Symmetrys Ltd
Structural Engineers

Basement Impact Assessment

Spiritualist Temple
Rochester Square
London
NW1

21st December 2016
2016061/DS
Rev. A – 27.06.17 – Drawings Updated
Rev. B – 04.12.17 – Scheme Updated
Rev C – 25.01.17 – Non Techincal Summary added, Clause 12.3

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E: Flood Risk Assessment – *UNDA Consultants via LMB Geosolutions Ltd*
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1. INTRODUCTION

1.1 Symmetrys Limited has been engaged by Spacelab Architects to carry out a structural report relating to *the proposed construction of a new three storey residential development at the rear of the spiritualist* temple, Rochester Square, London. It is proposed to demolish the existing masonry rear extension and develop the rear of the site with a three storey building including a single storey basement.

1.2 Our drawings and this report will be included within our client's planning application. Our documents are not intended for, and should not be relied upon by, any third party for any other purpose. Proposed and existing general arrangement drawings were passed to us from Spacelab Architecture.

1.3 This report will only detail the basement construction.

Photo 1 : Bird's eye view of rear elevation

Photo 2 : Bird's eye view of front elevation

1.3 <u>Reference documents</u>

The following documents have been used as guidance to complete this Structural Report:

1, Camden Planning guidance CPG4: Basements and Lightwells – July 2015
2, Camden's Core Strategy CS14
3, Camden Development Policy DP25
4, National Planning Policy Framework: Section 12.
5, The Lost Rivers of London, Nicholas Barton
6, LMB Geosolutions Basement Impact Assessment, Appendix D

2. EXISTING CONDITION

2.1. The existing structure is a double height single storey building of masonry construction with a timber pitched roof which used to be Rochester Square Spiritualist Temple, with a front and rear garden and a single storey extension to the rear.

Deformation of a masonry wall to the eastern boundary has taken place in the past due to the presence of a willow tree and subsequent horizontal forces applied to the footing of the wall from growth of the tree roots and heave of the soil stratum on which it is founded. The tree has since been removed from site.

2.2 *The main building and existing garden walls will be retained and repaired as necessary as part of the redevelopment works. Symmetrys envisage opening up works will be undertaken to further establish the condition of the existing building prior to undertaking detailed design to enable existing defects to be considered.*

3.0 DESIGN PROPOSALS

3.1 The proposal is to construct a new reinforced concrete basement and ground floor slab with load bearing wall construction above ground floor level, see structural drawings in Appendix A.

3.2 <u>Below the ground floor</u>

The proposed structure consists of a reinforced concrete shell below ground with a suspended reinforced concrete ground floor slab.

It is proposed to construct the basement walls using reinforced concrete retaining walls built in an underpinned sequence which is a well-known and frequently used technique to form basements. The use of temporary propping will ensure that the basement does not cause any local ground movements whilst the construction is taking place. The basement slab will be a 400mm thick ground bearing reinforced concrete slab and will be tied into the toes of the underpin structure. This will ensure that the basement slab resists any potential soil pressure due to heave or hydrostatic loads from localised perched water, leaking pipes, etc.

Heave forces from the ground occurs following removal of overlying ground and can cause short and long term deformation of substructure. Referring to LMB Geosolutions report, see Appendix C, there is a potential for long term heave deformation.

The basement structure will also be subject to hydrostatic pressure, and will be designed assuming a groundwater level of 1m below existing external ground level.

A heave protection system will be provided beneath the basement slab which will be designed to withstand the hydrostatic pressures and to transfer the forces to the perimeter retaining walls. These uplift forces will be resisted by the significant dead load of the existing building. *Our structural calculations also demonstrate that the existing structure can be safely supported on the proposed retaining wall structure within parameters provided by LMB Geosolutions for ground bearing capacity.*

The new ground floor will be formed with reinforced concrete slabs that span on the reinforced concrete walls. The 250mm thick concrete slab will act as a permanent prop to the heads of the new basement walls. To ensure continuity between the RC retaining walls and the masonry walls, dowels will be drilled into the underside of the masonry walls and cast in with the RC walls.

3.4 *Above the ground floor*

The superstructure is likely be load bearing masonry with timber joist floors and roof supported on the 250mm thick reinforced concrete ground floor slab. Please refer to appendix A for structural drawings and clause 6.1 for suggested sequence of works.

3.5 Waterproofing

BS8102 sets out guidance for the waterproofing of basement structures according to their use. Two waterproofing system must be implemented in the construction of basements to be used as habitable spaces. With this in mind the use of tanked, integral and/or drained methods of waterproofing will have to be considered, with the most likely solution being waterproof concrete for the secant piles and liner walls, and a cavity wall drainage system within the structure. This will require a sump and pump drainage system. These items will be considered once a tanking specialist has been employed.

4. SCREENING AND SCOPING MATRIX

Refer to LMB Geosolutions report in appendix D for the screening and scoping matrix. Based on their findings, they undertook a ground investigation assessment and flood risk assessment to determine the impact of the proposed basement.

5. SITE INVESTIGATION AND STUDY

5.1 Desktop Study

The first stage of a site investigation is to develop an understanding of the site and immediate surroundings. LMB carried a desktop study including a site walkover, see Appendix C.

5.2 Ground Conditions

The local geographical survey maps, accessible via the British Geological Society website http://mapapps.bgs.ac.uk/geologyofbritain/home.html?mode=boreholes, indicates that the underlying soil strata, much like the rest of London, is London Clay. Having reviewed the borehole cut in the vicinity of the property on Rochester Square, with the BGS reference TQ28SE4 (see figure 1), stiff clay was confirmed down to 44m.

Figure 1 - Historical bore hole log map taken from the British Geological Surveys

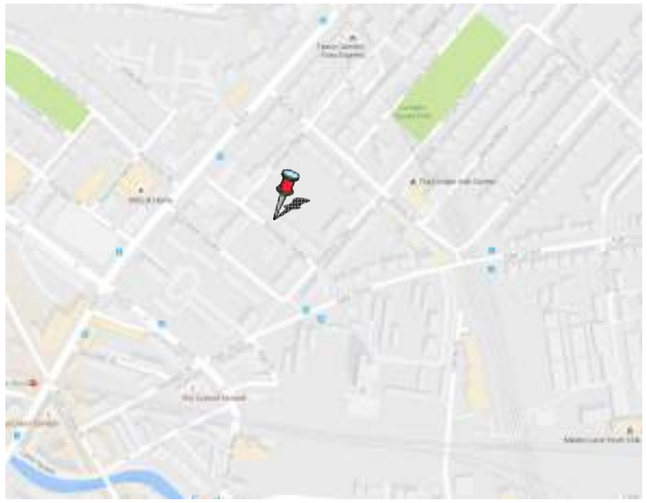

Figure 2 : Map showing local transport tunnels

5.3 Ground Investigation / Opening-Up Works Undertaken:

5.3.1 2No. 15m deep boreholes were cut to the east and west of the site to establish local soil stratum, extract soil samples for testing and install monitoring wells to allow for groundwater monitoring.

5.4 Ground Investigation and Geology

5.4.1 The interpretative report of the site-specific investigation has been undertaken by LMB Geosolutions Ltd in appendix C. The findings and recommendations are described in their report dated December 2016

5.4.2 The ground conditions are summarised as follows:

Borehole 1	
G.L to 0.8m	Made Ground
0.8m to 1.75m	Soft becoming Firm Light Brown Clay – Head Deposits
1.75m to 3.65m	Firm Brown to Light Brown gravelly Clay – Head Deposits
3.65m to 8.75m	Firm becoming stiff brown Clay – London Clay
8.75m to 15m	Stiff becoming very stiff dark grey/brown Clay – London Clay
Borehole 2	
GL to 0.65m	Made Ground
0.65m to 1.5m	Soft becoming firm light brown to brown Clay – Head Deposits
1.5m to 3.75m	Firm brown to orange/brown very gravelly Clay -Head Deposits
3.75m to 9.5m	Firm becoming stiff brown with occasional orange/brown sandy partings clay – London Clay
9.5m to 15m	Stiff becoming very stiff dark grey Clay – London Clay

5.4.3 Ground Water Monitoring:

Groundwater was recorded during the monitoring and is considered to form a thin but laterally continuous aquifer unit within the Head Deposits over the area of the site.

5.4.4 The report confirms that the safe ground bearing pressure at 4 – 4.5m below ground level should be 140kN/m2.

5.5 Hydrology

Referring to the “The Lost Rivers of London” by Nicholas Barton the closest known watercourse is described to be to the south west of the site approximately 150m away which is known as the Fleet which runs from Hampstead Heath heading southwards. UNDA consulting has undertaken a Flood Risk Assessment for the site, see Appendix E.

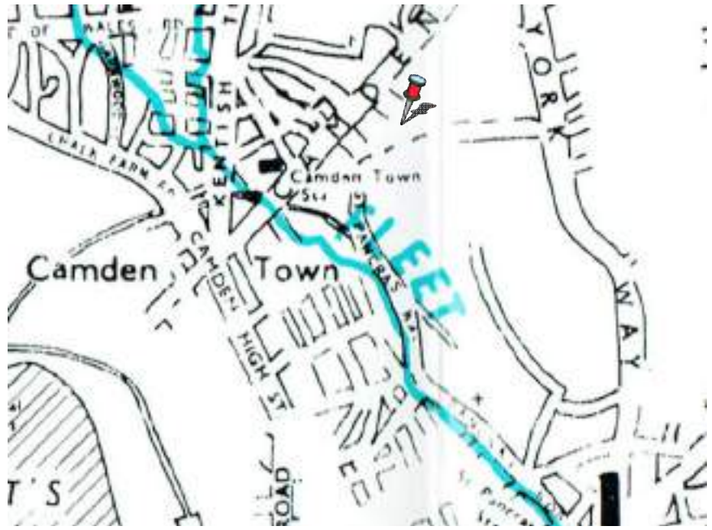

Figure 3 : Extract from the Lost River of London by Nicholas Barton

5.6 Flooding

A Strategic Flood Risk Assessment was carried out as groundwater was recorded during the ground investigation tests.

It is reported in the Flood Risk Assessment that:

- The site is situated with Flood Zone 1 when using the Environment Agency Flood Map for Planning (Rivers and Sea)

- The EA Surface Water Flood Map suggests that the site lies in close proximity to an area of "High" to "Medium" risk of flooding from surface water.
- The risk of flooding posed to the site by fluvial, tidal, groundwater and sewer surcharge flooding would appear to be negligible/low.

According to the strategic flood risk assessment map from URS, see figure 4 below, the site is not located within a critical drainage area nor in a local flood risk zone.

5.7 Post completion of the Flood Risk Assessment has been completed the proposed depth of the basement structure has increased by 300mm. This will have no adverse effect on the results of the Flood Risk Assessment.

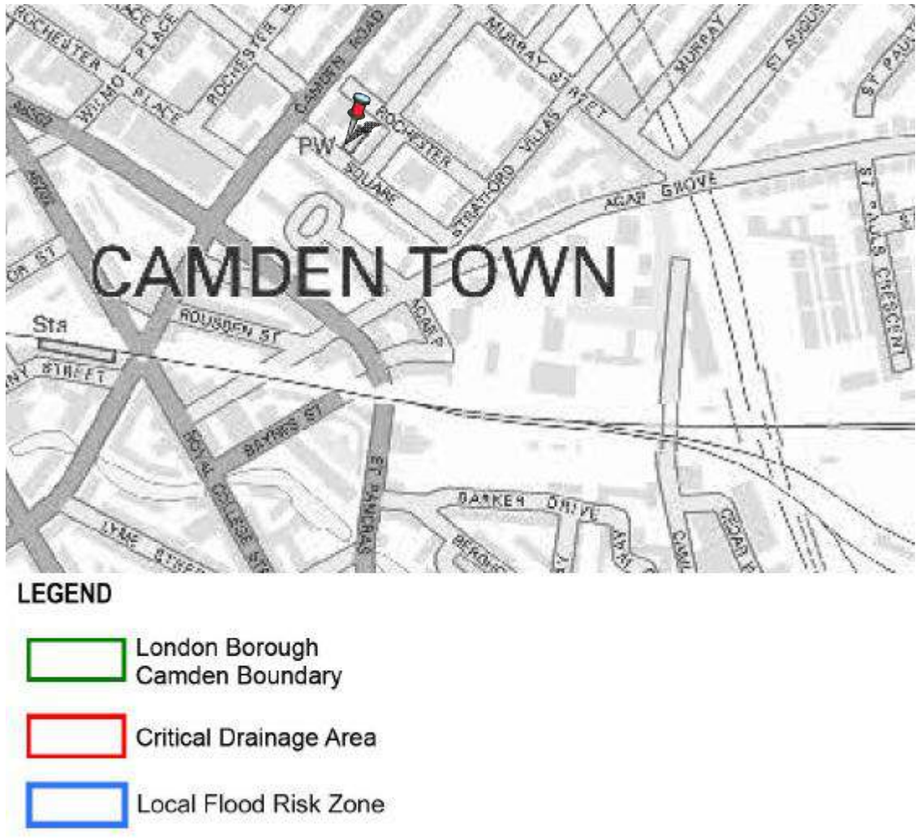

Figure 4 : Extract from Camden Strategic Flood Risk Assessment

6. PROPOSED SEQUENCE OF WORKS

6.1 The structural method statement provided, (see Appendix A), is for the design team's design development and for the client's planning application. The appointed contractor will be responsible for all temporary supports and for the stability of the structure during the works. The method of construction adopted minimises the need for temporary works. *However, propping during the underpinning sequencing will be required to minimise the risk of ground movement occurring.*

To ensure that the retained engineer's intent is correctly interpreted by the contactor, they will be required to submit all temporary works proposals to review a minimum of 7 working days prior to commencing excavation. The contractor should also submit a dewatering strategy to ensure a strategy is agreed should water be encountered.

6.2 Dewatering Strategy

Widely used methods for dewatering are described below. The appointed principal contractor must submit a detailed dewatering strategy to Symmetrys Ltd 14 days prior to commencing works on site.

Local Dewatering- simple sump method

All excavations shall be kept clear of water by submersible pump. Should large quantities of water be encountered, this will be pumped into the existing drainage system using a larger sump pump via a sediment settling tank. Long period of pumping will be avoided and regular inspections of the work area to ensure de-watering is carried out only when necessary,

Jetted Sumps

This method achieves the same objective as the simple sump methods of dewatering but will minimise the soil movement associates with this and other open sump methods. A borehole is formed in the subsoil by jetting a metal tube into the ground by means of pressurised water, to depth within the maximum suction lift of the extract pump. The metal tube is withdrawn to leave a void for placing a disposable well point and plastic suction pipe. The area surrounding the pipe is filled with course sand to function as a filtering media.

Other dewatering

Strategies such as grouting and ground freezing are likely to be impractical for a project of this size. However, this is to the discretion of the main contractor.

7. CONSTRUCTION METHOD STATEMENTS

Please see drawings in Appendix A for construction sequence and method statements. A Construction Management Plan has also been undertaken and submitted with this planning application. It contains a draft programme of the proposed works.

8. IMPACT ASSESSMENT

8.1 Stability of Neighbouring Structures

8.1.1 Due to the robust engineering principles and construction method applied, the extent of movement is limited in accordance with British and European codes. We can confirm that the proposed structural design and method of construction of the basement has been developed with a view to ensuring structural safety, and that if constructed in accordance with this document the works will be able to be completed without any adverse impact on the structural stability of the neighbouring properties, other adjacent structures, adjoining land and gardens or the adjoining Public Highway.

8.1.2 The reinforced concrete structure will be designed to accommodate surcharges from the neighbouring property, public highway and ground pressures. The structure will have adequate stiffness to ensure that the lateral deflections do not exceed the appropriate limits recommended by British Standards Codes of Practice in order to ensure that potential ground movements be kept to acceptable limits.

8.1.3 The structures will be designed to transfer horizontal and vertical loads into the ground safely.

8.2 Ground Movement Assessment

8.2.1 Ground movement assessment report has been undertaken by LMB Geosolutions and can be found in Appendix D.

8.2.2 LMB Geosolution's report confirms that the ground movement model predicts movement to fall within category 1 generally and category 2 to the adjacent building. The categories are described in figure 5.

8.3 Figure 2, shows the position of the Northern Line relative to the proposed basement. Due to the tunnels being 520m away, which is considered a significant distance, no consultation with the London Underground Asset Protection team will be undertaken.

Category of damage	Description of typical damage (Nature of repair in italic type)
0	Hairline cracking which is normally indistinguishable from other causes such as shrinkage and thermal movement. Typical crack widths 0.1mm. *No action required*
1	Fine cracks which can *easily be treated using normal decoration*. Damage generally restricted to internal wall finishes: cracks rarely visible in external brickwork. Typical crack widths up to 1mm.
2	*Cracks easily filled. Recurrent cracks can be masked by suitable linings.* Cracks not necessarily visible externally: *some external repointing may be required to ensure weather tightness.* Doors and windows may stick slightly and *require easing and adjusting*. Typical crack widths up to 5mm.
3	Cracks which *require some opening up and can be patched by a mason. Repointing of external brickwork and possibly a small amount of brickwork to be replaced.* Doors and windows sticking, service pipes may fracture. Weather-tightness often impaired. Typical crack widths are 5 to 15mm, or several of, say 3mm.
4	Extensive damage which *requires breaking-out and replacing sections of walls,* especially over doors and windows. Windows and door frames distorted, floor sloping noticeably*. Walls leaning or bulging noticeably; some loss of bearing in beams. Service pipes disrupted. Typical cracks widths are 15 to 25mm, but also depends on number of cracks.
5	Structural damage which *requires a major repair job, involving partial or complete rebuilding.* Beams loose bearing walls lean badly and require shoring. Windows broken with distortion. Danger of instability. Typical crack widths are greater than 25mm, but depends on the number of cracks.

Important Note. Crack width is one factor in assessing category of damage and should not be used on its own as a direct measure of it. * 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.

Figure 5: Building damage categories used by the IStructE and ICE

9. PARTY WALL MATTERS

9.1 The scope of works falls within the Party Wall Act 1996. Procedures under the Act will be dealt with by the client's Party Wall Surveyor. The Party Wall Surveyor will prepare and serve necessary Notices under the provision of the Acts and agree Party Wall Awards in event of disputes. The Contractor will be required to provide the Party Wall Surveyor with the appropriate drawings, method statements and all other relevant information covering the works notifiable under the Act. The resolution of the matters under the Act and provision of Party Wall Awards will protect the interests of all owners.

9.2 Monitoring

It is proposed that the structural stability of the surrounding/adjacent properties is safeguarded by a system of movement monitoring.

The Contractor shall monitor the movements of the elevations of the adjacent properties around the perimeter of the proposed excavation. The monitoring shall be undertaken by a specialist survey company. The monitoring system will have at least the following characteristics:

1) The existing facades of the neighbouring properties as well as the flank wall of the neighbouring building will be monitored near ground level and at roof level, at intervals not exceeding 3m centres.

2) Monitoring points (targets) shall be firmly attached, to allow 3D position measurement, for the duration of the work, to a continuous and uninterrupted accuracy of -/+ 1mm. A suitable remote reference base/datum unaffected by the works will be adopted, one located at least 50m from the site.

3) Points/targets shall be measured for 3D positioning on, at not less than the following intervals:

- Before any works commence (base reading)
- Weekly during the period of basement excavation/construction
- Monthly during the course of the remainder of the works.
- Six months after the completion of all construction works.

4) All measurements shall be plotted graphically, to clearly indicate the fluctuation of time. The survey company shall submit the monitoring results to the Engineer (Symmetrys Ltd) and to the Adjoining Owners Party Wall Surveyors/Engineer within 24 hour of measurement, graphically and numerically.

5) The following trigger levels for movement are proposed for agreement. In the event of a trigger value being reached the Contractor will immediately stop any work that might cause further movement, assess the situation and propose alternative methods for proceeding, with definitive further movement limits for those later steps.

6) Trigger movement limits are proposed as follows:

A) Existing Buildings Horizontal/Vertical movement

Amber	+/-10mm	All parties notified.
Red	+/-15mm	Works reviewed

B) The garden walls and excavation

Amber	+/-10mm	All parties notified.
Red	+/-15mm	Works reviewed

10. DRAINAGE

10.1 The above ground drainage will be subject to invert levels, drained by gravity to the existing combined sewage system. The below ground drainage will be drained to a submersible package sewage station situated below the basement slab which will then be pumped via a rising drain to the nearest available inspection chamber on the existing gravity drainage system. This can then flow by gravity into the existing combined sewage system. To mitigate the risk of back flow suitable measures such as non-return valves will be incorporated into the drainage design.

10.2 There will be appropriate drainage installed to the landscaping on the site. There will most likely be no available space for a typical attenuation system. It is therefore envisaged at this stage that a hydro break chamber and oversized pipes will be utilised as part of the surface water drainage strategy. However, this is subject to review and detailed design stage.

11. SUSTAINABILITY

As the substructure of the proposed extension will involve significant amounts of concrete, cement replacement alternatives should be considered. Cement replacements can used to replace up to 40% of the cement in concrete mix. These replacements are typically waste products from the energy production industry such as PFA (pulverised fuel ash) and GBFS (granulated blast furnace slag) are recycled and not sent to landfill sites. Furthermore this also reduces the amount of cement that needs to be mined. Concrete should be bought from a local supplier to further reduce the carbon footprint of transport.

There is a significant amount of reinforced concrete on the project for which steel reinforcement bars will be required. By specifying reinforcement from a UK supplier it ensures that the reinforcement is made from 100% recycled steel. Any structural steelwork should be sourced from a British manufacturer to ensure that rolled sections are made from at least 60% recycled steel. Sourcing the steel from a local supplier will further reduce the transport carbon footprint.

The use of timber as a structural element is to be maximised as timber production actively negates greenhouse gas production. Furthermore all timber is to be FSC certified insuring that the timber is produced from a sustainable source.

12. ADDENDUM TO APPENDICES

12.1 At the time of writing the technical reports appended to this BIA, it was proposed to demolish the existing temple entirely and build a single storey basement on the full perimeter of the site. The basement was proposed to be constructed with secant piles and reinforced concrete liner walls.

12.2 *A first version of the Basement Impact Assessment, along with proposed drawings and the reports, had been issued in December 2016 for a planning application. The structural drawings in Appendix A of this BIA have been revised and reissued in June 2017 to show some minor changes in the layout of the proposals which did not impact the conclusions of any of the assessments in the BIA.*

12.3 *It is now proposed to retain the existing temple and contain the development in the rear of the site. The new proposed basement will only extend below the new development and will be smaller than the first scope considered for the ground movement assessment and the flood risk assessment. As the current proposals are less invasive than those upon which the ground movement and hydrogeological reports were based, the conclusions of those previous reports still apply.*

12.4 *The proposed drawings in Appendix A have been revised for the purpose of this planning application. They reflect the new scope of work and the perimeter of the existing temple. The suggested sequence of works has also been revised to show the proposed underpinning sequence.*

12.5 *The ground movement assessment and flood risk assessment have modelled the impact of the basement on the neighbouring structures and potential flood risk based on the first larger scheme. However, by reducing the scope of the basement, we are reducing any risks described in those reports.*

By limiting the extent of the basement, we are also reducing the possible impacts on the neighbouring structures. Therefore the predicted damage category will not be impacted by the scheme proposed in this basement impact assessment. LMB Geosolutions provided a letter as an addendum to their ground movement assessment that confirm the new proposed sequence and the reduced layout will not have any additional adverse effects on the neighbouring properties.

Furthermore, the expected heave force will be less than those anticipated during our calculations in Appendix B.

12.6 *The findings in the Desktop Study and the Ground Investigation report undertaken by LMB Geosolutions are not affected by the change of scheme.*

12. SUMMARY

12.1 It is essential that a thorough review of all temporary works, contractors' method statements and calculations for these works is undertaken by a suitable qualified structural engineer prior to works starting. The permanent works will also be submitted to Building Control and the necessary Party Wall Surveyors for approval prior to the works commencing on site.

12.2 The proposed works at the land at the rear of spiritualist temple, Rochester Square have been designed with robust structural principles and methods of construction that are widely used and known. This will ensure the integrity of neighbouring structures and roadways are not compromised during its construction.

12.3 *The findings of this Basement Impact Assessment can be summarised as per below:*

- *The lower ground floor extension will be predominantly within London Clay.*
- *The development is expected to have negligible impact on surface water flow and flooding,*
- *Monitoring of adjacent properties will be undertaken*
- *The proposed development is not expected to provoke any cumulative effect as no existing basement was identified in the adjacent properties*.

12.4 This assumed Method Statement and Structural report has been completed by Symmetrys Limited have been reviewed by Christopher Atkins CEng MIStructE who is the Director of Symmetrys Limited.

David Snaith
BEng(Hons) PGCert Structs
Engineer

Christopher Atkins
CEng MIStructE
Managing Director

Symmetrys Limited
Consulting Structural Engineers

DOCUMENT ISSUE REGISTER

Job Number 2016061
Job Name Rochester Square, London **Series** 1 **Sheet Number** 1

		ISSUE DATE																
DRG. No.	**DOCUMENT TITLE**	SIZE	16.12.16	20.12.16	27.06.17	10.11.17	04.12.17											
		A1																
01	Basement Plan	A1	P1	P2	P3													
02	Ground Floor Plan	A1	P1	P2	P3													
03	Section A - A	A1	P1	P2	P3	P4	P5											
04	Proposed Construction Method Statement	A1	P1	P2	P3	P3	P4											
05	Underpinning Sequence					P1												
MEDIA TYPE D=Disk P=Print N=Negative E=Email		E	E	E	E	E												
DOCUMENT STATUS: P=Preliminary I=Information T=Tender C=Construction		P	P	P	P	P												
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Environmental:																		
Building Control:																		
Project Manager:																		
Contractors:																		
Party Wall:																		
File:	Symmetrys Ltd	~	~	~	~	~												

FOUNDATIONS HAVE BEEN BASED ON THE INFORMATION OBTAINED FROM LMB GEOSOLUTIONS 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 WORKS

CONTRACTOR/SPECIALIST DESIGN ELEMENTS

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

NOTES

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

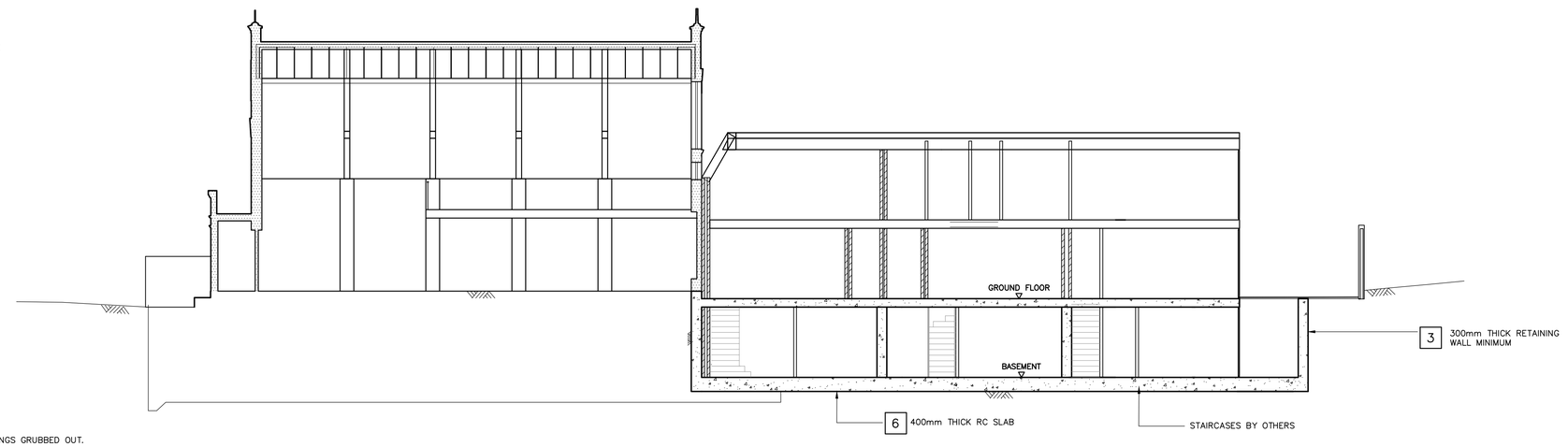
– PLEASE REFER TO ARCHITECTS DRAWINGS FOR ALL SETTING OUT DETAILS, INSULATION AND VENTILATION DETAILS, DAMP PROOF COURSES AND ALL TANKING DETAILS

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

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

PROPOSED METHOD STATEMENT/ SUGGESTED SEQUENCE OF WORKS

1. EXISTING REAR EXTENSION TO BE DEMOLISHED WITH EXISTING FOOTINGS GRUBBED OUT.
2. INSTALL TRANSITION UNDERPINS
3. FORM THE NEW CONCRETE UNDERPINS AND PERIMETER FOUNDATIONS IN AN UNDERPINNED SEQUENCE. SEE DRAWING 05 FOR PROPOSED PROPPING TO UNDERPINS
4. EXCAVATE BASEMENT
5. INSTALL ALL DRAINAGE AND THEN FORM BASEMENT SLAB
6. FORM RC BASEMENT SLAB
7. FORM RC GROUND FLOOR SLAB KEEPING THE TEMPORARY PROPS IN PLACE
8. REMOVE TEMPORARY WORKS IN REVERSE ORDER OF INSTALLATION
9. INSTALL WATERPROOFING



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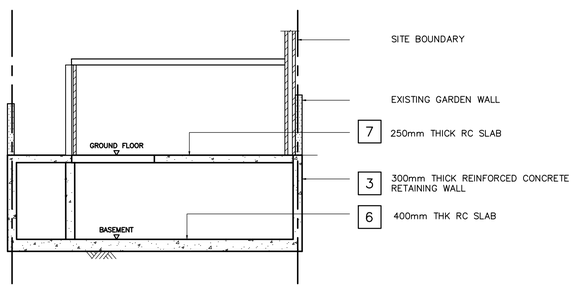

SECTION B–B
1:100

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

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
P5	04.12.17	CC	SCHEME UPDATED
P4	10.11.17	JSH	SCHEME UPDATED
P3	27.6.17	DS	UPDATED TO ARCH'S LATEST SCHEME
P2	20.12.16	DS	TITLE BLOCK AMENDED & UPDATED TO ARCH's DESIGN
P1	16.12.16	SAV	PRELIMINARY ISSUE

Drawing Status: PRELIMINARY

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Job Title

SPIRITUALIST TEMPLE
ROCHESTER SQUARE
LONDON, NW1

Drawing Title

SECTION A – A
& SECTION B – B

Job No.	Drawing No.	Revision
2016061	03	P5

Scales 1:100 AT A1 | Original Size A1

Drawn By SAV | Date NOV 2016 | Checked DS

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

REFER TO ARCHITECTS DRAWINGS FOR ALL SETTING OUT DETAILS

CONTRACTOR/SPECIALIST DESIGN ELEMENTS

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

LEGEND

- DENOTES NEW MASONRY WALLS BUILT IN 15N/mm² COMPRESSIVE STRENGTH BRICKWORK AND GRADE iii MORTAR
- DENOTES NEW MASONRY WALLS BUILT IN 7N/mm² COMPRESSIVE STRENGTH BLOCKWORK AND GRADE iii MORTAR
- DENOTES NEW NON LOAD BEARING WALL BY ARCHITECT
- DENOTES EXISTING MASONRY OR TIMBER WALLS
- (4) DENOTES SEQUENCE OF PROPOSED UNDERPINS. THE CONTRACTOR WILL HAVE TO PROVIDE HIS OWN SEQUENCE OF WORKS AND ALL METHOD STATEMENTS ONCE APPOINTED

NOTES

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

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

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

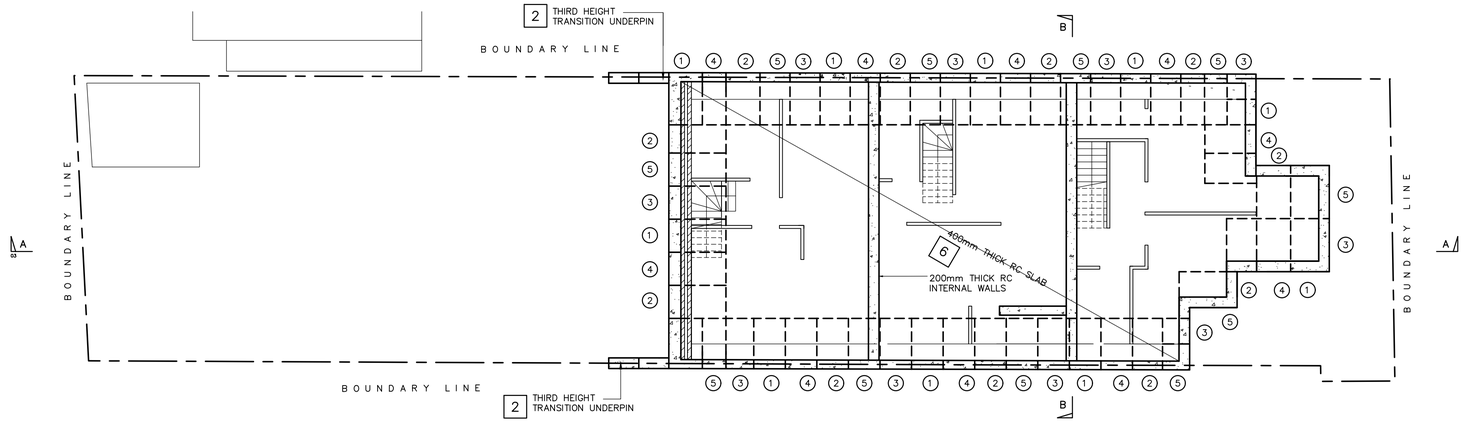
– FOR ALL FIRE WORK PROTECTION TO STEELWORK REFER TO THE ARCHITECTS DRAWINGS

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

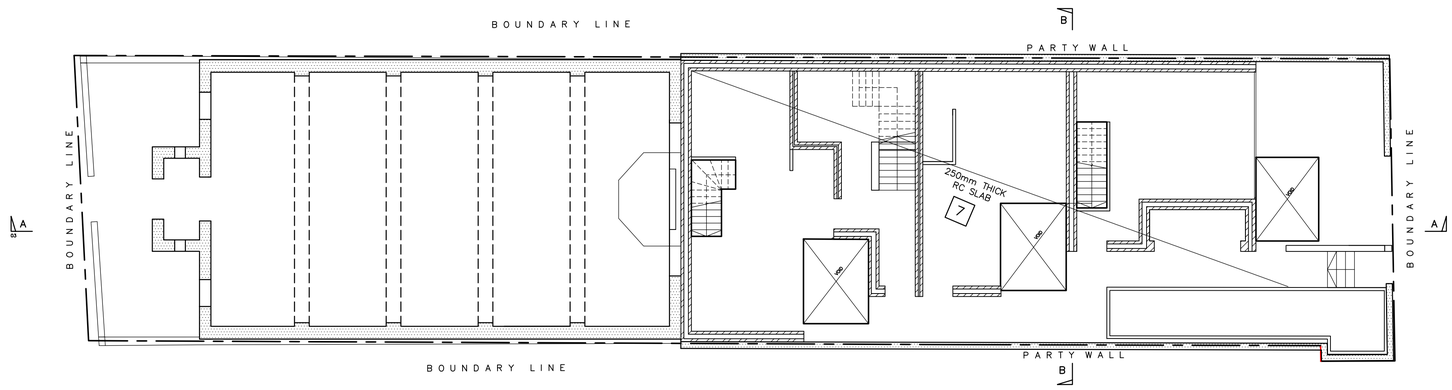
– ALL STAIRS BY OTHERS

PROPOSED METHOD STATEMENT/ SUGGESTED SEQUENCE OF WORKS

1. EXISTING REAR EXTENSION TO BE DEMOLISHED WITH EXISTING FOOTINGS GRUBBED OUT.
2. INSTALL TRANSITION UNDERPINS
3. FORM THE NEW CONCRETE UNDERPINS AND PERIMETER FOUNDATIONS IN AN UNDERPINNED SEQUENCE. SEE DRAWING 05 FOR PROPOSED PROPPING TO UNDERPINS
4. EXCAVATE BASEMENT
5. INSTALL ALL DRAINAGE AND THEN FORM BASEMENT SLAB
6. FORM RC BASEMENT SLAB
7. FORM RC GROUND FLOOR SLAB KEEPING THE TEMPORARY PROPS IN PLACE
8. REMOVE TEMPORARY WORKS IN REVERSE ORDER OF INSTALLATION
9. INSTALL WATERPROOFING



BASEMENT PLAN
1:100



GROUND FLOOR PLAN
1:100

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
P4	04.12.17	CC	SCHEME UPDATED
P3	10.11.17	JSH	SCHEME UPDATED
P2	20.12.16	DS	TITLE BLOCK AMENDED
P1	16.12.16	SAV	PRELIMINARY ISSUE

Drawing Status: PRELIMINARY

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Job Title

SPIRITUALIST TEMPLE
ROCHESTER SQUARE
LONDON, NW1

Drawing Title

PROPOSED CONSTRUCTION METHOD STATEMENT

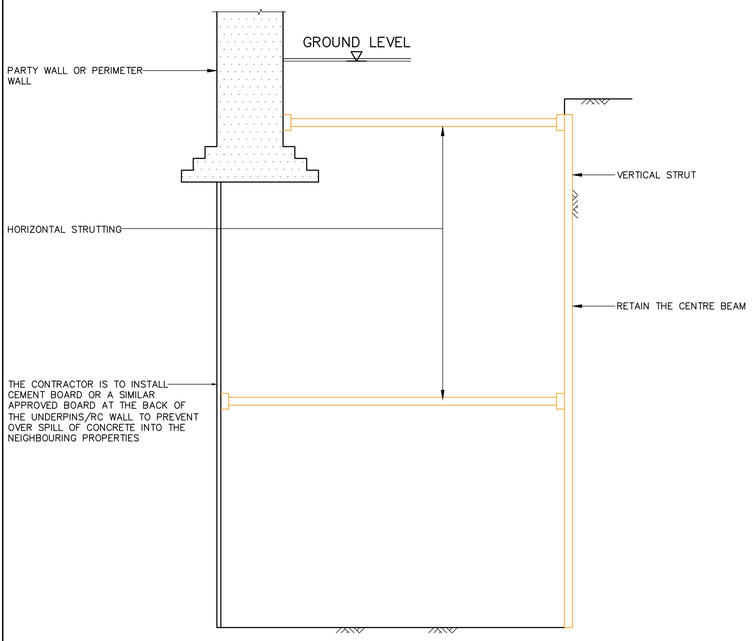
Job No.	Drawing No.	Revision
2016061	04	P4

Scales 1:100 AT A1 — Original Size A1

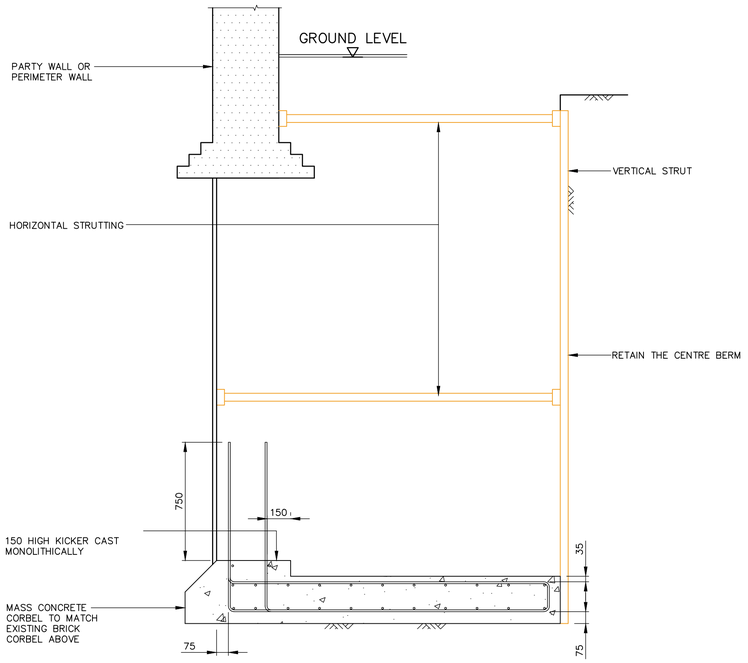
Drawn By SAV Date NOV 2016 Checked DS

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

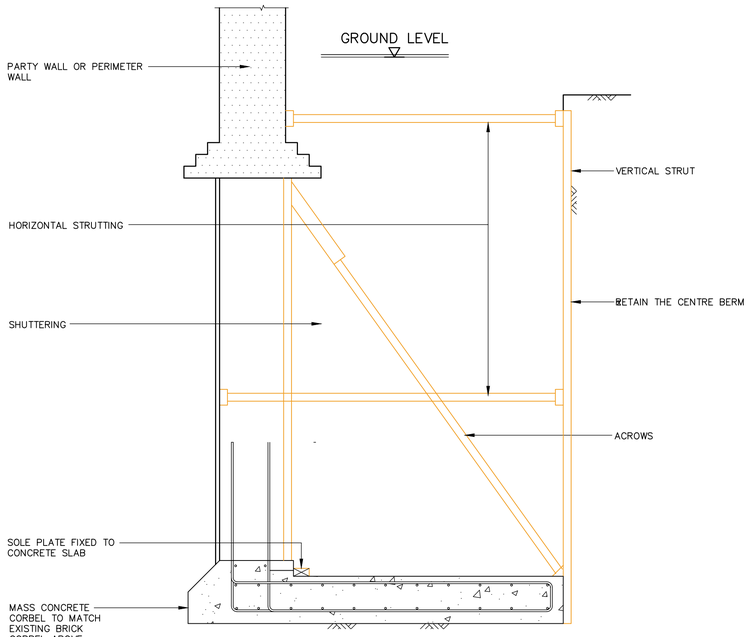
NOTE:
UNDERPINS TO BE DOWELLED INTO EACH OTHER WITH 6No. MIN H20 DOWELS WITH 400mm MIN. EMBEDMENT



SEQUENCE 1
1:20



SEQUENCE 2
1:20



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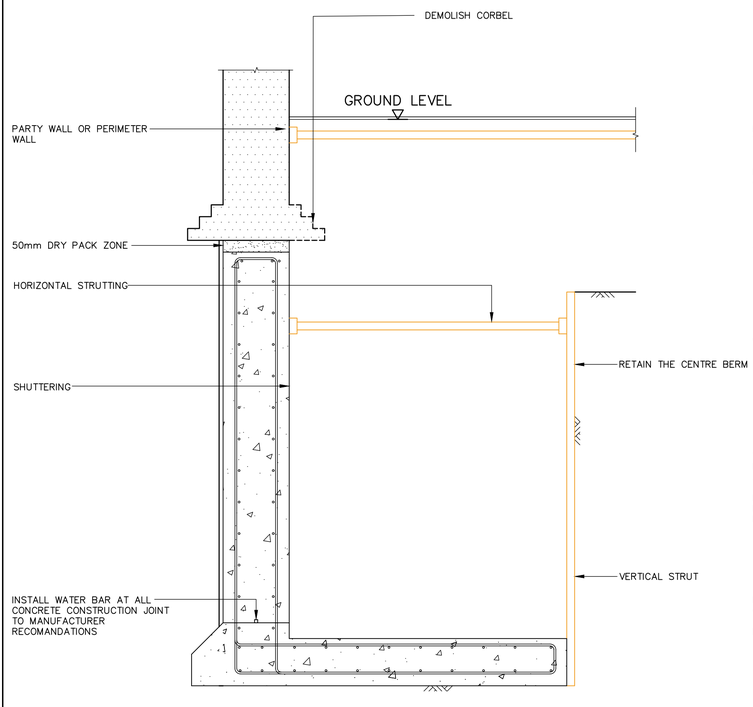
1:20



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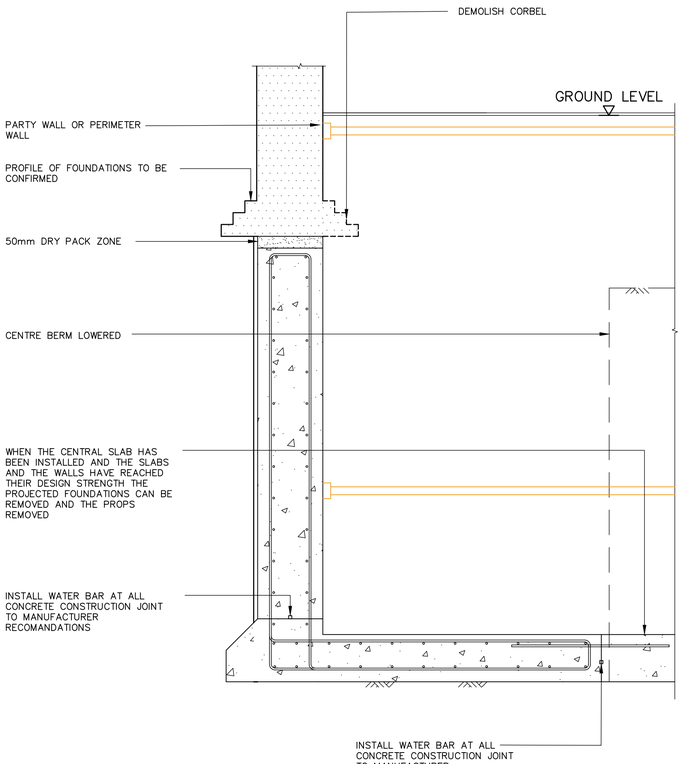

SEQUENCE 5
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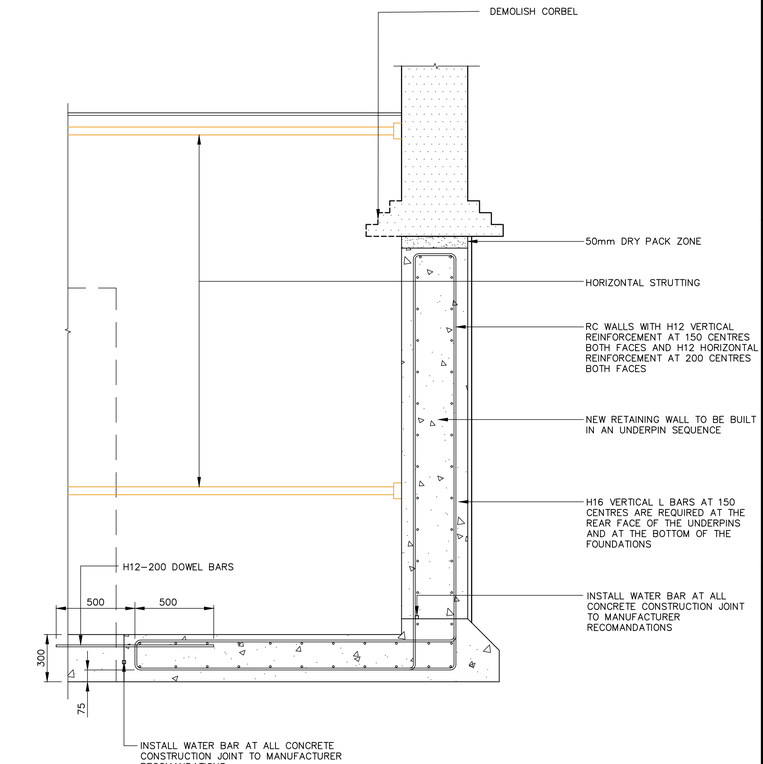

Notes

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Rev	Date	By	Amendments
P1	10.11.17	DS	ISSUED FOR PLANNING

Drawing Status
PRELIMINARY

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Job Title
SPIRITUALIST TEMPLE
ROCHESTER SQUARE
LONDON, NW1

Drawing Title
TYPICAL UNDERPINNING SEQUENCE

Job No.	Drawing No.	Revision
2016061	05	P1

Scales 1:100 AT A1 — Original Size A1
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Structural Calculations
For
Rear of Spiritualist Temple
Rochester Square
London

Rev B: November 2017

2016061

December 2016

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

CLIENT

Camden Land Partnerships Ltd

ARCHITECT

Spacelab

CODES USED

- NHBC
- BS 648: 1964 – Weights of Building Materials
- BS 6399: Pt 1: 1998 – Design Loads
- BS 5950: Pt 1: 2008 – Structural Steel
- BS 5628: Pt 1: 2005 – Masonry
- BS 5268: Pt 2: 2002 – Structural Timber
- BS 8110: 1997 – Reinforced Concrete

IMPOSED LOADS

- Domestic Floors – 1.5 kN/m^2

GROUND CONDITIONS

- London Clay – Allowable Safe Ground Bearing Pressure – 140 kN/m^2 (See LMB Geo report)

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		Job No	Sheet No.	Revision
Job Title	Rear of Spiritualist Temple, Rochester Square	Date	Made By	Checked By
Section				

LOADS		**kg/m²**		**DEAD kN/m²**	**LIVE**
Tiled Roof - (With Lining)	Tiles	75			
	Felt & Battens	6			
	Rafters	6			
	Battens & Insulation	4			
	Plasterboard & Skim	15			
		106 kg/m²			
	Plan Load	20º	=	1.13	0.75
		30º	=	1.22	0.75
		35º	=	1.29	0.67
		40º	=	1.38	0.58
		45º	=	1.5	0.5
		50º	=	1.65	0.42
Ceilings -	Joists	8			
	Insulation	2			
	Plasterboard & Skim	15			
		25 kg/m²		0.25	0.25
New Cavity -	102 Brick	210			
	100 Block	80			
	Plasterboard & Skim	24			
		314 kg/m²		3.14	
Older Cavity (or 215 Solid)	102 Brick	210			
	102 Brick	210			
	12mm Plaster	24			
		444 kg/m²		4.44	
New Tile Hung Cavity	Tiles	75			
	Felt & Battens	6			
	100 Block	80			
	100 Block	80			
	12mm Plaster	24			
		265 kg/m²		2.65	

LOADS (Cont'd)		**kg/m²**	**DEAD kN/m²**	**LIVE**
Stud Walls	Plasterboard x 2	20		
	Skim Coat x 2	10		
	Studs 75x50@400c/c's	10		
		40 kg/m²	0.4	

Note: 12mm plasterboard with no skim coat similar. For glazed tiling add 6 kg/m² per side.

Lath & Plaster	As Above with Lath	60	0.6	
Built-Up Felt Roof	Felt & Chippings	40		
	Boards & Insulation	15		
	Joists & Firings	10		
	Plasterboard & Skim	15		
		80 kg/m²	0.8	
			No Access	0.75
			Access	1.5
Timber Floor	Boards	15		
	Joists	15		
	Plasterboard & Skim	15		
		45 kg/m²	0.45	
			Domestic	1.5

Flat green roof				
	Waterproofing	40		
	Timber joists and insulation	20		
	Ceiling and services	15		
	Ground and Grass	65		
	Live load (non accessible)		0.75	
Lower Ground Floor Slab	250 RC Slab	60		
	Floor Build up	50		
	Screed 100mm	20		
	Partitions	10		

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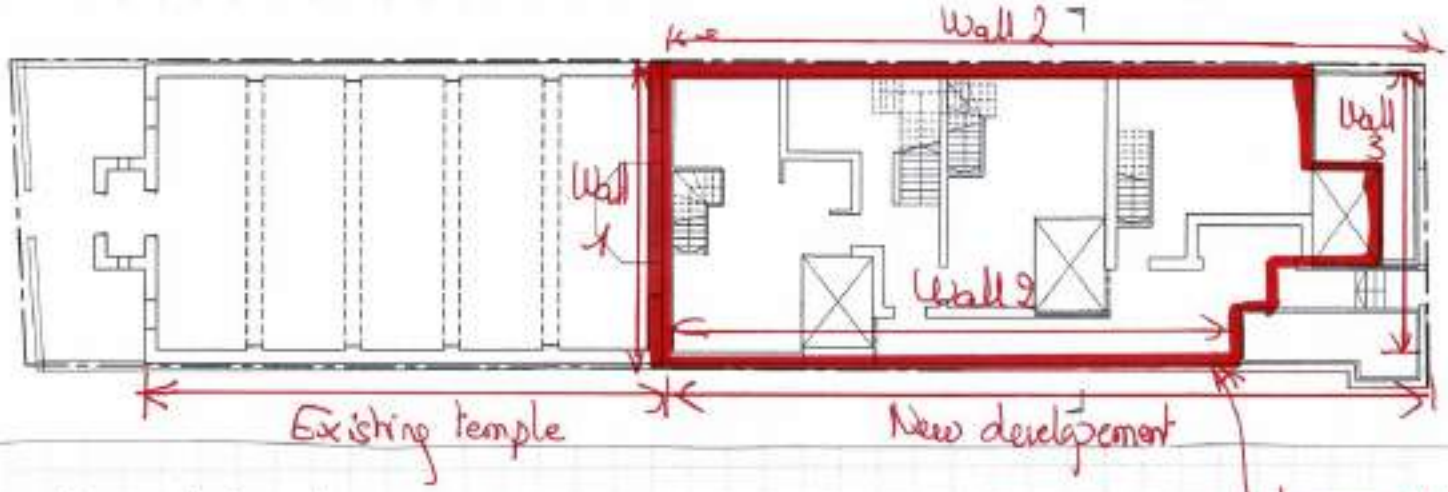
Job No.	Sheet No.	Revision
2016061		

Job Title	Rochester Square	Date	Made By	Checked By
Section	Load take down	11/17	C.C	DS

Proposed layout:



Load take down

Consider wall 1, 2 and 3

	(kN/m) DL	LL
Wall 1		
(1) Existing temple		
- Masonry wall (215mm assumed) 4.44 kN/m² x 10 metres	44.4	
- Mezzanine Floor (allow for mezzanine) 1.0 kN/m² (DL) / 1.5 kN/m² (LL) x 3.0m span /2	1.5	2.3
- Ground Floor assumed as ground bearing slab		
- Roof → Trussed Roof (timber) 1.5 kN/m² (DL) x 3.1m /2 span = / 0.75 kN/m² (LL)	2.3	1.2
	48.2	3.5

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Job No.	Sheet No.	Revision
206081		

Job Title	Rochester Square	Date	Made By	Checked By
Section	Load take down	11/17	C.C	DS

(kN/m)

	DL	IL
② New cavity wall (wall 1)		
- Assumed typical cavity walls above ground floor, 4.2m high x 3.14kN/m =	13.2	
- Roof (flat green roof) 1.4 kN/m² (DL) / 0.75 kN/m² (LL) x 4.5m/2 =	3.2	1.7
- 1st Floor (timber assumed) 1.0 kN/m² / 1.5 kN/m² x 4.5m/2 =	2.3	3.4
- Ground Floor Slab 1.4 kN/m² / 1.5 kN/m² x 6.7m/2 =	4.7	5.0
	23.4	10.1
Total Wall 1 =	71.6	13.6

(kN/m)

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Job No.	Sheet No.	Revision
2016061		

Job Title	Rochester Square	Date	Made By	Checked By
Section	Wall 2 - Load take down	11/17	C.C	D.S

	DL	IL
Wall II		
- Cavity wall 3.14kN/m² x 5.7m height	17.9	
- Roof As per wall 1 (3.2; 1.7kN/m)	3.2	1.7
- 1st Floor As per wall 1 (2.3; 3.4 kN/m)	2.3	3.4
- Ground Floor slab 1.4 kN/m² / 1.5kN/m² x 8.1m/2 Span	5.7	6.1
	29.1	11.2
Wall 3		
As per wall 1 New cavity wall (par ①)	23.4	10.1
	(kN/m)	

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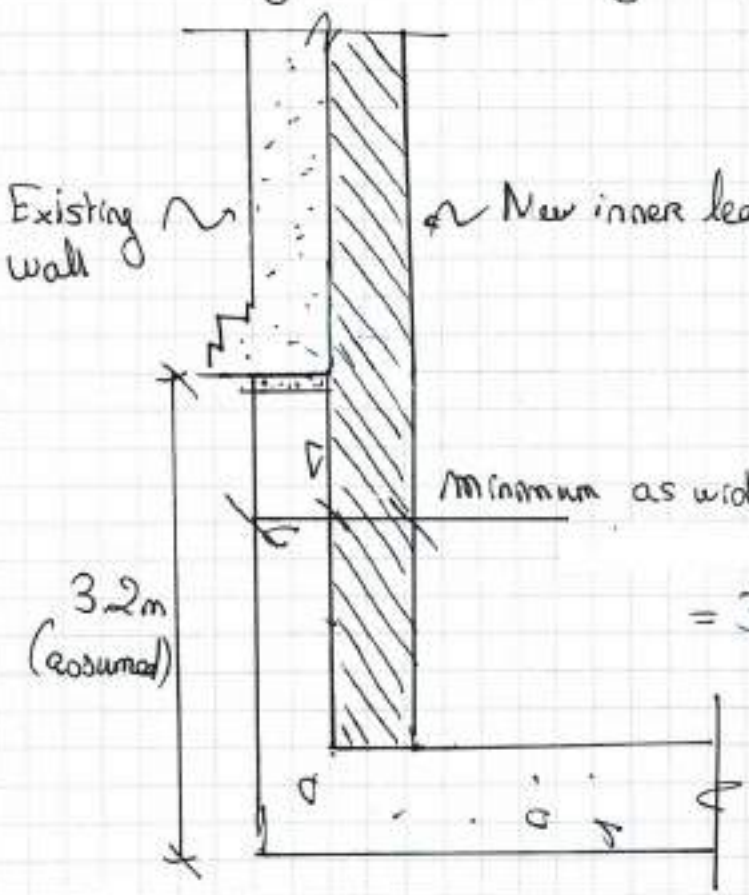
Job No.	Sheet No.	Revision
2016061		

Job Title	Date	Made By	Checked By
Rochester Square			
Section Design of Retaining wall	11.17	C.C	DS

Design of Retaining wall

No. 1 Retaining below existing temple

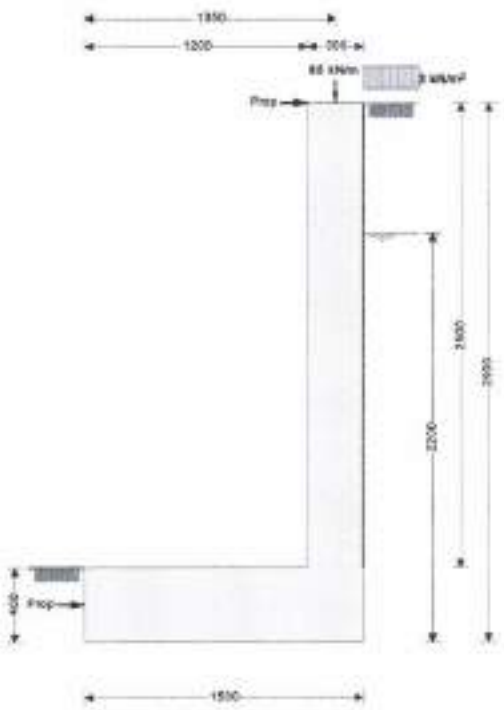


Surcharge from temple = 3.0kN/m²
(assumed).

Symmetrys Structural Engineers	Project: Rochester Square				Job no.: 2016061	
	Calcs for: Basement wall 1				Start page no./Revision: 1	
	Calcs by: CC	Calcs date: 09/11/2017	Checked by: DS	Checked date: 09/11/2017	Approved by: DS	Approved date: 09/11/2017

RETAINING WALL ANALYSIS (BS 8002:1994)

TEDDS calculation version 1.2.01.06



Wall details

Retaining wall type	**Cantilever**		
Height of wall stem	h_{stem} = **2500** mm	Wall stem thickness	t_{wall} = **300** mm
Length of toe	l_{toe} = **1200** mm	Length of heel	l_{heel} = **0** mm
Overall length of base	l_{base} = **1500** mm	Base thickness	t_{base} = **400** mm
Height of retaining wall	h_{wall} = **2900** mm		
Depth of downstand	d_{ds} = **0** mm	Thickness of downstand	t_{ds} = **400** mm
Position of downstand	l_{ds} = **800** mm		
Depth of cover in front of wall	d_{cover} = **0** mm	Unplanned excavation depth	d_{exc} = **0** mm
Height of ground water	h_{water} = **2200** mm	Density of water	γ_{water} = **9.81** kN/m³
Density of wall construction	γ_{wall} = **23.6** kN/m³	Density of base construction	γ_{base} = **23.6** kN/m³
Angle of soil surface	β = **0.0** deg	Effective height at back of wall	h_{eff} = **2900** mm
Mobilisation factor	M = **1.5**		
Moist density	γ_m = **18.0** kN/m³	Saturated density	γ_s = **21.0** kN/m³
Design shear strength	ϕ' = **24.2** deg	Angle of wall friction	δ = **18.6** deg
Design shear strength	ϕ'_b = **24.2** deg	Design base friction	δ_b = **18.6** deg
Moist density	γ_{mb} = **18.0** kN/m³	Allowable bearing	$P_{bearing}$ = **140** kN/m²

Using Coulomb theory

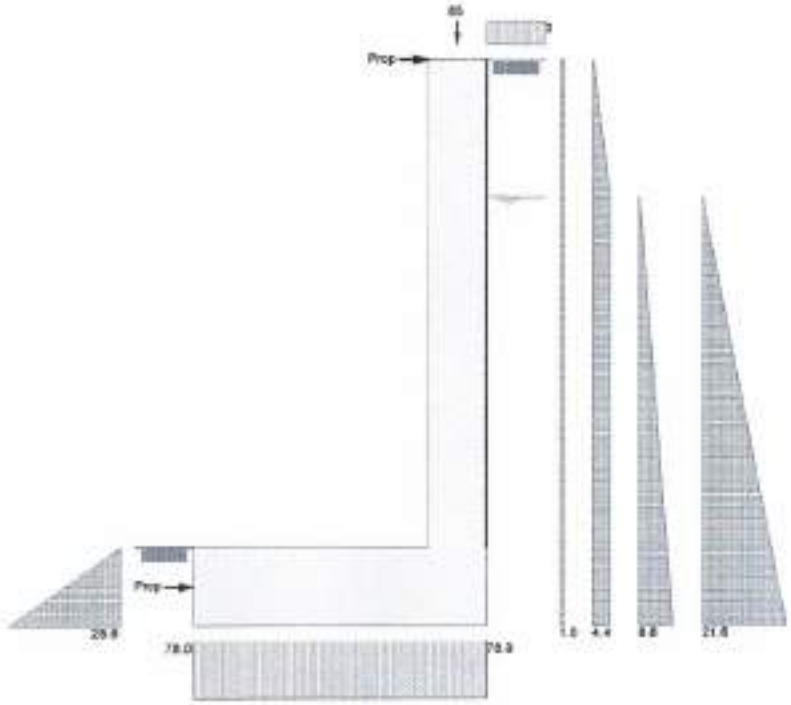
Active pressure	K_a = **0.369**	Passive pressure	K_p = **4.187**
At-rest pressure	K_0 = **0.590**		

Loading details

Surcharge load	Surcharge = **3.0** kN/m²		
Vertical dead load	W_{dead} = **71.6** kN/m	Vertical live load	W_{live} = **13.6** kN/m
Horizontal dead load	F_{dead} = **0.0** kN/m	Horizontal live load	F_{live} = **0.0** kN/m

Symmetrys Structural Engineers	Project: Rochester Square				Job no.: 2016061	
	Calcs for: Basement wall 1				Start page no./Revision: 2	
	Calcs by: CC	Calcs date: 09/11/2017	Checked by: DS	Checked date: 09/11/2017	Approved by: DS	Approved date: 09/11/2017

Position of vertical load l_{load} = **1350** mm Height of horizontal load h_{load} = **0** mm



Loads shown in kN/m, pressures shown in kN/m²

Calculate propping force

Propping force F_{prop} = **7.0** kN/m

Check bearing pressure

Total vertical reaction R = **117.1** kN/m Distance to reaction x_{bar} = **750** mm

Eccentricity of reaction e = **0** mm

Reaction acts within middle third of base

Bearing pressure at toe p_{toe} = **78.0** kN/m² Bearing pressure at heel p_{heel} = **78.0** kN/m²

PASS - Maximum bearing pressure is less than allowable bearing pressure

Calculate propping forces to top and base of wall

Propping force to top of wall F_{prop_top} = **-0.586** kN/m Propping force to base of wall F_{prop_base} = **7.552** kN/m

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	Calcs for: Basement wall 1				Start page no./Revision: 3	
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RETAINING WALL DESIGN (BS 8002:1994)

TEDDS calculation version 1.2.01.06

Ultimate limit state load factors

Dead load factor γ_{f_d} = **1.4** Live load factor γ_{f_l} = **1.6**

Earth pressure factor γ_{f_e} = **1.4**

Calculate propping force

Propping force F_{prop} = **7.0** kN/m

Calculate propping forces to top and base of wall

Propping force to top of wall $F_{prop\_top\_f}$ = **-2.981** kN/m Propping force to base of wall $F_{prop\_base\_f}$ = **36.600** kN/m

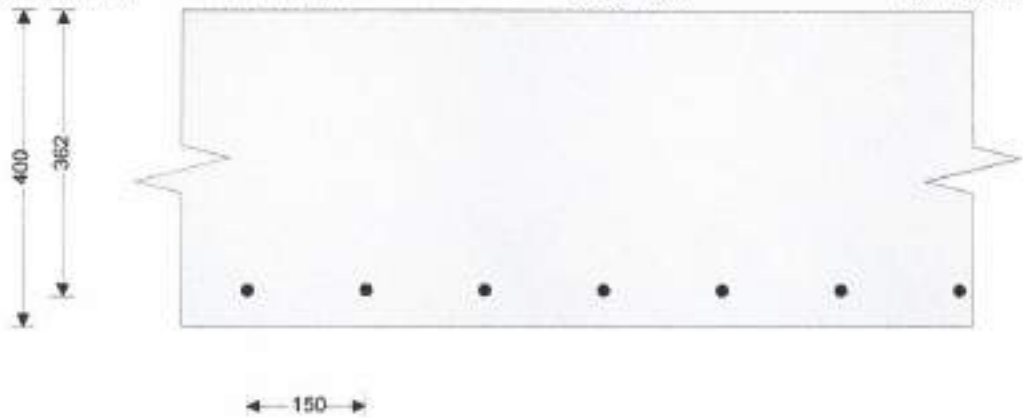
Design of reinforced concrete retaining wall toe (BS 8002:1994)

Material properties

Strength of concrete f_{cu} = **40** N/mm² Strength of reinforcement f_y = **500** N/mm²

Base details

Minimum reinforcement k = **0.13** % Cover in toe c_{toe} = **30** mm



Design of retaining wall toe

Shear at heel V_{toe} = **117.4** kN/m Moment at heel M_{toe} = **89.2** kNm/m

Compression reinforcement is not required

Check toe in bending

Reinforcement provided **16 mm dia.bars @ 150 mm centres**

Area required $A_{s\_toe\_req}$ = **592.8** mm²/m Area provided $A_{s\_toe\_prov}$ = **1340** mm²/m

PASS - Reinforcement provided at the retaining wall toe is adequate

Check shear resistance at toe

Design shear stress v_{toe} = **0.323** N/mm² Allowable shear stress v_{adm} = **5.000** N/mm²

PASS - Design shear stress is less than maximum shear stress

Concrete shear stress v_{c_toe} = **0.431** N/mm²

v_{toe} < v_{c_toe} - No shear reinforcement required

Design of reinforced concrete retaining wall stem (BS 8002:1994)

Material properties

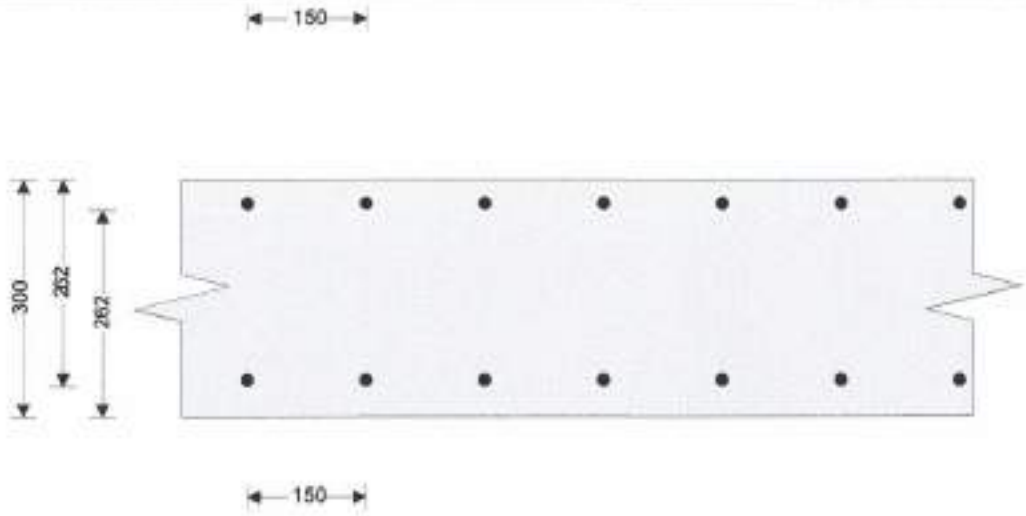
Strength of concrete f_{cu} = **40** N/mm² Strength of reinforcement f_y = **500** N/mm²

Wall details

Minimum reinforcement k = **0.13** %

Cover in stem c_{stem} = **30** mm Cover in wall c_{wall} = **30** mm

Symmetrys Structural Engineers	Project: Rochester Square				Job no.: 2016061	
	Calcs for: Basement wall 1				Start page no./Revision: 4	
	Calcs by: CC	Calcs date: 09/11/2017	Checked by: DS	Checked date: 09/11/2017	Approved by: DS	Approved date: 09/11/2017



Design of retaining wall stem

Shear at base of stem V_{stem} = **52.8** kN/m Moment at base of stem M_{stem} = **23.7** kNm/m

Compression reinforcement is not required

Check wall stem in bending

Reinforcement provided **16 mm dia.bars @ 150 mm centres**

Area required $A_{s\_stem\_req}$ = **390.0** mm²/m Area provided $A_{s\_stem\_prov}$ = **1340** mm²/m

PASS - Reinforcement provided at the retaining wall stem is adequate

Check shear resistance at wall stem

Design shear stress v_{stem} = **0.200** N/mm² Allowable shear stress v_{adm} = **5.000** N/mm²

PASS - Design shear stress is less than maximum shear stress

Concrete shear stress v_{c_stem} = **0.519** N/mm²

$v_{stem} < v_{c\_stem}$ - No shear reinforcement required

Design of retaining wall at mid height

Moment at mid height M_{wall} = **11.2** kNm/m

Compression reinforcement is not required

Reinforcement provided **16 mm dia.bars @ 150 mm centres**

Area required $A_{s\_wall\_req}$ = **390.0** mm²/m Area provided $A_{s\_wall\_prov}$ = **1340** mm²/m

PASS - Reinforcement provided to the retaining wall at mid height is adequate

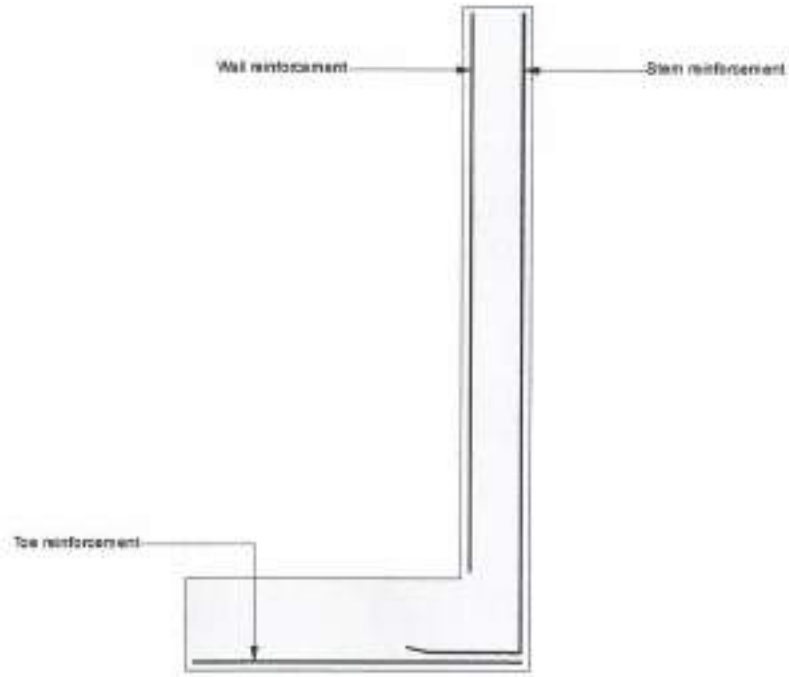
Check retaining wall deflection

Max span/depth ratio $ratio_{max}$ = **40.00** Actual span/depth ratio $ratio_{act}$ = **9.47**

PASS - Span to depth ratio is acceptable

Symmetrys Structural Engineers	Project: Rochester Square				Job no.: 2016061	
	Calcs for: Basement wall 1				Start page no./Revision: 5	
	Calcs by: CC	Calcs date: 09/11/2017	Checked by: DS	Checked date: 09/11/2017	Approved by: DS	Approved date: 09/11/2017

Indicative retaining wall reinforcement diagram



Toe bars - 16 mm dia.@ 150 mm centres - (1340 mm²/m)
Wall bars - 16 mm dia.@ 150 mm centres - (1340 mm²/m)
Stem bars - 16 mm dia.@ 150 mm centres - (1340 mm²/m)

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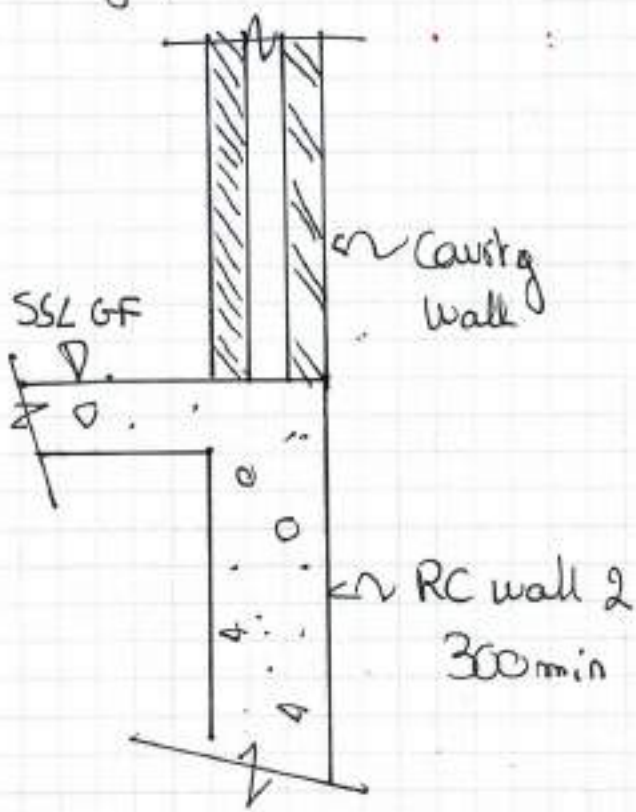
Job No.	Sheet No.	Revision
2016061		

Job Title	Rochester Square	Date	Made By	Checked By
Section	Wall 2 design	11/17	C.C	D.S

Wall 2 Design retaining wall

Allow for surcharge of 2.5kN/m^2

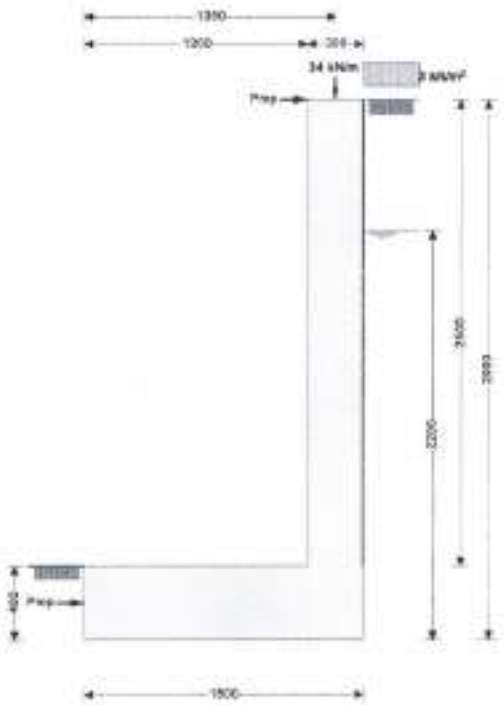
Wall at boundary, minimum 300mm thick



Symmetrys Structural Engineers	Project: Rochester Square				Job no.: 2016061	
	Calcs for: Basement wall 2				Start page no./Revision: 1	
	Calcs by: CC	Calcs date: 09/11/2017	Checked by: DS	Checked date: 09/11/2017	Approved by: DS	Approved date: 09/11/2017

RETAINING WALL ANALYSIS (BS 8002:1994)

TEDDS calculation version 1.2.01.06



Wall details

Retaining wall type	**Cantilever**		
Height of wall stem	h_{stem} = **2500** mm	Wall stem thickness	t_{wall} = **300** mm
Length of toe	l_{toe} = **1200** mm	Length of heel	l_{heel} = **0** mm
Overall length of base	l_{base} = **1500** mm	Base thickness	t_{base} = **400** mm
Height of retaining wall	h_{wall} = **2900** mm		
Depth of downstand	d_{ds} = **0** mm	Thickness of downstand	t_{ds} = **400** mm
Position of downstand	l_{ds} = **800** mm		
Depth of cover in front of wall	d_{cover} = **0** mm	Unplanned excavation depth	d_{exc} = **0** mm
Height of ground water	h_{water} = **2200** mm	Density of water	γ_{water} = 9.81 kN/m³
Density of wall construction	γ_{wall} = **23.6** kN/m³	Density of base construction	γ_{base} = **23.6** kN/m³
Angle of soil surface	β = **0.0** deg	Effective height at back of wall	h_{eff} = **2900** mm
Mobilisation factor	M = **1.5**		
Moist density	γ_m = **18.0** kN/m³	Saturated density	γ_s = **21.0** kN/m³
Design shear strength	ϕ' = **24.2** deg	Angle of wall friction	δ = **18.6** deg
Design shear strength	ϕ'_b = **24.2** deg	Design base friction	δ_b = **18.6** deg
Moist density	γ_{mb} = **18.0** kN/m³	Allowable bearing	$P_{bearing}$ = **140** kN/m²

Using Coulomb theory

Active pressure	K_a =**0.369**	Passive pressure	K_p = **4.187**
At-rest pressure	K_0 = **0.590**		

Loading details

Surcharge load	Surcharge = **3.0** kN/m²		
Vertical dead load	W_{dead} = **23.4** kN/m	Vertical live load	W_{live} = **10.1** kN/m
Horizontal dead load	F_{dead} = **0.0** kN/m	Horizontal live load	F_{live} = **0.0** kN/m

Symmetrys Structural Engineers	Project: Rochester Square				Job no.: 2016061	
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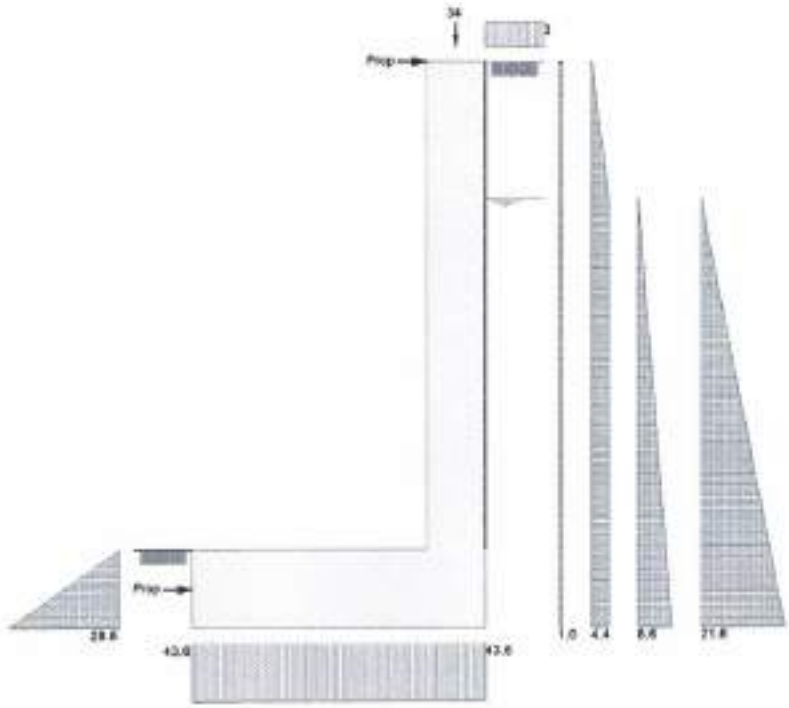
Position of vertical load l_{load} = **1350** mm Height of horizontal load h_{load} = **0** mm



Loads shown in kN/m, pressures shown in kN/m²

Calculate propping force

Propping force F_{prop} = **23.2** kN/m

Check bearing pressure

Total vertical reaction R = **65.4** kN/m Distance to reaction x_{bar} = **750** mm

Eccentricity of reaction e = **0** mm

Reaction acts within middle third of base

Bearing pressure at toe p_{toe} = **43.6** kN/m² Bearing pressure at heel p_{heel} = **43.6** kN/m²

PASS - Maximum bearing pressure is less than allowable bearing pressure

Calculate propping forces to top and base of wall

Propping force to top of wall F_{prop_top} = **7.952** kN/m Propping force to base of wall F_{prop_base} = **15.236** kN/m

Symmetrys Structural Engineers	Project: Rochester Square				Job no.: 2016061	
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	Calcs by: CC	Calcs date: 09/11/2017	Checked by: DS	Checked date: 09/11/2017	Approved by: DS	Approved date: 09/11/2017

RETAINING WALL DESIGN (BS 8002:1994)

TEDDS calculation version 1.2.01.06

Ultimate limit state load factors

Dead load factor γ_{f_d} = **1.4** Live load factor γ_{f_l} = **1.6**

Earth pressure factor γ_{f_e} = **1.4**

Calculate propping force

Propping force F_{prop} = **23.2** kN/m

Calculate propping forces to top and base of wall

Propping force to top of wall $F_{prop\_top\_f}$ = **11.577** kN/m Propping force to base of wall $F_{prop\_base\_f}$ = **44.752** kN/m

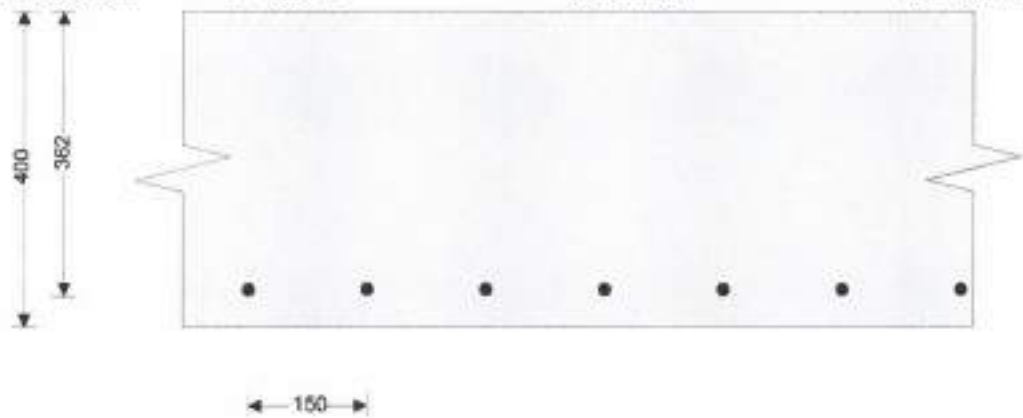
Design of reinforced concrete retaining wall toe (BS 8002:1994)

Material properties

Strength of concrete f_{cu} = **40** N/mm² Strength of reinforcement f_y = **500** N/mm²

Base details

Minimum reinforcement k = **0.13** % Cover in toe c_{toe} = **30** mm



Design of retaining wall toe

Shear at heel V_{toe} = **59.0** kN/m Moment at heel M_{toe} = **44.8** kNm/m

Compression reinforcement is not required

Check toe in bending

Reinforcement provided **16 mm dia.bars @ 150 mm centres**

Area required $A_{s\_toe\_req}$ = **520.0** mm²/m Area provided $A_{s\_toe\_prov}$ = **1340** mm²/m

PASS - Reinforcement provided at the retaining wall toe is adequate

Check shear resistance at toe

Design shear stress v_{toe} = **0.163** N/mm² Allowable shear stress v_{adm} = **5.000** N/mm²

PASS - Design shear stress is less than maximum shear stress

Concrete shear stress v_{c_toe} = **0.544** N/mm²

v_{toe} < v_{c_toe} - No shear reinforcement required

Design of reinforced concrete retaining wall stem (BS 8002:1994)

Material properties

Strength of concrete f_{cu} = **40** N/mm² Strength of reinforcement f_y = **500** N/mm²

Wall details

Minimum reinforcement k = **0.13** %

Cover in stem c_{stem} = **30** mm Cover in wall c_{wall} = **30** mm

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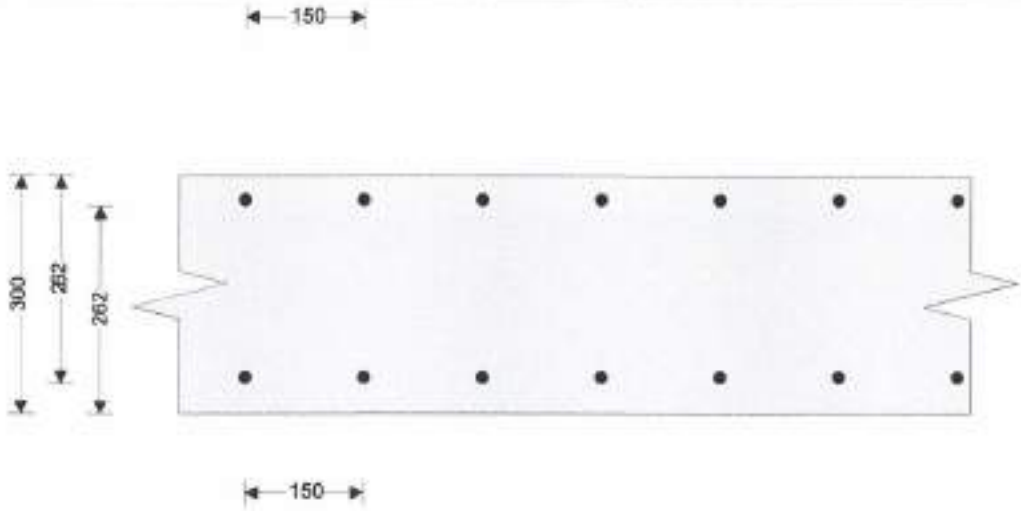
	Calcs by: CC	Calcs date: 09/11/2017	Checked by: DS	Checked date: 09/11/2017	Approved by: DS	Approved date: 09/11/2017



Design of retaining wall stem

Shear at base of stem V_{stem} = **52.8** kN/m Moment at base of stem M_{stem} = **23.7** kNm/m

Compression reinforcement is not required

Check wall stem in bending

Reinforcement provided **16 mm dia.bars @ 150 mm centres**

Area required $A_{s\_stem\_req}$ = **390.0** mm²/m Area provided $A_{s\_stem\_prov}$ = **1340** mm²/m

PASS - Reinforcement provided at the retaining wall stem is adequate

Check shear resistance at wall stem

Design shear stress v_{stem} = **0.201** N/mm² Allowable shear stress v_{adm} = **5.000** N/mm²

PASS - Design shear stress is less than maximum shear stress

Concrete shear stress v_{c_stem} = **0.657** N/mm²

$v_{stem} < v_{c\_stem}$ - No shear reinforcement required

Design of retaining wall at mid height

Moment at mid height M_{wall} = **11.2** kNm/m

Compression reinforcement is not required

Reinforcement provided **16 mm dia.bars @ 150 mm centres**

Area required $A_{s\_wall\_req}$ = **390.0** mm²/m Area provided $A_{s\_wall\_prov}$ = **1340** mm²/m

PASS - Reinforcement provided to the retaining wall at mid height is adequate

Check retaining wall deflection

Max span/depth ratio $ratio_{max}$ = **40.00** Actual span/depth ratio $ratio_{act}$ = **9.54**

PASS - Span to depth ratio is acceptable

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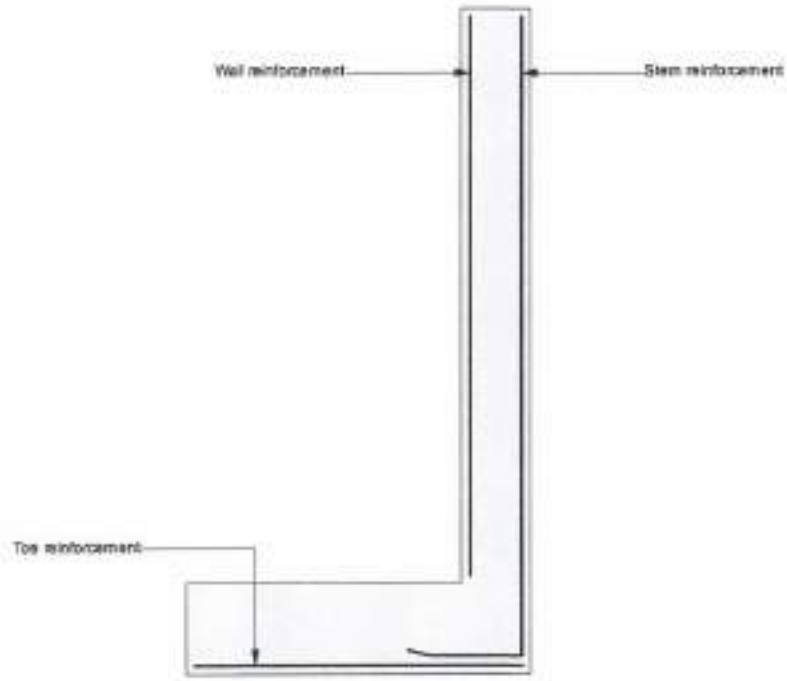
	Calcs for: Basement wall 2				Start page no./Revision: 5	
	Calcs by: CC	Calcs date: 09/11/2017	Checked by: DS	Checked date: 09/11/2017	Approved by: DS	Approved date: 09/11/2017

Indicative retaining wall reinforcement diagram



Toe bars - 16 mm dia.@ 150 mm centres - (1340 mm²/m)
Wall bars - 16 mm dia.@ 150 mm centres - (1340 mm²/m)
Stem bars - 16 mm dia.@ 150 mm centres - (1340 mm²/m)

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	Job No.	Sheet No.	Revision
	7c6061		
Job Title FORMER SPIRITUALIST TEMPLE, PICCADILLY SQ	Date	Made By	Checked By
Section	12/16.	DS	

EXPECTED HEAVE FORCES

DETAILED ANALYSIS HAS BEEN UNDERTAKEN BY CMS GEOSOLUTIONS - SEE APPENDIX C.

APPROXIMATE CONSERVATIVE HEAVE FORCES

EXCAVATION DEPTH : 3.55m.

HYDROSTATIC PRESSURE : $3.55m \times 10kN/m^3 = 35.5kN/m^2$

OVERBURDEN PRESSURE : $3.55m \times 18kN/m^3 = 64kN/m^2$

HEAVE : $35.5kN/m^2 + 0.5(64kN/m^2 - 35.5kN/m^2) = 49.75kN/m^2$

SCAR SLAB : $0.5m \times 24kN/m^3 = 12\ kN/m^2$

+ SCREED : $2\ kN/m^2$

$14\ kN/m^2$

∴ OVERALL UPLIFT : $49.75kN/m^2 - 14\ kN/m^2$

$= 36\ kN/m^2$.

HEAVE FORCES FROM THE SOIL ARE TO BE IGNORED FOR THE BASEMENT SLAB DESIGN AS HEAVE PROTECTION PRODUCT (CELLCORE HX 5 OR SIMILAR) WILL BE LAID BENEATH.

ie. SLAB TO BE DESIGNED FOR UPLIFT OCCURING DUE TO HYDROSTATIC PRESSURES.

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Job Title	Date	Made By	Checked By
Section			

UPLIFT = 35.5 kN/m² − 14 kN/m² = 21.5 kN/m².

ULTIMATE FACE = 21.5 kN/m² × 1.6

= 34.4 kN/m².

MAXIMUM MOMENT ON SCAD : $\frac{34.5 \times 1.0m \times 7.1m^2}{8}$

= 21.7 kNm.

- REFER TO SPREADSHEET DESIGN ANALYSIS.

PROVIDE H20 BARS @ 150mm C/S.

ELEMENT DESIGN to BS 8110:2005

SOLID SLABS

Originated from RCC11.xls v4.0

mpa The Concrete Centre

INPUT Location Basement Slab Design

Design moment, M	217.0	kNm/m	fcu	40	N/mm²	γc =	1.50
ßb	1.00		fy	500	N/mm²	γs =	1.15
span	7100	mm	steel class	A			
Height, h	400	mm	Section location	SIMPLY SUPPORTED SP.			
Bar Ø	20	mm	Compression steel	NOMINAL			
cover	50	mm to these bars		*(deflection control only)*			

ONE or TWO WAY SLAB

OUTPUT Basement Slab Design — Compression steel = NOMINAL 0.13%

d = 400 - 50 - 20/2 = 340.0 mm

(3.4.4.4) K' = 0.156 > K = 0.047 ok

(3.4.4.4) z = 340.0 [0.5 + (0.25 - 0.047 /0.893)]^½ = 321.2 < 0.95d = 323.0 mm

(3.4.4.1) As = 217.00E6 /500 /321.1 x 1.15 = 1554 > min As = 520 mm²/m

PROVIDE H20 @ 200 = 1571 mm²/m *As increased by 2.2% for deflection*

(Eqn 8) fs = 2/3 x 500 x 1554 /1571 /1.00 = 329.9 N/mm²

(Eqn 7) Tens mod factor = 0.55 + (477 - 329.9) /120 /(0.9 + 1.877) = 0.992

(Equation 9) Comp mod factor = 1 + 0.130/(3 + 0.130) = 1.042

(3.4.6.3) Permissible L/d = 20.0 x 0.992 x 1.042 = 20.654

Actual L/d = 7100 /340.0 = 20.882

LMB GEOSOLUTIONS LTD

GROUND INVESTIGATION & ASSESSMENT

ROCHESTER SQUARE SPIRITUALIST TEMPLE, ROCHESTER SQUARE, LONDON NW1

December 2016

DOCUMENT RECORD

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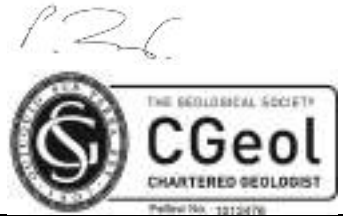
Site	Rochester Square Spiritualist Temple, London NW1
Document Date	7th December 2016
Document Version	Issue 1
Document Authorisation	Philip Lewis BSc (Hons), MSc, CGeol, FGS
	

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Ground Investigation
Land Contamination
Hydrogeology
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EXECUTIVE SUMMARY

Executive Summary

Site Details	Rochester Square Spiritualist Temple, Rochester Square, London NW1 9RY
Proposed Development	The development proposals include demolition of the existing structure and construction of a new mixed use four storey structure that will include a single storey basement.
Ground & Groundwater Conditions	Made Ground overlying Head Deposits and the London Clay Formation. Groundwater was recorded during monitoring and is considered to form a thin but laterally continuous aquifer unit within the Head Deposits over the area of the site.
Geotechnical Advice	For traditional spread or raft foundations placed on the competent firm to stiff clay at a depth of 4.00m to 4.50m bgl (i.e. approximate formation level) a net safe bearing pressure of 140kN/m2 should be available. However, should a piled foundation solution be considered, a preliminary assessment indicates that for a 10m pile (founded on the London Clay Formation) safe working loads of 263kN and 371kN are estimated for 450mm and 600mm pile diameters respectively. The above advice assumes that the proposed basement development and in particular foundations would not be within the influence of any trees or tree routes. Given the size of the excavation, the adjacent and nearby structures and the presence of shallow groundwater it is considered likely that temporary or permanent support (sheet/secant piles or similar) will be needed for construction. Coefficient of active earth pressure: Made Ground: 0.35. Head Deposits 0.30.London Clay Formation: 0.40. Coefficient of passive earth resistance: Made Ground: 3.5. Head Deposits 4.0.London Clay Formation: 2.5. Buried concrete: Made Ground: DS-1, AC-1s. Head Deposits DS-1, AC-1s. London Clay Formation: DS-2, AC-2.
Recommendations	The full set of recommendations should be reviewed but in summary the following are provided: • The preliminary pile assessment should be confirmed and/or amended by a competent piling contractor. • It is recommended that additional groundwater and ground gas monitoring be undertaken.
This executive summary is not a stand alone document and should be read in conjunction with the full report text, including conclusions and recommendations.	

INTRODUCTION

Introduction

AUTHORISATION

LMB Geosolutions Ltd (LMB) was instructed by Spacelab (Architects) on behalf of Camden Land Partnership Ltd (the Client) in November 2016 to undertake ground investigation and assessment works in relation to the proposed development at Rochester Square Spiritualist Temple, Rochester Square, London NW1 9RY (the Site).

PROJECT AND SITE DETAILS

Site Address	Rochester Square Spiritualist Temple, Rochester Square, London NW1 9RY (the Site). A Site Location Plan is provided as **Figure 1**.
Proposed Development	The site currently comprises a former temple that is occupied by live in security. The main entrance is via gate located on the southern side of Rochester Square with the rear garden accessed from a gate on the northern side of Rochester Square. Information provided by the Architects and Symmetrys Ltd (Consultant Engineers) indicates that the proposed development involves demolition of the existing structure and construction of a new mixed use four storey structure that will include a single storey basement. Based on the information provided, the following assumptions have been made: • The development will comprise demolition of the existing building and construction of commercial space and residential flats; • The basement will comprise a single storey structure; • The basement will occupy most the footprint of the development (326m^2 of 426m^2); and • The basement will be utilised for office space (front) and residential units (rear).
Background	The scope of works and requirements of this report were based on the information provided by Symmetrys (Consultant Engineers) within the following documents: • Specification for Geotechnical Site Investigation for 110 Rochester Square, London NW1 (ref. 2016061, 3rd November 2016); & • Borehole Location Plan (ref. SI01).

INTRODUCTION

AIMS & OBJECTIVES

This report aims to provide information sufficient to meet the requirements of the specification provided by the Consultant Engineers.

SCOPE OF WORKS

The following scope of works has been completed:

- Site set up including liaison with Consultant Engineers, Client and appointment of sub-contractors;
- Mobilisation to site and transport of the rig to the proposed location;
- Completion of 2No 'cut down' cable percussive boreholes to depths of 15.00m bgl (or refusal) with insitu SPTs and collection of disturbed and undisturbed samples for laboratory testing;
- Supervision and geological logging of the soil arisings in accordance with BS5930 by an appropriately experienced geo-environmental engineer;
- Installation of two monitoring wells to depths of 4.0m and 8.0m below ground level and return monitoring of groundwater levels on 1no. occasion;
- Geotechnical laboratory testing of the soil samples for an appropriate suite of determinands (including pH, sulphate, atterberg limits, and moisture content);
- Chemical analysis of 1no. sample of Made Ground, including Waste Acceptance Criteria (WAC);
- Completion of a factual and interpretive report that includes;
    - Details of the ground and groundwater conditions encountered;
    - Presentation of chemical analytical results;
    - Geotechnical laboratory testing and provision of advice on the material properties of the shallow soil horizon including parameters to aid in retaining wall design and foundation options; &
    - Conclusions and recommendations.

LIMITATIONS

LMB has prepared this report solely for the use of the named Client and those parties with whom a warranty agreement and/or assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from LMB and the Client.

LMB accepts no responsibility or liability for:

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b) issue of this document to any third party with whom an agreement has not been executed.

The risk assessment and opinions provided, among other things, take in to consideration currently available guidance and best available techniques relating to acceptable contamination concentrations and

interpretation of these values. No liability can be accepted for the retrospective effects of any future changes or amendments to these value.

Ground Investigation & Findings

INTRODUCTION

The ground investigation works were undertaken between 21st and 22nd November 2016 and comprised the progression of two 'cut down' cable percussive boreholes to 15.0m bgl with sampling of soil for laboratory testing (see **Figure 2**).

Groundwater monitoring was undertaken following completion of the fieldworks on 30th November 2016.

Details of the ground investigation completed, along with the findings of the investigation, are provided in the following sections. The exploratory hole logs and laboratory results are presented in **Appendix A, B** and **C** respectively.

Guidance Documents

Details of the best practice guidance documents and reference information used in undertaking the ground investigation and assessment are provided at the end of this report (see REFERENCES & GUIDANCE).

INVESTIGATION STRATEGY

The ground investigation was designed based on the requirements of the Consultant Engineers set out in the Specification for Geotechnical Site Investigation for 110 Rochester Square, London NW1 (ref. 2016061, 3rd November 2016).

Soil Chemical Analysis & Laboratory Testing

Soil samples were submitted to the UKAS and MCERTS accredited laboratories of i2 Analytical for chemical analysis and geotechnical testing.

The results of the geotechnical and chemical analysis (including waste acceptance criteria testing) are presented in **Appendix B** and **C** respectively.

GROUND & GROUNDWATER CONDITIONS

Ground Conditions

The table below provides a summary of ground conditions encountered with full descriptions provided in the associated exploratory hole logs provided in **Appendix A**:

GROUND INVESTIGATION & FINDINGS

Strata	Depth Range to Top (m bgl)	Depth Range to (Base (m bgl)	Summary Description
Made Ground	Ground Level	0.50 – 0.80	In BH1 (frontage) the ground surface was found to comprise concrete. The Made Ground soils were generally found to comprise an upper layer (0.15m) of slightly sandy clay with rootlets over clay with brick gravel. In BH1 the base of the Made Ground included broken tile and brick.
Head Deposits	0.50 – 0.80	3.65 – 3.75	Soils interpreted as Head Deposits were found to comprise an upper horizon (approx. 1m) of soft becoming firm clay overlying gravelly clay.
London Clay Formation	3.65 – 3.75	15.00(1)	The London Clay was found to comprise firm becoming stiff very closely fissured clay.

(1) Base of the London Clay was not determined.

Visual and Olfactory Observations

No visual or olfactory evidence of contamination was observed during the ground investigation works. However, Made Ground soils were encountered in all exploratory hole locations and can be indicative of the presence of contaminants.

Groundwater Conditions

Groundwater strikes were recorded during the ground investigation works within BH1 (0.70m and 7.0m). In BH2 no groundwater strikes were observed during drilling, but groundwater was recorded the following morning within the open hole (3.40m).

Return Monitoring

Groundwater and ground gas levels were monitored on Wednesday 30th November 2016 and the results are summarised in the table below:

Location	Strata	Groundwater Depth (m bgl)	VOC (ppm)	CH4 (% v/v)	CO2 (% v/v)	O2 (% v/v)	Flow Rate (l/hr)	Gas Screening Value (l/hr)
BH1	London Clay	6.58	0.7	0.10	1.40	18.2	0.2	0.0028
BH2	Head Deposits	1.64	-	-	-	-	-	-

GROUND INVESTIGATION & FINDINGS

Characteristic Values of Soil Parameters

A summary of the geotechnical properties of the strata based on the field and laboratory testing is provided in the table below.

Soil Property	**Stratum**		
	Made Ground	Head Deposits	London Clay
SPT 'N' Value	-	10 -25	18 – 26
Undrained Shear Strength (kN/m^2)	-	-	51 – 82
Bulk Density (mg/m^3)	1.70(1)	1.80(1)	1.96 – 2.03
Moisture Content (%)	15 – 20	12	19 – 29
Plasticity Index (%)	-	-	44
pH	7.2	8.4	8.3
Sulphate (g/l)	0.018	0.065	0.55

(1) Value based on BS8002

A plot of SPT 'N' value against depth is provided in **Appendix D.**

The plot indicates that there is a fairly uniform correlation between depth and relative density (SPT N Value).

Geotechnical Advice

INTRODUCTION

The temple currently comprises a main building of approximately three storey height with a rear single storey height extension. It is understood that the proposed development will comprise demolition of the existing structure and construction of a new mixed use four storey structure that will include a single storey basement.

On this basis, it the following assumptions have been made:

- The finished floor level of the basement will be -2.80m.
- The load from the existing structure will be in the region of 10-15kN/m^2 (rear extension) to 30-40KN/m^2 (main building).
- For the existing structure (including the roof) the wall load is estimated at approximately 60-80kN/m run.
- The new development will comprise a four-storey structure that will include a single storey basement. Assuming a weight from the new development of 12.5kN/m^2 / per storey (Tomlison, MJ 2001) that will equate to approximately 62.5kN/m^2.
- There will be no significant changes in elevation over the proposed basement development.
- Foundations will not be eccentrically loaded.

GROUND CONDITIONS SUMMARY AND ENGINEERING PARAMETERS

The ground conditions encountered in the exploratory holes comprise Made Ground overlying firm clay and gravelly clay (interpreted as Head Deposits), which rest on the firm becoming stiff London Clay.

Groundwater associated with the Head Deposits was recorded at a depth of approximately 1.64m bgl during monitoring. The groundwater is considered to form a thin but laterally continuous aquifer unit within the Head Deposits.

FOUNDATION DESIGN

Non-piled Foundations

Based on the information supplied, the finished floor level is at 2.80m bgl and it has been estimated that this would equate to a formation level of approximately 3.30m bgl. However, the presence of shallow groundwater within the Head Deposits is likely to preclude formation of foundations at this depth.

As such it has been assumed that formation level for foundations will be extended through the Head Deposits to the top of the underlying London Clay Formation at a depth of c.4.50m bgl.

GEOTECHNICAL ADVICE

Based on the findings of the ground investigation and the subsequent laboratory testing it has been concluded that for a traditional spread or raft foundations placed within the London Clay at the assumed formation level (4.50m bgl) a net safe bearing pressure of 140kN/m^2 should be available. The bearing pressure is based on a factor of safety of 3 to ensure that settlement remains within normally acceptable limits.

Foundations should be placed on the firm to stiff cohesive London Clay deposits present at the site and it is recommended that the undrained shear strength of soils at formation level be confirmed using a hand shear vane and should exceed 60kN/m^2.

The above advice assumes that the proposed basement development and in particular foundations would not be within the influence of any trees or tree routes.

Piled Foundations

Based on the proposed basement development and the ground conditions encountered it is possible that a piled foundation would be an economic and feasible solution.

At present, there is no information regarding the actual loads for the proposed building and at this stage the assessment of the likely pile capacities has been undertaken purely as an illustration of the feasibility of a piled solution and possible pile capacities.

A factor of safety (FOS) of 2.5 has been adopted in the following preliminary pile design. A lower FOS may be adopted but this will require preliminary and working pile tests and the approval of the local District Surveyor.

Based on the ground investigation data the following preliminary pile design is provided and should be confirmed and/or amended by a competent piling contractor.

Founding Depth (m)	Pile Diameter (mm)	Safe Working Load (kN)	Founding Stratum
10	450	263	Stiff London Clay Formation.
	600	371	

The actual pile design will depend on a number of factors including the particular details of the piling system to be adopted. The advice of a specialist piling contractor should be sought such that the final design of the piles can be undertaken and the suitability of the particular piling system can be considered. All information relating to the site should be provided to the piling contractor. The piling contractor should review all information available for the site and confirm that the information is adequate to complete the design of the piles or undertake further investigation as required.

The specialist piling contractor should consider noise and vibration and confirm the technique proposed is acceptable for the site and any impact on adjacent structures.

In addition, it is likely that due to the presence of groundwater, the retaining wall will need to be formed by the use of sheet piling or a secant pile wall and this is discussed in the further sections.

GROUND STABILITY & RETAINING STRUCTURES

The boreholes remained stable during the investigation but in BH2 there was some collapse following removal of casing and walls constructed in open cut are unlikely to be feasible for this situation. The instability is believed to be related to groundwater ingress from the Head Deposits.

The groundwater is considered to form a thin but laterally continuous aquifer unit within the Head Deposits and sustained inflows would be anticipated into any open excavations taken through the aquifer unit. This is supported by anecdotal information from site personnel at the adjacent site

To prevent inflow of groundwater and to enable construction of the basement and retaining wall it is recommended that consideration is given to the following:

- Use of temporary or permanent sheet piles that would be carried through the Head Deposits and 'keyed' into the firm to stiff London Clay below formation level.
- Use of a secant piles for formation of the basement retaining wall that would be carried through the Head Deposits and 'keyed' into the firm to stiff London Clay below formation level.

A discussion of potential heave, settlement and inward yielding is provided in the next section, however it is likely that any excavations will need to be trimmed back following heave of clay at formation level.

In addition, zones loosened by the removal of existing and relict construction may be particularly unpredictable and liable to collapse.

It would be beneficial to install the basement retaining wall and floor slab sequentially to provide propping and/or lateral restraint, which could help to minimise deflections.

Safe working conditions should be ensured where persons are required to work in excavations. It is recommended that reference be made to CIRIA Report No. 97,"Trenching Practice" 1992.

The parameters presented in the table below may be considered within the design of retaining walls.

Strata	Depth Range (m bgl)		Effective Angle of Shear Resistance (2)	Coefficient of Active Earth Pressure (Ka) (2)	Coefficient of Earth Pressure at rest (Kr) (3)	Coefficient of Passive Earth Resistance (Kp) (2)	Bulk Density
	Top	Base					
Made Ground	Ground Level	0.50 – 0.80	28	0.35	0.75	3.5	1.70(1)
Head Deposits	0.50 – 0.80	3.65 – 3.75	30	0.30	0.75	4.0	1.80(1)
London Clay Formation	3.65 – 3.75	15.00	22	0.40	1.0	2.5	1.96 – 2.03

(1) Assumed value based on literature information.

(2) Based on soil properties and reference to BS8002 & Tomlinson, M.J. (1986) for a free standing wall.
(3) Based on soil properties and reference to BS8002 & Tomlinson, M.J. (1986) for an embedded wall.

BURIED CONCRETE

In accordance with BRE Special Digest 1 (2005), the results indicate that the following design sulphate classes and Aggressive Chemical Environment for Concrete (ACEC) classes would apply:

Strata	Design Sulphate Class	ACEC Class
Made Ground	DS-1	AC-1s
Head Deposits	DS-1	AC-1s
London Clay Formation	DS-2	AC-2

ADDITIONAL CONSIDERATIONS

Existing Structures

It is recommended that any existing buried construction that will underlie the new development is broken out and removed. However, if buried construction (such as existing foundations) are to remain close to the new structure then care should be taken to avoid interaction i.e. to prevent the slab 'breaking its back' over the existing construction.

Potential for Heave, Settlement & Inward Yielding

Although the laboratory testing on the Head Deposits suggests that it is not high plasticity, the London Clay near assumed formation level is known to have high plasticity indices with a high volume change potential.

The removal of the overburden during the excavation of the basement is likely to result in heave and inward yielding of the London Clay soils at formation level and possibly a subsequent settlement of the soils outside the excavation. Based on the ground investigation data, the London Clay at formation level is anticipated to comprise firm to stiff clay and so the potential effects maybe limited by their relatively low compressibility (as compared to soft clay soils). Inward yielding in firm to stiff clays is typically in the range of 5-40mm (Tomlinson, M.J. (1986).

The total uplift will be a function of the soil heave pressure and water pressure, it is anticipated that almost half of this will be immediate upon excavation, while the remainder would be long term. The estimated depth of excavation is between 3.50m and 4.50m below current ground level, assuming an unsaturated unit weight of 20kN/m^3 and accounting for groundwater within the Head Deposits, the estimated unload due to the excavation would be in the order of 60kN/m^2 to 80kN/m^2

GEOTECHNICAL ADVICE

It is anticipated that following excavation and construction of the basement, the load imposed by the new sub-structure will be less than the overburden pressure at formation prior to excavation.

However, it is anticipated the basement slab would not be loaded if strip footings are adopted. In this case a suspended basement floor slab would be appropriate, constructed with suitable compressible void formers that can accommodate the expected ground heave.

As outlined, the basement is estimated to extend beneath the majority of the footprint of the site but there will be areas outside the basement. As such, there will be a difference in load at formation level between the area inside and outside the basement, which could result in differential heave over the long term.

This means there is the potential for longer term heave of the London Clay soils at formation level following basement construction.

Groundwater

As outlined, groundwater was encountered during the ground investigation works and recorded in the Head Deposits at approximately 1.64m bgl during monitoring.

The groundwater is considered to form a laterally continuous aquifer unit that is possibly confined and it is considered prudent to adopt a conservative approach in relation to the basement design and account for groundwater at a depth of approximately 1.00m bgl.

Based on the information presented above it is recommended that the basement design takes into account the following:

- The potential for short term and long term heave and inward yielding during construction and following construction.
- The potential for differential heave that will occur in the areas of the basement and areas where the basement doesn't extend.
- The potential for groundwater to cause both lateral and uplift pressure.
- The potential for groundwater ingress into the basement following construction.

Management of Formation Level

Should pockets of inferior material be present during the inspection of the foundation excavation, they should be removed and replaced with well graded, well compacted hardcore or lean mix concrete. The excavated surface should be protected from deterioration and a blinding layer of concrete used where foundations are not completed without delay. Any surface or perched water should not be allowed to collect in the base of excavations since the clay is prone to rapid deterioration in the presence of water, with loss of their favourable bearing properties.

GEOTECHNICAL ADVICE

Groundwater Management

It is presumed that the retaining wall would be constructed to act as a 'cut-off' to groundwater ingress. However, some dewatering should be anticipated during the construction of the basement and foundations. Assuming the retaining wall is installed prior to excavation then inflow of groundwater is likely to be dealt with by pumping from sumps. Should this not be the case then a larger dewatering system is likely to be required.

Potential Project Risk

It should be noted that the excavation of the basement may undermine the adjacent property and could lead to settlement in gardens and damage to buildings and below ground services. It is recommended that the principle contractor should allow for suitable mitigation measures that may include:

- A survey of existing ground levels and buildings;
- A survey of existing below ground services,
- Monitoring of adjacent buildings during construction
- Monitoring of adjacent ground levels during construction.
- Careful construction planning to deal with the above potential issues and potential groundwater ingress during construction.

REFERENCES & GUIDANCE

1. Environment Agency/Defra (2002). Model procedures for the Management of Land Contamination (CLR 11)
2. Environment Agency/Defra.. Contaminated Land Statutory Guidance (April 2012)
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8. Department of the Environment Industry Profiles.
9. Environment Agency/Defra (2002). Sampling strategies for contaminated land (CLR4)1
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15. CL:AIRE / CIEH (2008), Guidance on Comparing Soil Contamination Data with a Critical Concentration, May 2008;
16. CL:AIRE / EIC (2009), The Soil Generic Assessment Criteria for Human Health, December 2009.
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20. Environment Agency (2009a), Human Health Toxicological Assessment of Contaminants in Soil, Report SC050021/SR2, January 2009;
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[1] This document has been withdrawn but is considered to remain useful in proving technical background for designing ground investigation works.

[2] This document has been withdrawn but is considered to remain useful in proving technical background for designing ground investigation works.

REFERENCES & GUIDANCE

23. Environment Agency (2009d), A Review of Body Weight and Height Data Used in the CLEA Model, Report SC050021/Final Technical Review 1, January 2009;
24. Nathanial et. al., (2009), The LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment (2nd edition), Land Quality Press, Nottingham, ISBN 0-9547474-7-X
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27. Water Framework Directive (2000/60/EC)
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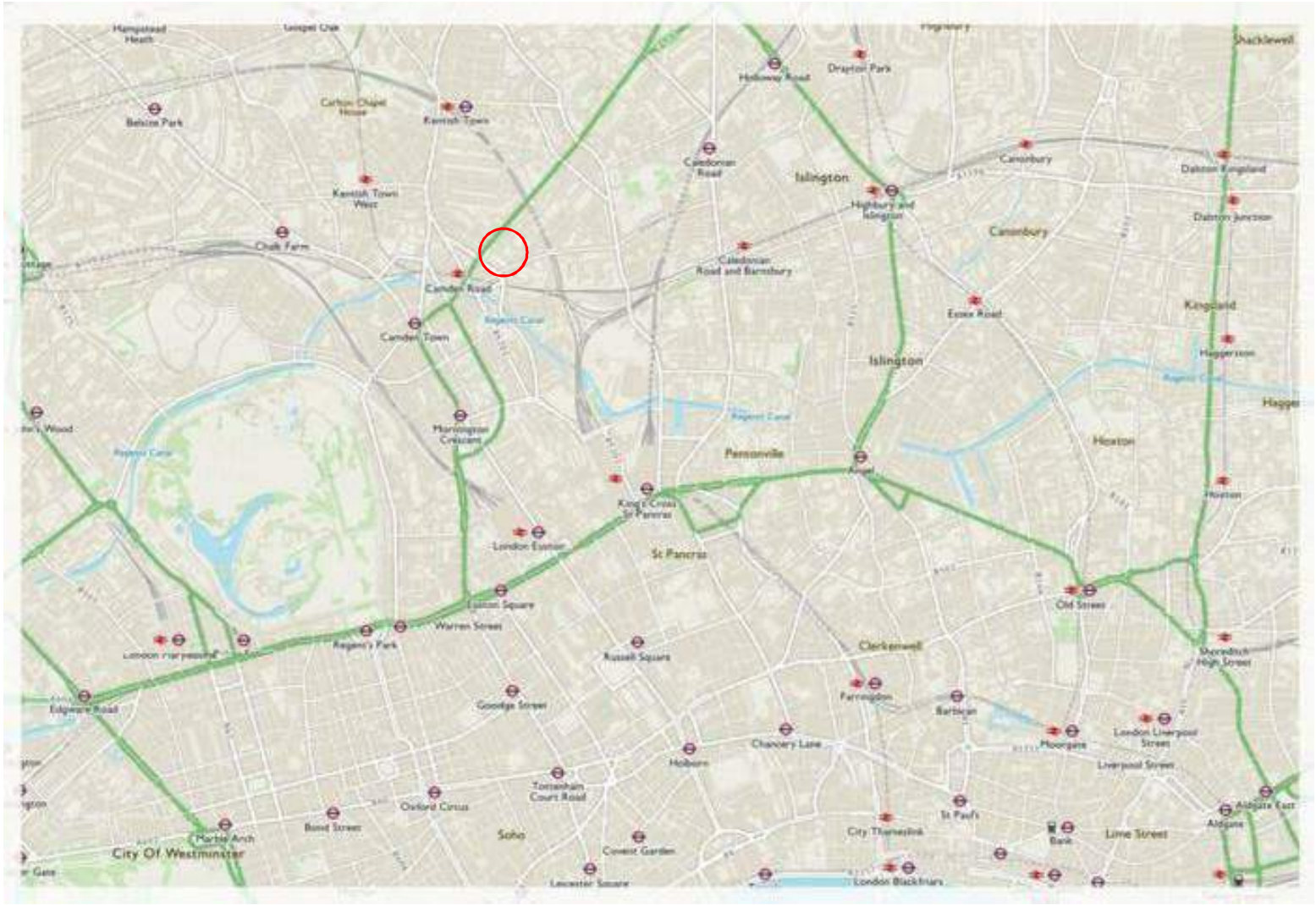
FIGURES



N

Key:

Approximate site location

IMPORTANT – Please Read

This drawing is for illustrative purposes only and is for use only in conjunction with associated reports relating to the project details below. LMB accepts no liability for the mis-interpretation or use of this illustration by any other parties.

LMB

Ground Investigation
Land Contamination
Hydrogeology
Engineering Geology

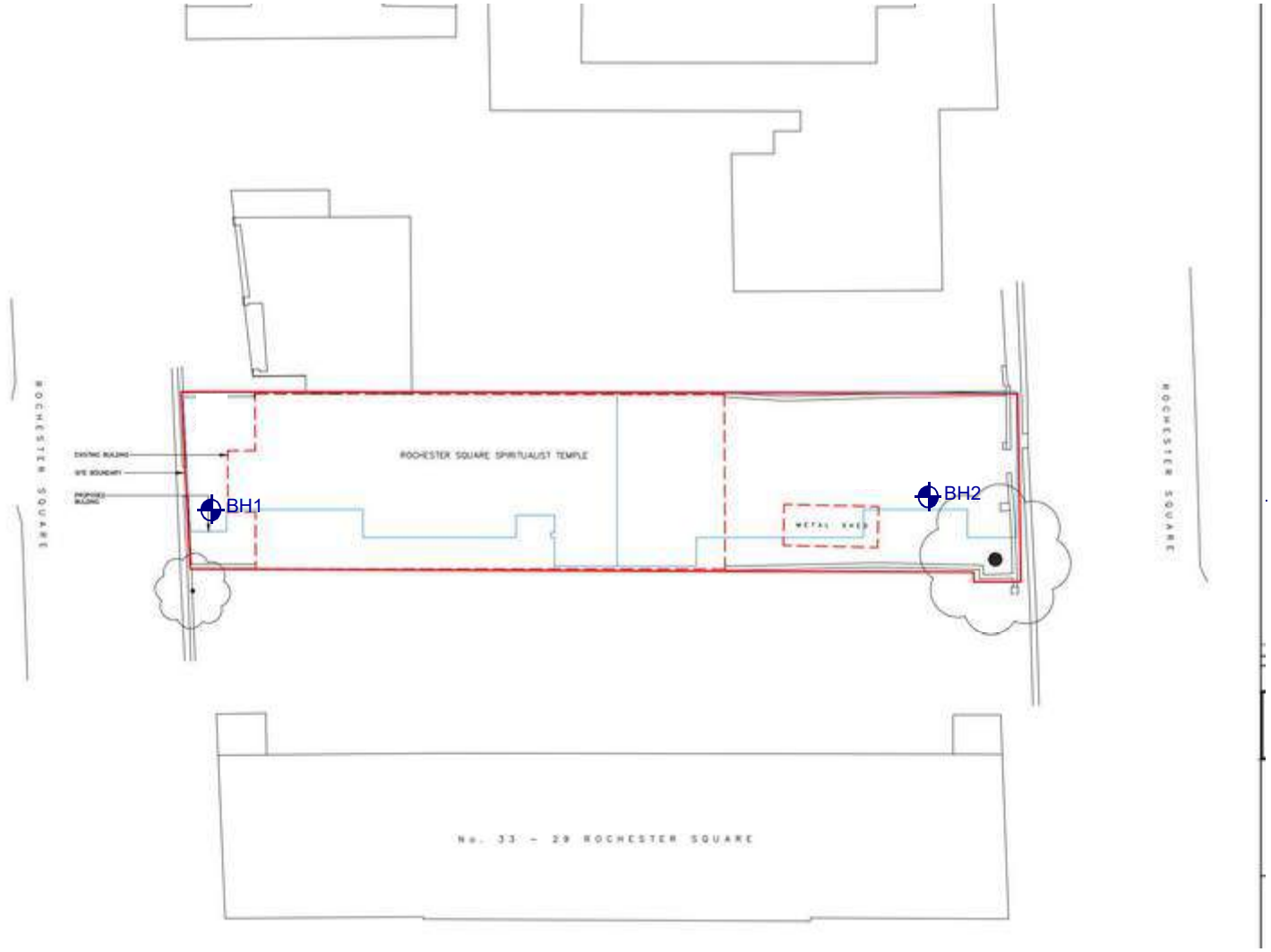
Site: Rochester Square, London NW1

Figure Number: Figure 1

Title: Site Location Plan

Project No:	Created By:	Date:
	PIL	Nov 2016

Client: Camden Land Partnership Ltd



Key:

BH Cable Percussive Borehole location

IMPORTANT – Please Read

This drawing is for illustrative purposes only and is for use only in conjunction with associated reports relating to the project details below. LMB accepts no liability for the mis-interpretation or use of this illustration by any other parties.

LMB
Ground Investigation
Land Contamination
Hydrogeology
Engineering Geology

Site: Rochester Square London NW1

Figure Number: Figure 2

Title: Exploratory Hole Location Plan

Project No:	Created By:	Date:
	PIL	Nov 2016

Client: Camden Land Partnership Ltd

APPENDICES

Appendices

APPENDIX A EXPLORATORY HOLE LOGS

Borehole Log

Borehole No. **BH1**

Sheet 1 of 2

Project Name: Rochester Square	Project No. LMB_Rochester	Co-ords: -	Hole Type CP
Location: Rochester Square, London NW1		Level:	Scale 1:50
Client: Camden Land Partnerships Ltd		Dates: 22/11/2016 - 22/11/2016	Logged By PIL

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.05			Concrete.
	▼	0.50	ES					MADE GROUND: dark brown slightly sandy slightly gravelly clay. Gravel sub-angular fine to medium brick and occasional gravel.
					0.80			*broken tile and brick.*
		1.20	B					Soft becoming firm brown to light brown CLAY. (HEAD DEPOSITS).
		1.20		N=10 (1,1/2,2,3,3)				
					1.75			Firm brown to light brown gravelly CLAY. Gravel sub-angular to rounded fine to coarse flint. (HEAD DEPOSITS).
		2.00	D					
		2.00		N=25 (4,5/5,6,7,7)				
		3.00	B					
		3.00		N=21 (6,5/6,6,4,5)				
					3.65			Firm becoming stiff brown with occasional blue/ grey veining CLAY. Closely fissured. (LONDON CLAY FORMATION).
		4.00	U					*becomes stiff.*
		5.00	D					
		5.00		N=18 (2,2/3,4,5,6)				
								occasional rare orange/brown silty partings.
		6.50	U					
	▼							
		8.00	D					
		8.00		N=18 (3,4/4,4,5,5)				
					8.75			Stiff becoming very stiff dark grey/brown CLAY with rare fine white shell gravel. Very closely fissured. (LONDON CLAY FORMATION).
		9.50	U					

Continued on next sheet

Remarks

water level at 7m after pulling casing. likely to be reflective of water from head deposits.

AGS

Borehole Log

Borehole No. **BH1**
Sheet 2 of 2

Project Name: Rochester Square	Project No. LMB_Rochester	Co-ords: -	Hole Type CP
Location: Rochester Square, London NW1		Level:	Scale 1:50
Client: Camden Land Partnerships Ltd		Dates: 22/11/2016 - 22/11/2016	Logged By PIL

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		11.00 11.00	D	N=21 (3,4/5,5,5,6)				
		12.50	U					
		14.55 14.55	D	N=26 (3,4/5,6,7,8)				
					15.00			End of borehole at 15.00 m

11
12
13
14
15
16
17
18
19
20

Remarks
water level at 7m after pulling casing. likely to be reflective of water from head deposits.

AGS

Borehole Log

Borehole No. **BH2**

Sheet 1 of 2

Project Name: Rochester Square	Project No. LMB_Rochester	Co-ords: -	Hole Type CP
Location: Rochester Square, London NW1		Level:	Scale 1:50
Client: Camden Land Partnerships Ltd		Dates: 21/11/2016 - 21/11/2016	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.15			MADE GROUND: dark brown slightly sandy clay with numerous rootlets and occasional brick gravel.
		0.30	ES					
		0.50	B		0.50			MADE GROUND: brown to light brown clay with rare angular fine to medium brick gravel.
								Soft becoming firm light brown to brown CLAY. (HEAD DEPOSITS).
		1.20	D					
	▼	1.20		N=14 (1,2/2,3,3,6)				
					1.50			Firm brown to orange/brown with occasional grey mottling very gravelly CLAY. Gravel sub-angular to rounded fine to coarse flint. (HEAD DEPOSITS).
		2.00	B					
		2.00		N=18 (3,5/3,5,4,6)				
								becomes less gravelly.
		3.00	D					
		3.00		N=19 (7,5/5,4,4,6)				
					3.75			Firm becoming stiff brown with occasional orange/brown sandy partings CLAY. Some close fissuring visible. (LONDON CLAY FORMATION).
		4.00	U					
		5.00	D					
		5.00		N=17 (2,3/3,4,4,6)				*becomes very closely fissured and stiff.*
		6.50	U					
		8.00	D					
		8.00		N=18 (2,3/4,4,5,5)				
		9.50	U		9.50			Stiff becoming very stiff dark grey CLAY. Very closely fissured. (LONDON CLAY FORMATION).
								Continued on next sheet

Remarks

water level at 1.40m in open hole overnight.

Borehole Log

Borehole No. **BH2**

Sheet 2 of 2

Project Name: Rochester Square	Project No. LMB_Rochester	Co-ords: -	Hole Type CP
Location: Rochester Square, London NW1		Level:	Scale 1:50
Client: Camden Land Partnerships Ltd		Dates: 21/11/2016 - 21/11/2016	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		11.00 11.00	D	N=22 (3,4/4,5,6,7)				
		12.50	U					
		14.55 14.55	D	N=28 (3,4/6,6,7,9)				
					15.00			End of borehole at 15.00 m

11 12 13 14 15 16 17 18 19 20

Remarks
water level at 1.40m in open hole overnight.

AGS

APPENDICES

APPENDIX B GEOTECHNICAL LABORATORY RESULTS

TEST CERTIFICATE

Determination of Moisture Content

Tested in Accordance with BS 1377-2:1990: Clause 3.2

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

4041

Client:	LMB Geosolutions Ltd	Client Reference:	16-33913
Client Address:	28 Dresden Road London N19 3BD	Job Number:	16-33913
		Date Sampled:	Not Given
		Date Received:	22/11/2016
Contact:	Philip Lewis	Date Tested:	01/12/2016
Site Name:	Rochester Square	Sampled By:	PIL
Site Address:	Not Given		

Test results

Laboratory Reference	Sample Reference	Location	Depth Top [m]	Depth Base [m]	Sample Type	Description	Moisture Content [%]
664320	Not Given	BH1	2	Not Given	D	Yellowish brown gravelly clayey SAND	12
664322	Not Given	BH1	5	Not Given	D	Brown CLAY	29

Remarks

Approved:

Mirosława Pytlik
PL Head of
Geotechnical Section

Date Reported: 05/12/2016

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

4041

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

Client:	LMB Geosolutions Ltd	Client Reference:	16-33913
Client Address:	28 Dresden Road London N19 3BD	Job Number:	16-33913
		Date Sampled:	Not Given
		Date Received:	22/11/2016
Contact:	Philip Lewis	Date Tested:	01/12/2016
Site Name:	Rochester Square	Sampled By:	PIL
Site Address:	Not Given		

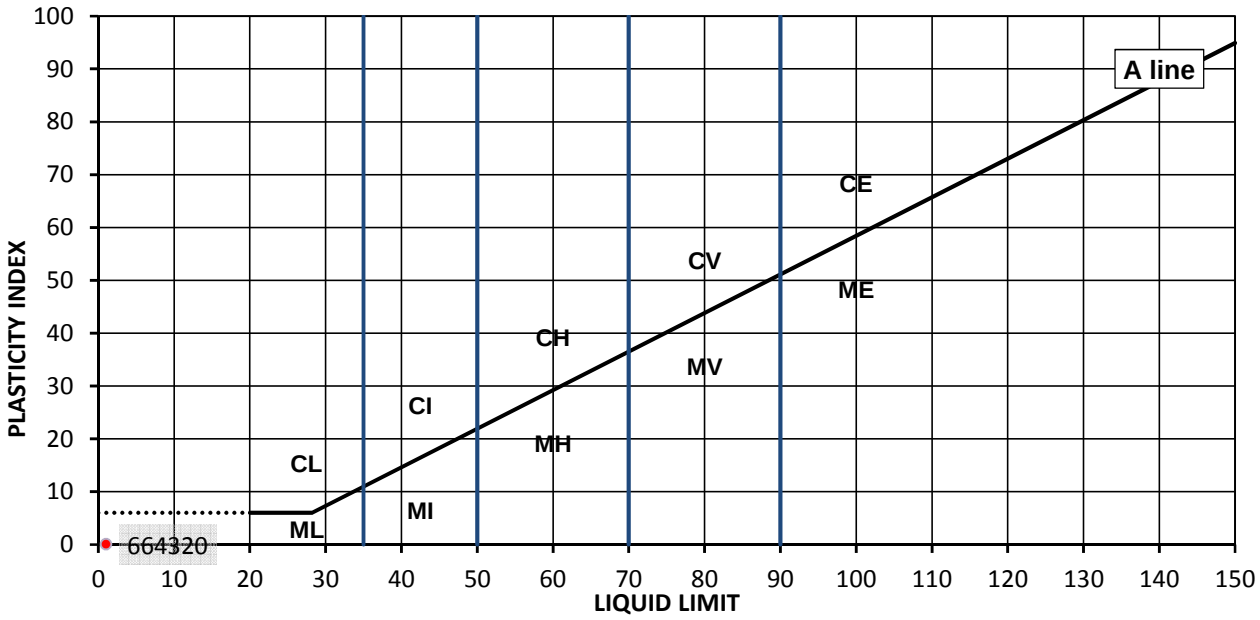
TEST RESULTS

Laboratory Reference: 664320
Sample Reference: Not Given

Description: Yellowish brown gravelly clayey SAND
Location: BH1
Sample Preparation: N/A

Sample Type: D
Depth Top [m]: 2
Depth Base [m]: Not Given

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
12	N/A	NP	N/A	N/A



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks: Sample unsuitable for the Atterberg test

Approved:

Mirosława Pytlik
PL Head of
Geotechnical Section

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

Date Reported: 05/12/2016

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

UKAS TESTING 4041

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

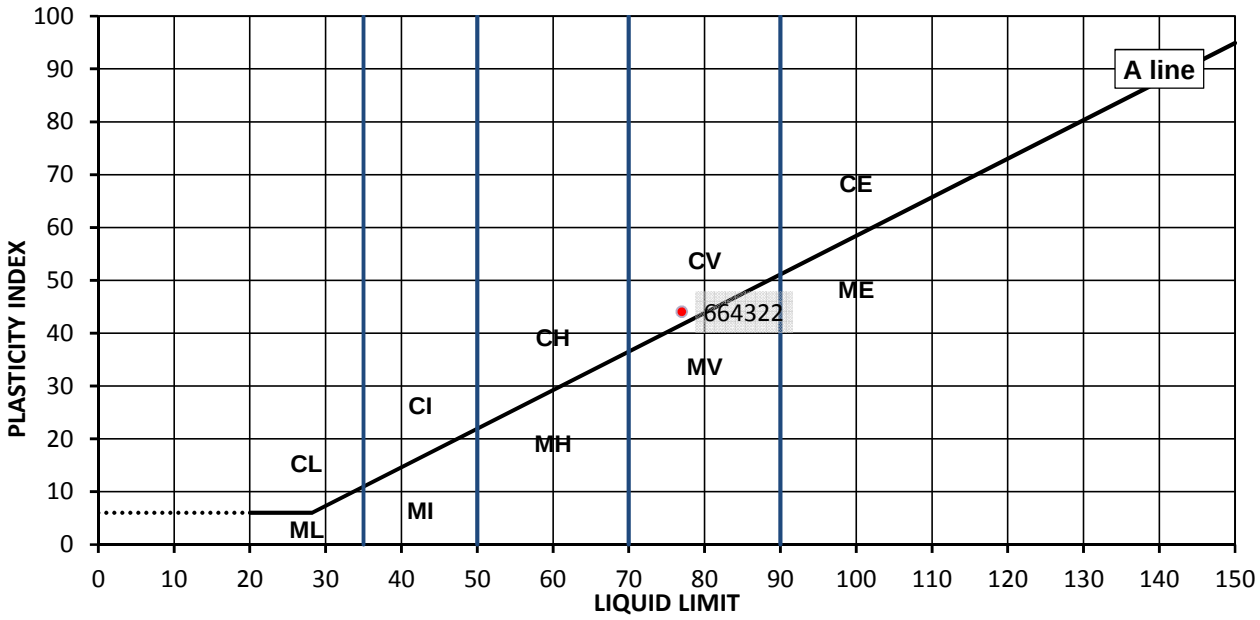
Client:	LMB Geosolutions Ltd	Client Reference:	16-33913
Client Address:	28 Dresden Road London N19 3BD	Job Number:	16-33913
		Date Sampled:	Not Given
		Date Received:	22/11/2016
Contact:	Philip Lewis	Date Tested:	01/12/2016
Site Name:	Rochester Square	Sampled By:	PIL
Site Address:	Not Given		

TEST RESULTS

Laboratory Reference: 664322
Sample Reference: Not Given

Description:	Brown CLAY	Sample Type:	D
Location:	BH1	Depth Top [m]:	5
Sample Preparation:	Tested in natural condition	Depth Base [m]:	Not Given

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
29	77	33	44	100



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks

Approved:

Mirosława Pytlik
PL Head of
Geotechnical Section

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

Date Reported: 05/12/2016

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Summary of Classification Test Results

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

Client: LMB Geosolutions Ltd
Client Address: 28 Dresden Road
London
N19 3BD

Contact: Philip Lewis
Site Name: Rochester Square
Site Address: Not Given

Client Reference: 16-33913
Job Number: 16-33913
Date Sampled: Not Given
Date Received: 22/11/2016
Date Tested: 01/12/2016
Sampled By: PIL

Test results

Laboratory Reference	Hole No.	Sample				Soil Description	Density		M/C	Attenberg				PD
		Reference	Top depth [m]	Base depth [m]	Type		bulk Mg/m3	dry Mg/m3	%	% Passing 425um %	LL %	PL %	PI %	Mg/m3
664320	BH1	Not Given	2.00	Not Given	D	Yellowish brown gravelly clayey SAND	-	-	12	N/A	NP	N/A	N/A*	-
664322	BH1	Not Given	5.00	Not Given	D	Brown CLAY	-	-	29	100	77	33	44	-

Comments: * Sample unsuitable for the Atterberg test

Approved:

Mirosława Pytlik
PL Head of Geotechnical Section

Signed:

Sushil Sharda
Technical Manager (Geotechnical Division)

Date Reported: 05/12/2016

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Particle Size Distribution

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

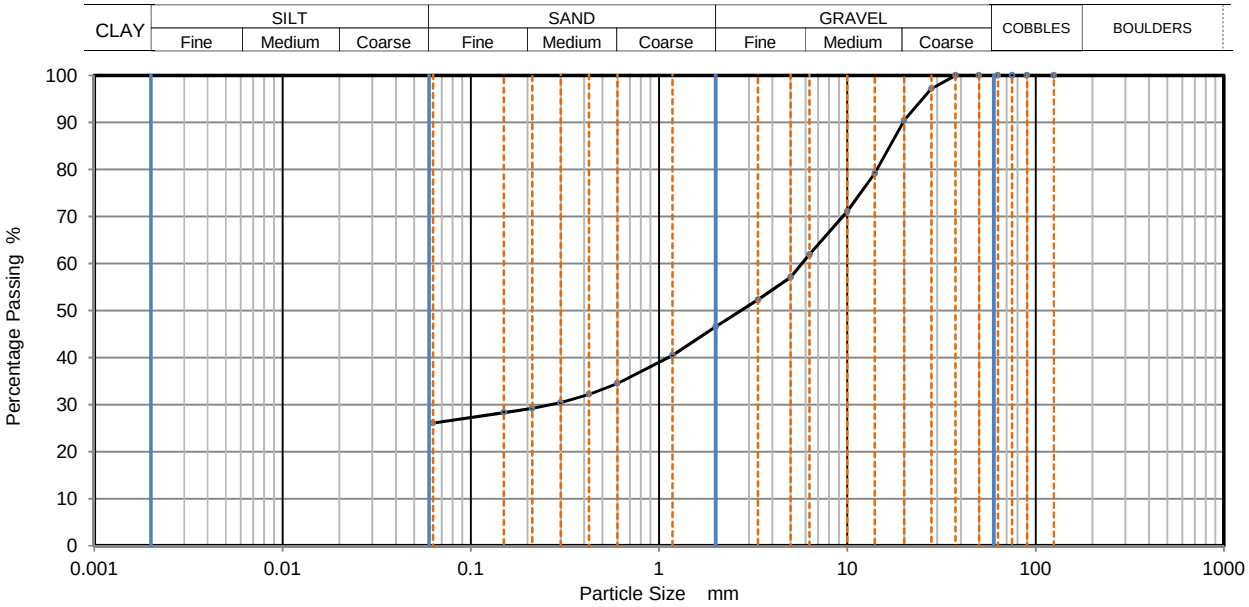
UKAS TESTING 4041

Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Client:	LMB Geosolutions Ltd	Client Reference:	16-33913
Client Address:	28 Dresden Road London N19 3BD	Job Number:	16-33913
		Date Sampled:	Not Given
		Date Received:	22/11/2016
Contact:	Philip Lewis	Date Tested:	07/11/3718
Site Name:	Rochester Square	Sampled By:	PIL
Site Address:	Not Given		

TEST RESULTS Laboratory Reference: 664323

Sample description:	Yellowish brown slightly sandy gravelly CLAY	Sample Reference:	Not Given
Location:	BH2	Sample Type:	B
Supplier:	Not Given	Depth Top [m]:	2
		Depth Base [m]:	Not Given



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	97		
20	90		
14	79		
10	71		
6.3	62		
5	57		
3.35	52		
2	47		
1.18	41		
0.6	35		
0.425	32		
0.3	30		
0.212	29		
0.15	28		
0.063	26		

Dry Mass of sample [g]: 2442

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	53.40
Sand	20.50
Fines <0.063mm	26.10

Grading Analysis		
D100	mm	37.5
D60	mm	5.75
D30	mm	0.266
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved:

Mirosława Pytlik
PL Head of
Geotechnical Section

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

Date Reported: 05/12/2016

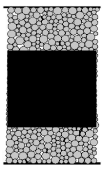
for and on behalf of i2 Analytical Ltd

Total Stress Triaxial Compression

Unconsolidated Undrained (Single Stage)

Summary Report

Sample Details



sketch showing specimen location in original sample

Depth			4.00
Description			Yellowish brown CLAY with thin laminae of grey clay
Type			U
Initial Sample Length	L_0	(mm)	199.0
Initial Sample Diameter	D_0	(mm)	98.2
Initial Sample Weight	W_0	(gr)	2994.1
Bulk Density	ρ_0	(Mg/m3)	1.99
Particle Density	ρ_s	(Mg/m3)	2.65

Initial Conditions

Initial Cell Pressure	σ_3	(kPa)	80
Strain Rate	m_S	(mm/min)	3.98020
MembraneThickness	m_b	(mm)	0.27
Displacement Input	L_{IP}	(mm)	CH 2
Load Input	N_{IP}	(N)	CH 1
Initial Moisture	$\omega_i\%$	(%)	31
Initial Dry Density	ρ_{d0}	(Mg/m3)	1.51
Initial Voids Ratio	e_0	.	0.75
Initial Degree of Saturation	S_o	(%)	100

Final Conditions

Max Deviator Stress	$(\sigma_1-\sigma_3)_f$	(kPa)	102
MembraneCorrection	m_C	(kPa)	0.337
Strain At Max Stress	$\varepsilon_f\%$	(%)	3.28
Shear Strength	c_U	(kPa)	51
Final Moisture	$\omega_f\%$	(%)	31
Final Dry Density	ρ_{df}	(Mg/m3)	1.51
Final Voids Ratio	e_f	.	0.75
Final Degree of Saturation	S_f	(%)	100.0

Notes

Triaxial at over burden

Failure Sketch

(surface inclination)

Test Method	BS1377-7 : 1990 Clause 8			Test Name	664321
Database: .\SQLEXPRESS \ 6171-I2 Analytical				Test Date	01/12/2016
Site Reference	Rochester Square			Borehole	BH1
Jobfile	16-33913			Sample	664321
Client	LMB Geosolutions Ltd			Depth	4.00
Operator	palmowskia	Checked	pytlikm	Approved	pytlikm

i2 Analytical Limited, 7 Woodshots Meadow, Croxley Green Business Park, Herts WD18 8YS

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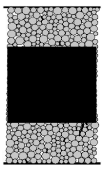
Total Stress Triaxial Compression

Unconsolidated Undrained (Single Stage)

Summary Report

Sample Details



sketch showing specimen location in original sample

Depth	4.00		
Description	Yellowish brown CLAY with thin laminae of grey clay		
Type	U		
Initial Sample Length	L_0	(mm)	198.6
Initial Sample Diameter	D_0	(mm)	98.8
Initial Sample Weight	W_0	(gr)	2979.4
Bulk Density	ρ_0	(Mg/m3)	1.96
Particle Density	ρ_s	(Mg/m3)	2.65

Initial Conditions

Initial Cell Pressure	σ_3	(kPa)	80
Strain Rate	m_S	(mm/min)	3.97220
MembraneThickness	m_b	(mm)	0.28
Displacement Input	L_{IP}	(mm)	CH 2
Load Input	N_{IP}	(N)	CH 1
Initial Moisture	$\omega_i\%$	(%)	32
Initial Dry Density	ρ_{d0}	(Mg/m3)	1.48
Initial Voids Ratio	e_0	.	0.79
Initial Degree of Saturation	S_o	(%)	100

Final Conditions

Max Deviator Stress	$(\sigma_1-\sigma_3)_f$	(kPa)	161
MembraneCorrection	m_C	(kPa)	0.893
Strain At Max Stress	$\varepsilon_f\%$	(%)	11.36
Shear Strength	c_U	(kPa)	81
Final Moisture	$\omega_f\%$	(%)	32
Final Dry Density	ρ_{df}	(Mg/m3)	1.48
Final Voids Ratio	e_f	.	0.79
Final Degree of Saturation	S_f	(%)	100.0

Failure Sketch

(surface inclination)

Notes

Triaxial at over burden

Test Method	BS1377-7 : 1990 Clause 8			Test Name	664324
Database: .\SQLEXPRESS \ 6171-I2 Analytical				Test Date	01/12/2016
Site Reference	Rochester Square			Borehole	BH2
Jobfile	16-33913			Sample	664324
Client	LMB Geosolutions Ltd			Depth	4.00
Operator	palmowskia	Checked	pytlikm	Approved	pytlikm

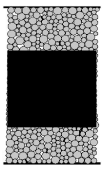
i2 Analytical Limited, 7 Woodshots Meadow, Croxley Green Business Park, Herts WD18 8YS

i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Total Stress Triaxial Compression

Unconsolidated Undrained (Single Stage)

Summary Report

Sample Details				
 *sketch showing specimen location in original sample*	Depth	9.50		
	Description	Brown CLAY		
	Type	U		
	Initial Sample Length	L_0	(mm)	196.6
	Initial Sample Diameter	D_0	(mm)	97.9
	Initial Sample Weight	W_0	(gr)	3010.2
	Bulk Density	ρ_0	(Mg/m3)	2.03
	Particle Density	ρ_s	(Mg/m3)	2.65

Initial Conditions

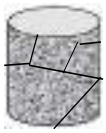
Initial Cell Pressure	σ_3	(kPa)	190
Strain Rate	m_S	(mm/min)	3.93260
MembraneThickness	m_b	(mm)	0.29
Displacement Input	L_{IP}	(mm)	CH 2
Load Input	N_{IP}	(N)	CH 1
Initial Moisture	$\omega_i\%$	(%)	29
Initial Dry Density	ρ_{d0}	(Mg/m3)	1.58
Initial Voids Ratio	e_0	.	0.68
Initial Degree of Saturation	S_o	(%)	100

Final Conditions

Max Deviator Stress	$(\sigma_1-\sigma_3)_f$	(kPa)	164
MembraneCorrection	m_C	(kPa)	0.500
Strain At Max Stress	$\varepsilon_f\%$	(%)	5.28
Shear Strength	c_U	(kPa)	82
Final Moisture	$\omega_f\%$	(%)	29
Final Dry Density	ρ_{df}	(Mg/m3)	1.58
Final Voids Ratio	e_f	.	0.68
Final Degree of Saturation	S_f	(%)	100.0

Notes

Triaxial at over burden



Failure Sketch

(surface inclination)

Test Method	BS1377-7 : 1990 Clause 8			Test Name	664325
Database: .\SQLEXPRESS \ 6171-I2 Analytical				Test Date	01/12/2016
Site Reference	Rochester Square			Borehole	BH2
Jobfile	16-33913			Sample	664325
Client	LMB Geosolutions Ltd			Depth	9.50
Operator	palmowskia	Checked	pytlikm	Approved	pytlikm

i2 Analytical Limited, 7 Woodshots Meadow, Croxley Green Business Park, Herts WD18 8YS
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APPENDICES

APPENDIX C CHEMICAL LABORATORY TESTING RESULTS

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Analytical Report Number : 16-33916

Project / Site name:	Rochester Square	**Samples received on:**	22/11/2016
Your job number:		**Samples instructed on:**	23/11/2016
Your order number:		**Analysis completed by:**	02/12/2016
Report Issue Number:	1	**Report issued on:**	02/12/2016
Samples Analysed:	4 soil samples		

Signed:

Rexona Rahman
Reporting Manager
For & on behalf of i2 Analytical Ltd.

Signed:

Emma Winter
Assistant Reporting Manager
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Analytical Report Number: 16-33916

Project / Site name: Rochester Square

Lab Sample Number				664337	664338	664339	664340	
Sample Reference				BH1	BH1	BH2	BH2	
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	
Depth (m)				5.00	0.50	0.30	2.00	
Date Sampled				Deviating	Deviating	Deviating	Deviating	
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
Moisture Content	%	N/A	NONE	19	15	20	12	
Total mass of sample received	kg	0.001	NONE	0.25	0.86	1.1	0.49	
Asbestos in Soil	Type	N/A	ISO 17025	-	Not-detected	Not-detected	-	
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	8.3	-	7.2	8.4	
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.55	-	0.018	0.065	
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	-	-	< 0.05	-	
Acenaphthylene	mg/kg	0.1	MCERTS	-	-	< 0.10	-	
Acenaphthene	mg/kg	0.1	MCERTS	-	-	< 0.10	-	
Fluorene	mg/kg	0.1	MCERTS	-	-	< 0.10	-	
Phenanthrene	mg/kg	0.1	MCERTS	-	-	0.42	-	
Anthracene	mg/kg	0.1	MCERTS	-	-	< 0.10	-	
Fluoranthene	mg/kg	0.1	MCERTS	-	-	0.97	-	
Pyrene	mg/kg	0.1	MCERTS	-	-	0.86	-	
Benzo(a)anthracene	mg/kg	0.1	MCERTS	-	-	0.51	-	
Chrysene	mg/kg	0.05	MCERTS	-	-	0.53	-	
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	-	-	0.46	-	
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	-	-	0.25	-	
Benzo(a)pyrene	mg/kg	0.1	MCERTS	-	-	0.34	-	
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	-	-	< 0.10	-	
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	-	-	< 0.10	-	
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	< 0.05	-	
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	1.6	MCERTS	-	-	4.34	-	
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	28	13	-	
Boron (water soluble)	mg/kg	0.2	MCERTS	-	1.0	2.0	-	
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	< 0.2	< 0.2	-	
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	27	38	-	
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	97	65	-	
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	610	360	-	
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	1.8	1.2	-	
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	25	24	-	
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	< 1.0	< 1.0	-	
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	150	140	-	
Petroleum Hydrocarbons								
TPH C10 - C40	mg/kg	10	MCERTS	-	-	< 10	-	

Analytical Report Number : 16-33916

Project / Site name: Rochester Square

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
664337	BH1	None Supplied	5.00	Brown clay.
664338	BH1	None Supplied	0.50	Brown loam and clay with gravel and vegetation.
664339	BH2	None Supplied	0.30	Brown loam and clay with gravel and vegetation.
664340	BH2	None Supplied	2.00	Light brown sandy clay.

Analytical Report Number : 16-33916

Project / Site name: Rochester Square

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
TPH Banding in Soil by FID	Determination of hexane extractable hydrocarbons in soil by GC-FID.	In-house method, TPH with carbon banding.	L076-PL	W	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Sample ID	Other_ID	Sample Type	Job	Sample Number	Sample Deviation Code	test_name	test_ref	Test Deviation code
BH1		S	16-33916	664337	a			
BH1		S	16-33916	664338	a			
BH2		S	16-33916	664339	a			
BH2		S	16-33916	664340	a			

Key: a - No sampling date b - Incorrect container
c - Holding time d - Headspace e - Temperature

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Analytical Report Number : 16-33918

Project / Site name:	Rochester Square	**Samples received on:**	22/11/2016
Your job number:		**Samples instructed on:**	23/11/2016
Your order number:		**Analysis completed by:**	05/12/2016
Report Issue Number:	1	**Report issued on:**	05/12/2016
Samples Analysed:	1 10:1 WAC sample		

Signed:

Rexona Rahman
Reporting Manager
For & on behalf of i2 Analytical Ltd.

Signed:

Emma Winter
Assistant Reporting Manager
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Waste Acceptance Criteria Analytical Results

Report No:	**16-33918**						
					Client:	**LMBGEOSOL**	
Location	**Rochester Square**						
Lab Reference (Sample Number)	664345 / 664346				**Landfill Waste Acceptance Criteria**		
					Limits		
Sampling Date	Deviating				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	BH1						
Depth (m)	0.50						
Solid Waste Analysis							
TOC (%)**	1.3				3%	5%	6%
Loss on Ignition (%) **	-				--	--	10%
BTEX (µg/kg) **	-				6000	--	--
Sum of PCBs (mg/kg) **	-				1	--	--
Mineral Oil (mg/kg)	-				500	--	--
Total PAH (WAC-17) (mg/kg)	-				100	--	--
pH (units)**	8.4				--	>6	--
Acid Neutralisation Capacity (mol / kg)	6.1				--	To be evaluated	To be evaluated
Eluate Analysis	10:1			10:01	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	0.0203			0.146	0.5	2	25
Barium *	0.0321			0.230	20	100	300
Cadmium *	< 0.0001			< 0.0008	0.04	1	5
Chromium *	0.0054			0.039	0.5	10	70
Copper *	0.015			0.10	2	50	100
Mercury *	< 0.0005			< 0.0050	0.01	0.2	2
Molybdenum *	0.0030			0.0218	0.5	10	30
Nickel *	0.0027			0.019	0.4	10	40
Lead *	0.036			0.26	0.5	10	50
Antimony *	0.0027			0.019	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.019			0.14	4	50	200
Chloride *	0.84			6.0	800	4000	25000
Fluoride	0.51			3.7	10	150	500
Sulphate *	3.2			23	1000	20000	50000
TDS	33			240	4000	60000	100000
Phenol Index (Monhydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	3.75			26.9	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	0.86						
Dry Matter (%)	85						
Moisture (%)	15						

Results are expressed on a dry weight basis, after correction for moisture content where applicable
Stated limits are for guidance only and I2 cannot be held responsible for any discrepencies with current legislation

*= UKAS accredited (liquid eluate analysis only)
** = MCERTS accrediited

Analytical Report Number : 16-33918

Project / Site name: Rochester Square

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
664345	BH1	None Supplied	0.50	Brown loam and clay with gravel and vegetation.

Analytical Report Number : 16-33918

Project / Site name: Rochester Square

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Acid neutralisation capacity of soil	Determination of acid neutralisation capacity by addition of acid or alkali followed by electronic probe.	In-house method based on Guidance an Sampling and Testing of Wastes to Meet Landfill Waste Acceptance""	L046-UK	W	NONE
BS EN 12457-2 (10:1) Leachate Prep	10:1 (as recieved, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.	In-house method based on BSEN12457-2.	L043-PL	W	NONE
Chloride 10:1 WAC	Determination of Chloride colorimetrically by discrete analyser.	In house based on MEWAM Method ISBN 0117516260.	L082-PL	W	ISO 17025
Dissolved organic carbon 10:1 WAC	Determination of dissolved inorganic carbon in leachate by TOC/DOC NDIR Analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	NONE
Fluoride 10:1 WAC	Determination of fluoride in leachate by 1:1ratio with a buffer solution followed by Ion Selective Electrode.	In-house method based on Use of Total Ionic Strength Adjustment Buffer for Electrode Determination"	L033-PL	W	NONE
Metals in leachate by ICP-OES	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil""	L039-PL	W	ISO 17025
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
Monohydric phenols 10:1 WAC	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
pH in soil	Determination of pH in soil by addition of water followed by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L005-PL	W	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate 10:1 WAC	Determination of sulphate in leachate by ICP-OES	In-house method based on MEWAM 1986 Methods for the Determination of Metals in Soil""	L039-PL	W	ISO 17025
Total dissolved solids 10:1 WAC	Determination of total dissolved solids in water by electrometric measurement.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L004-PL	W	NONE
Total organic carbon in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L023-PL	D	MCERTS

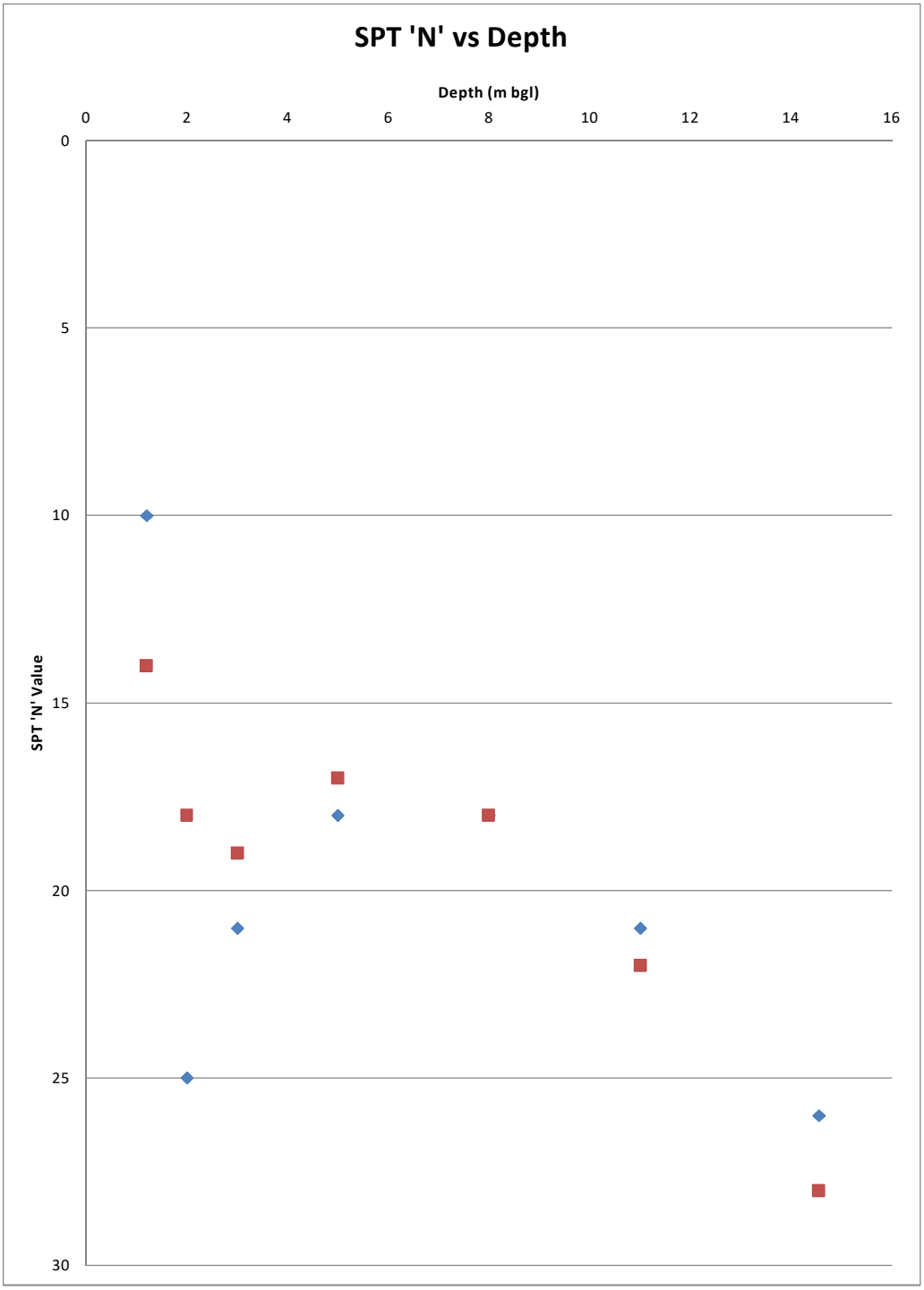
For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Sample ID	Other_ID	Sample Type	Job	Sample Number	Sample Deviation Code	test_name	test_ref	Test Deviation code
BH1		L	16-33918	664346	a			
BH1		S	16-33918	664345	a			

Key: a - No sampling date b - Incorrect container
c - Holding time d - Headspace e - Temperature

APPENDICES

APPENDIX D PLOT OF SPT ‘N’ VLAUE VS DEPTH



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SPT N DEPTH PLOT

Project: Rochester Square Spiritualist Temple
Client: Camden Land Partnership Ltd
Logged By: PIL

Depth	SPT N BH1	BH2		Geol
1.2		10	14	HD
2		25	18	HD
3		21	19	HD
5		18	17	LC
8		18	18	LC
11		21	22	LC
14.55		26	28	LC

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BASEMENT IMPACT ASSESSMENT

ROCHESTER SQUARE SPIRITUALIST TEMPLE, ROCHESTER SQUARE, LONDON NW1

December 2016

DOCUMENT RECORD

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	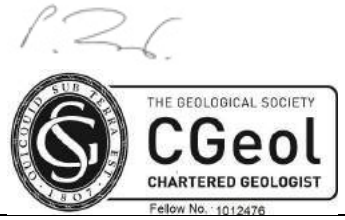

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INTRODUCTION

Introduction

AUTHORISATION

LMB Geosolutions Ltd (LMB) was instructed by Spacelab (Architects) on behalf of Camden Land Partnership Ltd (the Client) in November 2016 to complete a Basement Impact Assessment works in relation to the proposed development at Rochester Square Spiritualist Temple, Rochester Square, London NW1 9RY (the Site).

PROJECT AND SITE DETAILS

Site Address	Rochester Square Spiritualist Temple, Rochester Square, London NW1 9RY (the Site). A Site Location Plan is provided as **Figure 1**.
Proposed Development	The site currently comprises a former temple that is occupied by live in security. The main entrance is via gate located on the southern side of Rochester Square with the rear garden accessed from a gate on the northern side of Rochester Square. Information provided by the Architects and Symmetrys Ltd (Consultant Engineers) indicates that the proposed development involves demolition of the existing structure and construction of a new mixed use four storey structure that will include a single storey basement. Based on the information provided, the following assumptions have been made: • The development will comprise demolition of the existing building and construction of commercial space and residential flats; • The basement will comprise a single storey structure; • The basement will occupy most the footprint of the development (326m^2 of 426m^2); and • The basement will be utilised for office space (front) and residential units (rear). A development schematic is provided in **Appendix A**.
Previous Assessments	LMB are not aware of any previous reports and/or documents relating to the property or the proposed development at the site.

AIMS & OBJECTIVES

The information in this document aims to provide details of the local hydrological, geological and hydrogeological conditions beneath the site in the context of completing a Basement Impact Assessment suitable to support the planning application for the basement element of the proposed development.

INTRODUCTION

SCOPE OF WORKS

The following scope of works has been completed:

- an appraisal of the geological and hydrogeological conditions based on the ground investigation data and desk based literature information;
- consultation with potential below ground asset holders (e.g. Transport for London, Crossrail etc) to ascertain if the proposed basement development is in proximity to any of their below ground assets;
- an appraisal of potential land contamination issues based on the ground investigation data environmental search data (Environmental Health at London Borough of Camden);
- an appraisal of the hydrological conditions at the site based on literature information.

- A screening and scoping assessment in an appropriate form for submission to the London Borough of Camden (LBC).
- An appraisal of the potential impacts and provision of suitable mitigation measures.

CONTRIBUTORS

This report has been compiled by Philip Lewis a hydrogeologist and chartered Geologist with over nineteen years experience as a geoscience professional, including over fifteen years experience as a professional adviser (consultant) in hydrogeology, engineering geology and contaminated land.

Further specialist input has been provided in the form of a Flood Risk Assessment completed by Edward Bouet (Senior Flood Risk Consultant) and a Ground Movement Assessment completed by Corrado Candian (CEng, MICE).

LIMITATIONS

LMB has prepared this report solely for the use of the named Client and those parties with whom a warranty agreement and/or assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from LMB and the Client.

LMB accepts no responsibility or liability for:

a) the consequences of this document being used for any purpose or project other than for which it was commissioned, and

b) issue of this document to any third party with whom an agreement has not been executed.

The risk assessment and opinions provided, among other things, take in to consideration currently available guidance and best available techniques relating to acceptable contamination concentrations and interpretation of these values. No liability can be accepted for the retrospective effects of any future changes or amendments to these values, if applied.

Baseline Data & Criteria

INTRODUCTION

This section provides the baseline (desk study) data used to complete the Basement Impact Assessment (BIA) in relation to the proposed development. Reference information used for this purpose is outlined below:

- British Geological Survey – 1:50,000 Geological Sheet 256, North London (Solid & Drift);
- British Geological Survey borehole archive records.
- Environment Agency Groundwater Vulnerability Mapping (1:100,000 series) Sheet 40, Thames;
- Environment Agency Internet database (www.environment-agency.gov.uk);
- River Basin Management Plan (RBMP). Thames River Basin District (2009);
- Barton, N.J. (1982). Lost Rivers of London.
- London Borough Camden Flood Risk Management Strategy (2013).
- URS (2014). London Borough of Camden Strategic Flood Risk Assessment.
- Halcrow (2011). London Borough of Camden Surface Water Management Plan.

Guidance and Frameworks

The proposed development is located in the London Borough of Camden (LBC) and the guidance and policies outlined in the following documents are considered to be relevant:

- Camden Planning Guidance: Basements and Lightwells (CPG 4); and
- LBC: Camden geological, hydrogeological and hydrological study Guidance for subterranean development (Issue 01, November 2010).

The above documents provide information and a framework for undertaking a BIA within LBC. In summary, the key aim of the documents is to ensure that basement and underground development is only permitted where it does not:

- cause harm to the built and natural environment and local amenity;
- result in flooding; or
- lead to ground instability.

LBC require that a submission for a proposed basement development should include information relating to the above within a BIA which is site and development specific to the site.

BASELINE DATA & CRITERIA

About this Assessment

In the context of this assessment greatest emphasis has been placed on the requirements highlighted above relating to potential impacts on drainage, flooding from all sources, groundwater conditions and ground stability.

In accordance with the referenced guidance this report includes the following elements:

- Desk Study;
- Screening & Scoping;
- Site Investigation, monitoring, interpretation and ground movement assessment;
- Impact Assessment.

Regulatory Consultation

LBC Planning

The project planners (NTA Planning) consulted with LBC in November 2016 to gain pre-planning advice with a view to gaining an insight into the requirements for the proposed development. A pre-planning advice response was received on 5th October 2015 (ref. 2016/3442/PRE).

The pre-planning advice confirms that a Basement Impact Assessment is required in accordance with Camden guidance documents.

LBC Environmental Health

A representative of LBM contacted the Contaminated Land Officer at LBC in November 2016 with a view to obtaining pertinent information in relation to the current and historical site and surrounding land uses. A response was provided on 17th November 2016 and is discussed in more detail in the **Baseline Conditions** section of this report.

Copies of the regulatory correspondence are included in **Appendix B.**

SIGNIFICANCE CRITERIA

The assessment of potential effects from the proposed development has taken into account both the construction and operational phases. The significance level attributed to each effect has been assessed based on the magnitude of change due to the development proposals and the sensitivity of the effected receptor/receiving environment to change, as well as a number of other factors.

Assessment criteria developed from the guidance and frameworks referenced have been used to determine the significance of the potential effects as a result of construction and operation of the proposed development.

The significance of potential effects has been determined by considering the magnitude of the effect, in terms of a change in existing baseline conditions.

BASELINE DATA & CRITERIA

Significance Measures

The following terms have been used to define the significance of the effects identified:

- **Major effect**: where the proposed development could be expected to have a very significant effect (either positive or negative) e.g. significant risk of flooding effect, an improvement in water quality class, allowing new uses to be made of the water resource (e.g. potable water supply) or impacts from contamination issued e.g. risk to groundwater or future site users;
- **Moderate effect**: where the proposed development could be expected to have a noticeable effect (either positive or negative) e.g. moderate flooding effect;
- **Minor effect**: where the proposed development could be expected to result in a small, barely noticeable effect (either positive or negative), but where current uses could still be maintained; and
- **Negligible**: where no discernible effect is expected as a result of the proposed development.

Screening Assessment

The information presented within the LBC guidance provides decision-making matrices to enable an initial screening assessment to be made in relation to potential impacts and issues related to proposed basement development.

The matrices specifically focus on Land Stability, Groundwater Movement and Surface flow and Flooding. An example of the type of matrix is presented below:

Is the site located on an Aquifer?	Yes
Will the basement extend below the groundwater level?	
Is the site within 100m of a water course?	
Will the proposed development change the proportions of soft / hard surfaced areas?	
Will the development result in an increase in surface water infiltration to ground (e.g. via soakway and/or SUDS)?	
Will the development result in a change in slopes at the property boundary?	
Is the site located in an area where the soils are known to have a high volume change potential?	
Will the development result in the felling of any trees?	No
Is the site in a Flood Zone 2 or 3	
Is the site in an area where there has been historical flooding from sewers or where surface water ponding is prevalent?	

Yes → Carry forward to scoping stage.

No → Provide statement justifying decision not carry forward to scoping stage.

BASELINE CONDITIONS

Baseline Conditions

General

This section of the report uses **desk study** and site specific data to present the current conditions at the site (i.e. pre development) to enable a baseline to be established that can be used to predict the likely impact of the basement post construction.

SITE ENVIRONMENTAL SETTING

Relevant information relating to sites environmental setting, founded on desk based information and in the context of this assessment is summarised in the table below:

Site Description & Site Walkover	A site walkover was conducted by a representative of LMB on Monday 14th November 2016 and included external areas of the site. A photographic record is included as **Appendix C**. The site currently comprises a former spiritualist temple that is currently occupied by live in security. The temple comprises a main building of approximately three storey height with a rear single storey height extension. The main entrance is via a padlocked gate located on the southern side of Rochester Square (see Photo 1). However, access to the property is via the rear garden accessed from a gate on the northern side of Rochester Square (see Photo 2). During the walkover, the existing building and boundary walls were inspected to note any indicators of possible structural damage e.g. cracks. The existing structures appeared to be largely free of obvious defects, but a crack was observed along the facias and brick work on the south eastern corner of the building (see Photo 3). It was not clear whether this was associated with subsidence or vegetation (small tree) growing out of the roof of the property. No obvious sources of potential contamination were observed. The area immediately surrounding the site comprises residential properties, as follows: • Adjacent west: a two storey property with single storey basement (see Photo 4); • North west: a five storey block of residential flats (see Photo 5), possibly with an under croft car parking area; • East: a terrace of three storey residential buildings with lower ground floors and gardens that bound the site (see Photo 6); and

BASELINE CONDITIONS

	• South: a six storey block of residential flats. In addition, discussions with site personnel working on the development adjacent to the west indicates that they encountered water ingress at approximately 2.0-3.0m bgl and had issues with preventing ingress. Please refer to **Appendix A** for details of the proposed development relative to surrounding buildings.
Geology & Aquifer Designations	Reference to British Geological Survey (BGS) mapping indicates that the site lies directly over the London Clay Formation (typically silty clay) with no superficial deposits present. The geological sequence progresses with depth into the Lambeth Group (Secondary A Aquifer), Thanet Sands (Secondary A Aquifer) and Chalk (Principal Aquifer).
Hydrology	The nearest known surface water feature to the site is the Grand Union Canal, which is located approximately 280m south of the site. In addition, Hampstead Ponds are located approximately 2.5km north west. Reference to the UK Hydrometric Register indicates that the annual average rainfall for the Thames region is 710mm. Reference to freely accessible information contained on the Environment Agency website along with reference to the LBC Strategic Flood Risk Assessment indicates that the site is not located in a Flood Risk Zone. Reference to CPG 4 indicates that the site is not located on a street that has been identified as being affected by historical localised flooding from surface water. However, reference to information contained on the Environment Agency website indicates that the site is located in an area at a low to medium risk from surface water flooding (due to local soil conditions and topography) during times of heavy rainfall when the local combined sewer system is unable to deal with the volume and rate of flow.
Resource Potential & Ecological Sensitivity	The groundwater in the London Clay Formation is designated Unproductive Strata and as such is not characterised as a groundwater body within the relevant River Basin Management Plan (RBMP). In addition, the Site is not located within an EA designated Source Protection Zone (SPZ). The Grand Union Canal is included within the relevant RBMP. It has been assigned a moderate ecological quality and good chemical quality.

BASELINE CONDITIONS

REGULATORY CONSULTATION

Although not specifically required within the BIA framework prescribed by LBC, a review of potentially contaminative historical land uses has been completed through enquiry with the Contaminated Land Officer at LBC.

A copy of the formal response to the enquiry is provided in **Appendix B** with the salient information summarised below:

- There are no records of historical industrial land uses at the site. However, the officer did identify a former electrical sub station approximately 50m south of the site.
- There are no IPPC or LAPPC industrial processes within 50m of the site.
- There are no records of pollution incidents in the area.
- The officer confirmed that the site has not been prioritised for inspection as part of its contaminated land inspection strategy and is unlikely to be inspected in the future.
- The council holds '*no information about the extent of made ground on subject site, however Camden soil profile tends to exhibit high levels of Lead (see BGS data).*'
- The council holds no information relating to private water supplies.

BELOW GROUND ASSETS

As part of the assessment the following organisations were contacted to ascertain if they held any below ground assets below or in close proximity to the site:

- Network Rail;
- Crossrail;
- London Underground Ltd / Transport for London.

Responses have been received from London Underground and Crossrail confirm they do not hold any below ground assets in the vicinity of the site. A response from Network Rail has not been received to date.

Copies of correspondence are included in **Appendix D**.

SUMMARY OF SITE & SURROUNDING HISTORICAL LAND USES

In addition, an appraisal of the historical site and surrounding land uses has been undertaken based on a review of historical maps.

The historical maps reviewed suggest that the site was part of a square and the rear gardens of residential houses until its development as Spiritualist Temple, which was opened in October 1926. The layout of the site and immediately surrounding area does not appear to have altered to present day.

BASELINE CONDITIONS

During the period of the site development (Spiritualist Temple), surrounding land uses were predominated by residential housing but also included a nursery approximately 40m east south east and a tramway associated with Camden Road approximately 60m west.

The historical map for c.1953 indicates that the area to the south of the site has been redeveloped to include a residential housing estate comprising several blocks of high rise flats which remain to present day. The electricity sub-station identified by LBC was present associated with this development. Other features of note include garages approx. 60m west north west and 130m south west, the Institute of Ray Therapy approximately 20m north and a Scientific Instrument Works approximately 90m west. These features of note were not present on historical maps c.1990 and appear to have been replaced by residential housing, government offices and commercial retail units.

Copies of selected historical maps are included in **Appendix D**.

LOCAL HYDROLOGY, GEOLOGY & HYDROGEOLOGY

Local Hydrology

As outlined the site is not shown to be located in a Flood Risk Zone and the closest known surface water courses in the area are >250m from the site. However, the site is located in an area at low to medium risk from surface water flooding.

Reference to Barton, NJ (Lost Rivers of London) indicates that the former River Fleet is located approximately 425m west of the site.

The local area is primarily urban (residential and commercial) and as such the majority of surface water run-off is likely to be directed to the surface water (and possibly combined) drainage system. However, where rear gardens exist and areas of green space (such as Rochester Square and the area to the north enclosed by Stratford Villas, Rochester Square and Camden Mews), rainfall run-off to drains is likely to be reduced and taken up by evapotranspiration and the soil moisture deficit with the remainder potentially infiltrating to ground (although this will also be largely in areas where the London Clay does not outcrop).

The site primarily comprises hard surfacing but there are areas of soft landscaping and paving within the rear garden area. On this basis, it has been assumed that currently the majority rainfall run-off is directed to the local drainage system with some potential infiltration in the rear garden area.

Local Ground & Groundwater Conditions

Details of the ground investigation works and findings are provided in the LMB Ground Investigation and Assessment Report (ref. LMB_16.12.07_REPPIL_GI_Rochester_v1.0), with a description of the local ground and groundwater conditions in the context of the baseline assessment provided below.

BASELINE CONDITIONS

The ground conditions vary from those described by the BGS and comprise Made Ground overlying soils interpreted as Head Deposits (clay over gravelly clay), which in turn overlie the London Clay Formation (firm to stiff clay, locally silty and sandy).

Observations of groundwater during the ground investigation works are summarised in the table below:

Location	Depth (m bgl)	Strata	Aquifer Designation	Comments
BH1	0.70	Made Ground	Not Applicable	Likely to be localised water perched above the clay of the Head Deposits.
BH2	3.40	Head Deposits	Secondary (Undifferentiated)	No water was recorded during drilling but ingress into the open hole (casing removed) occurred overnight. The hole collapsed back to 3.90m and the observations are considered reflective of slow seepage of groundwater via the Head Deposits.
BH1	7.00	London Clay Formation	Unproductive Strata	No water was recorded during drilling but ingress into the open hole occurred following removal of casing. It is not clear whether the observations are reflective of seepage of groundwater from the Head Deposits or ingress via the London Clay.

Ground Gas and Groundwater Monitoring

Groundwater monitoring wells were installed in both borehole locations. In BH1 the well was installed with a screened section in the London Clay Formation and in BH2 the well was installed within the Head Deposits.

Groundwater and ground gas levels were monitored on Wednesday 30th November 2016 and the results are summarised in the table below:

Location	Strata	Groundwater Depth (m bgl)	VOC (ppm)	CH4 (% v/v)	CO2 (% v/v)	O2 (% v/v)	Flow Rate (l/hr)	Gas Screening Value (l/hr)
BH1	London Clay	6.58	0.7	0.10	1.40	18.2	0.2	0.0028
BH2	Head Deposits	1.64	-	-	-	-	-	-

The groundwater levels recorded during return monitoring confirm the observations during the ground investigation works and suggest that shallow groundwater is present within the Head Deposits.

The water recorded within BH1 may be reflective of groundwater within the London Clay but may also be water retained in the well from the ground investigation works i.e. seepage from the Head Deposits. Notwithstanding this, recording of groundwater in monitoring installations constructed within the London Clay is common. However, rather than being representative of a permanent and laterally continuous aquifer unit, the groundwater is present as discrete units within (for example) micro fissures and local mudstone horizons and the recorded groundwater level will most likely be reflective of the pore water pressure in these discrete features.

Soil Infiltration

The Head Deposits at the site comprise approximately 1.0m of clay over gravelly to very gravelly clay. The upper clay unit is interpreted to be low permeability and the underlying gravelly clay contains groundwater. The CIRIA SUDS Manual provides the following advice inter alia in relation to infiltration criteria: '*Groundwater levels must be checked to ensure that the infiltration surface is at least 1m above the maximum anticipated level. Infiltration systems require an unsaturated soil to provide effective pollution protection.*' As such the Head Deposits are likely to be unsuitable as a media for infiltration drainage

The London Clay Formation in this area comprises low permeability clay soils and reference to the CIRIA SUDS Manual and BGS data confirms that coefficients of infiltration through these soils are very low.

Summary

The information provided in the above sections has been used to compile a summary of the local conditions which are presented in the table below:

Strata	**Proven Thickness Range (m bgl)** (1)	**Depth to Groundwater (m bgl)** (2)	**Aquifer Designation**	**Infiltration Coefficient Range (m/d)** (3)
Made Ground	0.50 – 0.80	0.70 (only BH1)	Not Applicable	-
Head Deposits	2.85 – 3.25	1.64	Secondary (undifferentiated)	8.64E-03 – 8.64E-01
London Clay Formation	11.25 – 11.35	6.58	Unproductive Strata	2.60E-04 to 2.60E-06

(1) Site data.

(2) Site monitoring data.

(3) British Geological Survey (BGS), WN97/27. (Forster, 1997). The Engineering Geology of the London Area & SUDS Manual.

Screening & Scoping Assessment

SCREENING ASSESSMENT

The decision-making matrices presented in the Screening Assessment below have been completed based on the information presented in the previous sections.

Groundwater Flow

Is the site located on an Aquifer?	**Yes** The soils interpreted as Head Deposits are likely to be designated a Secondary (Undifferentiated) Aquifer
Will the basement extend below the groundwater level?	**Yes** Groundwater is present within the Head Deposits.
Is the site within 100m of a water course, well or potential springline?	No There are no known surface water courses within 250m of the site. The former coarse of the River Fleet is located approximately 425m west of the site.
Will the proposed development change the proportions of soft / hard surfaced areas?	**Yes** Based on observations during the site walkover and reference to development schematics the proportion of soft / hard surface cover will alter following development.
Will the development result in an increase in surface water infiltration to ground (e.g. via soakaway and/or SUDS)?	No The site is located over relatively low permeability Head Deposits and London Clay and surface water infiltration is unlikely to be a viable solution.
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.	No There are no known surface water courses within 250m of the site.

Land Stability

Does the existing site include slopes, natural or manmade, greater than 7°?	No

	Observations during a site walkover and reference to proposed development schematics and information within Camden guidance confirms that there are no slopes > 7°.
Will the proposed re-profiling or landscaping at the site change slopes at the property boundary to more than 7°?	No Reference to proposed development schematics confirms that there will be no slopes > 7° following development.
Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7°?	No Observations during a site walkover and reference to proposed development schematics indicates that there are no slopes > 7°.
Is the site within a wider hillside setting in which the general slope is greater than 7°?	No Observations during a site walkover confirms that there are no slopes > 7°
Is the London Clay the shallowest strata at the site?	No Made Ground and Head Deposits have been recorded to 3.75m bgl.
Will any trees be felled as part of the proposed development and/or are any works proposed within any tree protection zones where trees are to be retained?	**Yes** Reference to the pre-planning advice indicates that a mature tree in the rear garden was recently felled (within permission) and that there is a requirement for this to be replaced as part of the development.
Is there a history of seasonal shrink swell subsidence in the local area and/or evidence of such effects at the site?	**Unknown** Visual evidence of cracking was limited to one section of the fascia on the existing structure and this is not considered to be related to. It was not clear whether this was associated with shrink/swell subsidence or vegetation (small tree) growing out of the roof of the property. The London Clay is known to have a high volume change potential on change of moisture content. However, Head Deposits extend to c.3.65-3.75m bgl and as such the potential for seasonal shrink/swell effects may not be as significant.
Is the site within 100m of a water course or potential springline?	No There are no known surface water courses within 250m of the site.
Is the site in an area of previously worked ground?	No Ground investigation identified Made Ground but no previous site uses such as 'old pit' have been identified.
Is the site within an aquifer?	**Yes** The soils interpreted as Head Deposits are likely to be designated a Secondary (Undifferentiated) Aquifer

Is the site within 50m of Hampstead Heath ponds?	No There are no known surface water courses within 250m of the site (including Hampstead Heath ponds).
Is the site within 5m of a highway or pedestrian right of way?	**Yes** Part of the site is directly adjacent to a pavement with a public highway beyond.
Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	**Yes** The proposed basement will extend over most of the area of the development foot print and will be single storey. The depth to foundation is likely to be similar to the basement in the neighbouring property but lower than in the terrace houses to the east.
Is the site over any tunnels e.g. railway lines?	No Enquiries with assets holders have confirmed that they have no below ground assets in proximity to the site.

Surface Flow and Flooding

Is the site within the catchment if the pond chains on Hampstead Heath?	No
As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route?	**Yes** Although the drainage design is not finalised, the development will include green roofs which will provide attenuation of surface water run-off from the site.
Is the site within 100m of a water course, well or potential springline?	No
Will the proposed development change the proportions of soft / hard surfaced areas?	**Yes** There will be an increase in hard surfaced areas following development.
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?	**Unknown** Drainage design has not been finalised.
Is the site in an area known to be at risk from surface water flooding?	**Yes.** The site is located in an area at a low to medium risk from surface water flooding.

SCREENING & SCOPING ASSESSMENT

Summary

Based on the Screening Assessment presented above, the following potential issues have been carried forward to the scoping stage of the assessment:

- The site is located over an aquifer as the soils interpreted as Head Deposits are likely to be designated a Secondary (Undifferentiated) Aquifer.
- Based on observations during the site walkover and reference to development schematics the proportion of soft / hard surface cover will alter following development.
- The site is located in an area at a low to medium risk from surface water flooding.
- 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?
- The London Clay is known to have a high volume change potential on change of moisture content and as such there is potential for seasonal effects.
- Parts of the site are directly adjacent to a pavement with a public highway beyond.
- Reference to the pre-planning advice indicates that a mature tree in the rear garden was recently felled (within permission) and that there is a requirement for this to be replaced.
- The proposed basement will extend over most of the area of the development foot print and will be single storey. The depth to foundation is likely to be similar to the basement in the neighbouring property but lower than in the terrace houses to the east.

SCOPING ASSESSMENT

The potential issues identified within the screening assessment are considered within the following scoping sub-sections:

Groundwater

The site is located over soils that are consistent with Head Deposits and monitoring has confirmed the presence of groundwater within these deposits. The Head Deposits are likely to designated a Secondary (Undifferentiated) Aquifer.

The potential impact of the basement on this aquifer unit is considered to be minimal due to the limited areal extent of the basement i.e. it is considered likely that groundwater within the aquifer will flow around the basement and any increase in groundwater level will be localised.

Flooding & Drainage

The development will result in a net increase in hard surfacing over the area of the site. Given the relatively low permeability of the soils underlying the site it is likely that infiltration to ground would be minimal.

Although the drainage design has not been finalised, the development proposals include the use of green roofs which will provide some attenuation of the surface water run-off to the local drainage system.

The site is located in an area at a low to medium risk from surface water flooding and in accordance with LBC a Flood Risk Assessment is required.

Land Stability

Although the London Clay is known to have a high volume change potential on change of moisture content, the Made Ground and Head Deposits extend to depths of between 3.65 and 3.75m bgl with groundwater present within the Head Deposits. As such the potential for seasonal shrink/swell effects are not likely to be as significant.

In addition, the anticipated formation level for the proposed basement development is approximately 3.50m to 4.50m bgl which is within the firm to stiff London Clay i.e. this is likely to be beyond the depth profile of seasonal shrink/swell effects.

The site and proposed basement development are directly adjacent to pavements and public highways in a relatively flat lying area with a general slope to the south. The adjoining property to the west includes a single storey basement and the proposed basement is anticipated to be at a similar depth to this but will be lower than in the terrace houses to the east which have lower ground floor levels.

Notwithstanding this, the removal of overburden could result in inward yielding and the properties of the London Clay mean there is potential for short and long term heave. As such a Ground Movement Assessment (GMA) has been undertaken to appraise the potential impacts on neighbouring properties. The GMA is provided in the following section with the calculation worksheets provided in **Appendix F.**

Details of the structural design and construction sequencing will be provided under separate cover within a Construction Method Statement and related documents.

Ground Movement Assessment

INTRODUCTION

There is the potential for ground movements due to the proposed development from the wall installation and from the excavation process.

The magnitude and extent of ground movements resulting from installation of a wall and excavation in front of such a wall are typically estimated based on the guidance given in the CIRIA publication C580 Embedded Retaining Walls – Guidance for Economic Design. The guidance in the CIRIA publication is based on the behaviour of embedded walls at numerous sites in London, which are predominantly walls embedded in London Clay, though typically with some near surface deposits consisting of for example River Terrace Deposits and Made Ground.

BUILDING DAMAGE ASSESSMENT

For the installation of a bored contiguous/secant piled wall in stiff clay, the magnitudes of the movements are dependent on the overall wall depth (not excavation depth). Similarly, the distance from the wall to the point where negligible movements will occur is also related to overall wall depth.

Movements resulting from excavation in front of the wall are dependent on the depth of excavation. From the data provided, this is expected to be approximately 3.30m if a piled foundation is adopted and approximately 4.0m to 4.50m (including slab) if a raft or spread foundations is adopted. It is understood that the intended construction sequence will be bottom-up, with a temporary support system to the excavation.

C580 provides curves estimating horizontal and vertical ground surface movements due to piled wall installation and to excavation in front of wall. Total ground movements resulting from the excavation will be the combination of the installation movements and the excavation movements.

The method provided within Box 2.5 in CIRIA C580 has been used to inform the assessment. CIRIA 580 curves were used to make a prediction of ground movement considering a high support stiffness wall.

Using these predicted movements, estimates of possible damage have been made for the surrounding structures, based on the Damage Classification Scheme proposed by Burland and Wroth (1974).

Details of calculation are presented in **Appendix E**.

Raft / Spread Foundation

The results of the damage assessment on the surrounding structures for an assumed raft/spread foundation are summarised below:

Nearby Building / Structure	Estimated Damage Category No.	Category of Damage	Comments
Adjacent Building	2	Slight	Cracks easily filled. Redecoration probably required.
Julian Court	2		
29-36 Rochester Square	1	Very Slight	Fine cracks that can easily be treated during normal decoration.

Piled Foundation

The results of the damage assessment on the surrounding structures for an assumed piled foundation are summarised below:

Nearby Building / Structure	Estimated Damage Category No.	Category of Damage	Comments
Adjacent Building	2	Slight	Cracks easily filled. Redecoration probably required.
Julian Court	1	Very Slight	Fine cracks that can easily be treated during normal decoration.
29-36 Rochester Square	1		

Results

The ground movement assessment undertaken indicates that damage to surrounding properties will be Burland Category 2 (Slight) or less for both a piled foundation or raft/spread foundation. However, for a spread/raft foundation the damage to Julian Court I predicted to increase from Burland Category 1 (piled) to Burland Category 2 (spread/raft).

It should be noted that the predicted ground movements are indicative for long, straight walls, and take no account of the effects of corners to the excavation, which typically reduce excavation induced ground movements in their vicinity to about 50% of what is predicted. In addition, while C580 provides estimates of horizontal movement from pile installation, these are based on very limited data; more recent projects have shown that piling undertaken to current standards of quality and workmanship cause no significant horizontal movement.

Heave

The excavation of about 3.5m to 4.5m thickness of soil (taking into account the presence of groundwater in the Head Deposits) will generate an unloading of around 60kN/m^2 to 80kN/m^2. It is likely that the ground within the excavation will experience a net unload, rather than load, and will therefore heave rather than settle. Experience suggests that such heave movements tend largely to be restricted to within the site

boundary when excavations are created with contiguous/secant piled retaining walls, so it is not anticipated that the changes in loading at basement level will have a significant impact on any surrounding structures.

Ground Movements Monitoring

Movement monitoring should be undertaken. The surveying points should be set up using a total station prior to commencement of the works and it is recommended that monitoring be undertaken at weekly intervals.

Impact Assessment & Mitigation Measures

SUMMARY OF POTENTIAL IMPACTS & MITIGATION MEASURES

The table below provides a summary of the potential impacts and mitigation measures adopted to ensure that residual risks are minimised:

Description of Potential Impact		Significance of Impact	Summary of Mitigation Measures	Residual Effects following Mitigation
Land Stability	Seasonal subsidence.	Minor negative	• The basement foundation is assumed to be between approximately 3.50m (piled) to 4.50m bgl (spread/raft) and low plasticity Head Deposits extend to c.3.65-3.75m bgl. • Heave protection measures will be adopted. • Surveying and monitoring of surrounding buildings / structures will be undertaken.	Negligible
	Impact on local properties/structures	Moderate negative	• Adoption of appropriate management procedures for basement excavation/ construction within the Construction Method Statement. • Surveying and monitoring of surrounding buildings / structures will be undertaken. • Repair and maintenance in accordance with C580.	Negligible

IMPACT ASSESSMENT & MITIGATION MEASURES

Description of Potential Impact		Significance of Impact	Summary of Mitigation Measures	Residual Effects following Mitigation
Groundwater Flow	Impact on Secondary Aquifer	Minor negative	• The basement development will not prevent groundwater flow and any rise in groundwater elevation is likely to be localised.	Negligible
Surface water flooding & Drainage	Flooding from surface water	Moderate negative	• Completion of a Flood Risk Assessment.	Negligible
	Increase in run-off to drains	Moderate negative	• The proposed development includes green roofs which will provide some attenuation of the surface water run-off to the local drainage system.	Negligible

Conclusions and Recommendations

CONCLUSIONS

The proposed basement will comprise a single storey structure utilised as commercial and residential space and will extend over the majority of the development footprint (approximately 326m^2 of 426m^2).

The assessment completed indicates that there is potential for the proposed basement development to result in moderate impacts in relation to land stability and local surface water flooding.

However, following adoption of appropriate mitigation measures to be included within the design, the residual impacts of the proposed development are assessed to be negligible.

RECOMMENDATIONS

Based on the assessment completed and with regard to the proposed development in general it is recommended that the mitigation measures to minimise impacts associated with potential land stability and local surface water flooding are adopted within development design.

Further recommendations specific to the geotechnical appraisal, potential foundations options and in consideration of retaining wall design are provided in the LMB Ground Investigation and Assessment report (ref. LMB_16.12.07_REPPIL_GI_Rochester_v1.0).

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22. Environment Agency (2009d), A Review of Body Weight and Height Data Used in the CLEA Model, Report SC050021/Final Technical Review 1, January 2009;

[1] This document has been withdrawn but is considered to remain useful in proving technical background for designing ground investigation works.

[2] This document has been withdrawn but is considered to remain useful in proving technical background for designing ground investigation works.

REFERENCES & GUIDANCE

23. Nathanial et. al., (2009), The LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment (2nd edition), Land Quality Press, Nottingham, ISBN 0-9547474-7-X
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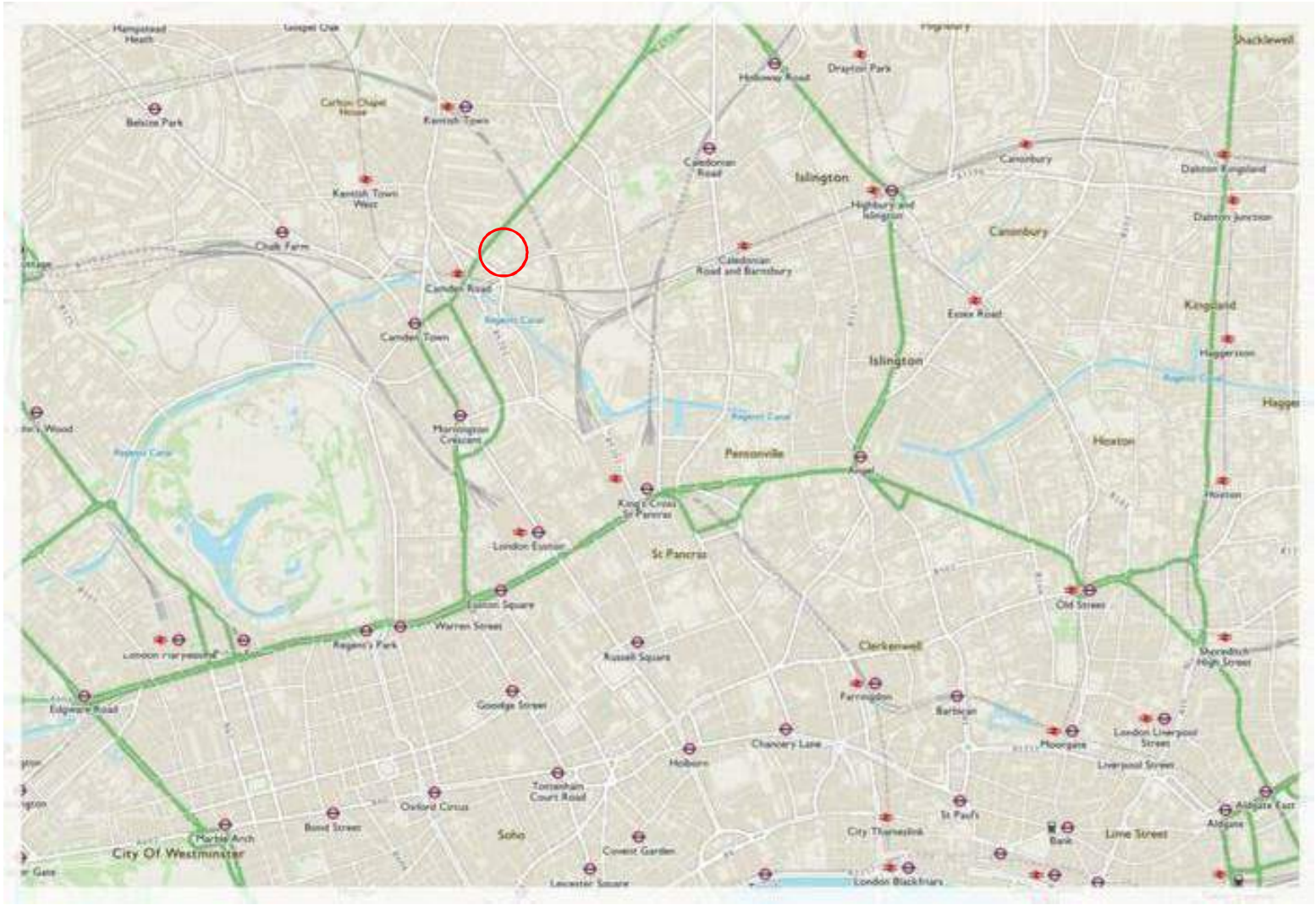
FIGURES



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Key:

Approximate site location

IMPORTANT – Please Read

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LMB

Ground Investigation
Land Contamination
Hydrogeology
Engineering Geology

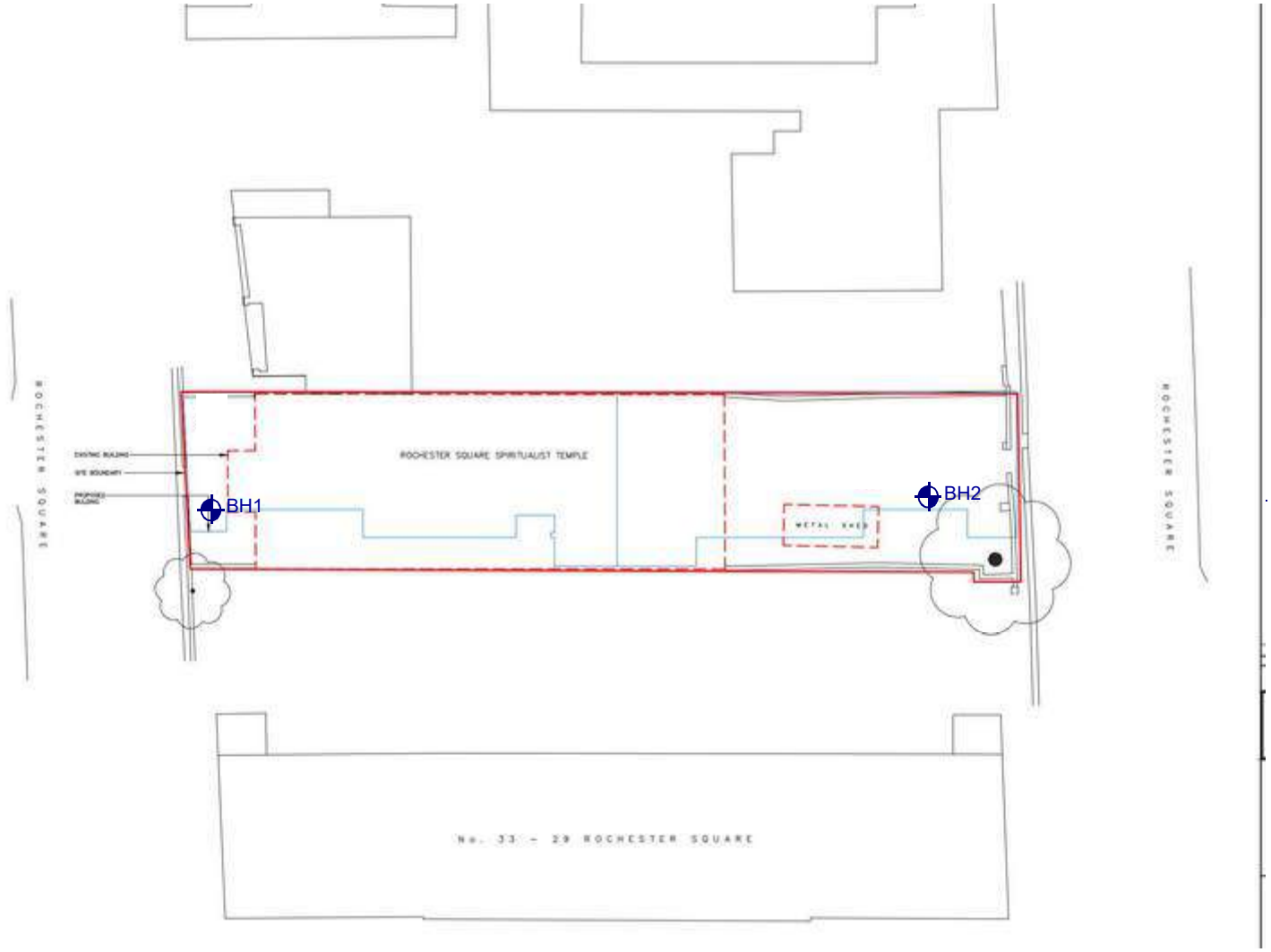
Site: Rochester Square, London NW1

Figure Number: Figure 1

Title: Site Location Plan

Project No:	Created By:	Date:
	PIL	Nov 2016

Client: Camden Land Partnership Ltd



Key:

BH Cable Percussive Borehole location

IMPORTANT – Please Read

This drawing is for illustrative purposes only and is for use only in conjunction with associated reports relating to the project details below. LMB accepts no liability for the mis-interpretation or use of this illustration by any other parties.

LMB

Ground Investigation
Land Contamination
Hydrogeology
Engineering Geology

Site: Rochester Square London NW1

Figure Number: Figure 2

Title: Exploratory Hole Location Plan

Project No:	Created By:	Date:
	PIL	Nov 2016

Client: Camden Land Partnership Ltd

APPENDICES

Appendices

APPENDIX A DEVELOPMENT SCHEMATIC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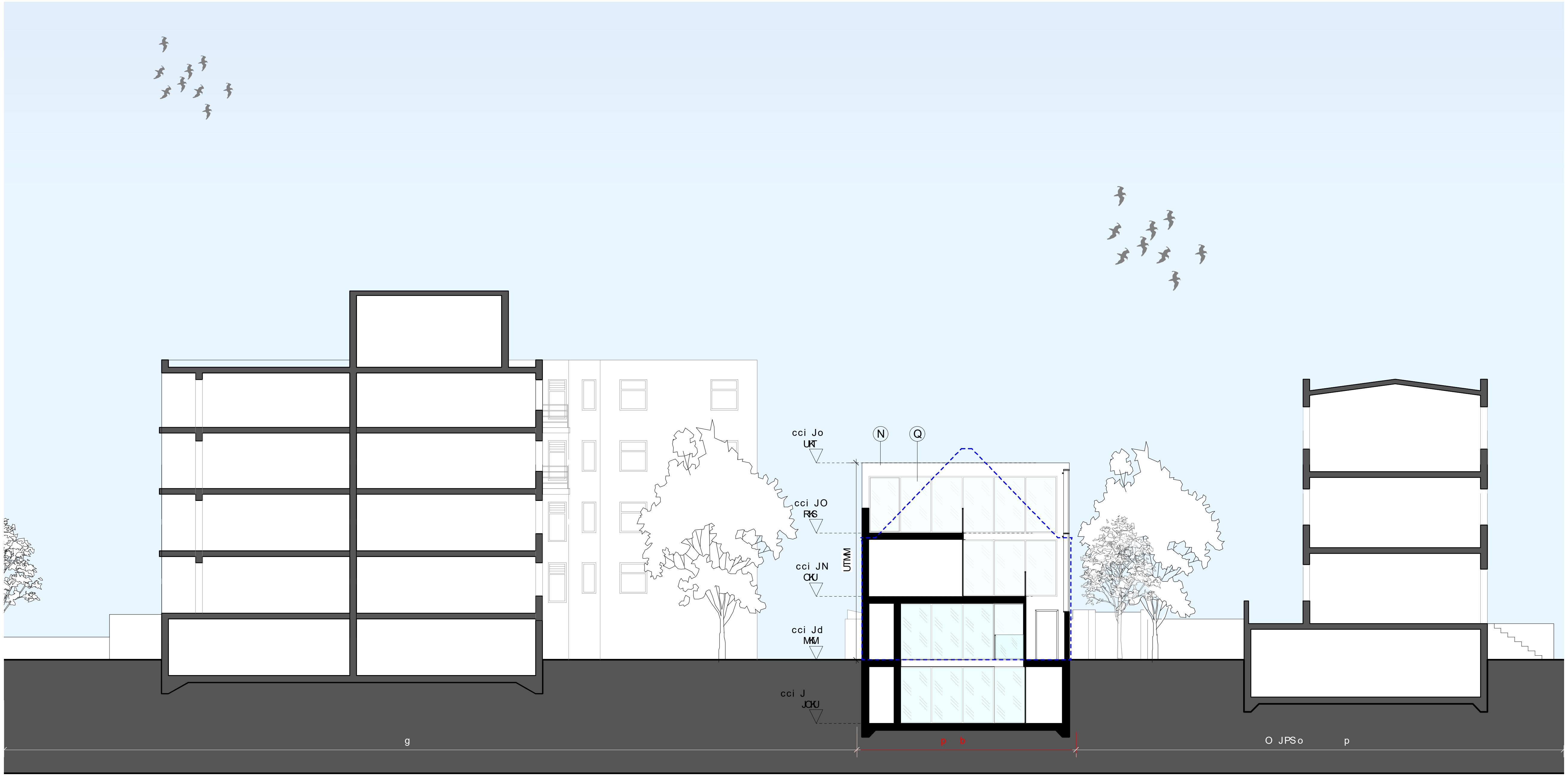

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APPENDICES

APPENDIX B REGULATORY CORRESPONDENCE

Date: 05/10/2016
Our ref: 2016/3442/PRE
Contact: Gideon Whittingham
Direct line: 020 7974 5180
Email: gideon.whittingham@camden.gov.uk

Planning Solutions Team
Planning and Regeneration
Culture & Environment Directorate
London Borough of Camden
2nd Floor
5 Pancras Square
London
N1C 4AG

www.camden.gov.uk/planning

Dear Mandip Sahota,

Re: Spiritualist Temple
Rochester Square
London
NW1 9RY

Thank you for submitting a pre-planning application enquiry for the above property which was received on 21/06/2016, together with the required fee of £3,600.00.

1. Proposal

Redevelopment of site involving demolition of the building and erection of a 3-storey building, plus basement level, to accommodate a D1 Class use and 7 dwellings (Class C3).

2. Site description

The application site is located on Rochester Square, to the west of Nos.29-36 (cons) Rochester Square and to the east Nos.144, 146 and 150 (Julian Court) Camden Road.

The site is located within the Camden Square Conservation Area.

The application site includes the Rochester Square Spiritualist Temple, an arts and crafts building designed by T. Yorke with an orange-red brick base and rendered gable. Founded in 1926, its members included Sir Arthur Conan Doyle and journalist Hannen Swaffer.

The subject building is also highlighted as a positive contributor within the Camden Square conservation appraisal and management strategy.

The 2nd to last paragraph of page 22 of the Camden Square conservation appraisal and management strategy states that “the usual concept of a square is harder to decipher here [Rochester Square]; from the beginning a nursery garden was located in the centre of the Square, and houses in Stratford Villas backed onto this nursery on the east side. Plots were leased for small developments as the Estate started tentatively. A feature of this smaller development was that mews were not developed. In the 1920s space in the rear gardens of Camden Road houses was filled by the Spiritualist Temple.”

The site also contains a TPO tree for which consent has recently been granted for its replacement.

3. Planning history

Spiritualist Temple:

2016/3236/T: (TPO REF. C10-T39) REAR GARDEN: 1 x Lime - fell to ground level. – Approve Works 09/09/2016

Condition 3 states:

Within the first available planting season following the completion of works, a Hornbeam shall be planted as an Extra Heavy Standard with a girth size of 14-16cm, within 5m of the removed tree unless otherwise agreed in writing by the local authority. Evidence of this shall be submitted to the council. The planting process should take into account the standards set out in BS8545:2014.

Reason: In order to comply with the provisions of Section 206 of the Town and Country Planning Act 1990 (as amended).

Rear Garden of 144-146 Camden Road:

2010/2152/P: Erection of a two storey residential dwelling house (class C3) within rear garden of 144 -146 Camden Road fronting Rochester Square. - Granted planning permission subject to a section 106 legal agreement 02/11/2010

4. Relevant policies and guidance

National and Regional Policy
National Planning Policy Framework (NPPF) 2012
National Planning Policy Guidance 2014
London Plan 2016

LDF Core Strategy and Development Policies:
CS5 (Managing the impact of growth and development)
CS10 (Supporting community facilities and services)
CS11 (Promoting sustainable and efficient travel)
CS13 (Tackling climate change and promoting higher environmental standards)
CS14 (Promoting high quality places and conserving our heritage)
CS16 (Improving Camden's health and well-being)
DP15 (Community and leisure uses)
DP16 (The transport implications of development)
DP17 (Walking, cycling and public transport)
DP18 (Parking standards and the availability of car parking)
DP19 (Managing the impact of parking)
DP20 (Movement of goods and materials)
DP21 (Development connecting to the highway network)
DP22 (Promoting sustainable design and construction)
DP23 (Water)
DP24 (Securing high quality design)
DP25 (Conserving Camden's heritage)
DP26 (Managing the impact of development on occupiers and neighbours)
DP27 (Basements and lightwells)
DP28 (Noise and vibration)
DP32 (Air quality and Camden's Clear Zone)

Camden Planning Guidance (CPG) 2016 – CPG 2
Camden Planning Guidance (CPG) 2015 – CPG 1, 3, 4, 8
Camden Planning Guidance (CPG) 2013 – CPG 5
Camden Planning Guidance (CPG) 2011 – CPG 6 and 7

Camden Square conservation area appraisal and management strategy (2011)

5. Assessment

Proposal

The application in more detail proposes:

- Demolition of existing building (234 sqm (GEA))
- Removal of all trees throughout
- Erection of 3-storey building, plus basement level brick clad building, covering 326sqm of the 426sqm site.
- Provision of 4 x 2 bedroom flats and 3 x 4 bedroom flats (Class C3) totalling 773sqm (7 units)
- Provision of Community Use (Gallery – Class D3) of 234 sqm (GEA)

Principle of the development

The key planning issues are as follows:

- Land use
- Demolition of site building / Design – scale, bulk and detailed design
- Housing mix, unit size and quality of accommodation.
- Impact on neighbouring amenity
- Impact of basement development
- Trees
- Transport, access and parking

Land Use

Community and leisure use loss

Policy CS10 states that the Council will support the retention and enhancement of existing community facilities and facilitate the efficient use of community facilities and the provision of multi-purpose community facilities that can provide a range of services to the community at a single, accessible location.

Policy DP15 states that the Council will protect existing community facilities by resisting their loss unless a replacement facility that meets the needs of the local population is provided (criteria c) or where the specific community facility is no longer provided and evidence is provided to show that the loss would not create, or add to, a shortfall in provision for the specific community use, and demonstrate that there is no demand for any other suitable community use on the site (criteria d). The policy requires proposals to meet either criteria (c) or criteria (d). The policy states that where this is successfully demonstrated the Council's preferred new use will be affordable housing.

In assessment of Policy DP15, a replacement facility would be provided of a similar floorspace, albeit on two floors and therefore broadly complies. It should be noted however, further details should be provided to demonstrate the replacement facility meets the needs of the local population and also represents both a marked improvement in terms of accessibility in and around the unit, particularly given that its across two floors and consists of clear, high ceiling heights.

Given that the proposal would provide a replacement facility, the principle of Class C3 accommodation on the remainder of the site is appropriate and in line with CS3, CS6 and

DP2. Housing is the priority land use of the LDF and this proposal would add to the housing stock in the borough.

Demolition of site building / Design – scale, bulk and detailed design

The proposal would result in the total loss of the temple as well the tree(s) on the site which would not be replaced. This would cause harm to the character and appearance of the area.

Planning Act
Statuary provision under section 72 of the Planning Act requires special attention to be paid to the desirability of preserving and enhancing the character and appearance of a conservation area.

This has been given great weight and importance as is required by law.

NPPF
The Camden Square conservation area is a designated heritage asset. Paragraph 132 requires that when considering the impact of a proposed development on the significance of a designated heritage asset, great weight should be given to the assets conservation.

Any harm to the conservation area from the loss of the existing building would result in less than substantial harm to the conservation area. The NPPF under Paragraph 134 requires the harm to be weighed against the public benefit of the proposal including optimum viable use of the site.

NPPF designates the building a non-designated heritage asset. The guidance states at para 135 that,

> *"The effect of an application on the significance of a non-designated heritage asset should be taken into account in determining the application. In weighing applications that affect directly or indirectly non designated heritage assets, a balanced judgement will be required having regard to the scale of any harm or loss and the significance of the heritage asset."*

Camden Policies
Camden policies seek to protect building which make a positive contribution. The policy states it would prevent the demolition of an unlisted building that makes a positive contribution to the character or appearance of a conservation area where this harms the character or appearance of the conservation area, unless exceptional circumstances are shown that outweigh the case for retention (policy DP25c) and that it will "preserve trees and garden spaces which contribute to the character of a conservation area and which provide a setting for Camden's architectural heritage (DP25e)

Policy DP24 and Planning Guidance I (CPG1) refer to design. The policy and guidance presumption is for design excellence in the borough.

Public benefit
The public benefit offered by the development includes:
1. Overall the proposed community space seeks to replace the 234 sqm of the existing building. The accommodation would be positioned over 2 floors with DDA compliant lift, together with disabled access WC.

2. The 4 x 2 bed units proposed are equivalent to 57% of the overall units proposed, well in excess of the 40% target set by Policy DP5.

3. The applicants have tentatively offered the potential 3D printing of the proposed building as a benefit. This would be 3D printing of the whole building or its many parts and would possibly be the first in Camden or the UK.

The benefits are limited and the scheme could be described as offering a limited positive effect. In this regard the proposed public benefit is not considered to outweigh the loss of the building which has to been given great weight as set out by the statutory provision and which requires *exceptional circumstances* to be met under Camden's own policies.

The potential 3D printing is an intriguing prospect but insufficient evidence justification or clarify on the product, manufacturer and benefit has been provided to give much weight.

The applicants have also suggested that the design is of public benefit. This has not been included in our assessment because our policy and guidance expect this as a prerequisite to any development in the borough.

Design
Moreover there are some additional concerns about the height of the development and how it relates to the villas facing Camden Road. This wasn't previously discussed as a potential issue but is considered important that the development should remain subordinate to the principal properties to be viewed as a 'mews style' development and at present it appears to be the same height as the frontage buildings. In addition the level of glazing to each frontage may need to be reduced again to reduce the perception of scale and prominence and to provide a more mews like quality to the development.

In conclusion of the demolition and design proposed, the building is considered to be making a limited positive contribution to the character and appearance of the area. Its loss would cause less than substantial harm to the conservation area which would need to be outweighed by any potential public benefit. Some benefit is afforded to the scheme by the new residential units and provision of community use but these are not considered to outweigh the harm to the conservation area through the loss of the building. Any future proposals would need to retain the building or offer greater benefit to outweigh its harm and greater consideration should be given to revealing the significance of the conservation area and its key architectural and historic components.

Housing mix, unit size and quality of accommodation.

In accordance with Policy CS6, the Council would also expect at least 40% of additional market housing to provide 2 bedroom units (high priority). The proposal would comply in this respect.

With regard to the size and arrangement of each unit the submitted documents indicate (save for units 2 and 3 which fail and should be addressed), these would meet the minimum floorspace requirements according to the CPG and London Plan standards.

Whilst many units depict dual aspect accommodation, the necessity of obscure glazing to limit overlooking and lack of amenity space afforded is of concern in respect of natural and clear outlook, ventilation and light to each unit. The necessity for daylight and ventilation assessments submitted alongside a planning application would be required to provide comfort that these units would be suitable and provide a good level of accommodation.

Impact on neighbouring amenity

Policy CS5 seeks to protect the amenity of Camden's residents by ensuring the impact of development is fully considered. Policy DP26 supports this, by seeking to ensure that development protects the quality of life of occupiers and neighbours by only granting permission to development that would not harm the amenity of neighbouring residents. This includes privacy, overlooking, outlook and impact on daylight and sunlight.

The proposed development would be significantly close in proximity to the residential rear of Nos.29-36 (cons) Rochester Square and Nos.144, 146 and 150 (Julian Court) Camden Road, with many openings servicing habitable rooms. Therefore, as a result of the proposal's proximity, it will need to adequately be demonstrated that it would not result in a material loss of light, outlook or privacy to existing residential occupiers. In line with CPG6 (Amenity) to ensure privacy, there should normally be a minimum distance of 18m between the windows of habitable rooms of different units that directly face each other. A daylight/sunlight report is recommended to demonstrate that habitable rooms to these properties are not significantly affected.

Impact of basement development

Notwithstanding the need to re-provide a mature tree(s) onsite, the proposed basement would cover 326sqm of the 426sqm site.

To accompany any application (in order to validate the application) a Basement Impact Assessment (BIA) would need to be submitted with the application. This is in line with CS13, DP22, DP23 and DP27. This is supported by CPG4 and Arup guidance for subterranean development 'Camden geological, hydrogeological and hydrological study'. Please see the website for more information.

The BIA will need to include the following stages:

· Stage 1 - Screening;
· Stage 2 - Scoping;
· Stage 3 - Site investigation and study;
· Stage 4 - Impact assessment; and
· Stage 5 - Review and decision making.

At each stage in the process the person(s) undertaking the BIA process on your behalf should hold qualifications relevant to the matters being considered. Paragraph 2.11 of CPG4 outlines the qualifications required for assessments.

In order to provide us with greater certainty over the potential impacts of proposed basement development, we will expect independent verification of Basement Impact Assessments, funded by the applicant, when certain criteria are met.

Furthermore, it has in recent months become standard practice for 'basement construction plans' to be secured via s106 agreement, which typically follows on from the findings of the independent reviews of the BIA.

Trees

As per the recent tree application, it will be necessary to replace the mature tree on site; however this has not been depicted on plan and should be addressed. You would need to demonstrate that all trees on site and those adjacent are to be retained (save for recent permissions for their removal) and would not be harmed by the proposed development.

You should provide a tree survey and arboricultural statement with your application. In accordance with BS5837:2012 (trees in relation to design, demolition and construction), you would need to provide the following information:

· A pre-development tree survey
· a tree constraints plan
· an arboricultural impact assessment
· an arboricultural method statement including a tree protection plan

Transport, access and parking

The site has a PTAL rating of 6a so Transport Planners will resist any proposals for general car parking. In line with DP18, the proposal would be car free.

Details about the intended servicing of the community facility should also be considered and provided; this would be secured in full via S106. Please see CS5, DP20, DP26 and CPG7 Ch4 for more details.

Given the scale of the proposed development, contributions towards pedestrian, cycle, and environmental improvements may be sought. This is in line with CPG8 paragraphs 10.11-2 and CPG7. Such contributions would be secured via s106.

A Section 106 contribution will be required for repaving any footways around the site, as these may be damaged during the construction of the proposed development.

A Construction Management Plan (CMP) will be necessary, to be secured by S106 Agreement. A substantial CMP should be submitted at the application stage to help inform public consultation responses. Please see CPG7 for more details. The verification of its implementation during the Construction Phase would cost £1,140.

Cycle parking

The application indicates 12 spaces provided by way of cycle stands. Broadly speaking this would comply with the requirement of each use, namely the D1 use would require 1 space per 100 sqm and the C3 use would require 2 spaces per all dwelling. It should be noted however the areas afforded, in terms of size and accessibility, do not comply with the requirements of CPG4 and should be reassessed.

Refuse

The refuse area afforded to both the commercial and residential element should be expanded to comply with policy.

This document represents an initial informal officer view of your proposals based on the information available to us at this stage and would not be binding upon the Council, nor prejudice any future planning application decisions made by the Council.

Yours sincerely,

Gideon Whittingham

Senior Planning Officer
Planning Solutions Team

philip lewis

From: Arthur, Anona <Anona.Arthur@camden.gov.uk>
Sent: 17 November 2016 16:14
To: philip lewis
Subject: Environmental Search Enquiry, 110 Rochester Sq NW1 9RY
Attachments: 542-PlanningApplicationPublic.csv; 542-LandUseHistoric.csv; 542-KellysLandUse.csv

Dear Philip Lewis

RE: Contaminated Land Enquiry - 110 Rochester Square, London NW1 9RY

Further to your contaminated land enquiry relating to the above land I would like to confirm the following.

The above site has not been determined as contaminated land under Part IIA of the Environmental Protection Act 1990.

Our records indicate that the site has no historical industrial land use.

With regards to details under the Council's Part IIA Strategy, Camden has a Contaminated Land Database to identify and prioritise sites within the Borough with a former potentially contaminative land use. Sites recorded on the database are not contaminated land (as defined by Part IIA of the Environmental Protection Act 1990); rather they are considered as having the potential to be contaminated land through their previous use. The Council is currently reviewing its Contaminated Land

Strategy for inspecting prioritised sites. The site at **110 Rochester Square** has not been identified as a priority for inspection.

Further to your enquiry, a historical record search was performed to determine historical land uses and it appears that there was a former Electrical Sub Station within 50m of the site (see map below). The Council holds no Site Investigations etc regarding the above site.

Additional Information:

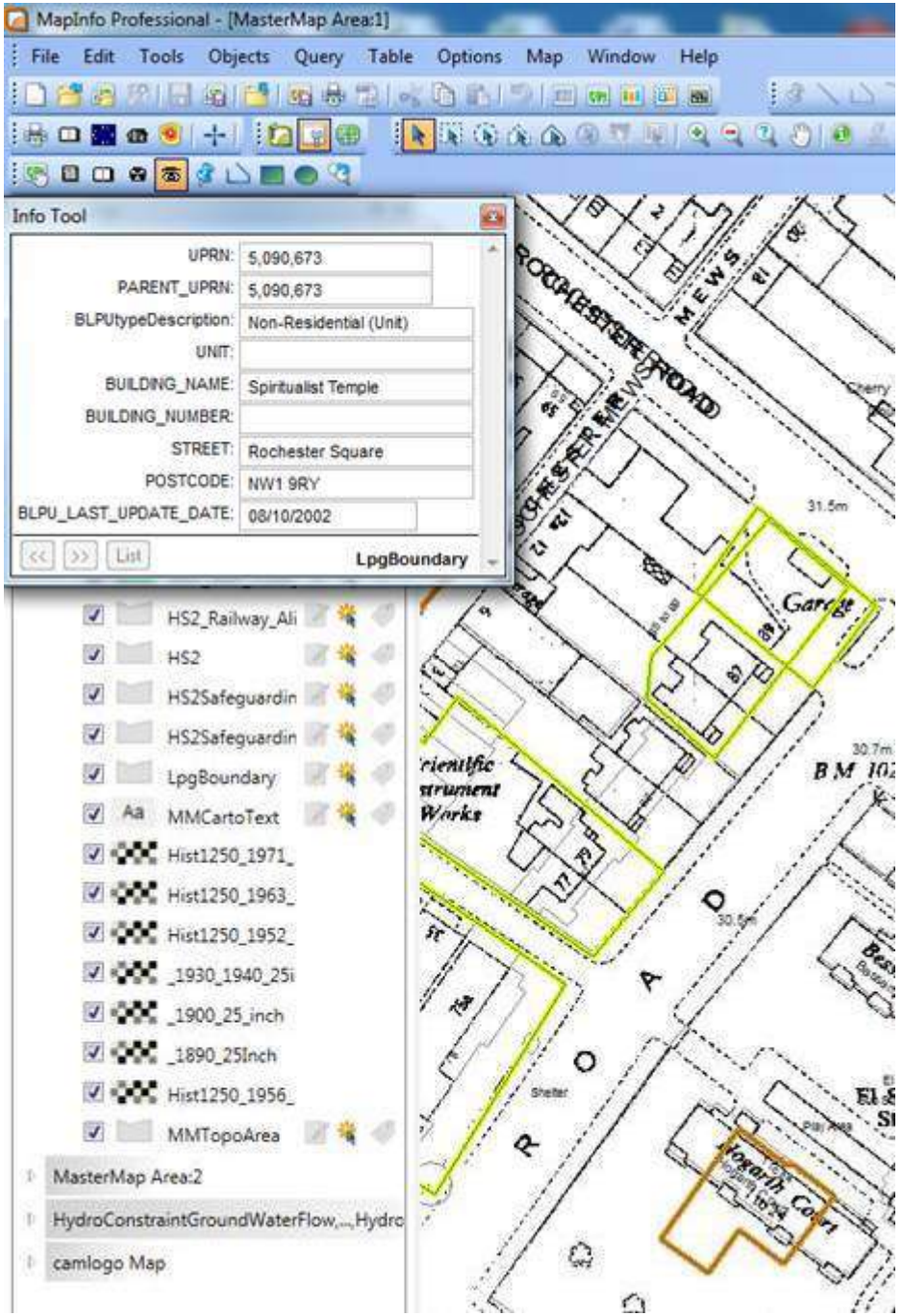
* The Council holds no information on pollution incidents in the area.
* There are no historical landfills identified within 250 metres of the site.
* Currently, the Council holds no information about water abstraction points or private water supplies.
* The Council holds no information relating to materials extraction, mine gasses, or animal burial grounds.
* There are no IPPC (Environment Agency) industrial processes within 50 metres of the site.
* There are no LAPPC (Local Authority) industrial process within 50 metres of the site.
* The Council holds no records relating to flooding.
* The Council has no information about the extent of made ground on subject site, however Camden soil profile tends to exhibit high levels of Lead (see BGS data)
* The Council holds no information relating to radon levels (Please enquired via the Environment Agency)
* Details of any records of complaints, notices etc. about nuisance relating to the current or previous site uses and its environs may be obtained from Council's Land Charges Department (0207 974 4444 - Contact Camden) but those will be limited to actual entries relating to outstanding matters i.e. fees for works in default etc. Details with regards to complaints

relating to noise issues may be obtained from Council's Noise & Licensing Team, odour issues from our Private Sector Housing Team. Both can be contact via the main line: 0207 974 4444.

Disclaimer:

The above response is provided from such information that is readily available to the Council and in its possession. It is believed to be correct but the Council expressly gives no warranty in this respect nor will the Council accept any liability whatsoever for any error, omission or loss occasioned thereby to any person (whether or not the person requested the information) and in particular the Council gives no warranty that it has researched all its relevant archives in order to respond to the request for information.

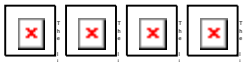
I hope the information provided is sufficient, however if you require further clarification please do not hesitate to contact me.



Regards

Anona Arthur
Environmental Health Officer / Contaminated Land Officer

Telephone: 020 7974 2990



APPENDICES

APPENDIX C PHOTOGRAPHIC RECORD

Plate 1: Main entrance.

Plate 2: Rear entrance.

LMB
Ground Investigation
Land Contamination
Hydrogeology
Engineering Geology

Photographic Record

Project: Rochester Square

Plates 1 & 2

Plate 3: Crack along facias and brick.

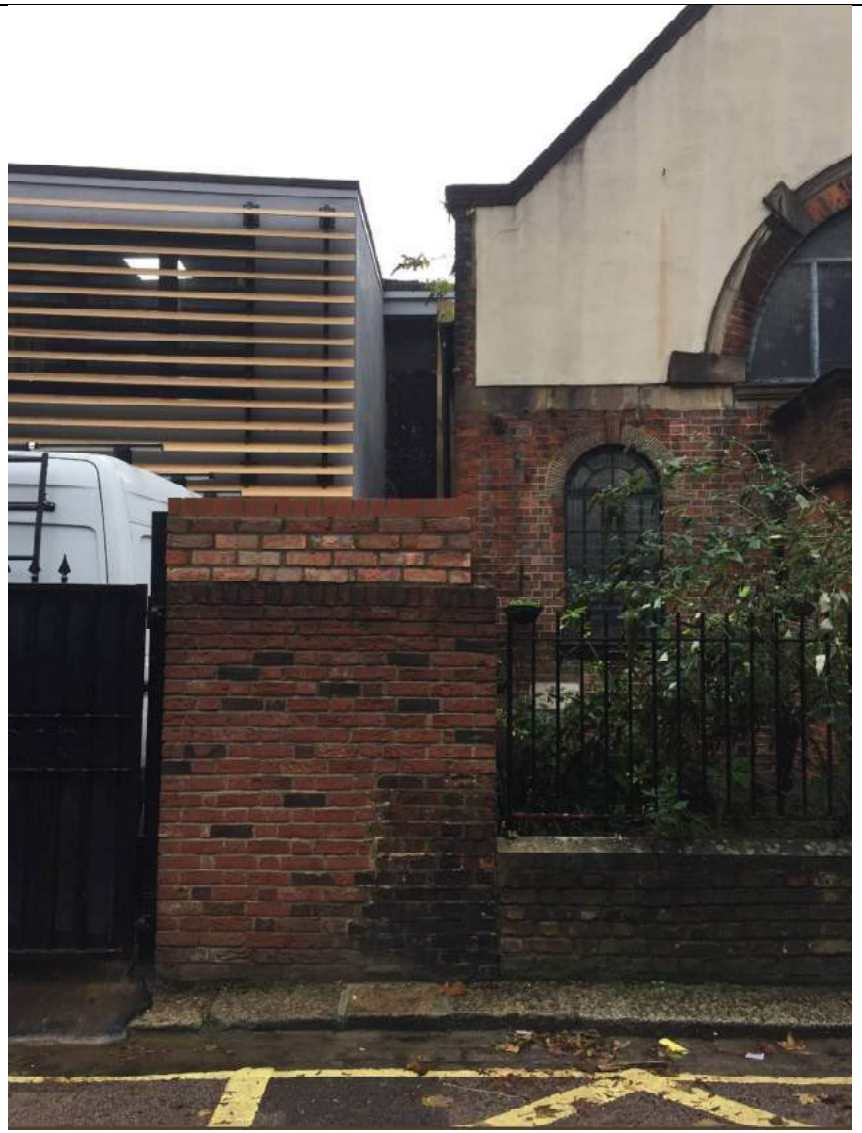


Plate 4: Property adjacent west.

Plate 5: Block of flats to north west.

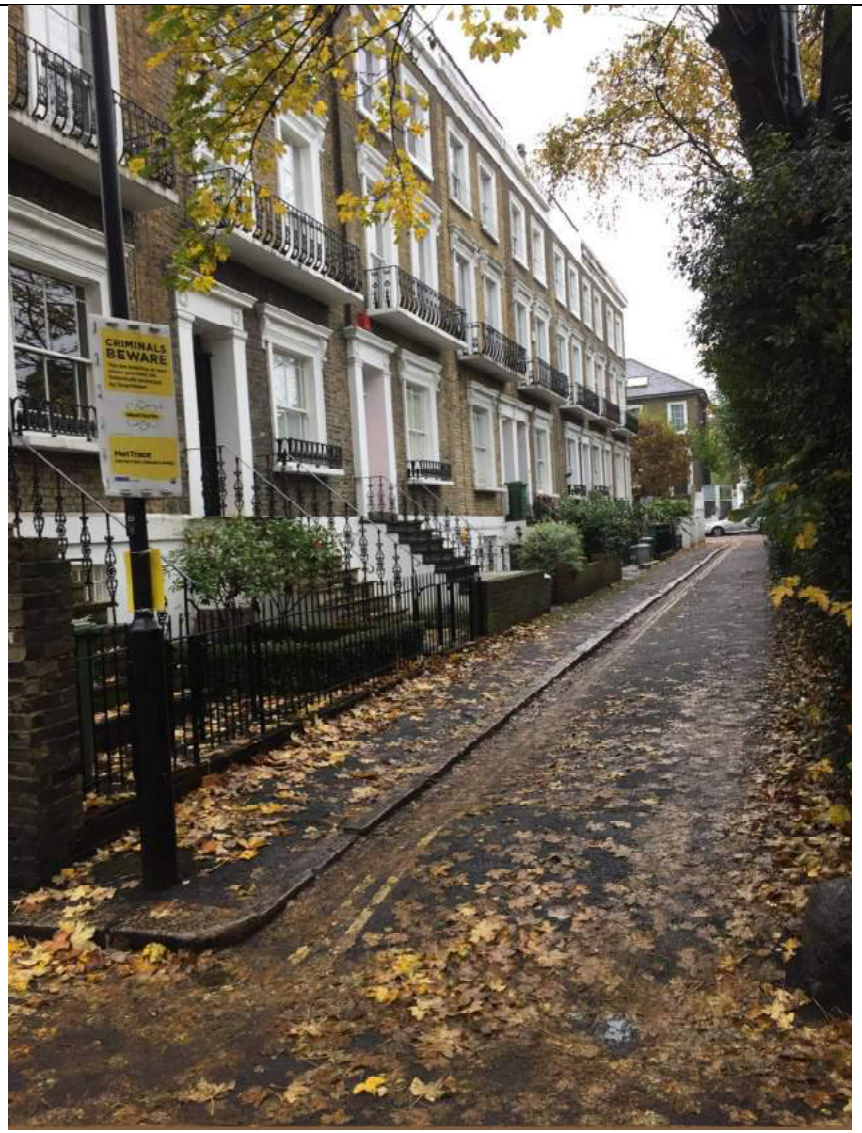


Plate 6: Terrace properties to east.

APPENDICES

APPENDIX D CONSULTATION WITH BELOW GROUND ASSET HOLDERS

philip lewis

From: Safeguarding <Safeguarding@crossrail.co.uk>
Sent: 15 November 2016 10:22
To: 'Philip Lewis'
Subject: 110 Rochester Square, London NW1 9RY Crossrail Ref: CRL-00-161524

Dear Mr. Lewis

Crossrail Ref: CRL-00-161524

110 Rochester Square, London NW1 9RY

Thank you for your letter dated 14 November 2016, requesting the views of the Crossrail Project Team on the above.

The area in question is outside the limits of consultation shown in the Safeguarding Direction issued by the Secretary of State for Transport on 24 January 2008.

The implications arising from Crossrail have been considered, and we do not wish to make any comments.

The Crossrail Bill which was introduced into Parliament by the Secretary of State for Transport in February 2005 was enacted as the Crossrail Act on the 22nd July 2008. The first stage of Crossrail preparatory construction works began in early 2009. Main construction works have started with works to the central tunnel section to finish in 2018, to be followed by a phased opening of services.

In addition, the latest project developments can be found on the Crossrail website www.crossrail.co.uk/safeguarding, which is updated on a regular basis.

I hope this information is helpful, but if you require any further assistance then please feel free to contact a member of the Safeguarding Team on 0345 602 3813, or by email to safeguarding@crossrail.co.uk

Yours sincerely

Helen McCarthy
Community Relations Assistant
CROSSRAIL HELPDESK
Tel (24 hour): 0345 602 3813
Helpdesk@crossrail.co.uk

MOVING LONDON FORWARD

philip lewis

From: Harrison Andrew <AndrewHarrison1@tfl.gov.uk>
Sent: 18 November 2016 15:01
To: 'philip@lmbgeosolutions.com'
Cc: LUL CED Infra Protection
Subject: 110 Rochester Square, London NW1 9RY

Importance: High

Dear Sir/Madam,

With reference to your email, complete with plans showing your proposed works within the areas you have highlighted London Underground has no shallow railway structures at this location and should not be affected by this proposal.

However as a precaution, I have also passed your enquiry on to power supply division (lulhvpowerassets@tfl.gov.uk) who will contact you directly regarding any of LUL cable/duct routes which may be affected.

Andrew Harrison
Streetworks | Infrastructure Protection

London Underground | Albany House Floor 3, 55 Broadway, London SW1H 0BD.
Email: andrewharrison1@tfl.gov.uk Mobile: 07932766603

Find out more about Infrastructure Protection -
https://youtu.be/0hGoJMTBOEg

Mitigating risk - while helping London develop.

Please consider the environment before printing this e-mail

From: philip lewis [mailto:philip@lmbgeosolutions.com]
Sent: 14 November 2016 10:52
To: Hayden Terry
Subject: 110 Rochester Square, London NW1 9RY
Importance: High

Dear Terry
We will be undertaking ground investigation works at the above residential property around Wednesday 23rd November and we would be interested in finding out if you hold any below ground assets in the nearby vicinity.

Best regards,

Philip Lewis
Bsc (Hons), Msc, FGS, CGeol
Director
LMB Geosolutions Ltd
Tel. +44 7739735097

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LinkedIn

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Transport for London is a statutory corporation whose principal office is at Windsor House, 42-50 Victoria Street, London, SW1H 0TL.

Further information about Transport for London's subsidiary companies can be found on the following link:
http://www.tfl.gov.uk/corporate/about-tfl/

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****

Transport for London
London Underground

London Underground
Infrastructure Protection

3rd Floor
Albany House
55 Broadway
London SW1H 0BD

www.tfl.gov.uk/tube

Your ref:
Our ref: 20403-SI-4-151116

Philip Lewis
LMB Geosolutions Ltd
philip@lmbgeosolutions.com

15 November 2016

Dear Philip,

10 Rochester Square London NW1 9RY

Thank you for your communication of 14th November 2016.

I can confirm that London Underground has no assets within 50 metres of your site as shown on the plan you provided.

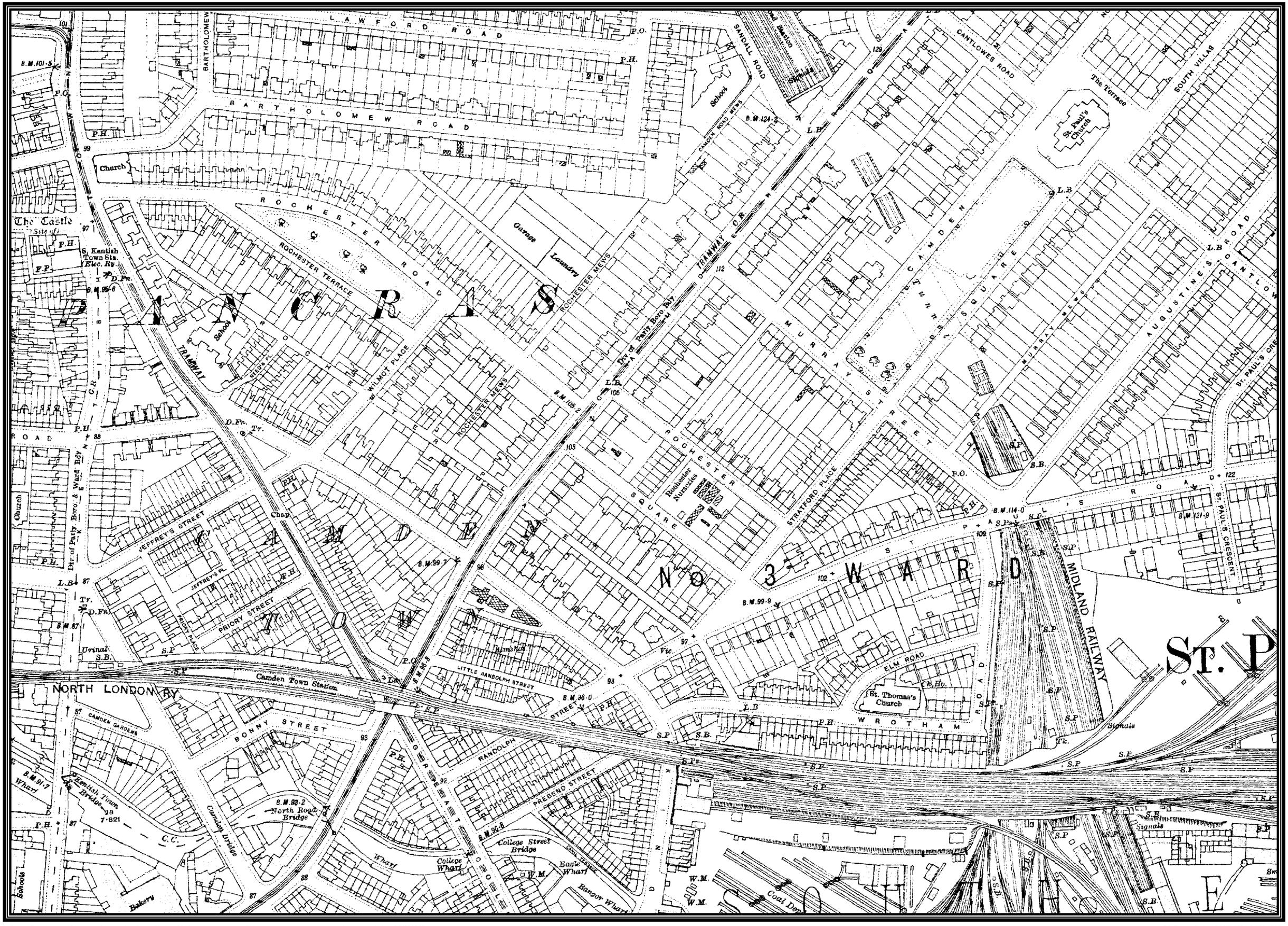
If I can be of further assistance, please contact me.

Yours sincerely

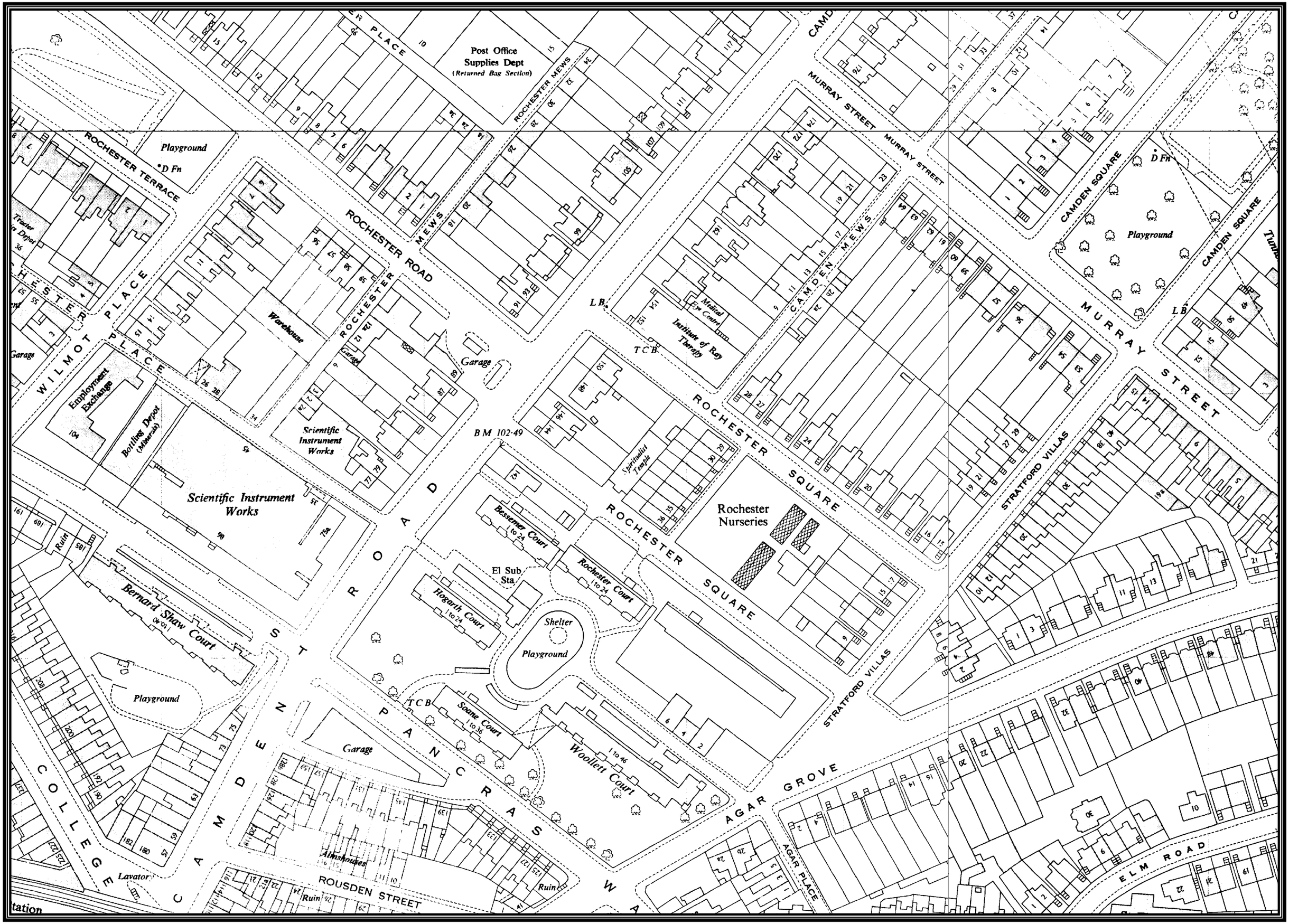
Shahina Inayathusein
Information Manager
Email: locationenquiries@tube.tfl.gov.uk
Direct line: 020 3054 1365

APPENDICES

APPENDIX E SELECTED HISTORICAL MAPS



OS County Series: LONDON 1:2,500 1916



OS Plan 1:1,250 1953

APPENDICES

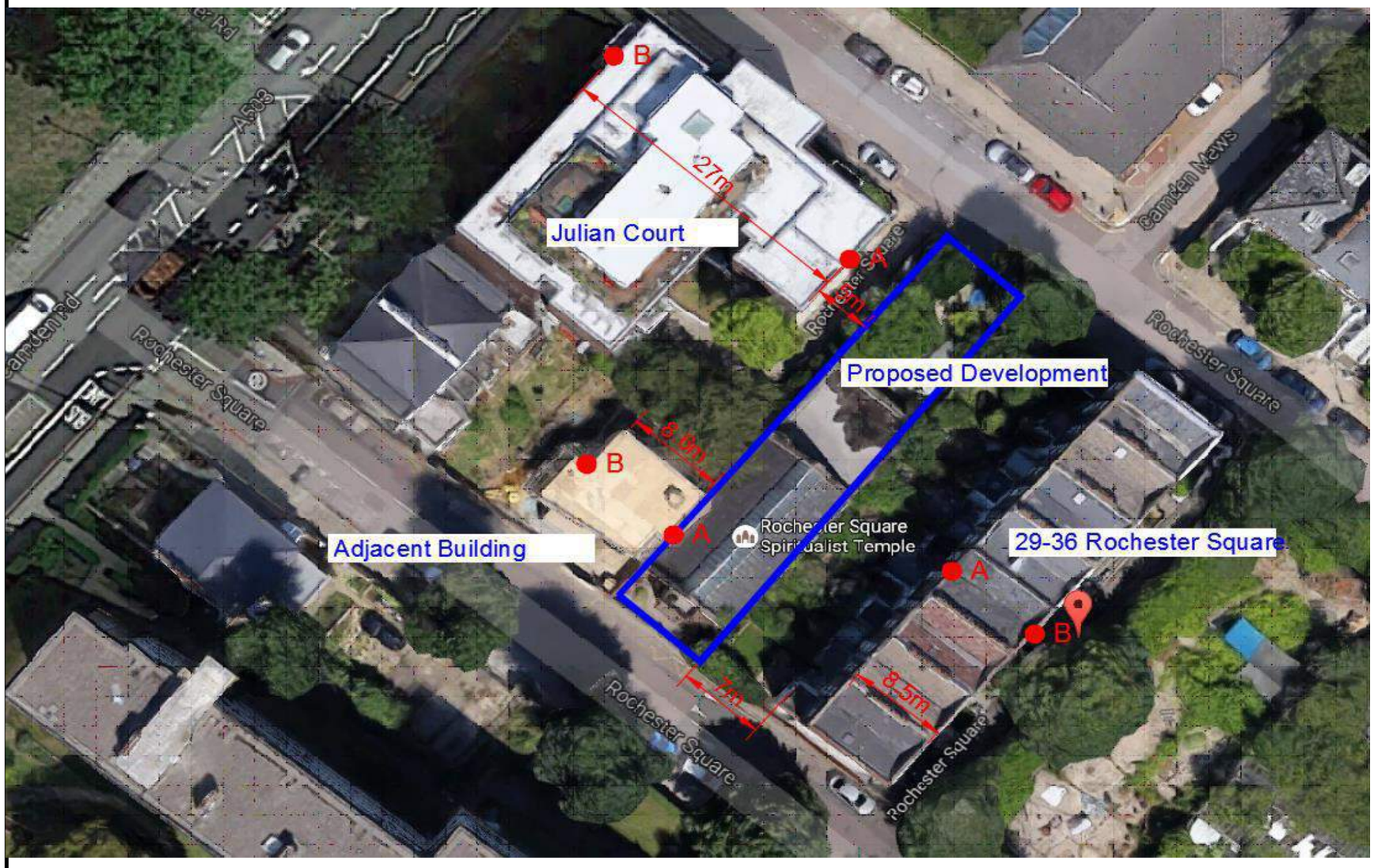
APPENDIX F GMA CALCULATION WORKSHEETS

Ground Investigation
Land Contamination
Hydrogeology
Engineering Geology

Calc No.	Sheet No.	Rev
	1	A

Calculation Sheet

Project	Ground Movement Assessment	Made by	CC
Location	Rochester Square - London	Date	02.12.16



Ground Investigation
Land Contamination
Hydrogeology
Engineering Geology

Calc No.	Sheet No.	Rev
	2	A

Calculation Sheet

Project	Ground Movement Assessment	Made by	CC
Location	Rochester Square - London	Date	02.12.16

Assumptions

Excavation depth - 3.3m, basement slab -2.8m plus 0.5m thk slab
Secant Piled Wall to -7.0m
Bottom-up construction, high stiffness, fully propped

Max Excavation Depth	3.3	m
Wall Depth	7.0	m

Nearby Structure	Note	Point	Distance from wall (m)	Ground movements arising from wall installation					Ground movements arising from excavation in front of wall				
				Distance from wall / wall depth	Horizontal movement / wall depth (%) Fig. 2.8a	Horizontal movement (mm)	Settlement / wall depth (%) Fig. 2.8b	Vertical movement (mm)	Distance from wall / max excavation depth	Horizontal movement / max excavation depth (%) Fig. 2.11a	Horizontal movement (mm)	Settlement / max excavation depth (%) Fig. 2.11b	Vertical movement (mm)
Adjacent Building	2 Storey plus Basement	A	0.0	0.0	0.08	5.6	0.05	3.5	0.0	0.15	5.0	0.04	1.3
		B	8.6	1.2	0.01	0.7	0.02	1.4	2.6	0.04	1.3	0.02	0.7
Julian Court	5 Storey. No basement	A	5.0	0.7	0.03	2.1	0.03	2.1	1.5	0.09	3.0	0.05	1.7
		B	32.0	4.6	0	0.0	0	0.0	9.7	0	0.0	0	0.0
29-36 Rochester Square	3 Storey plus Basement	A	7.0	1.0	0.018	1.3	0.025	1.8	2.1	0.07	2.3	0.03	1.0
		B	15.5	2.2	0	0.0	0	0.0	4.7	0	0.0	0	0.0

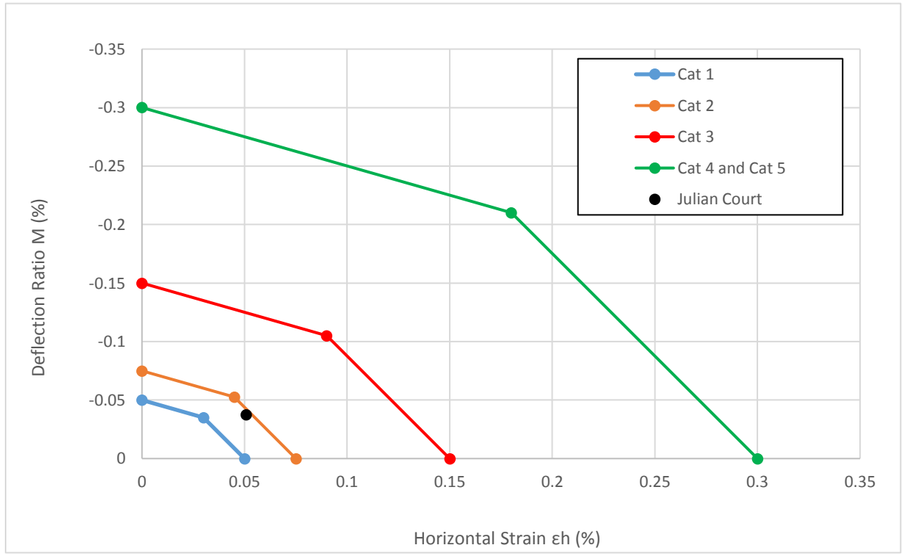
Nearby Structure	Total Movements								
	Horizontal movement (mm)	Vertical movement (mm)	L (m)	H (m)	L/H	Δ (mm)	M=Δ/L (%)	δh (mm)	εh=δh/L (%)
Adjacent Building	10.6	4.8	8.6	6.0	1.4	2.8	0.032	8.5	0.099
	2.0	2.1							
Julian Court	5.1	3.8	10.0	18.0	0.6	3.8	0.038	5.1	0.051
	0.0	0.0							
29-36 Rochester Square	3.6	2.7	8.5	10.0	0.9	2.7	0.032	3.6	0.042
	0.0	0.0							

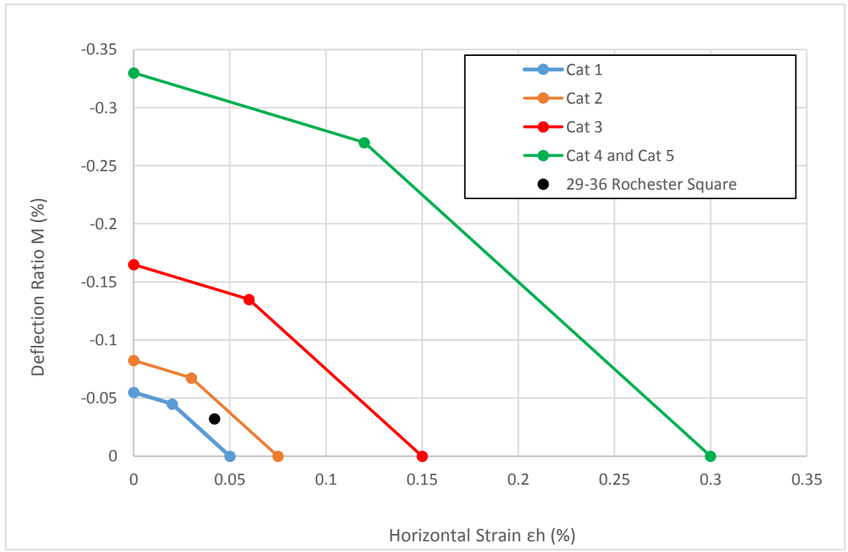
Ground Investigation
Land Contamination
Hydrogeology
Engineering Geology

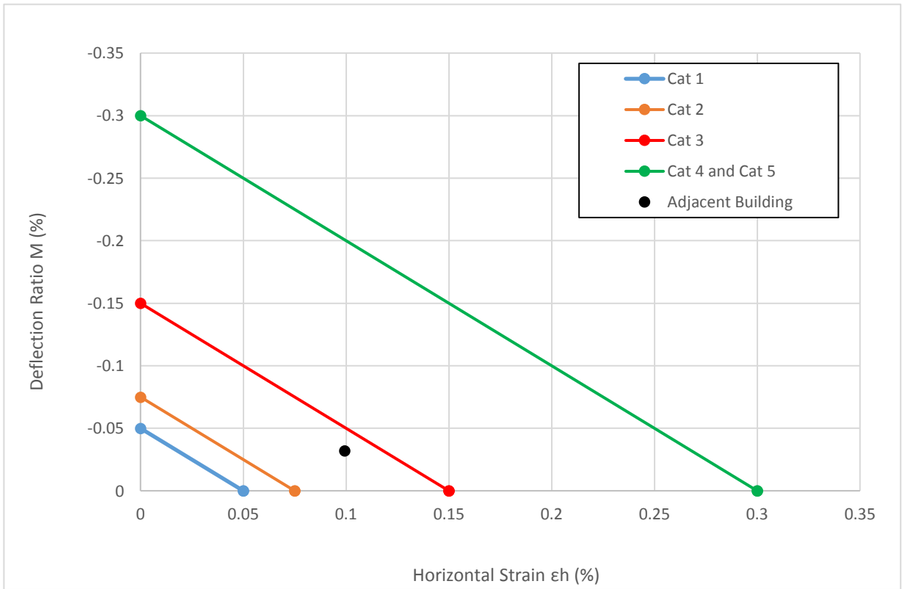
Calc No.	Sheet No.	Rev
	3	A

Calculation Sheet

Project	Ground Movement Assessment	Made by	CC
Location	Rochester Square - London	Date	02.12.16







Ground Investigation
Land Contamination
Hydrogeology
Engineering Geology

Calc No.	Sheet No.	Rev
	2	A

Calculation Sheet

Project	Ground Movement Assessment	Made by	CC
Location	Rochester Square - London	Date	07.12.16

Assumptions

Excavation depth - 4.0m
Secant Piled Wall to -7.0m
Bottom-up construction, high stiffness, fully propped

Max Excavation Depth 4.0 m
Wall Depth 7.0 m

Nearby Structure	Note	Point	Distance from wall (m)	Ground movements arising from wall installation					Ground movements arising from excavation in front of wall				
				Distance from wall / wall depth	Horizontal movement / wall depth (%) Fig. 2.8a	Horizontal movement (mm)	Settlement / wall depth (%) Fig. 2.8b	Vertical movement (mm)	Distance from wall / max excavation depth	Horizontal movement / max excavation depth (%) Fig. 2.11a	Horizontal movement (mm)	Settlement / max excavation depth (%) Fig. 2.11b	Vertical movement (mm)
Adjacent Building	2 Storey plus Basement	A	0.0	0.0	0.08	5.6	0.05	3.5	0.0	0.15	6.0	0.04	1.6
		B	8.6	1.2	0.01	0.7	0.02	1.4	2.2	0.04	1.6	0.02	0.8
Julian Court	5 Storey. No basement	A	5.0	0.7	0.03	2.1	0.03	2.1	1.3	0.09	3.6	0.05	2.0
		B	32.0	4.6	0	0.0	0	0.0	8.0	0	0.0	0	0.0
29-36 Rochester Square	3 Storey plus Basement	A	7.0	1.0	0.018	1.3	0.025	1.8	1.8	0.07	2.8	0.03	1.2
		B	15.5	2.2	0	0.0	0	0.0	3.9	0	0.0	0	0.0

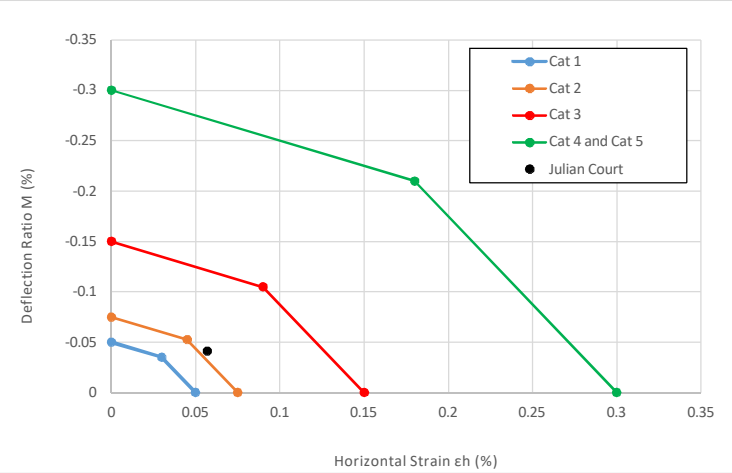
Nearby Structure	Total Movements								
	Horizontal movement (mm)	Vertical movement (mm)	L (m)	H (m)	L/H	Δ (mm)	M=Δ/L (%)	δh (mm)	εh=δh/L (%)
Adjacent Building	11.6	5.1	8.6	6.0	1.4	2.9	0.034	9.3	0.108
	2.3	2.2							
Julian Court	5.7	4.1	10.0	18.0	0.6	4.1	0.041	5.7	0.057
	0.0	0.0							
29-36 Rochester Square	4.1	3.0	8.5	10.0	0.9	3.0	0.035	4.1	0.048
	0.0	0.0							

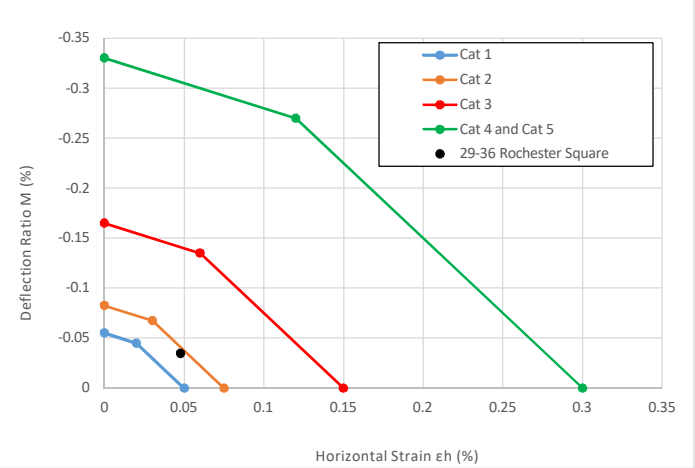
Ground Investigation
Land Contamination
Hydrogeology
Engineering Geology

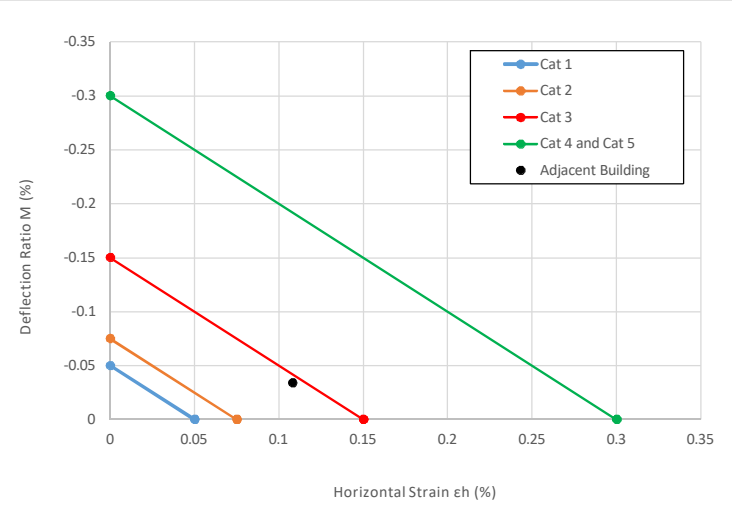
Calc No.	Sheet No.	Rev
	3	A

Calculation Sheet

Project	Ground Movement Assessment	Made by	CC
Location	Rochester Square - London	Date	07.12.16







Flood Risk Assessment for Planning

Prepared for:
LMB Geosolutions Ltd

December 2016

Location:
Former Spiritualist Temple
Rochester Square
London
NW1 9RY

Our reference:
86812-LMB-RochesterSq

The Studio, Lime Tree Cottage, Oldlands Avenue, Balcombe, West Sussex, RH17 6LS
+44 (0) 1444 819200
enquiries@unda.co.uk

Document Issue Record

Project:	Flood Risk Assessment for Planning
Client:	LMB Geosolutions Ltd
Location:	Former Spiritualist Temple, Rochester Square, London NW1 9RY
Application:	Mixed-use redevelopment
Our reference:	86812-LMB-RochesterSq
Version:	Draft v1.0 021216
Lead Consultant:	Ms Jaqueline Stone
Document Check:	Mrs Emma Jeffery
Authorisation:	Mr Edward Bouët

The Studio, Lime Tree Cottage, Oldlands Avenue, Balcombe, West Sussex, RH17 6LS

+44 (0) 1444 819 200

www.unda.co.uk

Key Facts

Flood Risk Posed:

- The site is situated within Flood Zone 1 when using the Environment Agency Flood Map for Planning (Rivers and Sea).
- The EA Surface Water Flood Map suggests that the site lies in close proximity to an area of "High" to "Medium" risk of flooding from surface water.
- The risk of flooding posed to the site by fluvial, tidal, groundwater, and sewer surcharge flooding would appear to be negligible / low.

Flood Risk Management:

- It is recommended that the ground floor level, and basement entry thresholds are raised 300mm above adjacent ground levels.

Introduction

Unda Consulting Limited have been appointed by LMB Geosolutions Ltd (hereinafter referred to as "the applicant") to undertake a Site Specific Flood Risk Assessment (FRA) for Planning at Former Spiritualist Temple, Rochester Square, London NW1 9RY (hereinafter referred to as "the site"). The FRA has been undertaken in accordance with the National Planning Policy Framework (NPPF) March 2012 and the associated technical guidance.

The site appears to be located within Flood Zone 1 as defined by the Environment Agency (EA) on their Flood Map for Planning. Under the National Planning Policy Framework (NPPF), a FRA is required if a proposed development:

- includes building or engineering works in Flood Zone 2 or 3;
- includes building or engineering works on land classified by the Environment Agency as having critical drainage problem;
- changes the use of land or buildings in a location at risk of flooding from rivers or the sea, or with critical drainage problems;
- changes the use of land or buildings in a way that increases the flood vulnerability of the development where it may be subject to other sources of flooding;
- is larger than 1 hectare.

Given that your proposed development is located in Flood Zone 1 (Low Risk of flooding from rivers or the sea), you would not normally require a FRA under the NPPF. However, it is understood that the sit falls within an area at potential risk of surface water flooding. The assessment should demonstrate to the Local Planning Authority (LPA) and EA how flood risk will be managed now and over the development's lifetime, taking climate change into account, and with regard to the vulnerability of its potential users.

The objectives of a FRA to support a planning application are to establish:

- whether the proposed development is likely to be affected by current or future flooding from any source;
- whether it will increase flood risk elsewhere;
- whether the measures proposed to deal with these effects and risks are appropriate.

Existing Situation

Site Usage:

The site is currently occupied by a former place of worship.

No detailed existing site plans are available.

Topography:

The site is situated 3.87km to the north east of the River Thames. LiDAR remotely sensed digital elevation data suggests that the topography on site ranges between approximately 30.60mAOD and 31.40mAOD.

Figure 1: Aerial view of the site and immediate surrounding area (Source: emapsite)

Geography and Soil:

The British Geological Survey (BGS) Map indicates that the bedrock underlying the site is London Clay - a clay and silt derived sedimentary bedrock formed 34 to 56 million years ago.

The soil type in the area taken from the UKSO Website is prequaternary marine/estuarine clay/silt (relatively deep clay and silt) which tends to be of relatively low permeability, but can be variable depending on the mix of clays and silts. With soil conditions such as these, it would be essential that this value is checked through trial pit infiltration tests on site prior to any final detailed drainage design requiring infiltration is carried out.

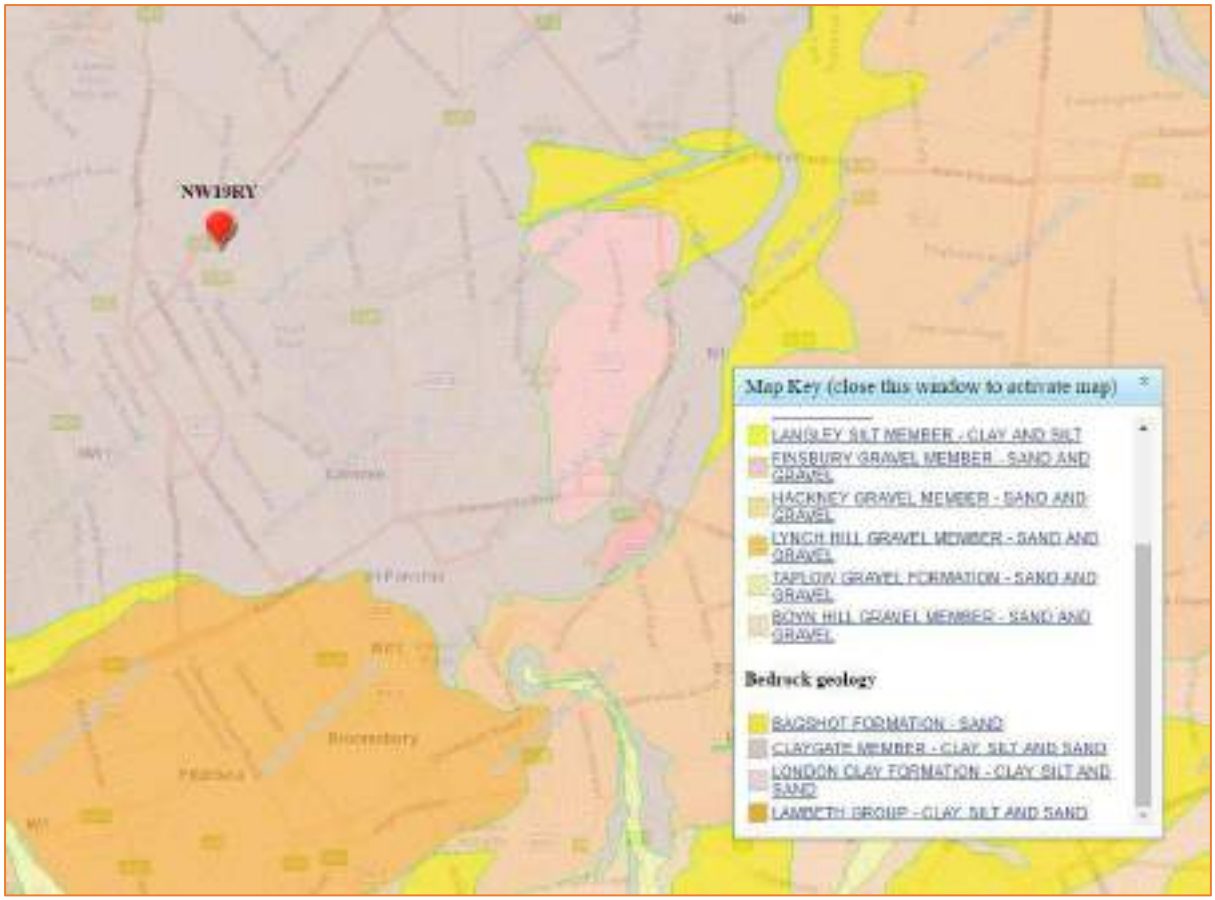


Figure 2: Local geology (Source: BGS)

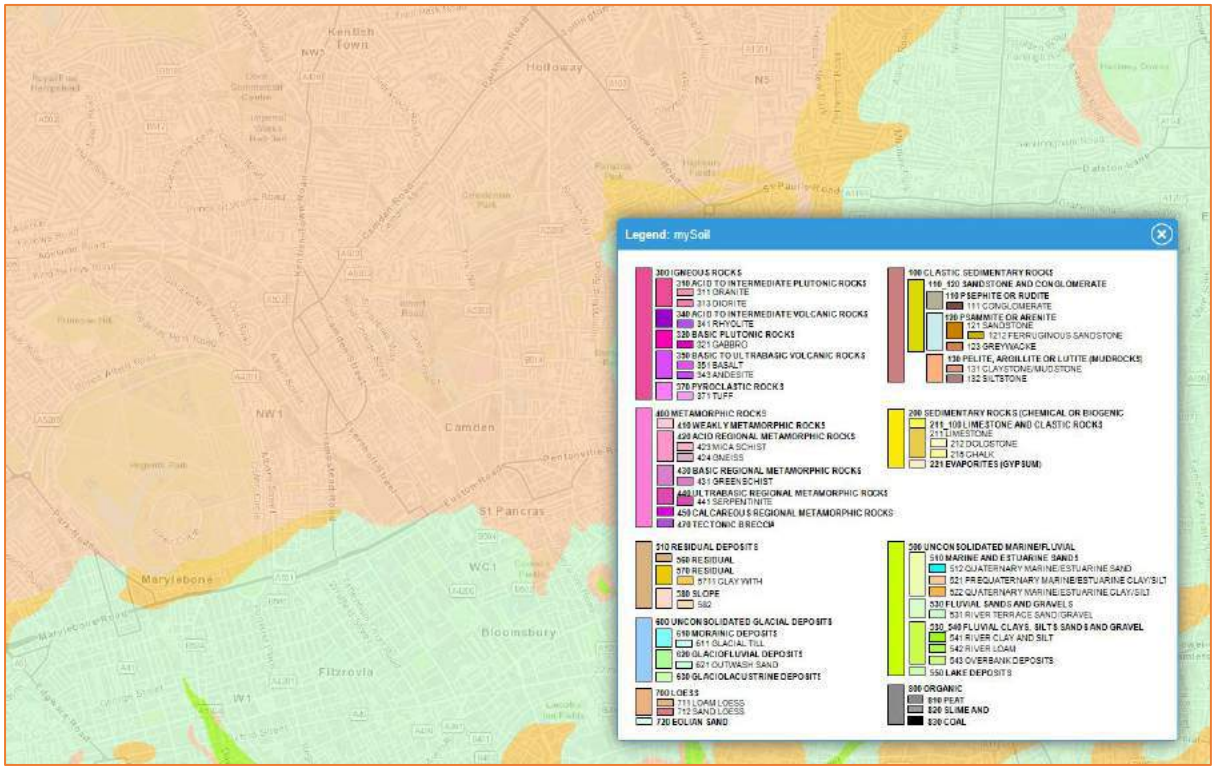


Figure 3: Local soil types (Source: UKSO)

Hydrology:

The site is situated 3.87km to the north east of the River Thames.

Greenfield runoff rates have been calculated using Microdrainage software, using ICP SUDS runoff estimation methods. See Appendix C.

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	0.041	Urban	0.000
SAAR (mm)	613	Region Number	Region 6

Results	**l/s**
QBAR Rural	0.2
QBAR Urban	0.2
Q100 years	0.5
Q1 year	0.1
Q30 years	0.3
Q100 years	0.5

As per the newly published climate change allowances (February 2016) for anticipated changes in extreme rainfall intensity in small and urban catchments, the upper end (40% increase) peak rainfall intensity allowances should be assessed to understand the impact of climate change. The increase in peak rainfall intensity has been assessed by increasing the SAAR (Standard average annual rainfall in mm) value in the calculations.

Proposed Development

The proposed planning application is for the demotion of the existing place of worship, and construction of a mixed use development.

Indicative proposed plans are provided in Appendix A. No detailed plans were available.

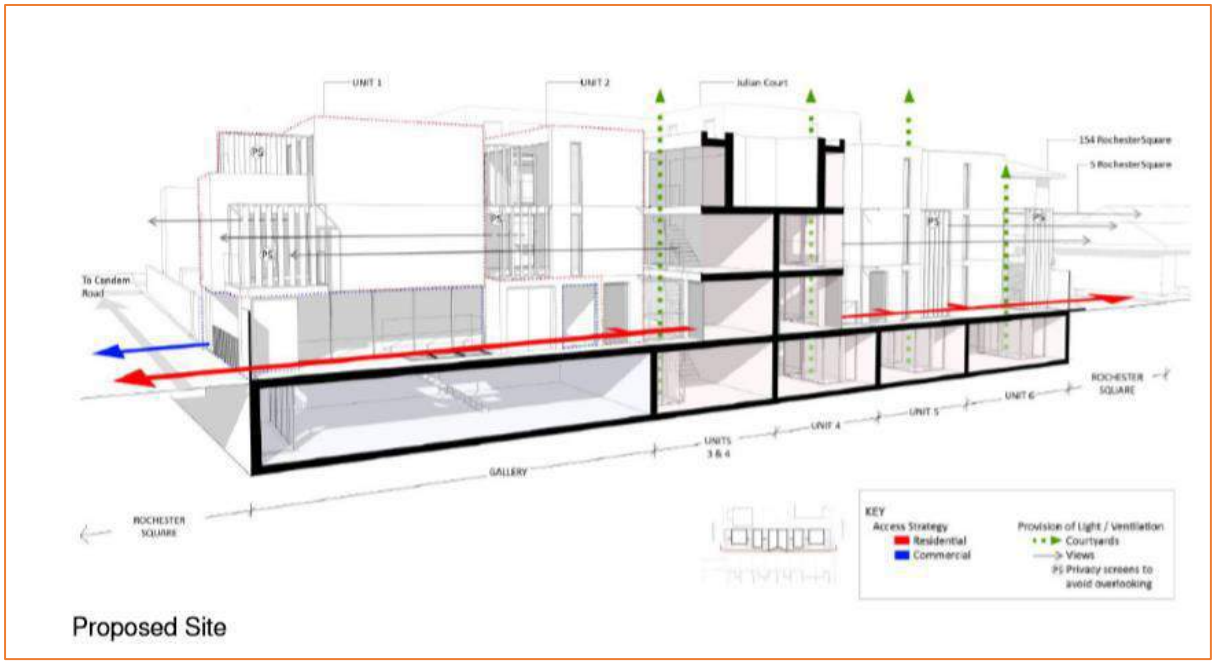


Figure 4: Indicative proposed section (Source: LMB Geosolutions)

Assessment of Flood Risk

Flood Zones:

Within planning, Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences. They are shown on the Environment Agency's Flood Map for Planning (Rivers and Sea), available on the Environment Agency's web site.

Flood Zone	Definition
Zone 1 **Low Probability**	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
Zone 2 **Medium Probability**	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a **High Probability**	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map)
Zone 3b **The Functional Floodplain**	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

Table 2: Flood Zones

The Flood Zones shown on the Environment Agency's Flood Map for Planning (Rivers and Sea) do not take account of the possible impacts of climate change and consequent changes in the future probability of flooding.

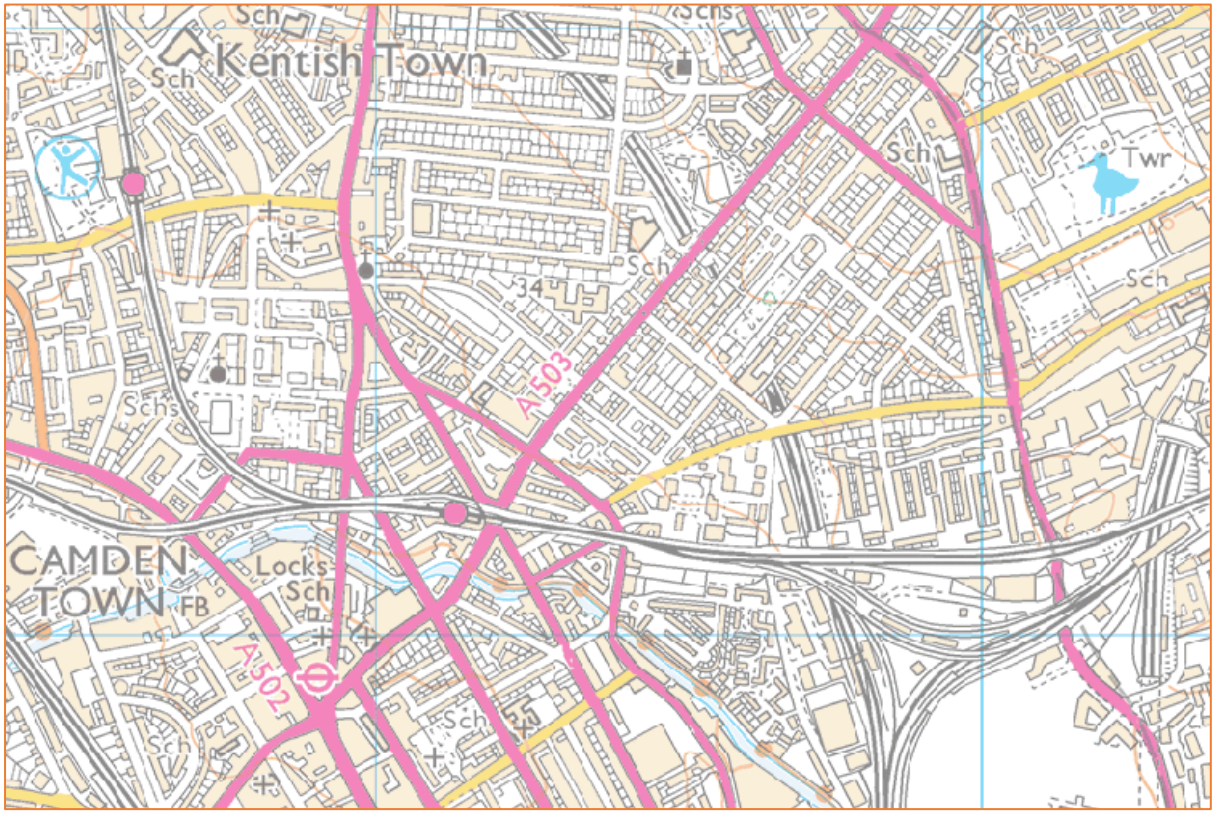


Figure 5: Environment Agency Flood Map for Planning (Rivers and Sea) (Source: EA)

The site is located within Flood Zone 1 (Low Probability), which means it is defined as land having a less than 1:1000 annual probability of river or sea flooding.

However, the site is located within an area at potential risk of surface water flooding, and as such the planning application submitted is required to be accompanied by a FRA which shows that the development can be achieved in a sustainable manner, with an overall reduction of flood risk to the site and surrounding area.

Fluvial / Tidal (River Thames):

The River Thames is predominantly tidal in the vicinity of the site. It flows west-east, and at its closest proximity lies approximately 3.87km to the south west of the site. It is defended to an extremely high standard.

Flood defences:

London is defenced from tidal flooding from the River Thames to a high standard. These defences include the Thames Barrier. The Thames Barrier is one of the largest movable flood barriers in the world. The EA runs and maintains the Thames Barrier as well as London's other flood defences.

The Thames Barrier spans 520m across the River Thames near Woolwich, and it protects 125km^2 of central London from flooding caused by tidal surges. It has 10 steel gates that can be raised into position across the River Thames. When raised, the main gates stand 15m high, and 61.5m wide. Each main gate weighs 3,300 tonnes.

The barrier is closed under storm surge conditions to protect London from flooding from the sea. It may also be closed during periods of high flow over Teddington Weir to reduce the risk of river flooding in some areas of west London including Richmond and Twickenham.

The Thames Barrier will then remain closed over high water until the water level downstream of the Thames Barrier has reduced to the same level as upstream. This is a managed process to provide for different circumstances, and takes approximately 5 hours. The Thames Barrier is then opened, allowing the water upstream to flow out to sea with the outward-bound tide.

The EA has closed the Thames Barrier 174 times since it became operational in 1982 (correct as of March 2014). Of these closures, 87 were to protect against tidal flooding and 87 were to alleviate river flooding. The frequency of closures has increased over recent decades:

- In the 1980s there were 4 closures;
- In the 1990s there were 35 closures;
- In the 2000s there were 75 closures;
- In the 2010s there were 65 closures (as of March 2014).

In addition to the Thames Barrier, the site benefits from the presence of raised man-made flood defences either side of the main River Thames channel. These raised defences act to prevent direct inundation of the site and surrounding area during high tides and periods of high fluvial flow.

Due to the level of the topography on site, the risk of fluvial or tidal flooding is considered negligible.

Pluvial (Surface Water):

Pluvial flooding is the term used to describe flooding which occurs when intense, often short duration rainfall is unable to soak into the ground or to enter drainage systems and therefore runs over the land surface causing flooding. It is most likely to occur when soils are saturated (or baked hard) so that they cannot infiltrate any additional water or in urban areas where buildings tarmac and concrete prevent water soaking into the ground. The excess water can pond (collect) in low points and result in the development of flow pathways often along roads but also through built up areas and open spaces. This type of flooding is usually short lived and associated with heavy downpours of rain.

The potential volume of surface runoff in catchments is directly related to the size and shape of the catchment to that point. The amount of runoff is also a function of geology, slope, climate, rainfall, saturation, soil type, urbanisation and vegetation.

Pluvial flooding can occur in rural and urban areas, but usually causes more damage and disruption in the latter. Flood pathways include the land and water features over which floodwater flows. These pathways can include drainage channels, rail and road cuttings. Developments that include significant impermeable surfaces, such as roads and car parks may increase the volume and rate of surface water runoff.

Urban areas which are close to artificial drainage systems, or located at the bottom of hill slopes, or in valley bottoms and hollows, may be more prone to pluvial flooding. This may be the case in areas that are down slope of land that has a high runoff potential including impermeable areas and compacted ground.

Pluvial flooding can affect all forms of the built environment, including:

- Residential, commercial and industrial properties;
- Amenity and recreation facilities; and
- Infrastructure, such as roads and railways, electrical infrastructure, telecommunication systems and sewer systems.

This type of flooding is usually short-lived and may only last as long as the rainfall event. However occasionally flooding may persist in low-lying areas where ponding occurs. Due to the typically short duration, this type of flooding tends not to have consequences as serious as other forms of flooding, such as flooding from rivers; however it can still cause significant damage and disruption on a local scale.

The EA Surface Water Flood Map suggests that the site lies in close proximity to an area of "High" to "Medium" risk of flooding from surface water.

Figure 6: Extract from Environment Agency Surface Water Flood Map (Source: EA)

The detailed flood mapping below shows likely flood depths expected across the site during the 1:30, 1:100, and 1:1000 year pluvial flood events. High resolution mapping is provided within the report Appendix.

Figure 7: 1:30 year pluvial flood depth mapping (Source: EA)

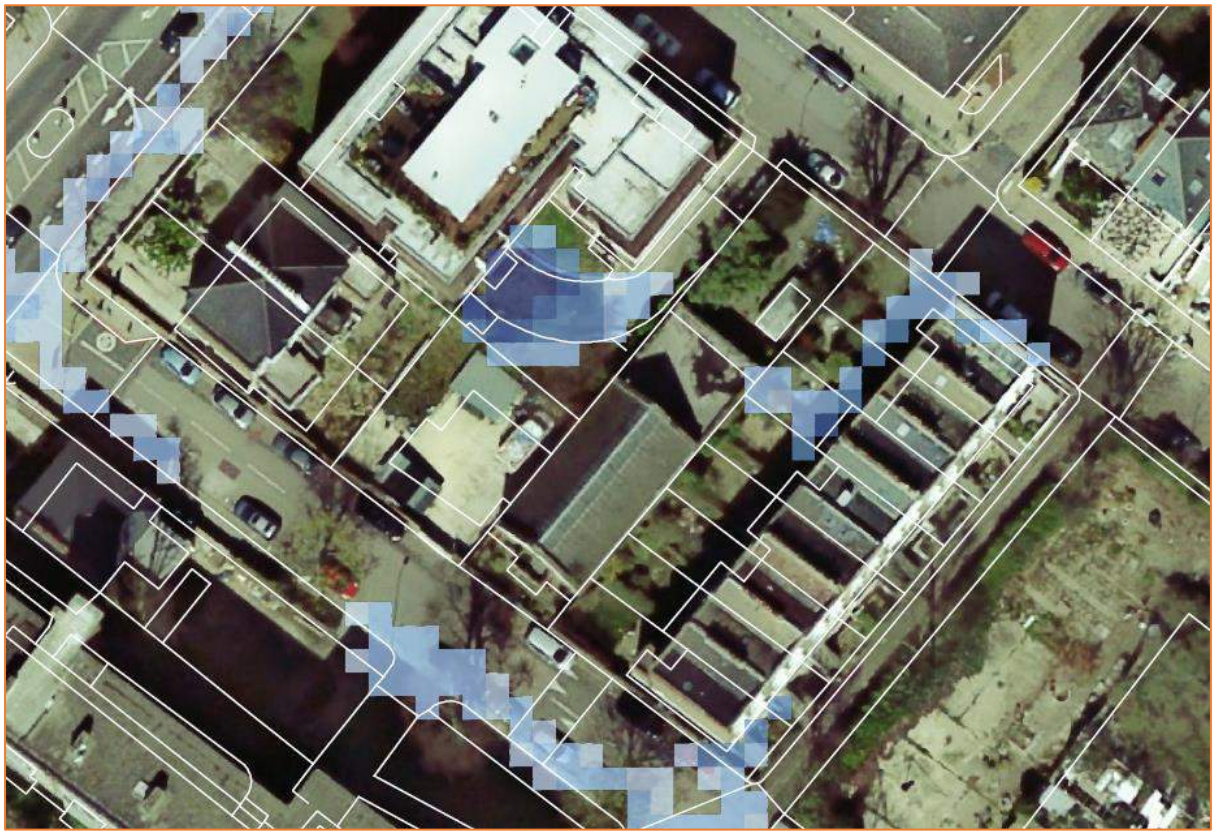


Figure 8: 1:100 year pluvial flood depth mapping (Source: EA)

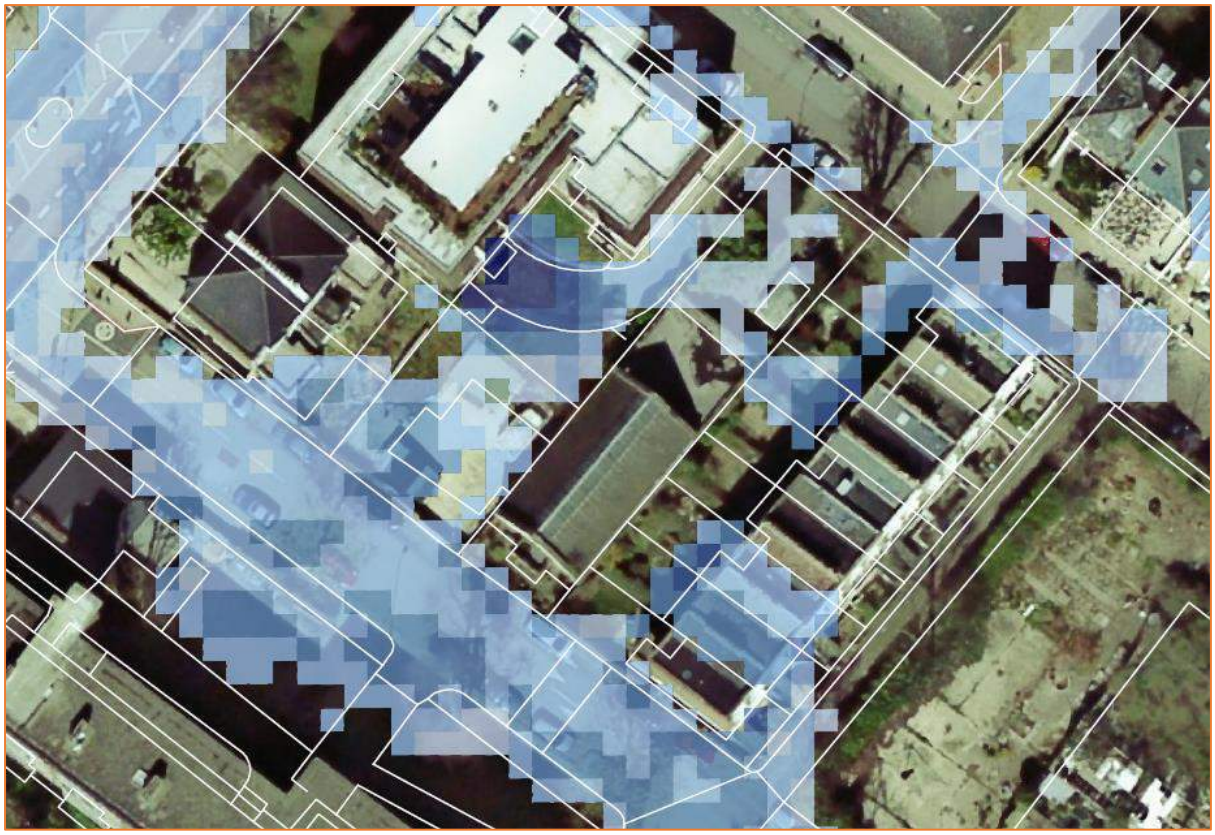


Figure 9: 1:1000 year pluvial flood depth mapping (Source: EA)

This mapping suggest that the site would be subject to a maximum depth of 300mm of pluvial floodwater during a 1:1000 year pluvial flood event.

Groundwater:

Groundwater flooding occurs as a result of water rising up from the underlying rocks or from water flowing from abnormal springs. This tends to occur after much longer periods of sustained high rainfall. Higher rainfall means more water will infiltrate into the ground and cause the water table to rise above normal levels. Groundwater tends to flow from areas where the ground level is high, to areas where the ground level is low. In low-lying areas the water table is usually at shallower depths anyway, but during very wet periods, with all the additional groundwater flowing towards these areas, the water table can rise up to the surface causing groundwater flooding.

Groundwater flooding is most likely to occur in low-lying areas underlain by permeable rocks (aquifers). These may be extensive, regional aquifers, such as chalk or sandstone, or may be localised sands or river gravels in valley bottoms underlain by less permeable rocks. Groundwater flooding takes longer to dissipate because groundwater moves much more slowly than surface water and will take time to flow away underground.

No information has been provided to suggest that the site is susceptible to groundwater flooding.

Sewer Surcharge:

Sewer flooding occurs when the sewer network cannot cope with the volume of water that is entering it. It is often experienced during times of heavy rainfall when large amounts of surface water overwhelm the sewer network causing

flooding. Temporary problems such as blockages, siltation, collapses and equipment or operational failures can also result in sewer flooding.

All Water Companies have a statutory obligation to maintain a register of properties/areas which have reported records of flooding from the public sewerage system, and this is shown on the DG5 Flood Register. This includes records of flooding from foul sewers, combined sewers and surface water sewers which are deemed to be public and therefore maintained by the Water Company. The DG5 register records of flood incidents resulting in both internal property flooding and external flooding incidents. Once a property is identified on the DG5 register, water companies can typically put funding in place to address the issues and hence enable the property to be removed from the register. It should be noted that flooding from land drainage, highway drainage, rivers/watercourses and private sewers is not recorded within the register.

No information has been provided to suggest that the site is susceptible to sewer surcharge flooding.

Other Sources:

The site is situated outside of the maximum inundation extent on the EA Reservoir Inundation Map. The areas of risk are confined to the lower parts of the site immediately adjacent to the un-named drainage channel.

The EA also advise on their website that reservoir flooding is extremely unlikely. All major reservoirs have to be inspected by specialist dam and reservoir Engineers. These inspections are monitored and enforced by the EA themselves. The risk to the site from reservoir flooding is therefore minimal and is far lower than that relating to the potential for fluvial flooding to occur.

There do not appear to be any further artificial (man-made) sources of flood risk (such as raised canals) in the vicinity of the site.

Figure 3: Extract from Environment Agency Risk of Flooding from Reservoirs Map

Flood Risk Management

Vulnerability to flooding:

The NPPF classifies property usage by vulnerability to flooding. The existing permitted site usage (place of worship) is classified as "less vulnerable" throughout. The proposal introduces additional residential properties. Post development, the site will become "more vulnerable" in part, with an intensification of usage.

EA Standing Advice:

The EA Standing Advice guidance is for domestic extensions and non-domestic extensions where the additional footprint created by the development does not exceed 250m^2. It should not be applied if an additional dwelling is being created, e.g. a self-contained annex or additional commercial unit.

Off-Site Impacts:

Fluvial floodplain storage:

The NPPF requires that where development is proposed in undefended areas of floodplain, which lie outside of the functional floodplain, the implications of ground raising operations for flood risk elsewhere needs to be considered. Raising existing ground levels may reduce the capacity of the floodplain to accommodate floodwater and increase the risk of flooding by either increasing the depth of flooding to existing properties at risk or by extending the floodplain to cover properties normally outside of the floodplain. Flood storage capacity can be maintained by lowering ground levels either within the curtilage of the development or elsewhere in the floodplain, in order to maintain at least the same volume of flood storage capacity within the floodplain.

In undefended tidal areas, raising ground levels is unlikely to impact on maximum tidal levels so the provision of compensatory storage should not be necessary.

For development in a defended flood risk area, the impact on residual flood risk to other properties needs to be considered. New development behind flood defences can increase the residual risk of flooding if the flood defences are breached or overtopped by changing the conveyance of the flow paths or by displacing flood water elsewhere. If the potential impact on residual risk is unacceptable then mitigation should be provided.

The application site is situated within Flood Zone 1. Post development, there will be no loss of fluvial floodplain storage.

Surface Water Drainage:

The EA Risk of Flooding from Surface Water Map suggests that the site lies in close proximity to an area of "Medium" to "High" risk of flooding from surface water.

Accordingly, it is recommended that the ground floor level, and basement entry thresholds are raised 300mm above adjacent ground levels.

Sequential and Exception Test

The Sequential Test aims to ensure that development does not take place in areas at high risk of flooding when appropriate areas of lower risk are reasonably available. The site is situated in Flood Zone 1 when using the Environment Agency Flood Map for Planning (Rivers and Sea). Post development, the site will become "more vulnerable", as the proposal includes residential properties.

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a	Exception Test required	✗	Exception Test required	✓	✓
Zone 3b	Exception Test required	✗	✗	✗	✓

Table 4: Flood risk vulnerability and flood zone 'compatibility'

Using the table about, the proposed application is considered to be suitable within Flood Zone 1. The Sequential and Exception Tests do not need to be applied to minor developments and changes of use.

Conclusion

Unda Consulting Limited have been appointed by LMB Geosolutions Ltd to undertake a Site Specific Flood Risk Assessment (FRA) for Planning at Former Spiritualist Temple, Rochester Square, London NW1 9RY. The FRA has been undertaken in accordance with the National Planning Policy Framework (NPPF) March 2012 and the associated technical guidance.

The proposed planning application is for the demotion of the existing place of worship, and construction of a mixed use development. The existing permitted site usage (place of worship) is classified as "less vulnerable" throughout. The proposal introduces additional residential properties. Post development, the site will become "more vulnerable" in part, with an intensification of usage.

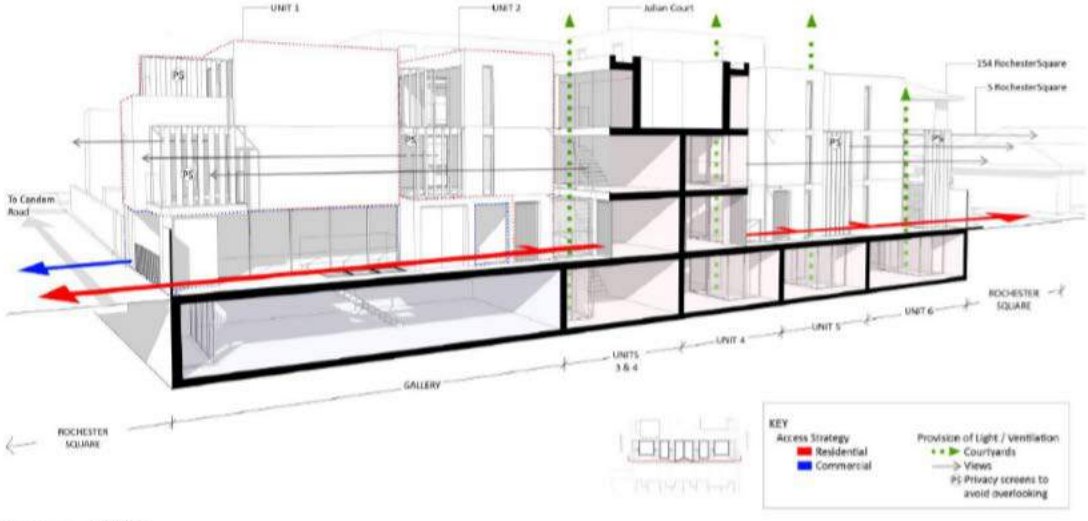
The site is located within Flood Zone 1 (Low Risk) as defined by the Environment Agency (EA) on their Flood Map for Planning, but falls within an area at potential risk of surface water flooding.

The EA Surface Water Flood Map suggests that the site lies in close proximity to an area of "High" to "Medium" risk of flooding from surface water. Detailed flood mapping from the EA shows likely flood depths expected across the site during the 1:30, 1:100, and 1:1000 year pluvial flood events. This mapping suggest that the site would be subject to a maximum depth of 300mm of pluvial floodwater during a 1:1000 year pluvial flood event.

Accordingly, it is recommended that the ground floor level, and basement entry thresholds are raised 300mm above adjacent ground levels.

Appendix A

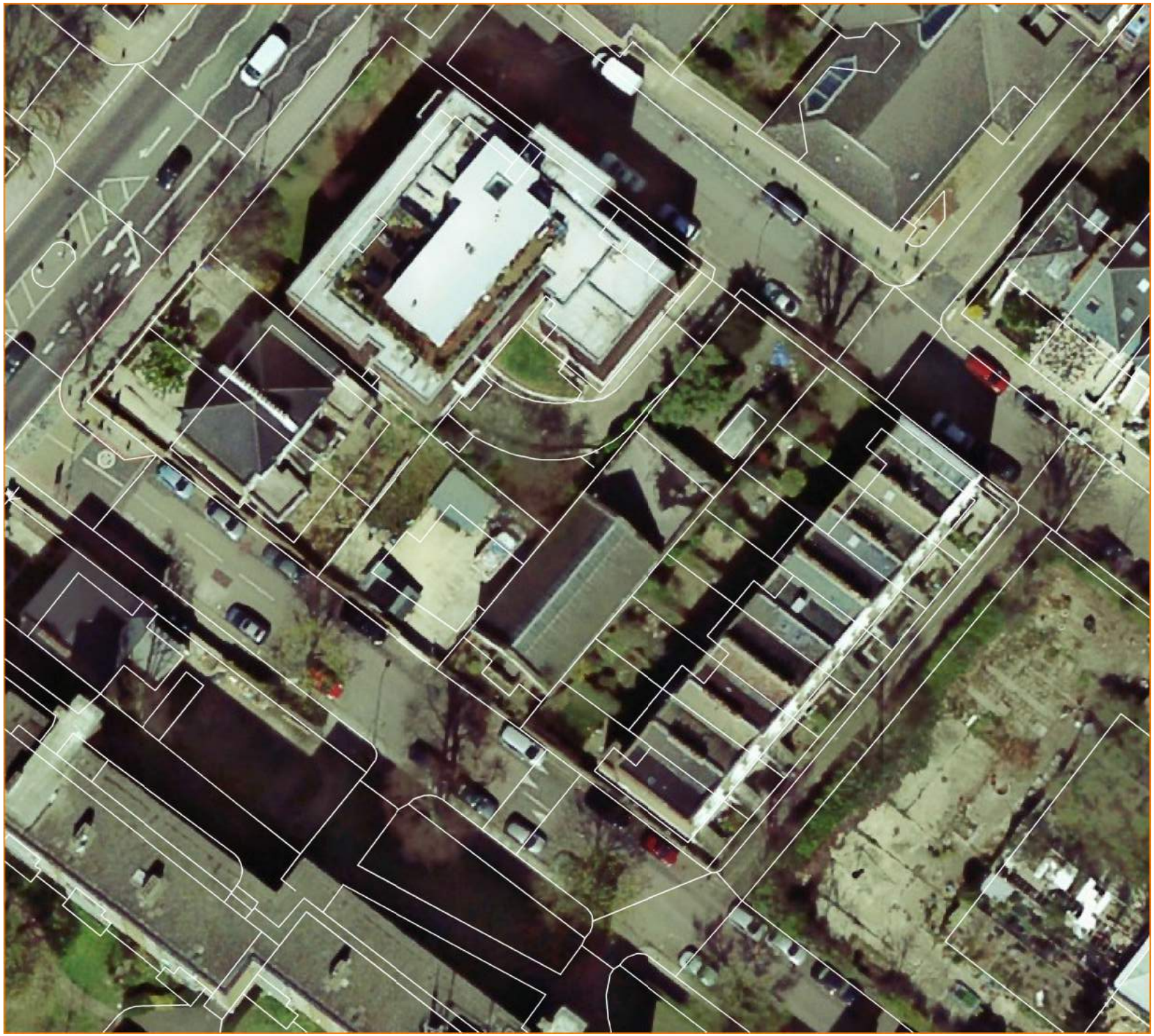
Page 19: Indicative proposed section.



Proposed Site

Appendix B

Pages 21 to 23: EA pluvial flood modelling.



1:30 year pluvial flood depths

Over 900mm

300 to 900mm

Below 300mm

N

5 0 5 10 15 20 m

1:100 year pluvial flood depths

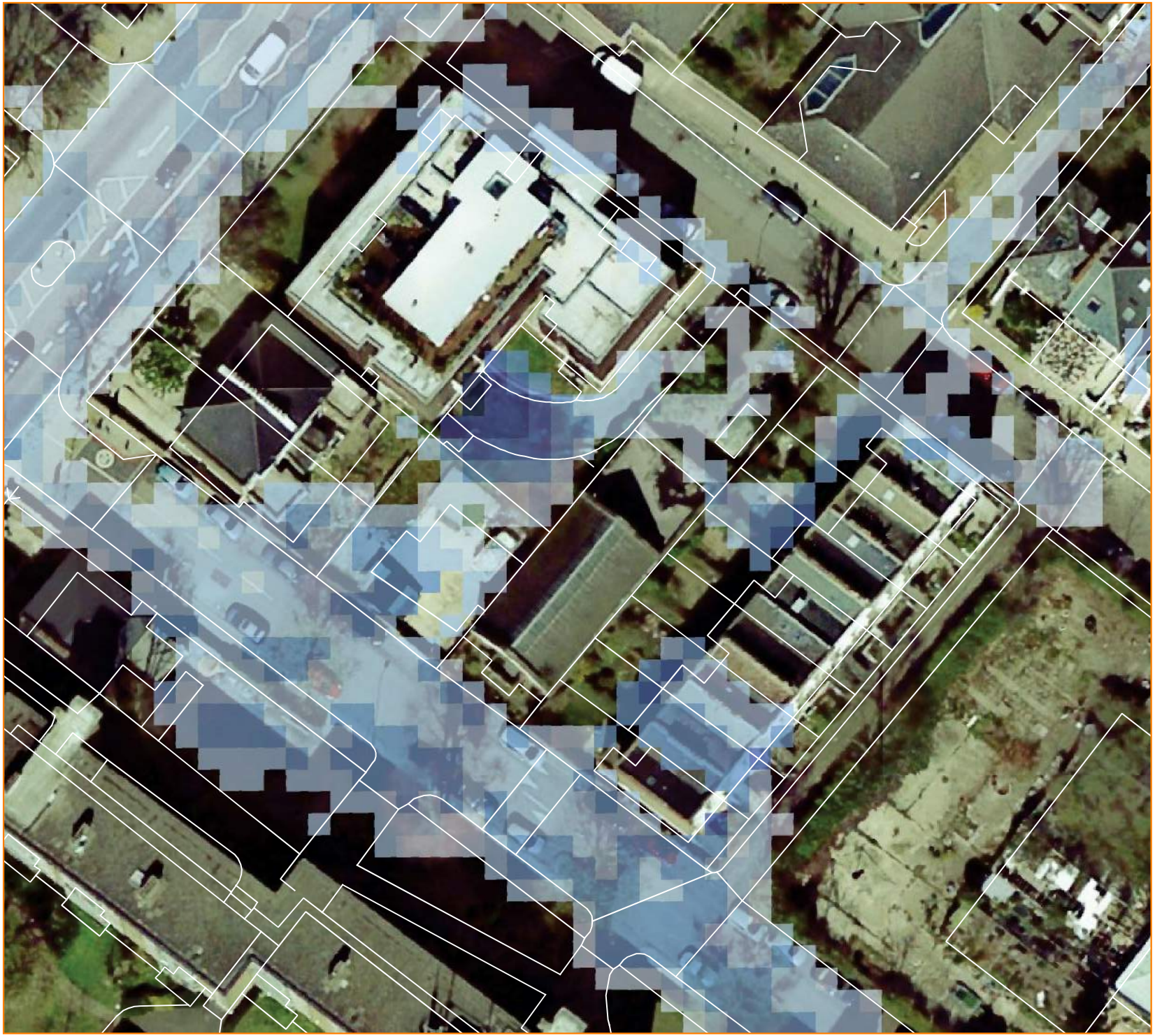
Over 900mm

300 to 900mm

Below 300mm

N

5 0 5 10 15 20 m



1:1000 year pluvial flood depths

Over 900mm

300 to 900mm

Below 300mm

N

5 0 5 10 15 20 m

Appendix C

Page 25: Microdrainage greenfield runoff calculation sheet.

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	0.041	Urban	0.000
SAAR (mm)	613	Region Number	Region 6

Results l/s

QBAR Rural	0.2
QBAR Urban	0.2
Q100 years	0.5
Q1 year	0.1
Q30 years	0.3
Q100 years	0.5

LMB Geosolutions Ltd

November 10, 2017

Camille Corvec
Symmetrys Ltd
Unit 6 The Courtyard,
Lynton Road,
London, N8 8SL

RE: Proposed development at Rochester Square Spiritualist Temple, Rochester Square, London NW1 9RY

Dear Camille:

Further to our recent correspondence and discussions I can confirm that we have produced the following technical reports and documents in relation to the proposed development at Rochester Square Spiritualist Temple:

- LMB Geosolutions Ltd (ref. LMB.16.12.07_REPPIL_GI_Rochester_v1.1_ALL, dated 7th December 2016). Ground Investigation & Assessment Report.
- LMB Geosolutions Ltd (ref. LMB.16.12.07_REPPIL_BIA_RochesterSq_v1.0_ALL, dated 7th December 2016). Basement Impact Assessment Report.
- LMB Geosolutions Ltd (ref. LMB_16.12.20_PILLET_Rochester_1.0, dated 20th December 2016). Update Letter.

Amendments to Proposed Development

The update letter referenced above confirmed that proposed changes to finished floor level would not significantly alter the conclusions and recommendations provided within the above referenced reports.

More recently the following drawings have been provided in relation to additional proposed changes to the basement design at the Rochester Square Spiritualist Temple:

- Spacelab (ref. 1606, Dated 06.09.17). Rochester Square, Camden. Proposed Plans – Basement Plan.
- Spacelab (ref. 1606, Dated 06.09.17). Rochester Square, Camden. Proposed Plans – Ground Floor Plan.
- Symmetrys (ref. 2016061, dated November 2017). Former Spiritualist Temple Rochester Square, London NW1. Proposed Construction Method Statement.
- Symmetrys (ref. 2016061, dated November 2017). Former Spiritualist Temple Rochester Square, London NW1. Typical Underpinning Sequence.

Based on review of the above drawings and discussions with Symmetrys Ltd (Consultant Engineers), the proposed amendments can be summarised as follows:

- It is proposed to use underpins to form the basement rather than a secant pile wall;
- Temporary support will be provided by sheet piles; and
- The basement area will be reduced by approximately 50% of the original area proposed and will only be formed beneath the existing rear garden area.

Appraisal of Amendments

Foundations

The formation level for the basement will remain c. 4.00-4.50m below ground level (bgl) and will be founded on the competent firm to stiff London Clay. As such the amendments should be of no consequence in terms of the allow bearing pressure and/or founding strata.

Ground Movements

A Ground Movement Assessment (GMA) was completed as part of the Basement Impact Assessment (BIA) for the original design. The GMA was completed in accordance with CIRIA publication C580 Embedded Retaining Walls – Guidance for Economic Design. C580 provides curves estimating horizontal and vertical ground surface movements due to piled wall installation and to excavation in front of wall.

The GMA completed in this way assumed installation of a secant pile wall and not underpins with temporary support provided by sheet piles. The depth of the basement wall was assumed to be 7m and it is anticipated that the temporary support provided by the sheet piling will be of a similar depth. It is understood that 'push in' sheet piles will be installed rather than vibration ones to minimise movements.

The area of the proposed basement has significantly decreased and thus the number of potential surrounding buildings impacted has decreased and there will no longer be an excavation along the party wall of the adjacent building.

Conclusions

Based on the information presented above, the existing GMA is likely to be overly conservative when considering current proposed basement development and as such it is concluded that the predicted ground movement presented within the existing GMA will not be exceeded and the amended development should not result in additional ground movement induced impacts.

I trust the above and appended information is of use. However, if you require any further information then please feel free to contact me at your convenience.

Sincerely,

Philip Lewis BSc (Hons), MSc, CGeol, FGS
Director
LMB Geosolutions Ltd

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