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Basement Structural Method Statement

156 Goldhurst Terrace
NW6 3HP Camden
London

Mr. Guy Shani

Garden Flat
24 Maresfield Gardens
London NW3 5SX

Revision	Date	Comment
-	18/06/14/	First Issue

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156 Goldhurst Terrace

Mr. Guy Shani

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RETAINING WALL DESIGN (BS 8002:1994)

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156 Goldhurst Terrace

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   Standard Lap Trench Sheeting

   KD4 sheets

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1. Design Information - Structural

Structural Summary

156 Goldhurst Terrace is a three Storey high multi occupancy property located in Camden. The structure is load bearing masonry external walls with internal masonry/stud walls, timber floors spanning from front to back and timber roof.

Figure 1: 156 Goldhurst Terrace: Front view

Proposed works

The proposed works constitutes a new basement development to the ground floor flat.

Croft Structural Engineers Ltd Structural Engineers has extensive knowledge of inserting new basements. Over the last 4 years we have completed over 150 basements in and around the local area. The method developed is:

1. Excavate front to allow for conveyor to be inserted.
2. Form lightwell with cantilevered retaining walls
3. Slowly work from the front to the rear inserting 1200 long cantilevered retaining walls sequentially
4. Cast ground slab
5. Waterproof internal space with a drained cavity system.

Structural Defects Noted

Diagonal, minor cracks to the first floor rear bedroom walls and ceiling as per photos.

Figure 2: 1st Floor rear bedroom wall crack

Figure 3:1st floor bedroom ceiling crack

Figure 4: Proposed ground floor plan

Figure 5: Proposed Basement Plan

Intended use of structure and user requirement	Family/domestic use

DP27	The Geotechnical Engineers, Ground and Water, have been appointed to undertake the geotechnical investigation for the ground works/ water table & Hydrology. Croft has answered these using the information given by the Ground and Water, Arups Hydrogeological Report & the Mouchel Report.
A	**Maintain Structural Stability of the building & Neighbouring Properties**. The attached drawing shows the reinforcement and construction required by maintain stability of the property, the neighbouring buildings The adjacent Garden Wall has also been considered and the road. Calculations results are shown in the Stage 4 – Impact Assessment
B	**Avoid Adversely Affecting drainage and Run off.** The area of hard standing remains unchanged and run off will not be altered. The property will not affect the main aquifer The drainage design is not by Croft Structural Engineers it may be wise to minimise the flow by use of SUDS systems. See Screening Stage information
C	**Avoid Cumulative Impact upon Structural Stability or the water environment.** See Scoping stage, that indicates location in relations to water course and Hampstead heath catchment. See Stage 4 Impact Assessment and drawings. The structure is designed to take account of Hydrostatic head on the basement.
D	**Harm the Amenity of Neighbours** Noise and nuisance has been considered in Stage 4
E	**Loss of Open Space or Trees** There is no loss of open space. Trees are unaffected. The current roots will be above the existing foundations and therefore the new foundations will not cut through

	significant roots.
References & Abbreviations	Camden Geological, Hydrogeological and Hydrological Study Guidance for Subterranean Development (Arup Report - Nov' 2010) – Arups Hydrogeological Report North London Strategic Flood Risk Assessment (Mouchel Report 2008) – Mouchel Flood Report Camden Planning Guidance Basements and Lightwells CPG4 Camden Development Policy DP27 Extracts of the relevant maps are given below; the larger map from which they have been taken is in an appendix to the rear.

2. Basement Impact: Screening

	The questions below are taken from the Camden CPG 4 – Basements and Lightwells. **Questions have been taken from Appendix E of the Arup Hydrology report**
Groundwater flow	**Figure 1 – Subterranean flow screening chart** **1a. Is the site located directly above an aquifer?** **No.** The Environment Agency maps do not show the site to lie above an aquifer.

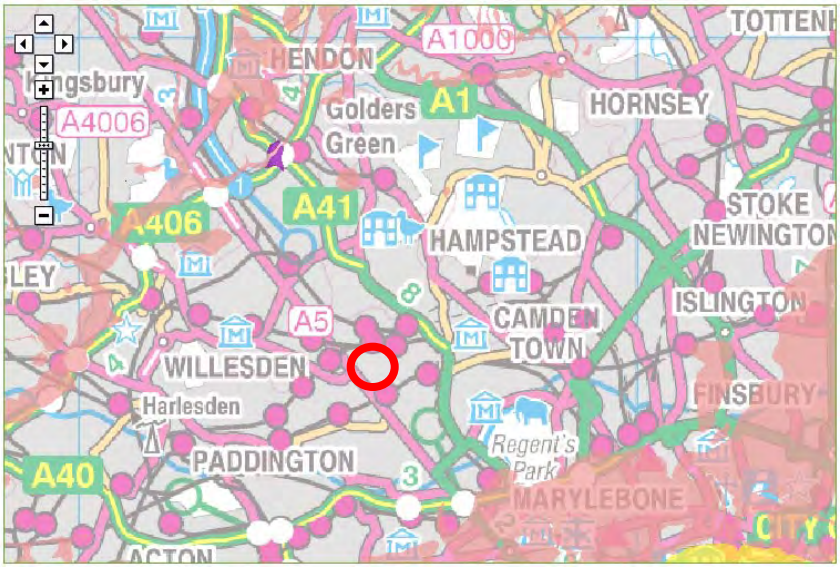


Figure 6: 156 Goldhurst Terrace on the Environment Agency Map

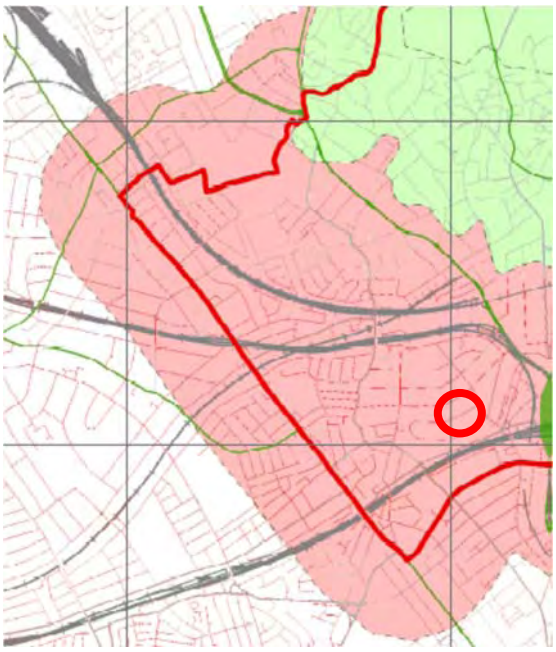


Figure 7: Figure 8 Arup report aquifer map showing unproductive strata

1b. Will the proposed basement extend beneath the water table surface?

Unknown. Proposed basement will extend to approximately 3.3meters.

Requires scoping assessment and investigation.

2. Is the site within 100m is a watercourse, well used/disused or potential spring line?

Unknown. Figure 11 of the Arup report shows potential water course within the area.

Requires scoping assessment and investigation.

3. Is the site within the catchment of the pond chains on Hampstead Heath?

No. The site lies outside the areas denoted by figure 14 of the Arup report.

4. Will the proposals basement development result in a change in the proportion of hard surfaced/ paved areas?

No. The surfaces to the front & rear are to remain unchanged.

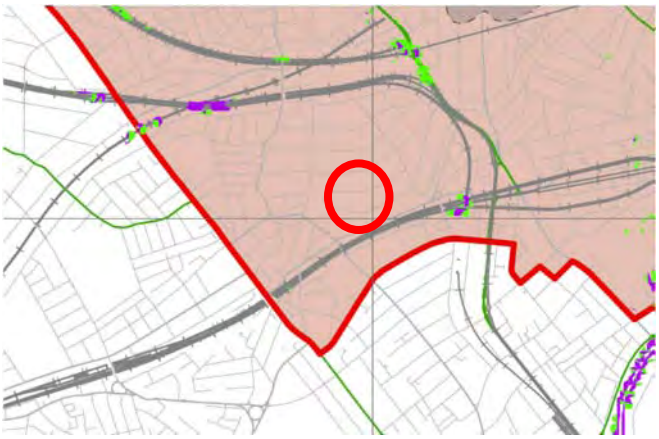
5. As part of the site drainage will more surface water (e.g. rainfall and run-off) than at present be discharged to the ground (e.g. via. Soakaways and or SUDS)?

No. Existing roof Drainage will run into the existing drainage system. Surface water will still discharge to ground.

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 and local pond (not just the pond chains on Hampstead Heath) or spring line?

Unknown. Figure 11 of the Arup report shows potential water course within the area.

Requires scoping and investigation

Slope Stability	**Figure 2 – Slope Stability screening flowchart** **1. Does the existing site include slopes, natural or man made greater than 7º (approximately 1 in 8)?** **No**. Difference in height between the rear garden and front is less than 1 in 8 slope (approx flat)  *Figure 8: Arup report figure 16* **2. Will the proposed re profiling of landscaping at site change slopes at the property boundary to more than 7º (approximately 1in 8)?** No. Proposed landscaping does not affect the slope. **3. Does the development neighbour land including railway cuttings and the like with a slope greater than 7º (approximately 1 in 8)?** No. Proposed landscaping does not affect the slope. **4. Is the site within a wider hillside setting in which the general slope is greater than 7º (approximately 1 in 8)?** No. The slope of the wider hillside setting is as per the property, less than 7º **5. Is the London Clay the shallowest strata on site?** **Yes**. The site sits on the London clay formation. Please see Soil Investigation report attached in Appendix E. **6. Will any tree/s be felled as part of the proposed development and/or are any of the works proposed within any tree protection zones where trees are to be retained?**

No. No local trees are to be felled. The impact of the basement on these trees should be considered

Carry forward to scoping stage.

7. Is there a history of seasonal shrink-swell subsidence in the local area, and/ or evidence of such effects at the site?

From the walk over survey subsidence was considered as an issue on this site to the front of the property. This could be due to the close proximity of the tree in the rear of the property.

The site is on Shrinkable ground and as such has an increased risk to subsidence. The basement and all foundations will be designed to take account of the ground conditions. The basement construction places the loads of the property on to deep ground. The depth further protects the building from the seasonal changes in the ground.

8. Is the site within 100m of a watercourse or a potential spring line?

Unknown. Figure 11 of the Arup report (see above) shows potential water course within the area.

Requires scoping and investigation.

9. Is the site within an area of previously worked ground?

No. From the historical maps, the site has been residential for the past 120 years.

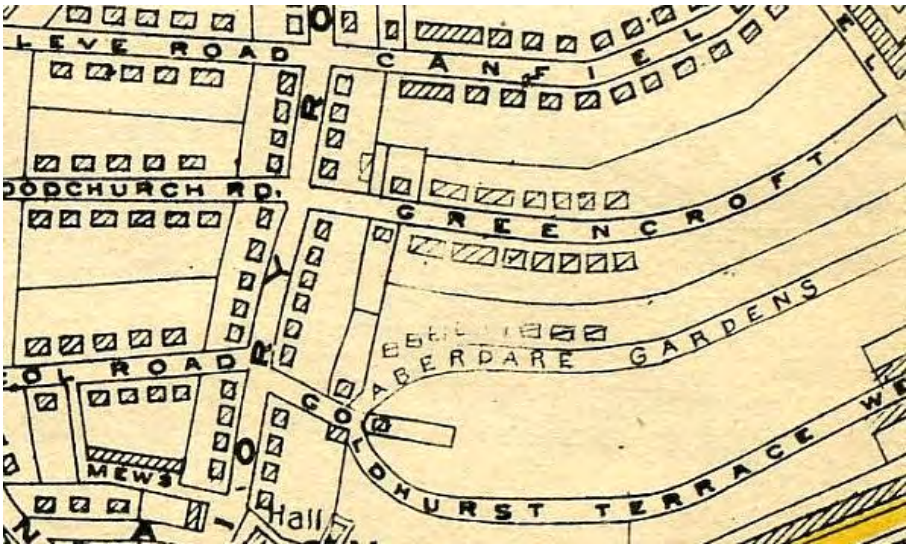


Figure 9: Stanford's Map of Central London 1897

Carry forward to scoping stage: Soil investigation to be completed to confirm the ground conditions.

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 Environment Agency maps do not show the site to lie above an aquifer.

The ground is London Clay, which is relatively impermeable; as such it is not an aquifer.

Requires scoping and investigation.

11. Is the site within 50m of the Hampstead Heath ponds?

No.

12. Is the site within 5m of a highway or pedestrian footway?

Yes. Site is within 5.5m of the footpath. Conservatively a 10kN/m^2 surcharge loading will be applied.

Carry forward to scoping stage.

13. Will the proposed basement significantly increase the differential depth of foundations relative to the neighbouring properties?

Yes. Party wall will be underpinned. Existing footings are expected to be corbelled masonry approx. 600mm below ground level.

Carry forward to scoping stage: Overall design to be considered.

14. Is the site over (or within the exclusion zone) of any tunnels, e.g. railway lines?

No. Nearest is the LUL Line approximately 100m from site.

Requires scoping and investigation

Surface flow and flooding	**Figure 3 – Surface flow and flooding screening flowchart** **1. Is the site within a catchment of the pond chains on Hampstead Heath?** **No**.The site lies outside the catchment areas of the Hampstead heath ponds as shown on figure 14 of the Camden Hydrological Study. **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?** **No**. The area of hard standing remains unchanged by the development. **3. Will the proposed basement development result in a change to the hard surfaced /paved external areas?** **No.** The amount of hard standing will remain unchanged **4. Will the proposed basement result in changes to the inflows (instantaneous and long term of surface water being received by adjacent properties or downstream watercourses?** **No**. The proposed development will enter the current drainage system. If Thames water requires a reduction in flow the drainage of the new external hard standing may need to be drained with a soak away /SUDS system. This design is not done by Croft. **5. Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?** **No**. The quality of water is unlikely to be altered. **6. Is the site in an area known to be at risk from surface water flooding, such as South Hampstead, West Hampstead Gospel Oak and King's Cross or is it at risk form flooding, for example because the proposed basement is below the static water lever of a nearby surface water feature?** The site is in South Hampstead and as shown on the Camden Flooding Map It was previously flooded in 1975 and 2002.

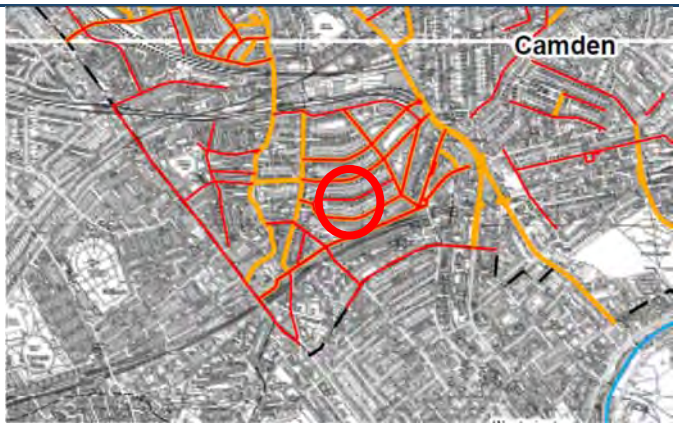


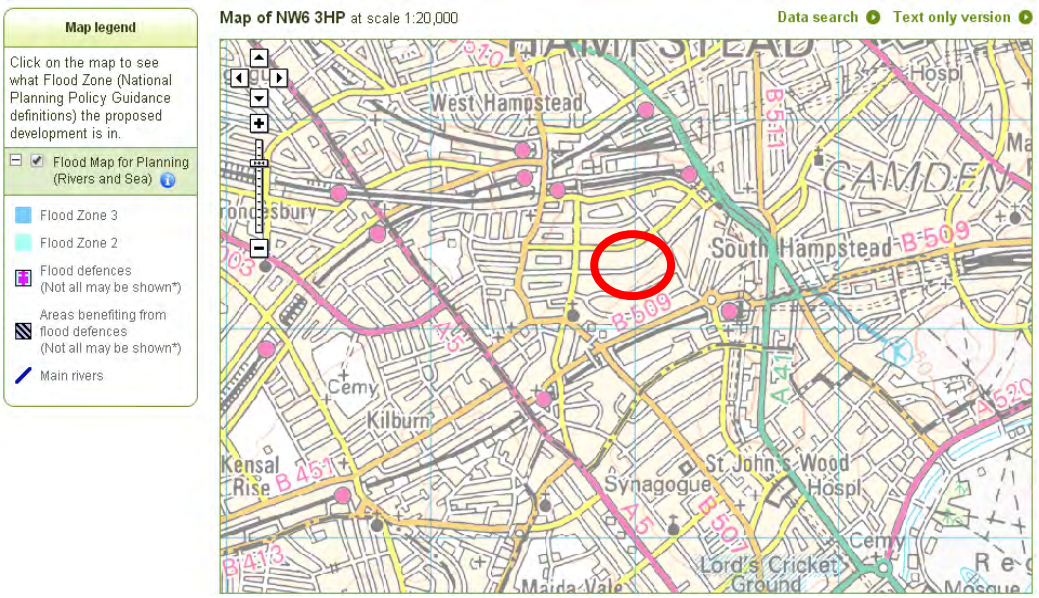
Figure 10: Camden Flooding map

Requires scoping and investigation

3. Basement Impact: Screening Maps

Attached maps support Screening information

4. Basement Impact: Scoping

Groundwater flow	**Subterranean flow** There is a need to find out groundwater table to see if basement will impact on the groundwater flow. This will be covered by a Soil Investigation. Soil investigation confirmed, that the soil is London clay formation. The bores holes are to have a stand pipe inserted to confirm the water level after a 1 month period. For full soil investigation report see Appendix E.
Slope Stability	A Soil Investigation confirmed that the top layer is the London clay. The slope stability of theses beds is in the region of 40˚. The design of the RC retaining walls will take this into account. Made ground was found on site up to approximately 1.1m. The basement is within 5m of the footpath, and will therefore be designed the front lightwell will be designed conservatively with a 10kN/m² surcharge. As party wall is to be underpinned and will leave the party wall with a deeper footing than the neighbours other walls, the design should look at the available bearing capacity. As part of the Party Wall agreement a pre-condition survey will be carried out. The design will consider the impact of the deeper footings.
Surface flow and flooding	This proposal is not considered to be in an area a risk of flooding.  *Figure 11: Flood zone map* As described in Section 2, the risk of surface water flooding is unknown. The street has flooded in 1975 and/ 2002. Section 2.41 of CPG4 requires that due to

	this/these occurrence(s), a Flood Risk Assessment should be carried out at the planning application stage. This is included in Section 7. The flow of surface water above the basement (top 1m of soil) will need to be considered.

5. Desk Study and Walkover Survey

Subsoil conditions	The North London Geological Maps Indicates the site is underlain by London Clay. This is as expected in the area and soil investigation confirmed the findings. The boreholes were 6m deep and no ground water was encountered.

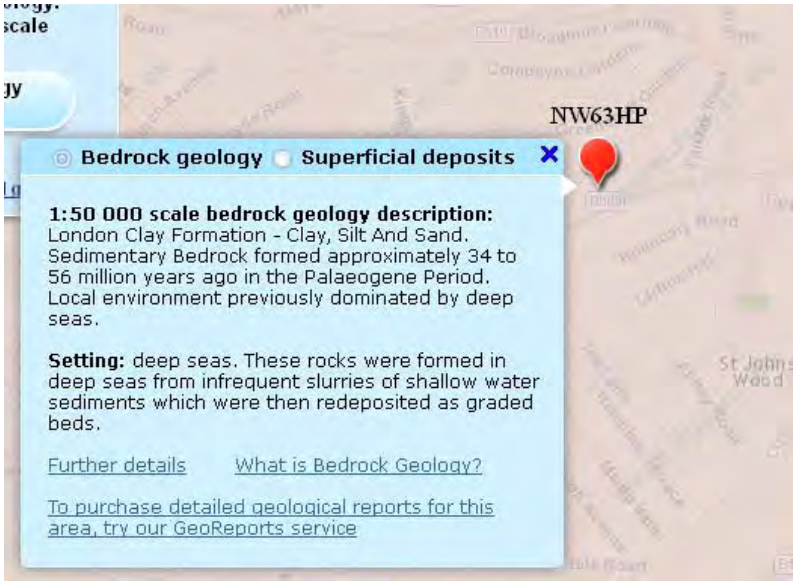


Figure 12: 156 Goldhurst terrace - Geology of Britain viewer

Walk over Survey

Figure 13: Rear area; adjacent property on the left hand side

Figure 14: Rear area; adjacent property on the right hand side

Figure 15: Rear garden trees

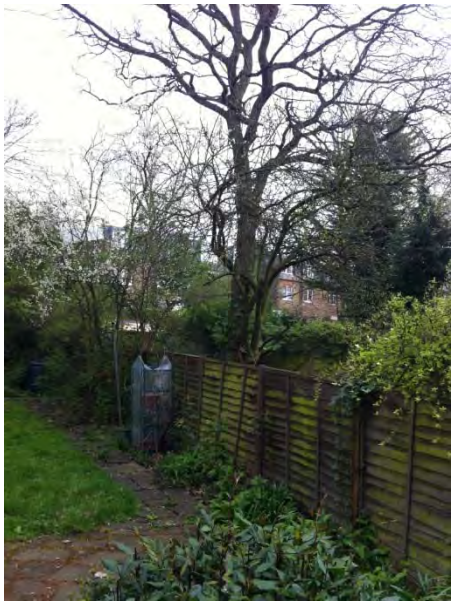


Figure 16: Rear garden trees

There are two nearby trees in the garden, approximately 8 meters away. The tree on the right side is on the adjacent property land.

The building is part of a terrace and the effects of the development on the adjacent properties will need to be considered.

From the walk over survey subsidence was considered as an issue on this site to the front of the property. This could be due to the close proximity of the tree in the rear of the property.

Drainage effects on Structure	No build over agreements known of
Under ground	Underground line is approximately 150m away from the site, therefore it's not a concern.  *Figure 17:Map of local areal. Underground approximately 150m from site*
Sources of Contaminates	From the Historic Maps it can be seen that the ground use has not been conducive to activities leading to poor ground. During the walk over survey no items were noted that may lead to contamination. The front garden is used for car storage that may result in minor petrochemical pollutants.
Water Course	The site is shown within the areas of recent local flooding in the Arup's report. The site is not within the Hampstead pond catchment area as shown in the Arup's report. The site is within local water course noted in the Arup's report.

6. Historic Maps

There is no sign of development within the area of question on the Map of London by Edward Weller from 1868.

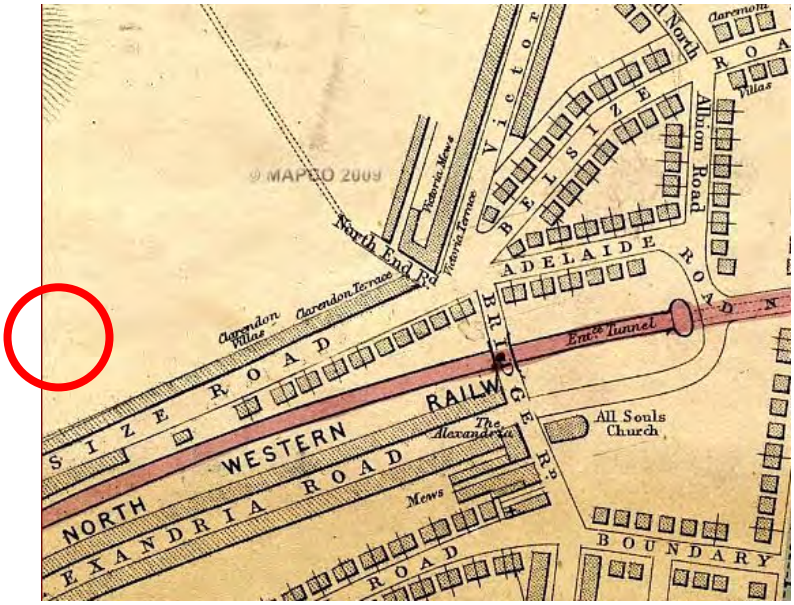


Figure 18: Map of London 1868, by Edward Weller

Goldhurst Terrace St appears on the Stanford's Map of Central London from 1897. The area is domestic.

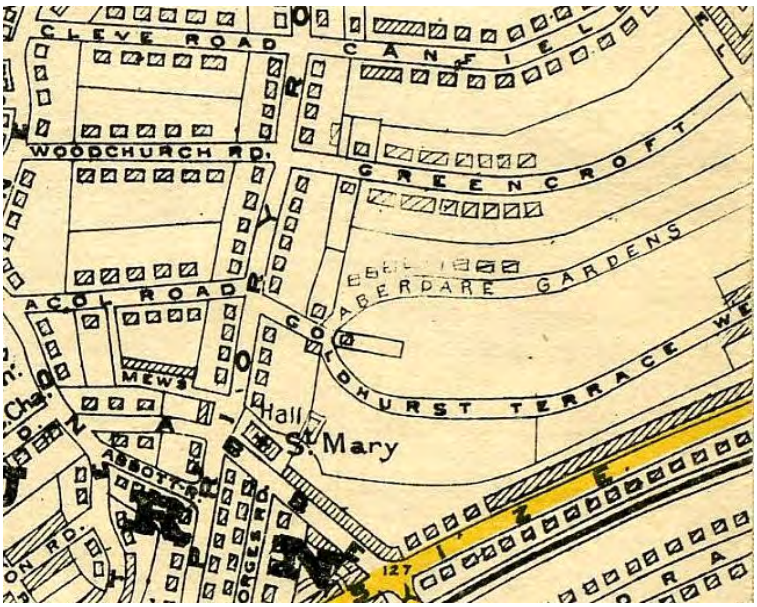


Figure 19: Stanford's map of Central London 1897

The ground use has not been conducive to activities leading to poor ground.

7. Flood Risk Assessment

	The ground investigation and hydrology report was conducted by Ground and Water. Refer to the geotechnical report in Appendix E

8. Site Investigation

Monitoring and Reporting	The Soil investigation was completed by Ground and Water. From the Scoping stage we considered that their brief should cover: • Two trial pits to the front side and rear to confirm the existing foundations. The purpose is to consider the effect of the works on the neighbouring properties and the find the ground conditions below the site. • Two bore holes, one to the front and one to the rear, both completed to the depth of 6m. • Site testing to determine insitu soil parameter. SPT testing to be undertaken. • Laboratory testing to confirm soil make up and properties. • The Historic maps and walk over survey did not highlight any significant contamination sources, therefore no site test of the ground has been requested. • Factual Report on soil conditions. • Calculation of Bearing pressures from SPT. • Indication of Ø (angle of friction) from SPT. • Indication of soil type See Appendix E for Soil report

9. OS Map extract showing location of Railway

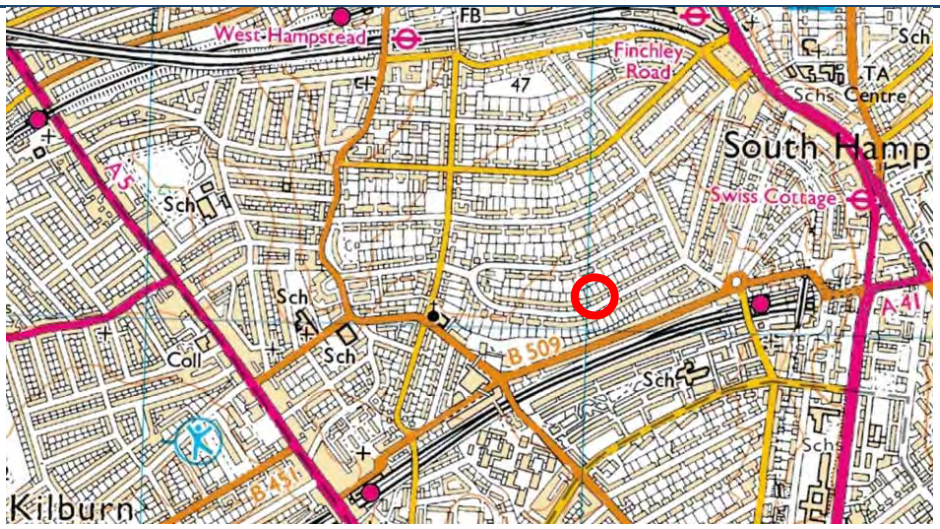


Figure 20: 211 Goldhurst Terrace; Extract from OS map showing proximity to nearest railways

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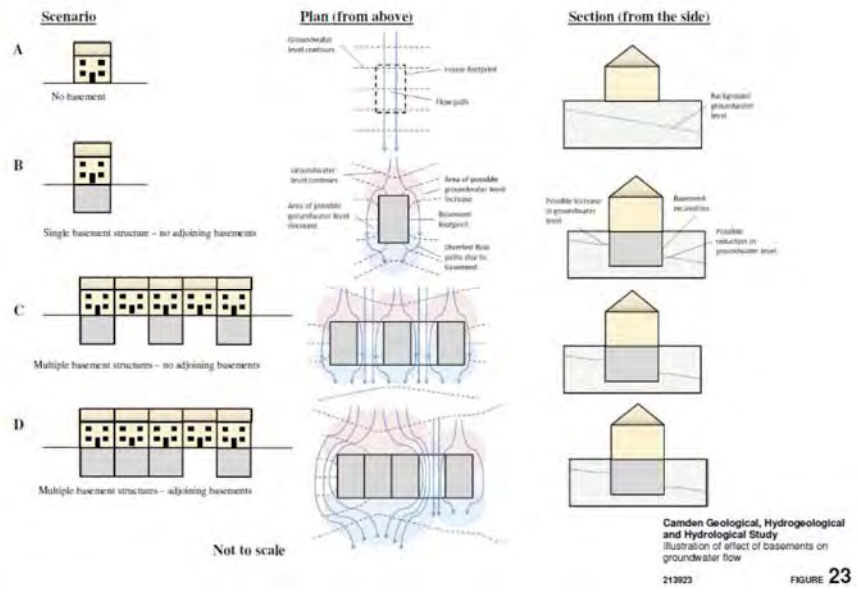
10. Impact Assessment

Subterranean flow	The site is not within the catchment of the Hampstead Heath Ponds. It is a considerable distance from the ponds and standing water courses in the area. The development will not have an impact on the Hampstead heath ponds nor their catchement. The proposed development depth is expected to be at 3.3m below external ground floor level. The ground below the basement was Claygate beds, a more permeable ground than pure London Clay. The bore holes during the site investigation remainded dry upon the finish at 6m below ground level. It is possible that the ground water may rise in the coming months and fluctuate throughout the year. The local affect of the basement will be to divert any flowing ground water away from the foot print of the building. To the front side and rear of the property large areas over 10m wide are present. With a large dispersal area for the flow to be diverted around the affects on the surrounding area will be minimal.  ***Without field testing in the neighbouring properties or along the road there is a low residual risk that the ground wall flow may affect the external ground.***

	The basement design must allow for variants in ground water. The retaining walls must be designed to provide lateral resistance to water up to 1m from the top of the wall. The design must follow the recommendations as noted in BS8102. ***For the level of development a full hydrology report is not suitable.***
Slope Stability	From the walk over survey, the OS map and the Arups report the slopes around the site are less than 7º. Land slip is not a problem due to any circular failure patterns. The retaining walls must be designed to accommodate the lateral pressures from the soils.
Foundation type	Reinforced concrete cantilevered retaining walls The designs for the retaining walls have been calculated using software TEDDS. The software is specifically designed for retaining walls and ensures the design is kept to a limit to prevent damage to the adjacent property. **Attached printout of TEDDS calculations and Deflections of walls in Appendix C** The overall stability of the walls are design using K_a & K_p values, while the design of the wall uses K_o values. This approach minimise the level of movement from the concrete affecting the adjacent properties. The walls are designed to cope with the hydrostatic pressure. The water table was low. The design of the walls however considers the long term items. It is possible that a water main may break causing local high water table. To account for this the wall is designed for water 1m from the top of the wall. The Design also considers floatation as a risk. The design of has considered the weight of the building and the uplift forces from the water. The weight of the building is greater than the uplift resulting in a stable structure. Below are the design pressures and loadings.

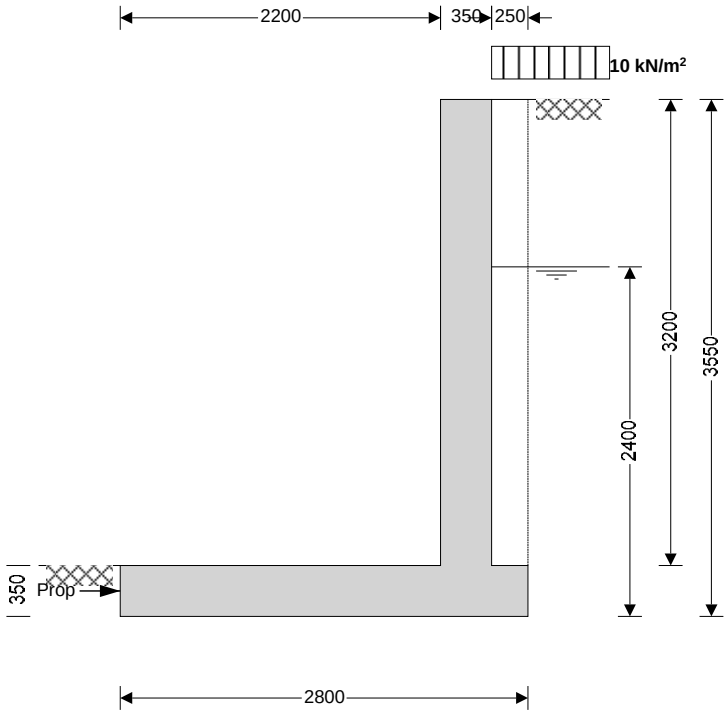


Figure 21: RC retaining wall 1 scheme

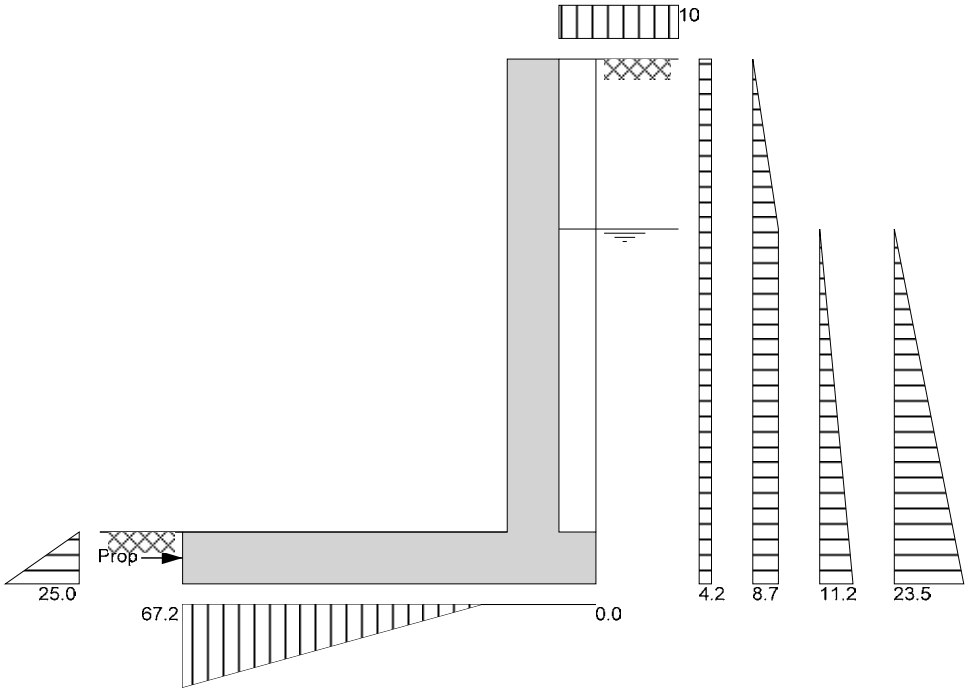


Figure 22 Loadings and Lateral stress patterns

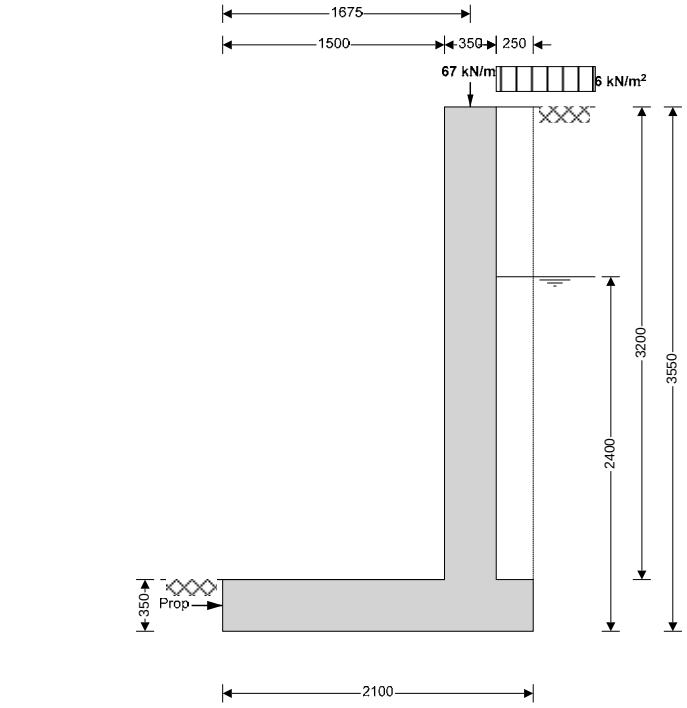


Figure 23: RC retaining wall 2 scheme

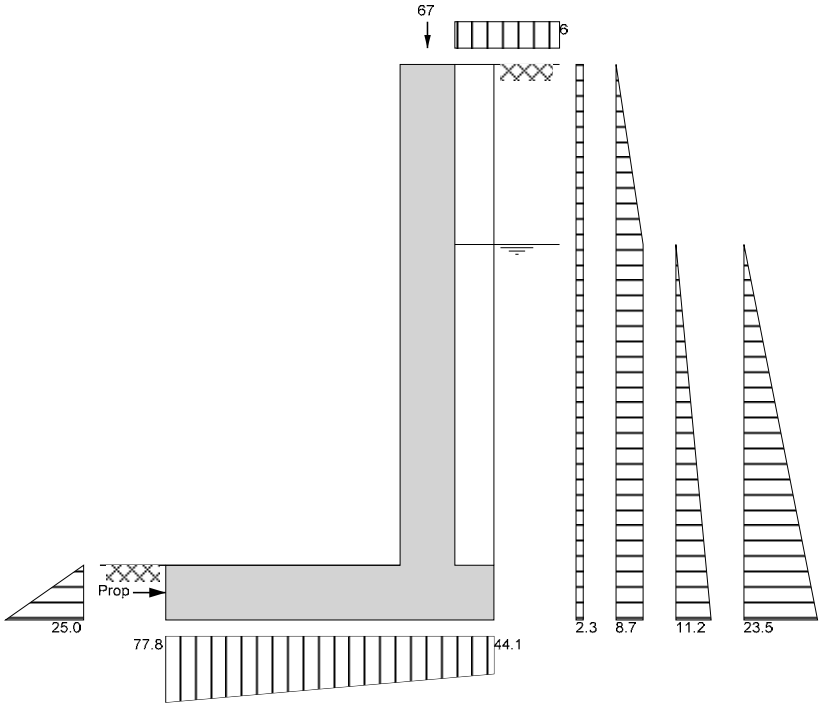


Figure 24: loadings and lateral stress patterns

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Vicinity of Trees	
Special precautions due to trees	Design using NHBC guidance Basement depth will allow for footings to be placed outside the effects of the trees. The current trees roots will be limited by the existing foundations. The new basements excavations will not significantly/ adversely affect the root protection zones of the neighbouring trees.
Drainage effects on Structure	No build over agreements known of. Flooding. The site is not in an area of high risk flooding.
Roads	The building does not undermine the highway, but car parking is present to the front of the property. It is possible for heavier goods vehicles to reverse on to the property to allow for this risk loadings are to be taken from the Highways loading code. 10kN/m² to front light well Garden Surcharge 2.5kN/m² Surcharge for adjacent property 1.5kN/m² + 4kN/m² for concrete ground bearing slab
Intended use of structure and user requirements	Family/domestic use
Loading Requirements (EC1-1)	See table below
Number of Storeys	3 + Existing cellar Is Live Load Reduction included in design No

	UDL kN/m²	Concentrated Loads kN
Domestic Single Dwellings	1.5	2.0

The basement does not line within a 45º angle of the highway. Therefore Highways HA loading is not required to be applied.

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Progressive Collapse	Design for consequences of localized failure in building from an unspecified cause
Is the Building Multi Occupancy?	No
Part A3 Progressive collapse	EN 1991-1-7:1996 Table A1

Class 1	Single occupancy houses not exceeding 4 storeys

Progressive collapse Change of use	To NHBC guidance compliance is only required to other floors if a material change of use occurs to the property.

Proposed Building Class	
If class has changed material change has occurred	Yes / No

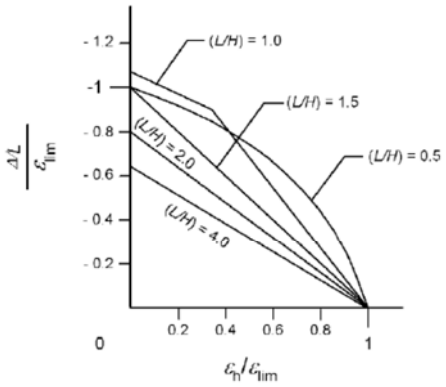
Additional Design Requirements to Comply with Progressive Collapse	**Class1 – Design to satisfy EN 1990 to EN 1999 stability requirements**

Lateral Stability Exposure and wind loading conditions	Basic wind speed Vb = 21 m/s to EC1-2 Site level +75.000 m above sea level. Topography not considered significant.
Stability Design	The cantilevered walls are suitable to carry the lateral loading applied from above
Lateral Actions	The soil loads apply a lateral load on the retaining walls. Hydrostatic pressure will be applied to the wall Imposed loading will surcharge the wall.

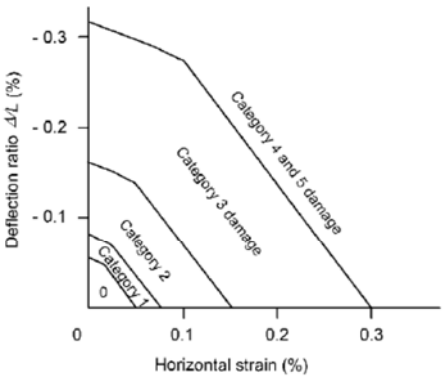
Adjacent Properties	***Any ground works pose an elevated risk to adjacent properties. The proposed works undermines the adjacent property along the party wall line:*** The party wall is to be underpinned. Underpinning the party wall will remove the risk of the movement to the adjacent property. The works must be carried out in accordance with the party wall act and condition surveys will be necessary at the beginning and end of the works. The method statement provided at the end of this report has been formulated with our experience of over 120 basements completed without error. The design of the retaining walls is completed to K_O lateral design stress values. This increases the design stresses on the concrete retaining walls and limits the overall deflection of the retaining wall. It is not expected that any cracking will occurring during the works. However our experience informs us that there is a risk of movement to the neighbours. To reduce the risk the development: • Employ a reputable firm for extensive knowledge of basement works. • Employ suitably qualified consultants. Croft Structural engineer has completed over 120 basements in the last 4 years. • Design the underpins to the stable without the need for elaborate temporary propping or needing the floor slab to be present. • Provide method statements for the contractors to follow • Investigate the ground, now completed. • Record and monitor the external properties. This is completed by a condition survey on under the Party Wall Act before and after the works are completed. See end of method statement. • Allow for unforeseen ground conditions: Loose ground is always a concern. The method statement and drawings show the use

of precast lintels to areas of soft ground; this follows the guidance by the underpinning association.

With the above the maximum level of cracking anticipated is Hairline cracking which can be repaired with decorative cracking and can be repaired with decorative repairs. Under the party wall Act damage is allowed (although unwanted) to occur to a neighbouring property as long as repairs are suitability undertaken to rectify this. To mitigate this risk The Party Wall Act is to be followed and a Party Wall Surveyor will be appointed.



(b) Influence of horizontal strain on Δ/L / ε_{lim} (after Burland, 2001)



(c) Relationship between damage category and deflection ratio and horizontal tensile strain for hogging for (L/H) = 1.0 (after Burland, 2001)

Extract from The Institution of Structural Engineers "Subsidence of Low-Rise Buildings"

Table 6.2 Classification of visible damage to walls with particular reference to type of repair, and rectification consideration

Category of Damage	Approximate crack width	Limiting Tensile strain	Definitions of cracks and repair types/considerations
0	**Up to 0.1**	0.0-0.05	**HAIRLINE – Internally cracks can be filled or covered by wall covering, and redecorated. Externally, cracks rarely visible and remedial works rarely justified.**
1	0.2 to 2	0.05-0.075	FINE – Internally cracks can be filled or covered by wall covering, and redecorated. Externally, cracks may be visible, sometimes repairs required for weather tightness or aesthetics. NOTE: Plaster cracks may, in time, become visible again if not covered by a wall covering.
2	2 to 5	0.075-0.015	MODERATE – Internal cracks are likely to need raking out and repairing to a recognised specification. May need to be chopped back, and repaired with expanded metal/plaster, then redecorated. The crack will inevitably

			become visible again in time if these measures are not carried out. External cracks will require raking out and repointing, cracked bricks may require replacement.
3	5 to 15	0.15-0.3	SERIOUS – Internal cracks repaired as for MODERATE, plus perhaps reconstruction if seriously cracked. Rebonding will be required. External cracks may require reconstruction perhaps of panels of brickwork. Alternatively, specialist resin bonding techniques may need to be employed and/or joint reinforcement.
4	15 to 25	>0.3	SEVERE Major reconstruction works to both internal and external wall skins are likely to be required. Realignment of windows and doors may be necessary.
5	Greater than 25		VERY SEVERE –Major reconstruction works, plus possibly structural lifting or sectional demolition and rebuild may need to be considered. Replacement of windows and doors, plus other structural elements, possibly necessary. NOTE – Building & CDM Regulations will probably apply to this category of work, see sections 10.4, 10.6 and Appendix F.

Monitoring and Predicted Category of Damage

Monitoring - In order to safeguard the existing structures during underpinning and new basement construction movement monitoring is to be undertaken. Surveying studs are to be attached to the adjacent structures at ground, first, second and third floor levels at front and rear.

The surveying points on the adjacent structures are to be set up using an EDM prior to commencement of the works and to be read daily and reported against the following control values.

Limits on ground and adjacent structures movement during underpinning and throughout the construction works.

Movement of survey points must not exceed:

Settlement:
Action values: 5mm (stop work)
Trigger values: 65% of action values (submit proposals for ensuring action values are not exceeded)

Lateral displacement:
Action values: 6mm (stop work)

	Trigger values: 65% of action values (submit proposals for ensuring action values are not exceeded) Movement approaching critical values: Trigger: Submit proposals for ensuring action values are not exceeded Action: Stop work The reporting format will be in the form of a table as attached. **Predicted Category of Damage** The predicted category of damage is likely to be within BRE Category Slight, with possible localised crack widths 2mm to 5mm Classification Aesthetic.
Drainage and Damp proofing	Assumed that drainage and damp proofing is by others: Details are not provided within our brief. Our recommendation is that drained cavity systems are used to habitable basements with pumped sumps. This is a specialist contractor design item. Concrete is not designed BS 8007. But where possible BS 8007 detailing is observed to help limit crack widths of concrete
Party Wall	Underpinning basement works has a risk associated to it. To mitigate these risks a Party wall surveyor must be appointed
Temporary Works	Temporary works are the contractor's responsibility. Loads can be provided on request. Foundations; All trenches deeper than 1.0m must be shored. Where works undermine existing foundations contractor must allow for additional support. The Method statement lays out the process for constructing the basement

Noise and Nuisance	The contractor is to follow the good working practices and guidance laid down in the "Considerate Constructors Scheme". The hours of working will be limited to those allowed; 8am to 5pm Monday to Friday and Saturday Morning 8am to 1pm. None of the practices cause undue noise that one would typically expect from a construction site. The conveyor belt typically runs at around 70dB. The site has car parking to the front to which the skip will be stored. The site will be hoarded with soil 8' site hoarding to prevent access. The hours of working will further be defined within the Party Wall Act. The site is to be hoarded to minimise the level of direct noise from the site. Ground floor slab is not being removed minimising the vibration and sound to adjacent properties. While working in the basement the work generally requires hand tools to be used. The level of noise generally will be no greater than that of digging of soil. The noise is reduced and muffled by the works being undertaken underground. A level of noise from a basement is lower than typical ground level construction due to this.