33 HARMOOD STREET
CAMDEN
LONDON
NW1 8DW

BASEMENT IMPACT ASSESSMENT
SCREENING

SCL/GB/9031 – BIA – Version 1.1

17th May 2016

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CONTENTS

APPENDICES

EXECUTIVE SUMMARY

The Basement Impact Assessment (BIA) is prepared in accordance with Camden Planning Guidance Basements and Lightwells CPG4 July 2015.

The Basement Impact Assessment Screening is separated into six sections covering 1.0 Introduction, 2.0 Structural Appraisal, 3.0 Hydrogeological Appraisal, 4.0 Drainage and Surface Water Flow Appraisal, 5.0 Flood Risk Assessment Appraisal and 6.0 Conclusions.

The Introduction provides the screening aspect with Figures 1, 2 and 3 noting Yes or No if the basement is likely to have any affect on the surrounding area and referenced to each of the relevant sections 2.0, 3.0, 4.0 and 5.0, within which are provided the scoping and details of potential impact and any mitigation measures with Recommendations and Conclusions within section 6.0.

A desktop study and site walkaround has been undertaken and reviewed against the site requirements along with the local British geological record for local borehole records. These provide the necessary site specific data to undertake the BIA screening.

A full Site Investigation and Topographic Survey will be undertaken and reviewed against the site requirements to allow for the detailed design to be undertaken following Planning Approval.

The consideration of SUDS on site for the surface water drainage system with attenuation and flow rates has been included.

The BIA concludes that the proposed reduction in ground level to the rear of the site and rear extension works can be carried out safely and without adverse affect on the adjacent structures, local hydrogeology, trees, surface water flow or increase local flooding risks.

The risks noted within the BIA, even though they are only slight, can be further mitigated by diligent detailed design and implementation to include the installation of additional surface water drainage, installation of reinforced concrete underpinning in sequence, careful detailed installation of temporary sequencing works, a suitable on site monitoring procedure and use of experienced contractors and an experienced design consultant team.

1.0 INTRODUCTION

1.1 This Basement Impact Assessment screening has been prepared by Taylor Whalley Spyra as requested by Belsize Architects as part of the Planning Application for the proposed new rear extension and reduction in the rear garden level.

1.2 The information contained within this Basement Impact Assessment screening (BIA) has been produced to cover the information required as set out by Camden Planning Guidance Basements and Lightwells CPG4 July 2015

1.3 The purpose of this Basement Impact Assessment document is to undertake a Stage 1 Screening to review the key points for the safe construction of the proposed redevelopment of 33 Harmood Street and surrounding area.

1.4 It reviews how the neighbouring buildings and the local environment and amenity will be protected.

1.5 The topics covered within the BIA are Structural Stability & Movement Assessment, Method of Construction, Hydrogeological, Drainage & Surface Water Flow, Flood Risk and Temporary Works during lower ground floor construction.

1.6 This is not the final design information but is intended to demonstrate that the aspects of the design and construction has been carefully considered. All aspects will be subject to detailed design once Planning Approval is granted.

1.7 The existing property is a two storey brick building with a single storey rear extension at the end of a terrace (refer to Appendix A).

1.8 The site is 20m long and 6m wide being wedge shape and orientated approximately East to West. The nearest adjoining properties are 35 Harmood Street which is attached to the North boundary and 31 Harmood Street to the South garden wall boundary. To the East boundary is Harmood Street and to the West boundary is a private forecourt Collard Place (refer to Appendix A).

1.9 The proposed lower ground floor reduced dig is 7.7m x 4.9m wide approximately at the rear of the property below the rear extension and part of the rear garden.

1.10 The existing building is to refurbished, with the rear extension demolished, a sequence of reinforced concrete underpinning will be installed for the reduced dig and then ground level can be reduced to form the lower ground floor reinforced concrete slab for the new rear extension. The new reduced dig area to form the lower garden will be backfilled to the required level with topsoil and be permeable through the existing ground below.

1.11 The new reinforced concrete underpinning and lower ground extension slab will be designed to form the permanent support works for the retaining walls. Once the reinforced concrete lower ground floor structure is completed only then will the remainder of the above ground rear extension construction be carried out.

1.12 The following screening stages in Figures 1, 2, and 3 are reviewed to see the effect of the construction on the surrounding area and the relevant scoping stages are noted in the adjacent contents items referenced to within this BIA screening report, which then outlines any possible impacts and any mitigation necessary to reduce the impact on the surrounding area.

Figure 1 - Subterranean (ground water flow) screening chart

Q 1a: Is the site located directly above an aquifer?	No	See Content 3.0
Q 1b: Will the proposed basement extend beneath the water table surface?	No	See Content 2.0, 3,.0, 4.0
Q 2: Is the site within 100m of a watercourse, well (used/disused) or potential spring line?	No	See Content 3.0,
Q 3: Is the site within the catchment of any Local pond chains?	No	See Content 3.0
Q 4: Will the proposed basement development result in a change in the proportion of hard surfaced/paved areas?	yes	See Content 4.0

Q 5: As part of the site drainage, will more surface water (e.g. rainfall and run-off) than at present be discharged to the ground (e.g. via soakaways and/or SUDS)?	No	See Content 4.0
Q6: Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to, or lower than, the mean water level in any local pond or spring line.	No	See Content 2.0, 3.0, 4.0

Figure 2 - Land stability screening chart

Q 1: Does the existing site include slopes, natural or man made, greater than 7°? (approximately 1 in 8)	No	See Content 2.0, 3.0
Q 2: Will the proposed re-profiling of landscaping at site change slopes at the property boundary to more than 7°? (approximately 1 in 8)	No	See Content 2.0, 3.0
Q 3: Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7°? (approximately 1 in 8)	No	See Content 2.0, 3.0
Q 4: Is the site within a wider hillside setting in which the general slope is greater than 7°? (approximately 1 in 8)	No	See Content 2.0, 3.0
Q 5: Is the London Clay the shallowest strata at the site?	Yes	See Content 2.0, 3.0,
Q 6: Will any tree/s be felled as part of the proposed development and/or are any works proposed within any tree zones where trees are to be retained?	No	See Tretec Ltd Arboriculture Report
Q 7: Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site?	No	See Content 2.0
Q 8: Is the site within 100m of a watercourse or a potential spring line?	No	See Content 3.0, 4.0
Q 9: Is the site within an area of previously worked ground?	No	See Content 2.0, 3.0
Q 10: Is the site within an aquifer?. If so, will the proposed basement extend beneath the water table such that dewatering may be required during construction?	No	See Content 3.0, 4.0
Q 11: Is the site within 5m of a highway or pedestrian right of way?	No	See Content 2.0
Q 12: Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	No	See Content 2.0,
Q 13: Is the site over (or with the exclusion zone of) any tunnels e.g. railway lines?	No	See Content 2.0,

Figure 3 - Surface flow and flooding screening chart

Q 1: Is the site within the catchment of any local ponds?	No	See Content 3.0
Q 2: As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route?	No	See Content 4.0
Q 3: Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	Yes	See Content 4.0
Q 4: Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface water being received by adjacent properties or downstream watercourses?	No	See Content 2.0, 3.0, 4.0
Q 5: Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	No	See Content 3.0, 4.0, 5.0
Q 6: Is the site in an area known to be at risk from surface water flooding,	No	See Content 3.0, 4.0, 5.0

1.13 The Client will appoint a competent contractor with experience of similar works to oversee the building contract and will liaise with London Borough of Camden and local residents to ensure the impact of the proposals are fully understood and mitigated as far as possible.

1.14 Safety both on site and adjacent to the site is of paramount importance and the method of construction proposed has taken this into account.

1.15 Taylor Whalley Spyra are retained as consulting civil and structural engineers for the project. The company was formed in 1955 and is a private company wholly owned by the directors. Our expertise covers all building types and we have particular experience of working in Central London locations where sites have tight urban constraints. Related examples of this type of work are included on the following page.

TYPICAL EXAMPLES OF DIFFICULT SUPERSTRUCTURE RETENTION AND SUBSTANTIAL BASEMENT CONSTRUCTION IN LONDON

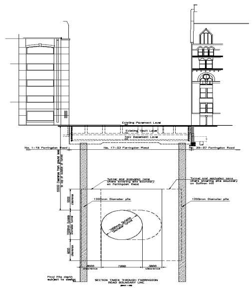



16 Boltons Place, London

37 Loudon Road, London

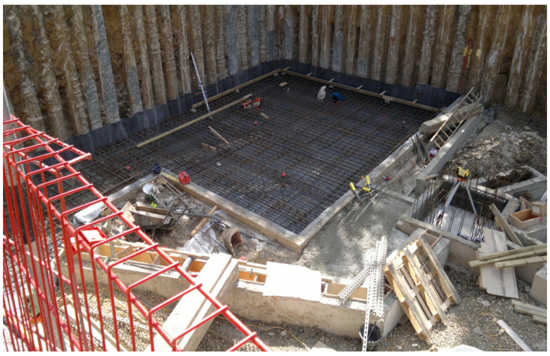
Formation of significant residential basements adjacent to and beneath existing


67 West Heath Road, London
New construction adjacent to existing buildings

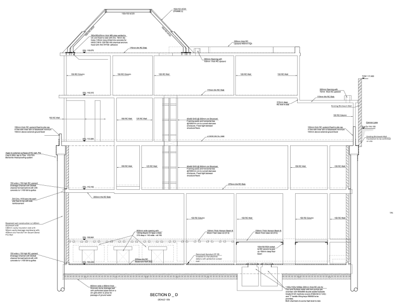



17-23 Farringdon Road, London
Construction of new retail, commercial and residential building over the proposed Crossrail link

60 Addison Road W14,
Facade retention over new basement



1 St Kildas Road N16
New single basement
office facility



5, Cannon Lane, NW3
New residential double basement



1 SOUTHWICH YARD, W2, UNDERPINNING/ RETAINING WALLS
New residential Lower Ground floor

2.0 STRUCTURAL APPRAISAL

2.1 A review of how best to construct the lower ground floor was undertaken and it was concluded that the most efficient form of construction would be sequenced construction of reinforced concrete underpinning as the reduced dig is approximately 1m. The installation of reinforced concrete underpinning in 1m wide bays will control ground movement and is also a well-established form of construction for these type of works.

2.2 To the North boundary is 35 Harmood Street. The proposed reduced dig and reinforced concrete underpinning will be at the Southwest corner at its nearest point to the main south wall of the house and will be offset from the party wall.

2.3 To the South boundary is 31 Harmood Street. The proposed lower ground floor reduced dig is 1m away at its nearest point to the main north wall of the house.

2.4 To the West boundary is Collard Place forecourt, situated at the rear of the garden. The reduced dig lower garden is 3m from the rear boundary.

2.5 All properties that are adjacent to the proposed development that will fall within The Party Wall Act 1996 which will require building condition surveys to be undertaken.

2.6 The design of the lower ground reinforced concrete underpinning and reduced dig works is to be undertaken to minimise any structural disturbance to the adjoining properties or infrastructure. The nearest building adjacent to the proposed lower ground floor is 35 Harmood Street which is located at the corner and will not be affected by the proposed works. The design of the reinforced concrete underpinning will incorporate an additional allowance for a surcharge loading to take into account the location and loads from the adjacent building site boundaries. This allowance will also be included to allow for any future surcharging of the adjacent ground next to the reinforced concrete walls. The reinforced concrete underpinning will be installed in sequenced bays and fully dry packed, no adjoining bay will be excavated until the cast bay has reached the required design strength. This will minimise any structural disturbance whilst carrying out the works (refer to Appendix C).

2.7 As part of the design and to control ground movement, a scheme will be agreed as part of the party wall process to install a movement monitoring system to monitor movement during the course of the lower ground floor works. This will involve the location of monitoring nodes to be located along the surrounding ground and also on adjacent property walls where allowed, as part of the party wall agreements. Readings will be taken at regular intervals and additional readings undertaken when specific works are planned that may be more prone to ground movement during the underpinning and excavation of ground works.

2.8 An analysis of the reinforced concrete underpinning retaining wall has been undertaken using Wallap Version 6.05 for this stage of the planning application.

2.9 The initial analysis of the wall design using Wallap has confirmed that the movement can be limited to the adjoining properties as Very Slight, as categorised by Damage Category Chart (CIRCA C580). The initial design undertaken confirms that the category of movement indicated above can be achieved for the reduced dig and with further detailed design improved upon.

2.10 In our experience it is likely that only a limited amount of movement will take place with reinforced concrete underpinning. With the underpinning/wall being adequately constructed the movement at the boundaries will not exceed 2mm.

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

Damage Category Chart (CIRIA C580)

Table 1.1

2.11 Proposed Sequence of Works.

- Install within the site area around the rear garden zone and surrounding area a number of fixed monitoring nodes to monitor possible movement during the works.
- The existing rear extension is to be demolished and all foundations to be grubbed out.
- Install reinforced concrete underpinning in agreed sequence of bays to the rear of the house, two sides of the garden boundary and to retain the higher garden level.
- Reduce dig for the area of the new extension and install two below ground granular drainage channels and cast lower ground slab tied to reinforced concrete underpinning.
- Reduce dig for the lower garden and install two granular drainage channels.
- The new rear extension structure over can now be constructed and will be supported on the reinforced concrete underpinning.
- Continue with construction of the remainder of the rear extension over using traditional load bearing brick/blockwork, steel framing.
- Install new top soil to rear lower garden.

2.12 A full soil investigation will been undertaken comprising of one 6m deep borehole, and two trial holes.

3.0 HYDROGEOLOGICAL APPRAISAL

3.1 The average existing site and surrounding ground level adjacent to the proposed building is in the order of 74.4m OD with the rear garden area level.

3.2 The geology of the area is well known as summarised on the relevant geological sheets, being London Clay formation. Reference to local bore hole logs held by the British geological survey confirm London Clay and a low water table.

3.3 It may be expected that there will be a perched ground water level within the shallow made ground formation, but it is unlikely therefore that the site will be influenced directly by the ground water.

3.4 The rate of seepage would be expected to be slow and any ground water flow on site is considered to be very low and will not affect the proposed lower ground reduced dig or adjoining properties.

3.5 The site is not within any ground water protection zone as indicated on Environment Agency maps and is classed by the EA as a non aquifer zone with negligible permeability. This is mainly due to the ground conditions in the area being London Clay.

3.6 The main historic river path in the area is the River Fleet which is some considerable distance to the North of the site. This is too great a distance from the site to be affected by the reduced dig works and has been culverted in to a main drain. As the waterway is well away from the site there is no potential threat to impediment of flow from the proposed development.

4.0 DRAINAGE AND SURFACE WATER FLOW APPRAISAL

4.1 The existing rear site area is 53.2m² consisting of 16.9m² of non-permeable hard standing and 36.3m² of permeable soft standing

4.2 The proposed rear site area is 53.2m² built-up of 25.8m² of non-pervious hard standing and 27.4m² of pervious soft standing

	Hard Standing	Soft Standing
Existing	16.9m²	36.3m²
Proposed	25.8m²	27.4m²

4.3 Initial calculations based on a 1:100 year event have been undertaken which show that the existing volume of surface water runoff from the site is in the region of 1.2m³ and the new surface water runoff would decrease to 0.8m³ (refer to Appendix I).

4.4 The surface water drainage will be designed to discharge to the existing sewer in Harmood Street at the existing flow rate.

4.5 It will be necessary to provide on-site storage of 0.4m³. This is minimal and a small attenuation chamber located at the rear of the lower garden which will provide on-site storage and can be used to provide grey water for the watering of the landscaped areas (refer to Appendix F).

4.6 The existing and proposed surface water runoff from site to the existing surrounding area is to remain the same.

4.7 The profile of surface water inflow to adjacent properties or water courses will not be materially changed and the sizes of two below ground granular drainage channels and small attenuation system will be designed to maintain the existing site conditions and with the use of SUDS to reduce the surface water discharge into the main drainage system.

4.8 The new structure will be designed to allow for water to flow under the lower ground floor slab and rear garden, where the installation of two granular stone drainage channels will allow ground water seepage to flow freely.

5.0 FLOOD RISK ASSESSMENT APPRAISAL

5.1 Reference to the Environment Agency maps confirms that the site is not within a flood zone area and is not at risk of flooding from local rivers/water features and defines the area as having a very low risk of flooding due principally to its topography.

5.2 Reference to The North London Strategic Flood Risk Assessment which London Borough of Camden is part of confirms that the site is not at risk or in the vicinity of past surface water flooding, potential elevated groundwater, past flooded sewer incidents, past flooded ground water incidents or any main river/fluvial/tidal incidents (refer to Appendix E).

5.3 Reference to Thames Water confirms that there are no known instances of sewer flood adjacent to the site

5.4 The inclusion of SUDS on site will reduce the surface water runoff from site and the discharge of surface water into the main drainage system. The affect of this is to reduce the volume of site runoff discharging into the main drainage system and reduce the effects of any possible flooding further down stream.

5.5 By virtue of the lower ground structure design with granular drainage channels, which will not restrict ground water flow and will allow groundwater to seep below the lower ground floor structure, this will not restrict ground water flow within any perched ground water.

6.0 CONCLUSIONS

6.1 Detailed analysis of the various aspects of construction has been undertaken to demonstrate how the level of sequencing will enable the development to be constructed safely with ground movements within acceptable levels.

6.2 The stability of the adjacent properties and surrounding ground will not be affected by the works, with the influence of adjoining building foundation depths taken into account during the initial design process. Within the design an allowance will be allowed for surcharge from adjoining properties and at the detailed design stage calculations will confirm working sizes of reinforced concrete underpinning, reinforcement to keep ground movement within the specified design limits.

6.3 There will be no temporary localized dewatering of the lower ground floor area.

6.4 Prior to commencement a full schedule of condition will be carried out to all relevant buildings as defined within The Party Wall Act 1996 where the excavations may be within the influence zone of existing foundations.

6.5 The desk top study carried out to date indicates that the construction of the new lower ground rear floor level will not lead to a cut off of natural ground water flow. Detailed designs will follow as part of the construction design. If any supplemental drainage is required it will be included as necessary to ensure that the current ground water equilibrium levels are maintained and that there is no increase in the risk of flooding.

6.6 The construction of the lower ground reduced dig will be within the London Clay and is not envisaged as having a detrimental effect on the local or surrounding hydrogeological conditions.

6.7 There is a slight reduction in hard standing areas at the rear of the site as shown on the proposed Architects drawings (refer to Appendix B). The existing ground water conditions on site will be maintained with the use of SUDS.

6.8 There is no increase in foul water flow from the site.

6.9 The subterranean flow from the site can be maintained with granular drainage channels beneath the lower ground floor slab and rear garden. This will minimise any changes to the existing conditions along the adjoining properties.

6.10 Safety both on site and adjacent to the site is of paramount importance and the method of construction proposed has taken this into account.

6.11 The selection of the main contractor and underpinning sub-contractor and designer of temporary works will be based on having previous experience constructing similar projects and a requirement to provide programmes and method statements detailing the final sequence of construction prior to carrying out works on site. The main contractor is to be registered with The Considerate Constructors Scheme.

6.12 One of the site requirements will be the selection of experienced site supervision staff and selection of plant and machinery based on minimising noise and vibration.

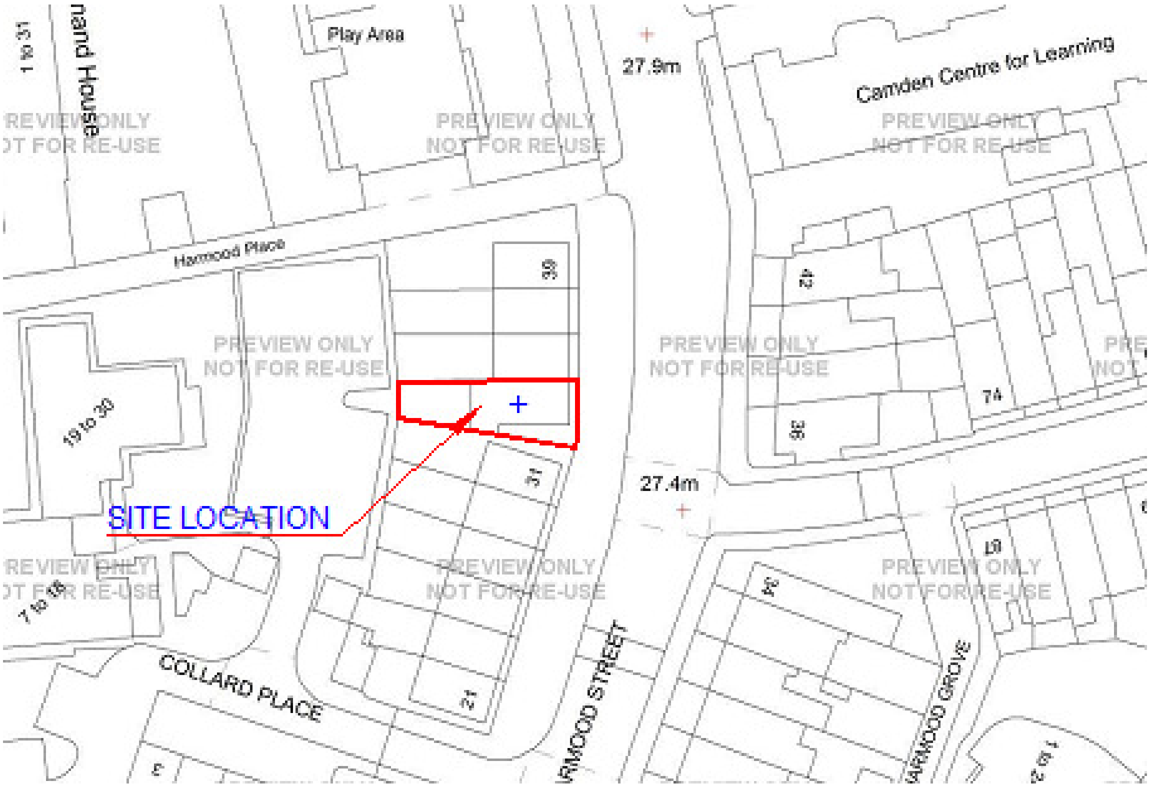
6.13 The project as currently envisaged is feasible in terms of the general construction process, structural stability, long term integrity of adjacent buildings and the existing site and surrounding infrastructure.

For and on behalf of
TAYLOR WHALLEY SPYRA

SIMON LANE
BSc(Eng), CEng, FICE, FIStructE, FConsE

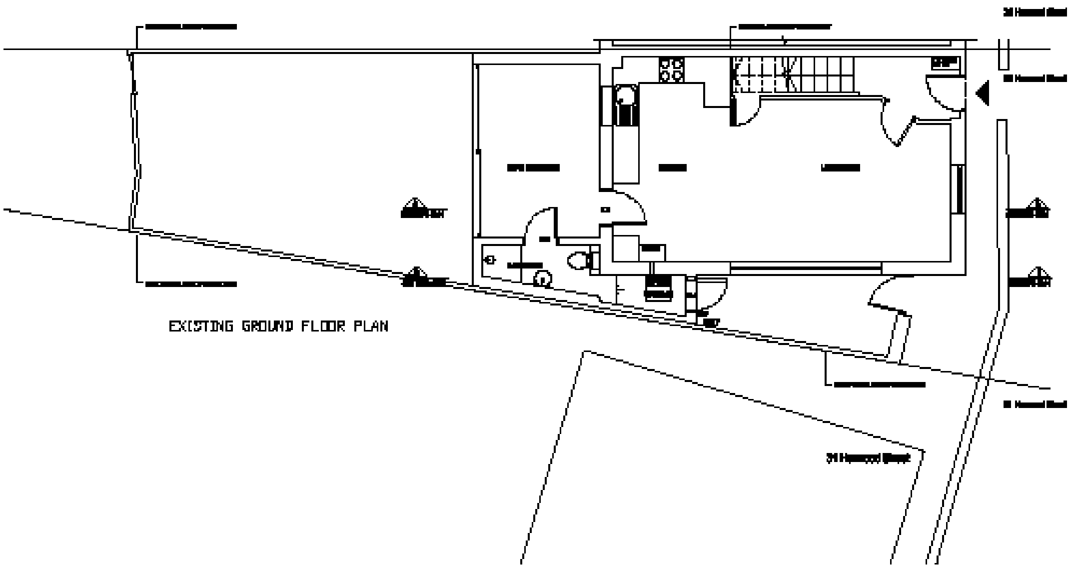
APPENDIX A

SITE LOCATION PLAN INDICATING ADJOINING PROPERTIES

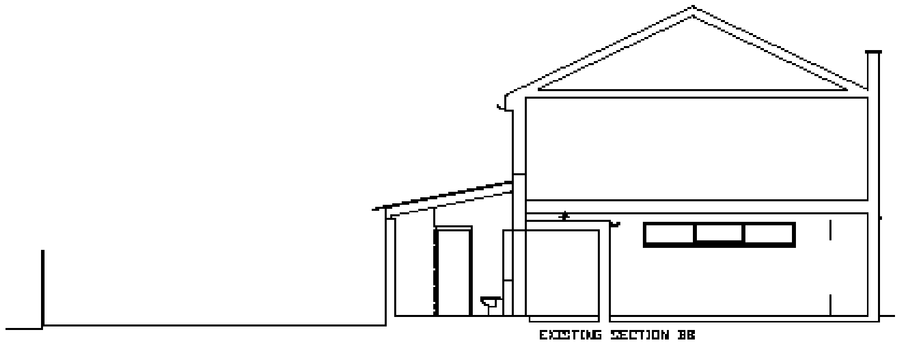


APPENDIX B

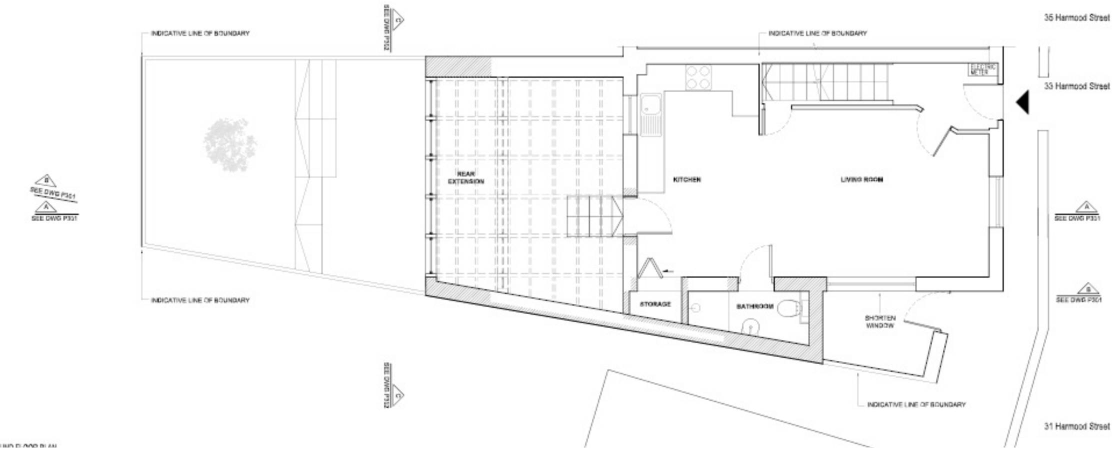
EXISTING GROUND FLOOR LAYOUT & LONG BUILDING SECTION
PROPOSED GROUND FLOOR LAYOUT & LONG BUILDING SECTION

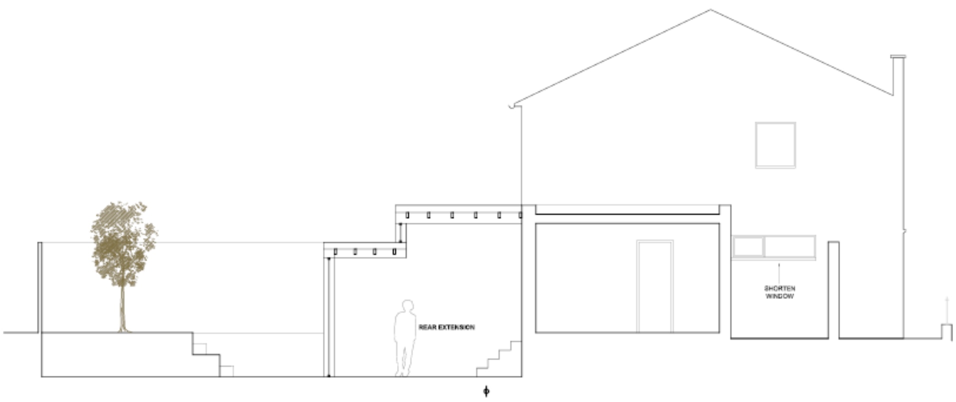


EXISTING GROUND FLOOR PLAN



EXISTING SECTION BB

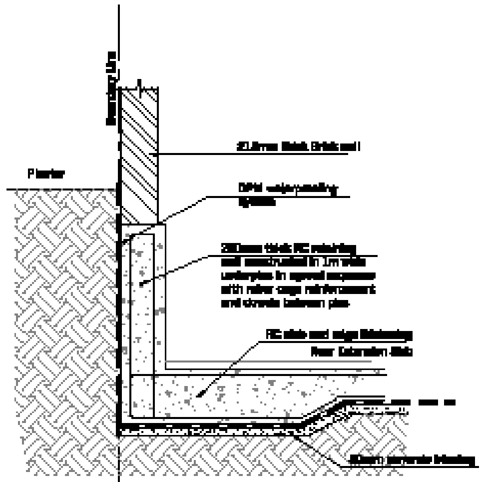

INDICATIVE LINE OF BOUNDARY
SEE DWG P312
INDICATIVE LINE OF BOUNDARY
35 Harmood Street
ELECTRIC METER
33 Harmood Street
B
SEE DWG P301
A
SEE DWG P301
REAR EXTENSION
KITCHEN
LIVING ROOM
A
SEE DWG P301
B
SEE DWG P301
STORAGE
BATHROOM
SHORTEN WINDOW
INDICATIVE LINE OF BOUNDARY
INDICATIVE LINE OF BOUNDARY
SEE DWG P312
31 Harmood Street


REAR EXTENSION
SHORTEN WINDOW

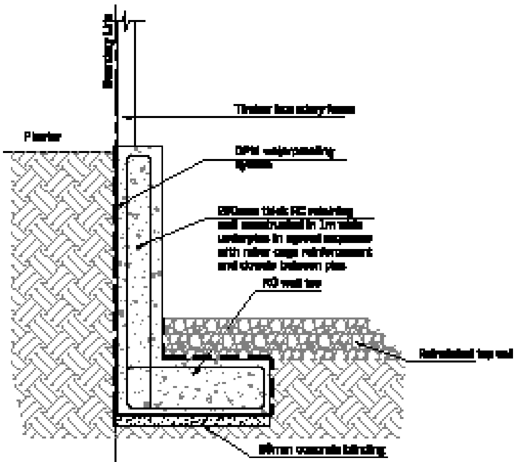
SECTION BB

APPENDIX C

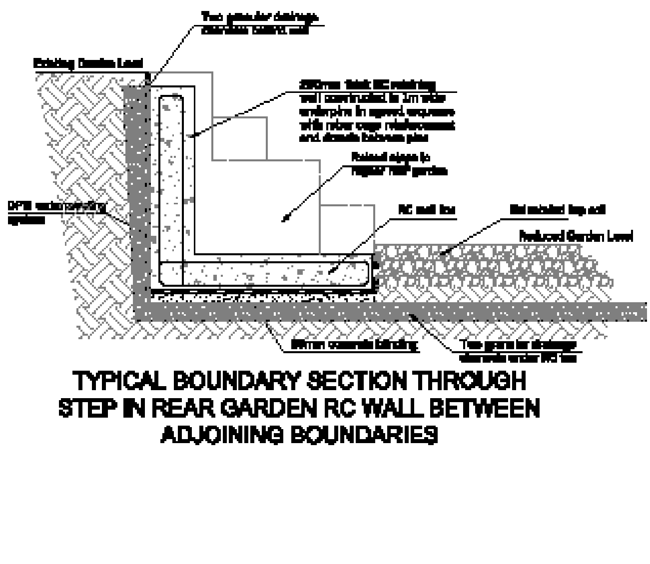
TYPICAL BOUNDARY SECTION THROUGH REAR EXTENSION RC WALL
TYPICAL BOUNDARY SECTION THROUGH GARDEN RC WALL
TYPICAL BOUNDARY SECTION THROUGH STEP IN REAR GARDEN RC WALL



TYPICAL BOUNDARY SECTION
THROUGH REAR EXTENSION RC WALL



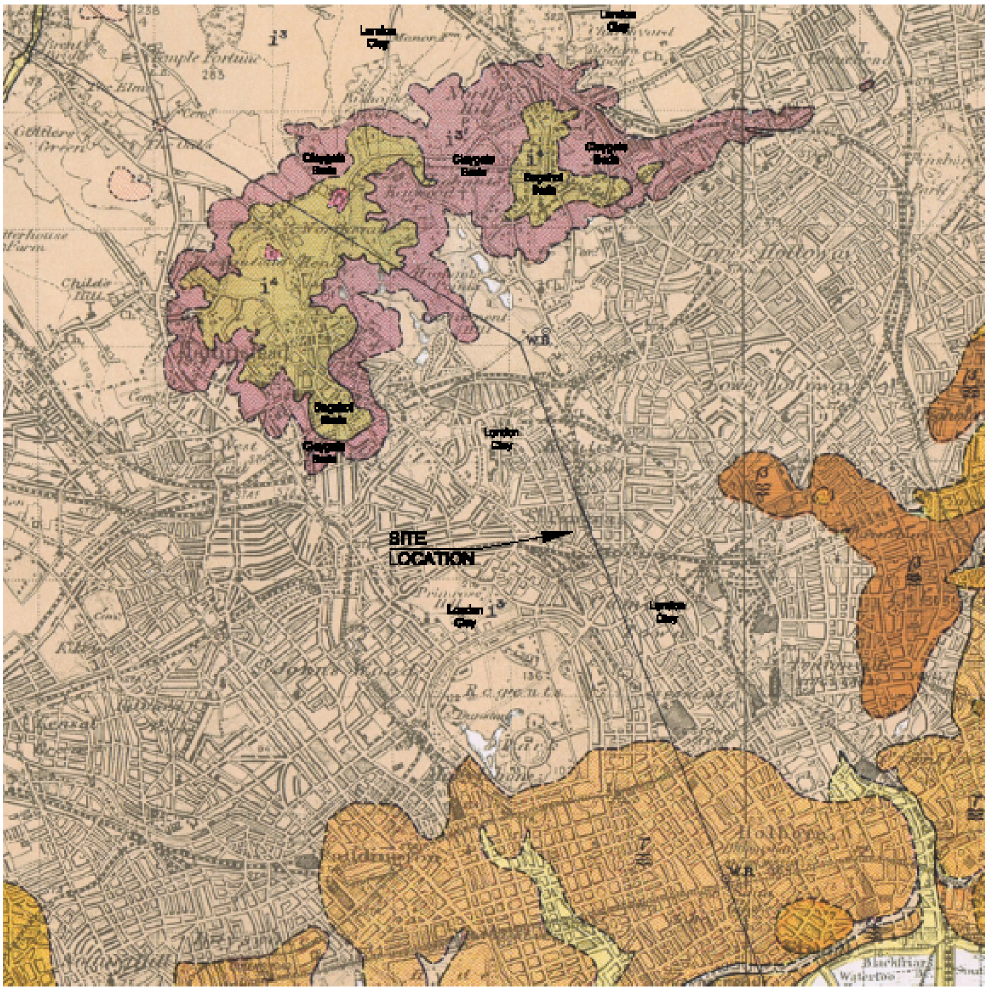
TYPICAL SIDE BOUNDARY SECTION
THROUGH REAR GARDEN RC WALL



TYPICAL BOUNDARY SECTION THROUGH
STEP IN REAR GARDEN RC WALL BETWEEN
ADJOINING BOUNDARIES

APPENDIX D

GEOLOGICAL MAP + LOCAL BOREHOLE LOG



GEA Geotechnical & Environmental Associates	Tyttenhanger House, Coursers Road, St Albans, AL4 0PG	Site: 5 Park Village West, London, NW1	Number: BH1

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Window Sampler		9.83	Mr and Mrs MacDonald	J09124
	Location	Dates 16/07/2009	Engineer: Fluid Structures	Sheet 1/1

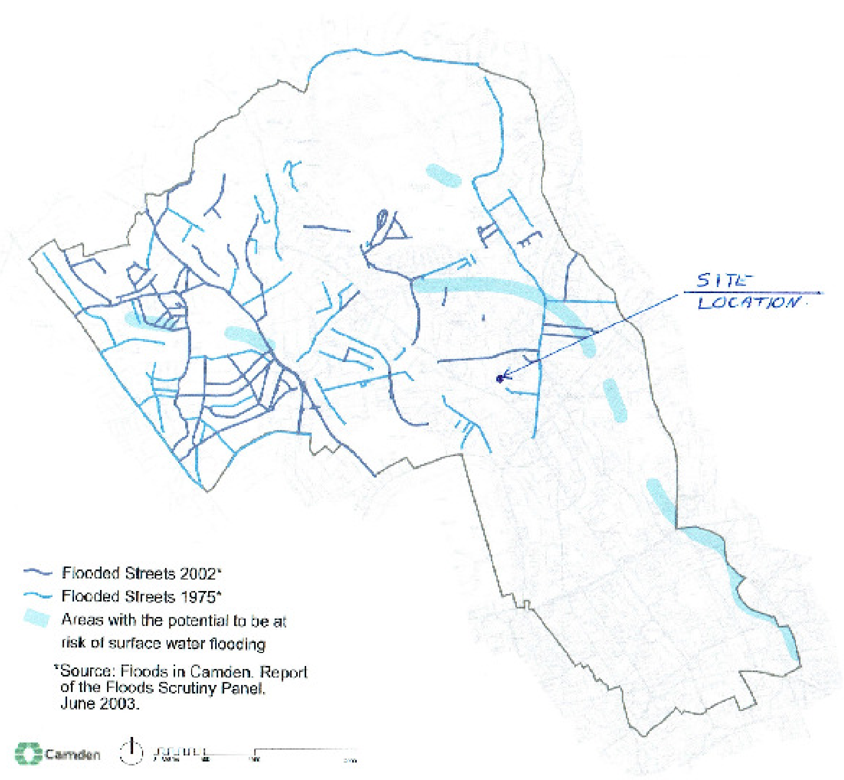
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	Made Ground (dark brown clay with brick, rootlets and gravel)		
0.30	D1			9.43	0.40	Firm brown fissured CLAY with blue-grey mottling		
			pp (2.5)					
1.00	D2		pp (2.0)					
			pp(2.0) pp(2.5)					
			pp(2.5) pp(3.0)		(2.30)			
2.00	D3		pp(3.0)					
			pp(3.0) pp(3.0)					
			pp(3.5) pp(3.75)	7.13	2.70	Stiff dark brown slightly silty fissured CLAY with occasional blue-grey mottling and selenite crystals. Partings of orange-brown silt.		
3.00	D4		pp(4.0)					
			pp(4.25) pp(3.75)					
			pp(4.0) pp(4.25)					
4.00	D5		pp(4.25)					
			pp(3.5) pp(3.75)		(3.30)			
4.50	D6		pp(3.0) pp(3.75)					
5.00	D7		pp(4.25)					
			pp(3.75) pp(4.5)					
			pp(4.5) pp(4.5)					
			pp(4.0)	3.83	6.00			
						Complete at 6.00m		

Remarks	Scale (approx)	Logged By
Ground water not encountered pp denotes pocket penetrometer readings	1:50	CMB
	Figure No. J09124.BH1	

APPENDIX E

CAMDEN FLOOD RISK MAP 2

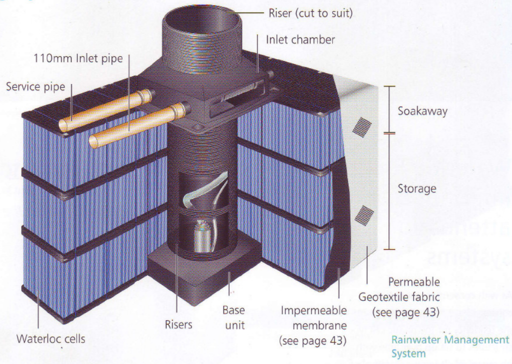
Map 2: Flood Risk



APPENDIX F

WATERLOC DATA SHEET

Waterloc for rainwater harvesting systems



Significant steps have been taken in recent years to reduce water wastage through improvements to the supply network and the introduction of more efficient water appliances. However, domestic and commercial water consumption could be significantly reduced, simply through collecting, storing and re-using rainwater at source. Not only does this reduce the use of metered water, the collection of rainwater reduces the demand on the drainage system, in turn reducing flood risk.

A modular, low cost water recycling and management system can be constructed from separate components consisting of an inlet chamber, filter unit, submersible pump unit and base unit combined with Waterloc cells to form a central filtering and pumping riser.

The system uniquely combines infiltration with recycling, thereby alleviating the problems of either water shortage or flooding. The versatility of this system means that any size and combination of storage or infiltration unit can be constructed, as long as room is allowed for the central pumping riser.

In operation, rainwater is collected from the available roof area and passed through a silt trap, UG60, before it enters the main filter in the inlet chamber, where any fine sedimentary particles are removed. The filtered water is then fed to the base of the installation where it aerates with the stored water. When the collected rainwater has reached a minimum level, the control system can be activated, allowing the submersible pump to supply water on demand.

Control units are all supplied pre-wired, requiring only a final connection to be made to a 240V power supply via a RCD breaker. Once installed, the microprocessor based controls can be easily set up to control the pump discharge pressure and monitor the water level.

Two versions of the rainwater harvesting system are available:

- A remote connection facility suitable for an outside tap.
- A domestic backup system which can be connected via a storage tank to provide a supplementary water supply for non potable applications.

APPENDIX G

MASTERDRAIN HYDROLOGY
STORMWATER STORAGE CALCULATIONS

EXISTING SITE CONDITION

Data:-
Hydrology:-

Location	= Camden	Grid reference	= TQ2585
M5-60 (mm)	= 21.1	r	= 0.44
WRAP/Soil	= 4 / 0.45	SAAR (mm/yr)	= 650
Return period	= 100	Mean intensity	= 42.8mm/hr for a 1 hour storm

Percentage runoff = 52.0% calculated from:-
Percentage runoff = (0.829*PIMP)+(25*SOIL)+(0.078*UCWI)-20.7
where
PIMP = ImpervArea*100/(ImpervArea+PervArea) = 67.9
UCWI = Calculated value for Wetness Index = 68.0

Imperv. area = 16.9m²	Pervious area = 36.3 m²
Total area = 53 m²	Equiv area = 28 m²
Total runoff = 1.2 m³	Discharge rate = 5.00 l/s

Storage (m³) = 0 m³ (Sum of all balance quantities)

PROPOSED SITE CONDITION

Data:-
Hydrology:-

Location	= Camden	Grid reference	= TQ2585
M5-60 (mm)	= 21.1	r	= 0.44
WRAP/Soil	= 4 / 0.45	SAAR (mm/yr)	= 650
Return period	= 100	Mean intensity	= 42.8mm/hr for a 1 hour storm

Percentage runoff = 37.0% calculated from:-
Percentage runoff = (0.829*PIMP)+(25*SOIL)+(0.078*UCWI)-20.7
where
PIMP = ImpervArea*100/(ImpervArea+PervArea) = 49.1
UCWI = Calculated value for Wetness Index = 68.0

Imperv. area	= 25.8 m²	Pervious area	= 27.4 m²
Total area	= 53 m²	Equiv area	= 20 m²
Total runoff	= 0.8 m³	Discharge rate	= 5.00 l/s

Storage (m³) = 0 m³ (Sum of all balance quantities)