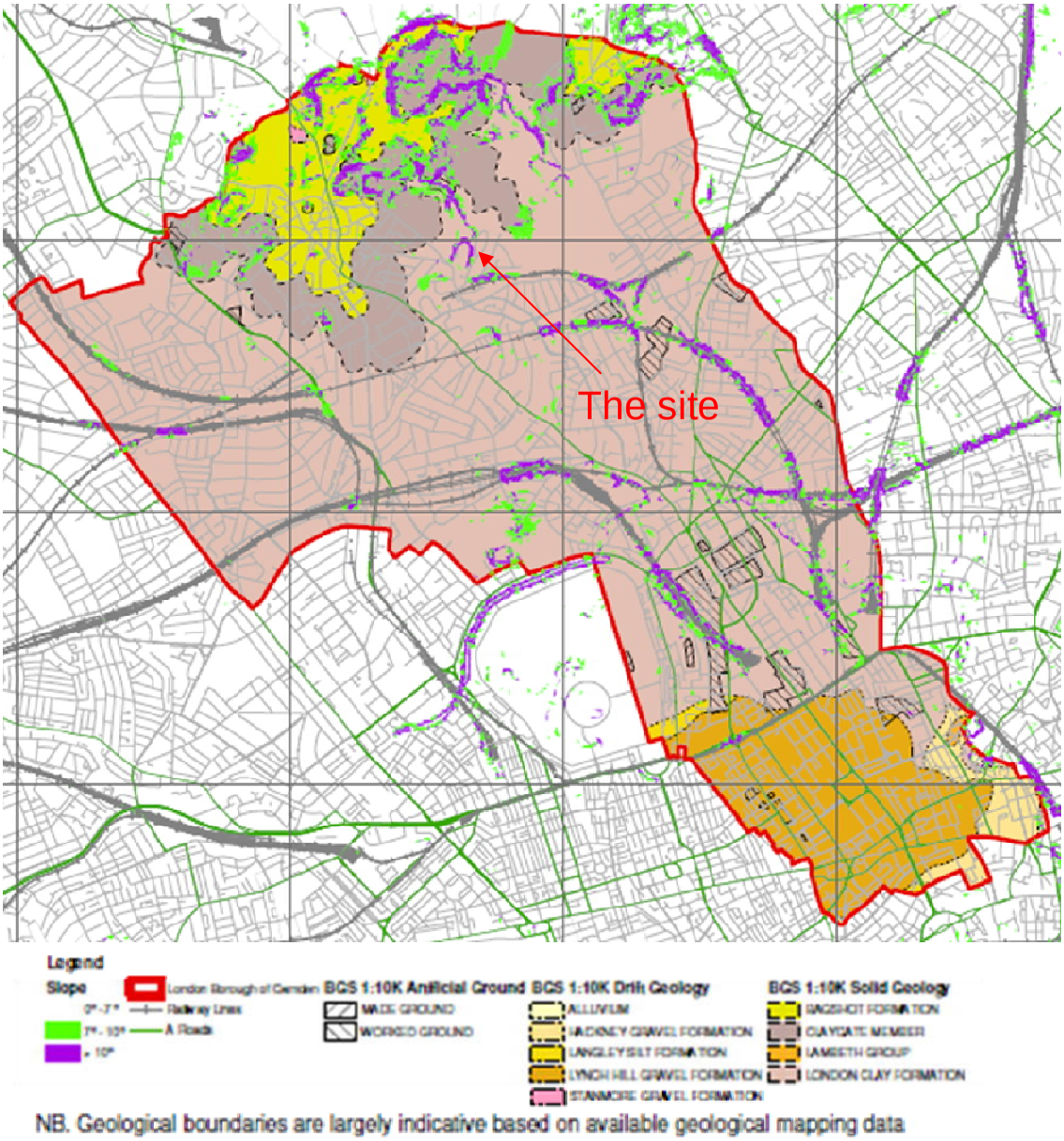
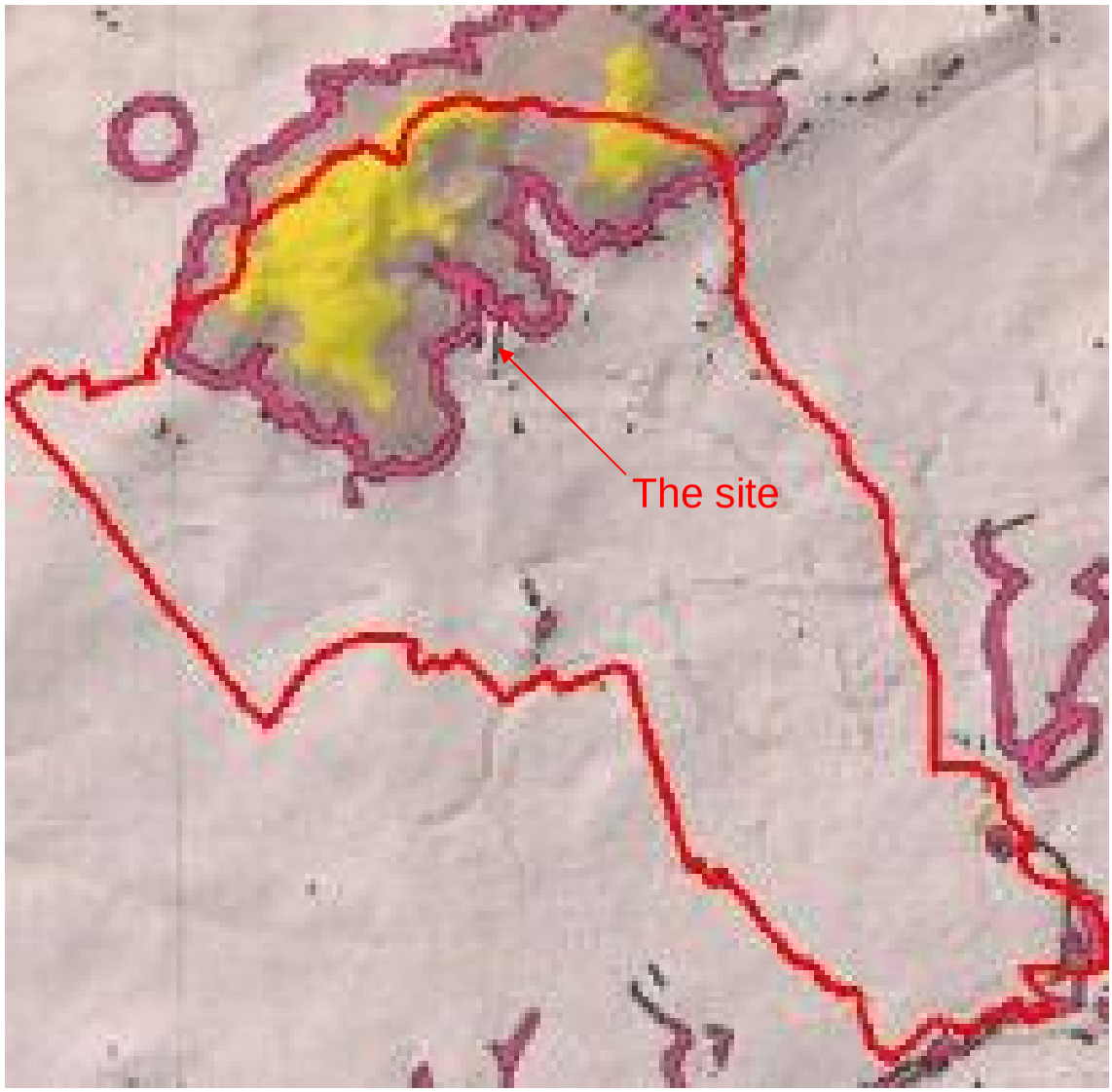


Geotechnical Consulting Group	**Slope Angle Map (Slope Angles calculated from Digital terrain Model Provided by Camden Borough)**	Figure 16
66 South Hill Park		



Geotechnical Consulting Group	**Areas of landslide potential (Source-British Geological Society, 1:50,000, Series England and Wales Sheet 256-North London)**	Figure 17
66 South Hill Park		

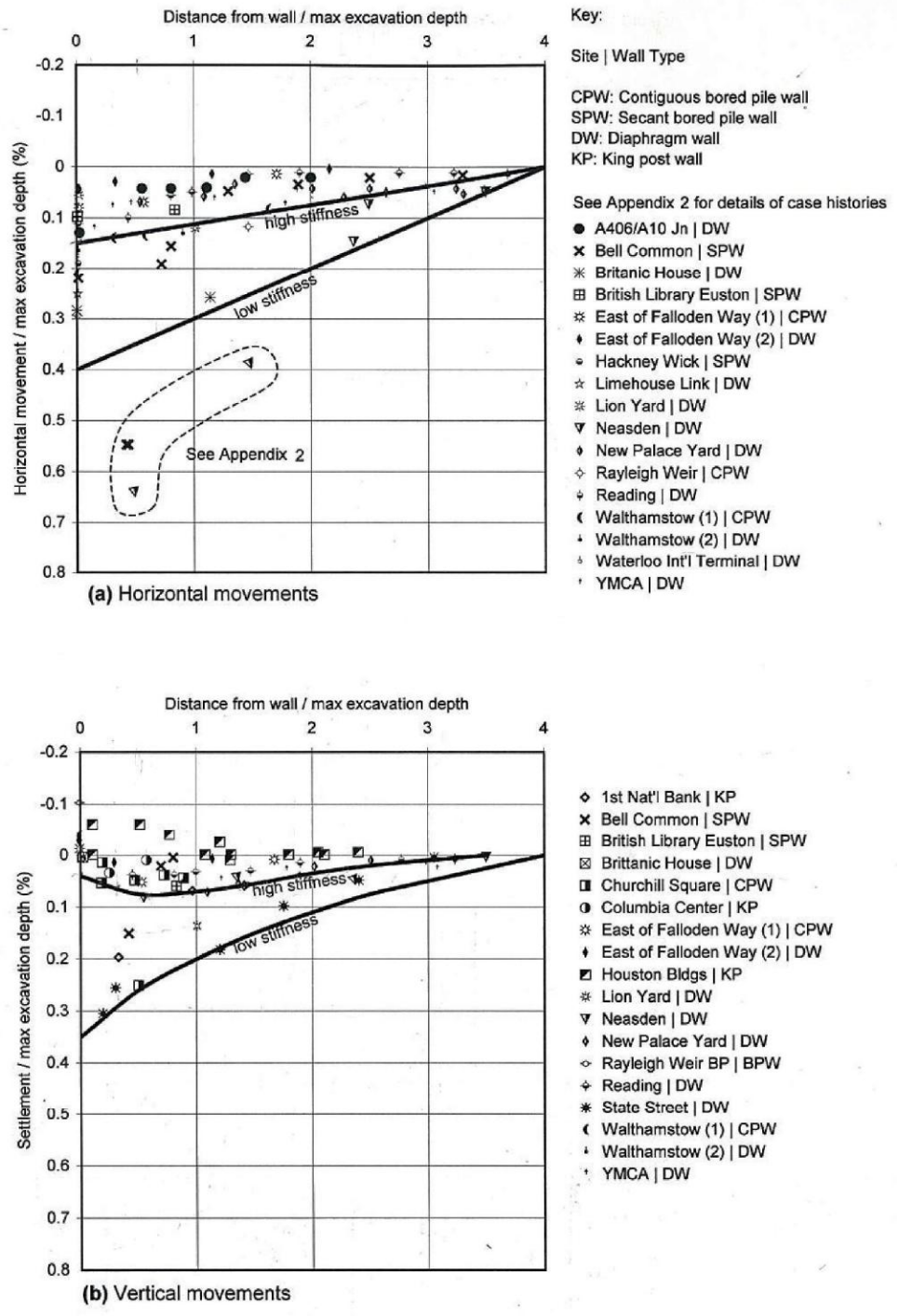
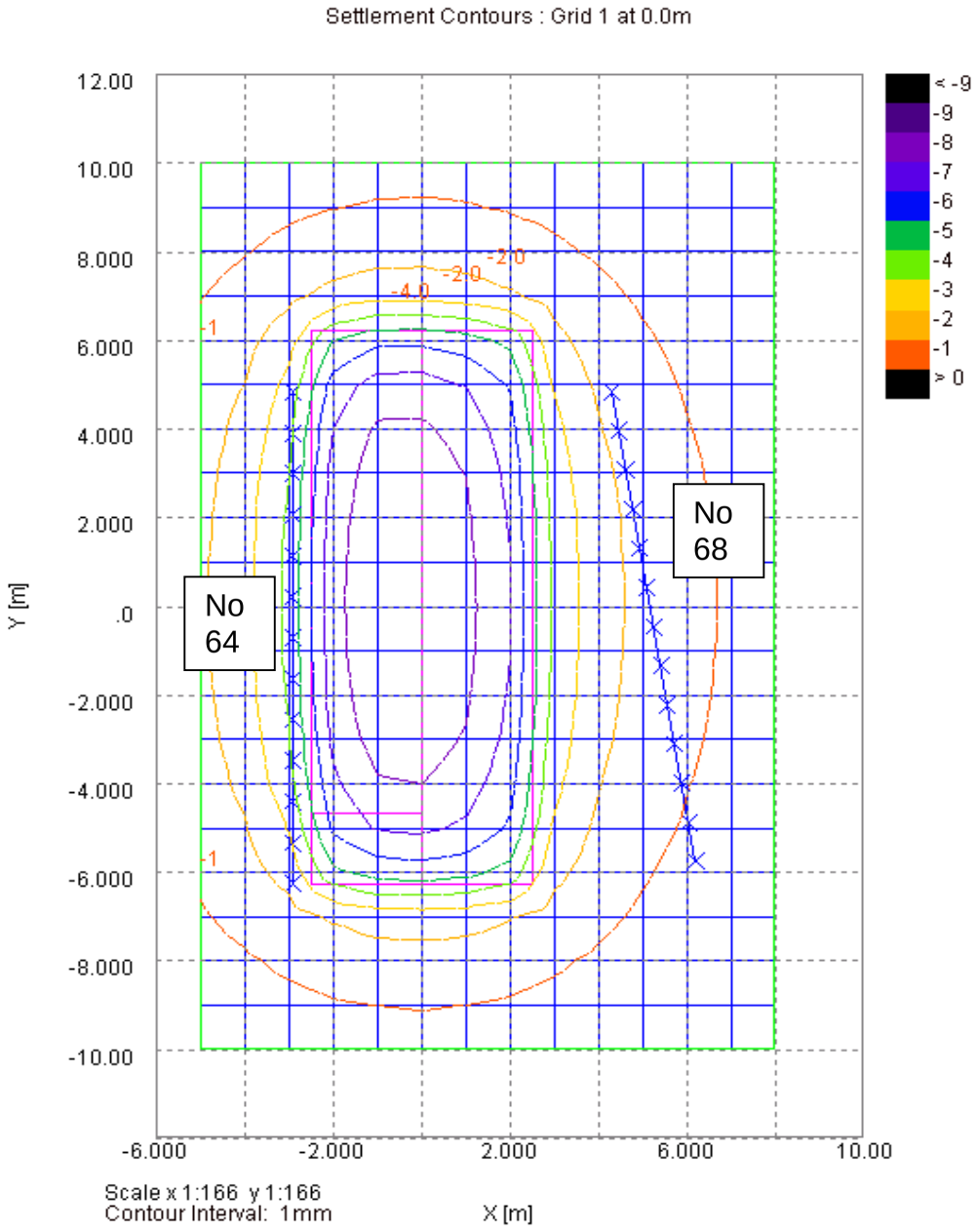
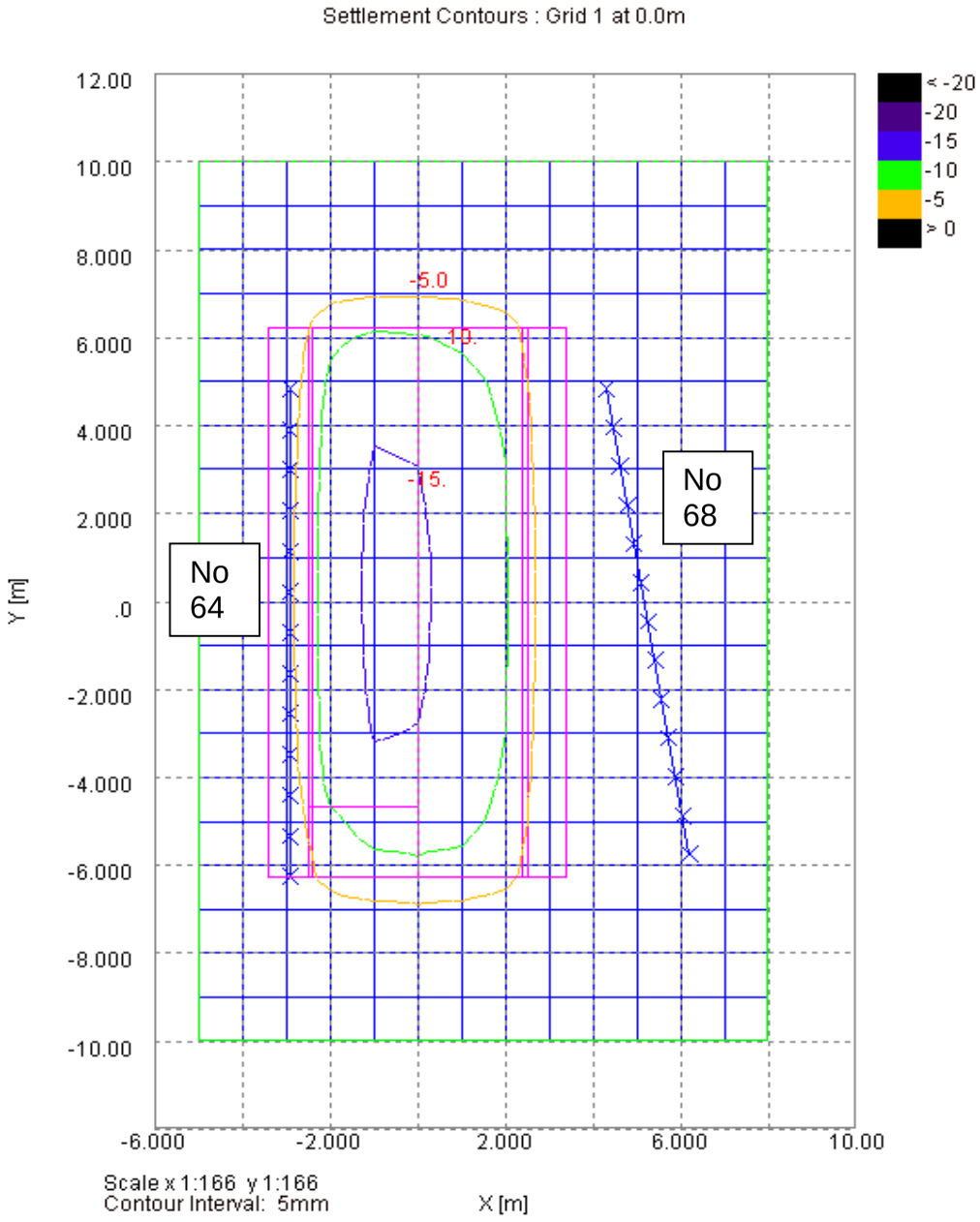


Figure 2.11 *Ground surface movements due to excavation in front of wall in stiff clay*

Geotechnical Consulting Group	**Ground surface movements due to excavation in front of wall in stiff clay (Figure 2.11 of CIRIA C580)**	Figure 18
66 South Hill Park		



Geotechnical Consulting Group	**Results of PDISP analysis: short term movements**	Figure 19
66 South Hill Park		



Geotechnical Consulting Group	**Results of PDISP analysis: long term movements**	Figure 20
66 South Hill Park		

Category of damage	Limiting tensile strain [%]	Normal degree of severity	Description of typical damage (Ease of repair is printed *italic*) Note: Crack width is only one factor in assessing category of damage and should not be used on its own as a direct measurement of it
0	0-0.05	Negligible	Hairline cracks less than about 0.1 mm
1	0.05-0.075	Very slight	*Fine cracks which are easily treated during normal decoration.* Damage generally restricted to internal wall finishes. Close inspection may reveal some cracks in external brickworks or masonry. Typical crack widths up to 1 mm.
2	0.075-0.15	Slight	*Cracks easily filled. Re-decoration probably required. Recurrent cracks can be masked by suitable linings.* Cracks may be visible externally and *some repointing may be required to ensure weathertightness.* Doors and windows may stick slightly. Typical crack width up to 5 mm.
3	0.15-0.3	Moderate[1]	*The cracks require some opening up and can be patched by mason. 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. Typical crack widths are 5 to 15 mm or several up to 3 mm.
4	>0.3	Severe	*Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows.* Windows and door frames distorted, floor sloping noticeably[2]. Walls leaning[2] or bulging noticeably, some loss of bearing in beams. Service pipes disrupted. Typical crack widths are 15 to 25 mm but also depends on the number of cracks.
5		Very severe	*This requires a major repair job involving partial or complete rebuilding.* Beams lose bearing, walls lean badly and require shoring. Windows broken with distortion. Danger of instability. Typical crack widths are greater than 25 mm but depends on the number of cracks.

[1] Note: Boscardin & Cording (1989) describe the damage corresponding to the tensile strain in the range 0.015 - 0.3%. as 'moderate to severe'. However, none of the cases quoted by them exhibit severe damage for this range of strains. There is therefore no evidence to suggest that tensile strains up to 0.3% will result in severe damage.

[2] Note: Local deviation of slope, from the horizontal or vertical, of more than 1/100 will normally be clearly visible. Overall deviations in excess of 1/150 are undesirable.

References:

Boscardin, M. D. & Cording, E. J. 1989. Building response to excavation induced settlement. *Journal of Geotechnical Engineering,* ASCE, Vol. 115, No. 1, 1-21.

Burland, J. B. 1995. Assessment of risk of damage to buildings due to tunnelling and excavation. Invited Special Lecture: In: *1st Int. Conf. on Earthquake Geotech. Engineering,* IS Tokyo '95.

Geotechnical Consulting Group	**Results of PDISP analysis: long term movements**	Figure 21
66 South Hill Park		

Appendix A

SURFACE FLOW AND FLOOODING SCREENING FLOWCHART

Question 1: Is the site within the catchment of the pond chains on Hampstead Heath?
Yes, the site is lies immediately to the east of the Hampstead Ponds, within the catchment of the pond chains.

Question 2: As the 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 existing surface water flow will not be altered. The existing land drainage system could be implemented.

Question 3: Will the proposed basement development result in a change in the proportion of hard surfaced/paved external areas?
No.

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 watercourses?
No. The proposed basement will extend entirely in the London Clay or other clays of low permeability, within which the horizontal water flow is very limited.

Question 5: Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?
No.

Question 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 a risk from flooding, for example because the proposed basement is below the static water level of a nearby surface water feature?
The Environmental Agency flood plan shows that the property is not in an area at risk of flooding. However, South Hill Park has been identified as a 'secondary area' at risk of flood by the London Borough of Camden because it has been affected by a major flood that occurred in 2002.

Appendix B

SUBTERRANEAN GROUND WATER FLOW SCREENING CHART

Question 1a: Is the site located directly above an aquifer?
No. The site is located above an unproductive area.

Question 1b: Will the proposed basement extend beneath the water table surface?
Yes. The water table in the area is expected to be at or just below the top of the London Clay and the pore water pressure distribution with depth would be expected to be hydrostatic from this level. However, this is not associated with horizontal water flow, which in the London Clay is very limited.

Question 2: Is the site within 100m of a watercourse, well (used/disused) or potential spring line?
Yes. The site overlooks the Hampstead Heath ponds to the west, which are along the line of the eastern branch of the lost Fleet River.

Question 3: Is the site within the catchment of the pond chains on Hampstead Heath?
Yes. The site overlooks the Hampstead Heath ponds to the west.

Question 4: Will the proposed basement development result in a change in the proportion of hard surfaced/paved areas?
No. The proposed basement will be constructed below the footprint of the existing building and although the lower ground floor would extend towards the front of the property a garden will be landscaped above the roof of the lower ground floor.

Question 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. However, it is recommended that the existing land drainage is implemented to minimize the risk that an episode of flooding such the one occurred in 2002 could re-occur.

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?
Yes. At its deepest point the proposed basement will probably be about 1.5m below the water level in the adjacent Hampstead Pond.

Appendix C

SLOPE STABILITY SCREENING FLOWCHART

Question 1: Does the existing site include slopes, natural or manmade, greater than 7°?(approximately 1 in 8)
Yes. The site is identified as being in an area with slope angle of about 10^{o}. However, the ground across the site is landscaped and steps down westwards from the street to the rear garden.

Question 2: Will the proposed re-profiling of landscaping at site change slopes at the property boundary to more than 7°?(approximately 1 in 8)
No. The proposed redevelopment will not include topographical changes to the existing landscape.

Question 3: Does the development neighbour land, including railway cuttings and the like, with a greater than 7°?(approximately 1 in 8)
No.

Question 4: Is the site within a wider hillside setting in which the general slope is greater than 7°?(approximately 1 in 8)
No.

Question 5: Is the London Clay the shallowest strata at the site?
Geological maps of the area show it to be underlain by London Clay. In the site-specific ground investigation, London Clay was the shallowest solid geology stratum, though at the rear of the property this appeared to be overlain by Head/Alluvium.

Question 6: Will any tree/s be felled as part of the proposed development and/or are any works proposed within any tree zone protection zones where trees are to be retained?
Yes, a tree present in the front garden will be felled.

Question 7: Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site?
There are no records of shrink-swell issues in the area of the site.

Question 8: Is the site within 100m of a watercourse, well (used/disused) or potential spring line?
Yes. The site overlooks the Hampstead Heath ponds to the west, which are along the line of the eastern branch of the lost Fleet River.

Question 9: Is the site within an area of previously worked ground?
No.

Question 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 located above an unproductive stratum.

Question 11: Is the site within 50m of the Hampstead Heath ponds?
Yes, the site overlooks the Hampstead Ponds to the west.

Question 12: Is the site within 5m of the highway or pedestrian right of way?
Yes.

Question 13: Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?
Yes. Assuming that the neighbouring properties are founded at the same level of the existing property on site, the proposed foundation level for the house will be at about 3m below the level of the existing lower ground floors.

Question 14: Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?
No.

66 SOUTH HILL PARK - BASEMENT IMPACT ASSESSMENT

APPENDIX D: Chelmers Ground and Environmental Reports

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Geotechnical Interpretive Report

Client:	Mr N Moore
Site:	66 South Hill Park London NW3 2SJ
CCS Ref:	GEO/3894
Dated:	September 2013

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APPENDICES

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1.0 EXECUTIVE SUMMARY

Item	Comments	Risk
Site	66 South Hill Park, London NW3 2SJ	
Geology	MADE GROUND was encountered to a maximum depth of 3.10m below existing ground level (bgl). Within borehole BH2 only, situated at the rear of the property, the MADE GROUND stratum was found to be underlain by HEAD DEPOSITS / ALLUVIUM to a depth of approximately 3.60m bgl. Below this was the Weathered London Clay stratum, which was not penetrated at the borehole termination depth of 15.00m bgl.	Medium
Groundwater	'Slight moisture' and 'pockets' of groundwater were observed within borehole BH1 during the drilling at 7.00 and 8.00m bgl. 'Standing' groundwater was also observed upon completion within borehole BH1 at 13.00m bgl and within borehole BH2. Groundwater was also observed during the monitoring visits at depths of approximately 4.00m and 1.90m bgl respectively within borehole BH1 and BH2. It must be assumed that the design water level could be at ground level. Excavations should be kept dry by a suitable dewatering system, the foundation base should be kept square and any soft spots replaced and compacted prior to pouring foundation concrete.	Medium
Roots	Roots of live appearance to 5, 3 and 1 mm were observed to 0.37, 2.70 and 4.50m bgl respectively within borehole BH1. Hairline rootlets were noted within borehole BH2 to 0.25m bgl.	Medium
Foundations	The new structure will be set at a depth of approximately 6.50m below existing ground level and therefore within the underlying Weathered London Clay. Relatively deep Made Ground and Head Deposits / Alluvium strata were encountered during the current investigation. The foundations will have to be set within the Weathered London Clay stratum and this should be confirmed by careful inspection of a competent Engineer prior to construction. The Weathered London Clay stratum appears to have good-load bearing characteristics, with the results of the in-situ and laboratory testing indicating a maximum safe (design) bearing pressure of approximately 150kN/m^2. This value is considered appropriate for RC rafts and monolithic upstand RC walls at lower basement floor level and for possible mass concrete pad foundations supporting temporary loads relating to the in-situ superstructure.	Medium
Piled Foundations	If due to the presence of a London Clay stratum and its well documented potential to swell/shrink, the magnitude of the anticipated loads or the presence of groundwater shallow foundations are not deemed acceptable or for any economic reasons, as an alternative, the installation of a combination of secant/contiguous piles around the perimeter of the site in order to construct the basement could be undertaken. At this site piles could be bored or driven to support foundation loads mainly in adhesion within the underlying London Clay stratum. Appropriate design parameters have been suggested, together with an indication of design capacity.	Medium
Settlement	Settlement due to this order of loading would not be expected to exceed normal tolerable limits for new build construction.	Low
Ground Movement	Excavating up to approximately 4.50m of cohesive material from over the London Clay stratum would release a significant amount of overburden pressure. It is possible that the weight of the proposed new basement and retained structure above may largely counteract the effects arising from the release of the overburden pressure. The appointed Structural Engineer should be able to provide additional advice on this matter. The construction would also be required to resist pressures arising from the groundwater regime, which is likely to be more onerous than that indicated during the current investigation.	Medium
Retaining Structures	The full design of temporary and permanent retaining structures is beyond the scope of this report. However, values have been given are given as a guide to assist in the design of these structures at this site.	Medium
Buried Concrete	Owing to the presence of selenite crystals found within the London Clay, we would recommend that a minimum of Class DS-2 conditions are adopted for concrete mix design and that consideration is given to using "sulphate resisting cement" at this site.	Low
Swelling/ Shrinking	Extensive root activity was noted during the current investigation and Weathered London Clay confirmed to possess 'medium' to 'high' volume change potential. Therefore precautions likely to be necessary.	Medium
Collapse of Excavations	Shoring may be required for excavations over 1.00m deep and a contingency should be allowed for this.	Medium
Additional Work	Prior to or as part of the final design stage it is recommended that a full Ground Movement Analysis for the project be undertaken in order to assess the impact of the proposed new development on the adjacent properties during both temporary and permanent works, together with recommending in detail on heave protection measures related to the anticipated stress changes. A Basement Impact Assessment should also be considered in order to fully understand the Hydrogeology beneath the site.	n/a

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2.0 INTRODUCTION & SCOPE OF WORKS

2.1 This report has been prepared by Chelmer Site Investigation Laboratories Limited (CSI) to the instructions of the Structural Engineers for the project, Symmetrys Limited.

2.2 The Client for the project was Mr N Moore.

2.3 At the time of the current survey, the site was found to be occupied by a substantial residential building, arranged over four levels including a lower ground floor.

2.4 It is understood that the initial proposed scheme is for the construction of one additional level of basement under the site, together with a swimming pool.

2.5 Chelmer Site Investigations have already carried out a Phase 1 *Non-Intrusive* investigation into the site, the results of which are contained within Desk Top Study Report No. DTS/3894, which has provided the basis for this subsequent Phase 2 *Intrusive* site investigation.

2.6 The Phase 1 investigation comprised a 'Desktop Study' and included a Walkover Survey, an Environmental Disclosure Report and a Historical Map Search.

2.7 This Phase 2 Intrusive site investigation has now been commissioned to provide information on the sub-soil conditions at the location of the proposed new basement together with laboratory testing and reporting, in order to enable future foundations to be designed.

2.8 In addition, a groundwater/gas monitoring survey was also carried out using the boreholes which were drilled during the current intrusive investigation work, together with a *preliminary contamination assessment,* the results of which are contained within the associated Environmental Interpretive Report No. ENV/3894.

2.9 This report presents the work carried out and discusses the findings.

3.0 FIELDWORK & FINDINGS

3.1 All fieldwork was generally executed in accordance with the recommendations given in British Standard BS 5930:1999+A2:2010, "Code of Practice for Site Investigations". Contamination sampling was undertaken in accordance with BS 10175 : 2011, "Code of Practice for the Investigation of Potentially Contaminated Sites".

3.2 The borehole locations were chosen by the Structural Engineer attached to the project and are indicated on the appended *Sketch Fieldwork Location Plan*.

3.3 Fieldwork was undertaken on 8th and 9th August July 2013 and comprised the following elements:

C.f.a Boreholes

3.4 Two c.f.a boreholes (BH1 & BH2) were drilled on the site at the positions indicated on the *Sketch Fieldwork Location Plan*. Borehole BH1 was located in the planting area towards the front of the existing property and borehole BH2 was located towards the rear of the property. Borehole BH1 was advanced to a depth of 15.00m below existing ground level. Borehole BH2 was advanced to a depth of 9.95m below existing rear garden ground level. The rear garden ground level was situated approximately 3.00m below ground level to the front of the property where BH1 was undertaken.

3.5 Disturbed samples were taken from the boreholes at regular depth intervals within each stratum and when a change of strata was encountered.

3.6 Hand Shear Vanes provided additional information on the consistency of the material encountered.

3.7 Upon completion of boreholes BH1 and BH2 combined groundwater/gas-monitoring standpipes were installed to depths of 8.00m and 10.00m respectively below existing ground level.

3.8 Full details of the borehole findings are given on the appended borehole record sheets.

Landborne Gas Emissions Monitoring

3.9 Following the initial site work, three return gas/groundwater monitoring visit have been undertaken to the installations fitted within boreholes BH1 and BH2 on the 15th, 22nd and 30th August 2013.

3.10 The barometric pressure was recorded together with the level of Carbon Dioxide, Oxygen and Methane within the borehole. In addition, gas flow measurements were taken and the depth to groundwater recorded.

3.11 Full details of the readings are included on the appended Gas/Groundwater Monitoring Record Sheet, the results of which are discussed fully within the associated Environmental Interpretive Report No. ENV/3894.

4.0 GROUND CONDITIONS

4.1 According to information published by the British Geological Survey the underlying geology at this site is shown as being London Clay Formation from the Eocene Period.

London Clay

4.2 It is thought that the London Clay Formation was deposited during a period of sea inundation in the area up to 200m in depth. The London Clay can be up to 150m thick beneath south Essex thinning across London to about 90m near Reading. The formation consists of mainly dark blue-grey to brown-grey clay containing variable amounts of fine-grained sand and silt. London Clay generally weathers to an orange-brown colour with pockets of silty fine sand. The formation is particularly susceptible to swelling and shrinking when subjected to moisture content changes and is commonly intensely fissured. In addition, gypsum (selenite) crystals and pyrite nodules are commonly found throughout the formation.

4.3 When exposed to the weathering process the upper regions of the London Clay oxidise to brown in colour. It usually contains selenite crystals, often grouped in bands or layers, which are thought to have originated from the decomposition of shell fragments. London Clay contains clay minerals in the form of illite, kaolinite and smectite. The presence of smectite renders the London Clay particularly susceptible to heave caused by alternate wetting and drying near the surface. In addition, weathering and possible slight transportation of semi-frozen material “en-masse” in glacial or peri-glacial regions can occur. This action often completely destroys the structure of the material and can involve a serious loss of strength. As the materials are based on local constituents, the lithology of the deposit is often similar to that of the parent strata.

4.4 Full details of the ground conditions encountered are presented on the borehole records appended to this report. The samples retrieved from the boreholes undertaken across the site were logged by a Chartered Geologist and the ground conditions can be summarised as follows for Borehole BH1 undertaken at the front of the property at approximately ground level:

Depth (m bgl)	Depth To (m bgl)	Description
0.00	3.10	MADE GROUND
3.10	15.00+	Weathered London Clay

And as follows for Borehole BH2 undertaken at the rear of the property:

Depth (m blgl)	Depth To (m blgl)	Description
0.00	0.25	MADE GROUND
0.25	3.60	HEAD DEPOSITS / ALLUVIUM
3.60	9.95+	Weathered London Clay

Borehole BH2 was undertaken at lower ground level; at an elevation approximately 3.00m lower than the elevation of borehole BH1.

4.5 It should be noted that the MADE GROUND depths recorded above are those encountered within the boreholes undertaken during the current work. Owing to the variable nature and unknown deposition criteria of MADE GROUND it is possible that deeper or more extensive areas of MADE GROUND may exist at this site which have not been revealed by the current work.

4.6 Groundwater was encountered during the investigation and the subsequent monitoring visits as summarised below:

Borehole Location	'Slight moisture' depth (m bgl)	'Pockets' of water depth (m bgl)	Water 'seepage' depth (m bgl)	'Standing' Water depth (m bgl)	Water depth during monitoring visits (m bgl)
BH1	7.00	8.00	-	9.00	3.96, 4.04, 3.94
BH2	-	-	6.00	Yes but depth n/a	1.90, 1.98, 1.87

4.7 Root activity was noted within the boreholes during the current investigation. The following table summarises the findings:

Location	Roots Diameter (mm)	Maximum Depth (m bgl)
BH1	5	0.37
	3	2.70
	1	4.50
BH2	Hairline rootlets	3.25

Ground level datum is taken at the elevation of BH1, approx. 3.00m above BH2.

5.0 LABORATORY TESTING

5.1 The following geotechnical tests have been carried out on samples recovered from the boreholes drilled across this site.

5.2 Unless otherwise stated, the geotechnical tests have generally been carried out in accordance with the recommendations given in British Standard 1377:1990, "Methods of Test for Soils for Civil Engineering Purposes".

5.3 The chemical testing requested as part of the current investigation has been discussed under cover of a separate report No. CHEM/3894.

5.4 *Moisture Content Tests*

Including the moisture contents associated with the Atterberg Limit tests a total of twenty-three moisture content tests have been carried out from samples collected from the boreholes undertaken across the site.

The natural moisture content for the Made Ground samples was found to vary between 20% and 31%. The natural moisture content for the Head Deposits / Alluvium samples was found to vary between 34% and 42% and for the Weathered London Clay it was recorded to vary between 21% and 38%.

The Moisture Content profiles for the boreholes carried out at this site have been appended.

5.5 *Atterberg Limits*

The Atterberg Limit and moisture contents have been determined for three samples from the Made Ground, for two samples from the Clay Head / Alluvium and for six samples collected and tested from the deeper underlying Weathered London Clay stratum.

<u>Made Ground</u>

The liquid limit (LL) was found to range between 52% and 75%, the plastic limit (PL) between 22% and 25%, and the modified plasticity index (PI) between 30% and 50%. The natural moisture contents of these three samples was found to equal 30%.

These results indicate that the cohesive elements of the samples tested would be classified as Clay of 'high' to 'very high' plasticity (CH-CV) in accordance with the Casagrande Geotechnical classification system.

In addition, the samples would fall into the "medium" to "high" volume change potential category of the National House Building Council's (NHBC) classification system given in Part 4 of their Standards.

Head Deposits / Alluvium

The liquid limit (LL) was found to range between 64% and 66%, the plastic limit (PL) between 21% and 22%, and the modified plasticity index (PI) between 42% and 45%. The natural moisture contents of these two samples was found to range between 37% and 42%.

These results indicate that the samples tested would be classified as Clay of 'high' plasticity (CH) in accordance with the Casagrande Geotechnical classification system.

In addition, the samples would fall into the "high" volume change potential category of the National House Building Council's (NHBC) classification system given in Part 4 of their Standards.

Weathered London Clay

The liquid limit (LL) was found to range between 56% and 81%, the plastic limit (PL) between 18% and 27%, and the modified plasticity index (PI) between 37% and 57%. The natural moisture contents of these six samples was found to range between 28% and 41%.

These results indicate that the samples tested would be classified as Clay of 'high' to 'very high' plasticity (CH-CV) in accordance with the Casagrande Geotechnical classification system.

In addition, the samples would fall into the "medium" to "high" volume change potential category of the National House Building Council's (NHBC) classification system given in Part 4 of their Standards.

5.6 *pH and Sulphate Tests*

The pH and sulphate content has been determined for eight samples recovered at various depths from the boreholes drilled at this site.

The pH was found to range between 6.2 and 7.1, with the sulphate content, on a 2:1 water:soil extract found to range between <0.01 g/l and 1.46 g/l.

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6.0 DISCUSSION

PROPOSED DEVELOPMENT & SCOPE OF WORKS

6.1 As discussed in Section 2 above it is understood that the initial proposed scheme is for the construction of one additional level of basement under the site.

6.2 Chelmer Site Investigations have already carried out a Phase 1 *Non-Intrusive* investigation into the site, the results of which are contained within Desk Top Study Report No. DTS/3894, which has provided the basis for this subsequent Phase 2 *Intrusive* site investigation.

6.3 The Phase 1 investigation comprised a 'Desktop Study' and included a Walkover Survey, an Environmental Disclosure Report and a Historical Map Search.

6.4 This Phase 2 Intrusive site investigation has now been commissioned to provide information on the sub-soil conditions at the location of the proposed new basement together with laboratory testing and reporting, in order to enable future foundations to be designed.

6.5 In addition, a groundwater/gas monitoring survey was also carried out using the boreholes which were drilled during the current intrusive investigation work, together with a preliminary contamination assessment, the results of which are contained within the associated Environmental Interpretive Report No. ENV/3894.

6.6 At the time of the current investigation, as no detailed information is available regarding the precise loadings associated with proposed new basement, the foundation design discussed below is, by necessity, general in nature.

6.7 This report presents the work carried out and discusses the findings.

FOUNDATION DESIGN

6.8 The current work encountered MADE GROUND to a maximum depth of 3.10m below existing ground level. Within borehole BH2 only, situated at the rear of the property, the MADE GROUND stratum was found to be underlain by HEAD DEPOSITS/ ALLUVIUM to a depth of approximately 3.60m below existing ground level. Below this was the Weathered London Clay stratum, which was not penetrated at the borehole termination depth of 15.00m below existing ground level.

6.9 It is assumed that the new basement will be set at a depth of approximately 6.50m below existing ground level (taken to the front of the building) and approximately 2.7m below the level of the rear lawn where BH2 was located. At that level the front end of the basement slab is expected to bear onto the 'very stiff' Weathered London Clay, which has demonstrated 'good' load-bearing characteristics according to the in-situ testing, whereas the rear end of the basement slab might bear onto soft silty clay of the alluvial deposit found in BH2. The latter will not provide an acceptable founding stratum so the underpins must be extended down until they are fully founded on stiff Weathered London Clay. In order to minimise differential movement between the front and rear of the building the clays on which the underpins bear must have a minimum undrained shear strength of 100 kPa. The soil strength should be verified by in-situ testing with a hand shear vane immediately on completion of excavation of each underpin. The swimming pool will be founded between 7.5m and 4.0m below ground levels at the front and rear of the building respectively, so is likely to fully founded in Weathered London Clay at the proposed level. Some heave will occur within the Weathered London Clay beneath the footprint of the proposed basement; the magnitude of such heave should be assessed during detailed design of the basement slab. Settlement due to this order of loading would not be expected to exceed normal tolerable limits for new build construction.

6.10 Groundwater was encountered during the investigation and the subsequent monitoring visits as summarised below:

Borehole Location	'Slight moisture' depth (m bgl)	'Pockets' of water depth (m bgl)	Water 'seepage' depth (m bgl)	'Standing' Water depth (m bgl)	Water depth during monitoring visits (m bgl)
BH1	7.00	8.00	-	9.00	3.96, 4.04, 3.94
BH2	-	-	6.00	Yes but depth n/a	1.90, 1.98, 1.87

6.11 Root activity was noted within the boreholes during the current investigation. The following table summarises the findings:

Location	Roots Diameter (mm)	Maximum Depth (m bgl)
BH1	5	0.37
	3	2.70
	1	4.50
BH2	Hairline rootlets	0.25

6.12 The Weathered London Clay stratum in which the foundations will be set has been indicated to possess a 'high' volume change potential.

BASEMENT CONSTRUCTION

6.13 At this site it is understood that the basement structure will extend across the whole of the footprint of the existing building and partially into the back garden. The wall configuration indicates that the basement could to be constructed by deep underpinning with reinforced concrete external walls (or mass concrete underpinning with reinforced concrete lining walls) and floor slabs. Again, the founding depth is expected to be up to approximately 6.50m/7.50m below existing ground level near the front boundary, and approximately 2.7m/4.0m below the level of the rear lawn where BH2 was drilled. At these depths the basement slab (excluding the swimming pool) is most likely to encounter 'very stiff' Weathered London Clay at the front of the basement and possibly soft alluvial clays at the rear, as described in paragraph 6.9 above. The foundations will have to be set entirely within the Weathered London Clay stratum as described above and this should be confirmed by careful inspection of a competent Engineer prior to construction.

6.14 In this case the Weathered London Clay appears to have good-load bearing characteristics, with the results of the in-situ and laboratory testing indicating a maximum safe (design) bearing pressure of approximately 150 kN/m^2. This value is considered appropriate for RC rafts and monolithic upstand RC walls at basement floor level with a minimum founding width of 600mm, and for possible mass concrete pad foundations supporting temporary loads relating to the in-situ superstructure.

6.15 London Clay is a particularly challenging material in which to dig and construct. London Clay is an overconsolidated material. Aeons ago it was thickly covered in deposits that compressed it, making it stiff and typically almost impermeable. The clay resists further compression under loading. Below a depth of about 50m this clay gives way to substantial amounts of water-bearing silt and sand. When the clay is unloaded by deep excavations compressive stress is relieved and it expands. After excavation the small immediate rebound is lost in the excavation process. However, this is not the end of the story, as the material then continues to swell, producing significant uplift at the surface within 50 years or so. If the total load of the building and basement matches or exceeds the weight of soil excavated, and the loads from the building are distributed uniformly (as far as that is possible) across the basement slab then this uplift can be minimised. Swelling clay would try to lift up any foundation piles and if a floor slab is laid directly onto the clay without being structurally connected to the basement walls then it would be lifted. Lateral stress relief will also affect the basement side walls, and will need to be allowed for during detailed design, owing to the high 'at rest' earth pressures in these over-consolidated clays.

6.16 Excavating up to approximately 4.50m of cohesive material from over the Weathered London Clay stratum would release a significant amount of overburden pressure. It is possible that the weight of the proposed new basement and retained structure above may largely counteract the effects arising from the release of the overburden pressure. The appointed Structural Engineer should be able to provide additional advice on this matter.

6.17 The construction would also be required to resist pressures arising from the assumed groundwater regime, which is likely to be more onerous than those indicated during the current investigation.

6.18 Thus in these circumstances it must be assumed that the design water level could be at ground level. This means that de-watering will be required during construction; see 'Foundation and Service Excavations' below. The basement must also be designed to accommodate the related uplift pressure.

6.19 Once the basement construction has been completed, there is always a possibility that this will act as a local "sump" for surface groundwater and run-off. Therefore, we would recommend that the basement construction is designed to minimise any ingress of groundwater. Detailed recommendations for the waterproofing system are beyond the scope of this report although it is noted that, as a minimum, it would be prudent for the system to be designed in compliance with the requirements of BS8102:2009.

6.20 It is anticipated that the up-slope side of the new basement will be set within the relatively impermeable Weathered London Clay, where borehole BH1 found no evidence of any permeable horizons other than dustings of silt on some fissure surfaces and pockets of fine sand which are unlikely to have been interconnected. And therefore, it is considered unlikely that the new basement will create a 'cut off' obstruction to groundwater because no groundwater flow is expected beneath the site at the level of the proposed basement. The new basement is therefore expected to have minimal or no effect on the hydrogeology below this site and the adjacent properties.

6.21 Again, it should be noted that should ground conditions differing significantly from those described in our report be encountered during foundation excavation, then Chelmer Site Investigation Laboratories Limited should be contacted immediately and that the recommended foundation type discussed may need to be altered accordingly.

PILED FOUNDATIONS

6.22 If due to the presence of a London Clay stratum and its well documented potential to swell/shrink, the magnitude of the anticipated loads or the presence of groundwater shallow foundations are not deemed acceptable or for any economic reasons, as an alternative, the installation of a combination of secant/contiguous piles around the perimeter of the site in order to construct the basement could be undertaken. It is assumed that the pile heads will be restrained in the permanent condition by a pile cap that will be formed of reinforced concrete and the pile walls will have a concrete inner liner wall. The house would first need to be underpinned and then the piling process could be undertaken along all sides of the basement.

6.23 At this site the piles could be bored or driven to support foundation loads mainly in adhesion within the underlying Weathered London Clay stratum. Given the nature of the ground conditions encountered, and the proximity to adjacent residential buildings, a bored pile solution would appear the most appropriate. However, we do not recommend cfa solid auger piles at this site as these would leave piles sides unsupported prior to placing of concrete.

6.24 It is beyond our brief to provide a full and detailed pile design and the advice of a specialist piling contractor should be sought in this respect. All pile design is of course the responsibility of the selected piling contractor, and thus the soil parameters/assumptions listed below are given for guidance purposes only. These soil parameters/assumptions relate to "static design" for vertically loaded single bored/cfa piles:-

Made Ground

Bulk unit weight, γ_b –	18kN/m^3
Effective angle of internal friction, φ'	Zero
Undrained shear strength, Su/Cu	Zero

London Clay

Bulk unit weight, γ_b -	20kN/m^3
Undrained shear strength, Su/Cu	Varying between approximately 150-200kN/m^2 (interpreted from Shear Vanes results)
Adhesion Factor, α	Piling contractor's advice, but within the range 0.45 to 0.60
Effective angle of internal friction, φ' -	15-20°
Bearing Capacity Factor, Nc	9

6.25 In addition, we have assumed that the top 2 to 3 metres of each pile is 'sleeved' to prevent 'heave' forces developing on the shaft. It was also assumed that the London Clay stratum extended beneath the maximum investigated depth of 15.00m.

6.26 The following table gives typical working loads for isolated bored piles to 12.00m and 15.00m below existing ground level.

Pile Type	Depth below existing ground level (m)	Diameter (m)	Working Load (tonnes)
Bored	12.00	0.30	10-15
Bored	12.00	0.45	20-25
Bored	12.00	0.60	30-35
Bored	15.00	0.30	15-20
Bored	15.00	0.45	25-30
Bored	15.00	0.60	45-50

6.27 Again, it is recommended that the advice of competent piling contractors is sought as to the most suitable pile type at this site and for confirmation of the order of working load achievable given the ground conditions encountered and the proprietary pile type selected.

6.28 Settlements of such piles can be expected to be small, typically less than 5-10mm.

6.29 Depending on pile spacing, the ultimate capacity of a pile group may be less than the sum of the ultimate capacities for the individual piles.

6.30 With regard to the possible downward migration of contaminants the recommendations given in the Environment Agency Document *"Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination : Guidance on Pollution Prevention"* National Groundwater and Contaminated Land Centre Report NC/99/73, May 2001, or similar updated guidance, should be followed when assessing pile design at this site.

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6.31 The calculation of permanent lateral pressures against the sides should relate to long-term (effective) stress analysis using critical state soil parameters. However, the following preliminary guidelines are accordingly considered appropriate:-

Made Ground

Bulk unit weight, γ_b -	18 kN/m^3
Effective cohesion, c' -	Zero
Effective angle of internal friction, φ' -	20-25^o
Friction at wall/soil interface, δ', -	Zero

London Clay

Active side (temporary and permanent)

Bulk unit weight, γ_b -	20 kN/m^3
Effective cohesion, c' -	Zero
Effective angle of internal friction, φ' -	23^o
Friction at wall/soil interface, δ', -	½ φ'

Passive side (temporary)

Bulk unit weight, γ_b -	20 kN/m^3
Effective cohesion, Cu/Su -	150 kN/m^2
Effective angle of internal friction, φ' -	Zero
Adhesion at wall/soil interface, Cu_w -	Zero

Passive side (permanent)

Bulk unit weight, γ_b -	20 kN/m^3
Effective cohesion, c' -	Zero
Effective angle of internal friction, φ' -	23^o
Friction at wall/soil interface, δ', -	½ φ'

6.32 For Surcharge loading it is necessary that the analyses take account of all lateral loadings arising from potential vehicle loading and any adjacent existing foundations.

6.33 Soil strengths and loads/actions should be factored in accordance with design code adopted.

FOUNDATION AND SERVICE EXCAVATIONS

6.34 From the evidence of the boreholes, all excavations may require full support against collapse of sides. This support must be installed as the excavations progress in order to minimise ground movements alongside the proposed basement.

6.35 Foundation and service excavations will be within MADE GROUND/Natural Cohesive Material and normal health and safety considerations need to be met with regard to the contamination test results obtained during the current work and discussed within associated Environmental Interpretive Report No. ENV/3894.

6.36 Groundwater was encountered during the investigation and the subsequent monitoring visits as summarised below:

Borehole Location	'Slight moisture' depth (m bgl)	'Pockets' of water depth (m bgl)	Water 'seepage' depth (m bgl)	'Standing' Water depth (m bgl)	Water depth during monitoring visits (m bgl)
BH1	7.00	8.00	-	9.00	3.96, 4.04, 3.94
BH2	-	-	6.00	Yes but depth n/a	1.90, 1.98, 1.87

6.37 Therefore, a suitable dewatering system will need to be employed during the construction of the basement. Sump pumping might be sufficient, however the advice of a specialist dewatering contractor should be sought to confirm whether other techniques will be required. It is very important that the base of foundation excavations is kept dry, the foundation base is kept square and that any soft spots are replaced and compacted prior to pouring foundation concrete.

BURIED CONCRETE

6.38 The results of the chemical analyses indicate that the samples tested would fall into Class DS-2 of the Building Research Establishments (BRE) classification system Special Digest Part 1:2005 "Concrete in aggressive ground".

6.39 Owing to the presence of selenite crystals found within the London Clay, we would recommend that a minimum of Class DS-2 conditions are adopted for concrete mix design and that consideration is given to using "sulphate resisting cement" at this site.

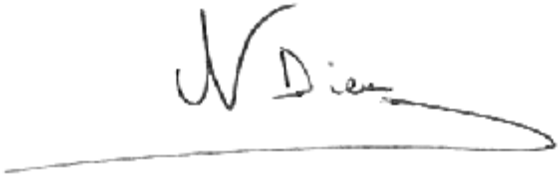
6.40 In addition, groundwater samples have also been collected and tested, the results of which are discussed fully within the associated Environmental Interpretive Report No. ENV/3894.

ADDITIONAL WORK

6.41 Prior to or as part of the final design stage it is recommended that a full Ground Movement Analysis for the project be undertaken in order to assess the impact of the proposed new development on the adjacent properties during both temporary and permanent works, together with recommending in detail on heave protection measures related to the anticipated stress changes. A Basement Impact Assessment should also be considered in order to fully understand the Hydrogeology beneath the site.

SOIL SAMPLES

6.42 All soil samples will be kept for a period of 28 days after the date of the invoice for this project unless otherwise notified to Chelmer Site Investigation Laboratories Limited in writing. Should samples be required to be stored for longer than 28 days then a storage charge will be levied.



Prepared By : Nicolas Dieu BEng (Hons)
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Senior Engineer

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c) All work carried out in preparing this report has used, and is based upon, our professional knowledge and understanding of the current relevant English and European Community standards, approved codes of practice, technology and legislation.
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Client: Symmetrys Ltd	**Scale:** N.T.S.	**Sheet No:** 1 of 2	**Weather:** Sunny	**Date:** 8.8.13	
Site: 66 South Hill Park, London NW3	**Job No:** 3894	**Borehole No:** 1	**Boring method:** Secondman (100mm Ø) C.F.A.		

Depth Mtrs.	Description of Strata	Thick-ness	Legend	Sample	Test Type	Test Result	Root Information	Depth to Water	Depth Mtrs
G.L.	MADE GROUND - TOPSOIL. dark brown, crumbly, humic, sandy, silty clay with whole bricks, fragments of brick and mortar (<20mm) and roots (<5mm, except one 40mm). Mid to dark brown from 0.25m.	0.37							
0.37	MADE GROUND. Stiff, friable, multi-coloured (brown, dark brown, grey-brown, yellow-brown) sandy, silty clay, with fragments of brick and mortar (<30mm). Contains local pockets of brown silty sand with clay clasts.	0.63							
1.0	REWORKED GROUND. Firm to stiff, fissured, brown mottled grey-brown and tan-brown, with occasional carbonaceous debris and roots <3mm. Became firm with depth.	1.7		D					1.0
				D					1.5
				D	V	83 80			2.0
				D					2.5
2.7	MADE GROUND. Firm, dark brown, (very) silty clay to clayey silt, with fragments of brick and mortar (<5mm) and hairline rootlets.	0.4		D	V	83 79			3.0
3.1	Firm to stiff, weakly fissured, brown, (very) silty CLAY, with lithic fragments (<1mm) and minor mid-grey gleying to 5.5m. Continued hairline to 1mm roots to 4.5m. (WEATHERED LONDON CLAY -probably UNIT D) Below 4.0m: Became stiff. At 6.0m: Seams(?) of scattered lithic pebbles (<2mm) and chert pebbles (<10mm), and rare shell fragments. Below 6.0m Very stiff(?). Mica crystals (<1mm) variably visible throughout. Below 7.0m: Increased fissuring, and some polished shear surfaces. Some fissure surfaces coated with yellow coarse silt. Rare small pockets of fine to coarse sand. Rare selenite crystals (<2mm). At around 8.0m: Gradual progressive transition to grey-brown. Below 8.0m: Contained occasional remnant clasts of yellow-brown silty clay. Below 9.0m: Intensely fissured and sheared. 9.0-10.0m: Local clusters of pockets of fine to coarse sand. Below 10.0m: Gradual transition to brown-grey colour. Fewer clasts and general reduction of inclued matter. Tiny voids visible in clay when torn open. (All recovered clay coated in very wet, remoulded grey-brown clay - drilling disturbance). Below 14.0m: Notable increase in strength. At base: Dark grey seam (or seams?) present.	11.90		D					3.5
				D	V	112 118			4.0
				D					4.5
				D	V	127 110			5.0
				D					5.5
				D	V	121 111			6.0
				D	V	140+ 140+			6.1
				D					7.0
				D					8.0
				D					9.0
				D					10.0

Drawn by: K. Gabriel **Approved by:** M. Edwards

Remarks:

CONTINUED ON SHEET 2 OF 2

Key: T.D.T.D. Too Dense to Drive
D Small Disturbed Sample J Jar Sample
B Bulk Disturbed Sample V Pilcon Vane (kPa)
U Undisturbed Sample (U100) M Mackintosh Probe
W Water Sample N Standard Penetration Test Blow Count

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Client: Symmetrys Ltd	**Scale:** N.T.S.	**Sheet No:** 2 of 2	**Weather:** Sunny	**Date:** 8.8.13	
Site: 66 South Hill Park, London NW3	**Job No:** 3894	**Borehole No:** 1	**Boring method:** Secondman (100mm Ø) C.F.A.		

Depth Mtrs.	Description of Strata	Thick-ness	Legend	Sample	Test Type	Test Result	Root Information	Depth to Water	Depth Mtrs
									11.0
									12.0
									13.0
									14.0
15.0	Borehole ends at 15.0m								15.0

Drawn by: K. Gabriel **Approved by:** M. Edwards

Remarks: BH located to left of front gate, in uppermost flower bed. Slight moisture noted from 7.0m; pockets of water below 8.0m, water collected in auger shaft between 9.0m and 10.0m. Groundwater standing at very approximately 13m on completion of borehole. Standpipe installed to a depth of 8.0m bgl.

Key: T.D.T.D. Too Dense to Drive
D Small Disturbed Sample J Jar Sample
B Bulk Disturbed Sample V Pilcon Vane (kPa)
U Undisturbed Sample (U100) M Mackintosh Probe
W Water Sample N Standard Penetration Test Blow Count

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Client: Symmetrys Ltd	**Scale:** N.T.S.	**Sheet No:** 2 of 2	**Weather:** Sunny	**Date:** 8.8.13	
Site: 66 South Hill Park, London NW3	**Job No:** 3894	**Borehole No:** 2	**Boring method:** Secondman (100mm Ø) C.F.A.		

Depth Mtrs.	Description of Strata	Thick-ness	Legend	Sample	Test Type	Test Result	Root Information	Depth to Water	Depth Mtrs
G.L.	DISTURBED GROUND. Dark brown, crumbly, humic, clayey, silty sand, with abundant sub-rounded fine to coarse gravel and fragments of brick and mortar (<10mm). Hairline rootlets.	0.25							
0.25	Firm to stiff, becoming firm, brown mottled yellow-brown, silty CLAY, with occasional lithic fragments and sand pockets (<10mm). No roots seen. (HEAD / ALLUVIUM). Below approx 1.0m: Gradual transition to tan-brown with feint grey-brown veining.	1.75		D D	V	38 60 71			1.0 1.5
2.0	Soft, mid-dark grey silty CLAY interbedded(?) with firm, brown-grey silty CLAY. Becomes very silty with depth. (ALLUVIUM) Below 3.0m: Firm clays, colour-banded light grey/grey-brown/brown-grey.	1.6		D D D D	V	99 108 67 75			2.0 2.5 3.0 3.5
3.6	Stiff, brown, silty CLAY with feint grey-brown veining and rare rounded gravel (<10mm). Remenant clasts (<20 Ø) visible in matrix. (WEATHERED LONDON CLAY - probably UNIT D). Below 4.0m: Fissured. Below 4.5m: Sheared, with some brown-grey veining. Below 5.2m: Very stiff. 5.9m: Shell fragments (crushed shell). 6.0-7.5m: Gradual colour transition, first to mid-dark brown, then dark brown. Grey veining on shears and fissures well-developed; occasional brown silt or fine sand in fissures. Below 9.0m: Dark grey, with some dark brown-grey clay with grey fissures and shears.	1.6		D D D D D D D D	V V	118 129 100 131 140+ 140+			4.0 4.5 5.0 5.5 6.0 7.0 8.0 9.0
9.95	Borehole abandoned on obstruction.			D					10.0

Drawn by: K. Gabriel **Approved by:** M. Edwards

Remarks: Borehole located close to upper end rear lawn.
Groundwater seepage from approx. 6.0m (clay recovered on auger was wet).
Groundwater standing in borehole on completion.
Standpipe installed to a depth of 9.95m bgl.

Key: T.D.T.D. Too Dense to Drive
D Small Disturbed Sample J Jar Sample
B Bulk Disturbed Sample V Pilcon Vane (kPa)
U Undisturbed Sample (U100) M Mackintosh Probe
W Water Sample N Standard Penetration Test Blow Count

Laboratory Testing Results

BS 1377 : 1990

Chelmer Geotechnical Laboratories

Job Number : CGL03504
Client : Symmertrys
Client Reference : CSI3894
Site Name : 66 South Hill Park, London, NW3

Date Received : 14/08/2013
Date Testing Started : 15/08/2013
Date Testing Completed : 20/08/2013
Laboratory Used : Chelmer Geotechnical, CM3 8AB

Sample Ref				Moisture Content (%) [1]	Soil Faction > 0.425mm (%) [2]	Liquid Limit (%) [3]	Plastic Limit (%) [4]	Plasticity Index (%) [5]	Liquidity Index (%) [5]	Modified Plasticity Index (%) [6]	Soil Class [7]	Filter Paper Contact Time (h) [8]	Soil Sample Suction (kPa)	Insitu Shear Vane Strength (kPa) [9]	Organic Content (%) [10]	pH Value [11]	Sulphate Content		
BH/TP/WS	Depth	UID	Sample Type														SO_3 [12]	SO_4 [13]	Class [14]
BH1	0.5	42429	D	20	12														
BH1	1.0	42430	D	27	<5														
BH1	1.5	42431	D	30	<5	71	24	47	0.13	47	CV					6.4	0.14	0.17	DS-1
BH1	2.0	42432	D	30	<5	75	25	50	0.10	50	CV								
BH1	2.5	42433	D	31	<5														
BH1	3.0	42434	D	30	<5	52	22	30	0.26	30	CH					6.2	0.83	1.00	DS-2
BH1	3.5	42435	D	26	<5														
BH1	4.0	42436	D	23	<5														
BH1	4.5	42437	D	21	<5														
BH1	5.0	42438	D	24	<5	56	18	37	0.15	37	CH								
BH1	5.5	42439	D	25	<5														
BH1	6.0	42440	D	25	<5											6.7	0.09	0.11	DS-1
BH1	7.0	42441	D	31	<5	81	24	57	0.13	57	CV								

Notes :-

[1] BS 1377 : Part 2 : 1990, Test No 3.2
[2] Estimated if <5%, otherwise measured
[3] BS 1377 : Part 2 : 1990, Test No 4.4
[4] BS 1377 : Part 2 : 1990, Test No 5.3
[5] BS 1377 : Part 2 : 1990, Test No 5.4
[6] BRE Digest 240 : 1993
[7] BS 5930 : 1981 : Figure 31 - Plasticity Chart for the classification of fine soils
[8] In-house method S9a adapted from BRE IP 4/93
[9] Values of shear strength were determined in situ by Chelmer Site Investigations using a Pilcon hand vane or Geonor vane (GV).
[10] BS 1377 : Part 3 : 1990, Test No 4
[11] BS 1377 : Part 2 : 1990, Test No 9
[12] BS 1377 : Part 3 : 1990, Test No 5.6
[13] $SO_4 = 1.2 \times SO_3$
[14] BRE Special Digest One (Concrete in Aggressive Ground) 2005
Note that if the SO_4 content falls into the DS-4 or DS-5 class, it would be prudent to consider the sample as falling into the DS-4m or DS-5m class respectively unless water soluble magnesium testing is undertaken to prove otherwise

Key

D	Disturbed sample
B	Bulk sample
U	U100 (undisturbed sample)
W	Water sample
ENP	Essentially Non-Plastic
U/S	Underside Foundation

Comments :-

Produced :- CW
Checked By :- AK
Date Checked :- 20-Aug-13

Laboratory Testing Results

BS 1377 : 1990

Chelmer Geotechnical Laboratories

Job Number : CGL03504
Client : Symmertrys
Client Reference : CSI3894
Site Name : 66 South Hill Park, London, NW3

Date Received : 14/08/2013
Date Testing Started : 15/08/2013
Date Testing Completed : 20/08/2013
Laboratory Used : Chelmer Geotechnical, CM3 8AB

Sample Ref				Moisture Content (%) [1]	Soil Faction > 0.425mm (%) [2]	Liquid Limit (%) [3]	Plastic Limit (%) [4]	Plasticity Index (%) [5]	Liquidity Index (%) [5]	Modified Plasticity Index (%) [6]	Soil Class [7]	Filter Paper Contact Time (h) [8]	Soil Sample Suction (kPa)	Insitu Shear Vane Strength (kPa) [9]	Organic Content (%) [10]	pH Value [11]	Sulphate Content		
BH/TP/WS	Depth	UID	Sample Type														SO_3 [12]	SO_4 [13]	Class [14]
BH1	11.0	42445	D	36	<5	73	25	48	0.24	48	CV								
BH1	12.0	42446	D													6.7	0.83	1.00	DS-2

Notes :-

[1] BS 1377 : Part 2 : 1990, Test No 3.2
[2] Estimated if <5%, otherwise measured
[3] BS 1377 : Part 2 : 1990, Test No 4.4
[4] BS 1377 : Part 2 : 1990, Test No 5.3
[5] BS 1377 : Part 2 : 1990, Test No 5.4
[6] BRE Digest 240 : 1993
[7] BS 5930 : 1981 : Figure 31 - Plasticity Chart for the classification of fine soils
[8] In-house method S9a adapted from BRE IP 4/93
[9] Values of shear strength were determined in situ by Chelmer Site Investigations using a Pilcon hand vane or Geonor vane (GV).
[10] BS 1377 : Part 3 : 1990, Test No 4
[11] BS 1377 : Part 2 : 1990, Test No 9
[12] BS 1377 : Part 3 : 1990, Test No 5.6
[13] $SO_4 = 1.2 \times SO_3$
[14] BRE Special Digest One (Concrete in Aggressive Ground) 2005
Note that if the SO_4 content falls into the DS-4 or DS-5 class, it would be prudent to consider the sample as falling into the DS-4m or DS-5m class respectively unless water soluble magnesium testing is undertaken to prove otherwise

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Comments :-

Produced :- CW
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Laboratory Testing Results

BS 1377 : 1990

Chelmer Geotechnical Laboratories

Job Number : CGL03504
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Sample Ref				Moisture Content (%) [1]	Soil Faction > 0.425mm (%) [2]	Liquid Limit (%) [3]	Plastic Limit (%) [4]	Plasticity Index (%) [5]	Liquidity Index (%) [5]	Modified Plasticity Index (%) [6]	Soil Class [7]	Filter Paper Contact Time (h) [8]	Soil Sample Suction (kPa)	Insitu Shear Vane Strength (kPa) [9]	Organic Content (%) [10]	pH Value [11]	Sulphate Content		
BH/TP/WS	Depth	UID	Sample Type														SO_3 [12]	SO_4 [13]	Class [14]
BH2	0.5	42451	D	38	<5														
BH2	1.0	42452	D	37	<5	64	22	42	0.34	42	CH								
BH2	1.5	42453	D	40	<5														
BH2	2.0	42454	D	42	<5	66	21	45	0.47	45	CH								
BH2	2.5	42455	D	42	<5											6.8	0.28	0.34	DS-1
BH2	3.0	42456	D	38	<5														
BH2	3.5	42457	D	34	<5														
BH2	4.0	42458	D	30	<5	69	21	48	0.18	48	CH								
BH2	4.5	42459	D	27	<5											7.1	<0.01	<0.01	DS-1
BH2	5.0	42460	D	31	<5														
BH2	5.5	42461	D	29	<5														
BH2	6.0	42462	D	35	<5	73	24	48	0.21	48	CV								
BH2	7.0	42463	D													6.8	1.22	1.46	DS-2

Notes :-

[1] BS 1377 : Part 2 : 1990, Test No 3.2
[2] Estimated if <5%, otherwise measured
[3] BS 1377 : Part 2 : 1990, Test No 4.4
[4] BS 1377 : Part 2 : 1990, Test No 5.3
[5] BS 1377 : Part 2 : 1990, Test No 5.4
[6] BRE Digest 240 : 1993
[7] BS 5930 : 1981 : Figure 31 - Plasticity Chart for the classification of fine soils
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[10] BS 1377 : Part 3 : 1990, Test No 4
[11] BS 1377 : Part 2 : 1990, Test No 9
[12] BS 1377 : Part 3 : 1990, Test No 5.6
[13] $SO_4 = 1.2 \times SO_3$
[14] BRE Special Digest One (Concrete in Aggressive Ground) 2005
Note that if the SO_4 content falls into the DS-4 or DS-5 class, it would be prudent to consider the sample as falling into the DS-4m or DS-5m class respectively unless water soluble magnesium testing is undertaken to prove otherwise

Key

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B	Bulk sample
U	U100 (undisturbed sample)
W	Water sample
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U/S	Underside Foundation

Comments :-

Produced :- CW
Checked By :- AK
Date Checked :- 20-Aug-13

Laboratory Testing Results

BS 1377 : 1990

Chelmer Geotechnical Laboratories

Job Number : CGL03504
Client : Symmertrys
Client Reference : CSI3894
Site Name : 66 South Hill Park, London, NW3

Date Received : 14/08/2013
Date Testing Started : 15/08/2013
Date Testing Completed : 20/08/2013
Laboratory Used : Chelmer Geotechnical, CM3 8AB

Sample Ref				Moisture Content (%) [1]	Soil Faction > 0.425mm (%) [2]	Liquid Limit (%) [3]	Plastic Limit (%) [4]	Plasticity Index (%) [5]	Liquidity Index (%) [5]	Modified Plasticity Index (%) [6]	Soil Class [7]	Filter Paper Contact Time (h) [8]	Soil Sample Suction (kPa)	Insitu Shear Vane Strength (kPa) [9]	Organic Content (%) [10]	pH Value [11]	Sulphate Content		
BH/TP/WS	Depth	UID	Sample Type														SO_3 [12]	SO_4 [13]	Class [14]
BH2	8.0	42464	D	38	<5	75	27	49	0.23	49	CV								
BH2	10.0	42466	D													6.9	0.72	0.86	DS-2

Notes :-

[1] BS 1377 : Part 2 : 1990, Test No 3.2
[2] Estimated if <5%, otherwise measured
[3] BS 1377 : Part 2 : 1990, Test No 4.4
[4] BS 1377 : Part 2 : 1990, Test No 5.3
[5] BS 1377 : Part 2 : 1990, Test No 5.4
[6] BRE Digest 240 : 1993
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[11] BS 1377 : Part 2 : 1990, Test No 9
[12] BS 1377 : Part 3 : 1990, Test No 5.6
[13] $SO_4 = 1.2 \times SO_3$
[14] BRE Special Digest One (Concrete in Aggressive Ground) 2005
Note that if the SO_4 content falls into the DS-4 or DS-5 class, it would be prudent to consider the sample as falling into the DS-4m or DS-5m class respectively unless water soluble magnesium testing is undertaken to prove otherwise

Key

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U	U100 (undisturbed sample)
W	Water sample
ENP	Essentially Non-Plastic
U/S	Underside Foundation

Comments :-

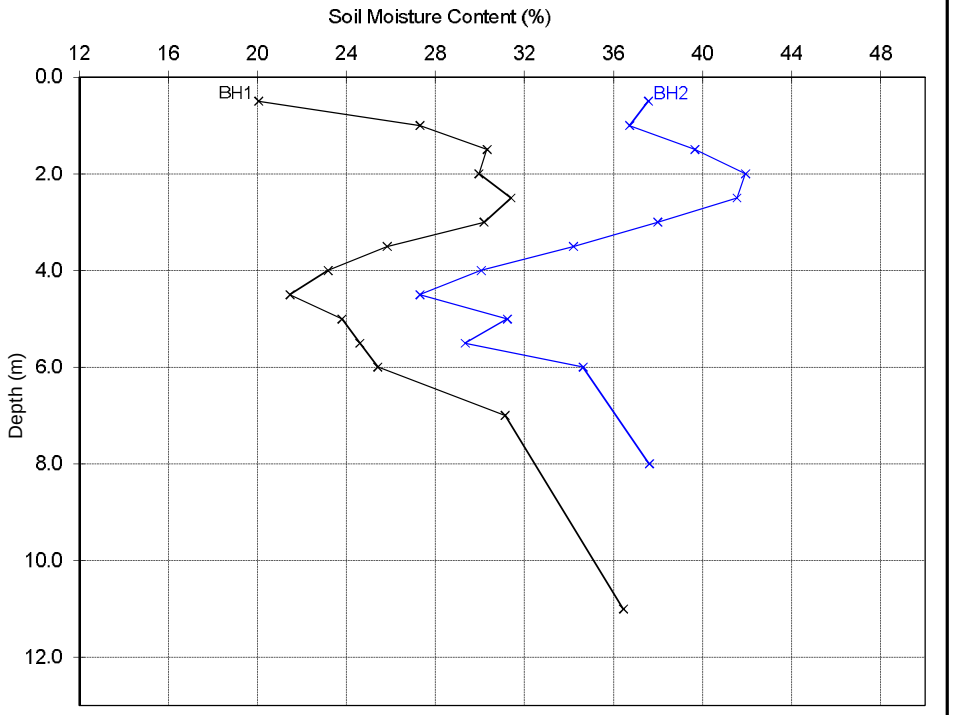
Produced :- CW
Checked By :- AK
Date Checked :- 20-Aug-13

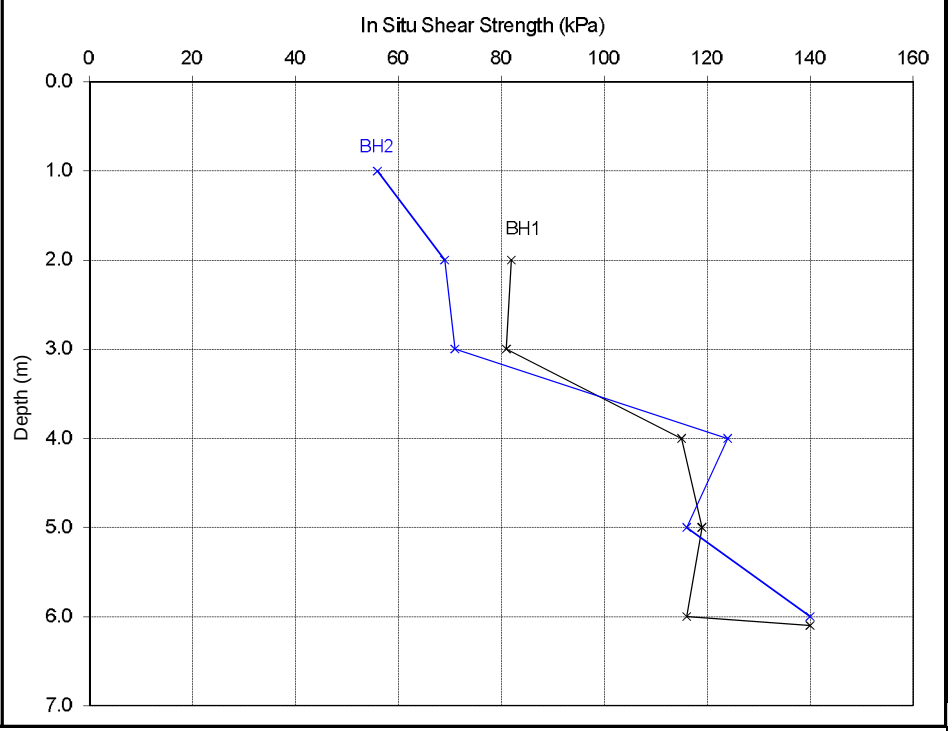
Laboratory Testing Results

Moisture Content/Shear Strength Profile

Chelmer Geotechnical Laboratories

Job Number :	CGL03504	Date Received :	14/08/2013
Client :	Symmertrys	Date Testing Started :	15/08/2013
Client Reference :	CSI3894	Date Testing Completed :	20/08/2013
Site Name :	66 South Hill Park, London, NW3	Laboratory :	Chelmer Geotechnical Laboratories, CM3 8AB





Notes :-

1. If the Soil Fraction > 0.425mm exceeds 5% the Equivalent Moisture Content of the remainder (calculated in accordance with BS 1377: Part 2 : 1990, cl.3.2.4 note 1) is also plotted and the alternative profile additionally shown as an appropriately coloured broken line.
2. If plotted, 0.4 LL and PL+2 (after Driscoll, 1983) should only be applied to London Clay (and similarly over consolidated clays) at shallow depths.

Unless otherwise stated, values of Shear Strength were determined in situ by Chelmer Site Investigations using a Pilcon Hand Vane the calibration of which is limited to a maximum reading of 140 kPa.

Comments :-

Checked By :- AK

Date Checked :- 20-Aug-13

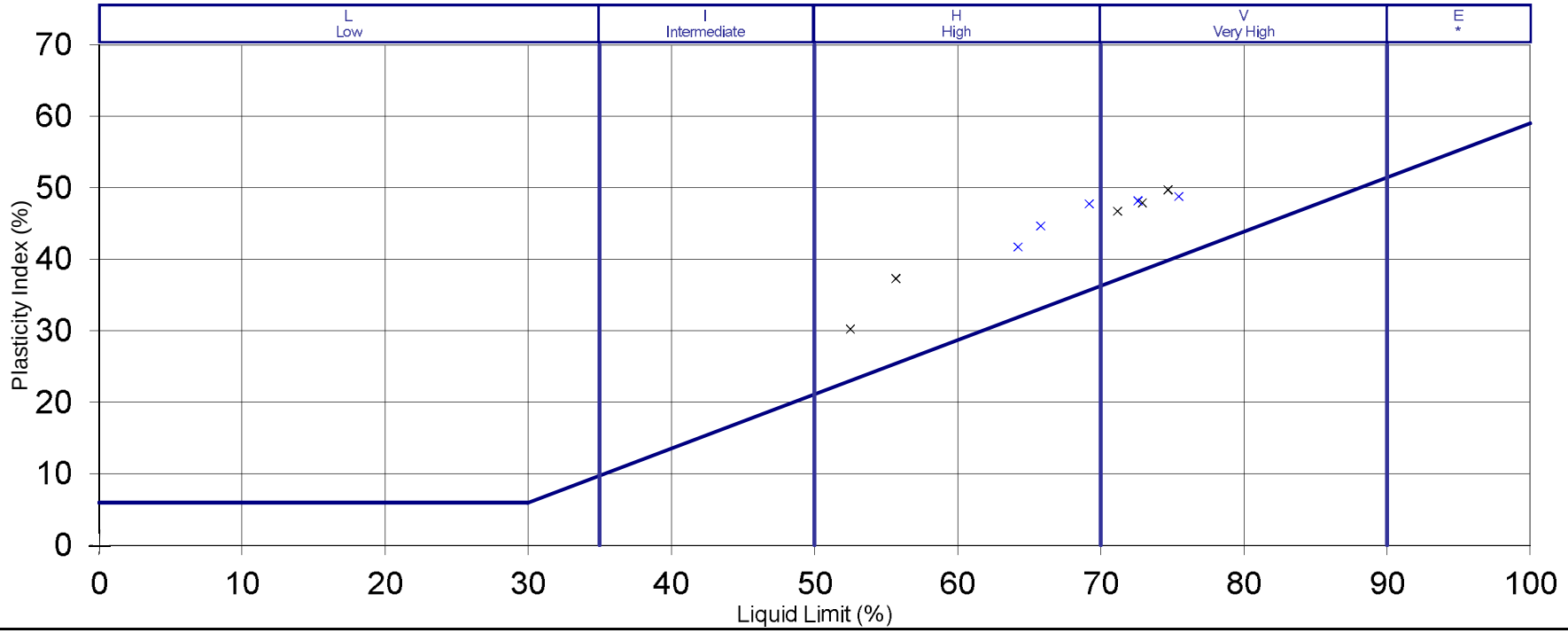
Laboratory Testing Results

Plasticity Chart for the classification of fine soils and the finer part of coarse soils
In Compliance with BS5930 : 1999

Chelmer Geotechnical Laboratories

Job Number : CGL03504
Client : Symmertrys
Client Reference : CSI3894
Site Name : 66 South Hill Park, London, NW3

Date Received : 14/08/2013
Date Testing Started : 15/08/2013
Date Testing Completed : 20/08/2013
Laboratory : Chelmer Geotechnical Laboratories, CM3 8AB



Notes :-

SILT (M-SOIL), M, plots below A-Line
CLAY, C, plots above A-Line }M and C may be combined as FINE SOIL, F.

Key :- BH1
BH2

Comments :-

Checked By :- AK

Date Checked :- 20-Aug-13

Chelmer Consultancy Services
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East Hanningfield, Essex CM3 8AB
Telephone: 01245 400 930 Fax: 01245 400 933
Email: info@siteinvestigations.co.uk Website: www.siteinvestigations.co.uk

Landborne Gas Assessment

Site Ref: **3894**
Site Name: **66 South Hill Park**

Well	Date	Methane Peak	Methane Steady	Methane GSV	Carbon Dioxide Peak	Carbon Dioxide Steady	Carbon Dioxide GSV	Oxygen	Atmos.	Flow	Response Zone	Depth to Base	Depth to Water	CO	H2S	Comments
		%v/v	%v/v	l/hr	%v/v	%v/v	l/hr	%v/v	mbar	l/hr	m bgl	m bgl	m bgl	ppm	ppm	
BH1	15/08/2013	0.1	0.1	0	1.7	1.7	0	19.0	1011	0.0	1.00 - 8.00	6.44	3.96	0	0	
	22/08/2013	0.5	0.5	0.0005	0.5	0.5	0.0005	19.8	1012	0.1		6.43	4.04	0	0	
	30/08/2013	0.1	0.1	0.0001	2.9	2.9	0.0029	17.8	1011	0.1		6.43	3.94	0	0	
BH2	15/08/2013	0.2	0.2	0	0.1	0.1	0	20.3	1011	0.0	1.00 - 10.00	9.86	1.90	0	0	
	22/08/2013	0.7	0.6	0	0.8	0.8	0	19.3	1012	0.0		9.86	1.98	0	0	
	30/08/2013	0.3	0.3	-0.0015	0.9	0.9	-0.0045	19.3	1010	-0.5		9.86	1.87	0	0	

Notes

NR = Not recorded
Values in Bold exceed the CO_2 Building Regulations threshold (>1.5%)
Values in Red exceed the Buildings Regulations Action Level (CO_2 >5.0% and CH_4 >1.5%)

Chelmer Site Investigations
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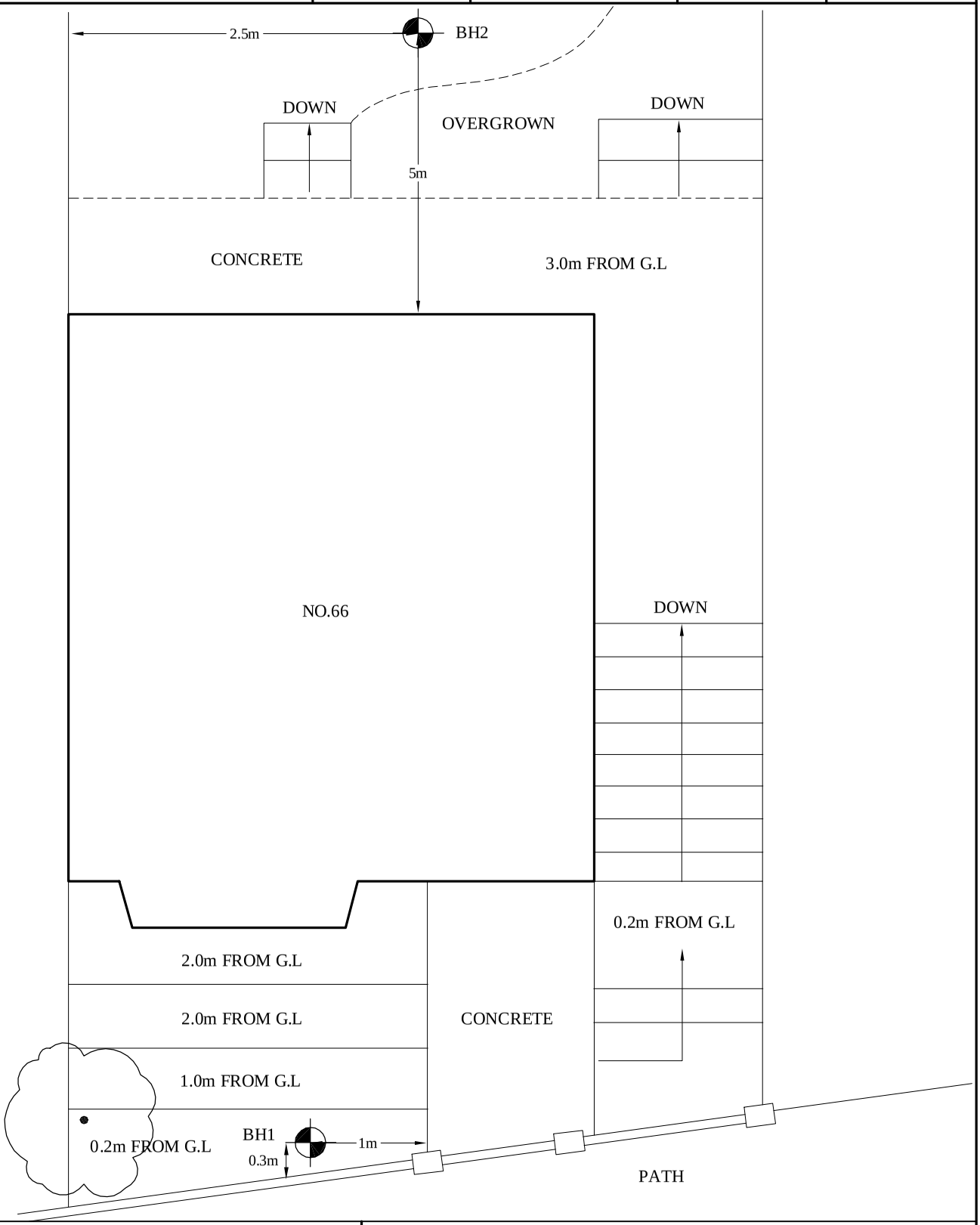
Old Church Road, East Hanningfield, Essex CM3 8AB
Telephone: 01245 400930 Fax: 01245 400933
Email: info@siteinvestigations.co.uk Website: www.siteinvestigations.co.uk

Chelmer Site Investigations

Client:	Symmetrys Ltd	**Scale:**	N.T.S.	**Sheet:**	1 of 1	**Date:**	8.8.13
Location:	66 South Hill Park, London NW3	**Job No:**	3894	**Weather:**	Sunny	**Drawn by: JP**	**Checked by: ME**

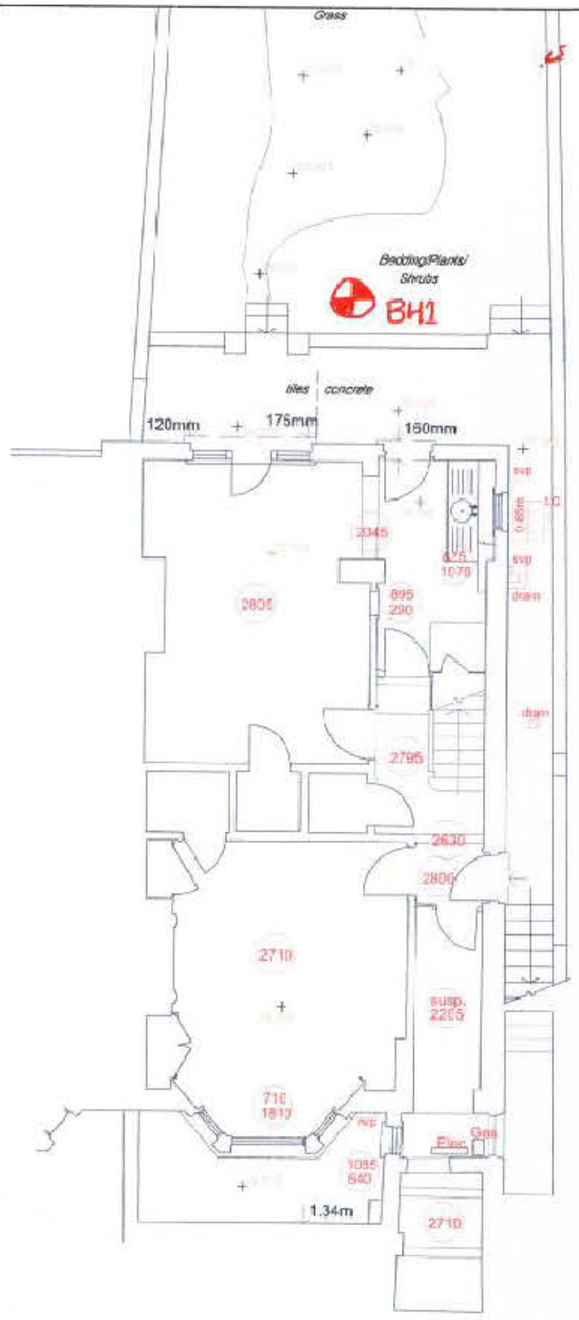


Notes:

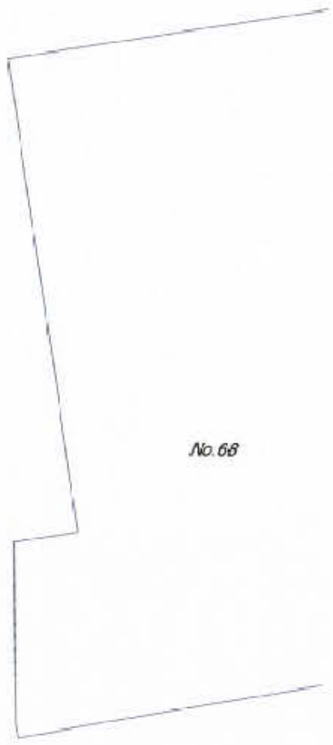
On site tree identification for guidance only. Not authenticated.

Key:

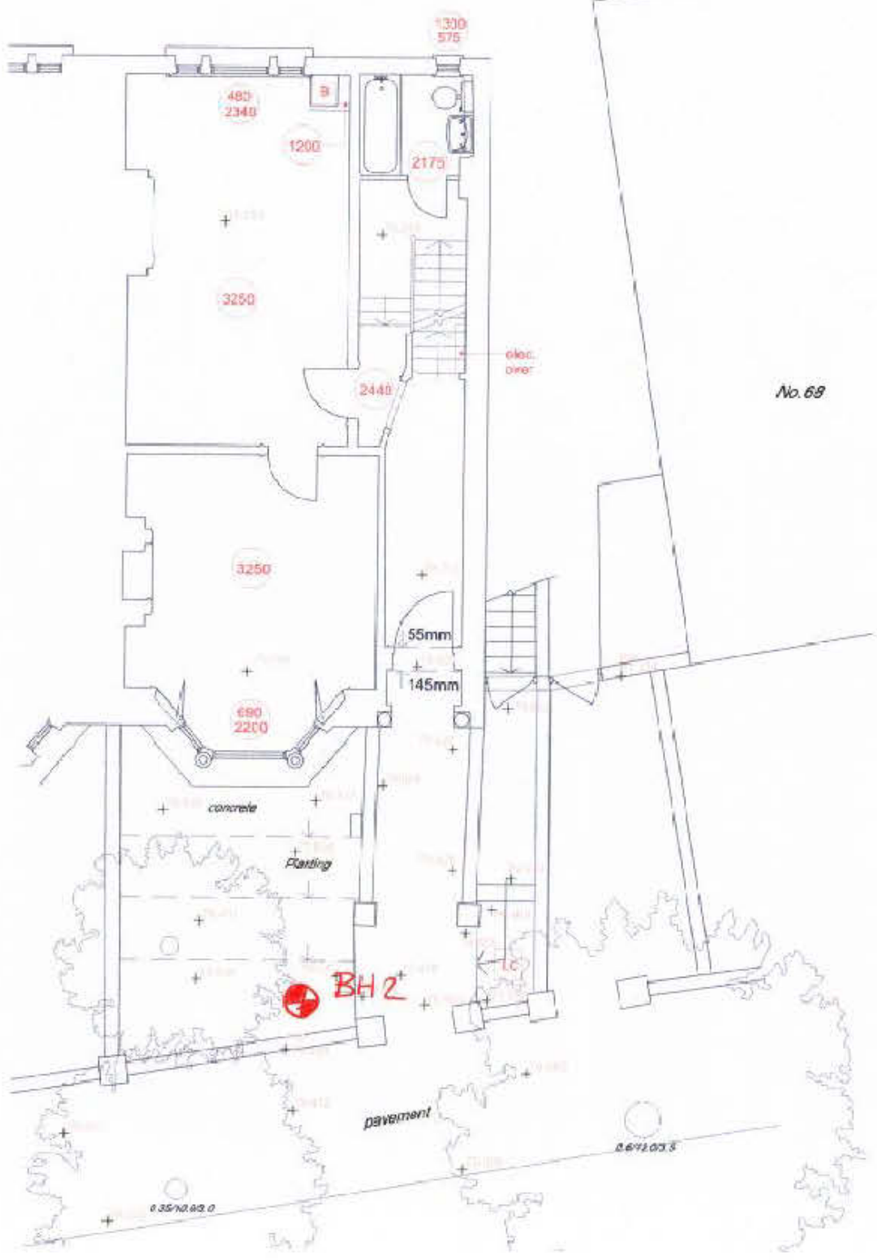
Tree/Shrub | Borehole | Trial Pit | G Gully | Tree Stump | Rain Water/ Soil Pipe | MH Manhole



LOWER GROUND FLOOR PLAN



DENOTES LOCATION OF BOREHOLE.



GENERAL NOTES:

Do not scale from this drawing.

Check drawings in detail and immediately report any discrepancies to the Architect.

Verify all dimensions and levels on site prior to construction.

No.	Date	Revision Notes

SYMMETRY LTD
BOREHOLE
MARK - UP
SK01, 24/07/13

PRELIMINARY

Stiff + Trevillion

Stiff + Trevillion Architects Ltd
55 Woodfield Road
London W9 2BD

T +44(0)20 8960 5503
F +44(0)20 8969 8848
mail@stiffandtrevillion.com
www.stiffandtrevillion.com

Project: 66 SOUTH HILL PARK
LONDON NW3

Drawing: FLOOR PLANS 1
AS EXISTING

Project No.	Drawing No.	Revision
3579	001	-

Scale: 1:50 @ A1, 1:100 @ A3 | Date: JUNE/2013 | Revised:

Chelmer Consultancy Services

Unit 15, East Hanningfield Industrial Estate
Old Church Road, East Hanningfield, Essex CM3 8AB
Telephone: 01245 400 930 **Fax:** 01245 400 933
Email: info@siteinvestigations.co.uk **Website**: www.siteinvestigations.co.uk

Environmental Interpretive Report

Client:	Mr N Moore
Site:	66 South Hill Park London NW3 2SJ
CCS Ref:	ENV/3894
Dated:	September 2013

Chelmer Consultancy Services
Unit 15, East Hanningfield Industrial Estate, Old Church Road
East Hanningfield, Essex CM3 8AB
Telephone: 01245 400 930 **Fax:** 01245 400 933
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CONTENTS

APPENDICES

Chelmer Consultancy Services
Unit 15, East Hanningfield Industrial Estate, Old Church Road
East Hanningfield, Essex CM3 8AB
Telephone: 01245 400 930 **Fax:** 01245 400 933
Email: info@siteinvestigations.co.uk **Website**: www.siteinvestigations.co.uk

1.0 EXECUTIVE SUMMARY

Item	Comments	Risk
Site	**66 SOUTH HILL PARK, LONDON, NW3 2SJ**	
Ground Conditions	MADE GROUND was encountered to a maximum depth of 3.25m below existing ground level (bgl). Within borehole BH2 only, situated at the rear of the property, the MADE GROUND stratum was found to be underlain by HEAD DEPOSITS/ ALLUVIUM to a depth of approximately 6.60m bgl. Below this was the Weathered London Clay stratum, which was not penetrated at the borehole termination depth of 15.00m bgl.	Medium
Groundwater	Water seepages were observed during the intrusive works, with standing water identified in BH1 at 13.00m bgl. Water levels were recorded during the return monitoring visits between 3.94m and 4.04m bgl in the front of the property and between 1.87m and 1.98m blgl in the rear of the property.	Low
Landborne Gas	Low concentrations of landborne gases were recorded during the return monitoring visits. It is considered the site would be classified as Green or Characteristic Situation 1.	Low
Soil Contamination	A single lead concentration was identified within the MADE GROUND at the rear of the property. As this material is due to be removed during the construction phase of the proposed basement development, it is not considered to pose a risk to future site users or controlled waters.	Low
Health and Safety	Due to the elevated lead concentration identified, any excavated material at this site may pose a '**medium'** hazard to ground workers as far as Health and Safety is concerned.	Medium
Water Contamination	No chemical water analysis was undertaken as part of this investigation, however based on the soil chemical analysis results, risk to controlled waters are considered to be 'low'.	Low
(WAC) tests	The results of the WAC test indicates that this sample would probably be classified as "Inert Waste Landfill" material.	Low
Additional Work	No additional works are considered necessary with regards to the risks from soils to human health or controlled water, given the proposed end usage. Due to the age of on-site building, an Asbestos Management Survey should be undertaken prior to development.	N/A

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2.0 INTRODUCTION & SCOPE OF WORKS

2.1 The following Preliminary Environmental Assessment has been prepared by Chelmer Site Investigation Laboratories Limited (CSI) to the written instructions, of the Structural Engineer for the project, Symmetrys Limited, on behalf of the client, Mr N Moore.

2.2 The site under consideration comprised a residential four storey property with private front and rear gardens, backing onto the Hampstead Ponds. The current layout of the site is detailed in the appended plan, *Site Plan.*

2.3 A Phase I Desk Study Investigations has been undertaken relating to the site, Phase I Desk Top Study, DTS/3894 at 66 South Hill Park, London, NW3 2SJ. The Phase I Desk Top Study was undertaken by CSI as part of the current investigation and should be read in conjunction with this report. The Phase I DTS identified the site appears to have had a residential building present on site from 1869. Since then, the building appears to have been extended in 1895 and has remained unchanged until the present day. The only risks identified to future users of the site were MADE GROUND within the site and potential asbestos containing materials, due to the age of the on-site building.

2.4 This Preliminary Phase 2 *Intrusive* site investigation has now been commissioned to provide information on the sub-soil conditions, together with laboratory testing and environmental reporting.

2.5 This report presents the work carried out and discusses the findings.

3.0 FIELDWORKS AND FINDINGS

3.1 All fieldwork was generally executed in accordance with the recommendations given in British Standard BS 5930:1999, "Code of Practice for Site Investigations", contamination sampling was undertaken in accordance with BS 10175: 2011, "Code of Practice for the Investigation of Potentially Contaminated Sites".

3.2 The borehole locations were chosen in conjunction with the requirements of the Phase I DTS and to obtain geotechnical data for the proposed development and are indicated on the appended Sketch Fieldwork Location Plan.

3.3 Fieldwork was undertaken on the 8th and 9th August 2013 and comprised the following elements:

3.4 *C.FA Borehole*

Two Continuous Flight Augered (CFA) boreholes (BH1 and BH2) were advanced to depths of 15.00m below ground level (bgl) and 9.95m below lower ground level (blgl) respectively. BH1 at ground level within the front garden was approximately 3.00m above BH2 at lower ground level within the rear garden.

Disturbed, bulk and jar samples were taken from the borehole at regular depth intervals within each stratum and when a change of strata was encountered. Hand Shear Vanes provided additional information on the consistency of the material encountered.

Upon completion of the each borehole, a combined groundwater/gas monitoring standpipe was installed to a depth of 8.00m below lower ground level (blgl) (BH1) and 9.95m below ground level (bgl) (BH2).

Full details of the borehole findings are given on the appended borehole record sheet.

3.5 Landborne Gas Emissions Monitoring

Following the initial site work, 3 No. return gas/groundwater monitoring visits were undertaken at boreholes BH1 and BH2 on the 15th, 22nd and 30th August 2013.

The barometric pressure was recorded together with the level of Carbon Dioxide, Oxygen and Methane within the borehole. In addition, gas flow measurements were taken and the depth to groundwater recorded.

Full details of the readings are detailed on the appended Gas/Groundwater Monitoring Record Sheet.

4.0 GROUND CONDITIONS

4.1 According to information published by the British Geological Survey the underlying geology at this site is shown as being the London Clay Formation.

4.2 London Clay

It is thought that the London Clay Formation was deposited during a period of sea inundation in the area up to 200m in depth. The London Clay can be up to 150m thick beneath south Essex thinning across London to about 90m near Reading. The formation consists of mainly dark blue-grey to brown-grey clay containing variable amounts of fine-grained sand and silt. London Clay generally weathers to an orange-brown colour with pockets of silty fine sand. The formation is particularly susceptible to swelling and shrinking when subjected to moisture content changes and is commonly intensely fissured. In addition, gypsum (selenite) crystals and pyrite nodules are commonly found throughout the formation.

When exposed to the weathering process the upper regions of the London Clay oxidise to brown in colour. It usually contains selenite crystals, often grouped in bands or layers, which are thought to have originated from the decomposition of shell fragments. London Clay contains clay minerals in the form of illite, kaolinite and smectite. The presence of smectite renders the London Clay particularly susceptible to heave caused by alternate wetting and drying near the surface. In addition, weathering and possible slight transportation of semi-frozen material “en-masse” in glacial or peri-glacial regions can occur. This action often completely destroys the structure of the material and can involve a serious loss of strength. As the materials are based on local constituents, the lithology of the deposit is often similar to that of the parent strata.

4.3 Full details of the ground conditions encountered are presented on the borehole records appended to this report. The samples retrieved from the boreholes undertaken across the site were logged by a Chartered Geologist and the ground conditions can be summarised as follows for Borehole BH1 undertaken at the front of the property at approximately ground level:

Depth From(m bgl)	Depth To (m bgl)	Description
0.00	3.10	MADE GROUND
3.10	2.6015.00+	Weathered London Clay

Borehole BH2 undertaken at the rear of the property as follows:

Depth (m blgl)	Depth To (m blgl)	Description
0.00	0.25	MADE GROUND
0.25	3.60	HEAD DEPOSITS / ALLUVIUM
3.60	9.95+	Weathered London Clay

Borehole BH2 was undertaken at lower ground level; at an elevation approximately 3.00m lower than the elevation of borehole BH1.

4.4 It should be noted that the MADE GROUND depths recorded above are those encountered within the boreholes undertaken during the current work. Owing to the variable nature and unknown deposition criteria of MADE GROUND it is possible that deeper or more extensive areas of MADE GROUND may exist at this site which have not been revealed by the current work.

4.5 Groundwater was encountered during the investigation and the subsequent monitoring visits as summarised below:

Borehole Location	'Slight moisture' depth (m bgl)	'Pockets' of water depth (m bgl)	Water 'seepage' depth (m bgl)	'Standing' Water depth (m bgl)	Water depth during monitoring visits (m bgl)
BH1	7.00	8.00	-	9.00	3.96, 4.04, 3.94
BH2	-	-	9.00	Yes but depth n/a	4.90, 4.98, 4.87

Ground level datum is taken at the elevation of BH1, approx. 3.00m above BH2.

4.6 Root activity was noted within the boreholes during the current investigation. The following table summarises the findings:

Location	Roots Diameter (mm)	Maximum Depth (m bgl)
BH1	5	0.37
	3	2.70
	1	4.50
BH2	Hairline rootlets	3.25

Ground level datum is taken at the elevation of BH1, approx. 3.00m above BH2.

5.0 LABORATORY TESTING

5.1 Geotechnical laboratory testing was undertaken on selected samples. The results of these are discussed in our Geotechnical Interpretative Report, ref GEO/3894.

The following contamination tests have been carried out on samples recovered from the borehole at this site and full details are appended to this report.

The chemical testing was carried out in accordance with standard industry methods in a UKAS approved laboratory which is also currently accredited in accordance with MCERTS for the majority of its testing. Further information regarding this accreditation is available on request together with a full list of test methods if required.

5.2 *Chemical Analysis*

Two representative MADE GROUND samples from BH1 at depths of 0.50m bgl and 2.50m bgl and one MADE GROUND sample from BH2 at a depth of 0.25m blgl were selected and tested for a range of commonly occurring contaminants and indicators of contamination including those given by the Contaminated Land Exposure Assessment (CLEA).

The contamination suite undertaken at this site included heavy metals, speciated **P**olycyclic**A**romatic **H**ydrocarbon (PAH) and speciated **T**otal **P**etroleum **H**ydrocarbon (TPH).

A sample from each of the boreholes from within the MADE GROUND was also scheduled for asbestos identification.

5.3 *Waste Classification Tests*

A sample collected from borehole BH2 was selected and tested for Waste Acceptance Criteria (WAC) in accordance with BS EN 12457 Part 3.

The sample was selected from borehole BH2 at a depth of 2.00m blgl.

Full details of the results are given on the appended result sheets.

5.4 *Samples*

All soil samples will be kept for a period of 28 days after the date of the invoice for this project unless otherwise notified to Chelmer Site Investigation Laboratories Ltd in writing. Should samples be required to be stored for longer than 28 days then a storage charge will be levied.

6.0 DISCUSSION

PROPOSED DEVELOPMENT & SCOPE OF WORKS

6.1 The proposed development will comprise the construction of a single storey basement under the existing property and extending under the existing rear garden.

6.2 This Preliminary Phase 2 *Intrusive* site investigation has now been commissioned to provide information on the sub-soil conditions, together with laboratory testing and environmental reporting.

PRELIMINARY CONTAMINATION ASSESSMENT

6.3 The National Planning Policy Framework contains the legislative framework for the regulation of Development on a site which "is affected by contamination or land stability issues". This legislation states that decisions should ensure that "the site is suitable for its new use taking account of ground conditions and land instability, including from natural hazards or former activities such as mining, pollution arising from previous uses and any proposals for mitigation including land remediation or impacts on the natural environment arising from that remediation" and that "adequate site investigation information, prepared by a competent person, is presented." A Competent Person is defined as "a person with a recognised relevant qualification, sufficient experience in dealing with the type(s) of pollution or land instability, and membership of a relevant professional organisation". Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the "developer and/or landowner." It also states that "all investigations of land potentially affected by contamination should be carried out in accordance with established procedures (such as BS10175 (2001)."

6.4 For this ***Preliminary Contamination Assessment*** the site has been modelled using the Source-Pathway-Receptor approach to produce a Conceptual Site Model.

Source	(substances or potential contaminants which may cause harm)
Pathway	(a linkage route between the source and receptor)
Receptor	(something which may be harmed by the source e.g. humans, plant, groundwater etc.)

6.5 Source

MADE GROUND was found across the whole site, to a maximum depth of 3.10m bgl at BH1.

Therefore, three representative samples of the MADE GROUND encountered across the site were selected and tested for a range of commonly occurring contaminants and indicators of contamination including those given by the Contaminated Land Exposure Assessment (CLEA), including asbestos identifications, due to the age of the on-site building.

6.6 Pathways

The pathways needing to be considered will depend on the land usage and will include, for example; soil ingestion, inhalation of vapour, fibres and dust.

6.7 Receptors

The following potential receptors have been identified.

- *Construction workers on the site likely to come into contact with the soils.*
- *Structures*
- *Neighbours*
- *Controlled water*
- *Any proposed vegetation*
- *Future user of the proposed development, including children.*

6.8 It should be noted that the CLEA software has limited functionality and contains algorithms, which the EA has publicly expressed its intention to update. As a consequence of this, some of the screening values generated by the CLEA software may not adequately reflect specific site conditions and in some instances are unduly conservative. In addition, it should also be noted that the figures given in the appended table are based on a 6% soil organic matter content.

6.9 The DEFRA/EA model has been developed on the basis of many critical assumptions about possible exposure to soil contamination and the development of conceptual exposure models to describe different land uses as follows:

Residential with plant uptake	Mainly refers to residential gardens in which vegetables are grown.
Residential without plant uptake	Refers to areas which have gardens (e.g. blocks of flats) but without vegetable uptake.
Open Spaces	Areas of open space only – not allocated for any specific usage.

Commercial/Industrial	Commercial/industrial usage where there are open areas which are not hard surfaced.

6.10 The Contaminated Land Exposure Assessment (CLEA) model was originally published in March 2002 as joint DEFRA/EA publications; Contaminated Land Research (CLR) Report CLR 11, with Report CLR7 as a supporting document, providing toxicity data and human tolerable daily intake (TDI) data to be used with this model. This model enabled the derivation of more site-specific values for contaminants present on a site, rather than the use of 'generic' values, which were previously used.

6.11 DEFRA/EA previously published a number of Soil Guideline Values (SGVs) for certain determinands, (common toxic metals), which were generic guideline criteria for assessing the risks to human health from chronic exposure to soil contamination for standard land-use functions. However, these were withdrawn in late 2008 and DEFRA/EA have now issued a new set of guidance documents. With regard to the Chelmer Site Investigations Laboratories Limited standard suite of tests, currently SGV figures have only been issued for Arsenic, Cadmium, Mercury, Nickel, Phenols and Selenium.

6.12 In the absence of currently published SGV values for the remaining contaminants, Messrs. W. S. Atkins have derived ATRISK^{soil} Soil Screening Values (SSVs) based on the new 2009 guidance (SC050021/SR3 (the CLEA Report) and SC050021/SR2 (the TOX report)) for commercial/industrial, residential without homegrown produce, residential with homegrown produce and allotment land uses. These have been based on the default assumptions provided in the CLEA report which it is understand will be used in the development of future Soil Guideline Values by DEFRA and the Environment Agency. Atkins SSVs have been derived in line with the new guidance using CLEA model v1.04. As the inhalation of vapour pathway contributes less than ten percent of total exposure, this is unlikely to significantly affect the combined assessment criterion and the SSV values used are the combined assessment criterion given by CLEA if free product is not observed.

6.13 Neither CLEA or ATRISK currently publish values for Hexavalent Chromium. Therefore, both Total Chromium and Hexavalent Chromium values have been compared against the Land Quality Management/Chartered Institute of Environmental Health (LQM/CIEH) Generic Assessment Criteria published in 2009 and based on CLEA v1.04 with Total Chromium values based on Chromium III.

6.14 The SGV and SSV levels represent "intervention" levels above which the levels of contamination may pose an unacceptable risk to the health of site-users such that further investigation and/or remediation is required.

6.15 Total Petroleum Hydrocarbons are considered in accordance with the fractions proposed by The Environment Agency, drawing on the TPHCWG methodology. These are contained in Table 4.2 – Petroleum hydrocarbon fractions for use in UK human health risk assessment, based on Equivalent Carbon (EC) number, contained

in Science Report P5-080/TR3, *The UK Approach for Evaluating Human Health Risks from Petroleum Hydrocarbons in Soils.*

6.16 The chemical results have been compared against the ***Residential with plant uptake*** criteria, due to the proposed end use of the site.

ASSESSMENT OF RESULTS

6.17 A single lead concentration (886mg/kg) from BH2 at a depth of 0.25m bgl within the MADE GROUND exceeded the criteria for *Residential with plant uptake* criteria.

6.18 A mean value test for lead was undertaken. The mean value test generated a result of 1142mg/kg normalised upper bound (95th percentile) and therefore ***further action is required***. The results of the SSV Mean Value Test are appended.

6.19 The elevated lead concentration was recorded from BH2 within the rear garden of the property. This area is proposed for the extension of a basement, therefore the site soils are to be removed from site during the construction phase. As a result, the elevated lead concentration will no longer be a risk to future users of the site.

6.20 No asbestos was detected in either samples from BH1 or BH2, therefore asbestos is considered to present a 'low' risk within the site soils.

WASTE ACCEPTANCE CRITERIA (WAC) TESTS

6.21 A single EN 14473/02 Waste Acceptance Criteria (WAC) test has been undertaken from BH2 at 2.00m bgl and the certificate pertaining to this has been appended to this report.

6.22 The result of the WAC test indicates that this sample would probably be classified as "Inert Waste Landfill" material.

6.23 However, it should be noted that Chelmer Site Investigation Laboratories Ltd are not a licensed landfill operator and we therefore strongly recommend that the WAC data should be presented to potential Waste Management Companies in order for them to confirm the waste classification of surplus soils to be removed from this site and to determine its acceptability at appropriate landfill sites for disposal/treatment.

6.24 There is a requirement for waste to be treated before being disposed to landfill. Treatment must be a physical, thermal, chemical or biological process, but can include sorting, and it must change the characteristics of the waste to achieve one of the following:-

1. Reduce its volume
2. Reduce its hazardous nature
3. Facilitate its handling
4. Enhance recovery

6.25 Materials with a significant deleterious odour or with visual indicators of contamination, such as being brightly coloured or containing fibrous material should not be disposed at inert waste or exempt facilities. The waste should also not contain any significant quantities of deleterious materials such as paper, plastic, textiles, wood, gypsum and metal.

6.26 Particular care should be taken to ensure that the material contains no Hazardous waste such as asbestos or invasive weeds such as Japanese Knotweed. Materials destined for 'general fill' should also not contain significant quantities of organic matter, such as peat, topsoil or vegetation.

LANDBORNE GAS EMISSIONS

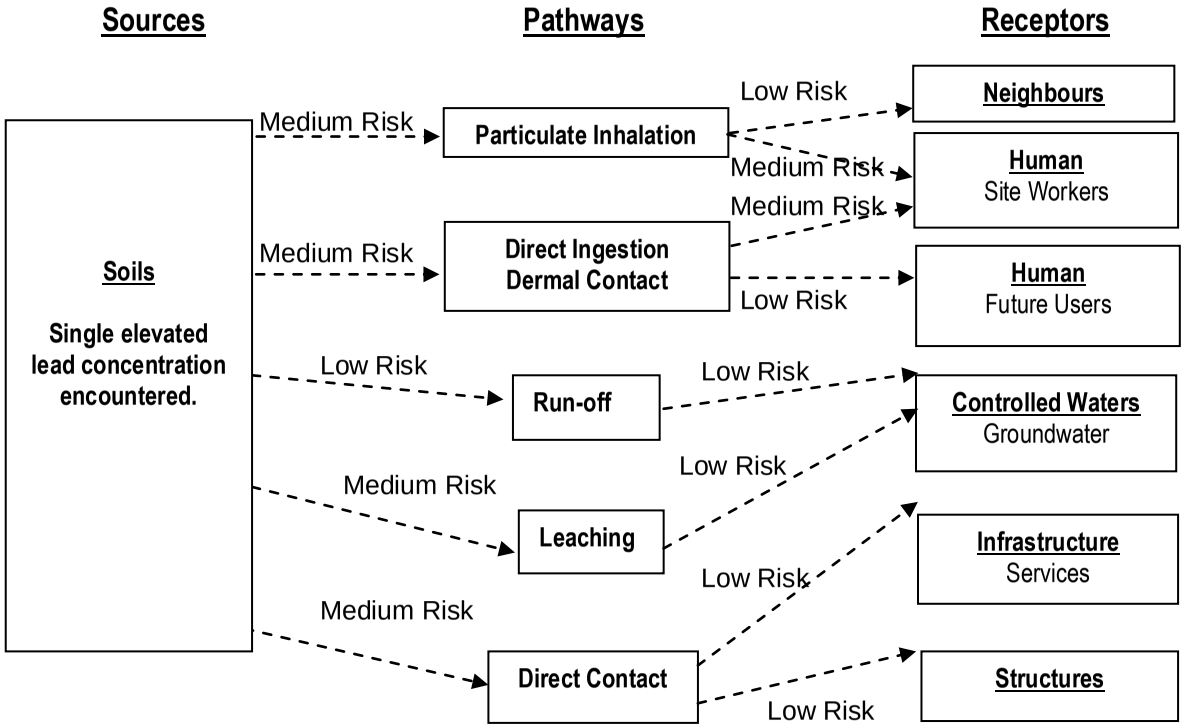
6.27 During the return gas/groundwater monitoring visits, within the installations fitted within borehole BH1, the maximum concentration of methane was recorded at 0.5%v/v and the maximum carbon dioxide concentration was recorded at 1.7%v/v. A maximum flow rate of 0.1l/hr was recorded.

6.28 Within the installations fitted within borehole BH2, the maximum concentration of methane was recorded at 0.7%v/v and the maximum carbon dioxide concentration was recorded at 2.9%v/v. A maximum flow rate of 0.1l/hr was recorded. The full landborne gas assessment details are appended.

6.29 CIRIA Publication C665 "Assessing Risks posed by Hazardous Ground gases to Buildings (Revised 2007) includes the NHBC "Traffic Light" system. The recorded gas concentrations and associated flow rates generate low Gas Assessment Values (GSVs). Therefore, in accordance with the NHBC "Traffic Light" system, we would consider that the current site would be classified as **GREEN**, or **Characteristic Situation 1**. However the Local Authority may require additional monitoring at the site.

UPDATED CONCEPTUAL MODEL

6.30 The following diagram summaries the potential pollution linkages identified for this site in the form of an updated diagrammatic Conceptual Model.



RECOMMENDATIONS

6.31 No additional works are considered necessary with regards to risk to human health or controlled water, given the proposed end usage.

6.32 However, due to the elevated lead concentration identified, any excavated material at this site may pose a '**medium'** hazard to ground workers as far as Health and Safety is concerned. We would therefore recommend that standard Health and Safety precautions be taken with regard to ground workers at this site. These should include PPE equipment such as gloves, overalls etc. to prevent dermal contact with the soils. Washing facilities should be made available on-site to reduce extended contact with site soils. During the construction phase, dust suppression measures may be required to minimise potential inhalation of dust by neighbours or ground workers.

6.33 Due to the age of on-site building, an Asbestos Management Survey should be undertaken prior to development.

Additional Comments

6.34 As always, the above recommendations are based on a selected number of representative samples and further testing may be required if any other contamination is suspected or encountered during future ground works.

6.35 With regard to the installation of any future water supply pipe work, reference should be made to the Water Regulations Advisory Service information and guidance note, The Selection of Materials for Water Supply Pipes to be Laid in Contaminated Land. It is recommended that the results of the contamination testing undertaken on the site should be provided to the water supplier in order to ensure that any pipe provided complies with their requirements.

Prepared By: Jack Hunter BSc (Hons),
Geo-Environmental Engineer

Reviewed By: Deborah Edwards MSci (Hons), FGS
Environmental Geoscientist

END OF REPORT

a) This report has been prepared for the purpose of providing advice to the client pursuant to its appointment of Chelmer Site Investigation Laboratories Limited (CSI) to act as a consultant.
b) Save for the client no duty is undertaken or warranty or representation made to any party in respect of the opinions, advice, recommendations or conclusions herein set out.
c) All work carried out in preparing this report has used, and is based upon, our professional knowledge and understanding of the current relevant English and European Community standards, approved codes of practice, technology and legislation.
d) Changes in the above may cause the opinion, advice, recommendations or conclusions set out in this report to become inappropriate or incorrect. However, in giving its opinions, advice, recommendations and conclusions, CSI has considered pending changes to environmental legislation and regulations of which it is currently aware. Following delivery of this report, we will have no obligation to advise the client of any such changes, or of their repercussions.
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f) The content of this report represents the professional opinion of experienced environmental consultants. CSI does not provide specialist legal advice and the advice of lawyers may be required.
g) In the Summary and Recommendations sections of this report, CSI has set out our key findings and provided a summary and overview of our advice, opinions and recommendations. However, other parts of this report will often indicate the limitations of the information obtained by CSI and therefore any advice, opinions or recommendations set out in the Executive Summary, Summary and Recommendations sections ought not to be relied upon unless they are considered in the context of the whole report.
h) The assessments made in this report are based on the ground conditions as revealed by walkover survey and/or intrusive investigations, together with the results of any field or laboratory testing or chemical analysis undertaken and other relevant data, which may have been obtained including previous site investigations. In any event, ground contamination often exists as small discrete areas of contamination (hot spots) and there can be no certainty that any or all such areas have been located and/or sampled.
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q) In addition CSI will not be liable for any loss whatsoever arising directly or indirectly from any opinion within this report.

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Client: Symmetrys Ltd	**Scale:** N.T.S.	**Sheet No:** 1 of 2	**Weather:** Sunny	**Date:** 8.8.13	
Site: 66 South Hill Park, London NW3	**Job No:** 3894	**Borehole No:** 1	**Boring method:** Secondman (100mm Ø) C.F.A.		

Depth Mtrs.	Description of Strata	Thick-ness	Legend	Sample	Test Type	Test Result	Root Information	Depth to Water	Depth Mtrs
G.L.	MADE GROUND - TOPSOIL. dark brown, crumbly, humic, sandy, silty clay with whole bricks, fragments of brick and mortar (<20mm) and roots (<5mm, except one 40mm). Mid to dark brown from 0.25m.	0.37							
0.37	MADE GROUND. Stiff, friable, multi-coloured (brown, dark brown, grey-brown, yellow-brown) sandy, silty clay, with fragments of brick and mortar (<30mm). Contains local pockets of brown silty sand with clay clasts.	0.63							
1.0	REWORKED GROUND. Firm to stiff, fissured, brown mottled grey-brown and tan-brown, with occasional carbonaceous debris and roots <3mm. Became firm with depth.	1.7		D					1.0
				D					1.5
				D	V	83 80			2.0
				D					2.5
2.7	MADE GROUND. Firm, dark brown, (very) silty clay to clayey silt, with fragments of brick and mortar (<5mm) and hairline rootlets.	0.4		D	V	83 79			3.0
3.1	Firm to stiff, weakly fissured, brown, (very) silty CLAY, with lithic fragments (<1mm) and minor mid-grey gleying to 5.5m. Continued hairline to 1mm roots to 4.5m. (WEATHERED LONDON CLAY -probably UNIT D) Below 4.0m: Became stiff. At 6.0m: Seams(?) of scattered lithic pebbles (<2mm) and chert pebbles (<10mm), and rare shell fragments. Below 6.0m Very stiff(?). Mica crystals (<1mm) variably visible throughout. Below 7.0m: Increased fissuring, and some polished shear surfaces. Some fissure surfaces coated with yellow coarse silt. Rare small pockets of fine to coarse sand. Rare selenite crystals (<2mm). At around 8.0m: Gradual progressive transition to grey-brown. Below 8.0m: Contained occasional remnant clasts of yellow-brown silty clay. Below 9.0m: Intensely fissured and sheared. 9.0-10.0m: Local clusters of pockets of fine to coarse sand. Below 10.0m: Gradual transition to brown-grey colour. Fewer clasts and general reduction of inclued matter. Tiny voids visible in clay when torn open. (All recovered clay coated in very wet, remoulded grey-brown clay - drilling disturbance). Below 14.0m: Notable increase in strength. At base: Dark grey seam (or seams?) present.	11.90		D					3.5
				D	V	112 118			4.0
				D					4.5
				D	V	127 110			5.0
				D					5.5
				D	V	121 111			6.0
				D	V	140+ 140+			6.1
				D					7.0
				D					8.0
				D					9.0
				D					10.0

Drawn by: K. Gabriel **Approved by:** M. Edwards

Remarks:

CONTINUED ON SHEET 2 OF 2

Key: T.D.T.D. Too Dense to Drive
D Small Disturbed Sample J Jar Sample
B Bulk Disturbed Sample V Pilcon Vane (kPa)
U Undisturbed Sample (U100) M Mackintosh Probe
W Water Sample N Standard Penetration Test Blow Count

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Client:	Symmetrys Ltd	**Scale:**	N.T.S.	**Sheet No:**	2 of 2	**Weather:** Sunny	**Date:** 8.8.13
Site:	66 South Hill Park, London NW3	**Job No:**	3894	**Borehole No:**	1	**Boring method:**	Secondman (100mm Ø) C.F.A.

Depth Mtrs.	Description of Strata	Thick-ness	Legend	Sample	Test Type	Test Result	Root Information	Depth to Water	Depth Mtrs
									11.0
									12.0
									13.0
									14.0
15.0	Borehole ends at 15.0m								15.0

Drawn by: K. Gabriel **Approved by:** M. Edwards

Remarks: BH located to left of front gate, in uppermost flower bed. Slight moisture noted from 7.0m; pockets of water below 8.0m, water collected in auger shaft between 9.0m and 10.0m. Groundwater standing at very approximately 13m on completion of borehole. Standpipe installed to a depth of 8.0m bgl.

Key: T.D.T.D. Too Dense to Drive
D Small Disturbed Sample J Jar Sample
B Bulk Disturbed Sample V Pilcon Vane (kPa)
U Undisturbed Sample (U100) M Mackintosh Probe
W Water Sample N Standard Penetration Test Blow Count

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Client: Symmetrys Ltd	**Scale:** N.T.S.	**Sheet No:** 2 of 2	**Weather:** Sunny	**Date:** 8.8.13	
Site: 66 South Hill Park, London NW3	**Job No:** 3894	**Borehole No:** 2	**Boring method:** Secondman (100mm Ø) C.F.A.		

Depth Mtrs.	Description of Strata	Thick-ness	Legend	Sample	Test Type	Test Result	Root Information	Depth to Water	Depth Mtrs
G.L.	DISTURBED GROUND. Dark brown, crumbly, humic, clayey, silty sand, with abundant sub-rounded fine to coarse gravel and fragments of brick and mortar (<10mm). Hairline rootlets.	0.25							
0.25	Firm to stiff, becoming firm, brown mottled yellow-brown, silty CLAY, with occasional lithic fragments and sand pockets (<10mm). No roots seen. (HEAD / ALLUVIUM). Below approx 1.0m: Gradual transition to tan-brown with feint grey-brown veining.	1.75		D	V	38			1.0
						60			
				D		71			1.5
2.0				D	V	99			2.0
	Soft, mid-dark grey silty CLAY interbedded(?) with firm, brown-grey silty CLAY. Becomes very silty with depth. (ALLUVIUM) Below 3.0m: Firm clays, colour-banded light grey/grey-brown/brown-grey.	1.6				108			
				D					2.5
				D	V	67			3.0
						75			
				D					3.5
3.6				D	V	118			4.0
						129			
				D					4.5
				D	V	100			5.0
	Stiff, brown, silty CLAY with feint grey-brown veining and rare rounded gravel (<10mm). Remenant clasts (<20 Ø) visible in matrix. (WEATHERED LONDON CLAY - probably UNIT D). Below 4.0m: Fissured. Below 4.5m: Sheared, with some brown-grey veining. Below 5.2m: Very stiff. 5.9m: Shell fragments (crushed shell). 6.0-7.5m: Gradual colour transition, first to mid-dark brown, then dark brown. Grey veining on shears and fissures well-developed; occasional brown silt or fine sand in fissures. Below 9.0m: Dark grey, with some dark brown-grey clay with grey fissures and shears.	1.6				131			
				D					5.5
				D	V	140+			6.0
						140+			
				D					7.0
				D					8.0
				D					9.0
9.95									
	Borehole abandoned on obstruction.			D					10.0

Drawn by: K. Gabriel **Approved by:** M. Edwards

Remarks: Borehole located close to upper end rear lawn.
Groundwater seepage from approx. 6.0m (clay recovered on auger was wet).
Groundwater standing in borehole on completion.
Standpipe installed to a depth of 9.95m bgl.

Key: T.D.T.D. Too Dense to Drive
D Small Disturbed Sample J Jar Sample
B Bulk Disturbed Sample V Pilcon Vane (kPa)
U Undisturbed Sample (U100) M Mackintosh Probe
W Water Sample N Standard Penetration Test Blow Count

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Reporting Date: 03 September 2013

ANALYTICAL REPORT No. 50305

Samples Received By: Laboratory Courier
Sample Receipt Date: 16/08/13
Your Job No: CSI 3894
Your Order No: ---
Site Location: 66 South Hill Park
ELAB Invoice Number: 41412
No Samples Received: 4
Date of Sampling: 08/08/13

This report was written by: N. Williams

Authorised By;

Steve Knight
Reporting Manager

Any comments, opinions or interpretations expressed herein are outside the scope of UKAS accreditation (Accreditation Number 2683)

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ANALYTICAL REPORT No. 50305

Location: 66 South Hill Park

Your Job No: CSI 3894
Your Order No: ---
Reporting Date: 03/09/13

F.A.O. Graham Wing
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Old Church Road
Essex, CM3 8AB

Soils

	Characteristic	Sandy silt loam	Clay loam	Silt loam
	Date Sampled	08/08/13	08/08/13	08/08/13
	TP/BH	BH1	BH1	BH2
	Depth (m)	0.50	2.50	0.25
	Our ref	80877	80878	80879
Stone Content	(%)	10	<1	9
Arsenic**	(mg/kg)	17.2	16.1	23.2
Cadmium**	(mg/kg)	<0.5	<0.5	0.9
Chromium**	(mg/kg)	54	73	38
Lead**	(mg/kg)	84	29	886
Mercury**	(mg/kg)	<0.5	<0.5	1.5
Nickel**	(mg/kg)	34	46	26
Copper**	(mg/kg)	31	27	160
Zinc**	(mg/kg)	109	88	268
Selenium**	(mg/kg)	1.5	1.6	2.0
Water Soluble Boron	(mg/kg)	0.7	1.1	0.8
Hexavalent Chromium	(mg/kg)	<2	<2	<2
pH Value**	(Units)	7.9	7.8	6.4
Free Cyanide	(mg/kg)	<1	<1	<1
Elemental Sulphur**	(mg/kg)	13.1	<10	<10
Total Monohydric Phenols***	(mg/kg)	<1	<1	<1
Moisture Content**	(%)	15.6	22.4	20.5
Stone Content**	(%)	9.7	<1	9.0

All results expressed on dry weight basis

** - MCERTS accredited test

* - UKAS accredited test *** - Sum of Phenol, 2, 3, 5,-Trimethylphenol, 2, 3,-Dimethylphenol, 3, 4-Dimethylphenol, Resorcinol/Catechol, o-Cresol, m, p-Cresol & Napthol

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Tel: 01424 718618 Fax: 01424 729911

2683

ANALYTICAL REPORT No. 50305

Location: 66 South Hill Park

Your Job No: CSI 3894

Your Order No: ---

Reporting Date: 03/09/13

F.A.O. Graham Wing
Chelmer Site Investigations Ltd
Unit 15, East Hanningfield Ind Est
Old Church Road
Essex, CM3 8AB

Soils	Characteristic	Sandy silt loam	Clay loam	Silt loam
	Date Sampled	08/08/13	08/08/13	08/08/13
	TP/BH	BH1	BH1	BH2
	Depth (m)	0.50	2.50	0.25
	Our ref	80877	80878	80879
Naphthalene**	(mg/kg)	<0.5	<0.5	<0.5
Acenaphthylene**	(mg/kg)	<0.5	<0.5	<0.5
Acenaphthene**	(mg/kg)	<0.5	<0.5	<0.5
Fluorene**	(mg/kg)	<0.5	<0.5	<0.5
Phenanthrene**	(mg/kg)	<0.5	<0.5	<0.5
Anthracene**	(mg/kg)	<0.5	<0.5	<0.5
Fluoranthene**	(mg/kg)	<0.5	<0.5	1.0
Pyrene**	(mg/kg)	<0.5	<0.5	0.9
Benz(a)anthracene**	(mg/kg)	<0.5	<0.5	0.5
Chrysene**	(mg/kg)	<0.5	<0.5	0.8
Benzo(b)fluoranthene**	(mg/kg)	<0.5	<0.5	0.6
Benzo(k)fluoranthene**	(mg/kg)	0.5	<0.5	0.9
Benzo(a)pyrene**	(mg/kg)	<0.5	<0.5	0.6
Indeno(123-cd)pyrene**	(mg/kg)	<0.5	<0.5	<0.5
Dibenz(ah)anthracene**	(mg/kg)	<0.5	<0.5	<0.5
Benzo(ghi)perylene**	(mg/kg)	<0.5	<0.5	0.6
Total PAH**	(mg/kg)	0.5	<0.5	5.9

All results expressed on dry weight basis

** - MCERTS accredited test

N. Williams

THE ENVIRONMENTAL LABORATORY LTD

Unit A2, Windmill Road, Ponswood Industrial Estate, St Leonards On Sea, East Sussex, TN38 9BY

Tel: 01424 718618 Fax: 01424 729911

2683

ANALYTICAL REPORT No. 50305

Location: 66 South Hill Park

Your Job No: CSI 3894
Your Order No: ---
Reporting Date: 03/09/13

F.A.O. Graham Wing
Chelmer Site Investigations Ltd
Unit 15, East Hanningfield Ind Est
Old Church Road
Essex, CM3 8AB

TPH CWG - Soil

	Characteristic	Sandy silt loam	Clay loam	Silt loam
	Date Sampled	08/08/2013	08/08/2013	08/08/2013
	TP/BH	BH1	BH1	BH2
	Depth (m)	0.50	2.50	0.25
	Our ref	80877	80878	80879
Aromatic				
>EC_5-EC_7	(mg/kg)	<0.01	<0.01	<0.01
>EC_7-EC_8	(mg/kg)	<0.01	<0.01	<0.01
>EC_8-EC_{10}	(mg/kg)	<5	<5	<5
>EC_{10}-EC_{12}	(mg/kg)	<5	<5	<5
>EC_{12}-EC_{16}	(mg/kg)	<5	<5	<5
>EC_{16}-EC_{21}	(mg/kg)	<5	<5	<5
>EC_{21}-EC_{35}	(mg/kg)	5	5	5
Aliphatic				
>EC_5-EC_6	(mg/kg)	<0.01	<0.01	<0.01
>EC_6-EC_8	(mg/kg)	<0.01	<0.01	<0.01
>EC_8-EC_{10}	(mg/kg)	<5	<5	<5
>EC_{10}-EC_{12}	(mg/kg)	<5	<5	<5
>EC_{12}-EC_{16}	(mg/kg)	<5	<5	<5
>EC_{16}-EC_{21}	(mg/kg)	<5	<5	<5
>EC_{21}-EC_{35}	(mg/kg)	<5	<5	<5
TPH (C_5 - C_{35})	(mg/kg)	5	5	5

All results expressed on dry weight basis

* * - MCERTS accredited test

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ANALYTICAL REPORT No. 50305
Location: 66 South Hill Park

F.A.O. Graham Wing
Chelmer Site Investigations Ltd
Unit 15, East Hanningfield Ind Est
Old Church Road
Essex, CM3 8AB

Your Job No: CSI 3894
Your Order No: ---
Reporting Date: 03/09/13

Asbestos Identification

Sample ref:	BH1
Depth (m)	0.50
Our ref:	80877
#Description of Sample Matrix:	Sandy silt loam
*Result	No asbestos identified

Sample ref:	BH2
Depth (m)	0.25
Our ref:	80879
#Description of Sample Matrix:	Silt loam
*Result	No asbestos identified

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ANALYTICAL REPORT No. 50305

Location: 66 South Hill Park

F.A.O. Graham Wing
Chelmer Site Investigations Ltd
Unit 15, East Hanningfield Ind Est
Old Church Road

Your Job No: CSI 3894
Your Order No: ---
Reporting Date: 03/09/13

*= UKAS accredited

Analytical result only applies to the sample as submitted by the client

Any comments, opinions or interpretations (marked #) in this report are outside UKAS accreditation (Accreditation No2683). They are subjective comments only which must be verified by the client

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THE ENVIRONMENTAL LABORATORY LTD

Waste Acceptance Criteria ANALYTICAL *RESULTS*

Report No:	ANALYTICAL REPORT No. 50305				Page 6 of 9		
					CLIENT:	Chelmer Site Investigations Ltd	
Project Name:	66 South Hill Park						
Lab Reference	80880				Landfill Waste Acceptance Critena Limits		
Sampling Date	08/08/13				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	BH2						
Depth	2.00						
Solid Waste Analysis							
TOC (%)	1.8				3%	5%	6%
Loss on Ignition (%)**	4.9				--	--	10%
BTEX (mg/kg)**	<0.01				6	--	--
Sum of PCBs (mg/kg)**	<0.01				1	--	--
Mineral Oil (mg/kg)**	<5				500	--	--
Total PAH (mg/kg)**	<0.5				100	--	--
pH (Units)**	6.8				--	--	--
Acid Neutralisation Capacity (mol/kg)	<0.1				--	To be evaluated	To be evaluated
Eluate Analysis	2:1	8:1		Cumulative 10:1	Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg (mg/kg)		
	mg/l	mg/l		mg/kg			
Arsenic*	0.005	<0.005		<0.1	0.5	2	25
Barium*	0.042	0.043		0.1	20	100	300
Cadmium*	<0.001	<0.001		<0.01	0.04	1	5
Chromium*	<0.005	<0.005		<0.1	0.5	10	70
Copper*	<0.005	<0.005		<0.1	2	50	100
Mercury*	<0.0001	<0.0001		<0.001	0.01	0.2	2
Molybdenum*	0.007	<0.005		<0.1	0.5	10	30
Nickel*	<0.005	<0.005		<0.1	0.4	10	40
Lead*	<0.005	<0.005		<0.1	0.5	10	50
Antimony	<0.005	<0.005		<0.01	0.06	0.7	5
Selenium*	<0.005	<0.005		<0.01	0.1	0.5	7
Zinc*	0.010	0.009		<0.1	4	50	200
Chloride	10	1		8	800	15000	25000
Fluoride	<1	<1		<1	10	150	500
Sulphate	241	230		756	1000	20000	50000
TDS	600	460		1562	4000	60000	100000
Phenol Index	<0.5	<0.5		<0.5	1	-	-
DOC	74.4	32.0		123	500	800	1000
Leach Test Information							
pH *	7.6	6.8					
EC*	636	540					
Sample Mass (kg)	0.240						
Dry Matter (%)	73						
Moisture (%)	39						
Stage 1							
Volume Eluate L2 (litres)	0.282						
Filtered Eluate VE1 (litres)	0.074						

Results are expressed on a dry weight basis, after correction for moisture content where applicable
Stated limits are for guidance only and ELAB cannot be held responsible for any discrepencies with current legislation

*= UKAS accredited

** - MCERTS accredited test

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THE ENVIRONMENTAL LABORATORY LTD

SOLID SAMPLE RECEIPT AND TEST DATES

Our Analytical Report Number	50305
Your Job No:	CSI 3894
Sample Receipt Date:	16/08/13
Reporting Date:	03/09/13
Registered:	16/08/13
Prepared:	17/08/13
Analysis complete:	03/09/13

SOLID TEST METHOD SUMMARY

PARAMETER	Analysis Undertaken on	Date Tested	Method Number	Technique
Arsenic**	Air dried sample	21/08/13	118	ICPMS
Cadmium**	Air dried sample	21/08/13	118	ICPMS
Chromium**	Air dried sample	21/08/13	118	ICPMS
Lead**	Air dried sample	21/08/13	118	ICPMS
Mercury**	Air dried sample	21/08/13	118	ICPMS
Nickel**	Air dried sample	21/08/13	118	ICPMS
Copper**	Air dried sample	21/08/13	118	ICPMS
Zinc**	Air dried sample	21/08/13	118	ICPMS
Selenium**	Air dried sample	21/08/13	118	ICPMS
Water Soluble Boron	Air dried sample	21/08/13	202	Colorimetry
Hexavalent Chromium	As submitted sample	23/08/13	110	Colorimetry
pH Value**	Air dried sample	21/08/13	113	Electrometric
Free Cyanide	As submitted sample	22/08/13	107	Colorimetry
Elemental Sulphur**	Air dried sample	21/08/13	122	HPLC
Total Monohydric Phenols	As submitted sample	20/08/13	121	HPLC
Speciated PAH**	As submitted sample	20/08/13	133	Gas Chromatography
Carbon Banding (TPH CWG)	As submitted sample	02/09/13	214	Gas Chromatography
Asbestos*	As submitted sample	01/09/13	179	See note

Asbestos analysis qualitative only
Note:- Documented In-house procedure based on HSG 248 2005
* = UKAS Accredited test
** - MCERTS Accredited test
Determinands not marked with * or ** are not accredited

MCERTS accreditation covers samples which are predominantly sand, clay, loam or combinations of these three soil types

All results have been expressed on a dry weight basis and where appropriate have been corrected for moisture and stone content accordingly

Any comments, opinions, or interpretations expressed herein are outside the scope of UKAS accreditation (Accreditation Number 2683)

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THE ENVIRONMENTAL LABORATORY LTD

SAMPLE RECEIPT AND TEST DATES

Our Analytical Report Number	50305
Your Job No:	CSI 3894
Sample Receipt Date:	16/08/13
Reporting Date:	03/09/13
Registered:	16/08/13
Prepared:	17/08/13
Analysis complete:	03/09/13

TEST METHOD SUMMARY

PARAMETER	Undertaken on	Date Tested	Method Number	Technique
pH Value**	Air dried sample	20/08/13	113	Electrometric
Total Organic Carbon	Air dried sample	02/09/13	210	Automated IR Absorption
Loss on Ignition**	Air dried sample	20/08/13	129	Gravimetric
Neutralization Capacity to pH 7	Air dried sample	20/08/13	-	EA
Benzene**	As submitted sample	20/08/13	181	GCMS
Toluene**	As submitted sample	20/08/13	181	GCMS
Ethyl Benzene**	As submitted sample	20/08/13	181	GCMS
Xylenes**	As submitted sample	20/08/13	181	GCMS
Mineral Oil**	As submitted sample	20/08/13	117	GCFID
PCB 28**	Air dried sample	20/08/13	120	GCMS
PCB 52**	Air dried sample	20/08/13	120	GCMS
PCB 101**	Air dried sample	20/08/13	120	GCMS
PCB 118**	Air dried sample	20/08/13	120	GCMS
PCB 138**	Air dried sample	20/08/13	120	GCMS
PCB 153**	Air dried sample	20/08/13	120	GCMS
PCB 180**	Air dried sample	20/08/13	120	GCMS
Speciated PAH**	As submitted sample	20/08/13	133	GCFID

The analysts' guide for sampling, analysis and clearance procedures
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THE ENVIRONMENTAL LABORATORY LTD

LEACHATE SAMPLE RECEIPT AND TEST DATES

Our Analytical Report Number	50305
Your Job No:	CSI 3894
Sample Receipt Date:	16/08/13
Reporting Date:	03/09/13
Registered:	16/08/13
Prepared:	17/08/13
Analysis complete:	03/09/13

LEACHATE TEST METHOD SUMMARY

PARAMETER	Method Number	Technique
Arsenic*	101	ICPMS
Cadmium*	101	ICPMS
Chromium*	101	ICPMS
Lead*	101	ICPMS
Nickel*	101	ICPMS
Copper*	101	ICPMS
Zinc*	101	ICPMS
Mercury*	101	ICPMS
Selenium*	101	ICPMS
Antimony	101	ICPMS
Barium*	101	ICPMS
Molybdenum*	101	ICPMS
pH Value*	113	Electrometric
Electrical Conductivity*	136	Probe
Dissolved Organic Carbon	102	TOC analyser
Chloride	131	Ion Chromatography
Fluoride	131	Ion Chromatography
Sulphate	131	Ion Chromatography
Total Dissolved Solids	144	Gravimetric
Phenol Index	121	HPLC

* = UKAS Accredited test
Determinands not marked with * are not accredited

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Telephone: 01245 400 930 Fax: 01245 400 933
Email: info@siteinvestigations.co.uk Website: www.siteinvestigations.co.uk

Contamination Test Results on Soil Samples

Location: 66 South Hill Park	Date : September 2013	Job No. : 3894	Sheet 1 of 1

Borehole No.	Units		BH1	BH1	BH2			ATRISK Contaminated Land Screening Values (SSV) derived using CLEA v1.04 for 6% SOM			
Sample No.			80877	80878	80879						
Depth (m)			0.50	2.50	0.25						
Material Type			MADE GROUND	MADE GROUND	MADE GROUND			Residential with plant uptake	Residential without plant uptake	Allotments	Commercial/ Industrial
Aromatic Hydrocarbons (mg/kg)	>C5-C7		<0.01	<0.01	<0.01			0.06	0.07	0.07	7.37
	>C7-C8		<0.01	<0.01	<0.01			14.9	15.2	106	1780
	>C8-C10		<5	<5	<5			23.7	24.1	53.2	2700
	>C10-C12		<5	<5	<5			132	147	71.3	36800
	>C12-C16		<5	<5	<5			452	700	132	38000
	>C16-C21		<5	<5	<5			804	1330	288	28400
	>C21-C35		5	5.0	5			1220	1330	1550	28400
Aliphatic Hydrocarbons (mg/kg)	>C5-C6		<0.01	<0.01	<0.01			26.1	26.1	4250	>1000000
	>C6-C8		<0.01	<0.01	<0.01			87.8	87.9	13900	>100000
	>C8-C10		<5	<5	<5			14.5	14.5	1780	86700
	>C10-C12		<5	<5	<5			87.7	87.8	7460	94600
	>C12-C16		<5	<5	<5			4010	4050	13300	95300
	>C16-C21		<5	<5	<5						
	>C21-C35		<5	<5	<5			88200	88900	281000	>1000000
TOTAL TPH	mg/kg		5	5	5						
Naphthalene	mg/kg		<0.5	<0.5	<0.5			8.71	9.22	23.4	22700
Acenaphthylene	mg/kg		<0.5	<0.5	<0.5			-	-	-	-
Acenaphthene	mg/kg		<0.5	<0.5	<0.5			2130	4770	612	106000
Fluorene	mg/kg		<0.5	<0.5	<0.5			1930	3100	725	72100
Phenanthrene	mg/kg		<0.5	<0.5	<0.5			-	-	-	-
Anthracene	mg/kg		<0.5	<0.5	<0.5			18300	24000	10400	545000
Fluoranthene	mg/kg		<0.5	<0.5	1.0			2160	3210	924	72700
Pyrene	mg/kg		<0.5	<0.5	0.9			1550	2400	620	54500
Benz(a)anthracene	mg/kg		<0.5	<0.5	0.5			18	18.2	76.8	218
Chrysene	mg/kg		<0.5	<0.5	0.8			2280	2330	6350	22000
Benzo(b)fluoranthene	mg/kg		<0.5	<0.5	0.6			24.1	24.4	93	223
Benzo(k)fluoranthene	mg/kg		0.5	<0.5	0.9			244	246	1100	2240
Benzo(a)pyrene	mg/kg		<0.5	<0.5	0.6			2.43	2.46	10.3	22.3
Indeno(123-cd)pyrene	mg/kg		<0.5	<0.5	<0.5			23.9	24.3	84.9	222
Dibenz(ah)anthracene	mg/kg		<0.5	<0.5	<0.5			2.4	2.42	12.3	22.4
Benzo(ghi)perylene	mg/kg		<0.5	<0.5	0.6			248	249	1630	2250
TOTAL PAH	mg/kg		0.5	<0.5	5.9						
Cyanide (Free)	mg/kg		<1	<1	<1			34	34	34	34
pH	unit		7.9	7.8	6.4			-	-	-	-
Copper (Total)	mg/kg		31	27	160			4020	8370	1110	109000
Lead (Total)	mg/kg		84	29	886			322	444	160	6830
Zinc (Total)	mg/kg		109	88	268			17200	46800	3990	917000
								LQM/CIEH Generic Assessment Criteria			
Chromium (Total)	mg/kg		54	73	38			3000	3000	34600	30400
Chromium (Hexavalent)	mg/kg		<2	<2	<2			4.3	4.3	2.1	35
								CLEA Soil Guideline Values (SGV)			
Arsenic (Total)	mg/kg		17.2	16.1	23.2			32	32	43	640
Cadmium (Total)	mg/kg		<0.5	<0.5	1			10	10	1.8	230
Mercury (Total)	mg/kg		<0.5	<0.5	1.5			170	170	80	3600
Nickel (Total)	mg/kg		34	46	26			130	130	230	1800
Phenols (Total)	mg/kg		<1	<1	<1			420	420	280	3200
Selenium (Total)	mg/kg		1.5	<0.5	<0.5			350	350	120	13000
Moisture Content	%		15.6	22.4	20.5			-	-	-	-
Stones	%		9.7	<1	9.0			-	-	-	-
Elemental Sulphur	mg/kg		13.10	<10	<10			-	-	-	-
Water Soluble Boron	mg/kg		0.7	1.1	0.8			-	-	-	-

Key

PAH - Polyaromatic Hydrocarbons
TPH - Total Petroleum Hydrocarbons
- Not determined

Result exceeds ATRISK screening value
Result exceeds EQS/CIEH generic assessment criteria
Result exceeds CLEA Soil Guideline Value (SGV)

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Job No.	**3894**
Location	**66 South Hill Park**
Date	**September 2013**
Number of Made Ground Samples	**3**
t value	**2.92**
Determinand	**Lead**
ATRISK (SSV) **Residential Without Plant Uptake**	**322**

Contaminant Concentration (mg/kg)	x^2
84	7056
29	841
886	784996
999.00	

Mean	**333**
Sum of x^2	**792893.00**
Standard Deviation^2 =	**230113.000**
Standard Deviation =	**479.701**

Normalised Upper Bound	**1142**

Is Action still required in the averaging area based on the mean value test after DEFRA R & D Publication CLR 7 methodology

Yes

Asbestos Identification

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Email: info@siteinvestigations.co.uk Website: www.siteinvestigations.co.uk

Location : 66 South Hill Park

Date : September 2013 | **Job No. : 3894**

Borehole No.			BH1	BH2						
Sample No.			80877	80879						
Depth (m)			0.50	0.25						
Not Detected			X	X						
Detected										

Remarks

No asbestos detected within any of the samples tested.

LOWER GROUND FLOOR PLAN

GENERAL NOTES:

Do not scale from this drawing

Check drawing as received and immediately report any discrepancies to the Architect

Verify all dimensions on site before commencement

The contents of this drawing are Stiff + Trevillion Architects LLP copyright and shall not be reused without written permission

No.	Date	Revision Notes

PRELIMINARY

Stiff + Trevillion

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Project: **66 SOUTH HILL PARK**
LONDON NW3

Drawing: **FLOOR PLANS 1**
AS EXISTING

Project No.	Drawing No.	Revision
3579	001	-

Scale: 1:50 @ A1, 1:100 @ A3 — Date: 30/07/2013 — Drawn:

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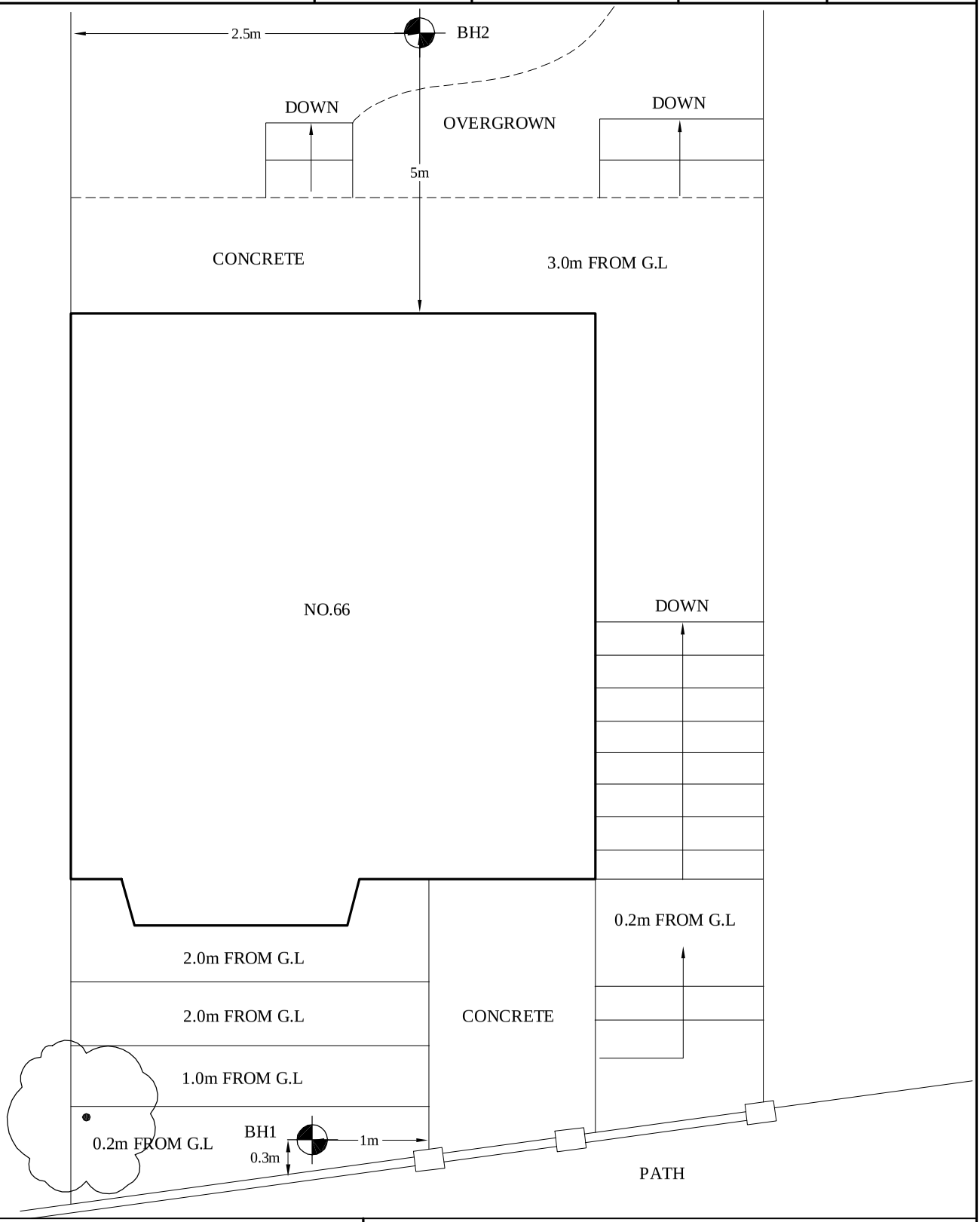
Client:	Symmetrys Ltd	**Scale:**	N.T.S.	**Sheet:**	1 of 1	**Date:**	8.8.13
Location:	66 South Hill Park, London NW3	**Job No:**	3894	**Weather:**	Sunny	**Drawn by: JP**	**Checked by: ME**



Notes:

On site tree identification for guidance only. Not authenticated.

Key:

Tree/Shrub | Borehole | Trial Pit | G Gully | Tree Stump | Rain Water/ Soil Pipe | MH Manhole

QD A1

FOUNDATIONS HAVE BEEN BASED ON THE INFORMATION OBTAIN FROM ????? GEOTECHNICAL SITE INVESTIGATION. THE ENGINEER AND LOCAL AUTHORITY BUILDING CONTROL OFFICER ARE TO BE AFFORDED THE OPPORTUNITY OF INSPECTING THE FOUNDATIONS PRIOR TO CONCRETING.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL TEMPORARY SUPPORTS AND RESPONSIBLE FOR STABILITY OF THE STRUCTURE DURING THE WORKS

ALL TANKING TO SPECIALIST CONTRACTOR DESIGN

PROPOSED METHOD STATEMENT/ SUGGESTED SEQUENCE OF WORKS

1. LOCALALY UNDERPIN WALLS AT POSITIONS MARKED
2. INSTALL TEMPORARY STEELS TO PICK UP THE INTERNAL LOAD BEARING WALLS BY NEEDLING THE WALL AT 1200CTS USING 152X30UC SUPPORTED ON A 203UC
3. DEMOLISH ALL NON LOAD BEARING WALLS
4. UNDERPIN EXISTING VAULTS AND INSTALL TRANSITION UNDERPINS.
5. INSTALL ALL TEMPORARY PROPS AND FORM THE NEW CONCRETE UNDERPINS AND PERIMETER FOUNDATIONS IN AN UNDERPINS SEQUENCE. SEE DRAWING SK03 FOR PROPOSED PROPPING TO UNDERPINS
6. INSTALL NEW GROUND FLOOR STRUCTURAL STEEL
7. REINSTATE FLOOR JOISTS WITH 18MM WBP PLY TO CREATE STIFF FLOOR PLATE.
8. INSTALL WATERPROOFING

SUBCONTRACTOR DESIGN ELEMENTS

1. ALL TEMPORARY WORKS
2. ALL REINFORCEMENT DRAWINGS AND BAR BENDING SCHEDULES
3. THE DESIGN OF STAIRCASES, GLASS FLOORS AND ALL BALUSTRADES
4. CALCULATIONS AND DRAWINGS FOR STEEL TO STEEL CONNECTIONS
5. THE DESIGN OF ALL TANKING. THE PROPOSED DETAILS ARE TO BE REVIEW PRIOR TO WORKS COMMENCING ON SITE TOGETHER WITH THE LOCATION OF ALL WATER STOP BARS

NOTES

SHOULD THE CONTRACTOR WISH TO SPLICE ANY OF THE STEELS FOR ACCESS PURPOSES THE ARCHITECT AND ENGINEER SHOULD BE AFFORDED THE OPPORTUNITY OF REVIEWING THE PROPOSED SPLICE CONNECTION PRIOR TO FABRICATION. THE SPLICES SHOULD BE DESIGNED BY THE CONTRACTORS FABRICATOR AS FULL STRENGTH MOMENT CONNECTIONS AND CALCULATIONS WILL HAVE TO BE PROVIDED FOR THEM

ALL STEELWORK IN THE EXTERNAL WALLS ARE TO BE GALVANISED (80 MICRONS).

FOR ALL FIRE WORK PROTECTION TO STEELWORK REFER TO THE ARCHITECTS DRAWINGS

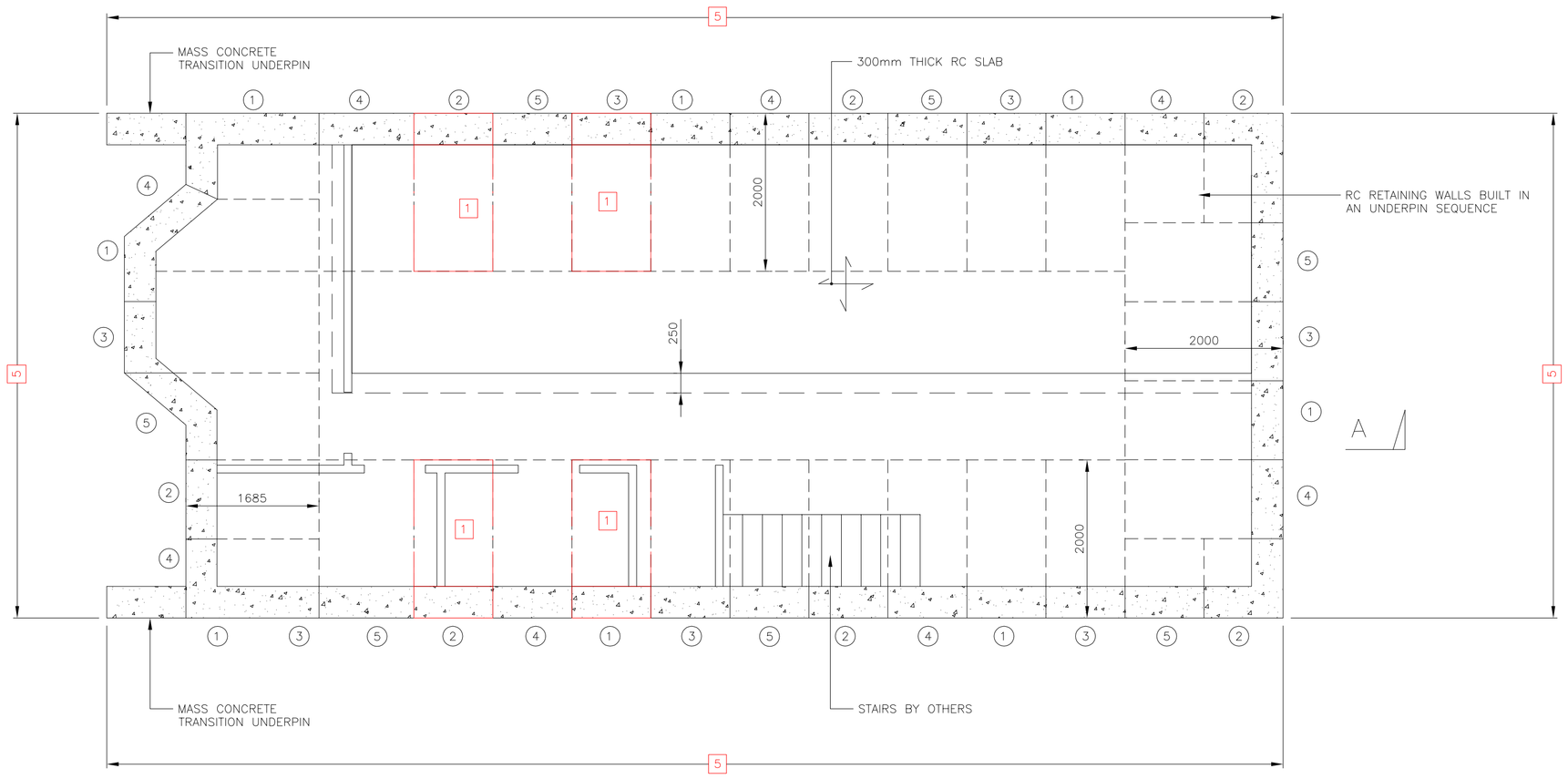
PLEASE REFER TO ARCHITECTS DRAWINGS FOR ALL SETTING OUT DETAILS, INSULATION AND VENTILATION DETAILS AND ALL DAMP PROOF COURSES

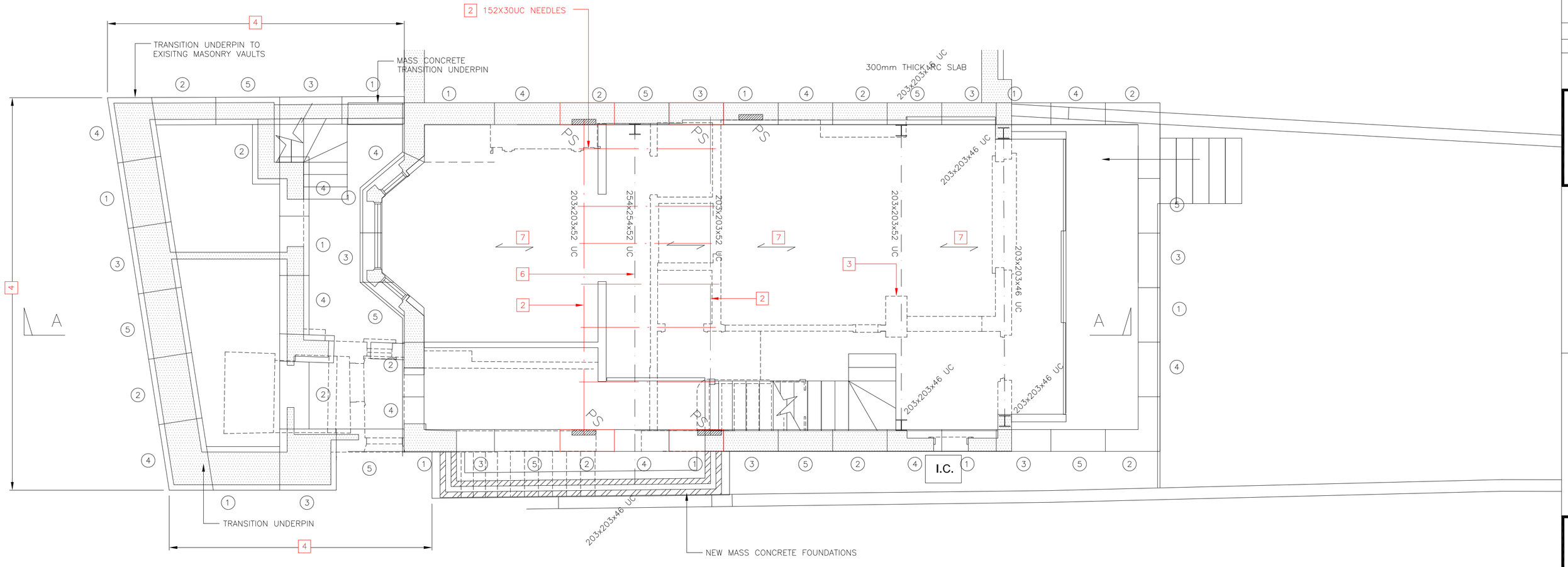
CONTRACTOR SHOULD ALSO REVIEW MECHANICAL ENGINEERS DRAWINGS FOR EXACT LOCATION OF SERVICE PENETRATION PRIOR TO CUTTING

LOCATION OF EXISTING AND PROPOSED DRAIN RUNS ARE TO BE CONFIRMED BY THE SERVICE ENGINEER

LEGEND

- DENOTES NEW STUD PARTITION. FLOOR JOISTS ARE TO BE DOUBLED UP OR NOGGINS ARE TO BE INSTALLED @ 300 CENTRES @ EVERY NEW STUD LOCATION
- DENOTES NEW BRICKWORK WITH 15N/mm SQUARED COMPRESSIVE STRENGTH AND GRADE iii MORTAR U.N.O
- DENOTES NEW BLOCKWORK WITH 7N/mm SQUARED COMPRESSIVE STRENGTH AND GRADE iii MORTAR U.N.O
- DENOTES EXISTING MASONRY
- SEE TYPICAL RESTRAINT DETAILS
- DENOTES 100 WIDE x 440 LONG x 225 HIGH MASS CONCRETE (C30) PADSTONE U.N.O
- (4) DENOTES SEQUENCE OF PROPOSED UNDERPINS. THE CONTRACTOR WILL HAVE TO PROVIDE HIS OWN SEQUENCE OF WORKS AND ALL METHOD STATEMENTS ONCE APPOINTED
- 300mm THICK FLAT SLAB WITH 75mm COVER TOP AND 25mm COVER BOTTOM. SEE PLAN FOR REINFORCEMENT
- DENOTES SPAN OF NEW TIMBER JOISTS
- DENOTES TEMPORARY BEAMS





Notes

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS & ENGINEERS DRAWINGS AND SPECIFICATIONS
2. DO NOT SCALE FROM THIS DRAWING

Rev	Date	By	Amendments
P1	05.09.13	AH	PRELIMINARY ISSUE

Drawing Status: PRELIMINARY

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Job Title

66 SOUTH HILL PARK LONDON, NW3

Drawing Title

PROPOSED BASEMENT PLAN

Job No.	Drawing No.	Revision
201374	SK01	P1

Scales 1:50 AT A1 — Original Size A1

Drawn By NIS Date AUGUST 2013 Checked AH

Company No. 5873122
VAT Registration No. 894 2993 61
Registered In England And Wales

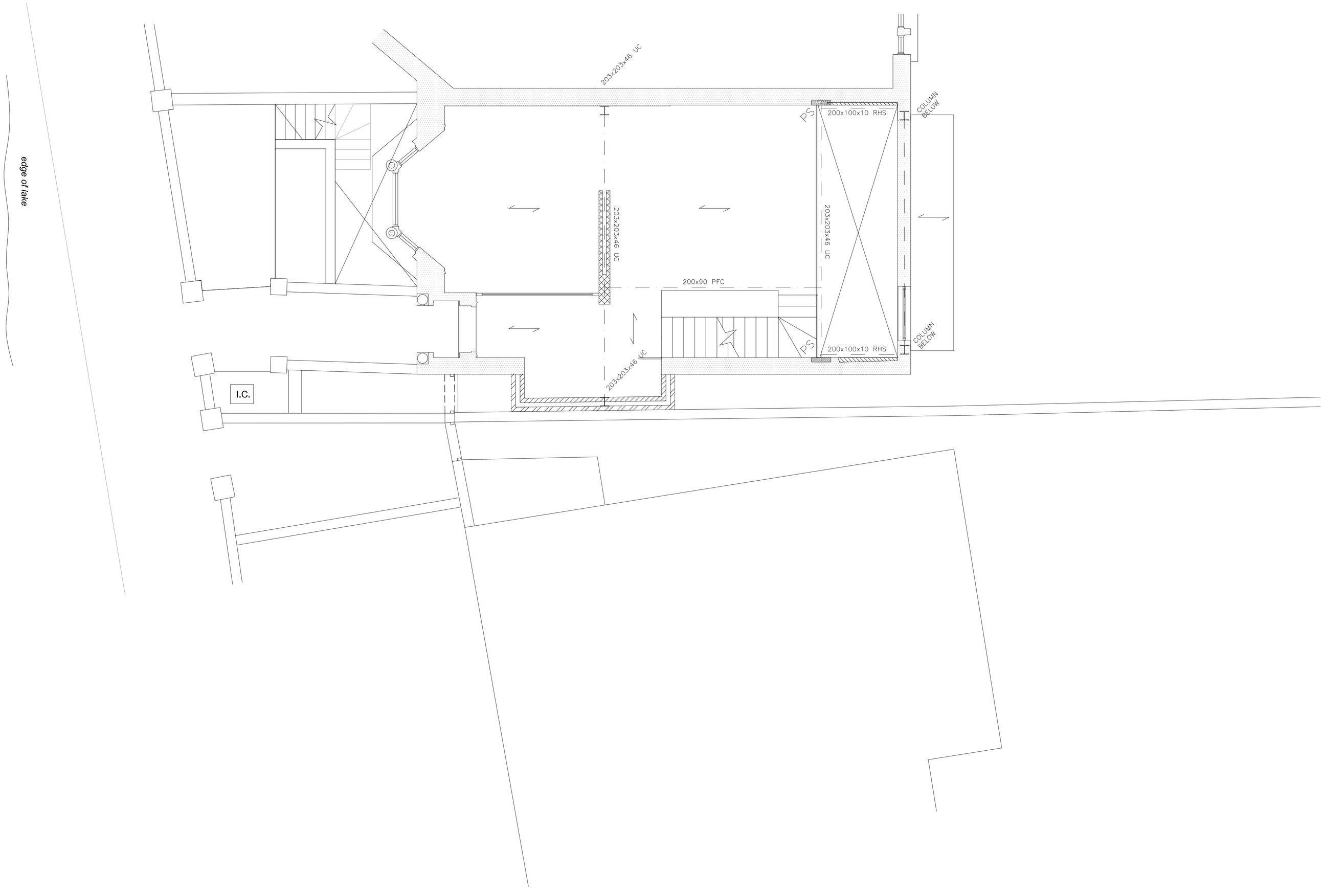
QD A1

THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL TEMPORARY SUPPORTS AND RESPONSIBLE FOR STABILITY OF THE STRUCTURE DURING THE WORKS

REFER TO ARCHITECTS DRAWINGS FOR ALL LEVELS AND SETTING OUT DETAILS

LEGEND

- DENOTES NEW STUD PARTITION. FLOOR JOISTS ARE TO BE DOUBLED UP OR NOGGINS ARE TO BE INSTALLED @ 300 CENTRES @ EVERY NEW STUD LOCATION
- DENOTES NEW BRICKWORK WITH 15N/mm SQUARED COMPRESSIVE STRENGTH AND GRADE iii MORTAR U.N.O
- DENOTES NEW BLOCKWORK WITH 7N/mm SQUARED COMPRESSIVE STRENGTH AND GRADE iii MORTAR U.N.O
- DENOTES EXISTING MASONRY
- SEE TYPICAL RESTRAINT DETAILS
- PS — DENOTES 100 WIDE x 440 LONG x 225 HIGH MASS CONCRETE (C30) PADSTONE U.N.O



Notes

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Drawing Title

PROPOSED UPPER GROUND FLOOR PLAN

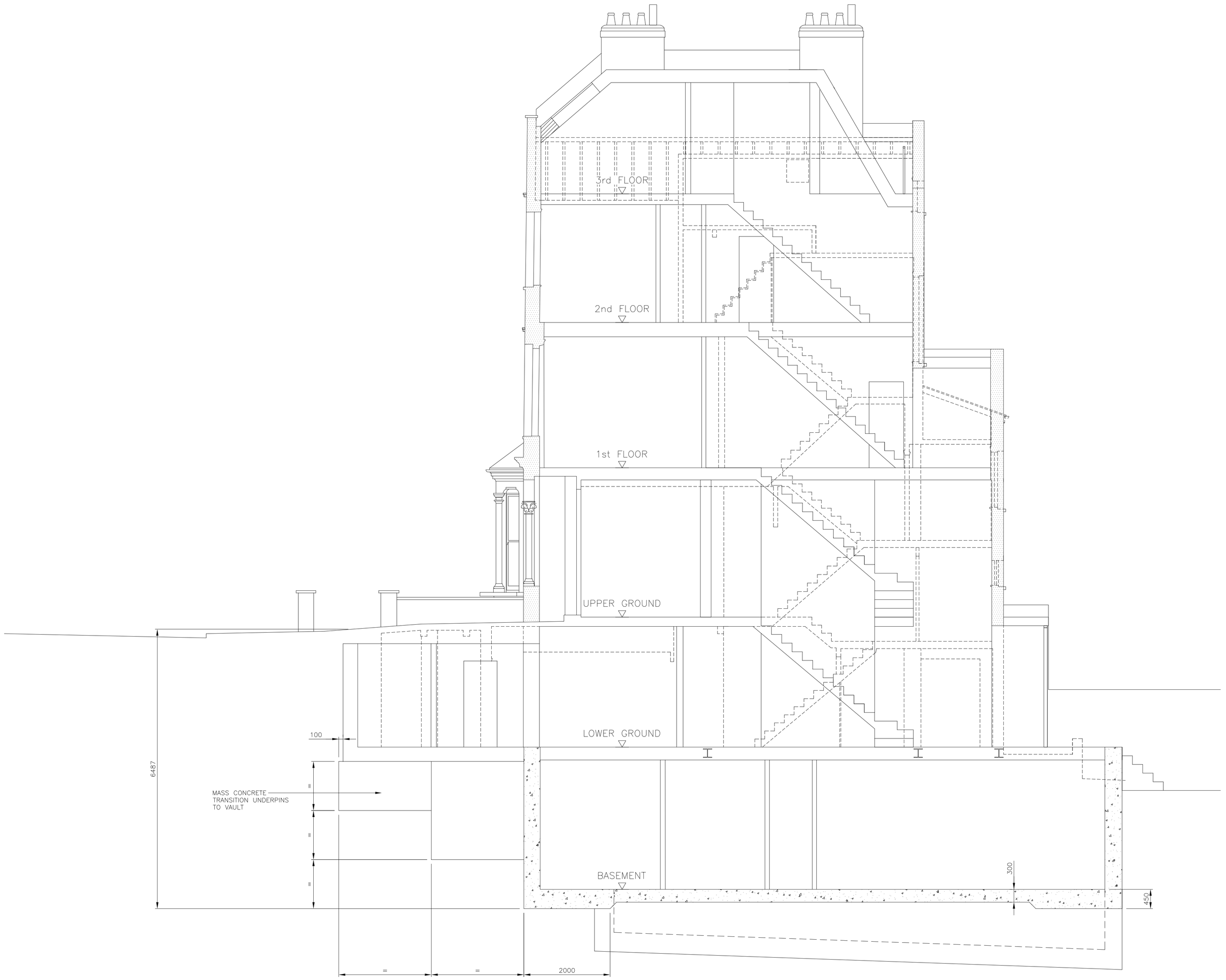
Job No.	Drawing No.	Revision
201374	SK02	P1

Scales 1:50 AT A1 — Original Size A1

Drawn By NIS — Date AUGUST 2013 — Checked AH

Company No. 5873122
VAT Registration No. 894 2993 61
Registered In England And Wales

QD A1



Notes

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Rev	Date	By	Amendments
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Drawing Title

PROPOSED SECTION A–A

Job No.	Drawing No.	Revision
201374	SK03	P1

Scales 1:50 AT A1 — Original Size A1

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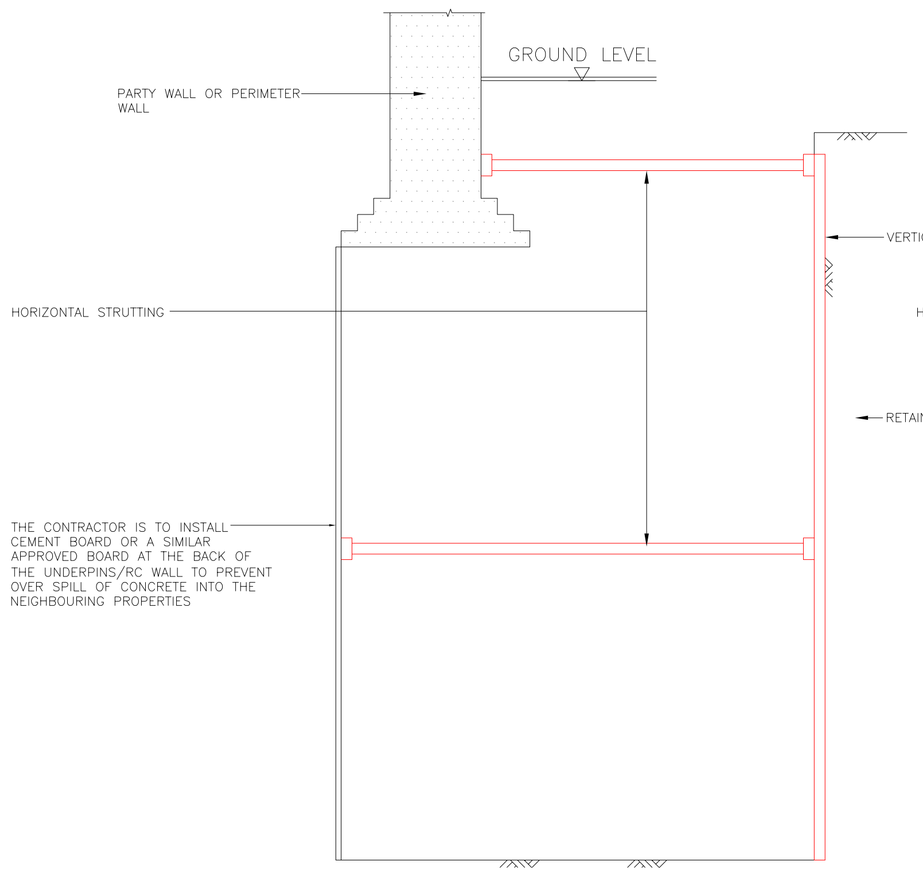
QD A1



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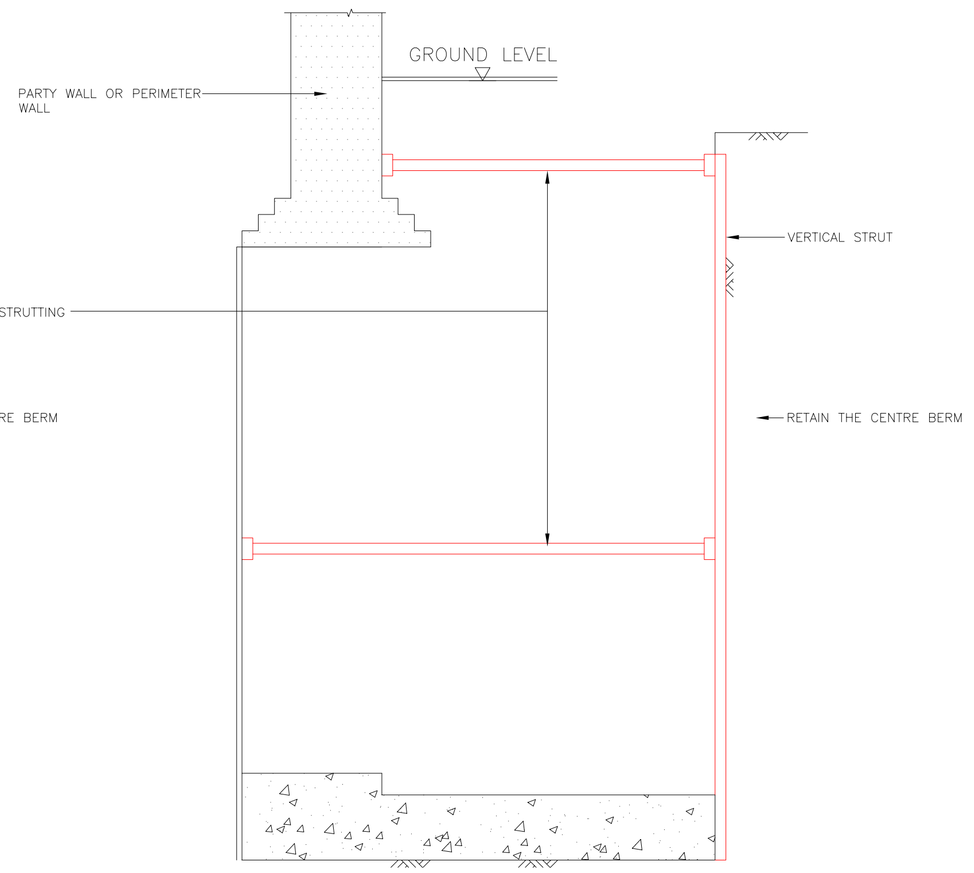

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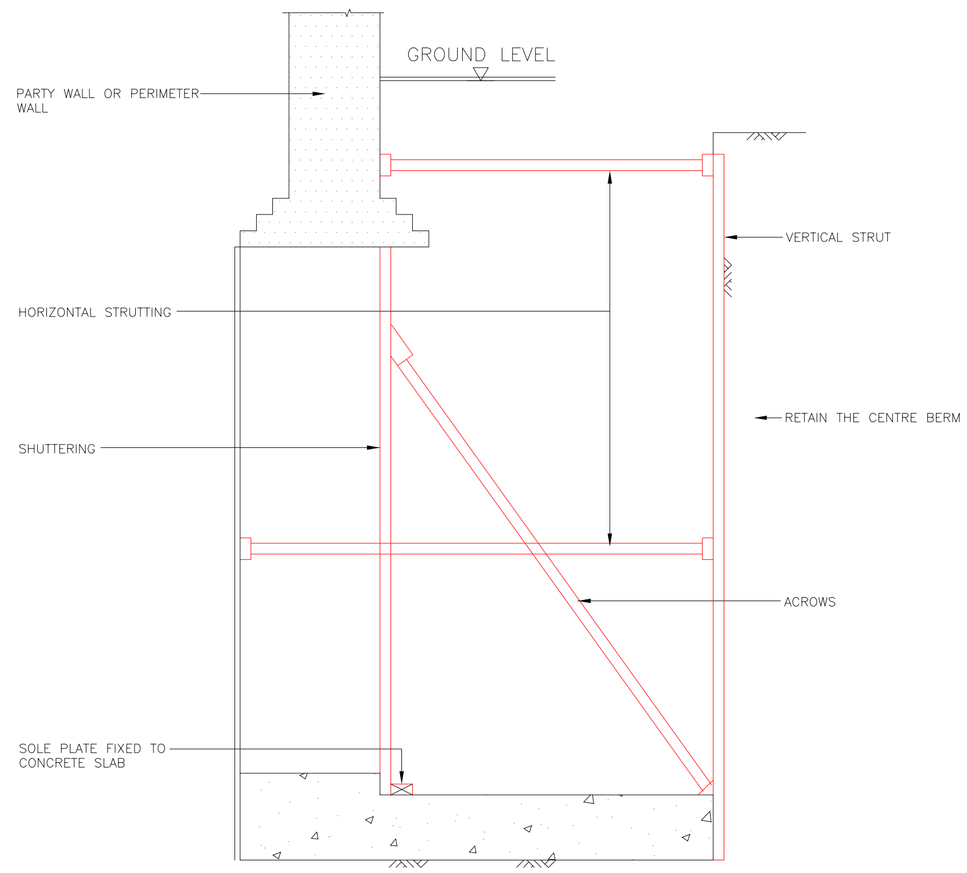

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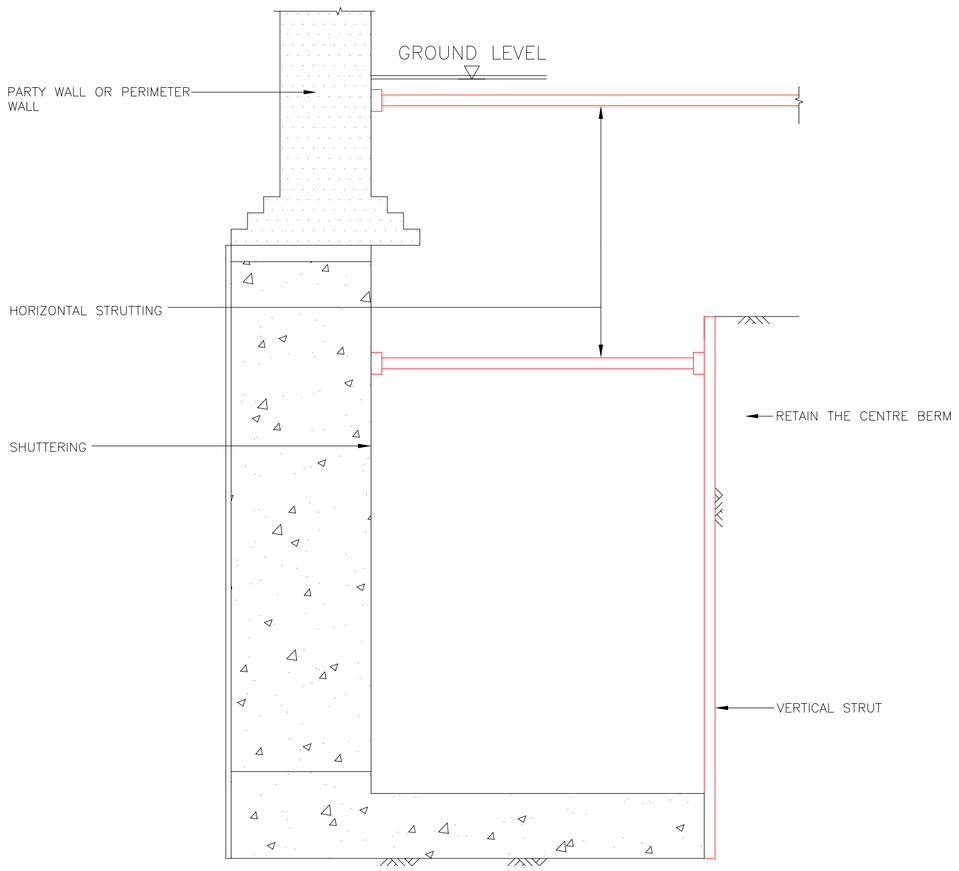

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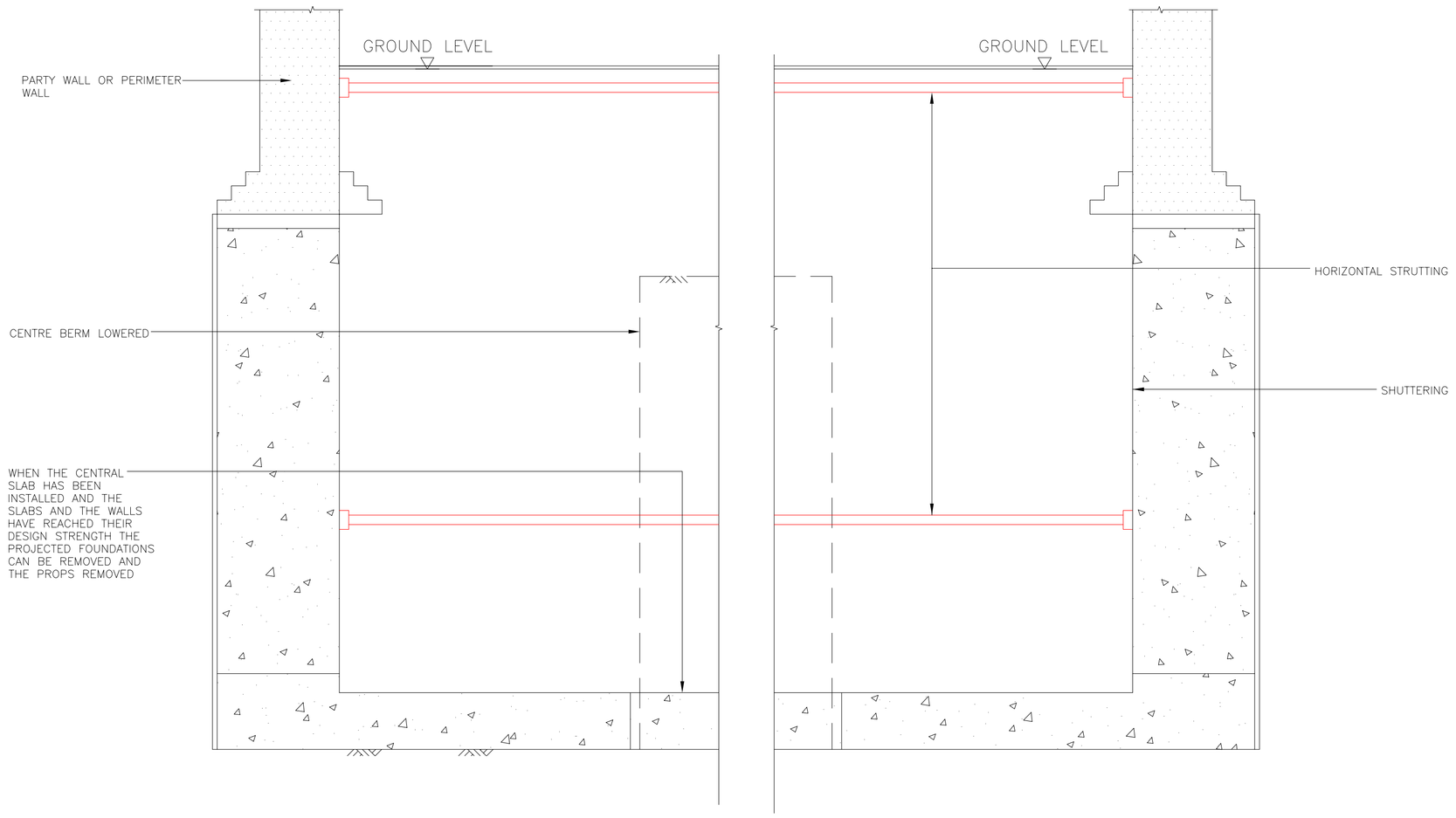

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Job Title
66 SOUTH HILL PARK
LONDON, NW3

Drawing Title
TYPICAL UNDERPINNING SEQUENCE

Job No.	Drawing No.	Revision
201374	SK04	P1

Scales SEQUENCE | Original Size A1
Drawn By NIS | Date AUGUST 2013 | Checked AH

66 SOUTH HILL PARK - BASEMENT IMPACT ASSESSMENT

APPENDIX E: City Of Westminster Flood Risk Maps.