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New basement
168 Haverstock Hill,
London
NW3 2AT

Basement Impact Assessment Report

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BASEMENT IMPACT ASSESSMENT REPORT

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RISQS AUDITED

ACM Registered to: ISO 9001 ISO 14001 OHSAS 18001

Aerial photograph of property

Approximate property boundaries edged in red.

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Report status and format

Report section	Principal coverage	Report status	
		Revision	Comments
1	Introduction and brief		
2	Description of the property and project proposals		
3	Desk study information and site observations		
4	Ground investigations		
5	External ground movements around the basement		
6	Hardened areas		
7	Tree removal		
8	Summary of scoping and screening		
9	Subterranean (Groundwater flow) screening		
10	Stability impact identification		
11	Surface flow and flooding impact identification		
12	Summary and Conclusion.		

List of appendices

Appendix	Content
A	Copy of drawings illustrating proposal
B	Copy of CV of Nigel Thornton and examples of Soiltechnics commissions on basement investigations and analysis.
C	Copy of comments on this report by Chartered Geologist.
D	Borehole and trial pit records and plan showing location of exploratory points
E	Plan showing estimated surface settlement contours as a result of basement excavations (drawing BIA 01)
F	Calculations to determine tensile strains in masonry and prediction of damage to adjacent buildings

1 Introduction and brief

1.1 Objectives

This report presents a Basement Impact Assessment (BIA) for a proposed development at 168 Haverstock Hill, London.

The principal objective of the assessment is to present evidence to support a planning application for the project as required by Camden Planning Guidance (CPG4) '*Basements and lightwells'*.

1.2 Client instructions and confidentiality

This report has been produced following instructions received from Mr M Assor through FAL Architects.

This report has been prepared for the sole benefit of our above named instructing client, but this report, and its contents, remains the property of Soiltechnics Limited until payment in full of our invoices in connection with production of this report.

1.3 Author qualifications

This report has been prepared by a Chartered Civil Engineer, (C.Eng., M.I.C.E) who is also a Fellow of the Geological Society (FGS). The Author is a practising Civil Engineer with specialist experience (34 years) in geotechnical engineering (including basement construction), flood risk and drainage. A copy of my CV and examples of my experience in basement construction is presented in Appendix B. This report has been reviewed by John Evans of Chord Environmental who is a Chartered Geologist and expertise in hydrogeology. A copy of his comments are presented in appendix C.

1.4 Guidance used

As described in paragraph 1.1 above we have followed Camden Planning Guidance (CPG4) '*Basements and lightwells'*, and Camden geological, hydrogeological and hydrological study report '*Guidance for subterranean development,*' produced by Arup on behalf of the London Borough of Camden. We have also referred to the '*Strategic Flood Risk Assessment Report for North London*' dated August 2008 prepared by Mouchel, as well as other readily available information on websites. This report has considered all four stages of the BIA process as described in CPG4. This report has also been prepared to satisfy the following parts of Camden's policy DP27, on basements and lightwells:

a) Maintain the structural stability of the building and neighbouring properties;

b) Avoid adversely affecting drainage and run-off or causing other damage to the water environment;

c) Avoid cumulative impacts upon structural stability or the water environment in the local area;

In order to satisfy part a) a construction method statement has been prepared by a Structural Engineer which is separately presented.

1.5 Format of this report in relation to CPG4

Sections 3 to 8 of this report describes project proposals and presents desk study and investigation data, information required to answer flow chart questions posed in figures 1, 2 and 3 of GPG4. Answers for these flow chart questions are provided in sections 9 to 11.

2 Description of the property and project proposals

2.1 Description of the property

The site is currently occupied by a three storey semi-detached house and includes a lower ground floor. A Based on inspection of old Ordnance Survey maps the house was constructed in the late 1800's. A single storey extension has been added to the rear both at lower ground floor and ground floor levels. There are gardens both to the front and rear. The front garden area is substantially paved. Rear gardens are laid to grass with some trees, and there is sunken, paved terrace garden immediately to the rear of the house.

Ground levels in the area generally gently fall to the south at an estimated general gradient of about 1.5 degrees. There are no major cutting slopes close to the property, and no railway tunnels.

2.2 Project proposals

Proposals are to provide a single storey deep basement is over the lower ground floor footprint of the existing building extending below the paved terrace garden area in rear gardens. The paved terraced garden will remain in the proposals. A light well will be added to the front of the property. The basement will extend to a depth of around 3.5m below ground floor levels (say 3.8m to allow for floor construction). A pool will be incorporated within the central part of the rear quadrant of the basement.

Underpinning will be required to perimeter and load bearing walls to the main house building allowing basement excavation. A contiguous piled retaining wall is proposed outside the main building footprint. A structural retaining wall will be constructed to allow excavation of the light wells to the front elevation.

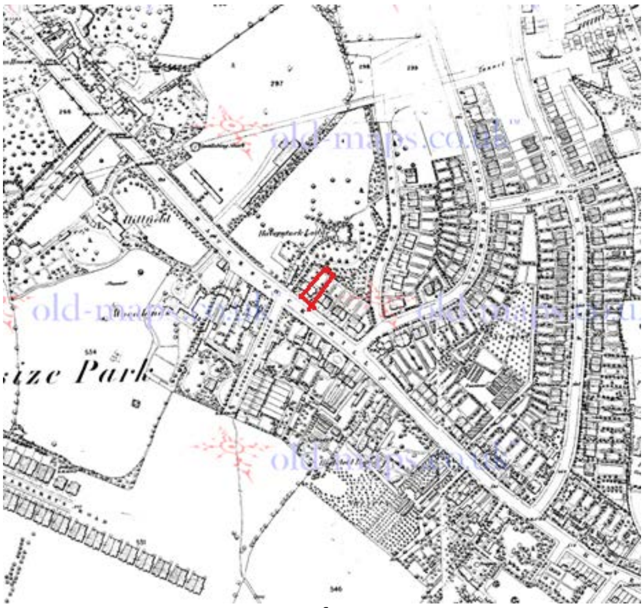
The front, south west, facing elevation of the property is about 6m distance from the highway.

Copies of our client's Architects drawings showing project proposals are presented in Appendix A.

3 Desk study information and site observations

3.1 Site history

Review of Ordnance Survey maps dating back to 1870s (first editions) records the current main house footprint. An extract copy of the 1871 map is presented below with the property edged in red.



Extract copy of 1871 map

At this stage is important to note there are no water courses recorded on the 1879 predevelopment map close to the property, and no evidence of any opencast quarrying activities in the locality.

3.2 Geology and geohydrology of the area

3.2.1 Geology

Inspection of the geological map of the area published by the British Geological Survey (BGS) indicates the following sequence of strata. The thickness of the strata has been obtained from a combination borehole record data formed within 500m of the property available on the BGS website, and geological sections shown on the BGS map.

Summary of Geology and likely aquifer containing strata					
Strata	**Bedrock or drift**	**Approximat thickness**	**Typical soil type**	**Likely permeability**	**Likely aquifer designation**
London Clay Formation	Bedrock	80	Clays	Low	Unproductive
Lambeth Group	Bedrock	16	Clays occasionally sandy	Low	Unproductive
Thanet sands	Bedrock	10	Fine sands	Low/moderate	Secondary Aquifer
Chalk	Bedrock	200	Chalk	High	Principal

Table 3.2

Soil types and assessments of permeability are based on geological memoirs, in combination with our experience of investigations in these soil types.

An extract copy of the geological map is presented below, with brown shading representing the outcrop of the London Clay Formation (LC). The property position is highlighted.

Based on the above any excavations within the property will be located within London Clays, however is it is acknowledged that a covering of made ground is inevitable, associated with development of the area.

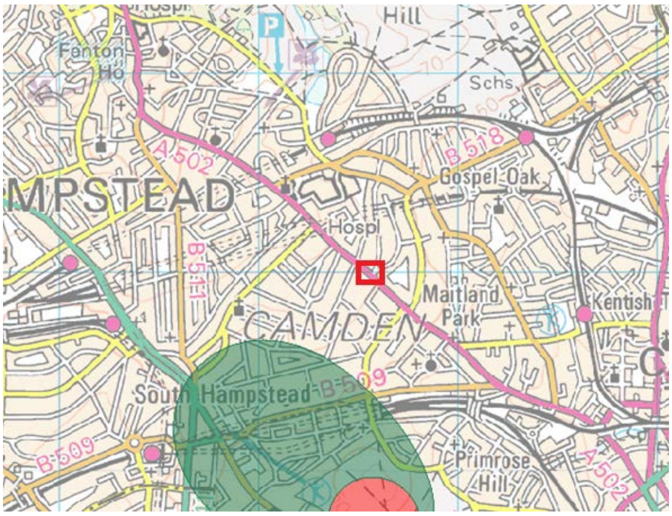
3.2.2 Geohydrology

The London Clay is classified as unproductive and regarded as not containing groundwater in exploitable quantities.

Chalk is classified a Principal Aquifer. Principal aquifers are defined as deposits exhibiting high permeability capable of high levels of groundwater storage. Such deposits are able to support water supply and river base flows on a strategic scale.

3.2.3 Source protection zone

The site is not recorded as being located within or close to a zone protecting a potable water supply abstracting from a principle aquifer (i.e. a source protection zone). An extract of the plan recording source protection zones is presented below, with green shading representing outer protection zones and red inner protection zones. The property is located within the red square and remote from source protection zones.



3.3 Quarrying/mining

3.3.1 With reference to the coal mining and brine subsidence claims gazetteer for England and Wales, available on the Coal Authority web site, the area has not been subject to exploitation of coal or brine. Inspection of old Ordnance Survey maps dating back to the first editions (late 1800s) does not record any quarrying activities within 250m of the property.

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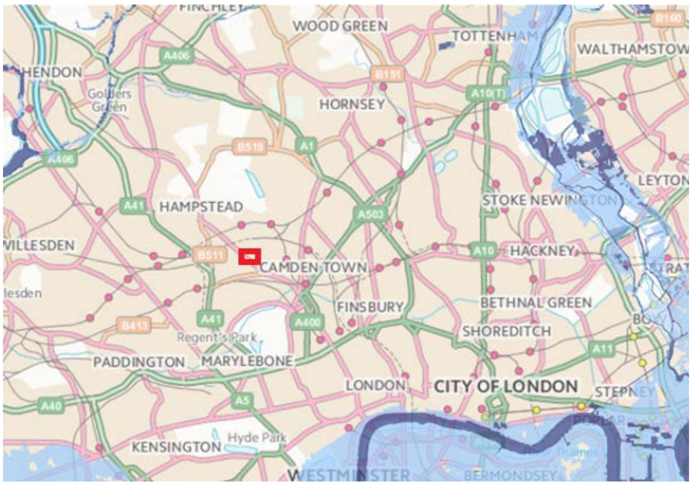
3.4 Flood risk

3.4.1 Fluvial/tidal flooding

The Environment Agency website indicates the site is not located within a fluvial or tidal flood plain. An extract copy of the flood risk map is presented below which shows no blue shading representative of flooding. The property is located within the red square.



3.4.2 Flooding from Reservoirs, Canals and other Artificial Sources

The Environment Agency website indicates the site is not located within an area considered at risk of flooding from breach of reservoir containment systems. An extract copy of the flood risk map is presented below which shows no blue shading representative of flooding as a result of failure of containment systems close to the site. The property is located within the red square.

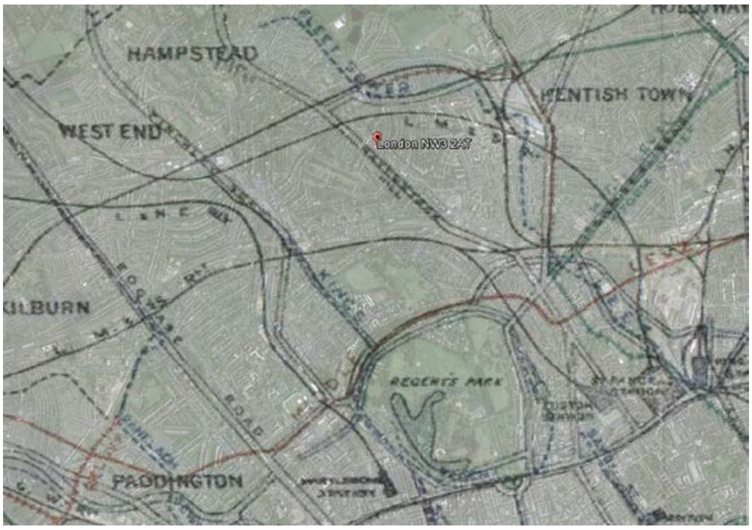
3.4.3 Flooding from Groundwater and surface waters

The site is underlain with a substantial thickness (80m) of relatively impermeable London Clay Formation. On this basis groundwater is not likely to be available at the site and thus is unlikely to present a risk of causing groundwater flooding.

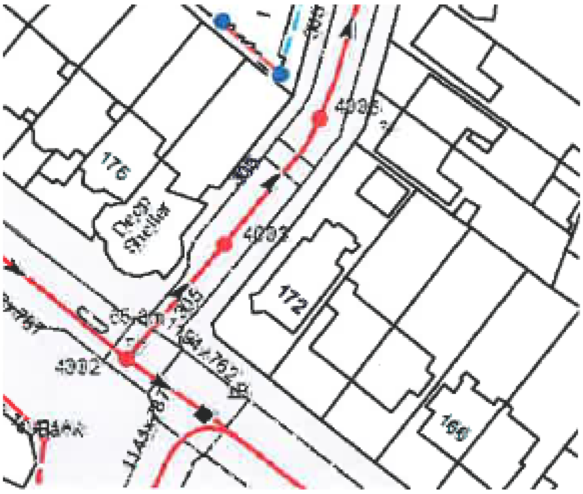
We have viewed the Environment Agency web site which provides maps showing areas a risk of flooding from surface waters. An extract of the map is presented below. The property is located within the red square and blue shading represents areas at risk of surface water flooding. The property is remote from blue shaded areas.

An extract of figure 11 from the Camden Geological, Hydrogeological and Hydrological Study is presented below. Blue shading show the locations of branches of the former River Westbourne (immediately to the south of the property) and the Fleet to the north. The property marked on the map. The property seems to be at the head waters of an upper branch of the Westbourne, but remote from these former watercourses.

With reference to old mapping of the area described in section 3.1 above, the 1871 map does not record any water courses close to or within the immediate area of the property. The Westbourne was a natural stormwater drainage system for this area of London prior to urbanisation. Development of London has resulted in original watercourses being culverted. The following is an extract plan showing main sewers installed between 1856 and 1930 to drain London. The nearest main sewers recorded on the map (in blue or brown) are located at least 350km distant from the property.



There are no major culverts in Haverstock Hill recorded on Thames Water Asset register, an extract copy of which is presented below. There is a 1154mm x 762mm combined sewer in the road following an easterly route.



An extract of figure 15 from the Camden Geological, Hydrogeological and Hydrological Study is presented below (property marked in a red box). The map records the property remote from areas of sewer flooding.

Extract copy of figure 15 from the Camden Geological, Hydrogeological and Hydrological Study

There will be below ground water supply pipes operated by Thames Water in public highways around the property. These are generally relatively small diameter pipes. It is considered that the property is unlikely to be at enhanced risk of flooding due to ruptures in the potable water supply system in the area.

3.4.4 Conclusions

Based on the above, in our opinion, the property is considered unlikely to be at enhanced risk of being flooded by exceedences in capacity of foul and stormwater drainage or water supply pipes. Evidence presented above demonstrates the property is not at an enhanced risk of being affected by tidal or fluvial flooding or indeed from artificial sources. The property and indeed proposals will not be affected by groundwater flooding.

4 Ground investigations

4.1 Scope

Two boreholes have been excavated at the property; one in rear gardens to 6m depth (WS1) and one in front gardens to 4m depth (WS2).

Fieldwork records are presented in appendix D together with a plan showing the location of boreholes.

4.2 Ground conditions encountered

Each of the two boreholes encountered a similar soil profile of naturally deposited London Clays capped in front gardens (WS2) with 0.95m of made ground and 1.9m of made ground in rear gardens reflecting the change in levels between front and rear gardens. The London Clays essentially comprised stiff brown grey silty clays. Although some water was observed in borehole WS1 (rear gardens) this originates from made ground as it overlies the relatively impermeable London Clays. No groundwater was encountered borehole WS2.

The investigations confirmed published geological maps for the near surface geology.

4.2 Foundations

Based on investigations completed to date we are of the opinion that the London Clays will adequately support new spread type foundations including traditional underpinning to existing spread type foundations to facilitate lowering of existing basement floor levels.

4.3 Summary of basement retaining wall design parameters

4.3.1 The following table provides soil parameters for foundation design purposes

Parameter	Value	Origin
Presumed bearing value for underpin L section (as proposed) assuming 1m wide base (temporary scenario)	200kN/m²	Based on undrained shear strength measurements and section of underpinning
Earth pressure at rest	1	Typical (published value)
Bulk density and saturated density	19kN/m²	Derived from BS8002;1994
Moisture content (average)	27%	Measured
Dry density	14.4 kN/m²	Derived from above
Critical state angle of shearing resistance	20°	Derived from BS8002;1994

4.4 Monitoring of ground conditions during construction

The shear strength of the London clays will be monitored to check consistency against ground investigation data, and if any changes are observed then the foundation design reviewed to suit actual ground conditions.

5 External ground movements around basement

5.1 Construction proposals

Proposals are to provide a single storey deep basement is over the lower ground floor footprint of the existing building extending below the paved terrace garden area in rear gardens. The paved terraced garden will remain in the proposals. A light well will be added to the front of the property. The basement will extend to a depth of around 3.5m below ground floor levels (say 3.8m to allow for floor construction). A pool will be incorporated within the central part of the rear quadrant of the basement.

Underpinning will be required to perimeter and load bearing walls to the main house building allowing basement excavation. A contiguous piled retaining wall is proposed outside the main building footprint. A structural retaining wall will be constructed to allow excavation of the light wells to the front elevation.

5.2 Settlement around and inward yielding of basement excavations

The following analysis is based on observations of ground movements around basement excavations in clays as reported in Tomlinson '*Foundation design and construction*' (seventh Edition)

It is recognised that some inward yielding of supported sides of strutted excavations and accompanying settlement of the retained ground surface adjacent to the excavation will occur even if structurally very stiff props / strutting is employed. The amount of yielding for any given depth of excavation is a function of the characteristics of the supported soils and not the stiffness of the supports. Based on observations of other excavations in over consolidated clay soils (which is the case at this site) the average maximum yield / excavation depth (%) was 0.16, with a range of 0.06 to 0.3. Assuming a maximum excavation depth of 3.8m then the likely inward yield will be in the order of 3.8 x 0.16/100 x 1000 = 6mm.

Coincidental with the inward yield of embedded perimeter piles, some settlement of the retained soils around the excavation will occur. Again, based on published observations, the ratio of surface settlement to excavation depth in over consolidated clays is about 0.3% (range 0.1 to 0.6). Adopting the average of 0.3, and a maximum 3.8m deep excavation, then surface settlement in the order of 3.8 x 0.3/100 x 1000 = 11mm will occur. Importantly, whilst some surface settlement will occur around the excavation, this settlement profile will extend for a distance of about 4 times the depth of excavation ie about 15m in a reasonably linear fashion.

We have produced a plan showing estimated surface settlement contours as a result of the basement excavation which is presented on drawing BIA01 in appendix E.

The adjoining property at No170 will be most affected (in terms of the effects of surface settlement) by the basement excavations. No 170 extends to a width of about 11m. Considering surface settlement of 11mm which diminishes over a horizontal distance of 15m, we have estimated strains to front / rear elevation masonry panels will be about 0.05% resulting in damage likely to fall into Burland category 0 as described in the following table (extract from CIRIA report 580). Taking into account the combined effects of inward yield and settlement, category 1 damage may occur.

Whilst it is acknowledged that settlement and inward yielding movement observations are generally for embedded piled or diaphragm retaining walls, we are not aware of any published observational data for underpinning walls and insitu concrete retaining walls, but consider a propped embedded piled wall would afford more onerous movements. The value of making a finite element analysis to determine the amount of inward yielding of excavation supports in all routine cases of basement excavations is questionable requiring estimates of soil moduli and other factors such as poisons ratio.

Table 2.5 *Classification of visible damage to walls (after Burland et al, 1977, Boscardin and Cording, 1989; and Burland, 2001)*

Category of damage	**Description of typical damage** (ease of repair is underlined)	**Approximate crack width (mm)**	**Limiting tensile strain ε_{lim} (per cent)**
0 Negligible	Hairline cracks of less than about 0.1 mm are classed as negligible.	< 0.1	0.0–0.05
1 Very slight	Fine cracks that can easily be treated during normal decoration. Perhaps isolated slight fracture in building. Cracks in external brickwork visible on inspection.	< 1	0.05–0.075
2 Slight	Cracks easily filled. Redecoration probably required. Several slight fractures showing inside of building. Cracks are visible externally and some repointing may be required externally to ensure weathertightness. Doors and windows may stick slightly.	< 5	0.075–0.15
3 Moderate	The cracks require some opening up and can be patched by a mason. Recurrent cracks can be masked by suitable linings. Repointing of external brickwork and possibly a small amount of brickwork to be replaced. Doors and windows sticking. Service pipes may fracture. Weathertightness often impaired.	5–15 or a number of cracks > 3	0.15–0.3
4 Severe	Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows. Windows and frames distorted, floor sloping noticeably. Walls leaning or bulging noticeably, some loss of bearing in beams. Service pipes disrupted.	15–25 but also depends on number of cracks	> 0.3
5 Very severe	This requires a major repair involving partial or complete rebuilding. Beams lose bearings, walls lean badly and require shoring. Windows broken with distortion. Danger of instability.	usually > 25 but depends on number of cracks.	

Notes

1. In assessing the degree of damage, account must be taken of its location in the building or structure.
2. Crack width is only one aspect of damage and should not be used on its own as a direct measure of it.

6 Hardened areas

Proposals will not increase in hardened and drained areas thus will not affect current rainfall run off discharge to Thames Water sewers.

7 Tree removal

No major vegetation will be removed to accommodate the extension building.

8 Summary of scoping and screening

Based on the above we have followed procedures described in CPG4 which are summarised in the following table.

Topic	CPG4 stage	Methodology	Impacts (CPG stage 4)
Flooding	Screening	Review of desk study information	No detrimental impacts identified. No cause for concern. No requirement for scoping further investigations.
Groundwater	Screening	Review of desk study information	No detrimental impacts identified. Confirmation of ground conditions required to inform BIA
	Scoping stage 2	Borehole investigation required	
	Scoping stage 3	Ground investigation complete	Ground investigations confirm desk study information No detrimental impacts identified. No cause for concern
Land stability	Screening	Review of desk study information	No detrimental impacts identified. No cause for concern. No requirement for scoping further investigations.

9 Subterranean (Ground water) flow screening

9.1 General overview.

The property is positioned on locally high ground to the north-west of central London. The property is outside areas considered to be at risk of being affected by tidal and fluvial flooding associated with the Thames or its tributaries, or artificial water sources (canals/reservoirs). In addition the property is not considered to be at enhanced risk of flooding from sewers or water supply pipes.

Geological records indicate the site is underlain by deposits of London Clay Formation extending to depths of approximately 80m. The property (being underlain with a substantial thickness of London Clay Formation) is not considered to be at risk of flooding from groundwater and the proposals will not affect any groundwater flows.

9.2 Responses to flow chart questions

The following provides site specific responses to questions posed in figure 1 of CPG4

Question and response		Text reference
Question 1a	Is the site located directly above an aquifer?	
Response.	No. The property is directly underlain by over 80m thickness of London Clays which are classified Unproductive Strata (formerly Non Aquifer) by the Environment Agency.	3.2
Question 1b	Will the proposed basement extend beneath the water table surface?	
Response	No. The London Clay Formation comprises reasonably homogenous relatively impermeable clays which are not able to transmit groundwater under normal hydraulic gradients.	3.2
Question 2	Is the site within 100m of a watercourse, well or potential spring line?	
Response.	No. The site is remote (in excess of 100m) of any known watercourse. The geology of the area is not conducive to spring lines or wells for extraction of water. Based on this there are no matters of concern.	3.4.3

Question and response		Text reference
Question 3	Is the site within the catchment of the pond chains on Hampstead Heath?	
Response	No. Based on figure 14 within the Camden geological, hydrogeological and hydrological study report, the property is not within the catchment of the pond chains on Hampstead Heath. The property is located about 850m distance from the pond chains on Hampstead Heath	3.4.2
Question 4	Will the proposed basement development result in a change in the proportion of hard surfaced/paved areas?	
Response	No. Proposals will not increase the hardened areas of the site, and thus will not increase stormwater discharge from the site.	5
Question 5	As part of the site drainage, will more surface water (e.g. rainfall and run off) than present be discharged to the ground (e.g. via soakaways/SUDS)?	
Response	No. The site is underlain by London Clays which are not amenable to disposal of stormwater using infiltration systems. Rainwater falling onto the garden area will be disposed of using natural absorption and natural run off (which is currently the case).	5
Question 6	Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to or lower than the mean water level in any local pond (not just the pond chains on Hampstead Heath) or spring line?	
Response	No. The London Clay Formation comprises reasonably homogenous relatively impermeable clays which are not able to transmit groundwater under normal hydraulic gradient. Basement excavations will be formed in the London Clays. Based on this there are no matters of concern.	3.4.3

10 Stability impact identification

10.1 General overview.

The property is positioned on locally high ground to the north-west of central London. Ground levels in the area fall in a general southerly direction (down Haverstock Hill) at a slope of 1.5 degrees.

No trees will be removed as part of the development

Proposals are to provide a single storey deep basement is over the lower ground floor footprint of the existing building extending below the paved terrace garden area in rear gardens. The paved terraced garden will remain in the proposals. A light well will be added to the front of the property. The basement will extend to a depth of around 3.5m below ground floor levels (say 3.8m to allow for floor construction). A pool will be incorporated within the central part of the rear quadrant of the basement.

10.2 Responses to flow chart questions

The following provides site specific responses to questions posed in figure 2 of CPG4

Question and response		Text reference
Question 1	Does the existing site include slopes, natural or manmade greater than 7° (approximately 1 in 8).	
Response.	No. The topography of the area falls by about 1.5 degrees in a southerly direction. Based on this there are no matters of concern.	2.1
Question 2	Will the proposed profiling of landscaping at the site change slopes at the property boundary to more than 7°?	2.2
Response	No. The proposed basement will not change the current topographical conditions. Based on this there are no matters of concern.	

Question and response		Text reference
Question 3	Does the development neighbour land including railway cuttings and the like with slopes greater than 7^o (approximately 1 in 8)?	
Response.	No. The topography of the area falls by about 1.5 degrees in a southerly direction. There are no railway cuttings in the area or significant changes in ground level. The basement construction will have no effect on the stability of natural slopes in the area. Based on this there are no matters of concern.	2.2
Question 4	Is the site within a wider hillside setting in which the slope is greater than 7^O?	
Response	No. The topography of the area falls by about 1.5 degrees in a southerly direction with the slope (down Haverstock Hill) being reasonably uniform. Based on this there are no matters of concern.	2.1
Question 5	Is the London Clay the shallowest strata at the site?	
Response	Yes. The property is underlain with London Clays, extending to depths of around 80m in the area. Given the shallow (natural) slope angles in the area, the property is not considered to be at risk of slope instability. Based on this there are no matters of concern.	2.1
Question 6	Will any trees be felled as part of the development and/or are there any works proposed within any tree protection zones where trees are to be retained?	
Response	No trees will be removed as part of the development.	7

Question and response		Text reference
Question 7	Is there a history of any seasonal shrink swell subsidence in the local area and/or evidence of such effects on site?	
Response	No we are not aware of any history of shrink / swell subsidence in the area. Based on this there are no matters of concern.	
Question 8	Is the site within 100m of a watercourse, well or potential spring line.	
Response	No. The site is remote (in excess of 100m) of any known watercourse. The geology of the area is not conducive to spring lines or wells for extraction of water. Based on this there are no matters of concern.	3.4
Question 9	Is the site within an area of previously worked ground?	
Response	No. There is no evidence to indicate the site has been subject to quarrying activities in the area. Based on this there are no matters of concern.	3.1
Question 10	Is the site located above an aquifer? If so will the proposed basement extend beneath the water table such that dewatering may be required during construction?	
Response	No. The property is directly underlain by over 80m thickness of London Clays which are classified Unproductive Strata (formerly Non Aquifer) by the Environment Agency. The London Clay Formation comprises reasonably homogenous relatively impermeable clays which are not able to transmit groundwater under normal hydraulic gradient. New basement excavations will be formed in the London Clays. Based on this there are no matters of concern.	3.2
Question 11	Is the site within 50m of Hampstead Heath ponds?	
Response	No. The property is located about 850m to the south of the pond chain on Hampstead Heath. Based on this there are no matters of concern.	3.4.2

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Question and response		Text reference
Question 12	Is the site within 5m of a public highway or pedestrian right of way?	
Response.	No. The proposed basement will not be located within 5m of a public highway/footway. Based on this there are no matters of concern.	2.2
Question 13	Will the proposed basement significantly increase the differential depth of foundations relative to adjacent properties?	
Response	Yes. Traditional underpinning will be used to extend existing foundations down to proposed basement levels possibly extending existing foundation depths down by around 2m. Although there will be differences in ground / basement level floors between the new build and adjacent properties, the proposed basement construction solution will not affect neighbouring properties, and estimates of movements which may occur during the construction phase are described in section 5 which indicate acceptable levels of differential movement. Based on this there are no matters for concern.	5
Question 14	Is the site over (or within the exclusion zone of) any tunnels e.g. Railway lines.	
Response	No. The property is not located within 50m of an underground railway. Based on this there are no matters of concern.	

11 Surface flow and flooding impact identification

11.1 General overview.

There will be no increase in hardened and drained areas resulting from the development. The property is underlain with a substantial thickness of relatively impermeable London Clays, which is not amenable to disposal of stormwater using soakaways.

11.2 Responses to flow chart questions

The following provides site specific responses to questions posed in figure 3 of CPG4

Question and response		Text reference
Question 1	Is the site within the catchment of the pond chains on Hampstead Heath?	
Response.	No. The property is not located within the catchment of the pond chains.	3.4.2
Question 2	As part of the site drainage, will surface water flows (e.g. rainfall and run off) be materially changed from the existing route?	
Response	No. Proposals will have no impact on surface water flows.	6
Question 3	Will the proposed basement development result in a change in the proportion of hard surfaced/paved areas?	
Response.	No. There will be no increase in hardened and drained areas resulting from the development	6
Question 4	Will the proposed basement result in changes to the profile of the inflows (instantaneous and long term) of surface water being received by adjacent properties or downstream water courses?	
Response	No. Proposals will have no impact on surface water received by adjacent properties or downstream watercourses.	6

Question and response		Text reference
Question 5	Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream water courses?	
Response	No. Proposals will have no impact on surface water flows to adjacent properties or downstream water courses.	6

12 Summary and Conclusions

12.1 A new basement is proposed extending over the full footprint of the building, rear extension and sunken (paved) garden

12.2 Old mapping of the area records the property on first edition maps published in the late 1800s. There is no evidence of any watercourses or ponds close to the site.

12.3 Published BGS maps of the area record topography local to the property is formed in deposits of London Clays which probably extend to depths in the order of 80m in the area. The London clays are classified as unproductive strata (formerly Non Aquifer) by the Environment Agency. Boreholes formed at the site confirm the site is directly underlain with London Clays. The London Clay Formation comprises reasonably homogenous relatively impermeable clays which are not able to transmit groundwater under normal hydraulic gradient. Basement excavations will be formed in the London Clays and based on the above, not affected by groundwater. Similarly, installation of the proposed basement will not affect any subterranean ground water flows.

12.4 Ground levels do fall in a southerly direction by about 1.5 degrees, and slope instability is not considered to present a risk. Installation of the basement will not induce any slope instability.

12.5 There is no reported evidence of subsidence damage to adjacent properties.

12.6 No trees will be removed as part of the development.

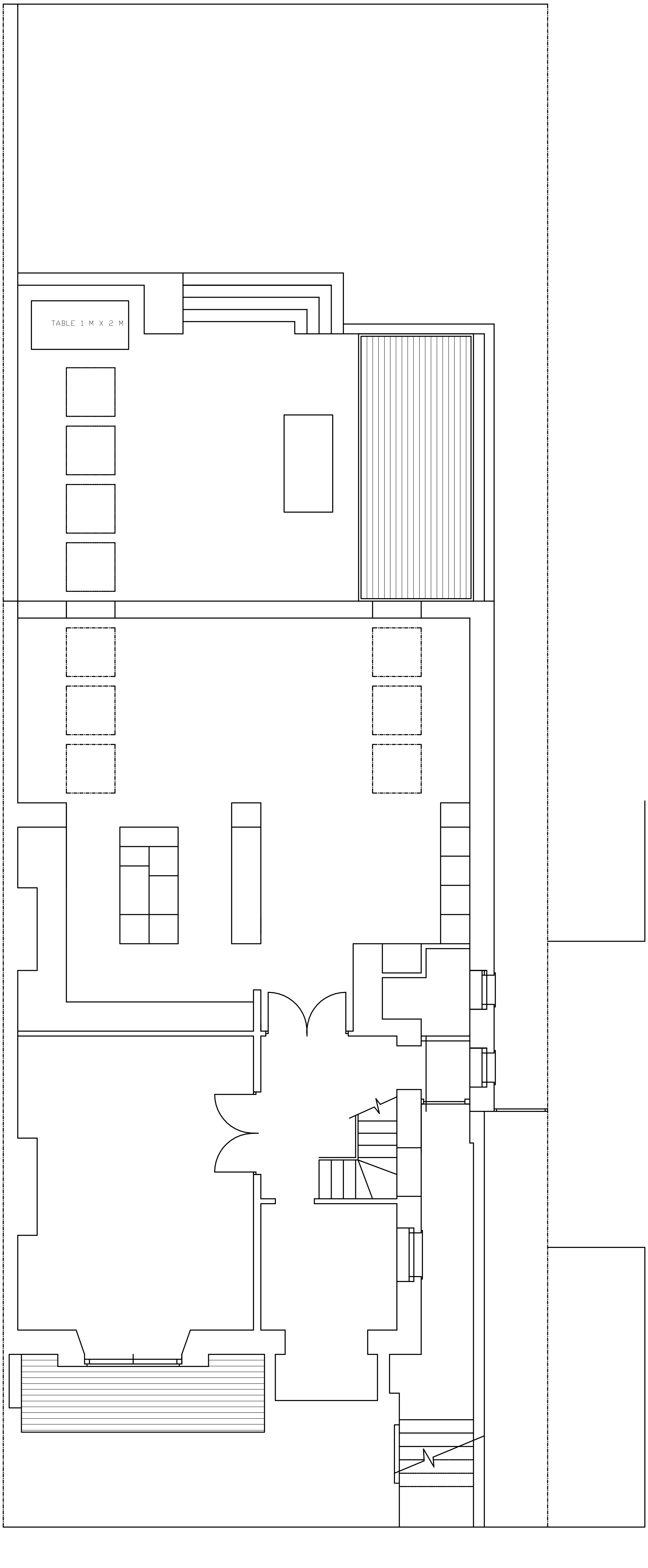
12.7 Installation of the basement will generate some ground movement close to the perimeter of the basement excavation. The amount of movement has been predicted based on records of observed movement in other basements during construction. Calculations have been produced to determine movement which would limit damage to adjacent properties to category 1, and monitoring is proposed to check and mitigate any adverse movements.

12.8 The property is considered to be at no enhanced risk of being subject to flooding.

12.9 There will be no increase in hardened and drained areas resulting from the basement construction.

12.10 The site is remote from underground tunnels.

12.11 In overall conclusion there are no outstanding issues of concern (singularly or cumulatively) from a stability, groundwater or surface water perspective.



Thierry Pain *Interior Design* *34 RUE DES PETITS CARREAUX* *75002 PARIS* *Email:* *thierrypaindesign@gmail.com*	*Mob :* *+ 33.6.08.25.77.26*	PROJET EXISTING LOWER GROUND FLOOR	HOUSE	NIVEAU LGF
				Phase APS
		LONDON	Plan	ECHELLE 1:50@A3
				Date 01.03.2014
		CLIENT MARC ASSOR 168 HAVERSTOCK HILL		DOSSIER 314/03-14

EXISTING FRONT ELEVATION

Thierry Pain
Interior Design

34 RUE DES PETITS CARREAUX
75002 PARIS

Email:
thierrypaindesign@gmail.com

Mob :
00.33.608.25.77.26

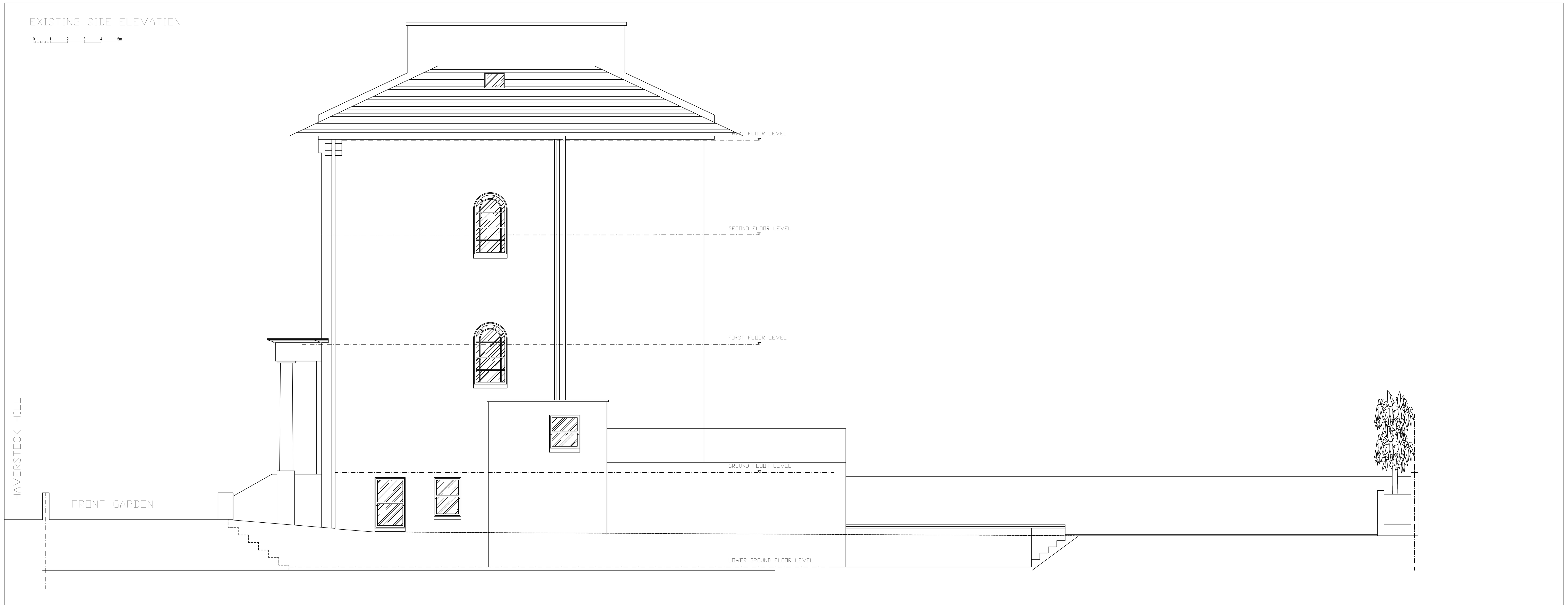
Project name	Building	Level	Phase
ASSOR LONDON	HOUSE		EXISTING

Drawing Description	Plan	Scale	Date
APS	FRONT ELEVATION	1:50@A3	15.03.2014

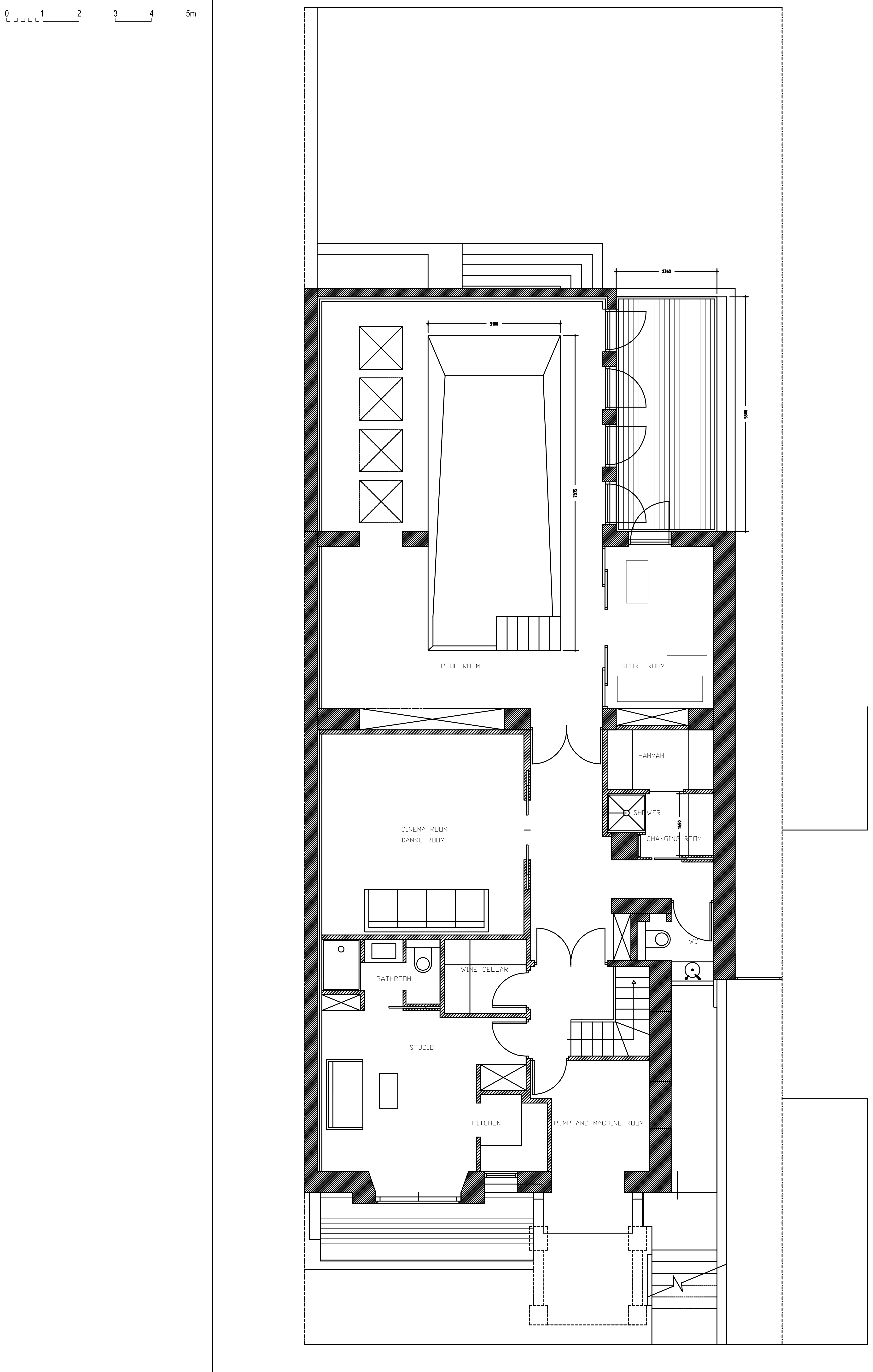
Note	Drawing
168 HAVERSTOCK HILL	312/03–14

EXISTING REAR ELEVATION

Thierry Pain *Interior Design*		Project name: ASSOR LONDON	Building: HOUSE	Level:	Phase: EXISTING
34 RUE DES PETITS CARREAUX 75002 PARIS	*Mob : 00.33.608.25.77.26*	Drawing Description: APS	Plan: REAR ELEVATION	Scale: 1:50@A3	Date: 15.03.2014
Email: thierrypaindesign@gmail.com		Note: 168 HAVERSTOCK HILL		Drawing: 312/03-14	



Thierry Pain *Interior Design* *34 RUE DES PETITS CARREAUX* *75002 PARIS* *Email:* *thierrypaindesign@gmail.com*	*Mob :* *00.33.608.25.77.26*	Project name: ASSOR LONDON	Building: HOUSE	Level	Phase: EXISTING
		Drawing Description: APS	Plan: SIDE SECTION	Scale: 1:50@A0	Date: 15.03.2014
		Note: 168 HAVERSTOCK HILL		Drawing: 312/03–14	



Thierry Pain
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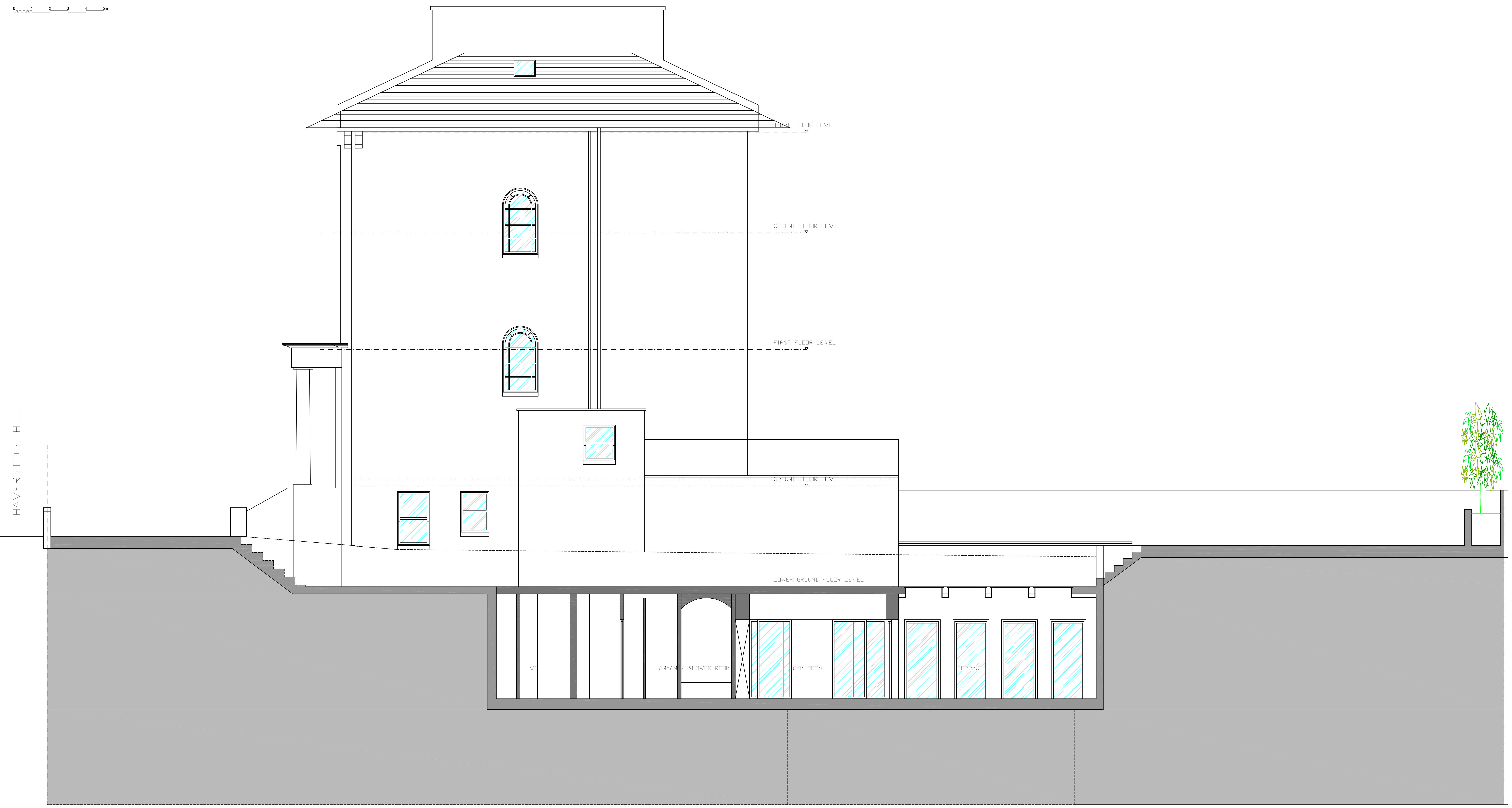
PROJET: PORPOSED NEW BASEMENT	HOUSE	NIVEAU: BASEMENT	Phase: APS
LONDON	Plan: VERSION 3	ECHELLE: 1:50@A3	Date: 01.03.2014
CLIENT: MARC ASSOR 168 HAVERSTOCK HILL		DOSSIER: 314/03-14	

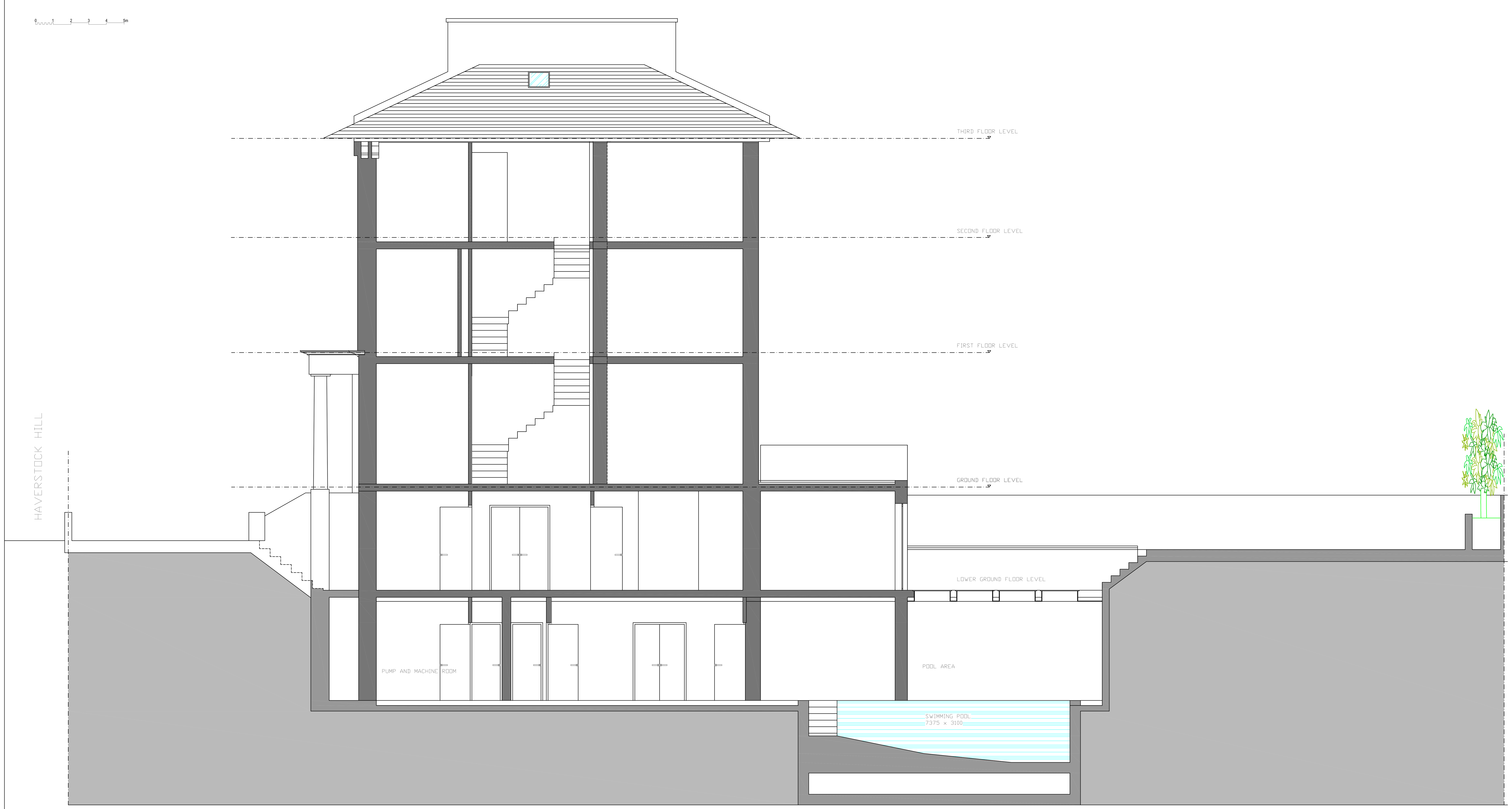


Thierry Pain *Interior Design* *34 RUE DES PETITS CARREAUX* *75002 PARIS* *Email:* *thierrypaindesign@gmail.com*	*Mob :* *00.33.608.25.77.26*	Project name ASSOR LONDON	Building HOUSE	Level - 1	Phase PROPOSED
		Drawing Description APS	Plan SIDE SECTION	Scale 1:50@A3	Date 15.03.2014
		Note 168 HAVERSTOCK HILL		Drawing 312/03-14	

Thierry Pain *Interior Design*		Project name ASSOR LONDON	Building HOUSE	Level - 1	Phase PROPOSED
34 RUE DES PETITS CARREAUX *75002 PARIS*	*Mob :* *00.33.608.25.77.26*	Drawing Description APS	Plan SIDE A SECTION 2	Scale 1:50@A1	Date 15.10.2014

Thierry Pain
Interior Design
34 RUE DES PETITS CARREAUX
75002 PARIS
Email:
thierrypaindesign@gmail.com
Mob :
00.33.608.25.77.26

Project name: ASSOR LONDON	Building: HOUSE	Level: - 1	Phase: PROPOSED
Drawing Description: APS	Plan: SIDE SECTION 4	Scale: 1:50@A1	Date: 15.10.2014
Note: 168 HAVERSTOCK HILL		Drawing: 312/03–14	



Thierry Pain *Interior Design* *34 RUE DES PETITS CARREAUX* *75002 PARIS* *Email:* *thierrypaindesign@gmail.com*	*Mob :* *00.33.608.25.77.26*	Project name: ASSOR LONDON	Building: HOUSE	Level: - 1	Phase: PROPOSED
		Drawing Description: APS	Plan: SIDE A SECTION	Scale: 1:50@A3	Date: 15.03.2014
		Note: 168 HAVERSTOCK HILL		Drawing: 312/03-14	

Thierry Pain
Interior Design

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Email:
thierrypaindesign@gmail.com

Mob :
00.33.608.25.77.26

Project name: ASSOR LONDON	Building: HOUSE	Level: - 1	Phase: PROPOSED
Drawing Description: APS	Plan: SIDE B SECTION	Scale: 1:50@A3	Date: 15.03.2014
Note: 168 HAVERSTOCK HILL		Drawing: 312/03-14	

Curriculam Vitae
Nigel Thornton
B.Sc, C.Eng, MICE, MCIHT, FGS.

soiltechnics
environmental and geotechnical consultants

Qualifications

- Awarded degree in Civil Engineering., City University, London in 1980
- Elected Member of the Institution of Civil Engineers in 1983 (Chartered Civil Engineer)
- Member of the Chartered Institution of Highways and Transportation since 1984
- Fellow of the Geological Society since 1986

Employment History

Northampton Borough Council	1975 - 1980
Northamptonshire County Council	1980 - 1989
The John Parkhouse Partnership	1989 - 1989
Associate Partner	1989 - 1993
Partner	1993 - 2005
JPP Consulting (Director)	2005 to date
Soiltechnics (Director)	1993 to date

Note

- In 2005, the John Parkhouse Partnership was incorporated into JPP Consulting Ltd (current complement 28 staff)
- Founding Director of Soiltechnics Ltd, a company specialising in geotechnical and geo-environmental matters. (Current complement 31 staff)

Relevant Experience

Bridgeworks

General design, contract administration and site supervision of various highway bridges and retaining structures.

Geotechnical and Geo-environmental

As Geotechnical Project Manager for Engineering Services Laboratory at NCC (ESL). (1985 - 1989)

Control of ground investigations for major highway schemes for local authority including implementation of fieldwork, direction of laboratory testing and production of factual and interpretative reports, following and satisfying geotechnical certification procedures for Department of Transport (schemes up to £15m)

Generally, at ESL, Soiltechnics and JPP.

Design and specification of earthworks, including determination of slope stability. Investigation and remediation of unstable slopes.

Control, implementation of fieldwork and production of geotechnical reports for industrial and commercial developments, housing schemes and water authority infrastructure (scheme values up to £80m).

Investigations for outline designs of landfill sites. Investigations for redevelopment of chemically contaminated sites, assessment of the same, design and verification of remediation works. Production of tender and contract documents for ground investigations.

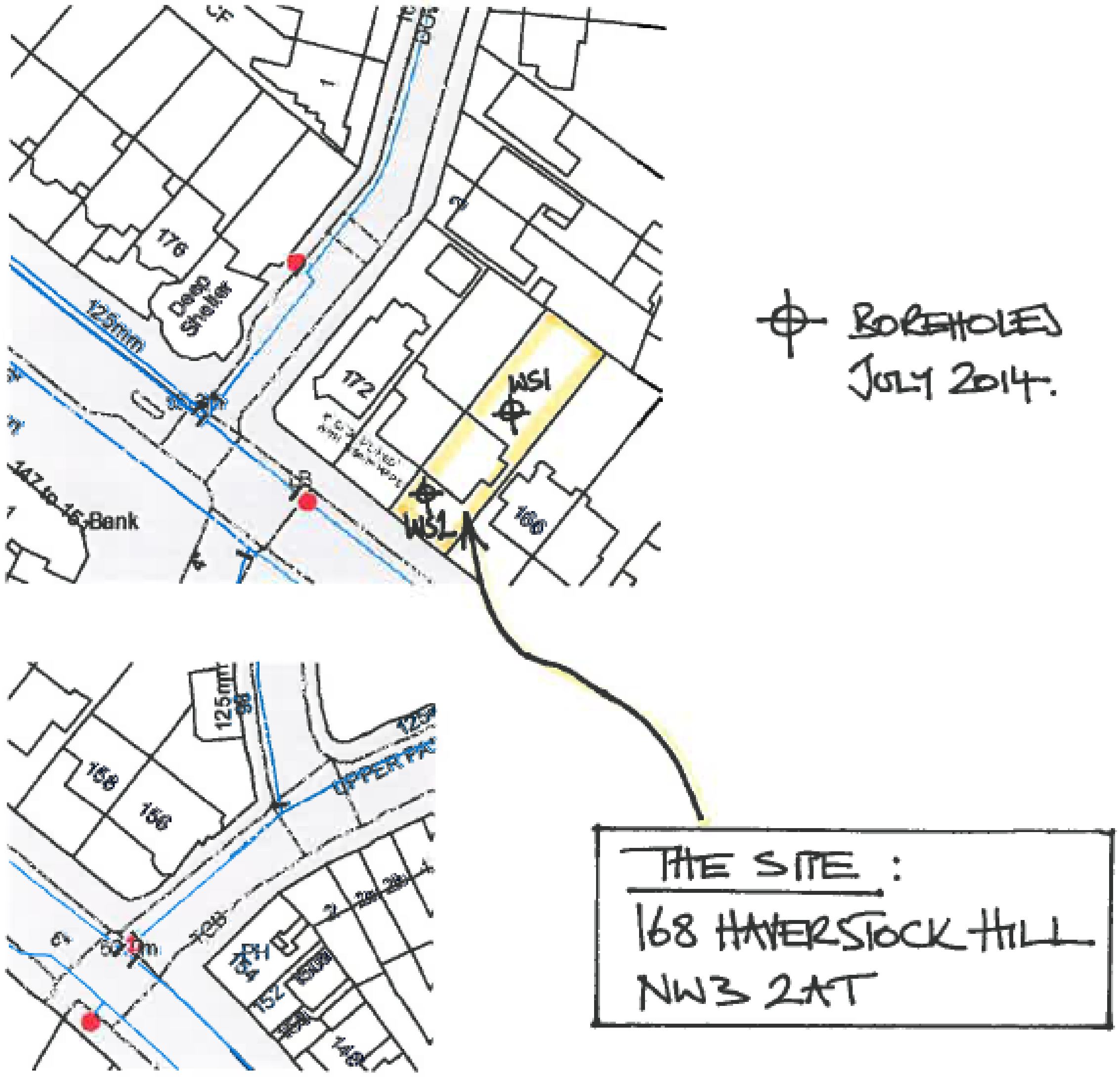
	Investigations into mine workings and assessment of their stability. Specifications for ground improvement works (vibrotreatment) and piling. Investigations and reporting on a wide range of basement constructions for commercial and residential buildings 1 to 4 stories deep. Producing basement impact reports. Lecturing to other professionals on the investigation assessment and remediation of contaminated land, and EPA part IIA Lectures to local ICE branch on geotechnical aspects.
Materials Management	Production of construction material specifications, primarily in concrete, aggregates and bituminous mixtures, but including masonry, timer, steel and protective systems. Control and implementation of investigations into failures of construction materials including scheduling and analysing test data, and production of technical reports providing specifications for appropriate remedial measures.
Building Structures	Structural inspections and surveys on a wide range of commercial, domestic, industrial and military buildings including direction of appropriate investigations and production of details repairs/construction specifications. Design and checking of building structures in timber, steel, concrete and masonry including supervision of works on site. Design works carried out both manually and using computerised systems following current British Standards and other recognised design standards.
Road Pavement Structures	Direction and implementation of condition surveys and investigations of road pavement using falling weight deflectometer, deflectograph bump integrator and coring. Direction of testing regimes for bituminous and cement bound and unbound pavement materials. Production of reports on condition and assessment of load carrying capacity of existing roadways and specification and structural design for new roadways for both highway and industrial use. Design of various road pavement structures (flexible and rigid) using Highways Agency guidelines and British Ports Federation guidelines.
Drainage and Flood Risk Assessments	Design of main (adoptable) and private foul and stormwater infrastructure for housing, commercial and industrial schemes, including detention basins, infiltration systems, pumping stations etc. Production of flood risk assessment reports.
Quality Assurance	Assisting in production of main laboratory procedures to obtain NAMAS accreditation for large spectrum of soils and materials testing. Geotechnical contributions to Quality Assurance Manual for Soiltechnics/JPP and implementation of procedures.
CPD and Health and Safety	Attendance of in house CPD Seminars and production of Health and Safety Plans/files for building works. Author of in house risk assessment and Practice policies.
Litigation	Acting as expert witness on numerous construction related matters.
Publications	Co-author of a book entitles 'Cracking and Building Movement' published by the Royal Institution of Chartered Surveyors, in late 2004.

Statement of experience on basements

Soiltechnics have carried out a large number of investigations for basement constructions throughout the UK and in more recent years outside the UK

The following table provides a limited number examples (for illustration purposes) of investigations carried out for basements which include interpretative reports providing parameters for detailed design such as settlement / heave, ground movements around basements, hydrological effects and in some cases preliminary design of piles.

Location	ground conditions	Basement	Approx size (m)	Date
Northamptonshire	Glacial Till	Single storey archive store for Rolls Royce. Part open excavation for construction of reinforced concrete box subsequently backfilled	10 x 8	Circa 1992
Central London (Kings Road)	Terrace sands and gravels over London Clays	Two storey deep car park with gardens at ground level. Contiguous pile wall with subsequent insitu concrete box	40 x 20	Circa 2000
Central London (Finsbury square)	Terrace sands and gravels over London Clays	Two storey deep basement below multi storey building with adjacent buildings. Contiguous pile wall with subsequent insitu concrete box	30 x 20	Circa 2002
Central London (Union Street)	Terrace sands and gravels over London Clays	Two storey deep basement below multi storey building with adjacent buildings including tube tunnels. Contiguous pile wall with subsequent insitu concrete box	40 x 30	2009
Central London (Blackfriars)	Terrace sands and gravels over London Clays	Two storey deep basement below multi storey building with adjacent buildings including railway viaduct . Contiguous pile wall with subsequent insitu concrete box	40 x 20	2005
Central London (Imperial College)	Terrace sands and gravels over London Clays	Single storey deep basement below multi storey residential block. Sheet pile walls with subsequent insitu concrete box	60 x15	2005
Coventry University	Mercia Mudstones	Single storey deep basement with three storey building over. Part cut and part sheet piled with subsequent insitu concrete box	50 x50	2010
Rabat Grand theatre Bouregrerg Morrocco	Alluvial gravels over sandstone	Single storey deep basement. Open excavations and sheet piles walls with subsequent insitu concrete box. Piled foundation for super structure. Area subject to earthquakes and liquefaction. Outline design of piles, specification for piling and testing.	50 x50	2012
Central London (various locations)	London Clays occasionally overlain with terrace sands and gravels	Various existing terraced semi and detached domestic properties. New single and two storey deep basements under building foot prints and extending into gardens. Construction using traditional underpinning techniques and contiguous / secant piled walls	Various	2000 to date
Central London (Holland Park)	London Clays	Two locally three storey deep basement below new four storey block of flats. Secant piled walls and insitu concrete box	70 x 20	2014



176
Deep Shelter
125mm
172
WS1
WS2
166
158
156
125mm
UPPER PA
PH
148
BOREHOLES
JULY 2014.
THE SITE :
168 HAVERSTOCK HILL
NW3 2AT

WINDOW SAMPLER / HAND AUGER BOREHOLE LOGS

Borehole WS1	(Window Sampler Borehole in Rear Garden)
Ground Level – 0.35m	Turf on hard friable greyish brown mix of topsoil with fragments of brick, stone, concrete, cinder etc
0.35m – 0.80m	Grading to: Firm mid brown silty CLAY with occasional gravel of brick
0.80m – 1.22m	Soft greyish orange brown fine sandy SILT/CLAY, becomes more damp with depth.
1.22m – 1.90m	Compact damp clayey GRAVEL. Gravel is subrounded medium to coarse of flint. Becoming more dense with depth.
1.90m – 6.00m	Stiff to very stiff brown fissured CLAY (London Clay) Trace rootlets noted to 2.90mbgl. 2.0m to 3.0m 60% sample recovery 3.0m to 4.0m 60% sample recovery 4.0m to 5.0m 100% sample recovery 5.0m to 6.0m 65% sample recovery Note pockets of gypsum mineralisation at 4.15m and 4.55mbgl From 4.25m becoming very stiff From 4.70m becoming bluish grey From 5.0m becoming brownish dark grey and more plastic From 5.0m becoming stiff to very stiff
6.00m	*End of Borehole*

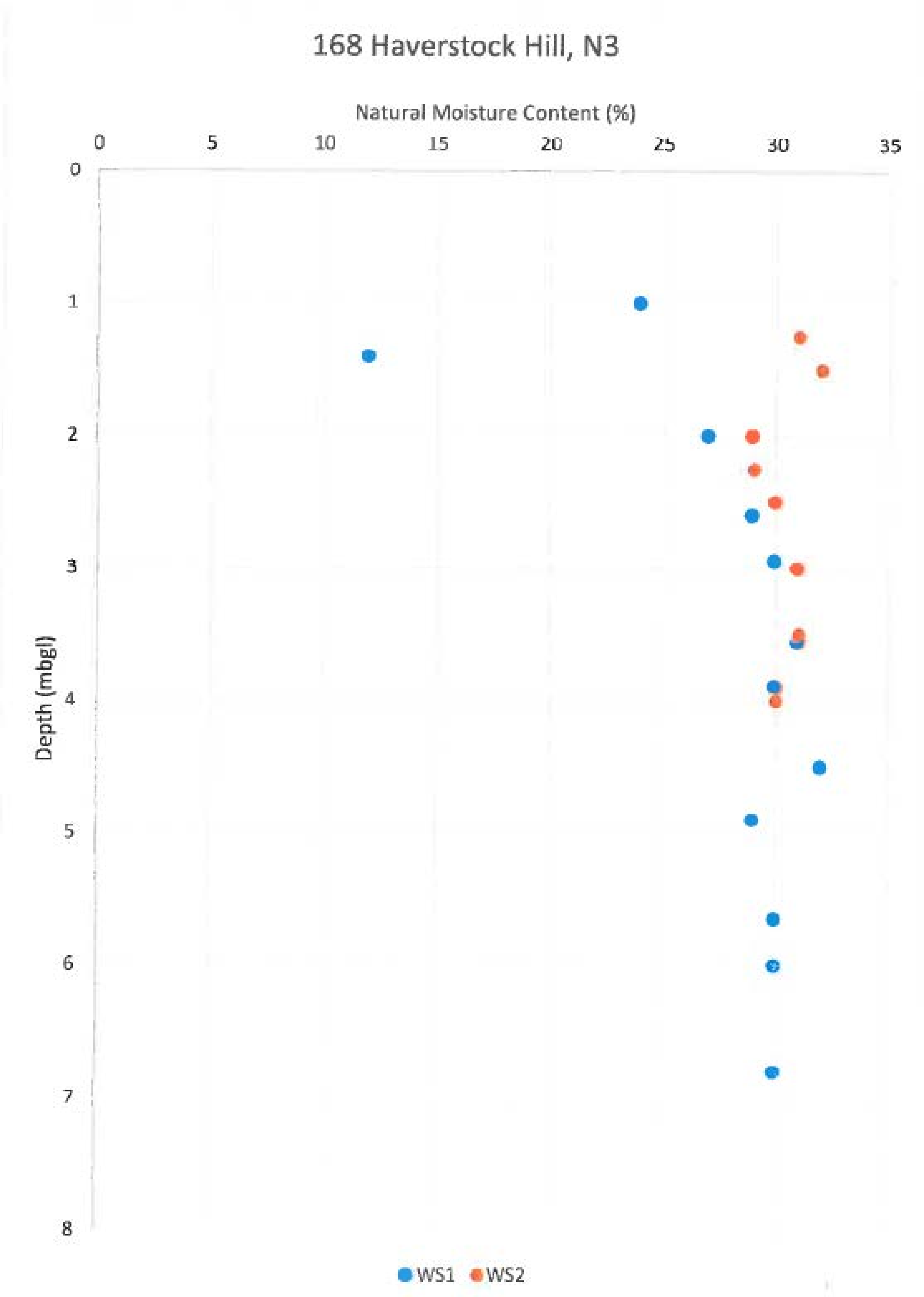
Additional Comments

- Groundwater was noted during driving of the window sampler equipment with steady slow inflow recorded at the bottom of the hole each time the tubes were withdrawn from the hole.
- Upon completion, 2No standpipe piezometers were installed with one response zone from 4.0m to 5.0m and another from 1.0m to 2.0m. A 1m bentonite seal was placed from 2.20m to 3.20m.
- One groundwater monitoring visit has been undertaken, 8 days after installation of the well.
- Continuous resistance to driving was encountered as the sample tubes were driven. No obvious softer zones were detected.
- Poor sample recovery occurred in the London Clay and this is considered to be due to the groundwater percolating down the hole as the sampling tubes were driven.
- Refer to attached sheets for pocket penetrometer results and natural moisture content results.

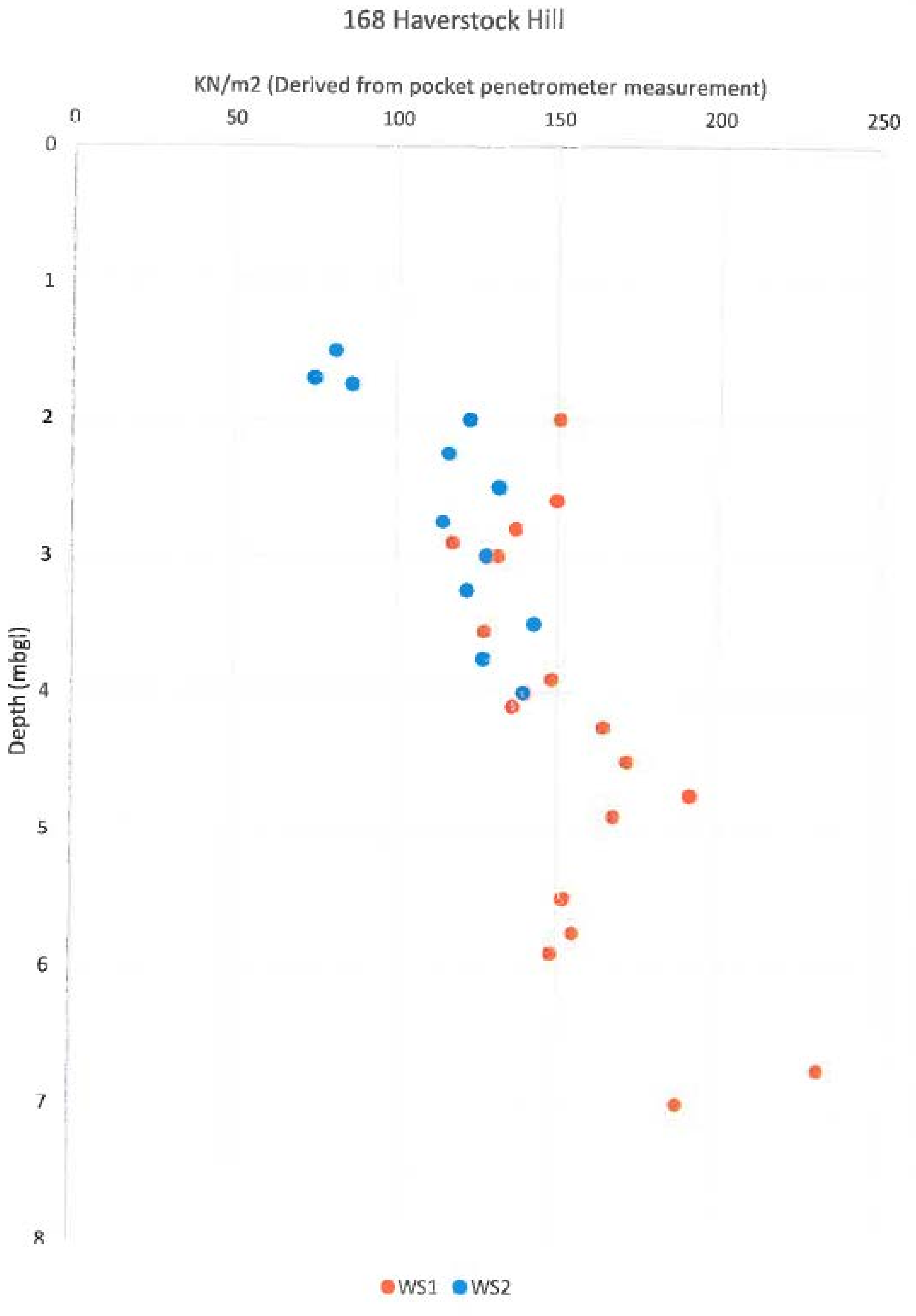
Borehole WS2	(Hand Auger Borehole at front of house)
Ground Level – 0.10m	Yorkstone Paving on concrete bedding
0.10m – 0.95m	MADE GROUND: Firm clayey fill with fragments of gravel. Grades into a layer of brick at base
0.95m – 4.00m	Firm orange brown CLAY. Traces of old rootlets noted down to 1.75mbgl. From 2.0m becoming dry stiff brown fissured and gleyed grey silty CLAY with orange fine sandy lenses. From 3.0m becoming mid brown From 3.5m becomes bluish grey Note pockets of gypsum mineralisation at 3.75m
4.00m	*End of Borehole*

Additional Comments

- No groundwater was noted during excavation of the inspection pit / borehole or for 1 hour after completion of the borehole. Sample tubes were recovered dry.
- Upon completion a standpipe was installed to 3.92mbgl with response zone from 2.92m to 3.92mbgl.
- One groundwater monitoring visit has been undertaken, 8 days after installation of the well.
- Continuous resistance to augering was encountered. No obvious softer zones were detected.
- Full sample recovery occurred as the auger was advanced.
- Refer to attached sheets for pocket penetrometer results and natural moisture content results.



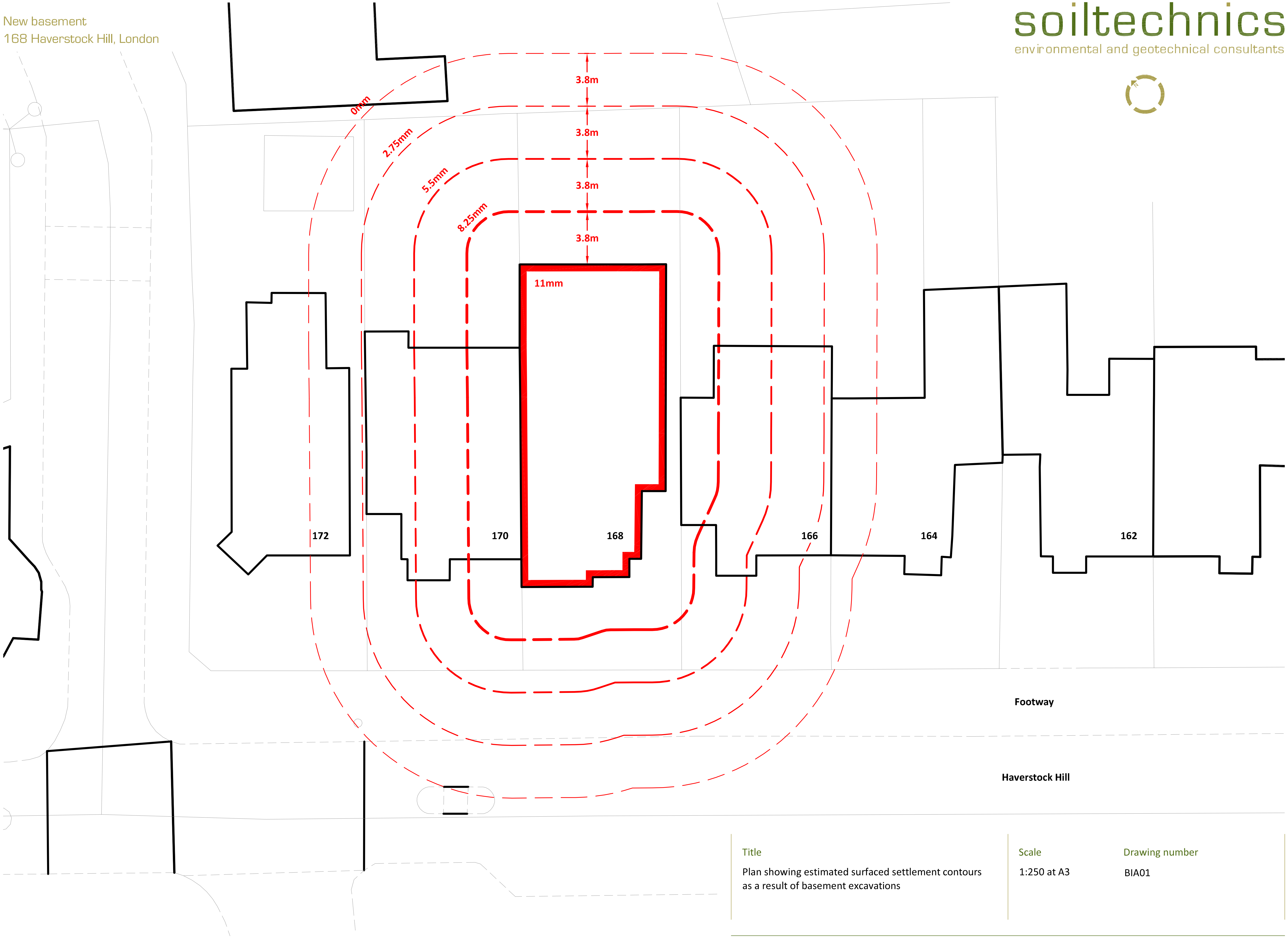
168 Haverstock Hill, N3
Natural Moisture Content (%)
0
5
10
15
20
25
30
35
0
1
2
3
4
5
6
7
8
Depth (mbgl)
WS1
WS2



168 Haverstock Hill
KN/m2 (Derived from pocket penetrometer measurement)
0
50
100
150
200
250
0
1
2
3
4
5
6
7
8
Depth (mbgl)
WS1
WS2

New basement
168 Haverstock Hill, London

soiltechnics
environmental and geotechnical consultants



Title
Plan showing estimated surfaced settlement contours as a result of basement excavations

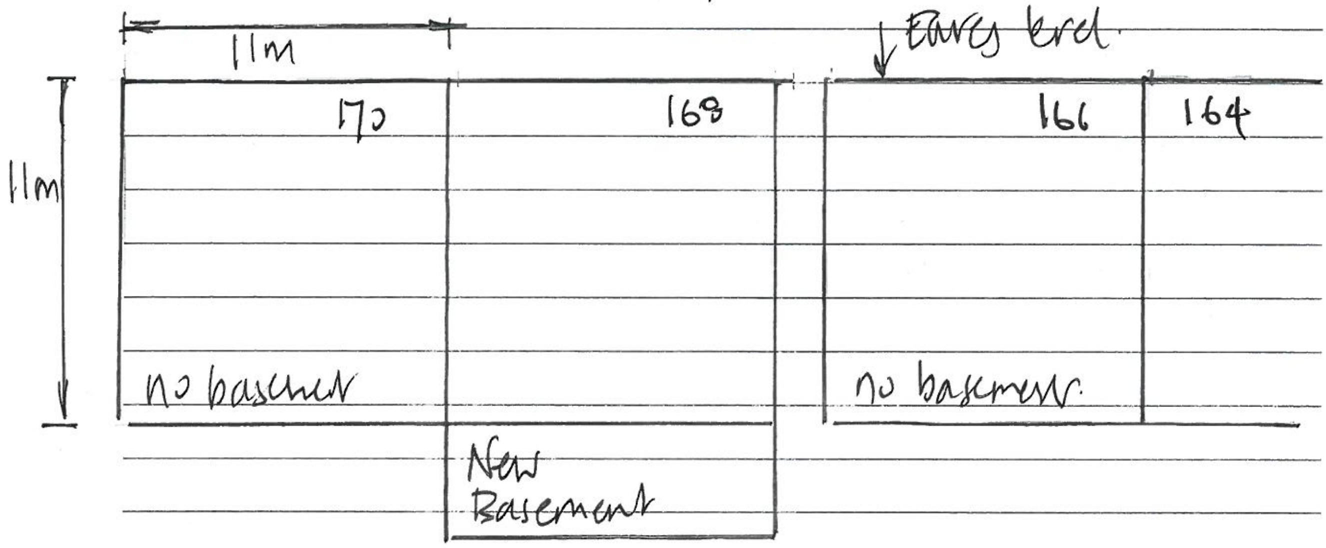
Scale
1:250 at A3

Drawing number
BIA01

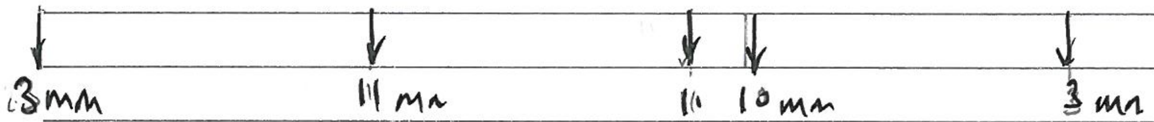
Report Ref: STM3333T-BIA
Revision: 0

November 2015

Consider front elevations of 170 to 164 (masonry panels)



surface settlements from Drawing BIA 01



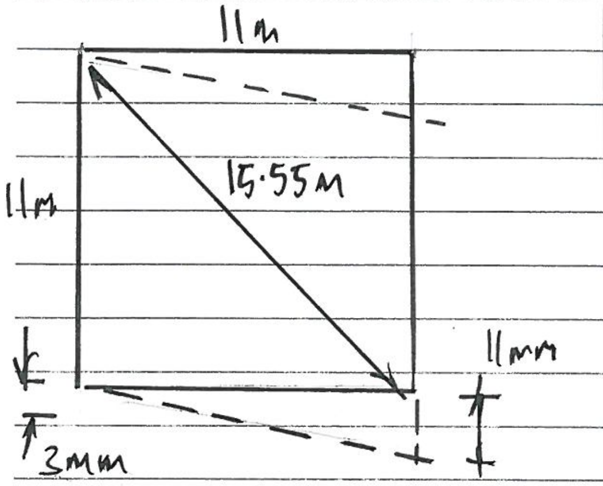
Front and rear elevations to 170 and 166 (neighbouring properties) considered most vulnerable to movement damage due to excavation of basement to N° 168

Refer drawing BIA 01 for predicted settlement contours.

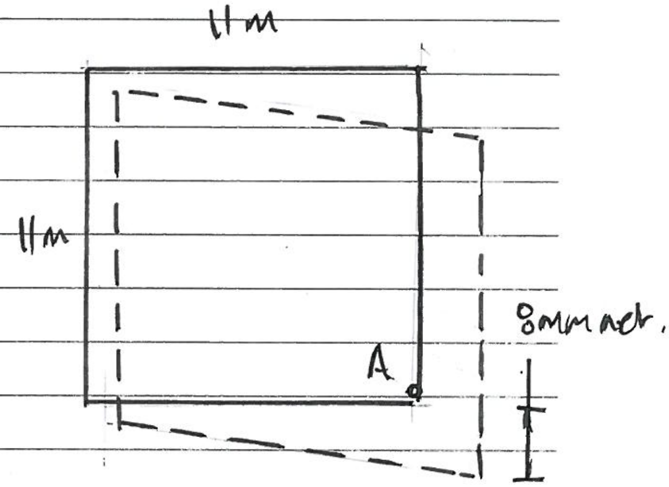
Originator	NLT	Checked	Title Estimate of strains in masonry and associated damage
Sheet number	192		Date November 2915

168 Havestock Hill, London

Consider front elevation of № 170 (considered most critical)



11-3 = 8mm net.



left report text . 6mm

Deformation for vertical component only of tensile strain on diagonal

$\frac{8}{15550} \times 100 = 0.05\%$

Burland category 0

Tensile strain on horizontal

11 000

8

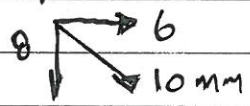
11 000.00291

$\frac{0.00291}{11\,000} \times 100 = 0.0000264\%$

Burland category 0

Deformation for horizontal and vertical components.

At A



Tensile strain on diagonal

$\frac{10}{15550} \times 100 = 0.064\%$

Burland category 1

Tensile strain on horizontal

$\frac{6 + 0.00291}{11000} \times 100 = 0.055$

Burland category 1.

Originator	NLT	Checked	Title Estimate of strains in masonry and associated damage
Sheet number	2 of 2		Date November 2915