Eckersley
O`Callaghan

Garden House, Structural Report and Basement Impact Assessment

Issue 06

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1 Executive Summary

This report is a revised issue of the Basement Impact Assessment at The Garden House, Vale of Health, Hampstead (Planning reference - 2017/2885/P).

This report includes supplementary information as requested by Camden Council (via Campbell Reith Audit Report).

This report has been written and reviewed by Chartered Structural Engineers with many years of experience in the design of deep basements and excavation works.

This report provides a detailed discussion of the proposed subterranean works to the Garden House.

It references an extensive set of existing building foundation and ground conditions and takes into consideration adjacent building levels and their respective foundations.

A detailed set of design information has been presented in plan and section.

A step-by-step construction sequence has been developed in conjunction with and taking advice from specialist piling and basement contractors.

A detailed geotechnical survey has been completed including assessment of ground movements and slope stability analysis.

A revised damage category assessment has been completed with reference to the adjoining and neighbouring properties and the predicted damage categories range between negligible and very slight, therefore meeting the requirements of CPG4.

Existing groundwater levels have been recorded over an extended period. These levels have been incorporated in a review of hydrology and hydrogeology at the site and the risks of impact to groundwater flow have been examined in detail.

The additional ground investigation has indicated that groundwater bearing Claygate is present to a significant depth in the west of the site such that the construction of a secant bored pile basement is unlikely to prevent groundwater flows towards the pond in the east. The basement elevations of the Heath Villa properties to the west lie above the proposed basement structure therefore localised groundwater related effects are highly unlikely to impact these properties.

As a precaution, mitigation measures should be incorporated into the development, such as drainage channels, to ensure that groundwater flow is diverted around the basement to the pond. Reference should be made to the ground movement and slope stability assessments in the report. It has been concluded that the impacts identified can be mitigated by appropriate design and standard construction practice.

2 Introduction

2.1 **Brief**

Eckersley O'Callaghan (EOC) have been asked by James Gorst Architects on behalf of Alex Vlachos, the client and landowner, to provide structural design information and to consider the construction aspects of the formation of a single storey external lightwell to the Garden House, Vale of Health, Hampstead. The refurbishment and extension works to the house include single level extensions to the west of the existing building and a basement extension to the south east. These works have been implemented and have planning approval under permitted development rights. Only the external works associated with the formation of the new lightwell area require additional planning approval for consideration in this application.

Notwithstanding the above, and although not an obligation of this planning application, this report provides a full professional assessment of the basement construction works as it is considered reasonable that the lightwell is shown in context with the main basement development that is approved and underway.

In support of this planning application EOC have commissioned a site investigation and geotechnical report to meet the requirements of the London Borough of Camden's planning policy criteria for the formation of lightwells. The report provides specific details of the excavation, suggested temporary works and construction techniques, including details of the potential impact of the lightwell and permitted basement on the existing and neighbouring structures, based on the specific site characteristics, geology and hydrogeology.

Recent geotechnical and environmental ground investigations were carried out in November 2016 by GEA Ltd and the interpretive reporting was completed in February 2017. A supplementary ground movement assessment and a slope stability analysis were completed in March 2017 and submitted to Camden to supplement the initial planning application.

Following the March 2017 submission, the Campbell Reith Audit Report (TAMtam12466-81-310717-The Garden House-D1.doc) requested further information including a deep borehole and an update version to the slope stability and ground movement assessment reports. The additional boreholes and were carried out in September 2017 and associated updated geotechnical reports have been appended to this report. This final report includes the additional information requested by Camden. The adjacent table 'figure 1' comprises the Camden Audit Query list and our responses provided and their location within the updated reports and supplementary information.

2.2 **LBC Requirements**

As stated in Camden Development Policy DP27 LB Camden "will only permit basement development that does not cause harm to the built and natural environment and local amenity and does not result in flooding or ground instability". LB Camden "will require developers to demonstrate by methodologies appropriate to the site that schemes:

— maintain the structural stability of the building and neighbouring properties;
— avoid adversely affecting drainage and run-off or causing other damage to the water environment;
— avoid cumulative impacts upon structural stability or the water environment in the local area."

The discussions within this report are based on the consideration of the following LBC policy documents:

— Development Policy DP23 and DP27, London Borough of Camden, 2010
— Planning Guidance CPG4 – Basement and Lightwells, London Borough of Camden
— Camden Geological, Hydrogeological and Hydrological Study. Guidance for Subterranean Development, Arup, Report No 213923, Issue01, 18 November 2010.

2.3 **Supporting Documents**

In support of this structural report the following supplementary documents have been compiled and are included as appendices.

— Outline Specification – Appendix A
— Design Parameters – Appendix B
— Proposed Structural Drawings – Appendix C
— Geotechnical Report & Movement Assessment by Geotechnical & Environment Associates Ltd. – Appendix D
— CCTV Survey & Thames Water Asset Maps – Appendix E
— Utilities Search – Appendix F
— Pile Capping Beam Analysis – Appendix G

2.4 **Camden Council Audit Information**

The below table includes a summary of outstanding information requested by Campbell Reith on behalf of Camden Council and a brief summary of responses and reference to areas in the report where additional information has been provided.

Query No.	Subject	Query	Design Team Response & Reference location of updated information
1	Site Investigation	Site exploration exploratory work was limited and GEA state further GI is required to confirm building damage and slope assessment.	GEA re-visited site in September 2017 and the updated report is provided in Appendix D of this report.
2	Slope and ground movement assessment	To be revised to ensure consistency between documents and to incorporate results of further GI. Mitigation measures to be proposed where damage exceed Category 1 and impact reassessed.	GEA revised the slope stability assessment incorporating results of the further GI. Damage Category 1 has now been proven to be the maximum damage category across all boundary structures and beyond. Full details available in Appendix D.
3	Subterranean groundwater flow	More detailed analysis on the disruption of groundwater flowing from the west by the basement is required.	Groundwater flow within the Claygate Formation will continue around the basement structure toward the Vale of Health pond. The additional ground investigation has indicated that groundwater bearing Claygate is present to a significant depth in the west of the site such that the construction of a secant bored pile basement is unlikely to prevent groundwater flows towards the pond in the east. The basements of the Heath Villa properties to the west lie above the proposed basement structure therefore localised groundwater related effects are highly unlikely to impact these properties. As a precautionary measure, drainage channels will be installed to each side of the excavation to ensure that groundwater flow is diverted around the basement towards the pond. Reference should be made to the ground movement and slope stability assessments in the report. It has been concluded that the impacts identified can be mitigated by appropriate design and standard construction practice.
4	Movement monitoring	Movement monitoring of adjacent properties and trigger level actions needs further development. In addition, an assessment as to the cause of historic cracking to existing buildings on the site is required.	A Movement Monitoring Specification developed in line with the predicted movements at the site during excavation works is provided in section 7 of this report. The cracking within the south elevation of the existing building is associated with the root growth of the Mulberry tree in close proximity – this tree is to be removed as part of the lightwell works and the cracking within the brickwork will be repaired to mitigate any further effects and to ensure robustness of this wall.
5	Utilities search	A Utilities search should be carried out.	A utilities search has been completed and is available in appendix F of this report.
6	Slope and ground movement assessment	The capping beam around the lightwell should be subject to analysis as reliance is placed on the stiffness of this element being sufficient to control deflections in the same manner as if it were a "top down" construction.	The analysis of the free spanning capping beam is available in appendix G of this report

Figure 1 Campbell Reith Audit Query Tracker and the location of the responses to queries provided within this document and supporting documents

3 Existing Site

3.1 Site Access

The site can be accessed from Vale of Heath by entering the existing entrance gate located between 12 and 13 Vale of Heath terraced properties. An existing concrete pathway connects the road to a randomly paved area and raised patio adjacent to the existing brick outhouse situated at the foot of the entrance pathway. The site borders the Vale of Heath Pond, backing onto Hampstead Public Park. The chosen construction entrance therefore is limited to the existing narrow gateway located within the brick archway. Figure 2 shows the entrance gate access proposed.

3.2 Site History

This area of Hampstead Heath was originally named Gangmoor and later Hatches Bottom after an early 18th Century cottager. The Pond was created in 1777 by the Hampstead Water Company, which drained enough of the formerly marshland to allow for houses to be built here. In 1860, the Hampstead Junction Railway opened, allowing day-trippers to flock to the small village. The 'Vale of Heath' was recognised in the mid-20th Century and now consists of villas and cottages, separated by narrow alleyways.

Fig 5, shows the surrounding villas suffered minor blast damage during WWII, with a larger building located to the North of the site also damaged.

Historical Maps provided in early reports documenting the site have been used to assess the presence of any existing underground features and archaeological history which may be encountered on the site. As the site was undeveloped prior to the existing buildings built in the 1950's, the risk of finding of any additional underground features is very low.

3.3 Existing Buildings

The existing building was built in the 1950's. It consists of masonry load bearing walls with a double pitched tiled roof and brick retaining walls bordering the Heath villas, additionally supported by brick buttress piers. This building is generally in a good structural condition however the south facing wall comprises some smalls cracks along the brick joints below a window in close proximity to a mulberry tree. The cracking is likely to be associated with the root growth of the tree and movement of the surrounding ground. The tree is to be removed as part of the proposed works and therefore any ongoing effects to the structure will be mitigated. There is a brick outhouse located in the South West corner of the site adjacent to the access route from the entrance gateway, which is a low-level building with small raised patio providing access. The front of the main residential building has a stepped rockery bed with steps located on the North East of the site providing entrance to the upper level of the building. The existing building does not contain a basement currently, however as suggested by previous reports from Richard Jackson in 2012, underpinning works have been completed in 2010 to facilitate an early basement extension that was not completed at that time, although the location of these are unknown currently.

The trial holes performed in 2012 confirmed the foundations to the existing Garden House to be concrete strip footings, founded on the Claygate Beds. The Site investigation completed by GEA in 2016 determined foundation details of the existing house and boundary walls (Appendix D), which also confirm the strip footings and brickwork details of the existing buildings.

3.4 Neighbouring Buildings

The neighbouring 'villas' which border the Vale of Heath were constructed in the 18th and 19th Centuries. The existing Victorian buildings are constructed with load bearing stone and masonry walls, with likely timber floors and joisting. The buildings have been well maintained and are generally believed to be in sound structural condition.

The foundations to the existing boundary wall to the West Villas where the existing buttress wall is found, consists of concrete strip footings, whereas the northern boundary wall has been founded on compacted hardcore. The level difference between the Western villa side and the Garden House level appears to be approximately only 1m. From a visual inspection, the buttresses do not appear to be necessary to retain this earth however they are apparently not original and may have been added subsequently to stabilise a slender wall. Temporary propping will be provided however during construction to support the wall where the buttresses will be reduced in thickness.

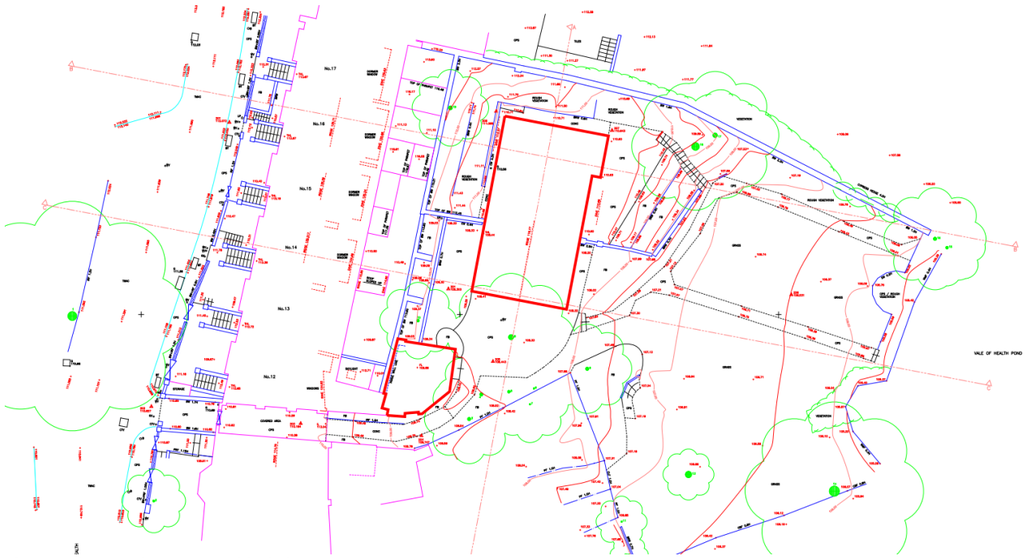


Figure 2 Site Location Topographical Plan

Figure 3 James Gorst Architects' Proposed Site Plan

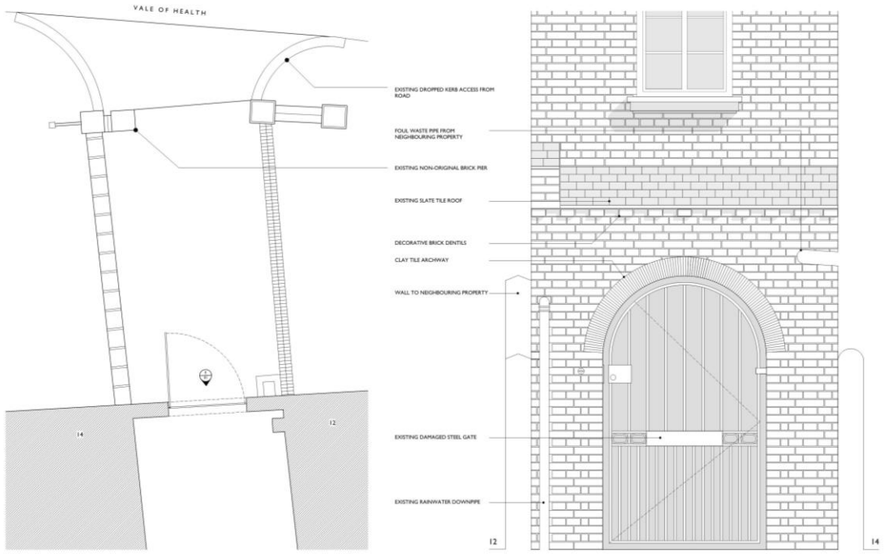


Figure 4 Existing Gated Entrance

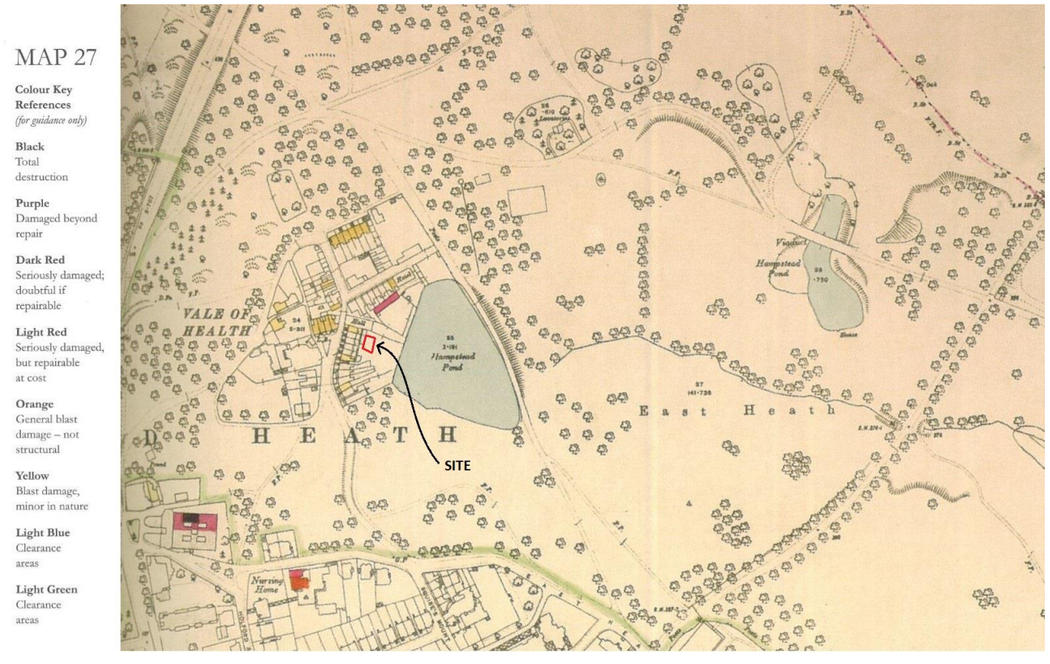


Figure 5 London City Council WWII Bomb Damage Map Extract

3.5 **Existing Below Ground Drainage**

A CCTV survey was completed on 20/10/2016 by JPD Technical Services to establish the layout and condition of the existing site drainage.

The existing system is combined, collecting the foul and surface water discharge from the roof, ground and existing upper floors, before discharging into MH3, located at the rear of the garden. The pipework is generally cast-iron rendered with clay channels flowing into brick manholes. The CCTV survey recommends that the system is suitable for re-use, should this be required.

Drainage records for the surrounding streets have been obtained from Thames Water, refer to Appendix E. These show connections to the Heath Villas from the Vale of Heath through a combined sewer. However, the map does not go as far to show the connection of the Thames water sewer with the CCTV survey pipework for the Garden House site. This is likely to be located further South of the Heath villas.

There have been no other drainage or public sewers found in or around the site. Therefore, no other third-party approvals will be required. During further design development Thames water will be provided with the proposed drainage strategy for review.

Due to the proposed ground level and architectural layout of Garden House, the foul drainage will need to be stored and pumped up to connect with the pipework within the boundary of the site. The storm water will also be pumped into an attenuation tank which will allow management of the surface water discharge flow rate.

Figure 6 Existing Site Drainage 2015 CCTV Survey by JBD Technical Services

4 Ground Conditions

4.1 **Introduction**

Existing historical information, BGS borehole information, existing borehole logs and supporting documentation have been used to inform an accurate anticipated ground model for the site. A full site investigation has been undertaken by GEA (Appendix D) and the supporting borehole logs and trial pit information has been used to validate the findings to date. Following this investigation, a ground model has been developed and assessment has been made of the predicted ground movements.

The site is located on a slope (West to East), facing Easterly downhill towards the Vale of Heath Pond. The existing slope is generally 5%, less than 8%, which is considered a stable gradient for the Claygate beds. Historical geo-investigations providing trial holes to expose the foundations to the Garden House and that of the boundary retaining walls to the Heath Villas were completed in 2012. This information has been used to help assess the impact of the proposed development on the surrounding buildings and to supplement the information obtained in the soil investigation report and conditions.

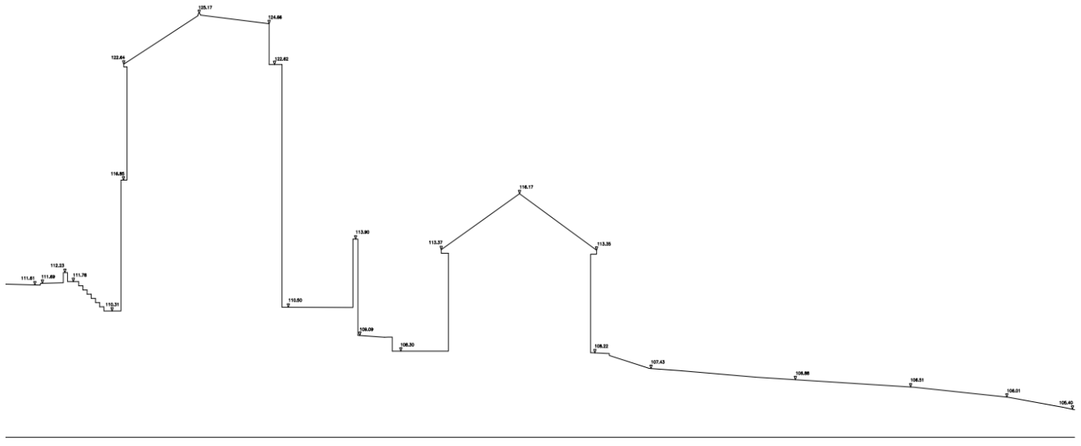


Figure 7 Topographical Survey Section

4.2 **Existing Conditions**

The British Geological Survey Map indicates that the site is in an area over Claygate formation beds with possible alluvium deposits. Previously Listers Geotechnical Consultants issued a report in September 2005, with results from 2no. 12m boreholes and 5 no. Hand auger trial pits. GEA were commissioned in 2016 to provide 3 no. approximately 4m deep boreholes and 8 no. trial pits were carried out across the site as shown on the below site investigation plan layout. Additionally, 2no. deep boreholes were carried out in September 2017 to supplement previously accumulated data.

Boreholes indicated subsoil strata generally as follows:

0.0	-	0.5m	of Made Ground,
0.5	-	3.5m	Soft Clay with partings of sand and silt,
3.5m	-	18m+	Stiff High Strength Clay with partings of clayey sandy silt – The ‘Claygate Member’

Made Ground is found within urban areas where much of the surface of the topography has been disturbed by human activity and replaced with a lower density soft topsoil. The BGS boreholes indicate that Made Ground occurs within the top layer to approximately 500mm below the ground level.

Claygate Member Beds comprising of dark grey clays with sand laminae, silts and fine grained sands, has an average thickness of 16m across the London area.

London Clay is generally expected below the Claygate beds and is a stiff stratum to depth.

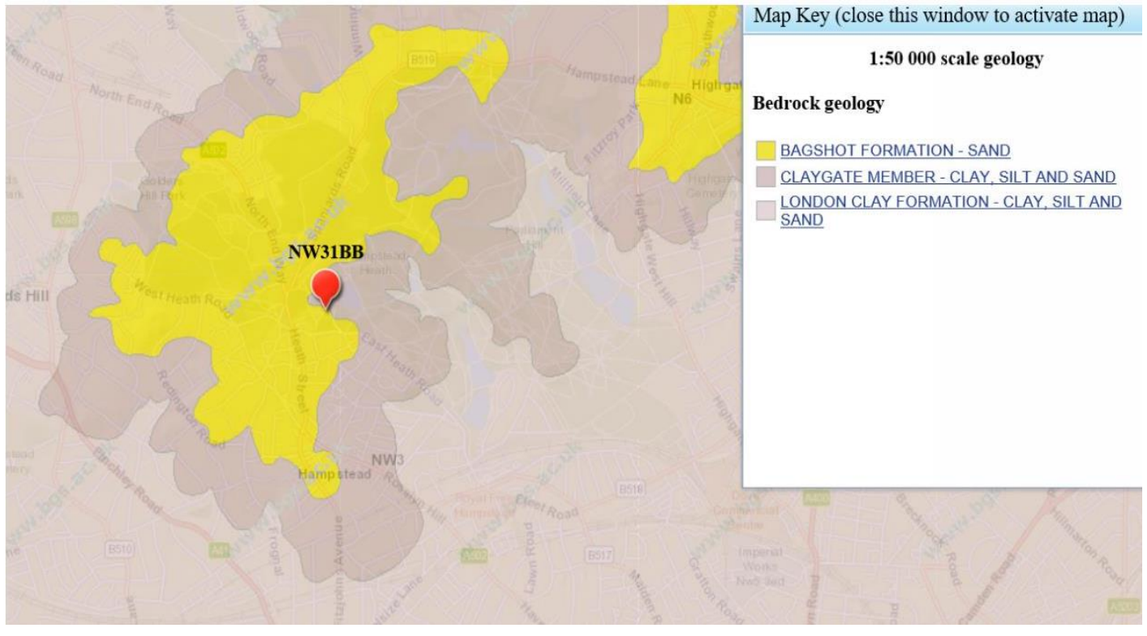


Figure 8 BGS Bedrock Geology Map- Claygate Member Beds

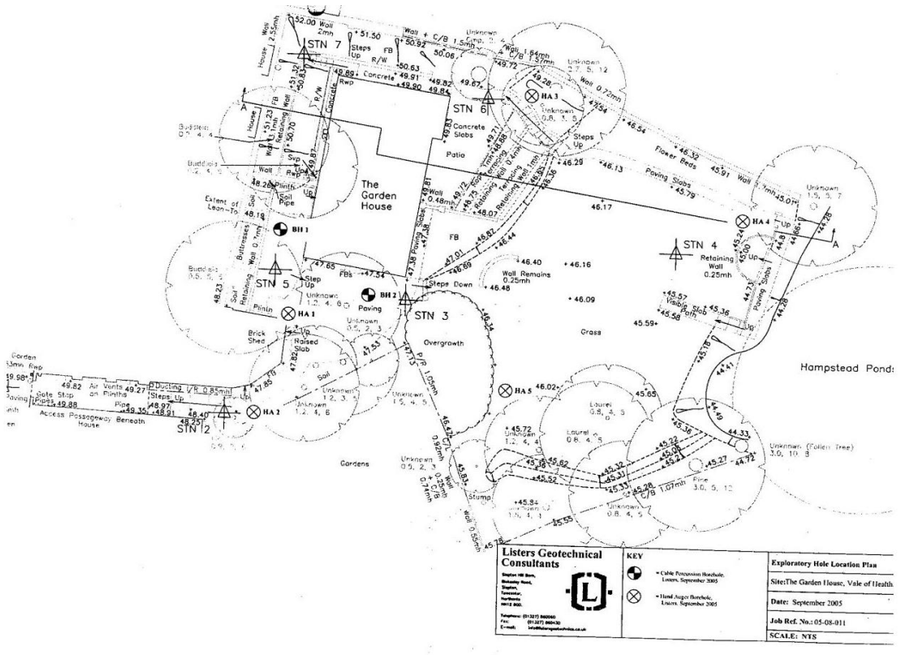


Figure 9 Site Investigation Plan - Listers Geotechnical Consultants, September 2005

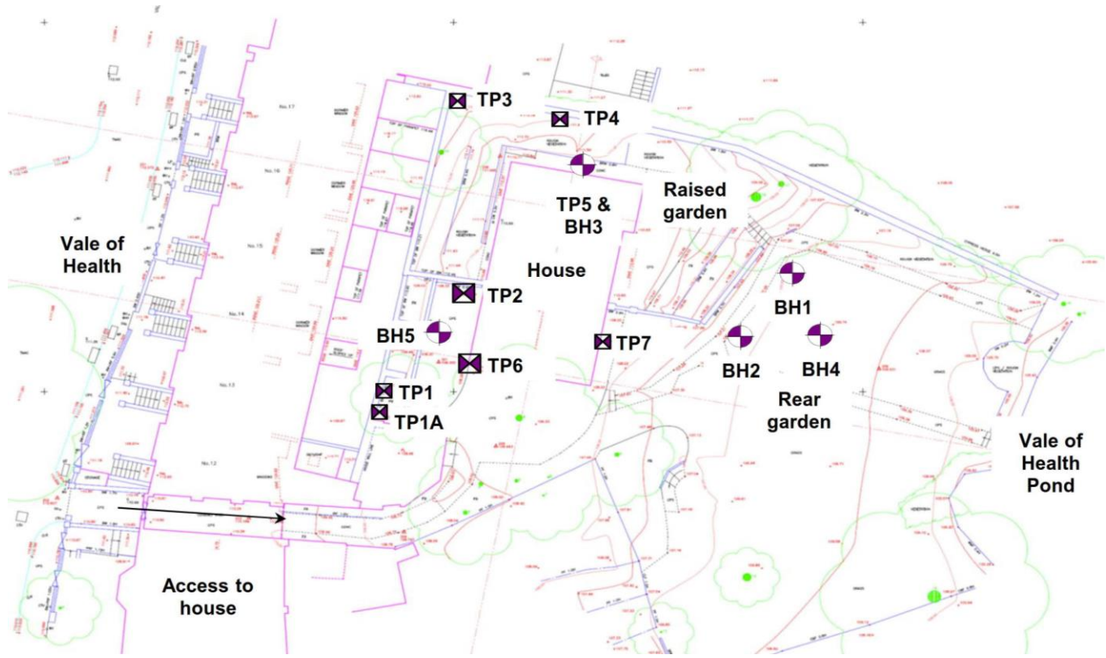
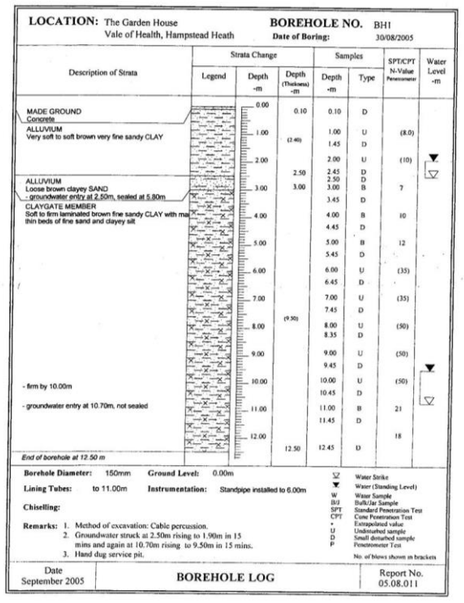


Figure 11 Site Investigation Plan - GEA, Up to and including site works in September 2017



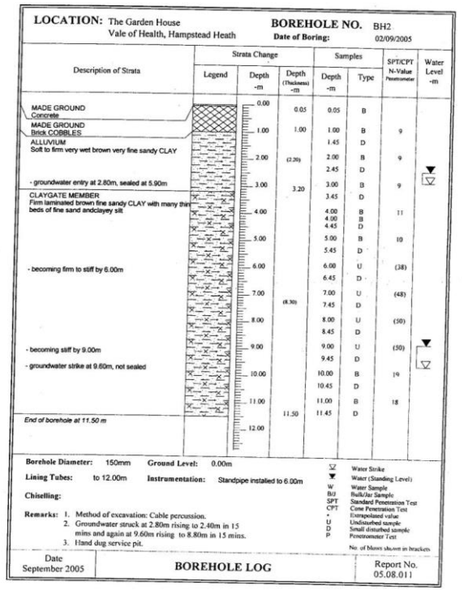
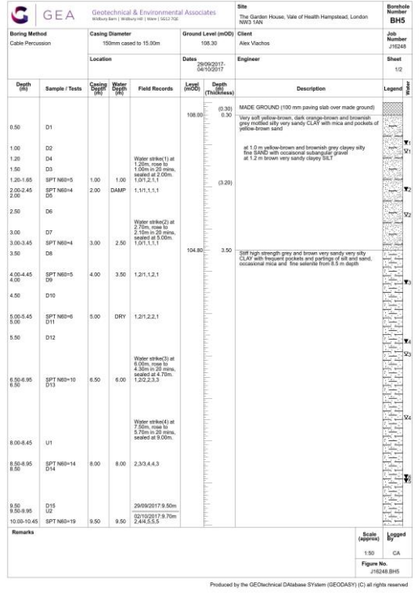


Figure 10 Typical Site Borehole Records-Listers Geotechnical Consultants, September 2005



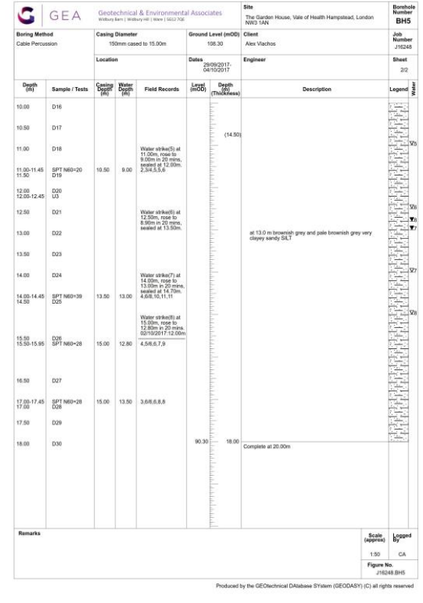


Figure 12 Borehole BH05 sheets 1 and 2 to 18m below ground level

4.3 **Existing Hydrogeology & Hydrology**

The Vale of Heath is underlain by Claygate member beds, which is designated a Secondary 'A' Aquifer, which refers to permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. This is shown in the below EA Groundwater Map (fig.11), by EA designation:

— Major Aquifer = Principal Aquifer
— Minor Aquifer = Secondary Aquifer

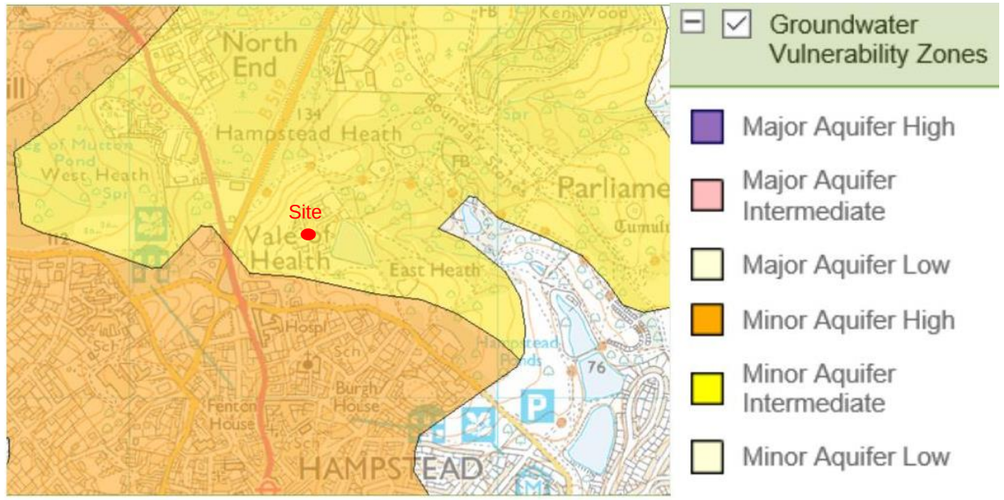


Figure 13 Environmental Agency Aquifer Designation Map

4.4 **Flood risk**

The property is adjacent to the Vale of Heath Pond, which is the nearest surface water feature to the site. The site is not at risk for flooding from the River Thames, located approximately 6 to 7miles to the south of the site. The direction of groundwater flow beneath the site is likely to be in a south easterly direction, downslope towards the pond. The key flood risk to the Camden area is from surface water flooding and there have been only two major flooding incidents in 1995 and 2002. The site is very low risk to surface water flooding as shown below.

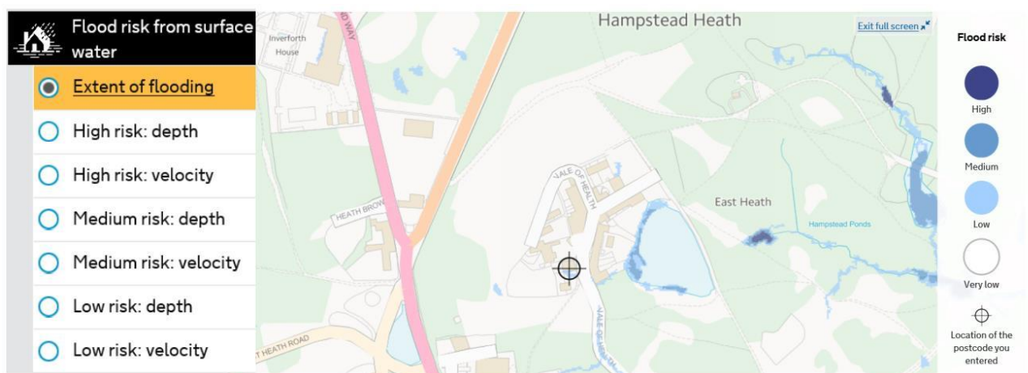


Figure 14 Environmental Agency Flood Risk from surface water Map

The existing buildings, landscaping and soft landscaped areas cover most of the site and therefore the majority of surface runoff is likely to drain into the Vale of Heath pond directly East of the site.

The site is not indicated as being at risk from flooding, nor is it located within a Groundwater Source Protection Zone as defined by the Environment Agency. It is in Flood Zone 1 and therefore does not need an associated flood risk assessment to be made.

Previously the historical maps show a stream located to the NW of the site, however this disappears after 1954 and does not appear on any hydrological information to date, including the lost rivers of London map. There are no watercourses passing through the site and this is supported by information within the LB Camden publications and supporting BGS information.

4.5 **Groundwater**

In 2012, the groundwater level was recorded between 0.38m and 0.83m below ground level. Groundwater levels are subjected to variations caused by changes in the local drainage conditions and by seasonal effects.

Standpipes were installed within all the boreholes and water levels were monitored to obtain a more accurate ground water level. BH1 & 2 identified the depth of the groundwater at 0.8m below the lower level at the East side of the building. BH3 recorded water at 3.3m below ground level taken from the upper level. This equates to an ordnance level of approximately +108.0m AOD. The excavation of the basement will extend below the existing groundwater level and therefore a secant piled wall has been advised surrounding the basement extent. The Groundwater level is high and for the purposes of design will be assumed to be located at within 1m from ground level.

The construction of the basement will extend into this groundwater profile. However, the extent of the proposed basement will extend marginally in plan towards the south and north, such that the majority of the water-bearing Claygate Member is likely to remain. Groundwater flow within the Claygate Formation would continue around the basement structure toward the Vale of Heath pond. However, as a precautionary measure, drainage channels can be constructed to ensure that the rate of groundwater is maintained around the basement structure.

4.6 **Waterproofing**

The design will proceed in accordance with BS 8102 (1990) Protection of Structures against water from the ground. The grade of environment to which the respective areas of the basement are to be designed informs the determination of suitable waterproofing strategy. This design decision is taken by the Client in consultation with the design team as the grade of protection chosen influences the architectural treatment of the basement proposed and the active measures necessary to control the environment. It is currently determined that the basement is to be Grade 3: habitable, requiring a double barrier for water protection to be installed. A proposed concrete liner wall will form the interior surface of the prosed basement extent with a cavity drain protection to the Architect's details, in which any collected water will be pumped into the proposed drainage system. A waterproof additive is also considered within the concrete lining wall or a waterproof membrane will provide a second barrier of defence.

There are three specific methods of water-resisting construction:

A - Tanked protection
B - Structurally Integral Protection
C - Drained Protection

The full cavity drained solution provides drained protection, which will be implemented into the basement area. It is not assumed that the reinforcement will be designed to satisfy water-retaining requirements in these areas, however the waterproof additive provides a structural integral protection barrier.

4.7 **Environmental Conditions**

Historical and present uses of the site indicate that there are no known contaminant sources expected on the site for potential pathways.

The BGS maps indicate that the ground may be underlain by alluvial deposits. There is a potential for ground gas on and adjacent to the site due to the historical degradation of alluvial deposits. The historical borehole logs do show potential for alluvium in the SW site location however, no ground gases were found in the site investigations and therefore no monitoring should be required.

5 Proposed Works

5.1 **Proposed Structure**

The structural works are described in detail on the EOC drawings, in Appendix C, and are summarised as follows.

The structural scheme involves the installation of a partial single storey and partial two storey basement, as shown adjacent, below the existing building with an external lightwell void located in the south east corner of the building allowing natural light into the basement area. The proposal is to remove the existing sloped bank to the east of the existing building and have a ground level access in this area. The basement extends predominantly within the existing building footprint; only the lightwell will extend outside of this area. An additional loft space is created by opening out the trussed timber roof volume. Upper floors will be constructed with lightweight concrete composite decking onto an internal steel frame. A transfer slab at ground floor level will transfer vertical walls loads into the capping beam to the piled retaining wall.

5.2 **Lateral Stability**

Stability is provided above ground level by masonry external walls transferring horizontal loads into the head of the piled foundations and in-turn into the underlying soil. Horizontal earth pressures are resisted by the piled retaining walls spanning between internal floor slabs, which transferring loads towards the opposing and perpendicular walls of the basements.

5.3 **Temporary Works Proposals**

The final temporary works proposals will be designed by the main contractor and their temporary works coordinator. The adjacent sketches indicate the proposed temporary works arrangements which have been used for the purposes of the ground movement assessment.

5.4 **Piled Foundations**

The piling to the perimeter walls and internally to the existing building footprint will be installed with a mini-piling rig for ease of access. Internal sacrificial piles will support the centre of the new ground level transfer slab in the temporary condition whilst excavation works progress and in the final condition will provide resistance to uplift whilst acting in tension to pin down the basement slab.

5.5 **Basement Slab Design**

The basement slab has been designed to accommodate heave and water pressures exerted by the Claygate formation and the existing ground water levels. The cordek heave matt installed below basement slab will crush therefore alleviating any long-term heave pressures on the basement. The downforce required to resist buoyancy forces has been confirmed with a factor of safety greater than >3 therefore more than satisfactorily meeting code requirements.

5.6 **Proposed Drainage**

In developing a strategy for the drainage, the following overarching principles have been used:

- Where practicable, foul and storm systems will be separated to reduce the risk of foul flooding during extreme rainfall events.
- Where practicable storm drainage does not drop to basement level where it increases flood risk. Removal at high level i.e. just below ground level is prioritised.
- Kitchen drainage is to be collected separately from general foul drainage so that it can be treated for grease removal before joining the other drainage streams.
- A degree of sustainable storm water drainage provision will be required by Thames Water and Camden Borough Council in order to meet their sustainability objectives under the London Plan. This takes account of the increase in impermeable surfaces and ensures that the post development run-off from the site has minimal impact on the receiving drainage infrastructure.
- In line with British Standard Document BS8102 the basement will comprise a cavity drain system to mitigate for any water ingress through the external walls. To mitigate for storm water surcharging the new basement the drain cavity pump station will contain an anti-flood valve.

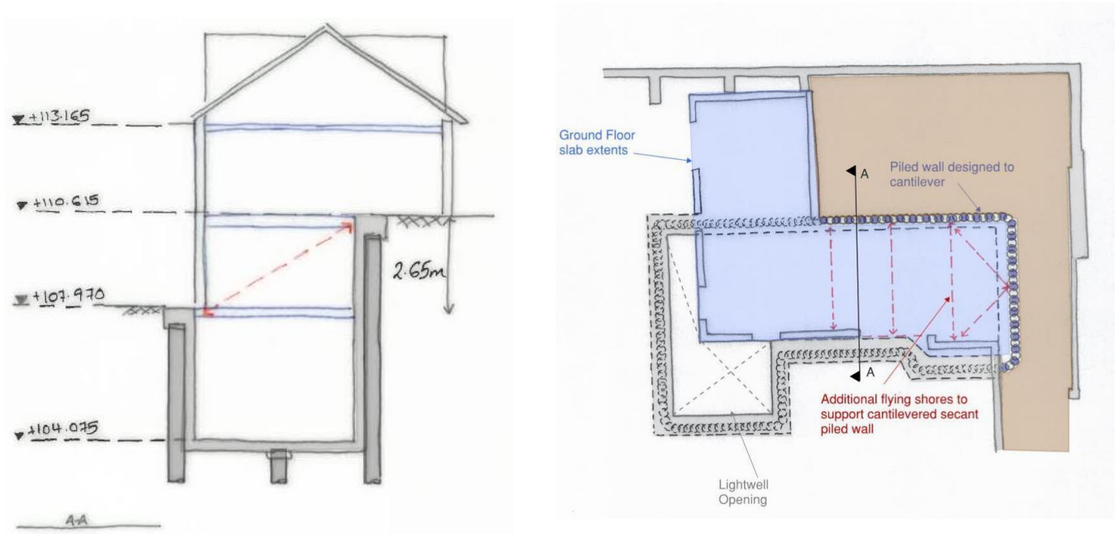


Figure 15 Proposed Temporary Works Flying shores for propped piled wall shown in plan and section

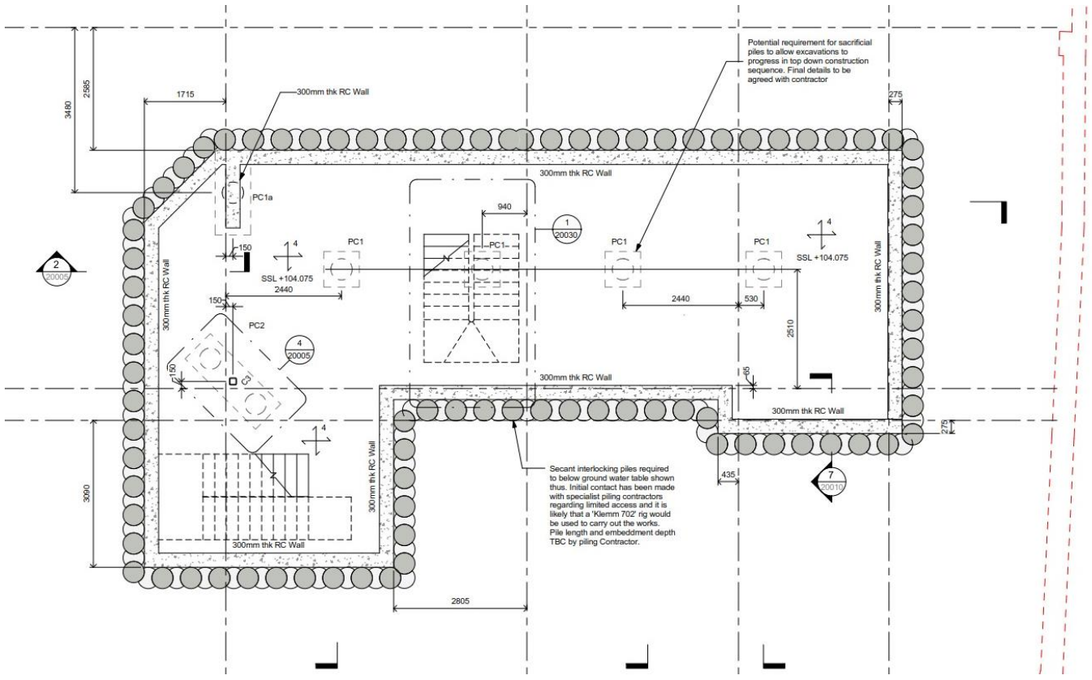


Figure 16 Structural Basement Plan Extract

6 Proposed Construction Sequence

The Basement Construction will commence in the form of top-down construction and is limited by the access requirements and site logistics in order to install the secant piled wall needed to form the extent of the basement box. The proposed construction sequence is described as follows:

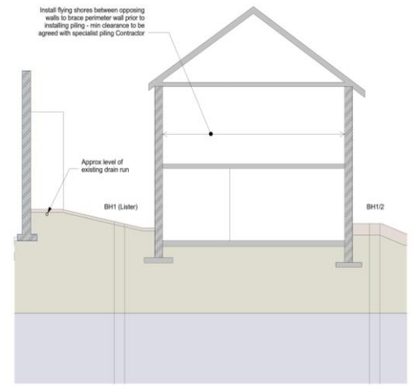
Site set up & Welfare – STEP 1
- Carry out site topographic survey and set up benchmarks as required.
- Terminate and divert existing services.
- A hoarding will be constructed to site perimeter in line with CMP, to provide protection to the public from accessing the site.
- Install tree protection measures and temporary works for site facilities if required.
- Set up site facilities and Commence initial demolition and excavation works.
- Access is only available from the Vale of Heath, so it is assumed that all deliveries, removals and access for operatives will be made from here.
- This entrance will be manned when any operational activities are commencing to ensure construction deliveries do not pose potential risk to pedestrians and site operatives.
- Install monitoring targets to adjacent boundary walls (as shown in following chapters).
- Carry out baseline readings over period of two weeks to generate control readings.
- Install temporary works to main structure and carefully create new openings both for permanent works and to allow rig access.

Reduce Levels, Commence Piling & install ground level foundations – STEP 2
- Reduce levels, carefully demolish slope towards the eastern extent, restraining the perimeter masonry walls during excavation.
- Install piling matt.
- Mobilise piling rig & commence piling of secant piled wall necessary for the temporary works of the basement box.
- Install sacrificial piles internally to the basement extents for initial support of the first floor and ground floor slab during top down construction.
- Excavate and install foundations to ground level for support of terrace.
- Continue to monitor the North and West boundary walls for duration as per the movement monitoring specification.

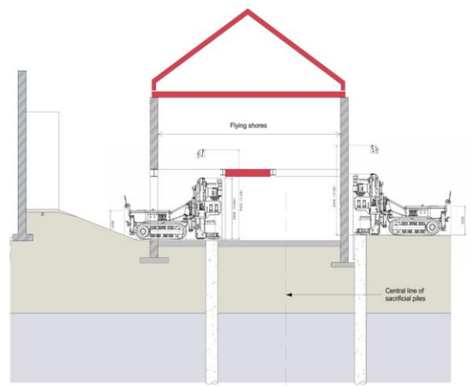
Install slab & Excavate Basement – STEP 3 & 4
- Cast pile capping beams and install ground floor slab and excavate.
- Carry out nominal dig using stair void opening to allow vertical access of digger through to basement level.
- Fully excavate to basement level and cut down piles, temporarily supporting ground floor slab.
- Install blinding layer on completion of excavation.

Install Below Ground Drainage – STEP 5
- Install below ground drainage runs, manholes and sumps for cavity drain, storm and foul water systems.
- Install void-former for heave control & lay reinforcement for new slab including shear dowels to perimeter of basement.
- Basement slab concrete to include waterproofing additive or membrane and install reinforcement and liner retaining wall to form permanent basement box.

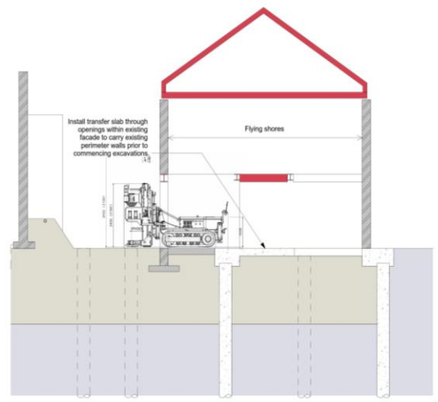
Superstructure Construction – FOLLOW ON WORKS
- Install columns, walls and concrete stair and slabs in sequence throughout the height of the building.
- Install exterior walls to provide support to slabs and roof and remove temporary works here.
- Flying shores can be removed upon adequate curing of internal floor slabs (now providing horizontal prop to capping beam).
- Movement Monitoring to be carried out on a weekly basis throughout basement dig and construction sequence.
- The structural works are now complete and the work can concentrate on making the building weather tight, upon which the finishing trades can commence.



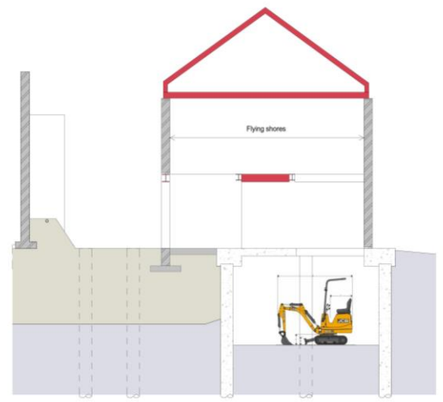
STEP 1



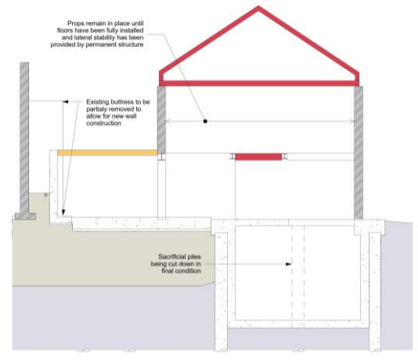
STEP 2



STEP 3



STEP 4



STEP 5

Figure 17 Suggested Construction Sequence – Sectional View – The 5 Stages Of Excavation; 1) Existing Condition, 2) Install Temporary works and Commence Piling, 3) Cast Ground floor Slab for Top-down Construction, 4) Commence Excavation to Formation level, 5) Install Basement Heave matt and ground slab prior to tanking internally

7 Impacts on Existing & Neighbouring Structures

7.1 **Safeguarding the Stability of Existing Buildings & Environment**

Stability of the existing buildings, local environment and highways adjacent to the building site will be maintained throughout the build process and guaranteed for the building design life by the careful planning, implementation and coordination of the temporary and permanent structural works.

The internal basement concrete lining wall is designed for the full water pressure loading, taken at ground level and forms the primary retaining element for the basement. The secant piled wall is propped at the North and West sections to provide horizontal stability in the temporary condition. Where the piles cantilever the propping and capping beams are limited to span/750.

The horizontal and vertical stability of the building will be provided by floor diaphragms tying into the external retaining walls matching the at rest pressures contained in the existing condition. Any temporary works framing required for the existing structure will not be removed until all the permanent works are completely installed and the concrete is cured sufficiently.

To prevent lateral movement and provide lateral stability of the ground throughout excavation, temporary props will be provided where necessary along the existing external walls. As the main building is set back from the existing party wall to the Heath Villas, these props may only be necessary to the North/ North-west wall in the location of the cantilevered secant wall and capping beam as shown in Fig 17. These are to remain in place until the permanent basement structure, first floor and ground floor slab is completed. The props will ensure that the surrounding ground beyond the excavation is continuously supported during construction.

The lightwell area will not be formed by means of top-down construction, however the piles will be supported at their head by a stiff capping beam such that the deflections will be controlled in the same manner as a wall constructed within a top-down sequence. GEA's report recommends that some form of slope stabilisation is required such as soil nailing or mini- piling. The detail of this will be agreed with a specialist contractor during prior to site works commencing.

As described above, the stability and structural integrity of the surrounding earth and the neighbouring properties will be maintained throughout construction without any structurally detrimental effect to existing condition.

As a precautionary measure a set of monitoring targets will be installed onto the adjoining walls with to the North and West of the building. These will be monitored throughout the building process for 3 dimensional movements. This will act as an early warning system to identify any unexpected movement allowing time for remedial action to be taken.

7.2 **Ground Movement Assessment & Predicted Damage Category Assessment**

In accordance with the requirements of CPG4, consideration has been given to the likely damage to the adjacent buildings according to the 'Burland Scale'. In order to predict and mitigate the likely damage category Geotechnical & Environmental Associates have carried out a site-specific ground movement assessment - the full report is available in Appendix D. The movement analysis was carried out with a finite element software to model the short and long-term settlement and heave of the surrounding structures and earth.

The report has concluded that the predicted damage to the existing buildings would generally be 'Negligible', with some limited areas of 'Very Slight' along sections of the existing structures that adjoin the site. These meet the requirements for CPG4 and therefore, the level of damage predicted is considered within acceptable limits.

The ground movements were based on a top-down construction sequence which minimises the extent of ground movements by installing permanent propping to the head of the retaining wall in the first instance. Localised openings around the lightwell will be laterally braced by a deep capping beam.

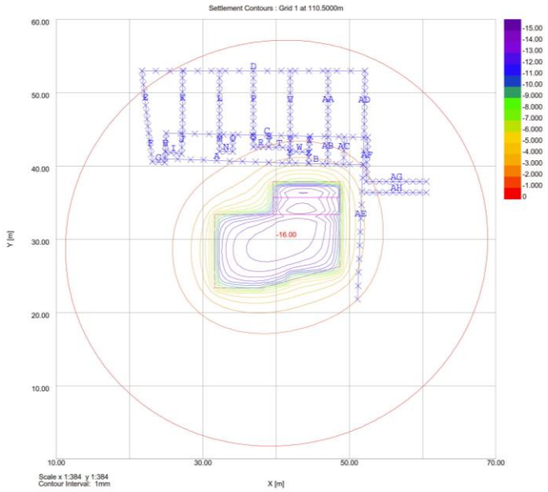


Figure 18 GEA – Short term settlement contours

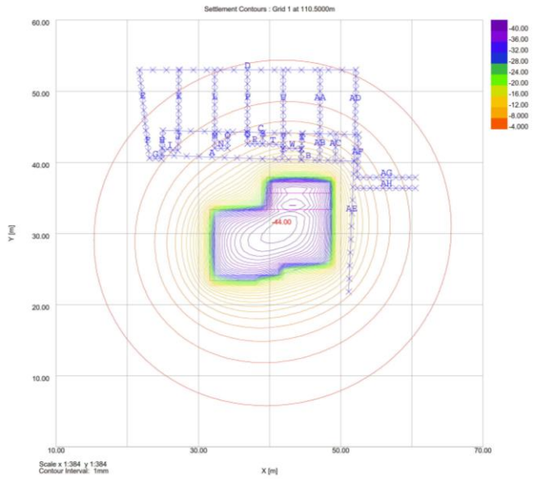


Figure 19 GEA – Long term settlement contours

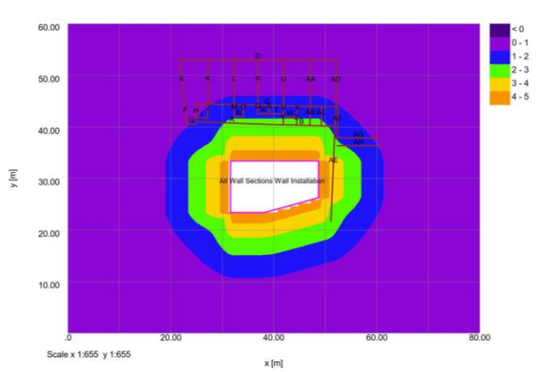


Figure 20 GEA – Horizontal Displacement Contours (Combined)

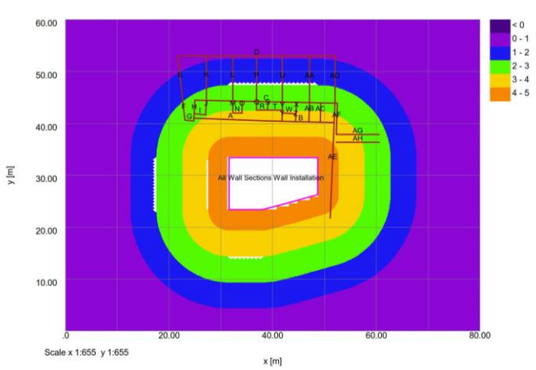


Figure 21 GEA – Vertical Settlement Contours (Combined)

7.3 **Demolition and Construction Impact**

A construction management plan will be developed with the contractor during subsequent stages following the appointment of the main contractor to include amongst other items detailed consideration of:

— Noise and Vibration (note: noise and vibration will be mitigated by the use of CFA piling which is both and vibration free.)
— Dust
— Visual impact
— Obstruction of pavement
— Removal of spoil
— Delivery of construction materials to site

Demolition: all demolition work will be planned and undertaken in accordance with BS 6187:2011 Code of practice for full and partial demolition. The contractor will devise an appropriate demolition methodology and safe method of work to be documented within the demolition plan, which will include:

— Statements addressing the planning and management of the site (including sequence of works, logistics, supervision and monitoring)
— Description of how the structural stability of the building and adjacent structures is to be maintained during the works and upon completion (including temporary support designs to be included)
— Description of measures taken to protect the public and site operative (including exclusion zones, control and protection measures)

7.4 **Hydrology, Hydrogeology and Flood Risk**

No fundamental alteration of the groundwater regime is proposed or is expected to occur as a result of the proposals. Provided sufficient means of permeation is maintained adjacent to the boundaries to relieve any water pressure that might otherwise occur. The proposed development is not anticipated to present significant impact of surrounding properties.

According to the Environmental Agency flood map, the site lies in flood zone 1 which is defined as an area to be at less than 0.1% chance of flooding in any year, with a return period of event of 1 in 1000. New surface drainage will be installed in areas of hardstanding within the proposed development discharging to the existing pipes within the site.

The additional ground investigation has indicated that groundwater bearing Claygate is present to a significant depth in the west of the site such that the construction of a secant bored pile basement is unlikely to prevent groundwater flows towards the pond in the east. The basement elevations of the Heath Villa properties to the west lie above the proposed basement structure therefore localised groundwater related effects are highly unlikely to impact these properties.

As a precautionary measure, mitigation will be implemented in the form of drainage channels cut into the landscape to match the depth of the measured ground water level. This will ensure that the existing groundwater level is retained at the status quo rather than reducing or raising the existing level which could have more onerous impacts to the surrounding environment.

The proposed location of the trenches is shown on the adjacent sketches, positioned outboard of the pile capping beams. At 650mm wide x 500mm deep, they match that of the measured existing ground water level, thus providing an overflow to release any increase in the groundwater level.

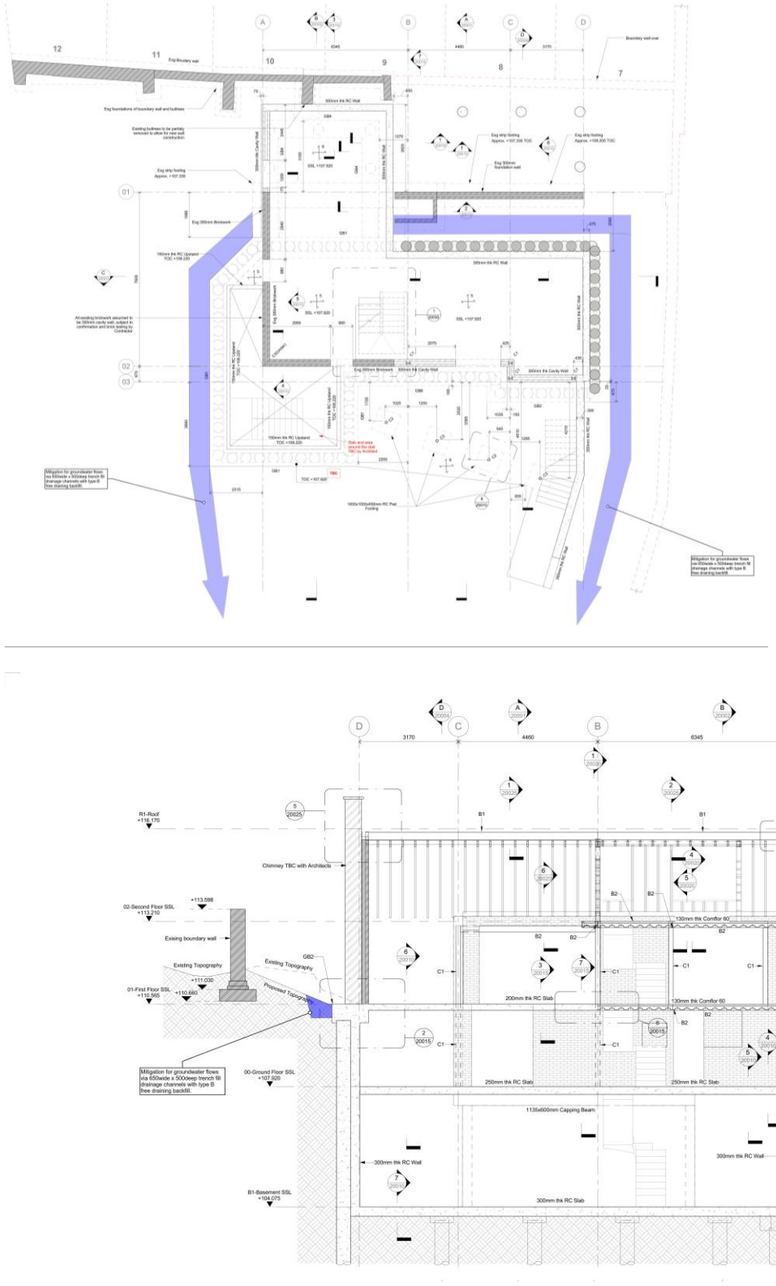


Figure 22 Proposed Drainage Channels in plan and section surrounding the excavation leading towards the east of the site

8 Movement Monitoring Proposals

This section of the report provides the requisite information for the 3-dimensional monitoring of vertical and horizontal movement of the existing walls and structures adjacent to the proposed excavation.

During the course of the piling and excavation works, reference should be made to the Ground Movement Assessment report appended to this report. Reference should also be made to the relevant clauses for monitoring within CIRIA Publication C579, Retention of Masonry Facades – Best Practice Guide.

8.1 **Monitoring survey points**

A suggested arrangement of movement monitoring targets is indicated on Sketch SK20 – extract adjacent.

Establish an agreed number and location of survey points and record initial positions to enable monitoring of:

a) 3-dimensional movements: in accordance with trigger points as identified in 7.5 and 7.6.

b) Crack widths: >1mm

c) Adjacent structure survey points: Before loading, establish and record initial positions to enable monitoring of adjacent building structures

d) Ensure datum for monitoring is on a solid structure away from building works and is not at risk of seasonal movement or damage from construction works.

8.2 **Location of Monitoring Targets**

The monitoring targets are to be located along the adjoining façades as indicated on the SK20, above ground level in pairs at 5m horizontal centres with an approximate vertical spacing of 3m, to allow for 3-dimensional movement monitoring to the full extent of the affected areas.

Hilti nail targets are also to be provided along the pile capping beam at 5m centres to monitor 3-d movements; these locations are shown in Figure 20 adjacent. The targets are not to be obstructed and should be accessible for monitoring at all times during the construction works.

8.3 **Timing and Frequency of Monitoring**

The proposed frequency of monitoring is as follows:

— The initial readings taken prior to work commencing on site should be stable and consistent. Inconsistencies should first be checked by repeating readings and checking the surveying instrumentation & method. The contractor should report on causes of all inconsistencies in readings and calibrate his monitoring equipment according to good practice.
— Prior to start of demolition: Three sets of readings taken over the duration of 3 weeks minimum before start of major structural intervention/demolition works commencing on site.
— During underpinning, piling and substructure works: full set of 3-D readings to be taken every week, for the duration of this period of work.
— A weekly information pack to be issued to Eckersley O'Callaghan within 24hrs of readings being carried out.Post basement works: façade readings to be taken monthly, for 3 months on completion of structural interventions (i.e. during the fit-out stage).

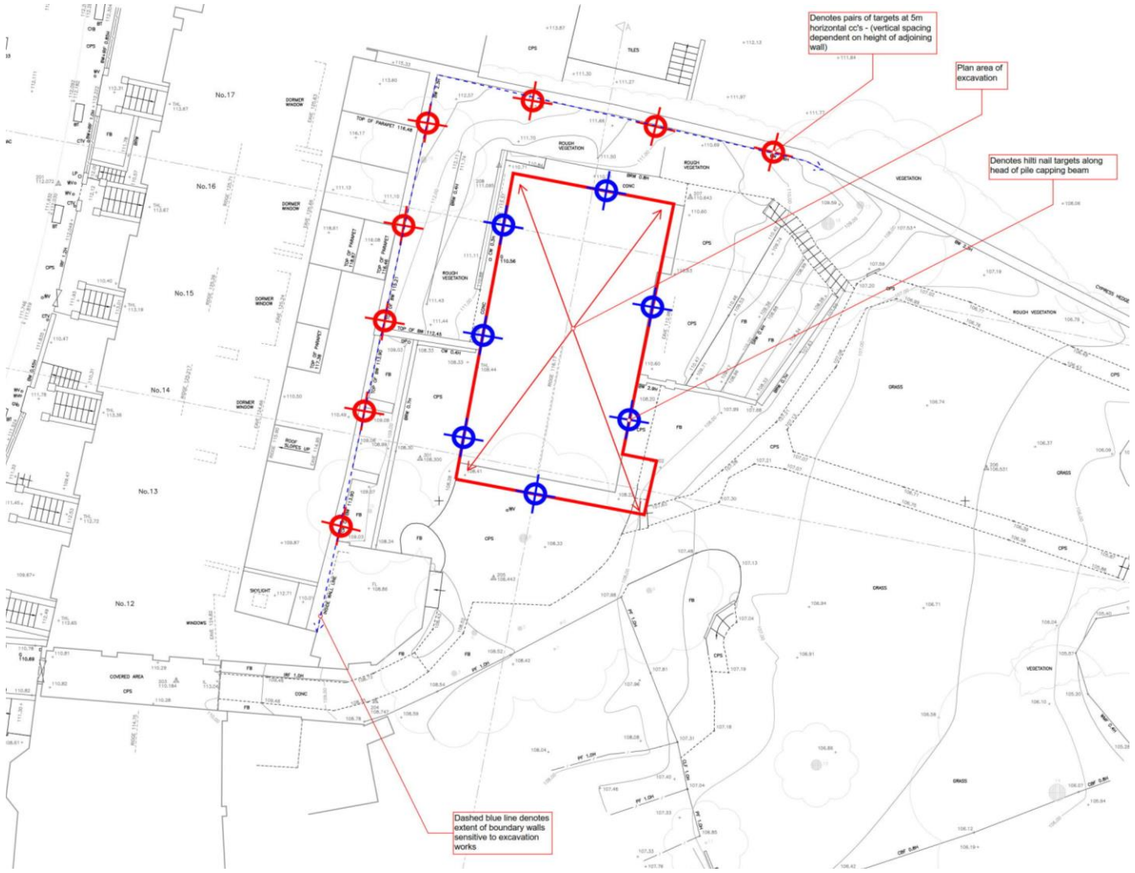


Figure 23 – Plan indicating area and extent of monitoring targets

8.4 **Method of Monitoring**

The method of monitoring should comply with the requirements of CIRIA Publication C579. This includes consideration of accuracy of readings, location of site, position of fixed datum not affected by the works on site and weather conditions.

The contractor is to submit a detailed method statement of the proposed monitoring regime, including types of targets and monitoring equipment.

The contractor is expected to review monitoring results immediately after readings are taken and report any excessive and unexpected movements to the engineer. Results of monitoring are to be issued to Eckersley O'Callaghan within 24 hours of readings being taken.

The monitoring report is to include all previous monitoring records referenced according to the dates and times at which the readings were taken. These should be presented in graphical or tabular format.

8.5 **Trigger Levels for Action - Vertical**

Based on the scale of allowable predicted movements within the Ground Movement Assessment report appended to this document the following "trigger levels" will be used for vertical movements at target locations:

Green	Amber	Red
>4mm	>8mm	>12mm

8.6 **Trigger Levels for Action - Horizontal**

Based on the scale of allowable predicted movements within the Ground Movement Assessment report appended to this document the following "trigger levels" will be used for horizontal movements at target locations:

Green	Amber	Red
>4mm	>6mm	>9mm

The above scale of movements are to trigger the following proportionate actions:

— Green: movement will be closely monitored to check if the structures are stable and movements are not accelerative.
— Amber: above this limit a review of working procedures and assumptions will be conducted, to provide reassurance that the total movement will not be excessive, or to warrant modifying working methods.
— Red: work to be stopped if this limit is exceeded until the reason for reaching the limit has been identified and any remedial action has been agreed.

Note: for movement below Green trigger level no action is required.

Accuracy of reading: to be provided as a minimum accuracy: **+/-2mm** (typically)

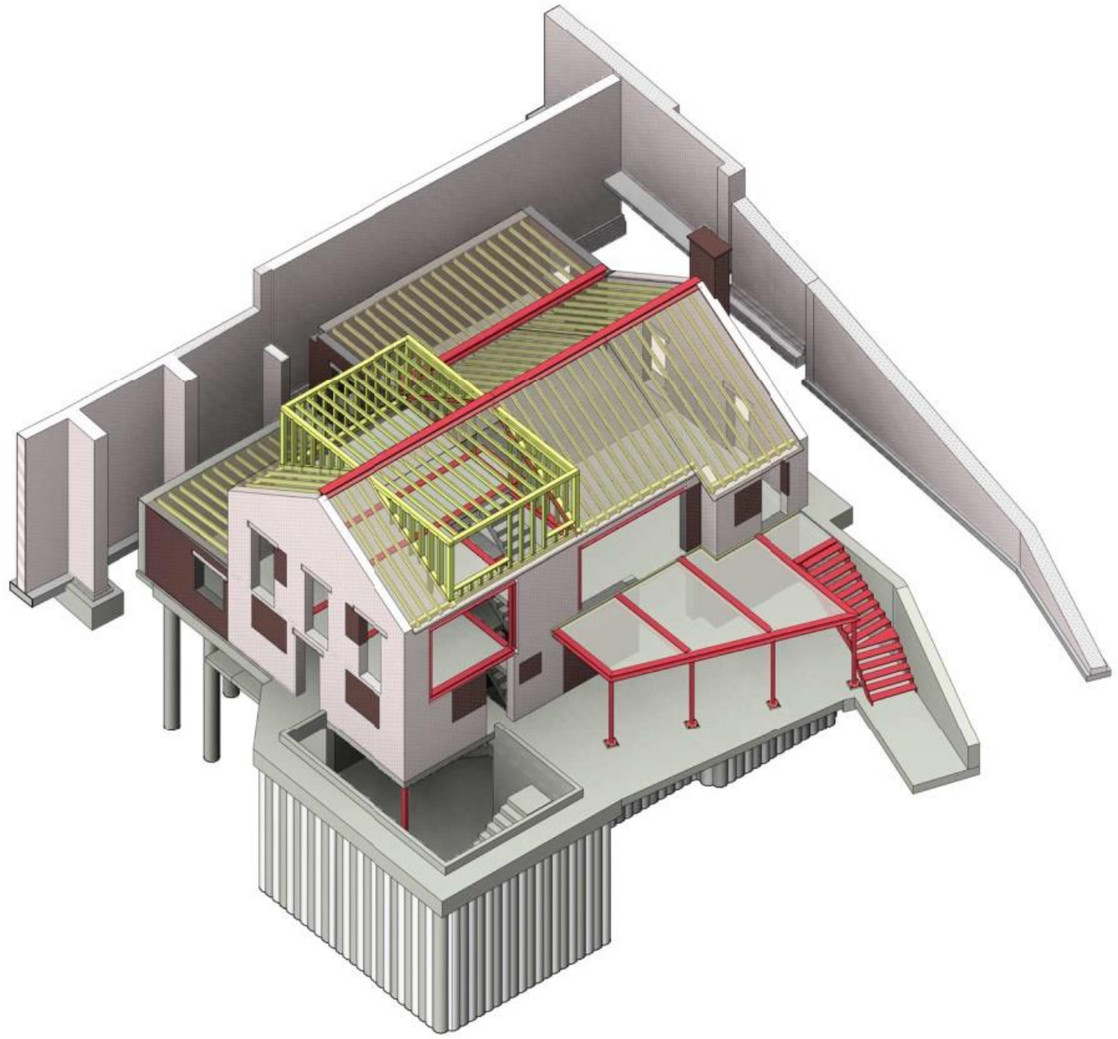


Figure 24 – Isometric View on Structural Model

9 Site Logistics

A Construction Management Plan will be carried out by the project design team with assistance from a contractor. The suggested construction programme runs for a total of 18 months.

All construction and demolition processes will be in accordance with:

— The Considerate Constructors Scheme Standards, CCS Ltd
— Demolition Protocol, Institution of Civil Engineers, ICE
— Guide for Contractors working in Camden, LBC 2008
— The Control of Dust and Emissions from Construction and Demolition Guidance, GLA
— Health and Safety Regulations, HSE

The appointed contractors proposed method of construction and sequence of works will be expected to conform and abide to the requirements above to ensure:

— Good planning and management of the works on site.
— With methods in place to mitigate nuisance from noise, vibration, dust, and light pollution.
— Safety at all times to local residents and businesses, pedestrians and road users.

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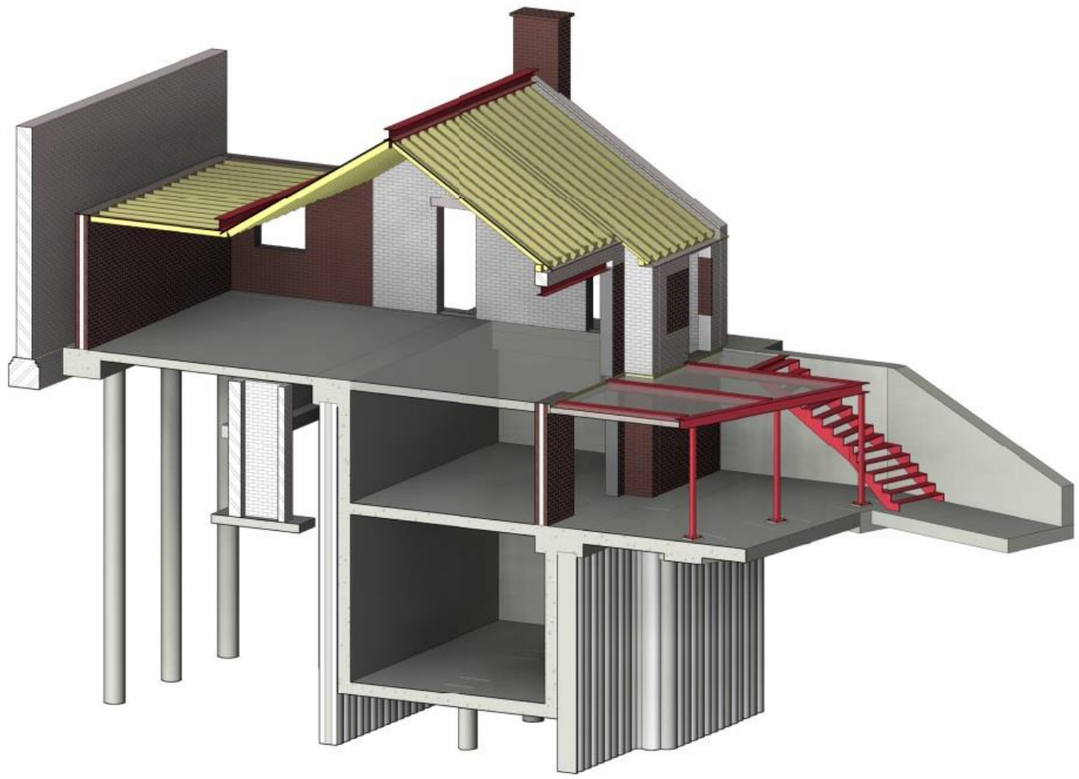

Figure 25 – Perspective cutaway View on Structural Model

10 Basement Impact Assessment Conclusion

10.1 Conclusions

A risk-based impact assessment, backed by site investigations, has been undertaken regarding hydrology, hydrogeology and land stability. This report and supporting documents indicate that the proposed development of the site will not cause harm to the built and natural environment and local amenity and does not result in flooding or ground instability.

The additional ground investigation has indicated that groundwater bearing Claygate is present to a significant depth in the west of the site such that the construction of a secant bored pile basement is unlikely to prevent groundwater flows towards the pond in the east. The basement elevations of the Heath Villa properties to the west lie above the proposed basement structure therefore localised groundwater related effects are highly unlikely to impact these properties. As a precaution, mitigation measures should be incorporated into the development, such as drainage channels, to ensure that groundwater flow is diverted around the basement to the pond. Reference should be made to the ground movement and slope stability assessments in the report. It has been concluded that the impacts identified can be mitigated by appropriate design and standard construction practice.

The report also confirms that the scheme will:

— Maintain the structural stability of the existing and neighbouring buildings;
— Meet the requirements set out in Camden's CPG4 damage category assessment;
— Avoid adversely affecting drainage and run-off or cause other damage to the water environment;
— Avoid cumulative impacts upon structural stability or the water environment in the local area.

10.2 Further Investigations & Mitigation of Risks

Ground conditions will be monitored during the works to account for any variations that may occur within the site geology. However, based on the similarities across all borehole records taken from the site, it is unlikely that the geological conditions will vary greatly.

Groundwater was recorded at a similar level across the site and conservatively will be taken close to ground level in accordance with the Concrete Basements - Guidance on design and construction of in-situ concrete basement structures. As a precaution, mitigation measures should be incorporated into the development, such as drainage channels, to ensure that groundwater flow is diverted around the basement to the pond.

Monitoring of the standpipes should be continued to determine equilibrium groundwater levels and to establish any seasonal fluctuations. Ideally, trial excavations extending to as close to the full depth of the proposed basement as possible should be carried out to determine likely groundwater inflows into the basement excavation. It is not economically feasible to carry out works of this nature beforehand. However this task could be completed by the contractor as a 'first task' once taken possession of the site.

The site is not considered to have had a historical contaminative use and no elevated concentrations of contaminants were measured by the chemical analyses. Remedial measures to protect sensitive receptors, including end users, are not therefore deemed necessary. However, in accordance with standard construction practice, a safe programme of working should be identified to protect workers handling any soil. In addition, it is also recommended that a watching brief be maintained during ground works and any suspected contamination, especially in areas not covered by the investigation, should be brought to the attention of a geo-environmental engineer.

The existing 1950's is generally in a good structural condition however the south facing wall comprises some minor cracking along brick joints in close proximity to a mulberry tree. The cracking is likely to be associated with the root growth of the tree. The tree is to be removed as part of the proposed works and therefore the long-term effect will be mitigated. The cracks in the brickwork will be repaired with a proprietary repair mortar and stainless steel tie rods prior to commencement of any major structural refurbishment works, therefore removing the risk of damage to the existing building, as works progress.