A-squared Studio

50 Maresfield Gardens

Basement Impact Assessment

July 2023

2588-A2S-XX-XX-RP-Y-0002-02

Project Name	50 Maresfield Gardens
Project Number	2588
Client	Webb Yates Engineers Limited
Document Name	Basement Impact Assessment

A-squared Studio Engineers Ltd
One Westminster Bridge Rd
London, SE1 7XW

020 7620 2868
contact@a2-studio.com
www.a2-studio.com

Prepared by	Checked by	Approved by
Alex Corrigan BEng(Hons)	Hamed Shariff MEng(Hons)	A. Nikolic BEng(Hons), MSc, DIC, CEng, MICE, MSt(Cantab)
Engineer	Associate	Director

Document Reference	Status	Notes	Revision	Issued by	Date
2588-A2S-XX-XX-RP-Y-0002-02	Third Issue	Updated loading plans.	02	AC	04/07/2023

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Appendices

1. Non-Technical Summary

1.1.1. The site is located at 50 Maresfield Gardens, London, NW3 5RX.

1.1.2. The site is currently occupied by a three-storey detached residential property with a garden to the rear, and an area of hardstanding at the front. The property currently comprises a single storey basement across a small portion of the building footprint.

1.1.3. The proposed development comprises the demolition of selected internal superstructure elements, the lateral extension of the superstructure, and extension of the basement across the whole building footprint. The proposed basement will be retained by a contiguous piled wall and underpinning the existing ground beams. The basement will extend to a depth of 5.1mbgl (at the formation level of the new ground beams), and 7.6mbgl at the pool area. The existing ground beams are piled, with a pile length of 19.0m proven by parallel seismic testing. The existing piles are proposed to be cut down, and new ground beams formed at basement level. It is understood that the piles do not have sufficient capacity to support the increase in loading, and so the increment will be taken by the new ground beams working in combination with the piles.

1.1.4. The proposed excavation is envisaged to be retained by a contiguous piled wall and underpins.

1.1.5. It is understood that the bulk excavation works and construction of permanent works elements including the underpinned walls will take place following the installation on the contiguous pile wall.

1.1.6. Temporary propping / shoring measures are likely to be required at ground level, prior to proceeding with bulk excavation works.

1.1.7. The following assessments are presented in the current document:

- Screening.
- Scoping.
- Additional evidence/assessments (as required), including:
  - Architectural and structural drawings.
  - Ground movement assessment.
- Basement impact assessment.

1.1.8. The ground conditions beneath the site comprise:

- Made Ground to a depth of 1.2m below ground level (bgl).
- Claygate Member to a depth of 6.6mbgl.
- London Clay Formation to a depth >30.5mbgl. The thickness and base of this stratum has not been proven; however, the strata below are not considered to be of engineering significance to the scheme as the anticipated *zone of influence* of the proposed works will remain within the London Clay Formation.

1.1.9. The hydrogeological conditions at the site, relevant to the proposed development, are anticipated to comprise:

- Finite bodies of local perched groundwater within the Made Ground, perched above the Claygate Member and London Clay Formation.
- A hydrostatic porewater pressure distribution within the Claygate Member and London Clay Formation.

1.1.10. The BIA has assessed land stability, and the impacts of the proposed development on neighbouring structures will be limited to *Category 1 – Very Slight*, in accordance with the Burland Damage Scale.

1.1.11. The BIA has not identified any hydrogeological impacts, as the site is not underlain by an aquifer. The majority of the basement will be constructed within the Claygate Member and London Clay Formation, which are classed as unproductive strata.

2. Introduction

2.1.1. A-squared Studio Engineers Ltd (A-squared) has been engaged by Webb Yates Engineers (Webb Yates) to prepare a Basement Impact Assessment (BIA) for the proposed development works at 50 Maresfield Gardens, London, NW3 5RX.

2.1.2. The purpose of this assessment is to consider the potential effects of the design on the local hydrology, geology, and hydrogeology, and to determine the potential impacts to neighbours and the wider environment.

2.1.3. The location of the proposed development is shown in Figure 2.1.

Approximate site boundary marked by red line.

Figure 2.1 Location of the proposed development

2.1.4. The development site is located within the jurisdiction of the London Borough of Camden.

2.1.5. The BIA comprises the following elements:

- Screening.
- Scoping.
- Additional evidence/assessments (as required), including:
  - Architectural and structural drawings.
  - Ground movement assessment (GMA).
- Basement Impact Assessment.

2.2. Credentials

2.2.1. The BIA has been reviewed by Hamed Shariff. Hamed is a Chartered Member of the Institution of Civil Engineers (MICE) with experience with designing basements in congested urban settings. Hamed also specialises in foundation design, advanced numerical modelling and hydrogeological assessments.

2.2.2. The BIA has been approved by Alex Nikolic. Alex is a Chartered Member of the Institution of Civil Engineers (MICE) with over 20 years of industry experience in geotechnical design and construction of ground engineering works. Alex has attained post-graduate qualifications, including a Master of Science in Soil Mechanics (MSc DIC) from the Imperial College London and a Master of Studies (MSt Cantab) in Sustainable Development from the University of Cambridge. Alex was formerly the Director of Ground Engineering at Buro Happold Ltd.

2.3. Sources of Information

2.3.1. The following baseline data has been referenced to complete the BIA in relation to the proposed development:

- *Phase I Desk Study* produced by A2 Site Investigation Limited (A2SI) (ref. 26822-A2SI-XX-XX-RP-Y-0001-00), dated January 2023.
- *Factual Report* produced by A2SI (ref. 26822-A2SI-XX-XX-RP-X-0002-00), dated March 2023.
- *Interpretive Report* produced by A2SI (ref. 26822-A2SI-XX-XX-RP-Y-0003-00) dated March 2023.
- Proposed scheme drawings produced by Webb Yates, dated May 2023.

2.4. Existing Development

2.4.1. The development is located at 50 Maresfield Gardens, London, NW3 5RX.

2.4.2. The site is generally flat with an existing ground level of approximately +80.9mOD.

2.4.3. The areas surrounding the site are sloped from north to south, with a gradient of approximately 1 in 13.

2.4.4. The site is currently occupied by a three-storey residential property with a basement over a small area of the building footprint, a soft-landscaped garden to the east, and a paved area to the west.

2.4.5. The existing building is expected to be founded on a combination of pile foundations and ground beams.

2.5. Neighbouring Properties and Infrastructure

2.5.1. The existing buildings on-site share no Party Walls with other structures and are detached on all sides. The closest buildings to the development are 48 Maresfield Gardens to the south, and 52 Maresfield Gardens to the north.

2.5.2. The closest listed structure is 48 Maresfield Gardens (Grade II listed), approximately 2.5m south. This structure is considered to be within the zone of influence of the proposed development.

2.5.3. Asset owners with existing underground services that may be impacted by the proposed development include the following:

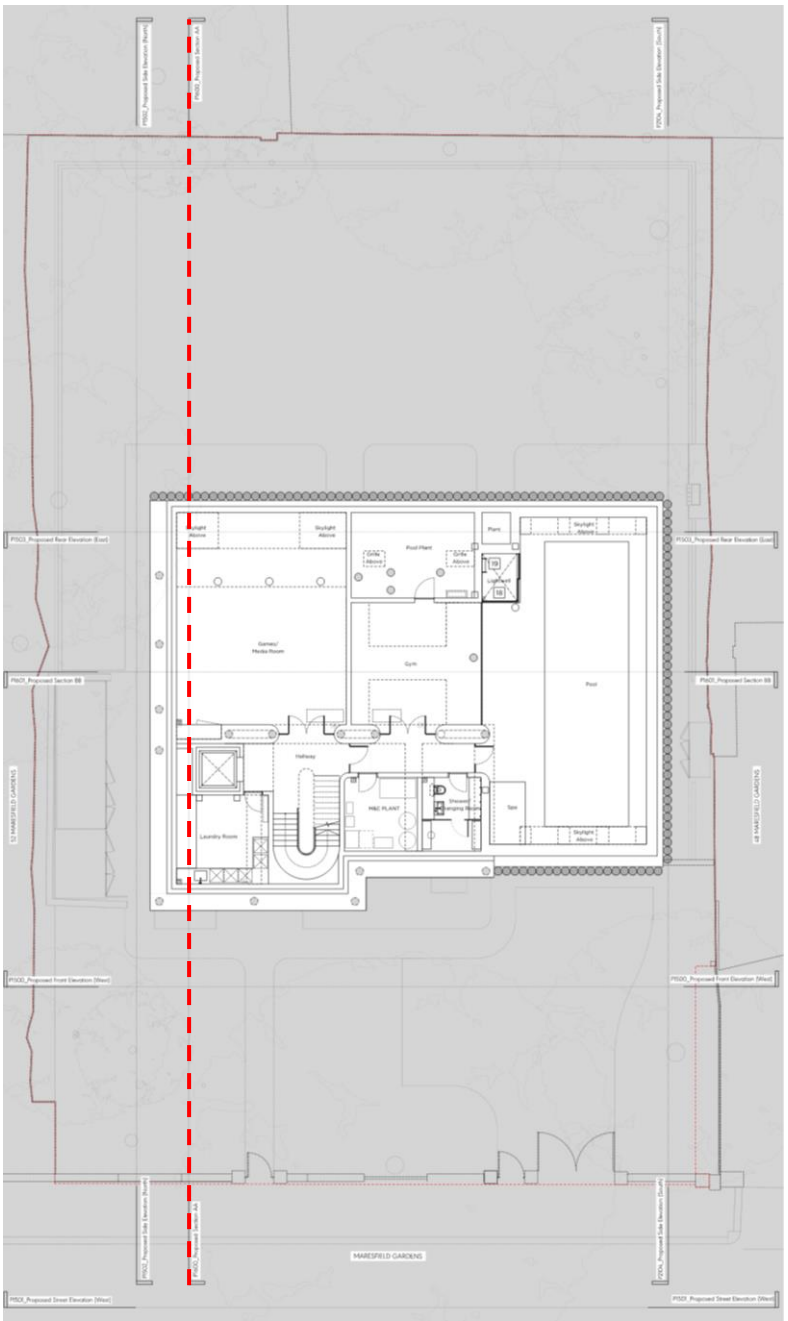
- London Borough of Camden and the Greater London Authority.
- Virgin Media Ltd and BT (BT Group Plc) – Telecoms.
- UK Power Networks Ltd and National Grid Electricity Transmissions Plc – Electricity distribution.
- Southern Gas Network and Cadent Gas – Gas.
- Thames Water – Clean and wastewater.

2.5.4. Asset protection teams for the assets listed under Section 2.5.3 will be engaged as the design of the proposed development progresses. Where necessary, separate GMAs will be prepared in order to meet design assurance requirements.

2.6. Proposed Development

2.6.1. Drawings of the proposed development are included in Appendix A.

2.6.2. The proposed development comprises the demolition of selected internal superstructure elements, the lateral extension of the superstructure, and extension of the basement across the whole building footprint. The proposed basement will be retained by a contiguous piled wall and underpinning the existing ground beams. The basement will extend to a depth of 4.5mbgl (at the formation level of the basement slab), and 7.6mbgl at the pool area. The existing ground beams are piled, with a pile length of 19.0m proven by parallel seismic testing. The existing piles are proposed to be cut down, and new ground beams formed at basement level. It is understood that the piles do not have sufficient capacity to support the increase in loading, and so the increment will be taken by the new ground beams working in combination with the piles. The proposed basement plan is presented in Figure 2.2 and proposed section A-A is presented in Figure 2.3.



Section A-A denoted by red dashed line.

Figure 2.2 Proposed basement plan

Figure 2.3 Proposed section A-A

2.6.3. A single-level basement is proposed as part of the development with a slab surface level of approximately +77.07mOD.

2.6.4. The basement perimeter is proposed to be retained by a contiguous pile wall and underpins.

2.6.5. The building is to be founded on a combination of pile foundations and ground beams.

3. Desk Study

3.1.1. A Phase I Desk Study report for the site has been produced by A2SI. The Desk Study report has been used to inform this BIA.

3.1.2. The Desk Study informs further actions in relation to site investigation and ground contamination risks. For more information, see the Phase I Desk Study Report produced by A2SI (ref. 26822-A2SI-XX-XX-RP-Y-0001-00).

4. Screening

4.1. Subterranean (Groundwater) Flow, Screening Flowchart

Question		Response	Details
1a.	Is the site located directly above an aquifer?	No	The site is underlain by Claygate Member and the London Clay Formation.
1b.	Will the proposed basement extend beneath the water table surface?	N/A	
2.	Is the site within 100m of a watercourse, well (used / disused) or potential spring line?	No	The nearest surface water feature is located 797m south of the site.
3.	Will the proposed basement development result in a change in the proportion of the hard surfaced / paved areas?	Yes	There will be approximately 16m^2 additional paved area due to the basement extension, however there will be a net decrease in paved areas as 32m^2 landscaping will be introduced.
4.	As part of the 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)?	Yes	There is a net increase in landscaped areas.
5.	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 or spring line?	No	There are no ponds or spring lines in the vicinity of the site.

4.2. Stability Screening Flow Chart

Question		Response	Details
1.	Does the existing site include slopes, natural or man-made, greater than 7 degrees (approximately 1 in 8)?	No	The site in its existing condition is generally flat.
2.	Will the proposed re-profiling or landscaping at the site change slopes at the property boundary to more than 7 degrees (approximately 1 in 8)?	No	The proposed development does not include any changes in ground elevations of the site.
3.	Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7 degrees (approximately 1 in 8)?	No	Maresfield Gardens is sloped, but with a gradient of approximately 1 in 13.
4.	Is the site within a wider hillside setting in which the general slope is greater than 7 degrees (approximately 1 in 8)?	No	The site is not located within a wider hillside setting of greater than 7 degrees.
5.	Is the London Clay the shallowest strata at the site?	No	Site-specific ground investigation has proven that the London Clay formation is overlain by Claygate Member.
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?	Yes	Two trees will be felled as part of the proposed development. The root protection zones of these trees do not extend beyond the boundary of the site.
7.	Is there a history of seasonal shrink-swell subsidence in the local area and/or evidence of such effects at the site?	Yes	There is evidence of soil shrinkage at the site.

Question	Response	Details
8. Is the site within 100m of a watercourse or a potential spring line?	No	The site is not within 100m of a watercourse or potential spring line.
9. Is the site within an area of previously worked ground?	No	Historical mapping indicates that there was no on-site construction prior to the construction of the existing building.
10. Is the site within an aquifer? If so, will the proposed basement extend beneath the water table such that dewatering may be required during construction?	No	The site is not located within an aquifer.
11. Is the site within 5m of a highway or pedestrian right of way?	Yes	The site is located within 5m of Maresfield Gardens.
12. Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	No	The proposed development does not include the addition of foundations significantly deeper than the current condition.
13. Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?	No	The site is not within the exclusion zone of any tunnels or railway lines.

4.3. Surface Water and Flooding Screening Flowchart

Question	Response	Details
1. 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?	No	The additional impermeable area of 16m^2 will drain into the adjacent soft landscaping. There will be no increase in the discharge from the site to the below ground storm water network.
2. Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	Yes	There will be approximately 16m^2 additional paved area due to the basement extension, however there will be a net decrease in paved areas as 32m^2 landscaping will be introduced. All paved areas are proposed to be permeable paving with a porous subbase.
3. 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	There will be no changes to the profile of inflows of surface water being received by adjacent properties.
4. Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	No	The proposed basement will maintain the quality of surface water discharged from the site.
5. 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	The site is classified as having limited potential for groundwater flooding to occur. Flood Maps For Planning indicates that the site is located within Flood Zone 1, designated for areas which have a low probability for flooding.

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:

- There will be a change in the portion of hard/paved areas.
- More surface water than present will be discharged into the ground.
- Trees will be felled as part of the proposed development.
- There is evidence of soil shrink/swell at the site.
- The site is located within 5m of a public highway.

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

5. Scoping

5.1. Subterranean Flow: There will be a change in the portion of hard/paved areas, and more surface water than present will be drained into the ground.

Hazards

5.1.1. More surface water running into neighbouring properties / highways.

5.1.2. A change in the groundwater flow regime.

Potential Impacts

5.1.3. The ability for water to drain through the site may be reduced.

5.1.4. There may be an increase in groundwater flow in a downwards gradient from the site.

5.1.5. Neighbouring properties / highways may flood due to a change in the groundwater flow regime.

Mitigating Factors

5.1.6. Site-specific ground investigation has confirmed that the Claygate Member and London Clay Formation are the shallowest stratum. Due to their low permeability, they are unable to provide significant drainage and the development is unlikely to alter the site from its current run-off condition.

5.1.7. The proposed scheme includes a robust drainage strategy to accommodate any excess surface water runoff. This includes permeable paving with a porous subbase in any additional paved areas.

Assessments and Further Actions

5.1.8. It is considered that there is a negligible risk of impact to the surrounding surface water flow regime. No further action is considered necessary.

5.2. Stability: Trees will be felled as part of the proposed development and there is evidence of seasonal shrink/swell at the site.

Hazards

5.2.1. Seasonal shrinking and swelling of the Claygate Member and London Clay Formation.

5.2.2. Swelling/heave effects due to the removal of trees.

5.2.3. Increased surface water into the local drainage system due to a reduction in uptake from vegetation.

Potential Impacts

5.2.4. Additional ground instability resulting from the removal of trees in the zone of influence of the proposed development.

5.2.5. Properties downstream from the proposed development may be subjected to an increase in surface water flow.

Mitigating Factors

5.2.6. The proposed development will be supported by piles with a heave mitigation produce beneath the basement slab.

5.2.7. Any potential changes to the surface run-off volume are to be incorporated into the drainage strategy, and mitigated by a drainage system.

Assessments and Further Actions

5.2.8. It is considered that the overall risk of shrink-swell subsidence is minimal. The piled basement box will provide a robust solution which extends below the root depth of the trees. No further action is considered necessary beyond design best practices.

5.2.9. The arboriculture report assessment suggests that the root zone of the trees to be felled are well within the boundaries of the site and are therefore unlikely to impact the neighbouring properties. In addition to this, the neighbouring properties are elevated above (52 Maresfield Gardens) and below (48 Maresfield Gardens) the trees that are to be felled. This will limit the impact that the felling of the trees will have on the neighbouring properties.

5.3. Stability: The site is located within 5m of a public highway.

Hazards

5.3.1. The proposed excavation is adjacent to public roads.

Potential Impacts

5.3.2. Collapse of the excavation and associated impact on the surrounding roads.

5.3.3. Damage to the road surface or buried surfaces within the public road easement due to excessive ground movements.

5.3.4. Ground movements arising due to the construction and excavation of proposed basements may impact neighbouring roads.

Mitigating Factors

5.3.5. Deposits underlying the development are largely natural and are anticipated to be relatively stable, i.e. the London Clay Formation.

5.3.6. Many basements of similar depths and scale have been successfully constructed throughout London with similar geological conditions and urban settings.

5.3.7. The proposed basement is offset from the neighbouring properties and adjacent public roads.

5.3.8. The scheme basement design and temporary works proposals shall be developed in a robust fashion and in line with current industry best practice, in order to limit the impact of ground movements resulting from basement construction.

Assessments and Further Actions

5.3.9. Various additional ground movement assessments may be required to determine the impact of the works on the surrounding buried utilities and other third-party assets surrounding the site. These assessments should confirm anticipated damage categories in accordance with performance limits set by the relevant third-party asset protection teams.

5.3.10. The design of the retaining walls will be carried out by an appropriately experienced and qualified specialist / engineer / ground engineering contractor in accordance with relevant Eurocodes / British Standards, Codes of Practice, and industry standards. The design will allow for appropriate surcharging behind the embedded walls to accurately reflect the type and intensity of traffic and building loads.

5.3.11. Appropriate ground movement monitoring should be implemented during construction in order to assess the performance of the earth retention system. Allowances should also be made for making good of any cracking / damage to adjacent pavement surfaces (if required).

6. Site Investigation

6.1.1. Site-specific ground investigation was carried out by A2SI in two phases: Phase I in December 2022 and Phase II in January 2023. The findings of the site investigation have been included as Appendix B.

6.1.2. The completed works to date comprised the following:

- 1no. cable percussive borehole to 20m (extended to 30m) to facilitate parallel seismic testing.
- 2no. cable percussive boreholes to 10m and 20m to facilitate sampling and in-situ testing.
- 1no. machine and hand excavated trench to determine the location and geometry of existing pile foundations, and pile reinforcement through ferro-scanning.
- 2no. hand excavated trial pits to determine ground floor beam dimensions.
- 7no. dynamic window samples to facilitate geo-environmental sampling.
- Installation of 8no. standpipes to facilitate groundwater and ground gas monitoring.
- In-situ and laboratory geotechnical testing.
- In-situ and laboratory geo-environmental testing.
- 7no. return visits for groundwater and ground gas monitoring.

6.1.3. The locations of the ground investigation positions are presented in Figure 6.1.

Location ID	Northing	Easting	mOD
BH01	185140.0	526456.0	80.86
BH02	185145.0	526479.0	80.87
BH03	185150.0	526484.0	80.99
TP01 (North)	185150.0	526479.0	80.85
TP01 (FW)	185148.0	526479.0	80.85
TP01 (South)	185147.0	526479.0	80.87
TP02 (North)	185145.0	526479.0	80.87
TP02 (South)	185143.0	526479.0	80.86
TP03	185140.0	526457.0	80.86
WS01	185141.0	526453.0	80.80
WS02	185144.0	526486.0	80.85
WS03	185134.0	526458.0	80.80
WS04	185065.0	526461.0	80.80
WS05	185063.0	526461.0	80.70
WS06	185060.0	526461.0	80.70
WS07	185054.0	526460.0	80.70

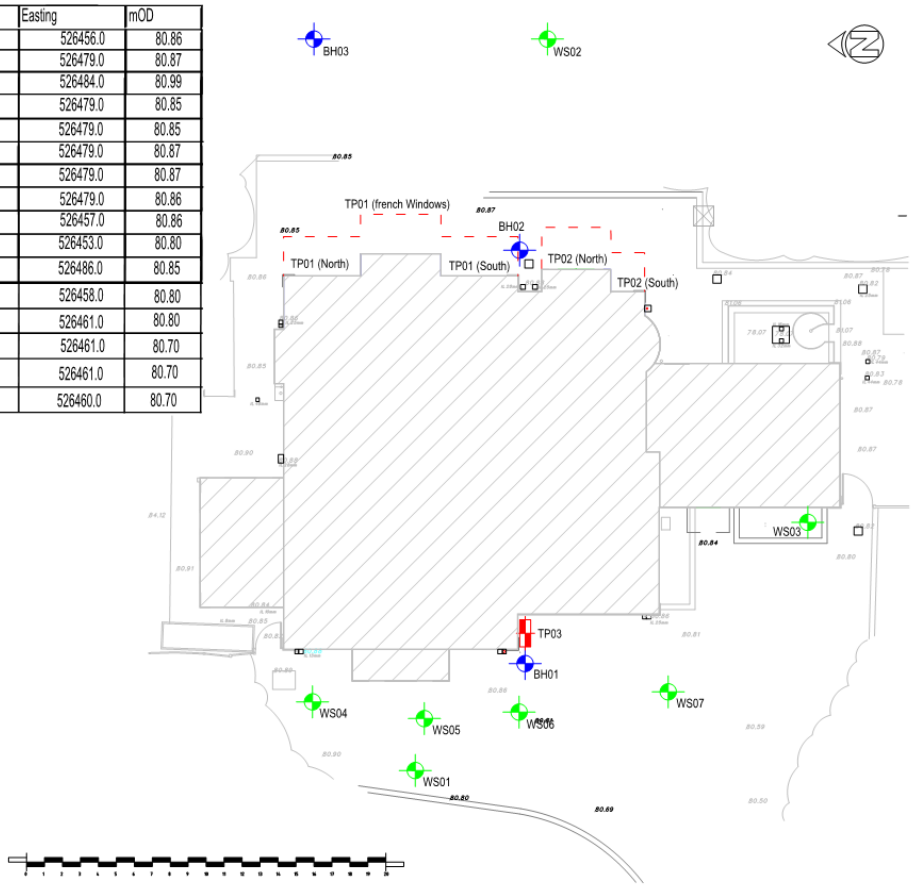


Figure 6.1 Ground investigation locations

6.1.4. The ground conditions encountered onsite are summarised in Table 6.1. The groundwater monitoring results are given in Table 6.2.

Table 6.1 Summary of the encountered geological profile

Unit	Minimum Depth (mbgl)	Maximum Depth (mbgl)	Maximum Thickness (m)	Description
Made Ground	0.0	2.5	2.5	Soft dark brown gravelly slightly sandy silty CLAY with occasional rootlets.
Claygate Member	0.9	9.0	7.9	Soft to firm yellowish brown mottled grey slightly sandy silty CLAY with occasional organic matter and rootlets surrounded by grey staining.
London Clay Formation	4.5	30.5	26.0	Firm to stiff, slightly micaceous dark grey slightly sandy silty CLAY. Sand is fine.

Table 6.2 Groundwater level monitoring results

Reference	Bottom of well (mbgl)	04/01/2023 (mbgl)	19/01/2023 (mbgl)	31/01/2023 (mbgl)	06/02/2023 (mbgl)	09/02/2023 (mbgl)	13/02/2023 (mbgl)	17/02/2023 (mbgl)	Notes
BH03	4.93	2.05	1.69	1.72	1.26	1.28	1.30	1.31	No free phase product detected
WS01	1.83	Dry	Dry	Dry	Dry	Dry	Dry	Dry	No free phase product detected
WS02	4.90	1.38	1.26	1.28	2.40	2.42	2.44	2.45	No free phase product detected
WS03	5.71	3.43	3.20	3.22	3.66	3.67	3.69	3.71	No free phase product detected
WS04	3.60	N/A	3.40	3.43	3.50	3.52	3.55	3.56	No free phase product detected
WS05	4.34	N/A	3.51	3.53	3.63	3.64	3.66	3.66	No free phase product detected
WS06	4.44	N/A	3.53	3.55	3.68	3.69	3.72	3.73	No free phase product detected
WS07	4.86	N/A	3.58	3.59	3.75	3.76	3.79	3.80	No free phase product detected

7. Construction Methodology / Engineer Statements

7.1. Outline Temporary and Permanent Works Proposals

7.1.1. The outline basement construction proposal is to construct the basement from top-down sequencing.

7.1.2. Standard means and methods of excavation are expected to be suitable to excavate the basement, based on the ground conditions proven by means of ground investigation works.

7.1.3. The basement excavation will be retained by a contiguous pile wall and underpinning.

7.1.4. Design of the retaining walls and temporary propping shall be carried out in accordance with the relevant Eurocodes/British Standards, non-conflicting codes of practice, and associated design best practice.

7.2. Ground Movement and Damage Impact Assessment

7.2.1. A GMA has been carried out in accordance with CIRIA C760 and takes into account the construction methodology and preliminary site-specific ground and groundwater conditions.

7.2.2. All structures / properties within the zone of influence of the proposed development have been assessed.

7.2.3. The following assumptions have been made within the GMA:

- The basement will be retained by a combination of a contiguous piled wall and underpins.
- The buildings adjacent to the site included in the GMA are assumed to be founded on ground surface.
- The walls of the above-mentioned buildings are assumed to behave as equivalent beams.
- Basements will be fully propped during construction.
- The contiguous piled wall has a length of 10m.

7.2.4. The ground movements resulting from the works comprise deformations arising from the following mechanisms:

- Installation of the contiguous pile wall and underpins.
- Bulk excavation works.
- Heave and settlement of the near-surface deposits and London Clay Formation due to unloading / load redistribution / loading.

7.2.5. The assessed facades in the XDisp model are shown in Figure 7.1.

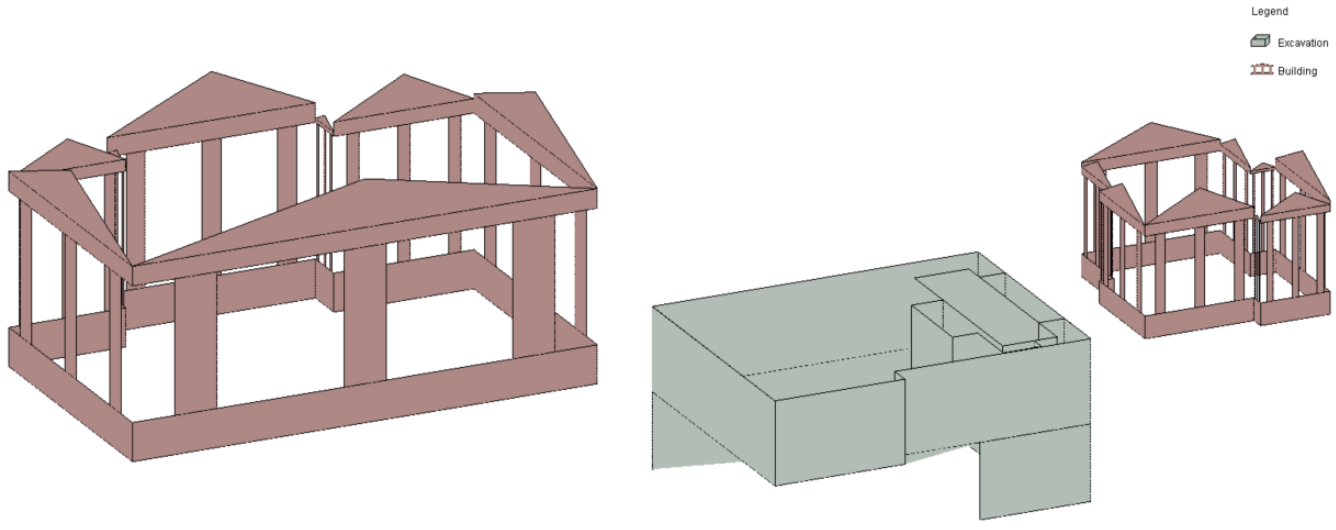


Figure 7.1 Three-dimensional modelled geometry in XDisp

7.2.6. The following mitigation measures are proposed to reduce ground movements and damage:

- Design of the contiguous pile wall, underpins and open-cut excavations shall be carried out in accordance with the relevant Eurocodes, non-conflicting codes of practice, and associated design best practice.
- Retaining wall construction to be performed by an experienced ground engineering contractor.
- Frequent monitoring of neighbouring properties to be carried out during excavation, to validate ground movement predictions against reality.
- Development of a monitoring-trigger-action plan that identifies trigger levels, responsible personnel and actions to be followed in the event of a trigger level exceedance.
- Incorporating stiff, high and intermediate level localised propping into the temporary works design of the basement excavation, so as to provide a high stiffness earth retention system. Design details regarding minimum wall flexural stiffness, prop stiffness and arrangement, shall be defined as part of detailed design development and will take cognisance of the results of the scheme GMAs.
- Designated areas for stacking and storing materials behind the embedded retaining wall should be identified. These should be located away from sensitive structures. The design of the retaining wall should incorporate an appropriate surcharge load to the rear of the wall, to capture effects of stacking and storing materials, vehicle traffic, etc.

7.2.7. It should also be noted than this GMA considers adjacent properties and does not assess the impact of the works on buried utilities. There remains the possibility that further propping measures may be required to safeguard such assets. Additional scheme GMAs will need to be performed in order to review the impact of the scheme on various third-party assets, such as Thames Water, at an early stage of the design development. These assessments will be brought forward post-planning and further refined based on the ongoing scheme development, prior to issue to the relevant asset protection teams.

8. Basement Impact Assessment

8.1. General

8.1.1. The Conceptual Site Model (CSM) is described as below:

- The ground conditions of the site comprise Made Ground overlaying Claygate Member and the London Clay Formation.
- Groundwater monitoring indicates that water is present within the Made Ground, perched above the Claygate Member. Finite volumes of water may be present within sandy elements of the Claygate Member.
- The areas surrounding the site are gently sloped and fall towards the south.
- The site currently comprises 50 Maresfield Gardens, a three-storey residential building with a small basement across part of the building footprint.
- The proposed development comprises the demolition of selected internal superstructure elements, the lateral extension of the superstructure, and extension of the basement across the whole building footprint. The proposed basement will be retained by a contiguous piled wall and underpinning the existing ground beams. The basement will extend to a depth of 4.5mbgl (at the formation level of the basement slab), and 7.6mbgl at the pool area. The existing ground beams are piled, with a pile length of 19.0m proven by parallel seismic testing. The existing piles are proposed to be cut down, and new ground beams formed at basement level. It is understood that the piles do not have sufficient capacity to support the increase in loading, and so the increment will be taken by the new ground beams working in combination with the piles.
- Neighbouring buildings are assumed to be founded near-surface.
- The nearest public highway is located approximately 16m from the proposed excavation.
- The proposed development may result in ground movements in the vicinity of the neighbouring properties and adjoining public highways. These ground movements will be managed by appropriate construction means and methods and controlled excavation operations.

8.2. Land Stability / Slope Stability

8.2.1. It is assumed that all new substructure elements will be founded in the Claygate Member and London Clay Formation, which is considered to be a suitable founding stratum.

8.2.2. A ground movement assessment has concluded that ground movements caused by excavation and construction of the proposed development will be limited. The upper bound damage category for surrounding structures within the zone of influence of the proposed development has been assessed as *Category 1 – Very Slight* in accordance with the Burland Scale.

8.2.3. The BIA has concluded that the risks to the adjacent properties, slopes, and infrastructure (including ultimate and serviceability limit state considerations) is limited and will be mitigated in a reasonable fashion as part of design development.

8.2.4. The BIA has concluded that there is a very low risk of groundwater flooding.

8.2.5. The BIA has concluded that impacts to the wider hydrogeological environment as a result of the proposed development will be limited.

8.3. Hydrology, Surface Water Flooding and Sewer Flooding

8.3.1. The BIA has concluded that there is a very low risk of surface water flooding.

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

Appendix A: Selected Project Information

Appendix B: Interpretive Report

Appendix C: Ground Movement Assessment Report

A-squared Studio

A-squared Studio Engineers Ltd
One Westminster Bridge Rd
London, SE1 7XW

020 7620 2868
contact@a2-studio.com
www.a2-studio.com