Basement Impact Assessment

pro forma 1v0

7 May 2021

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

Revisions & additional material

38 Frognal Lane NW3 6PP

Basement Impact Assessment

Planning reference no [if known]

Document History and Status

For

MRPP

Project Number: TAK 20080

7th May 2021

Revision	Date	Purpose/Status	File Ref	Author	Check	Review
Initial	7.10.20	Initial Submission	BIA 2020.10.07	NCT		
01	6.11.20	Soils 2020 SI included	BIA 2020.11.06	NCT	CS	
2021.01.07	7.01.21	Soils 2020 SI with standpipe monitoring & Response to CR Audit	BIA 2021.01.07	NCT	CS	
2021.02.10	10.02.21	Construction Methodology & Utility Search added	BIA 2021.02.10	NCT	CS	
2021.03.04	04.03.21	February Audit Queries	BIA 2021.03.04	NCT	CS	
2021.04.08	08.04.21	Hydrogeology in 5.5 revised by CS	BIA 2021.04.08	NCT	CS	
2021.04.15	15.04.21	References to drainage blanket removed	BIA 2021.04.15	NCT	CS	

2021.05.07	07.05.21	Pile design parameters clarified at 7.1.5	BIA 2021.05.07	NCT	CS	

Document Details

Last saved	7th May 2021
Path	20080
Author	Norman Train, TAK Structures Ltd
Reviewer	Chris Swainston, Soils Ltd
Project Name	38 Frognal Lane
Planning Reference No.	2020/4667/P

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
Appendix 2: Soil Reports	2020 and 2014 Investigations	Soils Ltd
Flood Risk Assessment	02	Norman Train
Ground Movement and Building Damage Assessment	03	Norman Train
Surface Water Strategy	Drg 1611-100 P2	Simon Dent Associates
Construction Methodology	TAK Report 2021.02.05 Rev B	TAK Structures
Utilities Search	38 Frognal Lane Primary Utility Report	Premier Energy
CR Audit 21.02 Response Checklist		Norman Train

Please list all revisions here:

D	Version	Produced by
Appendix 2 Soil Reports 2020 and 2014	2020 Rev 1.10	Soils Ltd
Ground Movement and Building Damage Assessment	04	Norman Train

Contents

Appendices

Appendix 1: Desk Study References

- Environment Agency Surface Water Flood Risk

Appendix 2: Site Investigation Reports

Appendix 3: Existing and Proposed Development Drawings Schedule

Appendix 4: Ground Movement and Damage Impact Assessment

Appendix 5: Structural Engineer's Construction Methodology Rev B.

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 drawings listed in 2.3.7.

3. The proposed development comprises a two storey detached house with a basement. See drawings listed in 2.3.7.

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 these assessments are:

    The lead author is Norman Train, BSc, CEng, FICE, FIStructE, consultant to TAK Structures Ltd 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. Whilst the BIA has identified that the basement perimeter piles will intercept the perched water table in the Claygate Members, this is not considered significant.

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 TAK Structures Ltd with over 40 years' experience in foundation design and structures

2.1.2. The BIA has been reviewed 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 of 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°.

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

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 a 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 the basement excavation. Streets in the surrounding area are wide enough for both goods and plant machinery.

2.3.9. The structural details are given in the Construction Methodology Report in Appendix 5

2.3.10. Details of the existing utilities in Frognal Lane is presented in Premier Energy's Report in Appendix 6

2.3.11. The outline construction programme for the proposed development will be developed 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, fencing 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 80m and 150m 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. As the site survey drawing, MSA 3798-T, the total site area is some 690m^2. The existing house has an impermeable area of 200m^2. The proposed scheme will have 230m^2 of impermeable roofs/patios/alleyways, 150m^2 of permeable driveway and the remaining 310m^2 as garden areas. The current greenfield rates for the sites are very low and the flows for 1 year, 30 year & 100 year events are 0.38 lit/sec, 1.02 lit/sec & 1.41 lit/sec respectively.

3.4.5. The geology of the site indicates infiltration to the ground is not possible. For storm water design, discharges from the site will be attenuated with a 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. In addition, all rainwater downpipes shall be provided with water butts to assist in reusing rainwater for irrigation and gardening.

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

3.4.7. The Surface Water Management Plan 2013, Fig 3.1, shows LFRZ 3015, Frognal, is to the east of the site.

3.5. Other Information

3.5.1. Utility search information is given in Premier Energy report

4. Screening

4.1. Hydrology

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 100m of a watercourse, well (used / disused) or potential spring line?	Yes	CGHH Fig 11, Watercourses, show that two tributaries to the River Westbourne starts at the junction of Lingfield and Langland Gardens and on the east side of Frognal at Frognal Close. These are 80m to the southwest and 150m to the southeast respectively
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?	Yes	The impermeable area will increase by some 10%. This will be address with attenuation
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^{o}
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 embankments
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?	Yes	CGHH Fig 11, Watercourses, show that two tributaries to the River Westbourne starts at the junction of Lingfield and Langland Gardens and on the east side of Frognal at Frognal Close. These are 80m to the southwest and 150m to the southeast respectively
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?	Yes	Whilst the basement will extend into the aquifer, the contiguous piled wall 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 Northern 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?	Yes	The impermeable area will increase by some 10%. This will be address with attenuation
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
- A tributary to the River Westbourne commences 80m to the southwest of the site
- The impermeable area will increase by some 10%
- 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°. This is correlated by GHHS Figure 16, which also shows the site is remote from any railway cuttings or embankments.

5.2.2. Whilst the site is within 80m of a tributary, the groundwater flow is restricted by No 12 Langland Gardens basement and the proposed basement will not impact on any ground stability downstream of the site.

5.2.3. The basement excavation will be framed with a box of contiguous piles, bored into the London Clay, and braced as ground level. There will be no ground stability issues upstream of the site.

5.2.4. There will be no impacts to slope stability.

5.3. Drainage

5.3.1. The application site is not within a Local Flood Risk Zone.

5.3.2. The existing impermeable area of 200m^2 will increase to 230m^2; 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. It will also be lower than the highway.

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 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 Investigations have established that the thickness of the Claygate Members beneath the site is between 4m and 5.5m 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 some 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.

5.5.3. Monitoring the groundwater level over a 3 month period established that it is between 1m and 2m below ground level

Catchment & Macro Groundwater Flows

5.5.4. The Claygate Member/London Clay contact is shown on CGHH Fig 4 to pass along Lindfield Gardens, across Langland Gardens and Frognal La ne, 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 80m south-west of the site, within a shallow valley. A second tributary commences beneath University College School, 150m 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.

5.5.5. 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.

5.5.6. 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 less than 1 litre per second.

5.5.7. Whilst it is unknown whether these tributaries flow all 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 beneath the site

5.5.8. The basic conceptual ground model and hydrogeology is that the site has a minimal Made Ground cover with underlying Claygate Member deposits. The latter are defined by British Geological Society as comprising dark grey clays with sand laminae, passing up into thin alternations of clays, silts and fine-grained sand, with beds of bioturbated silt. Ferruginous concretions and septarian nodules occur in places. As such it would be anticipated that flow of groundwater will be confined (in a literal sense) to the intermittent sand units. The Made Ground appears predominantly cohesive and typical of the area with only a relatively low level of vertical groundwater movement and infiltration anticipated. On this basis the majority of any groundwater flow in the system will be more horizontal than vertical in line with the strata and will be limited only to those cohesive sandy units where flow is actually possible and incentivised by pressure, which again is more likely to be lateral than vertical and will vary over time. Connectivity and conductivity is therefore likely to be relatively low over the unit as a whole and limited to select areas making general assumptions dubious in their specific reliability.

5.5.9. Given that connectivity is clearly going to be limited by the cohesive bands in this strata restricting vertical movement, the basement can be considered as a sealed unit with no surrounding materials providing that sufficient natural material is available around the structure to allow flow to continue around it. The calculation of consequences of such actions should be relatively simple if the characteristics of the strata are properly understood and modelled. Again, some structural allowance will probably be required to account for changes in pore pressure in the surrounding materials and to ensure that the structure is waterproofed and watertight so as not to supply an alternative route for the groundwater to exploit.

5.5.10. Local pore pressures will probably change and this will have a potential impact on the proposed structural solution. However, given the variability of the underlying strata, it should be noted that this pressure is also unlikely to be even across the whole structure (likely to be higher in saturated granular materials which are as noted variable in both thickness and extent) and allowance for that must be established and quantified. Based on the generic hydraulic conductivity of the Claygate Member and the assumed upgradient profile as usually derived being approximately 0.1 ltrs/hr/m^2. However, that does not mean that is how much will actually enter the system or that it will be constant and consistent across every m^2. Any upstream water rise is likely to be minimal and dependent on the nature of the downgradient strata and their ability to transmit liquids.

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.

The 2014 report was used to scope the 2020 Investigation with:

- A borehole to 20m for pile design
- Three standpipes to allow triangulation of the phreatic surface
- Three month standpipe monitoring commencing one month after the fieldwork was completed

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 held triangulate the depth of the London Clay, which ranges between 5.5m and 7.8m in depth as well as the ground water phreatic surface.

Standpipes were installed in all three holes and were monitored over a 3 month period. The initial readings during the boring of the holes were discounted. The results are reported in the report table 2.7 and presented below.

Standpipe Readings

Distance between Window samplers 10 m

	WS101		BH 1		WS Gradient			True Gradient			
Mth	Read	OD Level	Read	OD Level	Read	OD Level	Grad-ient	WS102 to BH1 water contour	WS101 to BH1 water contour	Grad-ient	Compass Bearing
Ground Level		90.5		90.5		91.0					
Oct	2.56	87.9	1.81	88.6	1.67	89.3	0.075	8.5	14.2	0.098	250°
Nov	1.97	88.5	0.99	89.5	0.92	90.0	0.098	5.8	13	0.119	247°
Dec	2.07	88.4	1.53	88.9	1.21	89.7	0.054	15.2	16.6	0.082	238°
								Average		0.100	245°

Over a three month period, the phreatic surface across the site has an average gradient of 10% in a direction of WSW.

As on Drawing 14604/01A in Appendix 1 of the Ground Movement and Damage Assessment, the width of 38 Frognal Lane basement perpendicular to the groundwater flow is 18m; the width of the basement storey to 12 Langland Gardens perpendicular to the flow is 16m.

6.2. Additional Assessments

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

6.2.2 An Arborcultural Report and Utilities Search are 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.

7.1.2. The parameters from the 2020 Report are:

7.1.2.1. The one triaxial tests in the Claygate Member was 83kN/m^2 and the SPTs ranged from 8 to 11.

7.1.2.2. Triaxial tests in the London Clay ranged between 94kN/m^2 to 144kN/m^2 and SPTs ranged from 16 to 33.

7.1.2.3. Two falling head permeability test established that the permeability, k, ranges between 1 x10^{-5} m/s and 1.4 x 10^{-5}m/s.

7.1.3. Standpipe Monitoring results from Soils Ltd 2020 Report Table 2.7 have been used in 6.1 above to calculate the gradient and direction of flow of the groundwater. The water table is between 1m and 2m below ground level and buoyancy will have to be considered in the pile design.

7.1.4. Based on the dynamic probes undertaken on the site, the calculated E value of the Claygate Member is 5.1MPa. Claygate Members typically have a drained internal angle of friction, Φ_d, up to 22°.

7.1.5. With the potential loss of fines within the Claygate Beds, their contribution to the frictional capacity of the piles should be discounted.

7.2. Outline Temporary and Permanent Works Proposals

7.2.1. As set out in the Construction Methodology in Appendix 5, 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 the excavation stiff
- Propping of the retaining wall to back of the pavement.
- 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 basement throughflow in 5.5.8 at 0.12l/s cis 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 and Damage Assessment, GM&DA, 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 and the highway.

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. The resulting horizontal strain of the highway is also considered.

7.3.7. In accordance with the Burland Scale, the damage impacts are assessed as being Category 0, Negligible or Category 1 Very Slight.

Mitigation Measures

7.3.8. Whist the ground movement does not require mitigation measures it would assist if the excavation propping had one of the props holding the last of the deep swimming pool piles on the western side at its junction with the shallower leisure suite excavation. This will ensure that this node is held tight.

7.3.9. Consideration should also be given to completing the leisure suite raft and basement walls on the western side before the deeper excavation to the swimming pool is undertaken.

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.

7.4.3. A ground movement monitoring scheme will be adopted. Given the anticipated magnitude of the movement, monitoring of the internal finishes in the adjacent buildings at key stages through the piling and basement construction would appear to give an appropriate and pragmatic solution. This will be undertaken utilising the party wall awards and agreed with the

adjoining owner's surveyor. The monitoring could be further surveys of internal finishes, using the initial Schedule of Condition as the datum, or the installation of Tell Tail crack gauges.

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 between 1m and 2m below ground level.
- 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.
- Potential Impacts arising from the screening are listed in 4.4.
- Proposed mitigation includes propping of the excavation.

8.2. Land Stability/Slope Stability

8.2.1. The site investigation has identified that the Claygate Member and London Clay are both 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 and the strains on the highway are minimal.

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 limited and below the basement there are the gaps between the contiguous piles.

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

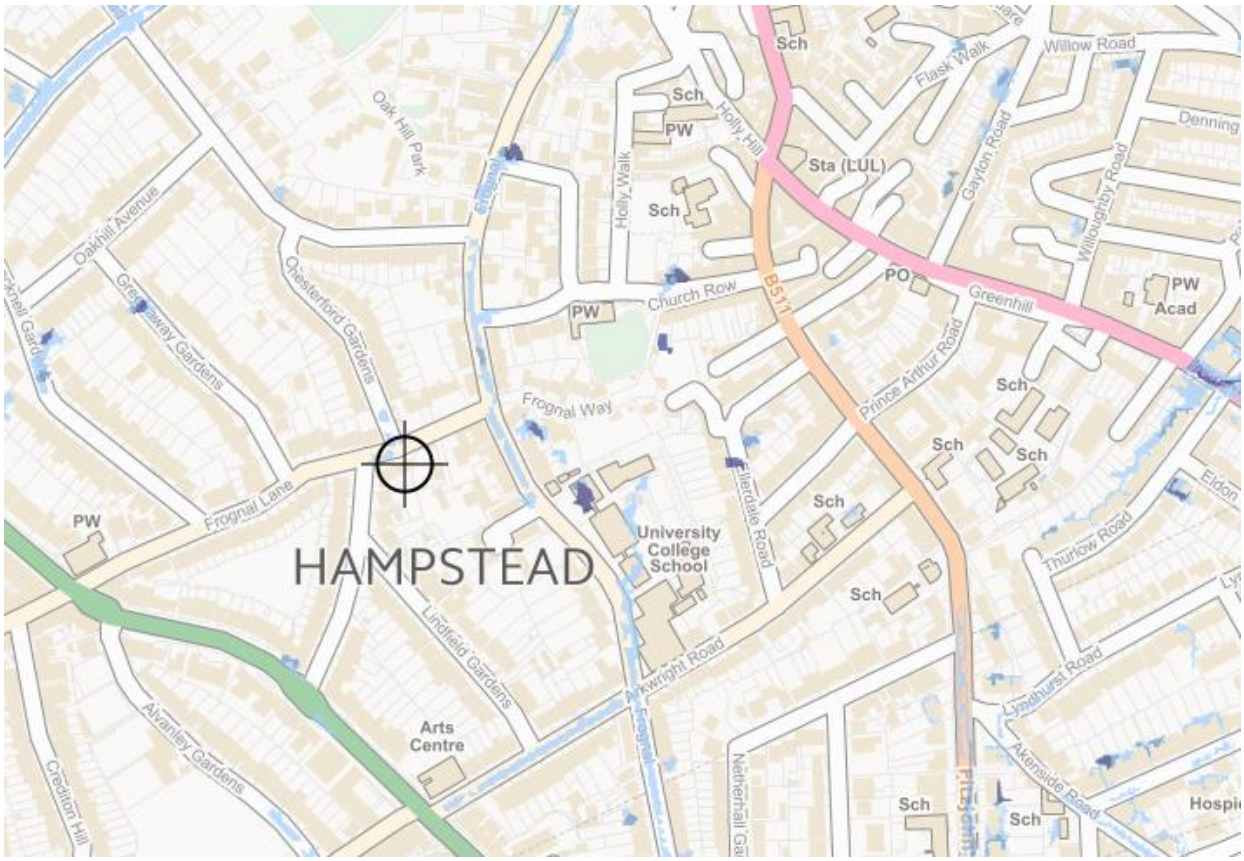
8.3.3. Flow around the basement is a viable solution, although it will affect local pore pressures which should be properly accounted for in the design.

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

Soils Ltd Site Investigation Report 2020, Rev 1.10	[Separate Document]
Soils Ltd Site Investigation Report 2014	[Separate Document]

Appendix 3: Existing and Proposed Development Drawings

The following Architects drawings form part of the planning application

20022-E-200 Front Elevation - North
20022-E-201 Side Elevation - East
20022-E-202 Rear Elevation - South
20022-E-203 Side Elevation - West
20022-E-204 Street Elevation
20022-P-099 Basement Floor Plan
20022-P-100 Ground Floor Plan
20022-P-101 First Floor Plan
20022-P-102 Second Floor Plan
20022-P-103 Roof Plan
20022-P-011 Site Plan

Appendix 4: Ground Movement and Damage Impact Assessment

See Train and Kemp Ground Movement and Building Damage Assessment [Separate Document]

Appendix 5: Structural Engineer's Statement and Calculations

TAK Structures Construction Methodology Report, 20080 TAK Report 2021.02.05 Rev B, gives details of the construction sequence including drawings of the 11 stages of the basement construction. [Separate Document]

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.

Appendix 6: Arboricultural Report/Other Reports (as required)

Arboriculturists Report by Tre Tec [Separate Document]

Surface Water Drainage Strategy on Simon Dent Associates Drawing 1611 100 [Separate Document]

Premier Energy Utilities Search Report [Separate Document]