Air Shaft

20

No.18

No.16A

No.16

St Christopher's

School

TD.

LYNDHURST GARDENS

185125N

526926E

526950E

76.6m

close board fence ht 1.10m

brick wall

close board fence ht 1.70m

paving

parking bays

ramp

conc

gas

bt

catv

tree Ø 0.30 ht 5m

silver birch Ø 0.30 ht 13m

silver birch Ø 0.30 ht 15m

bin store paving

canopy

brick setts

trellis 1.920m

roof light

trellis 0.85m (on top)

74.07 (approx)

77.46

lime Ø 0.50 ht 14m

compost area

green house

concrete

timber shed

decking

flower bed

brick and paving

gate

Ø 0.60 ht 16m

Ø 0.10 ht 5m

Ø 0.15 ht 3m

Ø 0.05 ht 3m

beech Ø 0.70 ht 15m

t 020 89680279
m 077 98854810
richard@webb-architects.co.uk
WEBB ARCHITECTS LIMITED

Drawing to be read in conjunction with consultants information.
Do not scale from drawing.
All dimensions to be checked on site.
Drawing only to be used for purposes indicated.
Notify Architect of any discrepencies.

REV

16A LYNDHURST GARDENS

EXISTING SITE PLAN

1:100 / A1, 1:200 / A3 FOR INFORMATION

1069.01.02(-)

TRIAL PIT LOG

TRIAL PIT No
TPA - North side

Client:
LYNDHURST GARDENS LLP

Project:
BASEMENT IMPACT ASSESSMENT 16A LYNDHURST GARDENS

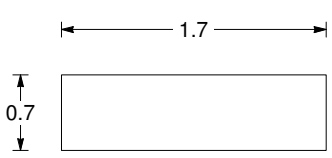
Project No:	Date:	Ground Level:	Co-ordinates:	Sheet:
401.03684.00001	16/06/11			1 of 1

SAMPLES & TESTS				Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
							(0.50) 0.50	Brown clayey silt TOPSOIL with frequent rootlets. Part of north side of trial pit overlain by 20cm of concrete.	
							(0.40) 0.90	Brown slightly clayey silty fine SAND with frequent rootlets and angular cobble sized brick fragments (MADE GROUND)	
1							(0.90) 1.80	Firm to stiff brown CLAY with occasional gravel sized brick fragments and occasional lenses of clayey silt (MADE GROUND)	
2								Trial Pit complete at 1.80m	
3									

GENERAL REMARKS:
No groundwater seepages

KEY:
V = Hand Vane Shear Strength
PP = Pocket Penetrometer Shear Strength
D = Small Disturbed Sample
B = Large Bulk Sample
HS = Head Space Measurement

Trial Pit Dimensions:



Shoring/Support:
Stability:

All dimensions in metres	Contractor :	Method: Trial Pit/trench	Logged By:	Approved By:
Scale 1:25	Plant:		P Slater	D Morgan

SLR Consulting Ltd, Treenwood House, Bradford on Avon, BA14 8GH, Tel: 01225 309400, Fax: 01225 309401

LOGGING HAS BEEN CARRIED OUT IN ACCORDANCE WITH BS5930

TRIAL PIT LOG

TRIAL PIT No
TPA - South side

Client:
LYNDHURST GARDENS LLP

Project:
BASEMENT IMPACT ASSESSMENT 16A LYNDHURST GARDENS

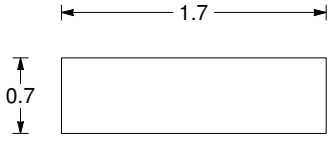
Project No:	Date:	Ground Level:	Co-ordinates:	Sheet:
401.03684.00001	16/06/11			1 of 1

SAMPLES & TESTS				Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
							(0.50) 0.50	Brown clayey silt TOPSOIL with frequent rootlets	
							(0.40) 0.90	Brown silty fine SAND with frequent angular cobble sized brick fragments (MADE GROUND)	
1							(0.60) 1.50	Grey coarse CONCRETE (MADE GROUND)	
							(0.30) 1.80	Stiff brown CLAY with occasional coarse gravel sized brick fragments (MADE GROUND)	
2								Trial Pit complete at 1.80m	
3									

GENERAL REMARKS:
No groundwater seepages

KEY:
V = Hand Vane Shear Strength
PP = Pocket Penetrometer Shear Strength
D = Small Disturbed Sample
B = Large Bulk Sample
HS = Head Space Measurement

Trial Pit Dimensions:



Shoring/Support:
Stability:

All dimensions in metres	Contractor :	Method: Trial Pit/trench	Logged By:	Approved By:
Scale 1:25	Plant:		P Slater	D Morgan

SLR Consulting Ltd, Treenwood House, Bradford on Avon, BA14 8GH, Tel: 01225 309400, Fax: 01225 309401

LOGGING HAS BEEN CARRIED OUT IN ACCORDANCE WITH BS5930

TRIAL PIT LOG

TRIAL PIT No **TPB**

Client: **LYNDHURST GARDENS LLP**

Project: **BASEMENT IMPACT ASSESSMENT 16A LYNDHURST GARDENS**

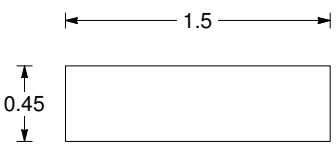
Project No:	Date:	Ground Level:	Co-ordinates:	Sheet:
401.03684.00001	17/06/11			1 of 1

SAMPLES & TESTS				Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
							(0.50) 0.50	Brown, clayey silt TOPSOIL with frequent rootlets	
							(0.30) 0.80	Brown, slightly clayey silty, fine SAND with frequent angular cobble sized brick fragments (MADE GROUND)	
1							(0.50) 1.30	Silty CLAY with frequent brick fragments (MADE GROUND)	
							(0.50) 1.80	Brown slightly sandy SILT with frequent angular gravel sized brick fragments (MADE GROUND)	
2								Trial Pit complete at 1.80m	
3									

GENERAL REMARKS:
No groundwater seepages

KEY:
V = Hand Vane Shear Strength
PP = Pocket Penetrometer Shear Strength
D = Small Disturbed Sample
B = Large Bulk Sample
HS = Head Space Measurement

Trial Pit Dimensions:



Shoring/Support:
Stability:

All dimensions in metres	Contractor :	Method: Trial Pit/trench	Logged By:	Approved By:
Scale 1:25	Plant:		P Slater	D Morgan

Form SLR AGS3 UK TP File 110617_401-3684-00001_TRIALPITS.GPJ 20-06-11

LOGGING HAS BEEN CARRIED OUT IN ACCORDANCE WITH BS5930

TRIAL PIT LOG

TRIAL PIT No
TPC - North side

Client:
LYNDHURST GARDENS LLP

Project:
BASEMENT IMPACT ASSESSMENT 16A LYNDHURST GARDENS

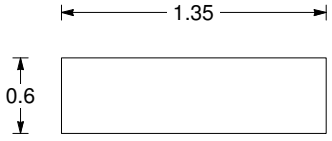
Project No:	Date:	Ground Level:	Co-ordinates:	Sheet:
401.03684.00001	17/06/11			1 of 1

SAMPLES & TESTS				Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
							(0.30) 0.30	Grey coarse CONCRETE (MADE GROUND)	
							(0.20) 0.50	Brown silty fine SAND with frequent rootlets and numerous bricks (MADE GROUND)	
							(0.50) 1.00	Brown silty fine SAND with frequent rootlets and occasional angular gravel sized brick fragments (MADE GROUND)	
1							(0.30) 1.30	Brown slightly sandy SILT with occasional rootlets and rare pockets of sand sized brick fragments (MADE GROUND)	
							(0.30) 1.60	Firm to stiff brown CLAY with rare pockets of sand sized brick fragments (MADE GROUND)	
							(0.20) 1.80	Stiff to very stiff dark brown CLAY with occasional gravel sized angular brick fragments and rare rootlets (MADE GROUND)	
2								Trial Pit complete at 1.80m	
3									

GENERAL REMARKS:
No groundwater seepages

KEY:
V = Hand Vane Shear Strength
PP = Pocket Penetrometer Shear Strength
D = Small Disturbed Sample
B = Large Bulk Sample
HS = Head Space Measurement

Trial Pit Dimensions:



Shoring/Support:
Stability:

All dimensions in metres	Contractor :	Method: Trial Pit/trench	Logged By:	Approved By:
Scale 1:25	Plant:		P Slater	D Morgan

SLR Consulting Ltd, Treenwood House, Bradford on Avon, BA14 8GH, Tel: 01225 309400, Fax: 01225 309401

LOGGING HAS BEEN CARRIED OUT IN ACCORDANCE WITH BS5930

TRIAL PIT LOG

TRIAL PIT No
TPC - South side

Client:
LYNDHURST GARDENS LLP

Project:
BASEMENT IMPACT ASSESSMENT 16A LYNDHURST GARDENS

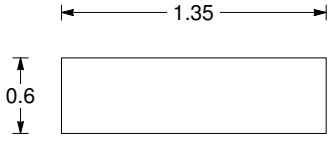
Project No:	Date:	Ground Level:	Co-ordinates:	Sheet:
401.03684.00001	17/06/11			1 of 1

SAMPLES & TESTS				Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
							(0.30) 0.30	Grey coarse CONCRETE (MADE GROUND)	
							(0.30) 0.60	Brown silty fine SAND with frequent rootlets and occasional angular gravel sized brick fragments (MADE GROUND)	
							(0.40) 1.00	Grey coarse CONCRETE (MADE GROUND)	
1							(0.25) 1.25	Brown slightly sandy SILT with occasional rootlets and rare pockets of sand sized brick fragments (MADE GROUND)	
							(0.35) 1.60	Firm to stiff brown CLAY with rare pockets of sand sized brick fragments (MADE GROUND)	
							(0.20) 1.80	Stiff to very stiff dark brown CLAY with occasional gravel sized angular brick fragments and rare rootlets (MADE GROUND)	
2								Trial Pit complete at 1.80m	
3									

GENERAL REMARKS:
No groundwater seepages

KEY:
V = Hand Vane Shear Strength
PP = Pocket Penetrometer Shear Strength
D = Small Disturbed Sample
B = Large Bulk Sample
HS = Head Space Measurement

Trial Pit Dimensions:



Shoring/Support:
Stability:

All dimensions in metres	Contractor :	Method: Trial Pit/trench	Logged By:	Approved By:
Scale 1:25	Plant:		P Slater	D Morgan

SLR Consulting Ltd, Treenwood House, Bradford on Avon, BA14 8GH, Tel: 01225 309400, Fax: 01225 309401

LOGGING HAS BEEN CARRIED OUT IN ACCORDANCE WITH BS5930

20th June 2011

Daniel Baliti
Lyndhurst Gardens LLP
c/o Vabel Limited
53 Hemstal Road
LONDON
NW6 2AD

Our Ref: 401-03684-00001

Dear Daniel

RE: 16A LYNDHURST GARDENS – BASEMENT IMPACT ASSESSMENT FOR GROUNDWATER AND SURFACE WATER

SLR Consulting has been appointed by Lyndhurst Gardens LLP to carry out the groundwater and surface water components of a Basement Impact Assessment (BIA) for the proposed basement development at 16a Lyndhurst Gardens, as required by Camden Planning Guidance CPG4 'Basements and Lightwells'.

1.0 PROJECT INFORMATION FOR SCREENING PROCESS

CPG4 states that the BIA should start with a Screening Process, and that where the answers to any of the questions in the flowcharts are 'YES' OR 'UNKNOWN', these matters will need further investigation. Paragraph 233 of 'Guidance for Subterranean Development', LBC, 2010, indicates that the following summary information should be included in the BIA Screening Process.

1.1 Brief Description of the Proposed Development

As detailed in the planning application, the proposal is for demolition of the existing dwelling and construction of a new-build single private dwelling including a full basement with courtyard and a partial sub-basement. The proposed footprint of the basement with courtyard is shown in Drawing 1. The proposed partial sub-basement will be beneath the northern half of the basement, as shown in Drawing 1.

The excavations required for the partial sub-basement are estimated (based on the structural report accompanying the planning application) as having a basal elevation of approximately 69maOD. The excavations for the full basement are estimated in the structural report as being 2m higher than for the sub-basement i.e. approximately 71 maOD. The current site layout and topography are shown in Drawing 1069.01.02.

1.2 Proposed Construction Programme

As detailed within the Construction Management Plan in the planning application, the key phases of construction will be:

- a mini piling rig will pile the perimeter of the proposed development;
- soil will be excavated and moved immediately by an awaiting dumper truck; then
- the building structure will be built with reinforced concrete.

2.0 GROUNDWATER FLOW

2.1 Subterranean (Groundwater) Flow Screening Flowchart Questions

Q1a: Is the site located directly above an aquifer?

SLR Response: **NO.** The available published information[1] indicates that the application site is located on London Clay, which is not an aquifer. It is noted that, as stated in the notes in the Groundwater Flow Screening Chart in CPG4, boundaries on the geological map should be considered to accurate to ±50m. However, even if the boundary was 50m further south-east than indicated on the geological map, only a negligible thickness of Claygate Member aquifer (less than c.1m) would be likely to be present at the site, and only in the western half of the proposed basement site.

Q1b: Will the proposed basement extend beneath the water table surface?

SLR Response: **NO**. As stated in the response to Q1a, the geological map indicates that the application site is located on London Clay, which does not contain an effective water table due to its low permeability.

Q2: Is the site within 100m of a watercourse, well (used/disused) or potential springline?

SLR Response: **UNKNOWN.** As discussed in Q1a above, the available published information indicates that the potential springline at the south-eastern boundary of the Claygate Member is somewhere[2] between 40 – 150m north-west of the application site.

The available information indicates that there are no watercourses within 100m, (including culverted underground watercourses) as indicated by Figure 11 of 'Guidance for Subterranean Development'. Furthermore, Figure 2 of 'Guidance for Subterranean Development' indicates that no wells were present within 100m in 1920, as do historical maps from 1871 to the present, and the British Geological Survey Geoindex http://maps.bgs.ac.uk/GeoIndex/default.aspx confirms that this remains the case.

[1] Based on Figure 8 of 'Guidance for Subterranean Development' showing the areas of aquifer, the south-eastern edge of the Claygate Member aquifer is approximately 150m north-west of the site. However, based on the 1994 British Geological Survey geological map (Sheet 256 North London, reproduced as Figure 4 of 'Guidance for Subterranean Development', LBC, 2010) the outcrop of the Claygate Member is only approximately 40m to the north-west of the north-western corner of the proposed basement. The discrepancy between the two maps may be due to the variability of the Claygate Member, and it is possible that the south-eastern margins of the Claygate Member are considered too clayey to comprise an aquifer.

[2] Historical maps do not indicate any springs nearby, however the 1871 1:1056 London town plan (http://www.old-maps.co.uk/maps.html) indicates a pond approximately 80m west-north-west of the site at a time when the area was no yet residential, and this could be related to the springline.

Q3: Is the site within the catchment of the pond chains on Hampstead Heath?

SLR Response: **NO,** as indicated in Figure 14 of 'Guidance for Subterranean Development' (LBC, 2010).

Q4: Will the proposed basement development result in a change in the proportion of hard surfaced/paved areas?

SLR Response: **NO.** Currently the whole of the 380m^2 application site is hard surfaced/paved apart from the following small areas as shown in Drawing 1069.01.02:

- approximately 20m^2 of bushes on soil along the northern edge of the driveway – it is not proposed to change this as part of the proposed basement development; and
- approximately 58m^2 of flowerbeds and soil between the current building and the south-southern and eastern site perimeters.

The basement development will involve the loss of the approximately 58m^2 area of soil and flowerbeds to the east and south of the current building. However, this will be offset by the fact that an area of approximately 60m^2 of the roof of the single storey part of the proposed development will be constructed as a 'green roof', as shown in Drawing 1. Furthermore, much of the remaining roof and basement courtyard surfaces will drain into a rainwater storage reservoir. The loss of rainfall infiltration into the approximately 58m^2 area of soil and flowerbeds will result in a reduction of any seepage through Made Ground and into adjoining gardens to the south and east.

Q5: 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)

SLR Response: **NO.** As detailed in Q4 response, there will not be an increase in the impermeable area of the application site and therefore there will be no increase in runoff generated by the site. Given the site setting on a steep hillside on low permeability London Clay, with the adjoining property at an elevation several metres lower, it is not considered appropriate to discharge more surface water to the ground.

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 (not just the pond chains on Hampstead Heath) or springline.

SLR Response: **UNKNOWN.** As discussed in Q2, based on the local geology any nearby potential springline would be between 40 – 150m north-west of the application site, at an elevation of approximately 77maOD. As the lowest point of the proposed excavation will be approximately 69maOD, this would be significantly lower than the water level at any nearby springline that may exist. There are no ponds or other surface water features in close proximity to the site.

2.2 Subterranean (Groundwater) Flow Scoping and Impact Assessment

2.2.1 Introduction

As some of the responses in the Subterranean (Groundwater) Flow Screening were UNKNOWN, it is necessary to proceed to further stages of the BIA. As detailed in CPG4 and chapter 6 of 'Guidance for Subterranean Development', these further stages involve presentation of a conceptual ground model, site investigation and including identification of potential impacts. To facilitate the development of the conceptual ground model and impact

assessment, site investigation was carried out on June 16th – 17th 2011, involving the excavation of three trialpits at locations shown in Drawing 1. Trialpit logs are appended at the end of this letter report.

2.2.2 Conceptual Ground Model and Potential Impacts

Geology

The available published information indicates that the application site is located on London Clay, as detailed in Q1a above. The recent trialpit investigations confirmed that this is likely, as trialpits TPA and TPC encountered stiff clay (with occasional brick fragments) from 1.5m below ground level. Available published information also indicates that the geological boundary with the silty clays and sandy silt of the Claygate Member is approximately 40m north-west of the site.

The natural geology at the application site is likely to be covered by up to approximately 2m of Made Ground, which may have been used to create the current flat terrace which is at an elevation approximately 2m higher than the back garden of 16 Lyndhurst Gardens - the landform prior to residential development of this area is likely to have been a slope of approximately 1 in 12. Trialpit TPB reached a depth of 1.8m without encountering clay – the Made Ground appears to be thicker in the north-eastern part of the site, with a significant terrace height above the nearby St Christopher's School sports area. The basal Made Ground above the clay is generally silt (at TPB and TPC) or concrete (at TPA and TPC).

Hydrogeology

Rainfall is likely to be able to infiltrate into the Claygate Member through gardens on the hillside to the north-west of the site. This process is only likely to be significant in the winter, as from April to September most incident rainfall can be expected to be lost to evapotranspiration or surface runoff. Water which has infiltrated is then likely to flow downgradient to the south-east through the Claygate Member until it reaches the boundary with the London Clay, where it may emerge as seepages at the ground surface (or into any Made Ground overlying this geological boundary).

Drawing 1 indicates that any such seepages would emerge in gardens to the north of 20 Lyndhurst Gardens and at the hospice across the road (assuming that the geological boundary is as shown on the geological map). The only possible pathway for this water to flow towards the proposed basement would be if there is a significant thickness of permeable Made Ground between the geological boundary and the application site. There are no known basements beneath 18 or 20 Lyndhurst Gardens which would block this potential pathway, however building foundations may partially block the pathway.

No groundwater was observed during trialpitting. Trialpits TPC and TPA suggest that along the southern boundary of the site, any potential groundwater seepages flowing from the north-west are likely to be restricted by clayey Made Ground and concrete. More permeable sandy Made Ground is only present within approximately 1m of the ground surface.

At the north-eastern corner of the application site, the sandy or silty Made Ground identified within Trialpit TPB could allow any potential groundwater seepages in this area to flow downhill to the east.

Potential Impacts of Basement on Subterranean (Groundwater) Flow

As discussed above, based on the available site investigation information it is considered very unlikely that there is currently significant shallow[3] groundwater flow beneath the application site towards the south, owing to the presence of clayey Made Ground and concrete below approximately 1m below ground level. Hence, under these conditions it is considered that the proposed basement is unlikely to make a significant difference to groundwater flow to the south.

However, it is possible that there could currently be minor groundwater seepages beneath the application site to the east, particularly during the winter and spring months. The proposed basement could block any such seepages beneath the site, resulting in groundwater seepages being diverted around the perimeter of the basement and emerging into the grounds of St Christopher's School near the north-eastern corner of the no.16 site. Any such impact is likely to be offset by the loss of rainfall infiltration into the soil and flowerbeds to the east of the current building.

The potential localised slight rise in groundwater levels which might be caused by any diversion of seepages along the northern side of the basement could (without mitigation measures) affect the moisture content in clays beneath the south-eastern corner of 18 Lyndhurst Gardens, with resultant potential structural impacts. To avoid this risk, it may be necessary to construct a drainage corridor e.g. French drain or similar, along the northern and eastern side of the proposed basement.

Although the trialpitting results indicate that it is very unlikely that any groundwater seepages currently occur across the southern site boundary, it is considered that any potential seepages that may be present following the proposed basement development, could be blocked and back up in between the basement of no.16 and the proposed basement of no.16a, unless a groundwater pathway is available between the two basements.

Proposed Mitigation Measures

The following mitigation measure could be employed to address the above noted potential groundwater flow scenarios:

- construction of a drainage corridor (e.g. French drain, geocomposite or similar) around the perimeter of the proposed basement.

3.0 SURFACE FLOW AND FLOODING

3.1 Surface Flow and Flooding Screening Flowchart Questions

Q1: Is the site within the catchment of the pond chains on Hampstead Heath?

SLR Response: **NO,** as indicated in Figure 14 of 'Guidance for Subterranean Development' (LBC, 2010).

Q2: 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?

[3] Shallow groundwater is distinguished from deep groundwater flow in the Chalk deep beneath the London Clay

SLR Response: **NO.** Currently, surface water drainage from the application site enters Thames Water combined sewers under Lyndhurst Gardens road. As detailed in Q3 below, the proportion of hard surfaced/paved areas will not be increased, due to the incorporation of a 'green roof'. Furthermore, excess rainwater falling on the remainder of the roof and on the basement courtyard will reach the rainwater storage reservoir, and harvested rainwater will be used for plant irrigation and toilet flushing. Any overflow from the rainwater storage reservoir will be released to the site drain which feeds into the Thames Water combined sewer.

Q3: Will the proposed basement development result in a change in the proportion of hard surfaced/paved areas?

SLR Response: **NO.** As detailed in the response to Q4 of the Groundwater Flow Screening above, the proposed development will not increase the total area of hard surfaced / paved areas at the application site.

Q4: 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?

SLR Response: **NO.** As discussed in Q3 above, the net runoff from the application site will not be significantly increased by the proposed basement development. The rainwater harvesting tank is likely to slightly reduce the peak flow and total volume of surface water discharged from the site.

Q5: Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?

SLR Response: **NO.** After the proposed development, there will be less runoff from paved garden areas, but more runoff from the increased roof area and basement courtyard, but the latter will be collected in a rainwater storage system. There is unlikely to be any significant change in the quality of surface water being received by the drainage system as a result of this change. There will be no change to the car parking area, hence no changes in surface water quality for this reason.

Q6: Is the site in an area known to be at risk from surface water flooding?

SLR Response: **YES,** as the table on page 29 of CPG4 indicates that Lyndhurst Gardens flooded in 1975.

3.2 Surface Flow and Flooding Scoping

As the responses to questions Q1 to Q5 above were all NO, no further surface flow scoping is required apart from the Flood Risk Assessment required in relation to Q6.

3.3 Flood Risk Assessment

It is recognised that developments that are designed without regard to flood risk may endanger lives, damage property, cause disruption to the wider community, damage the environment, be difficult to insure and require additional expense on remedial works. Current guidance on development and flood risk[45] identifies several key aims for a development to ensure that it is sustainable in flood risk terms. These aims are as follows:

[4] CIRIA, 2004, Funders Report CP/102 Development and Flood Risk – Guidance for the Construction Industry

- the development should not be at a significant risk of flooding and should not be susceptible to damage due to flooding;
- the development should not be exposed to flood risk such that the health, safety and welfare of the users of the development, or the population elsewhere, are threatened;
- normal operation of the development should not be susceptible to disruption as a result of flooding;
- safe access to and from the development should be possible during flood events;
- the development should not increase flood risk elsewhere;
- the development should not prevent safe maintenance of watercourses or maintenance and operation of flood defences;
- the development should not be associated with an onerous or difficult operation and maintenance regime to manage flood risk. The responsibility for any operation and maintenance required should be clearly defined;
- future users of the development should be made aware of any flood risk issues relating to the development;
- the development should not lead to degradation of the environment; and
- the development should meet all of the above criteria for its entire lifetime, including consideration of the potential effects of climate change.

In order to achieve the aims outlined above, a staged approach has been adopted in undertaking this Flood Risk Assessment (FRA), in accordance with current best-practice guidance. A screening study has initially been undertaken to identify whether there are any potential sources of flooding at the application site which may warrant further consideration. Any potential flooding issues identified in the screening study have subsequently been considered in a scoping study. The aim of the scoping study is to define the input data requirements and study methodologies required to technically assess each of the flood risks and produce a site layout which addresses each of the issues appropriately.

The FRA has been undertaken with due regard to the EA's National Standing Advice on Development and Flood Risk[6].

3.3.1 Site Location

The application site is approximately 0.4ha in size and is located on a densely built-up hillside sloping to the south-east with an average slope of approximately 1 in 12. As shown in Drawing 1069.01.02, the site is bounded to the north and south by dwellings with gardens, and to the east by a school garden and playground. To the west is the corner of Lyndhurst Gardens as shown in Drawing 1069.01.02 – the road slopes steeply down from the north, but is almost flat to the west. The site is set on a terrace at approximately 76 maOD which appears to have been built up with Made Ground, and the sites immediately to the south and east are several metres lower. The site currently comprises a single dwelling, with gardens composed of approximately 78 m^2 of soil beds and approximately 130m^2 of paved driveway and garden terraces.

The nearest watercourses, as indicated by Figure 11 of 'Guidance for Subterranean Development', are culverted underground watercourses approximately 300m to the south-east and 400m to the west. There are no EA flood zones[7] associated with these culverted underground watercourses, and the site is in a Flood Zone 1. As the site is less than 1ha

[5] Planning Policy Statement 25: Development and Flood Risk Practice Guide (CLG, Dec 2009)

[6] Environment Agency, January 2011, National Standing Advice to Local Planning Authorities for Planning Applications – Development and Flood Risk (Version 3.0).

[7] EA website http://maps.environment-agency.gov.uk/ reviewed on 10th June 2011

and in a Flood Zone 1, it would not normally require a FRA. However, Camden Planning Guidance CPG4 'Basements and Lightwells' requires in section 2.41 that all applications for basement developments in streets where there was surface water flooding in 1975 or 2002 (as listed on page 29 of CPG4) should include a FRA.

3.3.2 Proposed Development

As detailed in the planning application, the proposal is for demolition of the existing dwelling and construction of a new-build single private dwelling including a full basement with courtyard and a partial sub-basement. The proposed footprint of the basement with courtyard is shown in Drawing 1. The proposed partial sub-basement will be beneath the northern half of the basement, as shown in Drawing 1.

3.3.3 Screening Study of Potential Flood Risk

All potential sources of flooding must be considered for any proposed development. A summary of the potential sources of flooding and a review of the potential risk posed by each source at the application site is presented in Table 1.

Table 1 - Potential Risk Posed by Flooding Sources

Potential Source	Potential Flood Risk at Site?	Justification
Fluvial flooding	No	EA Flood Mapping shows Flood Zone 1 Distance from nearest surface watercourse 750m
Tidal flooding	No	Site location is 'inland' and topography > 75mAOD.
Flooding from rising / high groundwater	Yes	Potential springline may exist 40m uphill from site.
Surface water (pluvial) flooding	Yes	Recorded in Lyndhurst Gardens in 1975.
Flooding from artificial drainage systems	Yes	Nearby drainage in Lyndhurst Gardens could potentially overflow
Flooding due to infrastructure failure	Yes	The site does not rely on flood protection infrastructure. However, drainage of the basement courtyard relies on pumping up to the rainwater storage reservoir.

3.3.4 Scoping Study

Following the screening study additional information has been gathered in order for an experienced SLR hydrologist to scope the studies required to further assess the flood risk at site. A site visit was undertaken on 8th June 2011.

3.3.5 Groundwater Flooding

As discussed in Q1a of the Groundwater Flow Screening above, the available published information indicates that there is a potential springline somewhere between 40 – 150m north-west of the site. As discussed in the Conceptual Ground Model in section 2.2.2 above, there may be a pathway for seepages from this springline through Made Ground beneath the application site. Currently, any such seepages flowing beneath the site would be likely to appear close to ground level at St Christopher's School (to the east) which has ground elevations several metres lower than ground levels on the application site.

The construction of the proposed basement would be likely to divert any groundwater flow along the northern side of the proposed basement, potentially increasing seepages into the grounds of St Christopher's School near the north-eastern corner of the application site. However, it is considered unlikely that there is currently significant groundwater flow beneath the site. Furthermore, the rate and volume of flows are likely to be minimal and any such impact is likely to be offset by the loss of rainfall infiltration into the soil and flowerbeds to the east of the current building, which would reduce seepage into the school garden.

It is considered unlikely that groundwater runoff would cause significant flooding at the site and it is considered unlikely that the development would increase the risk of groundwater flooding in the local area.

3.3.6 Surface Water (Pluvial) Flooding

Potential Surface Water Flooding affecting the Application Site

Any surface water runoff generated along the length of Lyndhurst Gardens north of the site, as well as some flows from Wedderburn Road (which crosses Lyndhurst Gardens approximately 100m north of the site), could cause overland flow to occur down Lyndhurst Gardens to the low point at the corner outside 12 Lyndhurst Gardens, at an estimated elevation of approximately 75.5 maOD. The low point is drained by a gulley pot as shown in Figures 1 and 2 below.

Figure 1
Lowest Point in Road looking looking towards 16a Driveway

Figure 2
Lowest Point in Road with 12 Lyndhurst Gardens

It is recorded that Lyndhurst Gardens suffered surface water flowing in August 1975, although there are no records as to which part of the road was affected. It is possible that the low point of Lyndhurst Gardens near no.12 was affected. Thames Water has informed[8] SLR that surface water on Lyndhurst Gardens currently drains into a combined trunk sewer of cross-section 940mm by 610mm. This trunk sewer runs down Lyndhurst Gardens from the northern end to the western end, then continues downgradient with the same cross-section into Belsize Crescent and on into Belsize Lane. As the total catchment drained by

[8] Telephone call between Phil Slater (SLR) and Imran Hussain (Operations Team, Thames Water), 10/6/2011

this trunk sewer above the corner of Lyndhurst Gardens is estimated at less than 4ha, the trunk sewer cross-section is considered adequate to remove rainfall from the area.

If the drain is blocked or the capacity of the drainage is exceeded, the following sequence of events is likely to occur:

- water levels at the lowest point would rise by 17cm, when they would spill on to the pavement outside 12 Lyndhurst Gardens;
- water levels on the pavement would rise by approximately a further 30cm until they spill on to the steps leading down to the basement at 12 Lyndhurst Gardens;
- as the no. 12 basement steps only provide limited storage, water levels could then rise by approximately a further 10cm along the pavement to the east until they spill on to the steps leading down to the basement at 14 Lyndhurst Gardens;
- as the no. 14 basement steps provide a pathway for water to flow further down the hillside to the south-east, more water could flow down this route.

The topographic information on Drawing 1069.01.02 and site inspection indicate that the threshold for water to flow down the no.14 basement steps is likely to be approximately 76maOD. As the threshold for water to flow onto the driveway of no.16 is approximately 76.6 maOD, it is not considered likely that overland flow down Lyndhurst Gardens would affect the proposed basement development

As for other surface water which could reach the site, the rear garden of 18 Lyndhurst Gardens slopes gently towards the site, but it is vegetated (as shown in Figure 3) and hence unlikely to generate significant runoff. However, runoff from the side terrace of no. 18 (shown in Figure 4, approximately 50m^2) could flow beneath the existing fence and on to the no.16a site. Furthermore, additional runoff could develop if there was a blockage at the base of the two downpipes (draining a roof area of approximately 40m^2) which feed into drains beneath the side terrace of no.18.

Figure 3
Rear Garden of No.18

Figure 4
Side Terrace of No. 18 with Downpipe

This small potential amount of runoff from no.18 is likely at present to flow beneath the fence and infiltrate into the soil along the northern side of the driveway of no.16a. As it is proposed to replace this fence with a brick wall, and the soil along the northern side of the driveway will be retained, this potential runoff is unlikely to reach the proposed basement development.

Potential Surface Water Flooding caused by Proposed Development

The proposed basement development is unlikely to cause increased surface water flooding at adjoining properties. As discussed in Q3 of section 3.1 of the Surface Water Flow Screening above, the net runoff from the site will not be significantly increased by the proposed basement development. All new hard surfaces will drain into a rainwater storage reservoir, any overflow from which will be released to enter the site drain which feeds into the Thames Water combined sewers.

It is considered unlikely that surface water runoff would cause significant flooding at the site and it is considered unlikely that the development would increase the risk of surface water flooding in the local area.

3.3.7 Flooding from Artificial Drainage Systems

In the event of a blockage or capacity exceedance in the trunk sewer mentioned in section 3.3.6 above, the sewer would surcharge spilling onto the road and any flow would be as described above. It is considered unlikely that artificial drainage systems could cause significant flooding at the site and it is considered unlikely that the development would increase the risk of flooding from artificial drainage systems within the local area.

3.3.8 Flooding due to Infrastructure Failure

Rainfall falling on the basement courtyard area (approximately 40 m^2) will be collected in a sump and pumped up to the rainwater storage reservoir. However, if this pumping system failed, then it is possible that rainfall falling in the basement courtyard could cause limited flooding to the basement and sub-basement. The depth of flooding would increase slowly and water would not be flowing, therefore the risk to life would be minimal however the risk to the property may be considerable.

It is recommended that the following flood resilience measures be considered around the basement courtyard:

- a dual pumping system from the basement courtyard sump, to ensure that pumping can continue when necessary, even if one pump breaks down;
- the levels of all thresholds into the property should be set at least 300mm above the exterior ground levels to offer protection against floodwater ponding outside the building;
- all electrical and communications services to be routed from ceiling down rather than floor up; and
- tiles are recommended rather than carpets for flooring in the basement rooms.

It is proposed to check and service the pumping system on a regular basis. As the basement courtyard is not likely to flood quickly to significant depth, regular checking of the pumping system should be adequate to avoid the risk of flooding the basement.

3.4 Management of Off-Site Impacts

As detailed in sections 3.3.5 to 3.3.7 above, it is considered unlikely that the development would increase the risk of flooding within the local area.

4.0 SUMMARY AND CONCLUSIONS

This letter report has presented the Basement Impact Assessment screening responses for groundwater flow and for surface flow / flooding.

As the responses to Q2 and Q6 of the groundwater flow screening (regarding a possible nearby springline) were UNKNOWN, it was considered appropriate to carry out some initial site investigation to assist with the development of a conceptual ground model and an assessment of potential impacts. The conceptual ground model found that it is possible (but not likely) that there could currently be some groundwater seepage to the east in silty Made Ground beneath the application site. Also it is possible that any potential seepages that may be present following the proposed basement development, could be blocked and back up in between the basement of no.16 and the proposed basement of no.16a, unless a groundwater pathway is available between the two basements.

A recommended mitigation measure to address these potential issues could involve the construction of a drainage corridor (e.g. French drain, geocomposite or similar) around the perimeter of the proposed basement.

As the responses to Q1 to Q5 of the surface flow screening were NO, it was not necessary to proceed to develop a surface flow scoping. However, as the response to Q6 was YES due to previous surface water flooding in Lyndhurst Gardens in 1975, it was considered appropriate to undertake a Flood Risk Assessment.

The Flood Risk Assessment examined four potential risks. The potential risk from surface water flooding and flooding from artificial drainage systems was found to be negligible. The rate and volume of flows caused by potential groundwater flooding or by flooding due to infrastructure failure were found to be negligible in terms of off-site impacts. Regular checking and servicing of the overflow pumps for the basement courtyard sump is recommended as a mitigation measure to avoid the possibility of basement courtyard overflow after heavy rains causing flooding of the basement.

Compared to the pre-development site condition, the proposed basement development is very unlikely to increase the rate or volume of surface water discharged from the application site.

The Flood Risk Assessment therefore demonstrates that the proposed basement development can be deemed sustainable and ‘safe’ in flood risk terms, and in compliance with the requirement of PPS25, assuming the proposed mitigation measures are incorporated into the design of the property.

5.0 CLOSURE

This report has been prepared by SLR Consulting Limited with all reasonable skill, care and diligence, and taking account of the manpower and resources devoted to it by agreement with the client. Information reported herein is based on the interpretation of data collected and has been accepted in good faith as being accurate and valid.

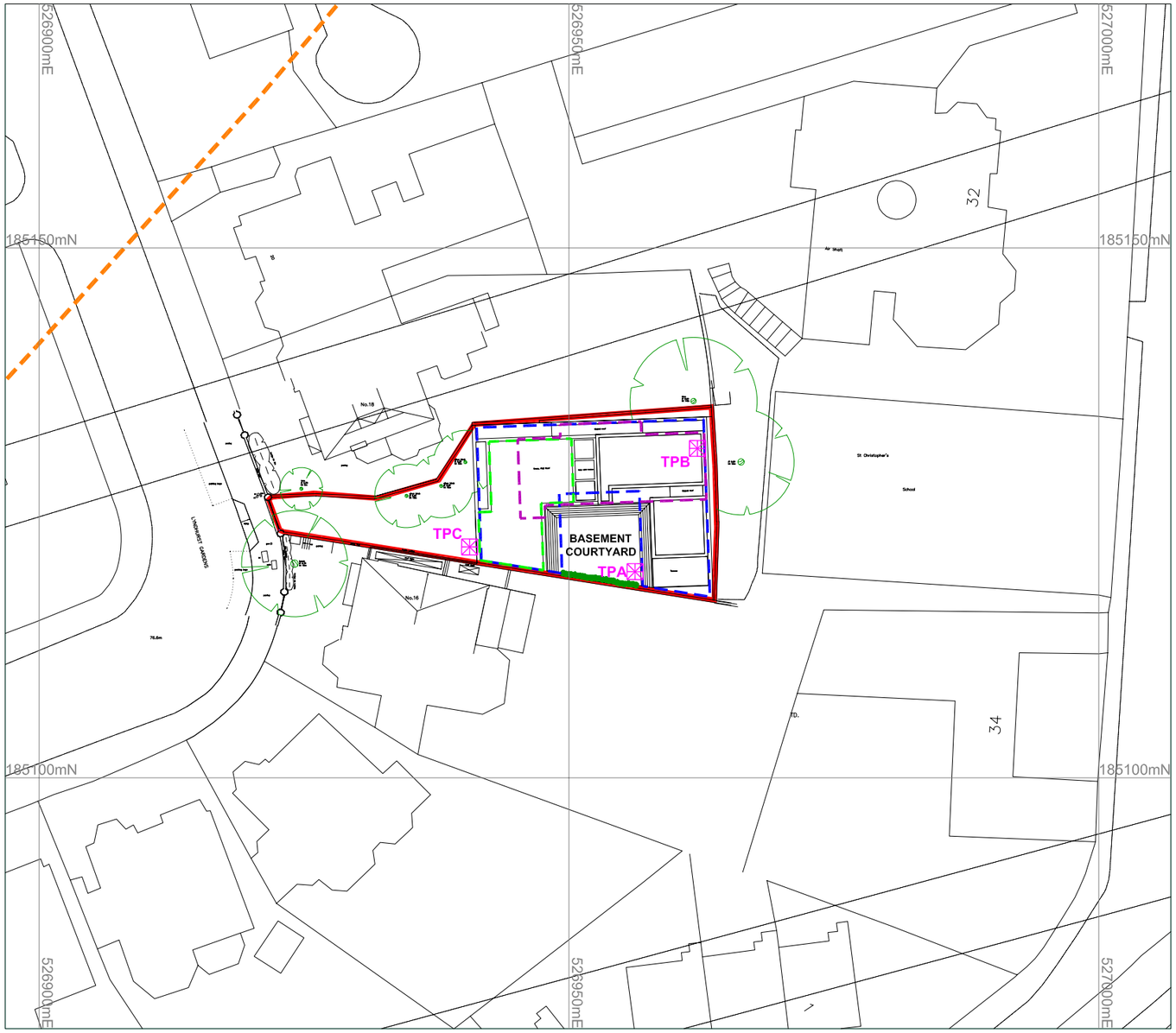
This report is for the exclusive use of Lyndhurst Gardens LLP; no warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of the work.

Yours sincerely
SLR Consulting Limited

for **Phil Slater CGeol** **Paul Klimczak C.WEM**
Associate Hydrogeologist Senior Hydrologist

cc Richard Webb, Webb Architects
Enc Drawing 1 – Proposed Development and Site Geology
Drawing 1069.01.02 - Existing Site Plan
Trialpit Logs



0 5 10 15 20m 30 40 50
Metres
1:500

N
W E
S

NOTES

1. DRAWING INFORMATION SUPPLIED BY WEBB ARCHITECTS LTD, REF: 1069-PRPSD PLNS-A1.DWG, DATE RECEIVED: 07.06.2011.

2. ADDITIONAL INFORMATION SUPPLIED BY WEBB ARCHITECTS LTD, REF: FIGURE 4 TAKEN FROM CAMDEN GEOLOGICAL, HYDROGEOLOGICAL & HDROLOGICAL STUDY (LONDON BOROUGH OF CAMDEN, 2010), DATE RECEIVED: 07.06.2011.

LEGEND

- SOUTHERN EXTENT OF CLAYGATE BEDS TAKEN FROM BGS SHEET 256 (NORTH LONDON)
- SITE BOUNDARY
- OUTLINE OF BASEMENT FOOTPRINT
- OUTLINE OF SUB-BASEMENT FOOTPRINT
- OUTLINE OF GREEN FLAT ROOF FOOTPRINT
- TPA — TRIAL PIT LOCATION & REFERENCE

Revision	By	Chk'd By	Date	Comments
0	KW	PS	06/11	

SLR
7 WORNAL PARK
MENMARSH ROAD
WORMINGHALL, AYLESBURY
BUCKS. HP18 9PH
T: 01844 337380
F: 01844 337381
www.slrconsulting.com

Site
16a LYNDHURST GARDENS

Project
BASEMENT IMPACT ASSESSMENT

Drawing Title
PROPOSED DEVELOPMENT & SITE GEOLOGY

Scale	Date
1:500 @ A3	JUNE 2011

Drawing Number	Revision
001	0

03684.00001.11.001.0B Proposed Development.dwg