel is angular to sub-angular, fine to coarse brick and occasional fine flint gravel. MADE GROUND.		
			89.58	0.90				
			89.48	1.00		From driller's logs: Stiff brown CLAY. Frequent brick gravel. MADE GROUND.		
1.20	D					Stiff to firm, black speckled, grey and yellowish brown mottled, brown, slightly sandy silty CLAY. Sand is fine and features in occasional laminations and partings. Occasional rootlets and woody roots 3mm diameter. Rare coarse to fine gravel sized sand sized selenite crystals from 4.5m bgl. CLAYGATE MEMBER.		
1.70	D					*Firm from 1.5m bgl. Rare sub-rounded, fine to medium marl gravel from 3.5m bgl. Becoming stiff at 3.7m bgl.*		
2.20	D							
2.70	D			(3.00)				
3.20	D							
3.70	D							
4.10	D		86.48	4.00		Stiff, grey mottled, brown, slightly sandy, silty CLAY. Sand is fine, and features in occasional laminations. Frequent desiccated rootlets. Occasional to rare coarse to fine gravel sized sand sized selenite crystals.		
4.60	D					*Sandy lens with medium to coarse sand sized selenite crystals at 3.65m bgl. Grey mottling to 5.9m bgl. Rare yellowish brown fine gravel sized silt inclusions and laminations from 5.0m bgl.*		
5.20	D							
5.70	D			(3.30)				
6.20	D							
6.70	D							
7.40	D		83.18	7.30		Stiff to very stiff, slightly black speckled brownish grey, silty CLAY. Rare fine gravel sized selenite crystals. Very rare fine gravel sized calcareous shells. LONDON CLAY FORMATION.		
7.90	D					*Coarse gravel to cobble sized broken marl nodule at 7.5m bgl. Occasional fine sand in top of stratum. Fine gravel sized pyritised plant fossil at 7.6m bgl.*		
8.40	D							
8.90	D			(2.70)				
9.40	D							
9.90	D							
			80.48	10.00		End of Borehole at 10.00m		

Start & End of Shift Observations					Borehole Diameter		Casing Diameter	
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)
					10.00	150		

Remarks:
Live rootlets observed to 3.8m bgl.

Chiselling			
From (m)	To (m)	Duration	Remarks

Installation			
Top (m)	Base (m)	Type	Dia (mm)
0.00	1.00	PLAIN	33
1.00	10.00	SLOTTED	33

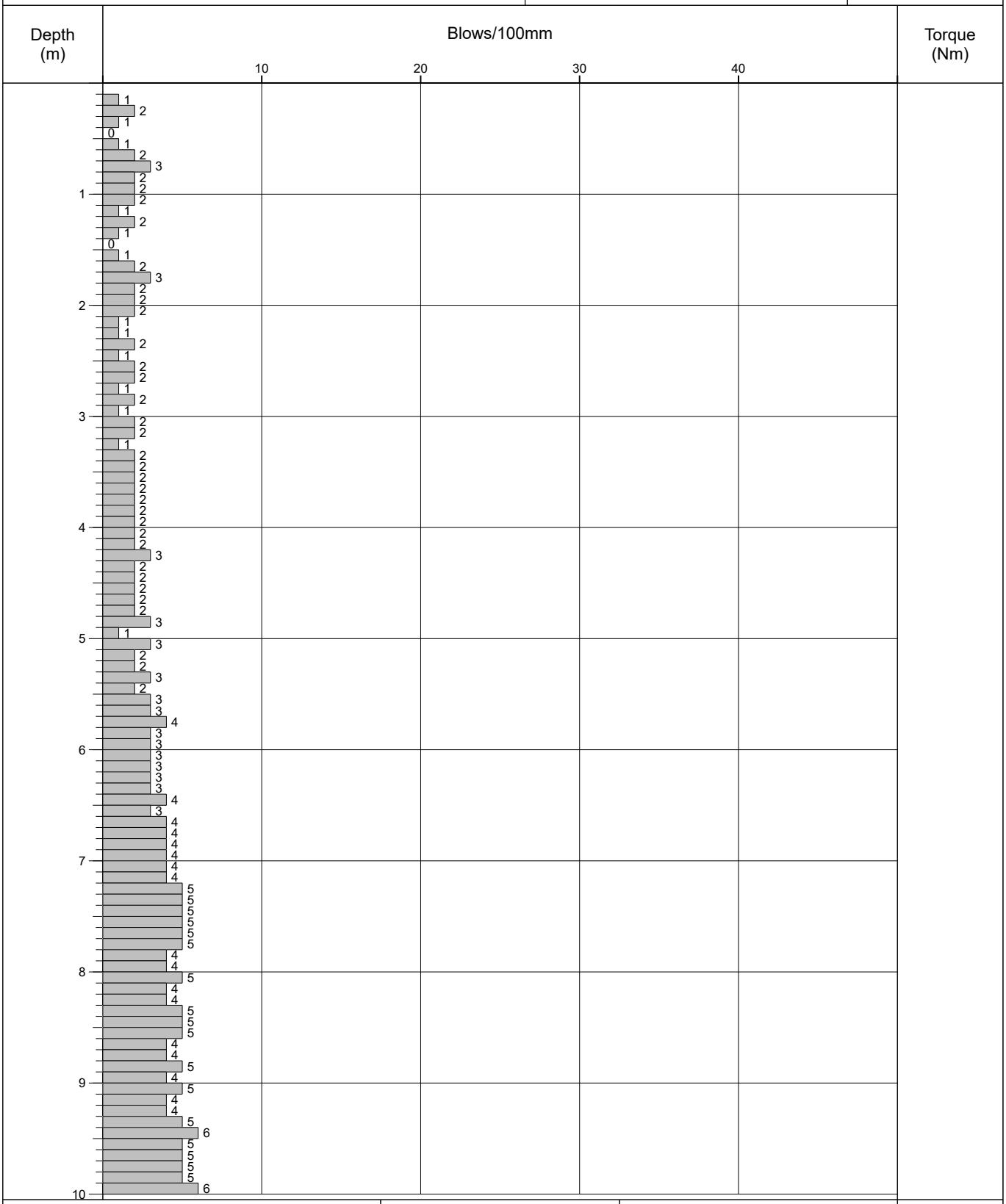
Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
			0	0.00	No groundwater encountered.

Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.

soils LIMITED	**Soils Limited** Newton House, Cross Road, Tadworth KT20 5SR Tel: 01737 814221 Email: admin@soilslimited.co.uk	**Probe Log**	Probe No. **DP101** Sheet 1 of 2

Project Name:	Frognal Lane	Project No. 18577	Co-ords: 526008.91E - 185446.87N	Hole Type DP
Location:	Lodon, NW3 6YA		Level: 90.4714m AOD	Scale 1:50
Client:			Dates: 04-09-2020	Logged By



Remarks		Fall Height	0.76mm	Cone Base Diameter	52mm
		Hammer Weight	63.5kg	Final Depth	10m
		Probe Type	DPSH	Energy Ratio (Er)	%

AGS REGISTERED USER 2020

soils LIMITED	**Soils Limited** Newton House, Cross Road, Tadworth KT20 5SR Tel: 01737 814221 Email: admin@soilslimited.co.uk	**Probe Log**

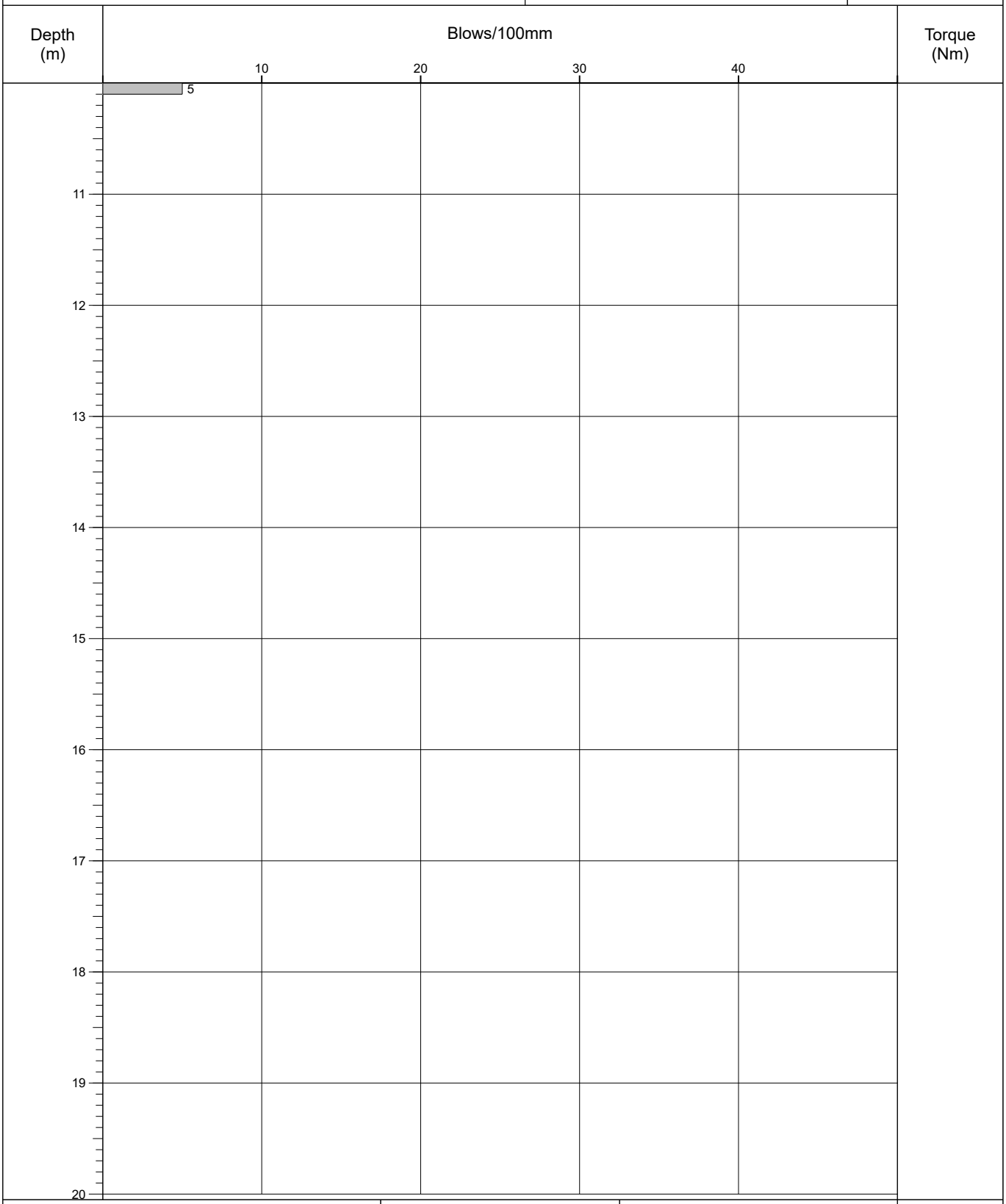
Probe No.
DP101
Sheet 2 of 2

Project Name:	Frognal Lane	Project No. 18577	Co-ords:	526008.91E - 185446.87N
Location:	Lodon, NW3 6YA		Level:	90.4714m AOD
Client:			Dates:	04-09-2020

Hole Type
DP

Scale
1:50

Logged By



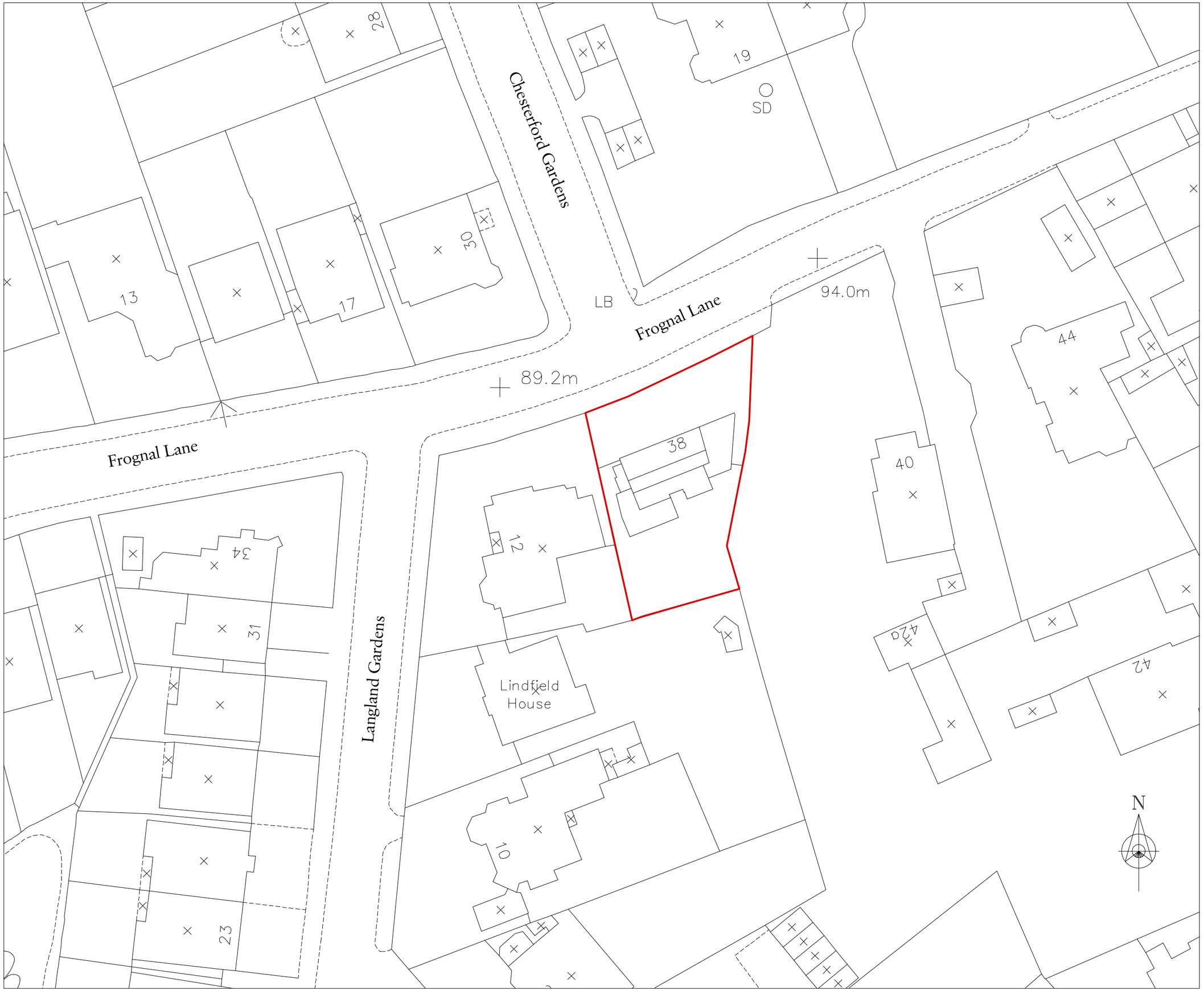
Remarks				
	Fall Height	0.76mm	Cone Base Diameter	52mm
	Hammer Weight	63.5kg	Final Depth	10m
	Probe Type	DPSH	Energy Ratio (Er)	%

AGS
REGISTERED USER 2020

Appendix 3: Existing and Proposed Development Drawings

The following Architects drawings form part of the planning application

PL-010 Location Plan
PL-011 Site Plan
PL-099 Basement Plan
PL-100 Ground Floor Plan
PL-101 First Floor Plan
PL-102 Second Floor Plan
PL-103 Roof Plan
PL-200 Front Elevation _ North
PL-201 Side Elevation _ East
PL-202 Rear Elevation _ South
PL-203 Side Elevation _ West
PL-204 Street Elevation
PL-300 Sections - AA
PL-305 Sections - BB



0 5 10 15 20 25

Rev Date Details By

Charlton Brown
Architecture & Interiors

The Belvedere, 2 Back Lane, Hampstead, London, NW3 1HL

Telephone +44(0)20 7794 1234
Email office@charltonbrown.com
Website www.charltonbrown.com

Client
MRPP

Project
38 Frognal Lane, NW3

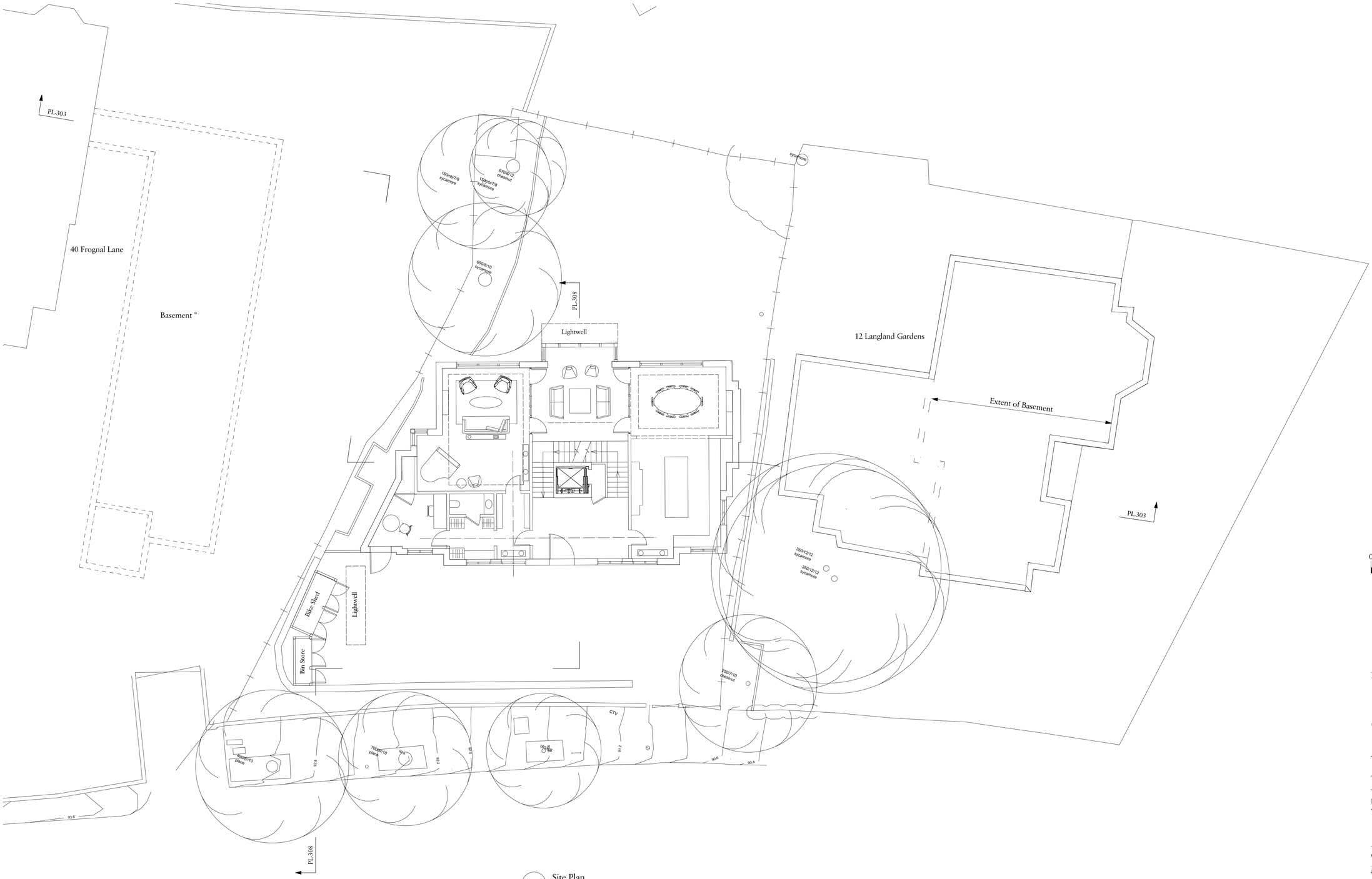
Drawing Title
Location Plan

Date	Drawn	Checked
29/09/2020	MCW	JM

Scale
1:500 @ A1 / 1:1000 @ A3

Issue Status
Planning Application

Project Number	Drawing Number	Revision
20022	PL-010	



40 Frognal Lane position from O/S.

* Basement Plan derived from Planning application ref: 2014/5915/P
Live consent until 1 May 2021

12 Langland Gardens position from O/S.

1 Site Plan
Scale: 1:100

Rev	Date	Details	By

Charlton Brown
Architecture & Interiors

The Belvedere, 2 Back Lane, Hampstead, London, NW3 1HL

Telephone +44(0)20 7794 1234
Email office@charltonbrown.com
Website www.charltonbrown.com

Client
MRPP

Project
38 Frognal Lane, NW3

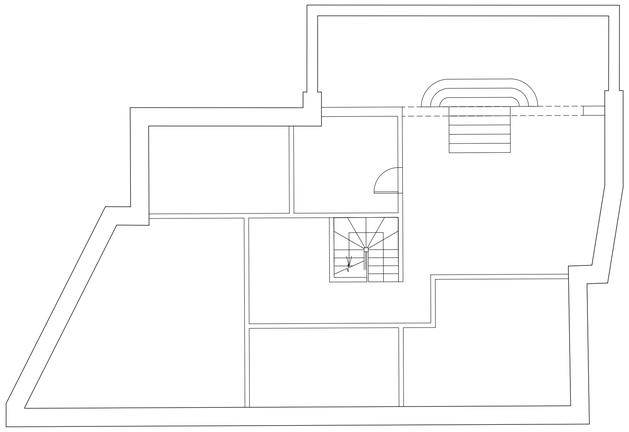
Drawing Title
Site Plan

Date	Drawn	Checked
29/09/2020	MCW	JM

Scale
1:100 @ A1 / 1:200 @ A3

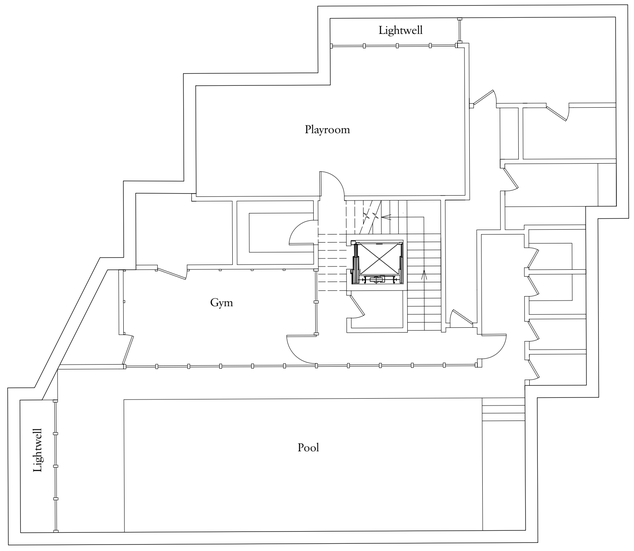
Issue Status
Planning Application

Project Number	Drawing Number	Revision
20022	PL-011	

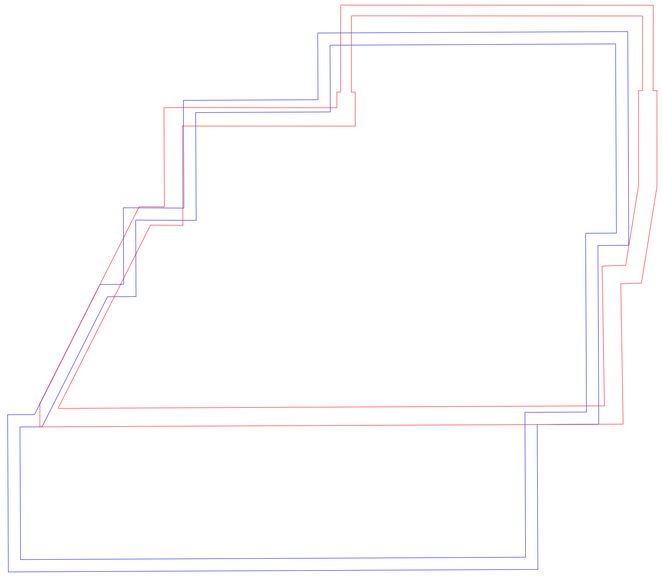


1 Consented Basement
Scale: 1:100

Consent Ref: 2014/5915/P
(consent for basement level swimming pool excavation)
Expired on 11th May 2019



2 Proposed Basement
Scale: 1:100



3 Comparison Basement
Scale: 1:100

Consented Design
Proposed Design

N

0 1 2 3 4 5 6 7 8 9 10

Rev Date Details By

Charlton Brown
Architecture & Interiors

The Belvedere, 2 Back Lane, Hampstead, London, NW3 1HL

Telephone +44(0)20 7794 1234
Email office@charltonbrown.com
Website www.charltonbrown.com

Client
MRPP

Project
38 Frognal Lane, NW3

Drawing Title
Basement Plan

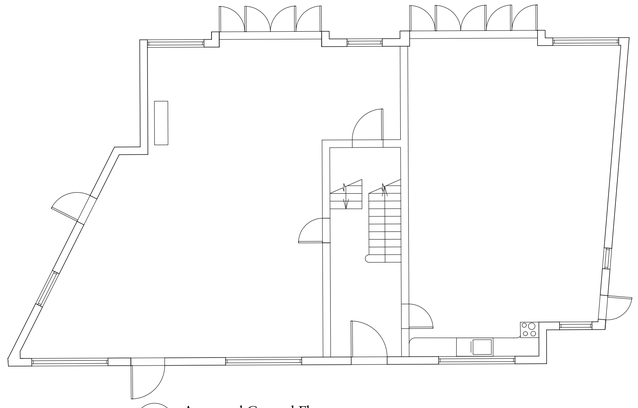
Date 29/09/2020 Drawn MCW Checked JM

Scale
1:100 @ A1 / 1:200 @ A3

Issue Status
Planning Application

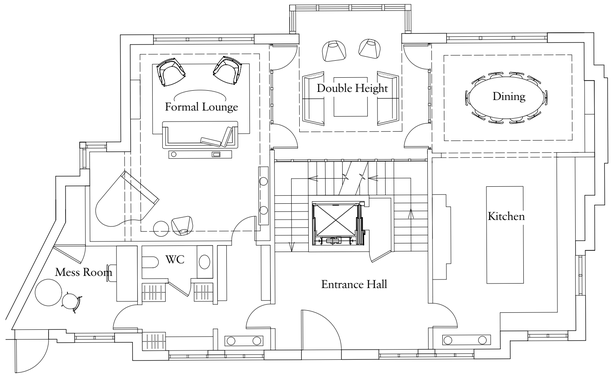
Project Number 20022 Drawing Number PL-099 Revision

FOR FINAL COMMENT

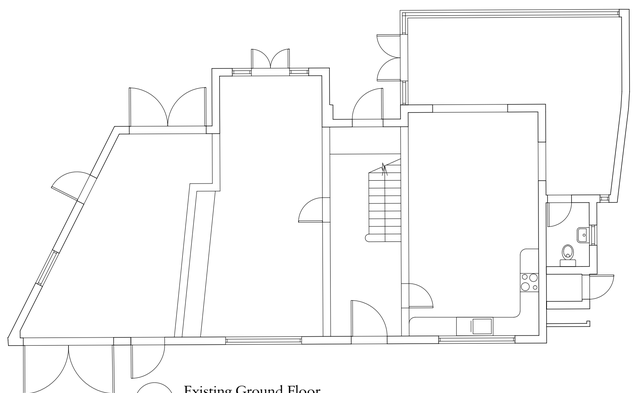


2 Approved Ground Floor
Scale: 1:100

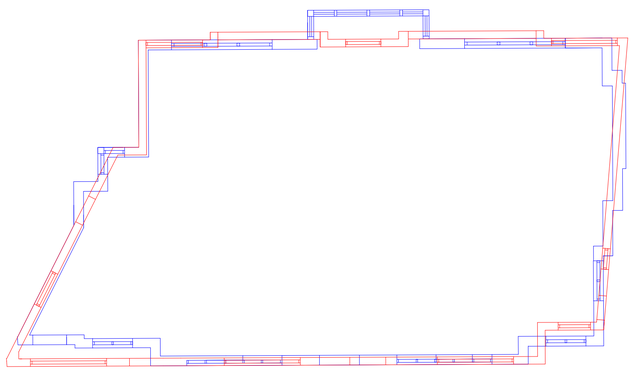
Approved Ref: 2019/4220/P
(approval for full demolition and replacement)



3 Proposed Ground Floor
Scale: 1:100



1 Existing Ground Floor
Scale: 1:100



4 Comparison Ground Floor
Scale: 1:100

Approved Design
Proposed Design

N

0 1 2 3 4 5 6 7 8 9 10

Rev	Date	Details	By

Charlton Brown
Architecture & Interiors

The Belvedere, 2 Back Lane, Hampstead, London, NW3 1HL

Telephone +44(0)20 7794 1234
Email office@charltonbrown.com
Website www.charltonbrown.com

Client
MRPP

Project
38 Frognal Lane, NW3

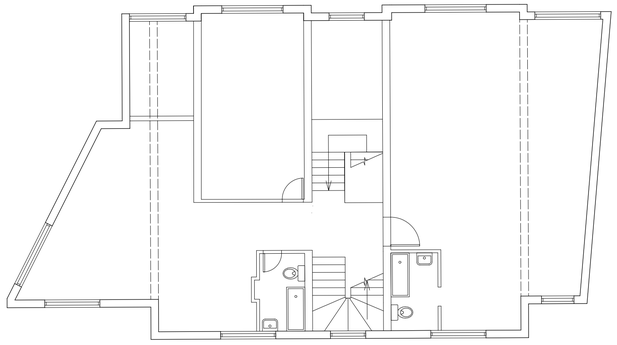
Drawing Title
Ground Floor Plan

Date	Drawn	Checked
29/09/2020	MCW	JM

Scale
1:100 @ A1 / 1:200 @ A3

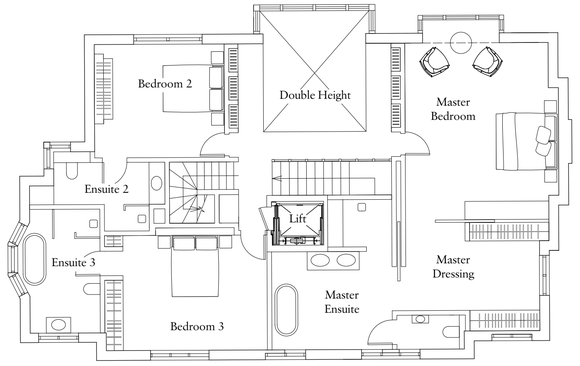
Issue Status
Planning Application

Project Number	Drawing Number	Revision
20022	PL-100	

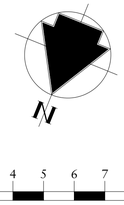


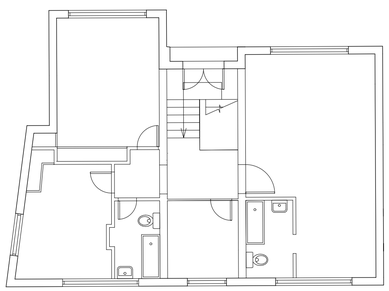
2 Approved First Floor
Scale: 1:100

Approved Ref: 2019/4220/P
(approval for full demolition and replacement)

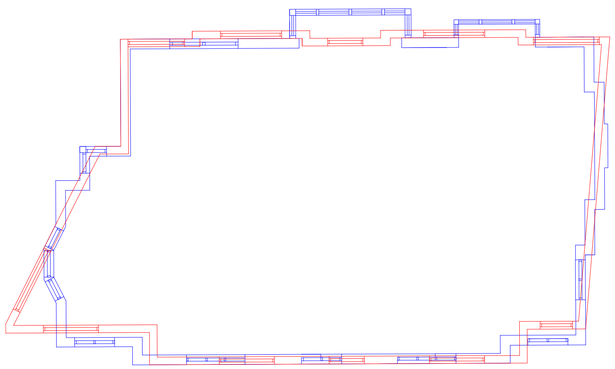


3 Proposed First Floor
Scale: 1:100





1 Existing First Floor
Scale: 1:100



4 Comparison First Floor
Scale: 1:100

Approved Design
Proposed Design

Rev Date Details By

Charlton Brown
Architecture & Interiors

The Belvedere, 2 Back Lane, Hampstead, London, NW3 1HL

Telephone +44(0)20 7794 1234
Email office@charltonbrown.com
Website www.charltonbrown.com

Client
MRPP

Project
38 Frognal Lane, NW3

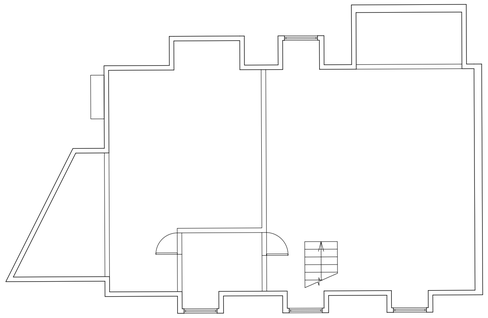
Drawing Title
First Floor Plan

Date	Drawn	Checked
29/09/2020	MCW	JM

Scale
1:100 @ A1 / 1:200 @ A3

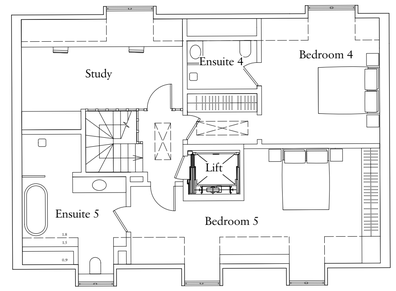
Issue Status
Planning Application

Project Number	Drawing Number	Revision
20022	PL-101	

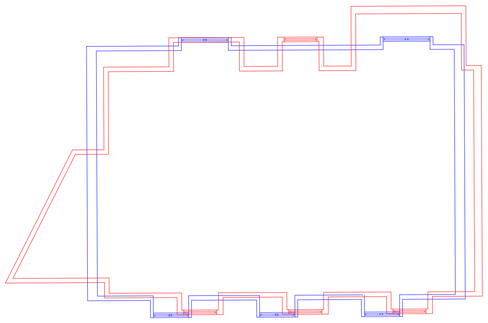


1 Approved Second Floor
Scale: 1:100

Approved Ref: 2019/4220/P
(approval for full demolition and replacement)

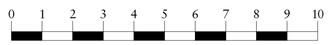


2 Proposed Second Floor
Scale: 1:100



3 Comparison Second Floor
Scale: 1:100

Approved Design
Proposed Design



Rev Date Details By

Charlton Brown
Architecture & Interiors

The Belvedere, 2 Back Lane, Hampstead, London, NW3 1HL

Telephone +44(0)20 7794 1234
Email office@charltonbrown.com
Website www.charltonbrown.com

Client
MRPP

Project
38 Frognal Lane, NW3

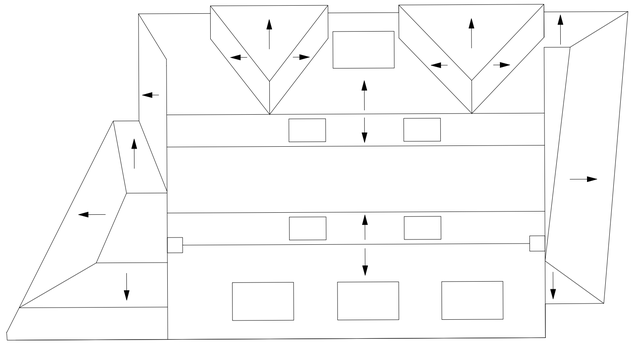
Drawing Title
Second Floor Plan

Date	Drawn	Checked
29/09/2020	MCW	JM

Scale
1:100 @ A1 / 1:200 @ A3

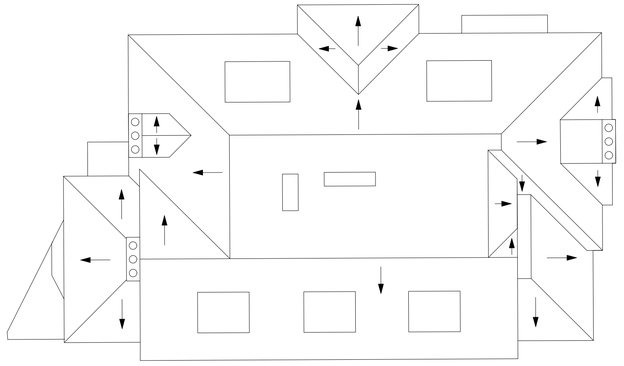
Issue Status
Planning Application

Project Number	Drawing Number	Revision
20022	PL-102	

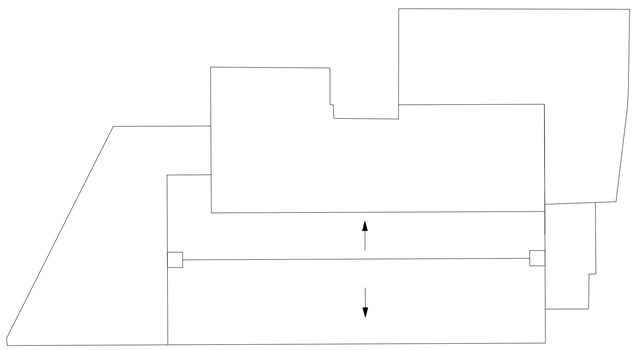


2 Approved Roof Plan
Scale: 1:100

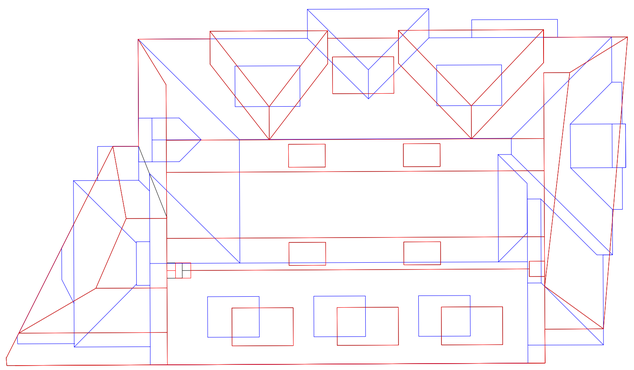
Approved Ref: 2019/4220/P
(approval for full demolition and replacement)



3 Proposed Roof Plan
Scale: 1:100



1 Existing Roof Plan
Scale: 1:100



4 Comparison Roof Plan
Scale: 1:100

Approved Design
Proposed Design

N

0 1 2 3 4 5 6 7 8 9 10

Rev	Date	Details	By

Charlton Brown
Architecture & Interiors

The Belvedere, 2 Back Lane, Hampstead, London, NW3 1HL

Telephone +44(0)20 7794 1234
Email office@charltonbrown.com
Website www.charltonbrown.com

Client
MRPP

Project
38 Frognal Lane, NW3

Drawing Title
Roof Plan

Date	Drawn	Checked
29/09/2020	MCW	JM

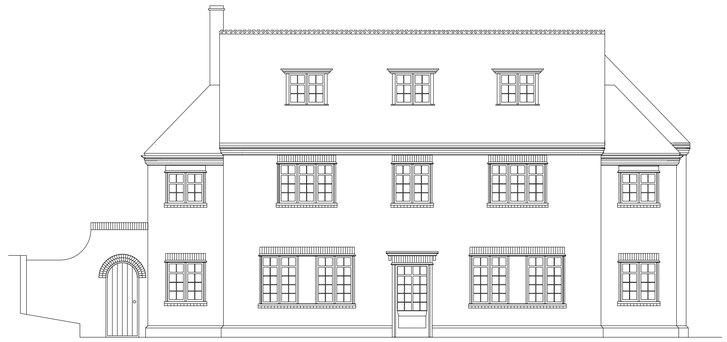
Scale
1:100 @ A1 / 1:200 @ A3

Issue Status
Planning Application

Project Number	Drawing Number	Revision
20022	PL-103	

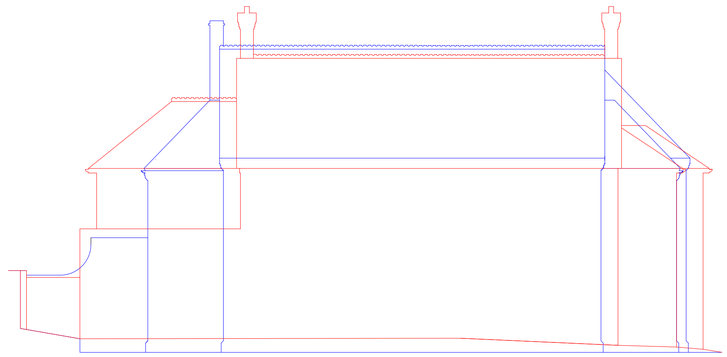
2 Approved Front Elevation
Scale: 1:100

Approved Ref: 2019/4220/P
(approval for full demolition and replacement)



3 Proposed Front Elevation
Scale: 1:100

1 Existing Front Elevation
Scale: 1:100



4 Approved Front Elevation
Scale: 1:100

Approved Design
Proposed Design

0 1 2 3 4 5 6 7 8 9 10

Rev	Date	Details	By

Charlton Brown
Architecture & Interiors

The Belvedere, 2 Back Lane, Hampstead, London, NW3 1HL

Telephone +44(0)20 7794 1234
Email office@charltonbrown.com
Website www.charltonbrown.com

Client
MRPP

Project
38 Frognal Lane, NW3

Drawing Title
Front Elevation _ North

Date	Drawn	Checked
02/10/2020	MCW	JM

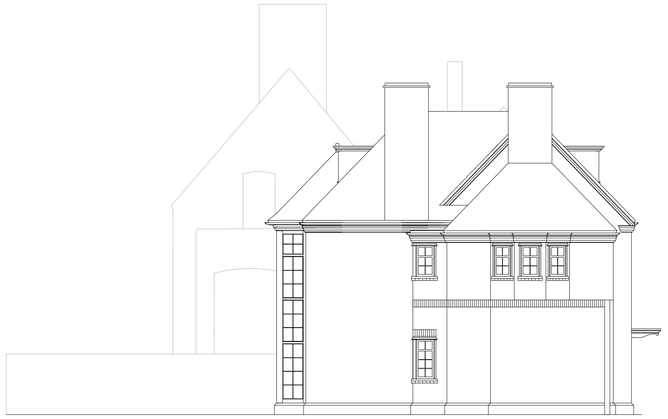
Scale
1:100 @ A1 / 1:200 @ A3

Issue Status
Planning Application

Project Number	Drawing Number	Revision
20022	PL-200	

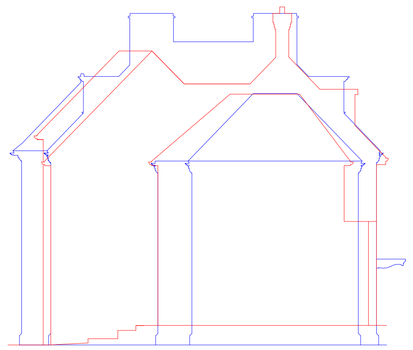
2 Approved Side Elevation - East
Scale: 1:100

Approved Ref: 2019/4220/P
(approval for full demolition and replacement)



3 Proposed Side Elevation - East
Scale: 1:100

1 Existing Side Elevation - East
Scale: 1:100



4 Comparison Side Elevation - East
Scale: 1:100

Approved Design
Proposed Design

0 1 2 3 4 5 6 7 8 9 10

Rev	Date	Details	By

Charlton Brown
Architecture & Interiors

The Belvedere, 2 Back Lane, Hampstead, London, NW3 1HL

Telephone +44(0)20 7794 1234
Email office@charltonbrown.com
Website www.charltonbrown.com

Client
MRPP

Project
38 Frognal Lane, NW3

Drawing Title
Side Elevation _ East

Date	Drawn	Checked
02/10/2020	MCW	JM

Scale
1:100 @ A1 / 1:200 @ A3

Issue Status
Planning Application

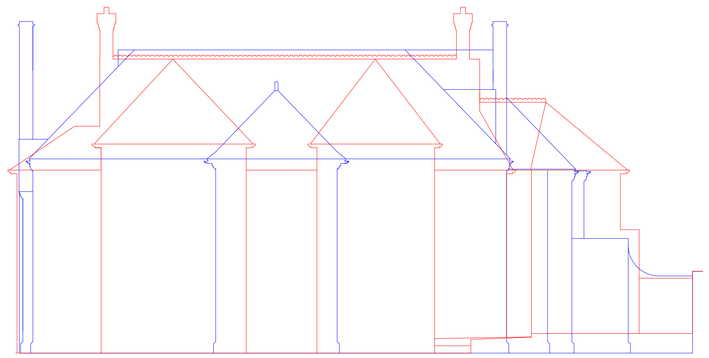
Project Number	Drawing Number	Revision
20022	PL-201	

2 Approved Rear Elevation
Scale: 1:100

Approved Ref: 2019/4220/P
(approval for full demolition and replacement)

3 Proposed Rear Elevation
Scale: 1:100

1 Existing Rear Elevation
Scale: 1:100



4 Comparison Rear Elevation
Scale: 1:100

Approved Design
Proposed Design

0 1 2 3 4 5 6 7 8 9 10

Rev	Date	Details	By

Charlton Brown
Architecture & Interiors

The Belvedere, 2 Back Lane, Hampstead, London, NW3 1HL

Telephone +44(0)20 7794 1234
Email office@charltonbrown.com
Website www.charltonbrown.com

Client
MRPP

Project
38 Frognal Lane, NW3

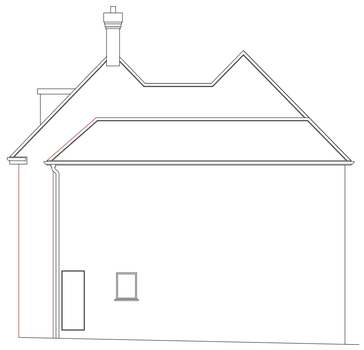
Drawing Title
Rear Elevation _ South

Date	Drawn	Checked
02/10/2020	MCW	JM

Scale
1:100 @ A1 / 1:200 @ A3

Issue Status
Planning Application

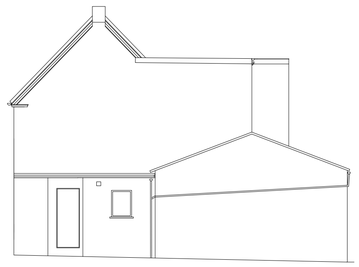
Project Number	Drawing Number	Revision
20022	PL-202	



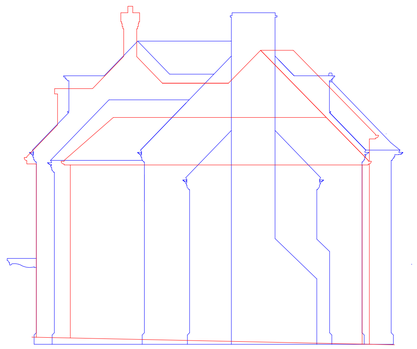
2 Approved Side Elevation - West
Scale: 1:100

Approved Ref: 2019/4220/P
(approval for full demolition and replacement)

3 Proposed Side Elevation - West
Scale: 1:100



1 Existing Side Elevation - West
Scale: 1:100



4 Comparison Side Elevation - West
Scale: 1:100

Approved Design
Proposed Design

0 1 2 3 4 5 6 7 8 9 10

Rev	Date	Details	By

Charlton Brown
Architecture & Interiors

The Belvedere, 2 Back Lane, Hampstead, London, NW3 1HL

Telephone +44(0)20 7794 1234
Email office@charltonbrown.com
Website www.charltonbrown.com

Client
MRPP

Project
38 Frognal Lane, NW3

Drawing Title
Side Elevation _ West

Date	Drawn	Checked
02/10/2020	MCW	JM

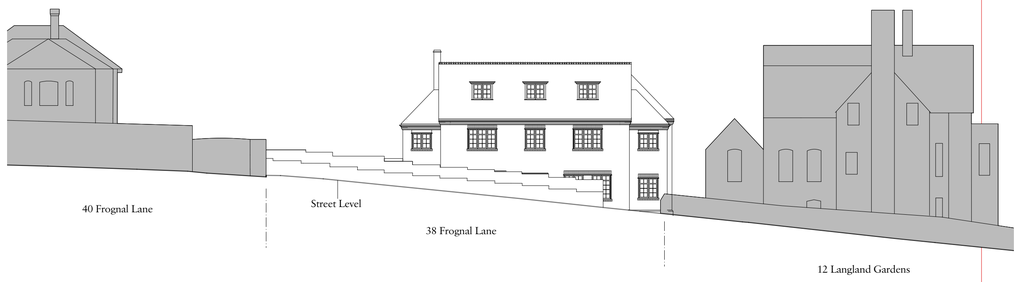
Scale
1:100 @ A1 / 1:200 @ A3

Issue Status
Planning Application

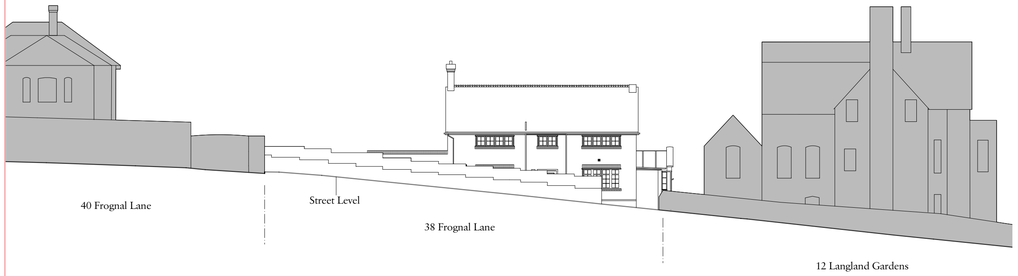
Project Number	Drawing Number	Revision
20022	PL-203	

2 Approved Street Elevation
Scale: 1:200

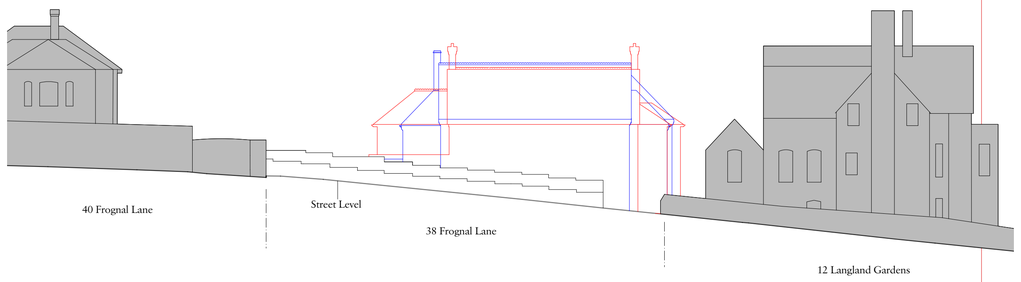
Approved Ref: 2019/4220/P
(approval for full demolition and replacement)



3 Proposed Street Elevation
Scale: 1:200



1 Existing Street Elevation
Scale: 1:200



4 Comparison Street Elevation
Scale: 1:200

Approved Design
Proposed Design

40 Frognal Lane position from O/S.

12 Langland Gardens position from O/S.

0 2 4 6 8 10 12 14 16 18 20

Rev	Date	Details	By

Charlton Brown
Architecture & Interiors

The Belvedere, 2 Back Lane, Hampstead, London, NW3 1HL

Telephone +44(0)20 7794 1234
Email office@charltonbrown.com
Website www.charltonbrown.com

Client
MRPP

Project
38 Frognal Lane, NW3

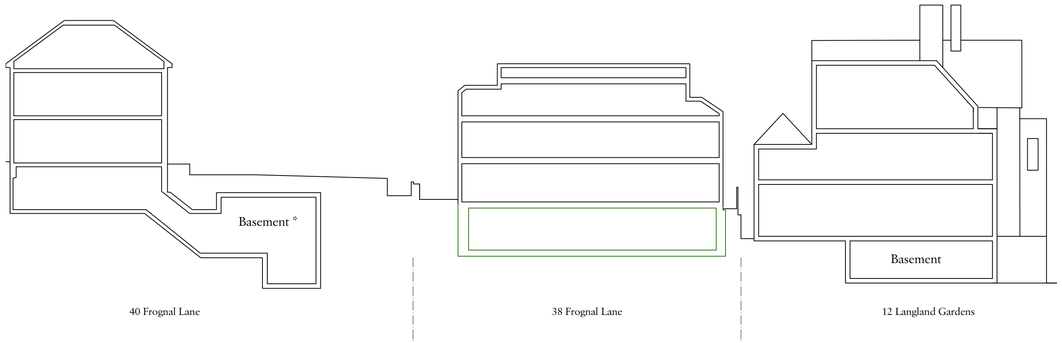
Drawing Title
Street Elevation

Date	Drawn	Checked
29/09/2020	MCW	JM

Scale
1:200 @ A1 / 1:400 @ A3

Issue Status
Planning Application

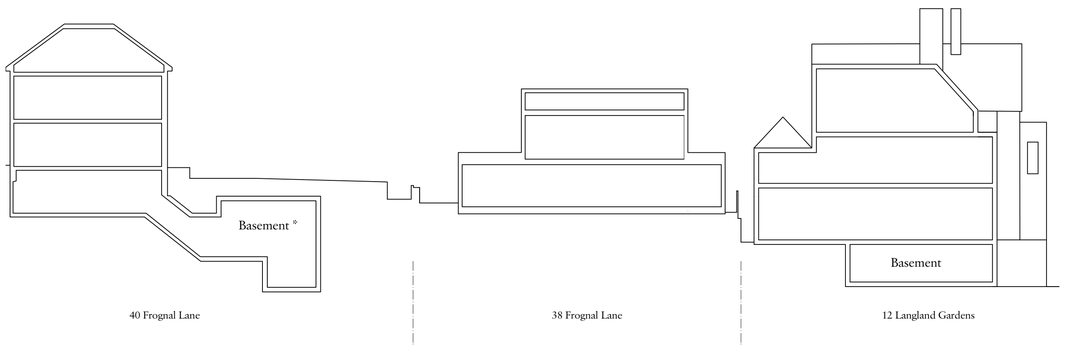
Project Number	Drawing Number	Revision
20022	PL-204	



2 Approved + Consented Section
Scale: 1:200

Approved Ref: 2018/5502/P
(approval for full demolition and replacement)

Consent Ref: 2014/5915/P
(consent for basement level swimming pool excavation)
Expired on 11th May 2019

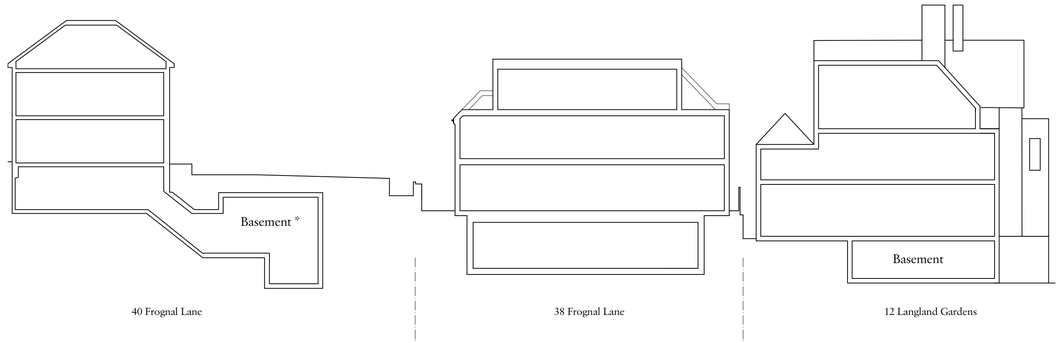


1 Existing Section
Scale: 1:200

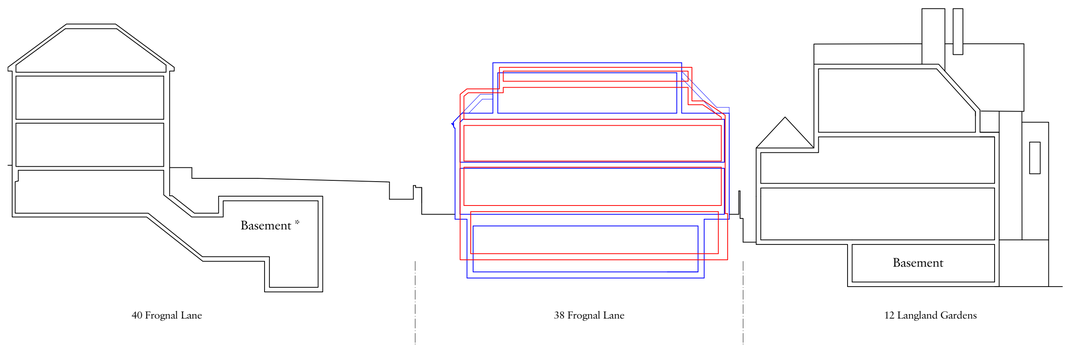
40 Frognal Lane position from O/S.

* Basement Plan derived from Planning
application ref: 2014/5915/P
Live consent until 1 May 2021

12 Langland Gardens
position from O/S.



3 Proposed Section
Scale: 1:200



4 Proposed Front Elevation
Scale: 1:200

Approved Design
Proposed Design

0 2 4 6 8 10 12 14 16 18 20

Rev Date Details By

Charlton Brown
Architecture & Interiors

The Belvedere, 2 Back Lane, Hampstead, London, NW3 1HL

Telephone +44(0)20 7794 1234
Email office@charltonbrown.com
Website www.charltonbrown.com

Client
MRPP

Project
38 Frognal Lane, NW3

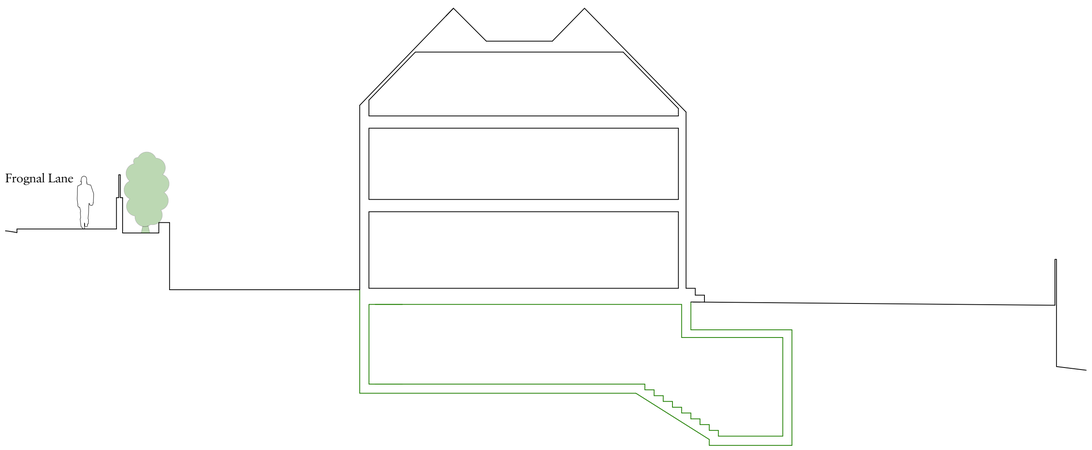
Drawing Title
Sections - AA

Date 29/09/2020
Drawn MCW
Checked JM

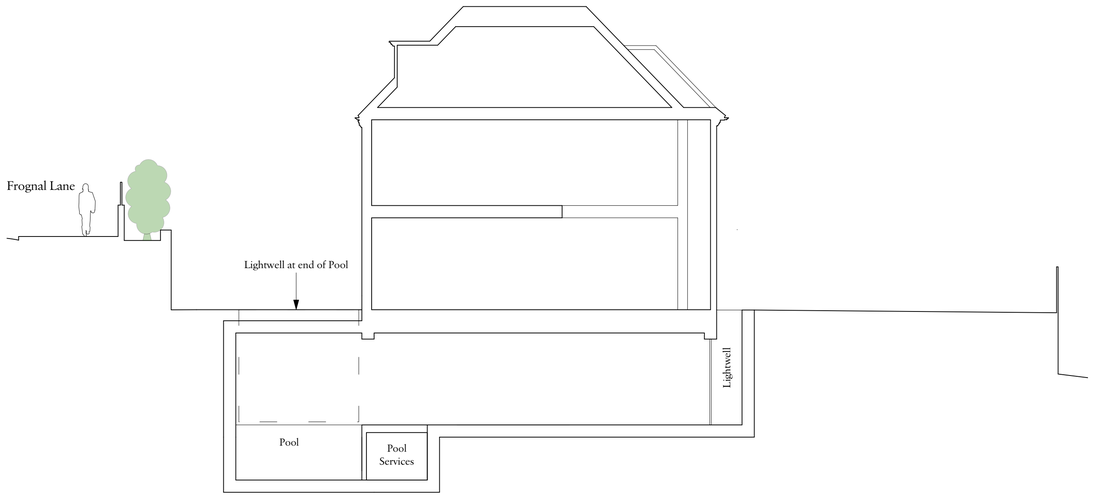
Scale
1:200 @ A1 / 1:400 @ A3

Issue Status
Planning Application

Project Number 20022
Drawing Number PL-300
Revision



2 Approved + Consented Section - BB
Scale: 1:100

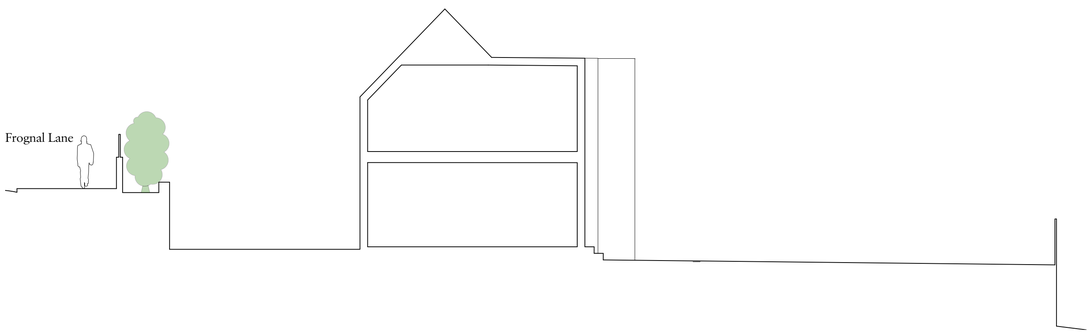


3 Proposed Section - BB
Scale: 1:100

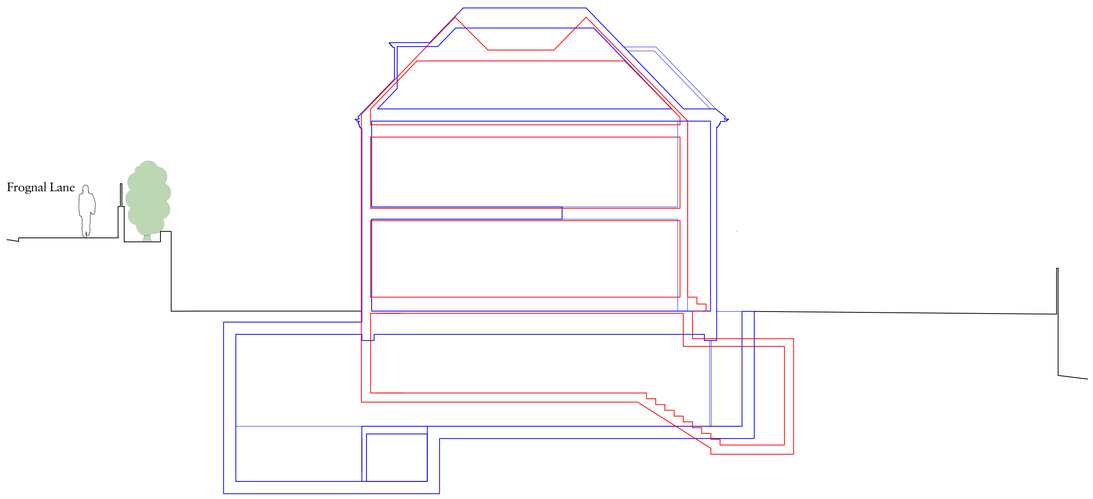
Approved Ref: 2018/5502/P
(approval for full demolition and replacement)

Consent Ref: 2014/5915/P
(consent for basement level swimming pool excavation)
Expired on 11th May 2019

0 1 2 3 4 5 6 7 8 9 10
1:100



1 Existing Section - BB
Scale: 1:100



4 Comparison Section - BB
Scale: 1:100

Approved Design
Proposed Design

Rev Date Details By

Charlton Brown
Architecture & Interiors

The Belvedere, 2 Back Lane, Hampstead, London, NW3 1HL

Telephone +44(0)20 7794 1234
Email office@charltonbrown.com
Website www.charltonbrown.com

Client
MRPP

Project
38 Frognal Lane, NW3

Drawing Title
Sections - BB

Date	Drawn	Checked
02/10/2020	MCW	JM

Scale
1:100 @ A1 / 1:200 @ A3

Issue Status
Planning Application

Project Number	Drawing Number	Revision
20022	PL-305	

Appendix 4: Ground Movement and Damage Impact Assessment

TRAIN & KEMP
CONSULTING ENGINEERS

Basement Impact Assessment Appendix 4

Ground Movement and Building Damage

Assessment

for

Redevelopment of

38 Frognal Lane, NW3 6PP

Job No: 14604

1 October 2020

Revision 0

CONTENTS

0 NON TECHNICAL SUMMARY

0.1 As required in Camden CPG on Basements, a Ground Movement and Building Damage Assessment has been completed on the proposed basement at 38 Frognal Lane.

0.2 The proposed basement is part of a rebuild of the detached house on the site. The basement is single storey with a deeper front section for a swimming pool and a shallower rear section, which forms a leisure suite.

0.3 The site is founded on Claygate Members overlying London Clay and the basement will be formed with a contiguous piled perimeter wall, with the depths adjusted to suit the swimming pool and leisure suite. The piled wall will be propped in both the temporary and permanent conditions. A waterproof concrete box will be constructed within the piled wall.

0.4 A ground movement assessment has been undertaken in accordance with CIRIA Report C580, as the industry standard on such movement. The effect of both the deep and shallow basements on the adjacent properties at No 40 Frognal Lane and No 12 Langland Gardens has been completed with the analysis in Appendix 2 and presentation of the potential damage in the graphs in Section 6.

0.5 The assessment has established that the movement in the adjacent properties will be limited to Damage Category 1, Very Slight, and hence complies with LB Camden acceptability criteria.

1 INTRODUCTION

1.1 Introduction

1.1.1 This Ground Movement and Building Damage Assessment, GM&BD, has been prepared in support of a planning application for the redevelopment of 38 Frognal Lane NW3 6PP, which includes a basement extension.

1.1.2 This GM&BD has been prepared in accordance with LB of Camden Planning Guidance on Basements, March 2018.

1.1.3 Reference is made to LB Camden Geological, Hydrogeological and Hydrological Study, GHHS, 2010

1.2 Authorship

1.2.1 This GM&BDA has been prepared by Norman Train, a Chartered Civil Engineer and Chartered Structural Engineer with experience in ground movement and damage assessment

2.0 LOCATION AND SITE DESCRIPTION

2.1 Location

2.1.1 The site is on the slopes falling from the high ground of Hampstead Heath towards the Finchley Road to the southwest. For the purposes of this assessment the orientation of Frognal Lane is taken as east west with No 38 being on the south side; No 40 Frognal Lane and No 12 Langland Gardens are to the east and west respectively.

2.1.2 As shown on T&K drawing 14604-01 in Appendix 1, the site is a parallelogram with the road frontage along Frognal Lane being 25m by some 30m deep, front to rear, giving a plot area of 650m^2

2.2 Topography and Levels

2.2.1 The topographical survey shows that the gradient to this part of Frognal Lane is 1 in 10. This gradient is also repeated on Langland Gardens to the south west of the site.

2.2.2 The site is located opposite the junction to Chesterford Gardens with the ground rising to the north and east. The adjacent house to the east on Frognal Lane is No 40 which is some 3m higher. The adjacent house to the west is No 12 Langland Gardens; which is some 2m lower.

2.2.3 The site is level and it is clear that the ground has been terraced with retaining walls to the back of the pavement and to the front sections of the eastern and western boundaries. The natural fall of the ground means that the level difference is less pronounced towards the rear, where the differences are accommodated within banking and steeper slopes to the perimeter flower beds rather than formal retaining walls.

2.2.4 The forecourt off Frognal Lane is at +90.9m OD with the rear garden at +90.5m OD. The passageways to the east and west of the house are +91.3m OD and +90.6m OD respectively, with the maximum height of the eastern and western retaining walls at their northern front ends being 2m and 1m high respectively.

2.3 Existing Site and Building

2.3.1 38 Frognal Lane is a detached two storey house with pitched roof that has a single storey attached garage to the east. To the rear is a single storey extension that wraps around onto its western side. There is no basement.

2.3.2 The gravel forecourt does not have any formal drainage.

2.3.3 As shown on T&K Drawing 14604-01 in Appendix 1, there are three trees in the rear garden and three along the front.

2.3.4 Both the foul and surface water connect to the adopted drainage on Frognal Lane which is a combined system.

2.4 Adjacent Buildings

2.4.0 Reference: T&K Drawing 14604-01 Site Location and Clearance to Adjacent Properties in Appendix 1.

2.4.1 No 40 Frognal Lane is a grade listed detached three storey house with a lower ground floor as a semi basement. No 40 Frognal Lane is 19m to the east of No 38 and its lower ground floor is at +92m OD. There is also a current planning permission for a basement swimming pool in the garden to No 40 which would be 5.5m clear at a depth of +86.5m OD. The swimming pool would be a reinforced concrete box with perimeter concrete piles.

2.4.2 No 12 Langland Gardens is 2.5m to the west of No 38 and is split level. The upper ground floor is at +88.8m OD and the lower ground floor, with access from Langland Gardens, is at +86.2m OD.

2.4.3 Next to No 12 Langland Gardens is Lindfield House, the back garden of which extends across the whole of the rear boundary to No 38. There are timber outhouses within 2m of this southern boundary, but with the slope of the ground these are estimated to be at +89m OD.

3.0 SCHEME

3.0.0 References: Carlton Brown Architect Drawings 20022 P 099 to 108

3.1 Proposed Redevelopment

3.1.1 The proposed redevelopment comprises the demolition of the existing house and the construction of a new two storey house of similar proportions over an extended basement. The front of the basement, beneath the forecourt, will be a swimming pool with the remainder being a leisure suite.

3.1.2 The impervious area will increase from 200m^2 to 230m^2.

3.1.3 As a rebuild, the house will be constructed bottom upwards. The leisure suite will have columns at around 5m centres, both ways, to support the ground floor and superstructure. The columns will be supported on piles.

3.2 Basement

3.2.1 The swimming pool beneath the forecourt will be 4.8m deep internally; the leisure suite behind will be 3m deep internally. The excavated depths will be +84.4m OD and +86.2m OD respectively.

3.2.2 The basement will have lightwells to the eastern end of the swimming pool and to the southern side of the leisure suite.

3.2.3 The basement will require the construction of a contiguous piled perimeter wall with an inner box of waterproof concrete. As a mitigation against disruption of the groundwater flow, an externally pea shingle layer will be installed around the outside of the piles will act as the groundwater interceptor and redistributor.

4.0 GROUND CONDITIONS AND SITE INVESTIGATIONS

4.0.0 References: The two site investigations are given in BIA Appendix 2.

4.1 Published Ground Conditions

4.1.1 The British Geology Survey, Map of the Geology of UK, indicates that the site is underlain by Claygate Members overlying London Clay which outcrops further to the south on Langland Gardens.

4.1.2 GHHS Fig 8, Aquifer Designation Map, shows that the Claygate Members are classified as a Secondary A Aquifer. London Clay is classified as an unproductive aquifer.

4.1.3 GHHS Fig 9, Slope Angle Map, shows that there are no slopes greater than 7^{o} in the vicinity of the site.

4.2 Soil Ltd 2014

4.2.1 Soils Ltd completed a site investigation in 2014 comprising two window samplers to a depth of 6m in the forecourt. This established that the Claygate Members extend to a greater depth than 6m.

4.2.2 Standpipes were installed in both window samplers with the groundwater measured in December 2013 and January 2014. Initially the depth to the water was 2.0m [east] and 2.8m [west] rising after a month to 0.8m [east] and 1.5m [west]. Being on the forecourt, the locations were at the same level,18m apart, so the gradient of the phreatic surface across the site in early 2014 was 1 in 20.

4.3 Soil Ltd 2020

4.3.1 Soils Ltd site investigation in 2020 comprised a 20m borehole in the forecourt and two 10m window samplers in the rear garden. The 20m borehole gives strength parameters for the pile design. The 10m window samplers established the depth of the London Clay, which ranges between 5.5m and 7.8m in depth.

4.3.2 Standpipes were installed in all three holes

5.0 GROUND MOVEMENT ASSOCIATED WITH BASEMENT CONSTRUCTION

5.0.0 Reference: CIRIA Report C580: Embedded Retaining Walls- Guidance for Economic Design; 2003

5.1 Ground Movements with Basements

5.1.1 Basement excavation leads to ground movements and with time this can lead to damage and cracking within the zone of influence of the excavation. Assessing the potential damage to buildings requires a Ground Movement Assessment, GMA, to be undertaken first, followed by categorising of the resulting damage to buildings.

5.1.2 There are two types of movement.
- 5.1.2.1 The removal of the soil mass within the basement causes the ground beneath to recover and heave as an upward movement. This can be modelled assuming Boussinesq elastic stress distribution and is greatest in the middle of the excavation. Whilst this recovery will also extend outside the basement, the zone is small.
- 5.1.2.2 The sides of the excavation tend to rotate into the hole with both horizontal movement and settlement of the ground outside the basement. The settlement is a downward movement. Field measurements of the movements outside basements are presented in CIRIA C580 figures 2.8, 2.9 & 2.11 for stiff clays and 2.12 for sands. The movement to the sides of the excavation is sensitive to the propping or stiffness of the walls

5.1.3 Since the field measurements will include the effects of any heave from the removal of the soil mass, the recovery does not have to be considered separately.

5.1.4 Based on the fieldwork, CIRIA C580, Tables 2.2 and 2.4 give guidance on the potential movement in stiff clays. There are two aspects to this movement:
- 5.1.4.1 The relaxation of the soil mass outside the excavation;
- 5.1.4.2 The settlement associated with the wall construction itself.

5.1.5 Each aspect can be resolved into vertical and horizontal components giving four value sets, each of which has its own zones of influence.

5.1.6 The build up of the resulting horizontal and vertical movements are given in Appendix 2 assuming:
- 5.1.6.1 The strains are uniformly distributed over the zone of influence
- 5.1.6.2 The strains tabulated in C580 are:
  - 5.1.6.2.1 at the surface, reducing linearly to zero at the base of the excavation or walling element. This means that on a slope, where the adjoining building is at a different level, it is the net difference in level rather than the excavation depth that defines the zone of influence
  - 5.1.6.2.2 perpendicular to the excavation. Whilst only applicable to the horizontal strains at excavation corners or changes in the depth of the wall, if the orientation is at an angle, it is the perpendicular component horizontal strain that is appropriate.

5.2 Movement associated with Contiguous Pile Construction

5.2.1 C580, Section 2.5.1 states that there is little ground movement with the installation of isolated bored piles. However, with sequential construction to form a wall there is movement in the adjacent ground. This is greatest with secant walls, with contiguous piles having a lesser effect.

5.2.2 As 5.1.2.2, the movements associated with the excavation are sensitive to the propping and stiffness of the perimeter wall. The contiguous piles will be held with wailers and props in the construction phase and by the capping beam and lid in the completed works. This means that high support stiffness values can be taken from Table 2.4.

5.2.3 The recommended movements for contiguous piles in Table 2.2 with high support excavation in Table 2.4 are:

Element	C580 Table	Horizontal		Vertical	
		ε %	Zone of Influence	ε %	Zone of Influence
Contiguous Piles	2.2	0.04	1.5 piles	0.04	2 piles
Excavation [High Support Stiffness]	2.4	0.15	4 excavations	0.1	3.5 excavations

5.3 Ground Movement Analysis and Results

5.3.1 The depth of the contiguous piles to the Leisure Suite and Swimming Pool basements are taken as 10m and 15m respectively.

5.3.2 The extent of the deeper piles to the pool is shown on T&K drawing 14604-01 in Appendix 1. The clearance of the closest point in the Leisure Suite and Pool to both No 12 Langland Gardens and No 40 Frognal Lane are given as the four locations for analysis. The depth of the foundations of both buildings is taken as 0.8m below the respective floor levels. As 3.2.1, the depth of No 38 basement excavations are taken as +86.2m OD and +84.4m OD

5.3.3 Whilst the proposed swimming pool to No 40 is also indicated on T&K 14604/01, it has not been built yet and as reinforced concrete the Burland Categories are not applicable. Consequently it has not been analysed.

Location	Ref	Clear-ance m	Angle to Perp	Level		No 38 Basement	
				Floor	Foundation		Level
12 Langland Gdns	LG/1	2.5	Perp	+88.8m OD	+88.0m OD	Leisure	+86.2m OD
	LG/2	6	45º	+88.8m OD	+88.0m OD	Pool	+84.4m OD
40 Frognal Lane	FL/1	19	Perp	+92.0m OD	+91.2m OD	Leisure	+86.2m OD
	FL/2	23	45º	+92.0m OD	+91.2m OD	Pool	+84.4m OD
Proposed No 40 Pool	[FL/3]	5.5			+86.5m OD	Pool	+84.4m OD

5.3.4 The two key results that are required in assessing the damage of adjoining brick buildings are:
- 5.3.4.1 Horizontal Strain ε_H.
- 5.3.4.2 Vertical Differential Settlement Δ/L. Note it is the differential settlement and not the total settlement that causes the cracks.

5.3.5 The Horizontal Strain ε_H and Vertical Differential Settlement Δ/L are the two boxed values in the individual analysis sheets in Appendix 2. Both values are dimensionless and presented as %.

6.0 DAMAGE ASSESSMENT OF ADJACENT PROPERTIES

6.1 Burland Scale

6.1.1 In brittle materials with limited tensile strength, such as brickwork, damage occurs when the tension strains exceed a critical value and cracks form. A limiting strain, ε_{lim}, can be defined for different sizes of cracks, or damage classifications. In brickwork, five categories of damage are defined as.

Category of Damage	Description of Damage	Approx Crack Width	Limiting Strain ε_{lim}
0. Negligible	Hairline	0.1mm	0.05%
1. Very Slight	Fine cracks addressed during decoration	1mm	0.075%
2. Slight	Cracks easily filled with redecoration	<5mm	0.15%
3. Moderate	Patch brick repairs	5mm to 15mm	0.3%
4. Severe	Extensive repairs	15mm to 25mm	Over 0.3%
5. Very Severe	Major rebuilding	>25mm	

6.1.2 Reinforced concrete can resist tension and has ductility and the above correlation of crack width and limiting strains does not hold.

6.1.3 The two primary sources of cracking are vertical distortions from differential settlement and tapering cracks arising from the horizontal tension strains from the settlement/rebound wave. Burland suggested that the façade of the building can be considered as a large deep beam with the bending and diagonal strains within it depending on its proportions, i.e. ratio of the Length/Height, L/H. On tall narrow buildings, with L/H below unity, diagonal cracking from differential settlement predominates whereas on long squat buildings or terraces, tension cracks due to bending predominates.

6.1.4 The two types of cracking relate to vertical and horizontal strains. Utilising the concept of the limiting strains, envelopes of increasing damage can be developed combining the two types of movement for various building proportions. This is of limited value and it is more useful in practice to develop envelopes of different damage categories for a given façade proportion. The two axes on the Burland Scale charts are vertical differential settlement, Δ/L, and horizontal strains ε_H on to which different crack severity envelopes can be plotted

6.1.5 The vertical differential settlement and horizontal strains from the Ground Movement Analysis in Appendix 2 is presented on the charts for No 12 Langland Gardens and No 40 Frognal Lane

6.2 LB Camden Damage Acceptance Criteria

6.2.1 LB of Camden CPG on Basements, Para 4.33 requires any potential damage to neighbouring properties is no higher than category 1, Very Slight.

6.3 No 12 Langland Gardens Upper Ground Floor

6.3.1 The western half of No 12 is three storeys with a width of 8m and a height of 10m giving a L/H ratio of just under 1.

12LG/1 Leisure Suite Basement

6.3.2 The horizontal strain ε_H and vertical differential settlement Δ/L from Appendix 2 are 0.053% and 0.004% respectively.

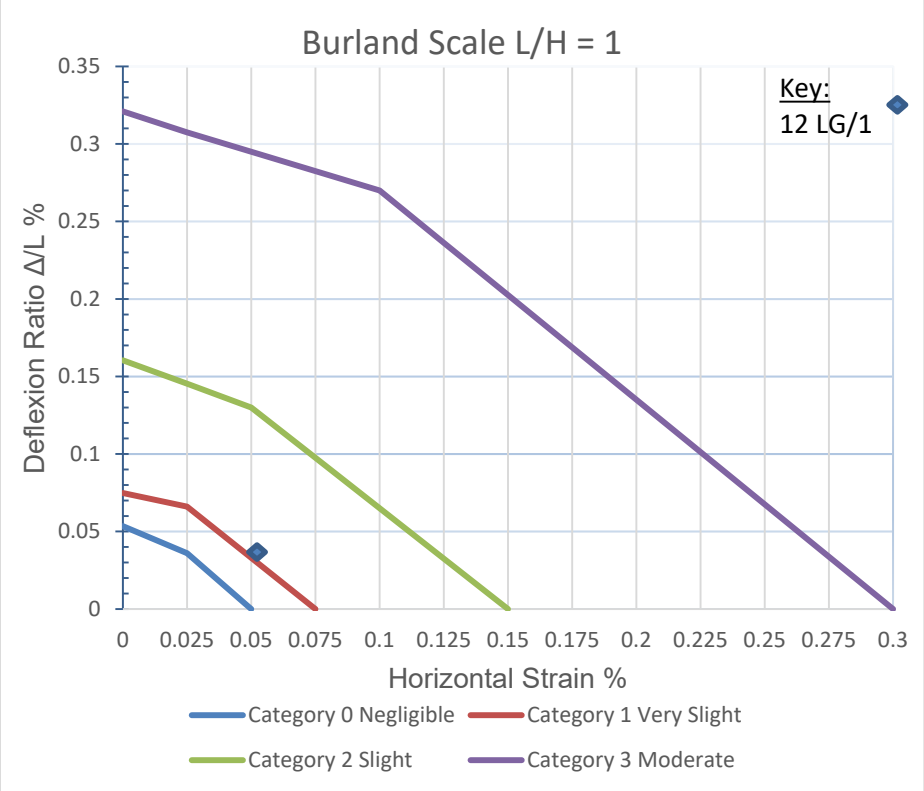


Fig 1 Leisure Suite Basement on No 12 Langland Gardens

6.3.3 As Fig 1, the predicted movement within No 12 Langland Gardens Upper Ground Floor due to the Leisure Suite Basement is on the envelope for Burland Category 1, Very Slight.

12LG/2 Swimming Pool Basement

6.3.4 The horizontal strain ε_H and vertical differential settlement Δ/L from Appendix 2 are 0.045% and 0.002% respectively.

6.3.5 As Fig 2, the predicted movement within No 12 Langland Gardens Upper Ground Floor due to the Swimming Pool Basement is within the envelope for Burland Category 1, Very Slight.

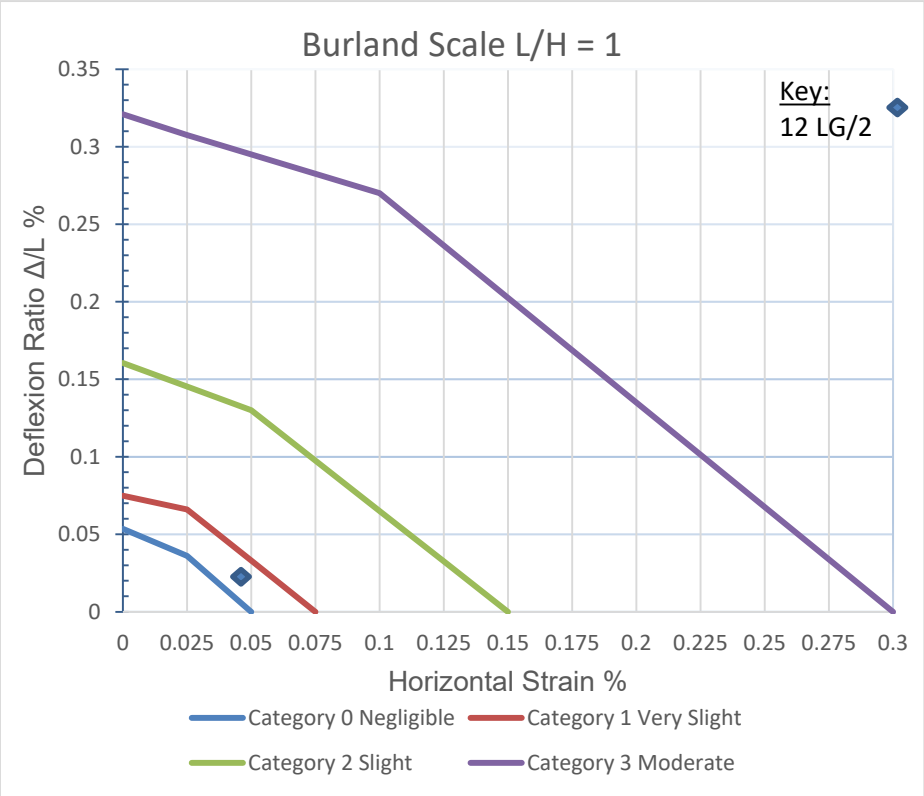


Fig 2 Swimming Pool Base on 12 Langland Gardens

6.4 No 40 Frognal Lane

6.4.1 The main house is three storeys with a width of 9m and a height of 10m giving a L/H ratio of just under 1.

40FL/1: Leisure Suite Basement

6.4.2 The horizontal strain ε_H and vertical differential settlement Δ/L from Appendix 2 are 0.024% and 0.002% respectively.

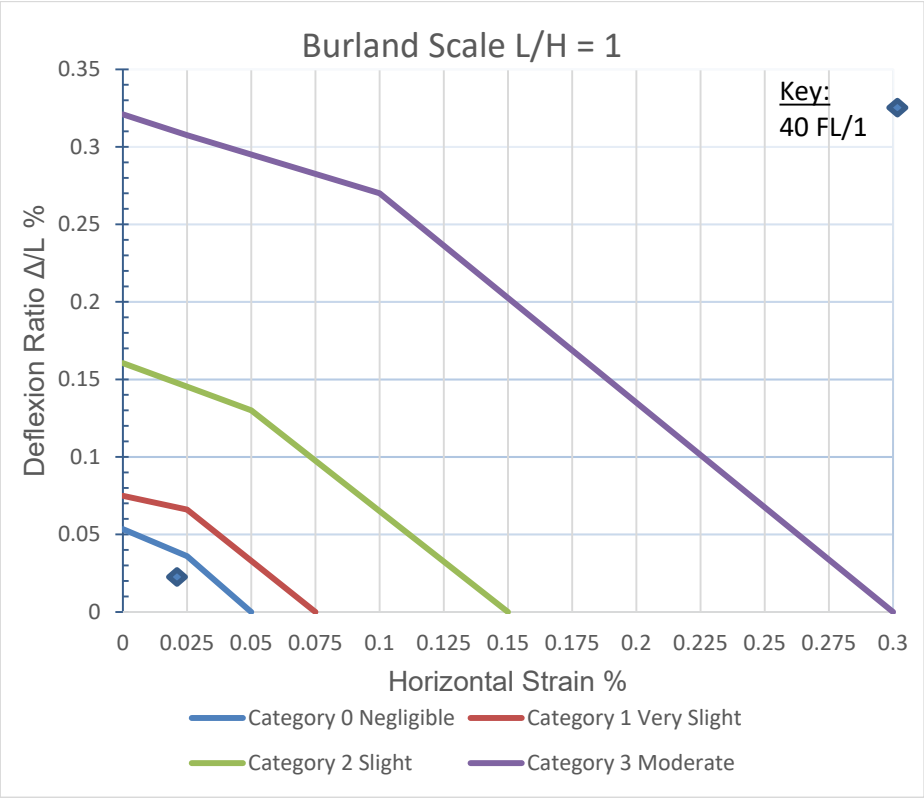


Fig 3 Leisure Suite Basement on No 40 Frognal Lane

6.4.3 As Fig 3, the predicted movement within No 40 Frognal Lane Lower Ground Floor due to the Leisure Suite Basement is within Burland Category 0, Negligible.

40FL/2: Swimming Pool Basement

6.4.4 The horizontal strain ε_H and vertical differential settlement Δ/L from Appendix 2 are 0.042% and 0.002% respectively.

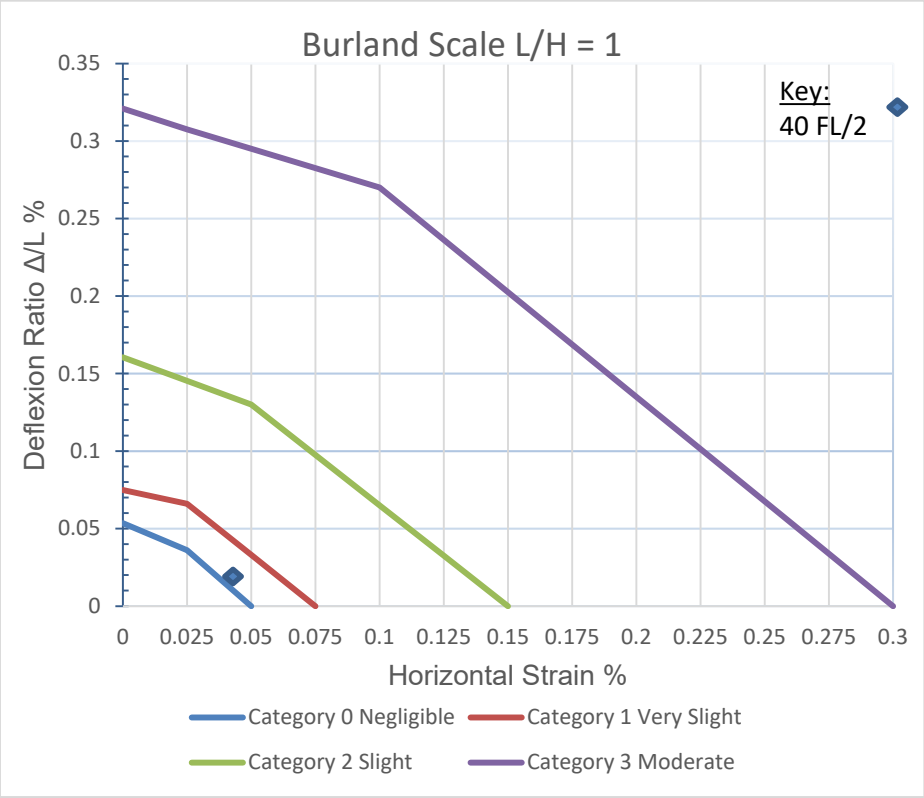


Fig 4 Swimming Pool Base on No 40 Frognal Lane

6.4.5 As Fig 4, the predicted movement within No 40 Frognal Lane Lower Ground Floor due to the Swimming Pool Basement is on the envelope to Burland Category 0, Negligible.

6.5 Monitoring

6.5.1 The maximum movements generated in Appendix 2 are 5mm horizontally and 3mm vertically. These are too small for any meaningful surveying monitoring regime.

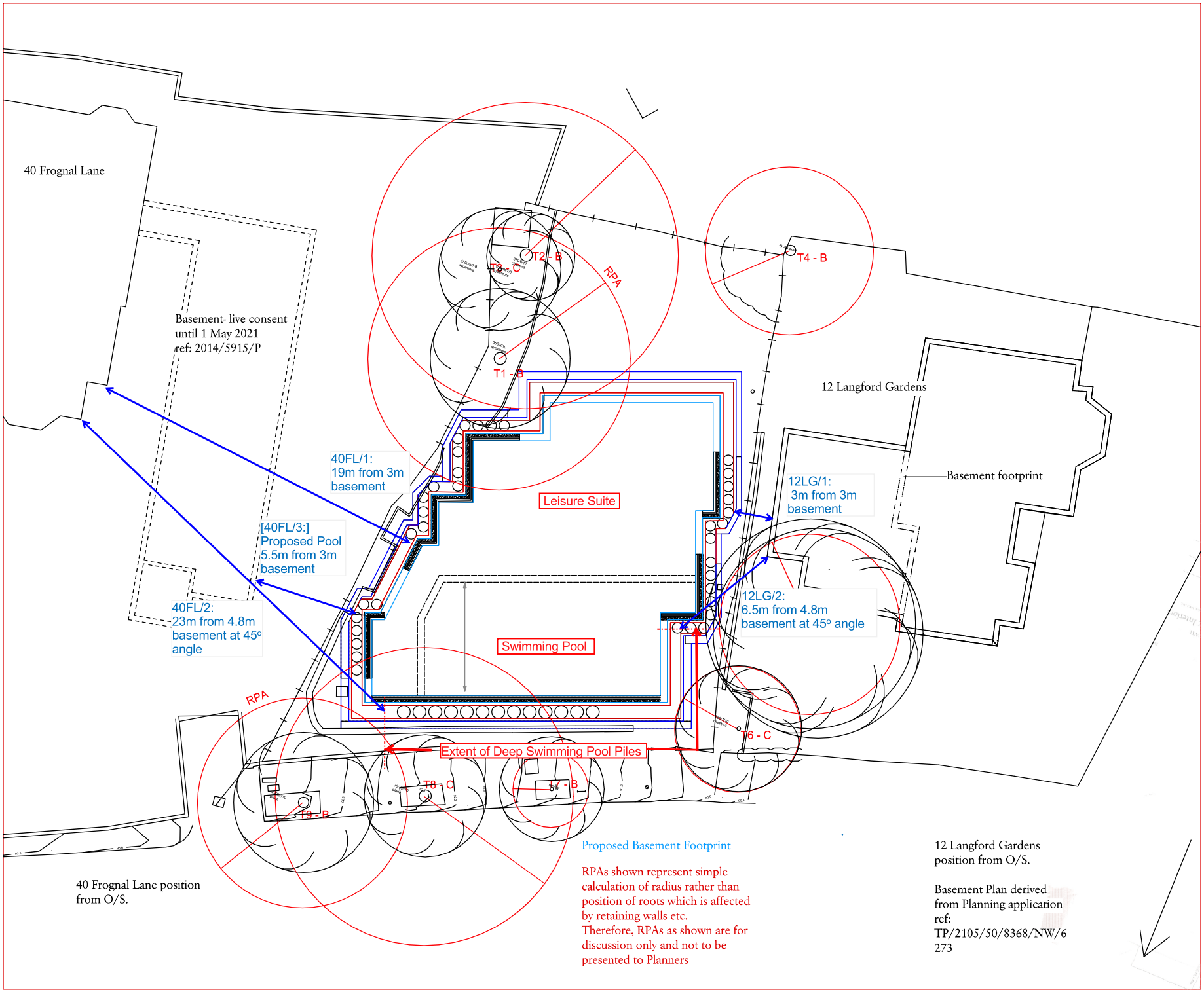
6.5.2 The basement will require party wall awards which in turn will require condition surveys. If the adjoining owner's surveyor wishes for any existing cracks to be monitored with DEMEC gauge or Tell-tale crack monitors, this will be undertaken as part of the award.

7.0 CONCLUSION

7.1 As shown on Figs 1 to 4, the impact of the proposed basement on the adjacent houses is within the acceptance criteria set out in LB Camden CPG on Basements.

N C Train BSc, C.Eng, FIStructE, FICE, FCIArb

Appendix 1 T&K Drawing 14604/01 Site Layout with Clearance to Adjacent Properties



Important note

All dimensions in millimetres. Where dimensions are not given, drawings must not be scaled and the matter referred back to Charlton Brown Architects.

All dimensions and conditions are to be checked on site by the contractor prior to preparing drawings or commencing any work. The contractor is responsible for checking that there is no conflict between site dimensions and drawn dimensions.

In the event of any detail or dimensional conflict between Charlton Brown Architects drawings, the matter must be referred back to Charlton Brown Architects for clarification

Rev	Date	Details	By

TRAIN & KEMP

10 Kennington Park Place London SE11 4AS
Tel: +44 (0) 20 7582 1276
www.trainandkemp.co.uk

Client
MRPP

Project
38 Frognal Lane, NW3

Drawing Title
Site Layout with basement clearances to adjacent properties

Date	Drawn	Checked
07/10/20	NCT	

Scale
1:200 @ A3

Ground Movement & Building Damage Assessment

Project Number	Drawing Number	Revision
14604	01	

Appendix 2 Ground Movement Analysis

08/10/2020

38 Frognal Lane NW3 6PP
Ground Movement with 12LG-1 Leisure Suite Basement

Job No: 14604

C580
Table

2.2	Pile Type:	Contiguous		Depth	10 m	Zone of Influence		
	Horizontal Strain	0.04%	at pile reducing to zero over		1.5	pile lengths =	15 m	
	Vertical Strain	0.04%	at pile reducing to zero over		2	pile lengths =	20 m	
2.4	Excavation	Propped High Level		Depth	4.3 m			
	Horizontal Strain	0.15%	at pile reducing to zero over		4	excavation depths=	17.2 m	
	Vertical Strain	0.10%	at pile reducing to zero over		3.5	excavation depths=	15.05 m	

No 12 Langland Gardens Length 8 m Height 10 m L/H= 0.8 No 12 UG Foundation 88.0 m OD
Clearance from basement 3 m No 38 Leisure Excavation 86.2 m OD
Depth Difference 1.8 m

		Horizontal Movement							Vertical Movement								
		Pile 10 m			Excavation 1.8 m			Σ	Pile			Excavation			Σ	Diff	Dist
Position	Clear	Portion	ε	mm	Portion	ε	mm	mm	Portion	ε	mm	Portion	ε	mm	mm	mm	m
Contig Wall	*0 m*	*0.00*	*0.040%*	*4.0*	*0.0*	*0.150%*	*2.7*	*6.7*	*0.00*	*0.040%*	*4.0*	*0.0*	*0.100%*	*1.8*	*5.8*		
Building Face	3 m	0.20	0.032%	3.2	1.7	0.087%	1.6	4.8	0.15	0.034%	3.4	1.7	0.052%	0.9	4.3		
																1.0	2
2 m into Bldg	5 m	0.33	0.027%	2.7	2.8	0.046%	0.8	3.5	0.25	0.030%	3.0	2.8	0.021%	0.4	3.4		
																1.2	4
6 m into Bldg	9 m	0.60	0.016%	1.6	Beyond Zone	0.000%	0.0	1.6	0.45	0.022%	2.2	Beyond Zone	0.000%	0.0	2.2		
																0.4	2
8 m into Bldg	11 m	0.73	0.011%	1.1	Beyond Zone	0.000%	0.0	1.1	0.55	0.018%	1.8	Beyond Zone	0.000%	0.0	1.8		
																2.5	8.0

Horizontal Displacement

Building Face to 6 m Horizontal Diff 3.2 mm
Av Horizontal ε 0.053%

Vertical Displacements

Over a Distance of 6 m Vertical Difference Building Face to 2 m into Bldg 1.0 mm
Av slope= ΣDiff/ΣDist = 0.032% Av Diff on 2 m into Bldg 0.6 mm
Differential Settlement Δ= 0.3 mm
Δ/ΣDist= 0.004%

08/10/2020

38 Frognal Lane NW3 6PP
Ground Movement with 12LG-2 Swimming Pool Basement

Job No: 14604

C580 Table

2.2	Pile Type:	Contiguous	Depth	15 m	Zone of Influence		
	Horizontal Strain	0.04%	at pile reducing to zero over	1.5	pile lengths =	22.5	m
	Vertical Strain	0.04%	at pile reducing to zero over	2	pile lengths =	30	m
2.4	Excavation	Propped High Level	Depth	6.1 m			
	Horizontal Strain	0.15%	at pile reducing to zero over	4	excavation depths=	24.4	m
	Vertical Strain	0.10%	at pile reducing to zero over	3.5	excavation depths=	21.35	m

No 12 Langland Gardens Length 8 m Height 10 m L/H= 0.8 No 12 UG Foundation 88.0 m OD

Angle of basement corner to wall θ = 45 ° ° No 38 Pool Excavation 84 m OD

Clearance from basement 6.5 m Depth Difference 3.6 m

		Horizontal Movement							Vertical Movement								
		Pile	15 m		Excavation	3.6 m		Σ	Pile			Excavation			Σ	Diff	Dist
Position	Clear	Portion	ε	mm	Portion	ε	mm	mm	Portion	ε	mm	Portion	ε	mm	mm	mm	m
Contig Wall	*0 m*	*0.00*	*0.040%*	*6.0*	*0.0*	*0.150%*	*5.4*	*11.4*	*0.00*	*0.040%*	*6.0*	*0.0*	*0.100%*	*3.6*	*9.6*		
Building Face	6.5 m	0.29	0.028%	4.3	1.8	0.082%	3.0	7.2	0.22	0.031%	4.7	1.8	0.048%	1.7	6.4		
																1.0	2
2 m into Bldg	8.5 m	0.38	0.025%	3.7	2.4	0.061%	2.2	5.9	0.28	0.029%	4.3	2.4	0.033%	1.2	5.5		
																1.9	4
6 m into Bldg	13 m	0.56	0.018%	2.7	3.5	0.020%	0.7	3.4	0.42	0.023%	3.5	3.5	0.001%	0.0	3.5		
																0.4	2
8 m into Bldg	15 m	0.64	0.014%	2.1	Beyond Zone	0.000%	0.0	2.1	0.48	0.021%	3.1	Beyond Zone	0.000%	0.0	3.1		
																3.3	8.0

Horizontal Displacement

Building Face to 8 m Horizontal Diff Δ_H 5.1 mm perpendicular to wall

Component of Horiz Diff at angle θ= $\Delta_H \cos\theta$ = 3.6 mm

Av Horizontal ε 0.045%

Vertical Displacements

Over a Distance of 8 m Vertical Difference Building Face to 2 m into Bldg 1.0 mm

Av slope= ΣDiff/ΣDist = 0.042% Av Diff on 2 m into Bldg 0.8 mm

Differential Settlement Δ= 0.1 mm

Δ/ΣDist= 0.002%

08/10/2020

38 Frognal Lane NW3 6PP
Ground Movement with 40FL-1 Leisure Suite Basement

Job No: 14604

C580
Table

2.2	Pile Type:	Contiguous		Depth	10 m	Zone of Influence		
	Horizontal Strain	0.04%	at pile reducing to zero over		1.5	pile lengths =	15 m	
	Vertical Strain	0.04%	at pile reducing to zero over		2	pile lengths =	20 m	
2.4	Excavation	Propped High Level		Depth	6.1 m			
	Horizontal Strain	0.15%	at pile reducing to zero over		4	excavation depths=	24.4 m	
	Vertical Strain	0.10%	at pile reducing to zero over		3.5	excavation depths=	21.35 m	

No 40 Frognal Lane Length 9 m Height 10 m L/H= 0.9 No 40 LG Foundation 91.2 m OD
Clearance from basement 19.0 m No 38 Leisure Excavation 86 m OD
Angle of basement corner to wall θ = 0 ° Depth Difference 5.0 m

		Horizontal Movement							Vertical Movement								
		Pile 10 m			Excavation 5.0 m			Σ	Pile			Excavation			Σ	Diff	Dist
Position	Clear	Portion	ε	mm	Portion	ε	mm	mm	Portion	ε	mm	Portion	ε	mm	mm	mm	m
Contig Wall	*0 m*	*0.00*	*0.040%*	*4.0*	*0.0*	*0.150%*	*7.5*	*11.5*	*0.00*	*0.040%*	*4.0*	*0.0*	*0.100%*	*5.0*	*9.0*		
Building Face	19.0 m	Beyond Zone	0.000%	0.0	3.8	0.008%	1.4	1.4	0.95	0.002%	0.2	Beyond Zone	0.000%	0.0	0.2		
																0.2	3
3 m into Bldg	22 m	Beyond Zone	0.000%	0.0	Beyond Zone	0.000%	0	0.0	Beyond Zone	0.000%	0.0	Beyond Zone	0.000%	0.0	0.0		
																0.0	3
6 m into Bldg	25 m	Beyond Zone	0.000%	0.0	Beyond Zone	0.000%	0	0.0	Beyond Zone	0.000%	0.0	Beyond Zone	0.000%	0.0	0.0		
																0.2	6.0

Horizontal Displacement

Building Face to 6 m Horizontal Diff Δ_H 1.4 mm perpendicular to wall
Component of Horiz Diff at angle θ= $\Delta_H \cos\theta$ = 1.4 mm
Av Horizontal ε 0.024%

Vertical Displacements

Over a Distance of 6.0 m Vertical Difference Building Face to 3 m into Bldg 0.2 mm
Av slope= ΣDiff/ΣDist = 0.003% Av Diff on 3 m into Bldg 0.1 mm
Differential Settlement Δ= 0.1 mm
Δ/ΣDist= 0.002%

08/10/2020

38 Frognal Lane NW3 6PP
Ground Movement with 40FL-2 Swimming Pool Basement

Job No: 14604

C580
Table

2.2	Pile Type:	Contiguous	Depth	10 m	Zone of Influence			
	Horizontal Strain	0.04%	at pile reducing to zero over	1.5	pile lengths =	15 m		
	Vertical Strain	0.04%	at pile reducing to zero over	2	pile lengths =	20 m		
2.4	Excavation	Propped High Level	Depth	6.1 m				
	Horizontal Strain	0.15%	at pile reducing to zero over	4	excavation depths=	24.4 m		
	Vertical Strain	0.10%	at pile reducing to zero over	3.5	excavation depths=	21.35 m		

No 40 Frognal Lane Length 9 m Height 10 m L/H= 0.9 No 40 LG Foundation 91.2 m OD
Clearance from basement 23.0 m No 38 Pool Excavation 84.4 m OD
Angle of basement corner to wall θ = 45 ° Depth Difference 6.8 m

		Horizontal Movement							Vertical Movement								
		Pile	10 m		Excavation	6.8 m		Σ	Pile			Excavation			Σ	Diff	Dist
Position	Clear	Portion	ε	mm	Portion	ε	mm	mm	Portion	ε	mm	Portion	ε	mm	mm	mm	m
Contig Wall	*0 m*	*0.00*	*0.040%*	*4.0*	*0.0*	*0.150%*	*10.2*	*14.2*	*0.00*	*0.040%*	*4.0*	*0.0*	*0.100%*	*6.8*	*###*		
Building Face	23.0 m	Beyond Zone	0.000%	0.0	3.4	0.023%	5.3	5.3	Beyond Zone	0.000%	0.0	3.4	0.003%	0.2	0.2		
																0.2	3.5
3.5 m into Bldg	26.5 m	Beyond Zone	0.000%	0.0	3.9	0.004%	1.02	1.0	Beyond Zone	0.000%	0.0	Beyond Zone	0.000%	0.0	0.0		
																0.0	3.5
7 m into Bldg	30 m	Beyond Zone	0.000%	0.0	Beyond Zone	0.000%	0	0.0	Beyond Zone	0.000%	0.0	Beyond Zone	0.000%	0.0	0.0		
																0.0	2
9 m into Bldg	32 m	Beyond Zone	0.000%	0.0	Beyond Zone	0.000%	0	0.0	Beyond Zone	0.000%	0.0	Beyond Zone	0.000%	0.0	0.0		
																0.2	9.0

Horizontal Displacement

Building Face to 9 m Horizontal Diff Δ_H 5.3 mm perpendicular to wall
Component of Horiz Diff at angle θ= $\Delta_H \cos\theta$ = 3.8 mm
Av Horizontal ε 0.042%

Vertical Displacements

Over a Distance of 9.0 m Vertical Difference Building Face to 3.5 m into Bldg 0.2 mm
Av slope= ΣDiff/ΣDist = 0.003% Av Diff on 3.5 m into Bldg 0.1 mm
Differential Settlement Δ= 0.1 mm
Δ/ΣDist= 0.002%

Appendix 5: Structural Engineer's Statement and Calculations

As a rebuild, the house will be constructed in a sensible and orthodox manner from the bottom upwards. The leisure suite will have columns at around 5m centres, both ways, to support the ground floor slab and superstructure. These basement columns will be supported on piles within the basement box.

The basement will require the construction of a contiguous piled perimeter wall with an inner box of waterproof concrete.

The ground movement analysis assumes the basement walls are held stiff. This will be achieved during construction by wailer and bracing. In the permanent solution the walls will have capping beams and the lid to the basement.

As orthodox construction, there are no unusual features that require preliminary design calculations.