PRICE&MYERS

Flood Risk Assessment

254 Kilburn High Road, London

April 2014

STRUCTURES GEOMETRICS SUSTAINABILITY INFRASTRUCTURE

30 Newman Street London W1T 1LT T 020 7631 5128 F 020 7462 1390 E mail@pricemyers.com www.pricemyers.com

PRICE&MYERS

Flood Risk Assessment

254 Kilburn High Road

Contents

Prepared by: Cynthia Conger-Thompson MEng (Hons)

Checked by: Dimitris Linardatos BEng (Hons) MSc CEng MICE

Date: May 2014

1 Introduction

Price and Myers have been commissioned by Artich Group Ltd to undertake a Flood Risk Assessment (FRA) for the proposed redevelopment of the 254 Kilburn High Road, located within the London Borough of Camden. The flood risk classification of this site is based on the observations and the recommendations stated. This report is intended for the use of the developer of the site in support of their planning application for the site only.

This FRA has been carried out in accordance with:

- National Planning Policy Framework (NPPF),
- Planning Policy Statement (PPS) Statement 25 Technical Guidance,
- Advice and guidance from the Environment Agency (EA) and CIRIA documents,
- Information and recommendations within the North London Strategic Flood Risk Assessment (SFRA).

The NPPF states that an appropriate FRA will be required for all development proposals of 1 Ha or greater in Flood Zone 1, or for any development within Flood Zones 2 or 3. The site is within Flood Zone 1 and is less than 1 Ha; although a FRA is not required in this case it is required for compliance with the Code for Sustainable Homes (CSH) and Building Research Establishment Environmental Assessment Methodology (BREEAM) purposes.

2 Site Description and Location

The site is located on Kilburn High Road in Kilburn. The site coordinates are at grid ref. OS 524992/184221 and the postcode is NW6 2BS. The site is situated to the west of Kilburn Grange Park within an urban area of London and has a vehicular entrance from Kilburn High Road. The entire site covers an approximate area of 0.203 Ha.

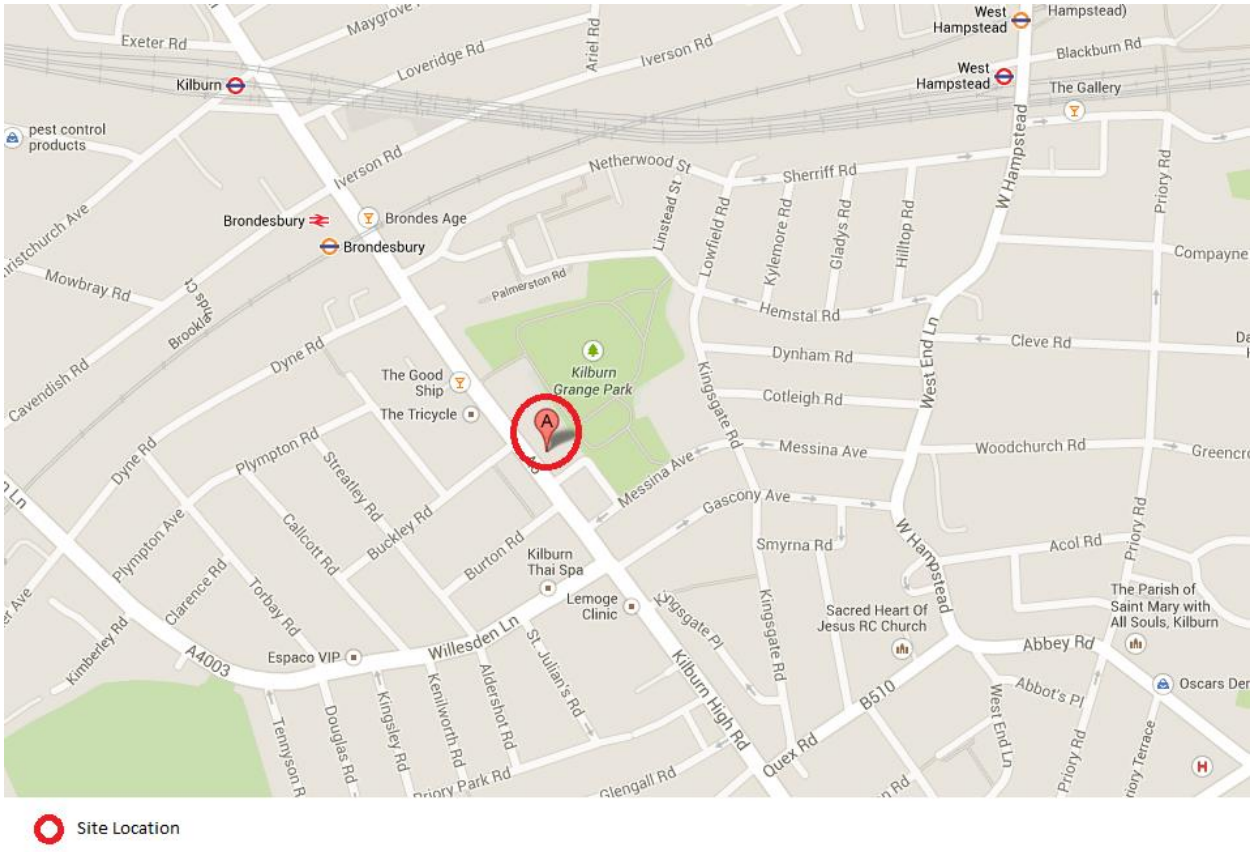

Figure 1 - Site Location Map

Figure 2 - Existing Development

3 Development Proposal

The proposed works comprise the demolition of the current buildings and redevelopment of the site to provide a mixed use scheme to offer a four/five storey building with small commercial space at ground level and 62 residential units above. The proposals will have minor effect to the external areas and access to the proposed development will remain at Kilburn High Road.

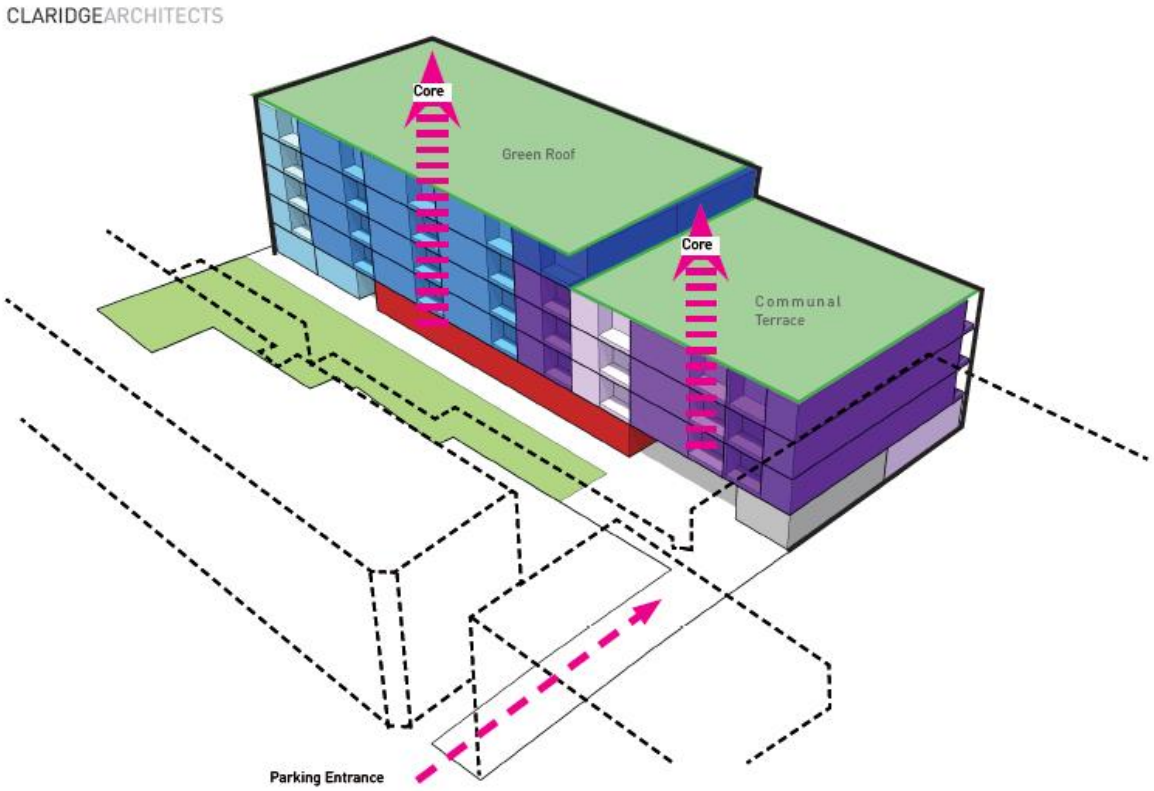

Figure 3 - Proposed Development

4 Flood Risk Assessment

4.1 Flood Risk from Watercourses (Fluvial/Tidal)

There is no risk of flooding from rivers and sea as identified on the Environment Agency (EA) indicative flood outline map. The map shows that the site lies within Flood Zone 1.

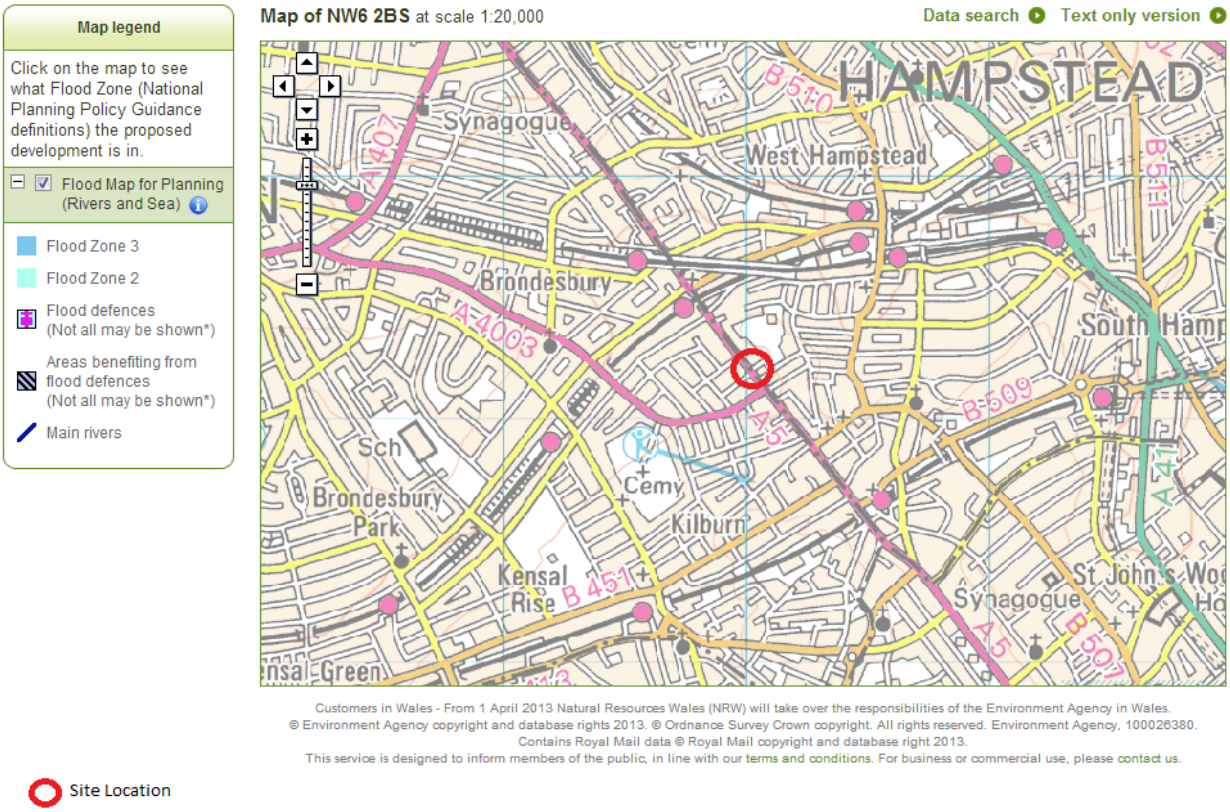

Figure 4 - Environment Agency indicative floodplain map

4.2 Flood Risk from Groundwater

The EA's groundwater source protection zones confirm that the site is outside the source protection zone and is not underlain by an Aquifer. Therefore, the proposed development will not affect the local hydrology.

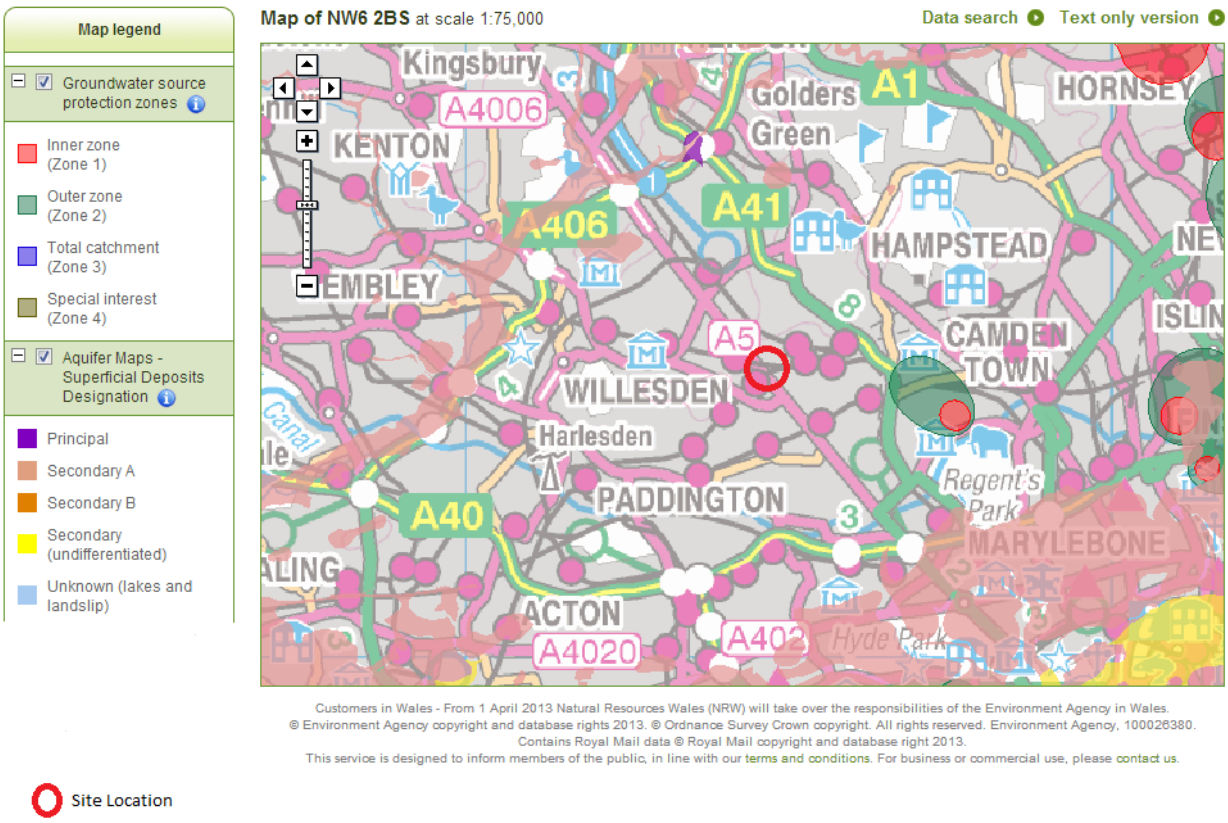

Figure 5 - Environment Agency Groundwater Source Protection Zones Map

A geotechnical site investigation was not available at the time of this study was undertaken. However, the British Geological Survey map for the site location confirms that this area is entirely underlain by London Clay Formation. This confirms that the flood risk from ground water is low as the London Clay is impermeable, preventing the groundwater from rising near the ground surface in this area.

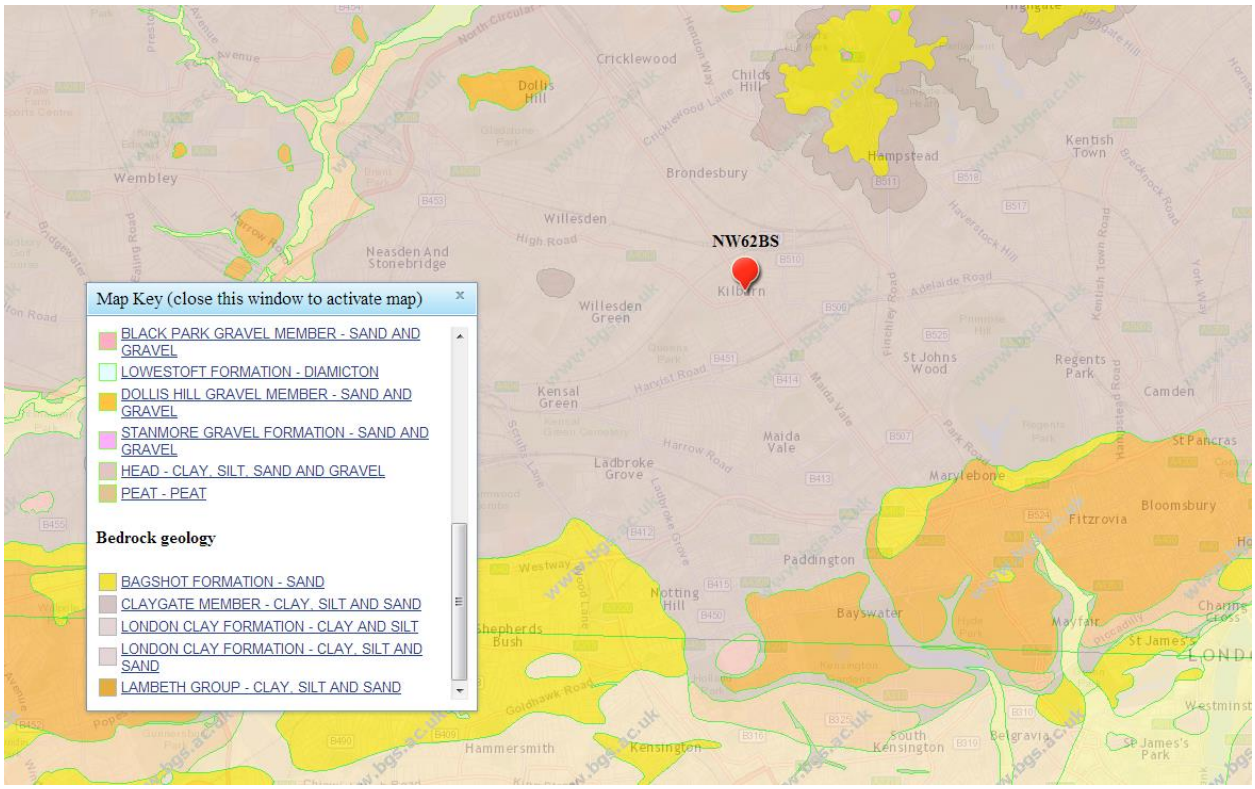

Figure 6 - British Geological Survey Map of the Site

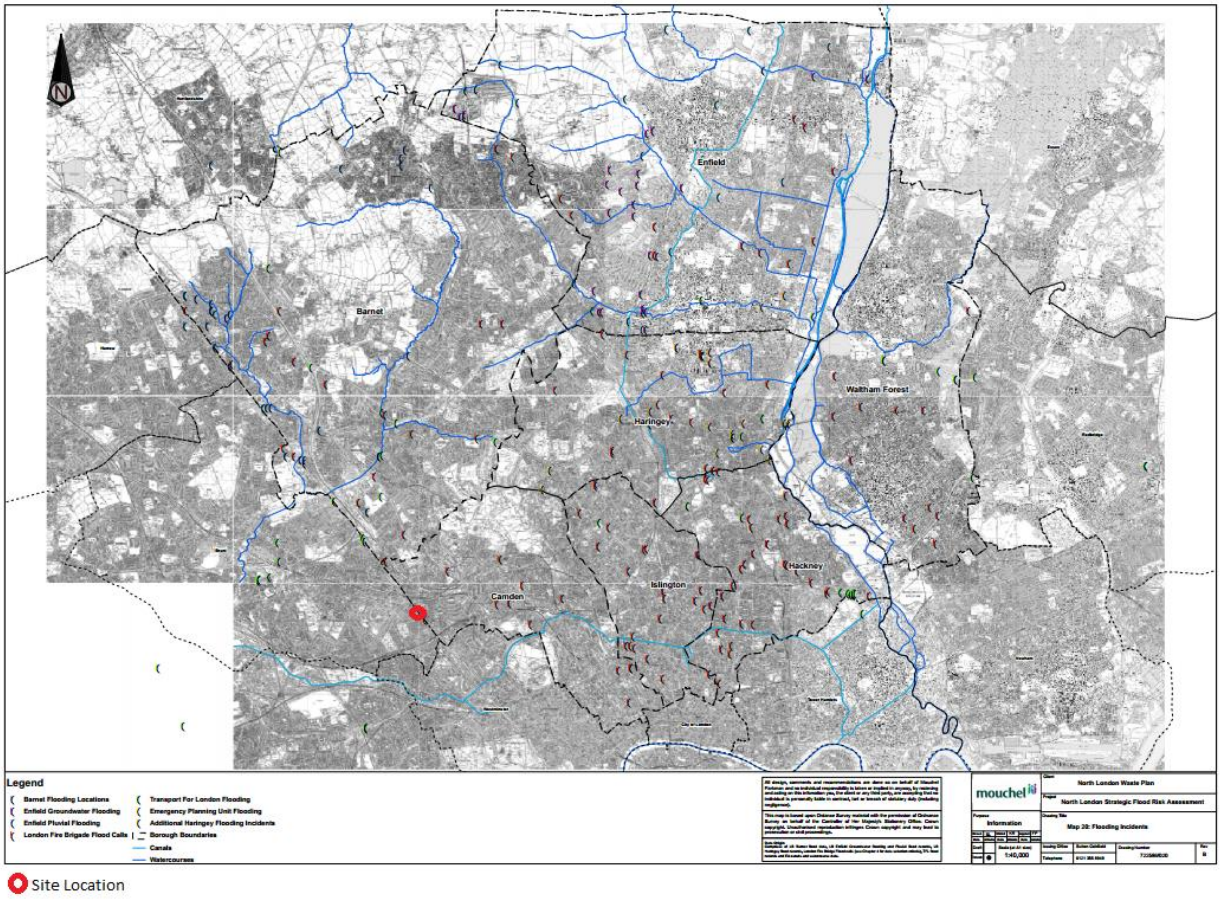

Figure 7 - Flooding Incidents (Extract from SFRA)

The North London SFRA also confirms the information stated above. Figure 7 shows the reported flood incidents of the area. The map shows that the London Fire Brigade Flood Calls were contacted in the past for a flood incident near the site; however, it is not stated whether the flooding was related to a pluvial inundation.

Furthermore, no basements or lower ground level structures are proposed which are vulnerable to groundwater flooding. Therefore, the risk of flooding from groundwater is considered ‘‘low’’.

4.3 Flood Risk from Overland Flows and Sewers

Historical records show that the site entrance is located in an area that has flooded in the past.

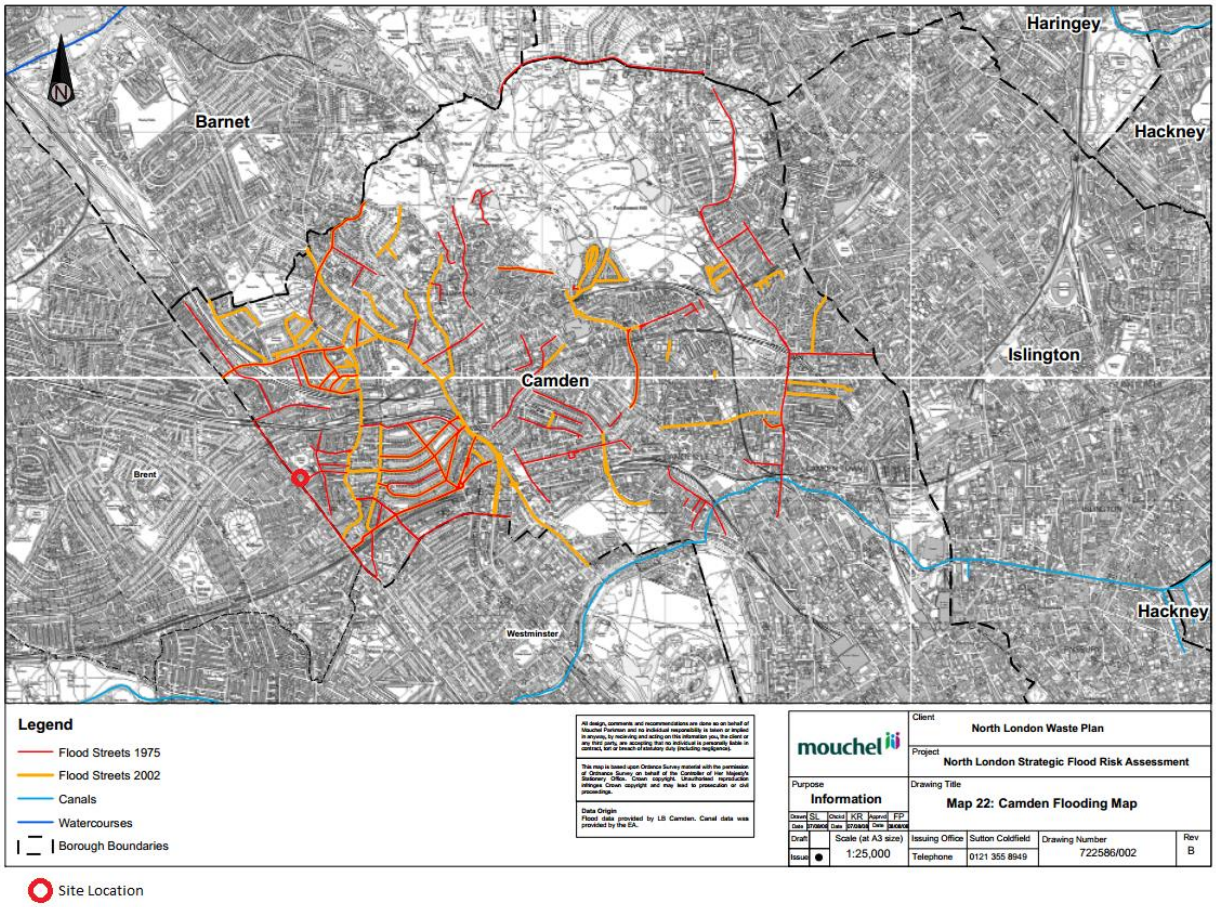

Figure 8 - Historical Flood Records (Extract from SFRA)

The proposal does not include a lower floor level that is defined by the NPPF as ‘highly vulnerable’. As the ground floor will be mainly used for commercial and storage purposes and the consecutive floors will be residential, there will be no flood risk to the property.

Topographical survey (see Figure 9) for the area suggests that Kilburn High Road falls to the south-east. This indicates that surface water will flow to the south-east without ponding the local area. Furthermore, the levels at the site entrance can be raised to ensure that no overland flows from the main road will enter the site.

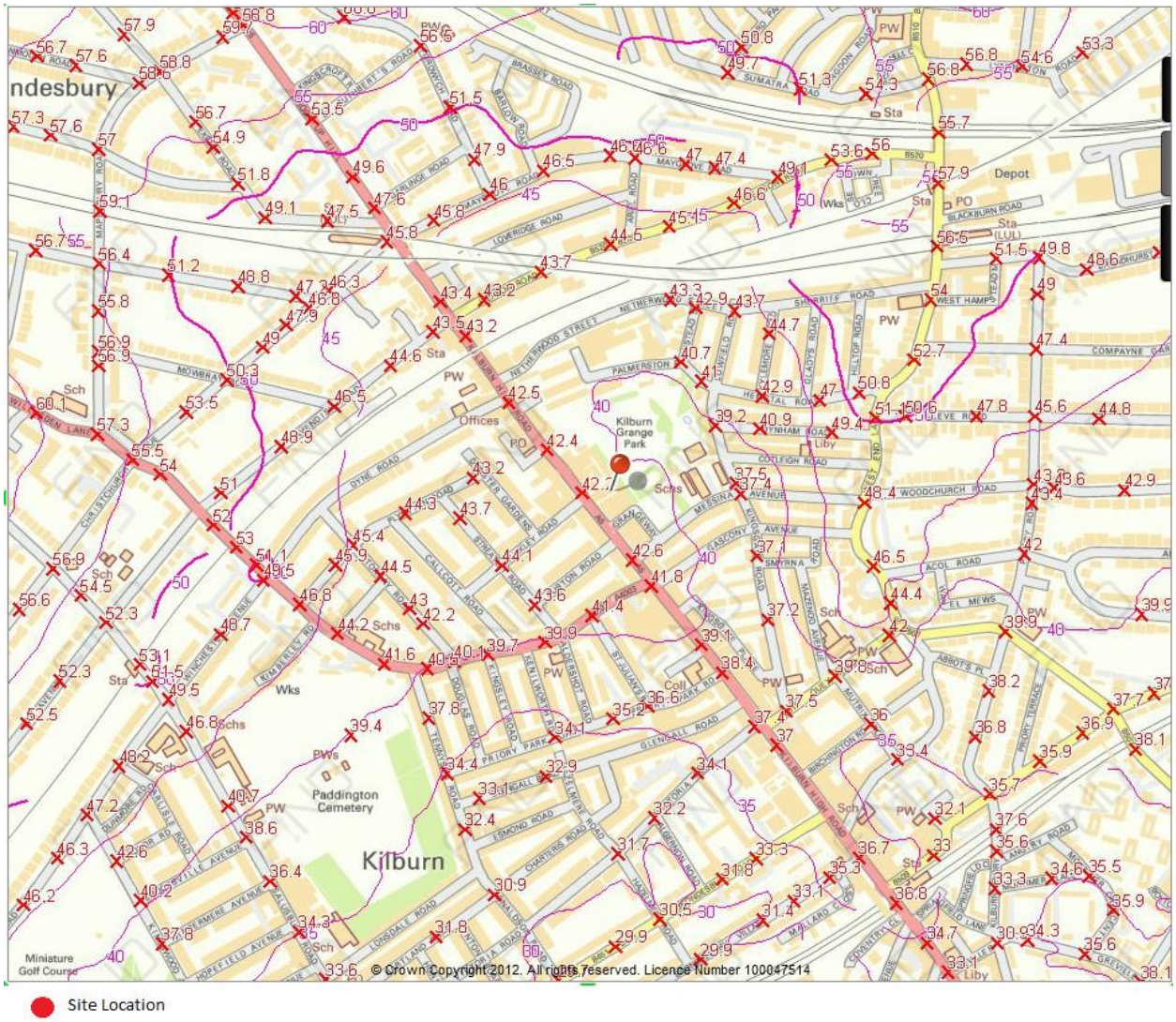

Figure 9 - Contours and Spot Heights (Source: FINDmaps, 2014)

5 Run-off Assessment

Existing Run-off

The impermeable areas currently cover approximately 0.203 Ha. It is thought that these areas currently drain to the public sewers. The existing run-off rate for the 1 in 100 year storm event was estimated based on the modified rational method:

Q_{100} = 2.78 x A x i (where "A" is the catchment area in Ha and "i" is the rainfall intensity in mm/hr. as estimated from WinDes Software).

Q_{100} = 2.78 x 0.203 x 105.122 = 59.32 l/sec.

5.2 Proposed Run-off

The proposed development will not increase the footprint of the existing hard standing areas and subsequently the run-off rates will mimic existing conditions.

In accordance with the London Plan, EA guidelines, Building Regulations and Water Authorities advice the preferred means of surface water drainage for any new development is into a suitable soakaway or infiltration drainage system. Sustainable Drainage Systems (SUDS) can reduce the impact of urbanisation on watercourse flows, ensure the protection and enhancement of water quality and encourage recharge of groundwater in a manner that mimics natural conditions. If drainage to an infiltration system proved to be an unsuitable option for the site then drainage to public sewers will be assessed. Drainage to the public sewers can be considered only when all other options proved unsuitable.

However, published information confirms that the ground strata (London Clay) is unsuitable for the use of infiltration techniques. Furthermore, the development proposals indicate that only a very small area of the site will not be occupied by buildings providing no sufficient area for infiltration techniques, considering that infiltration systems must be constructed atleast 5m away from structures.

Alternatively, attenuation techniques can be employed. Various opportunities to reduce the run-off rates from the site must be assessed during the detailed design stage. The site layout and topography shows that attenuation systems such as storage tanks and permeable paving can be accommodated on site.

The surface water drainage system must be designed for the 1 in 100 year storm event, also making allowances for climate change. Hence the surface water run-off rate will be increased by 30% due to climate change, Q_{100+30} = 77.12 l/sec.

6 Surface Water and Flood Risk BREEAM Assessment Criteria

The assessment criterion is split into three parts for which credits may be awarded.

6.1 Flood Risk

As stated in section 4 of this report. The EA's indicative flood map shows that the site lies in Flood Zone 1, an area with less than 0.1% annual probability of flooding by rivers and/or the sea. Therefore the proposed development can achieve two credits.

6.2 Surface Water Run-off

Section 5 analyses the surface water run-off of the proposed site. The surface water run-off rates were calculated.

BREEAM states that "where impermeable areas drainage to the watercourse (natural or municipal) has decreased or remains unchanged post-development, the peak and volume rate of run-off requirements for surface water run-off credits will be met by default." Therefore the development can achieve additional two credits.

6.3 Minimising watercourse pollution

Whilst the proposed development poses low risk of contamination to watercourses, surface water from all areas must pass through SUDS in order to meet BREEAM's requirements. The single credit which is available cannot be achieved as infiltration techniques cannot be used on site.

7 Conclusions & Recommendations

- In accordance with NPPF this site falls within Flood Zone 1, areas with little or no potential risk of flooding (annual probability less than 0.1% for fluvial flooding) which are already developed. Proposed Developments in these areas have no restrictions provided that the surface water drainage will not increase the flood risk on site and the surrounding areas.

- Information from the EA and SFRA shows that the site is at low risk of flooding from watercourses, ground water and overland flows.

- Surface water from the site will drain to the public sewers and the proposed works will not increase the run-off rate.

- The surface water drainage by means of attenuation will be designed for the 1 in 100 year plus 30% storm event.

- The proposed development meets BREEAM's requirements and has the potential to achieve four credits for flood risk and surface water run-off.

- Therefore, the proposed redevelopment has an acceptable flood risk within the terms and requirements of NPPF.

APPENDIX A – Preliminary Calculations

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 180 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	0.525	0.525	0.0	3.7	3.7	49.9	O K
30 min Summer	0.658	0.658	0.0	4.1	4.1	62.5	O K
60 min Summer	0.761	0.761	0.0	4.5	4.5	72.3	Flood Risk
120 min Summer	0.808	0.808	0.0	4.6	4.6	76.8	Flood Risk
180 min Summer	0.806	0.806	0.0	4.6	4.6	76.5	Flood Risk
240 min Summer	0.793	0.793	0.0	4.5	4.5	75.4	Flood Risk
360 min Summer	0.760	0.760	0.0	4.5	4.5	72.2	Flood Risk
480 min Summer	0.723	0.723	0.0	4.3	4.3	68.7	Flood Risk
600 min Summer	0.687	0.687	0.0	4.2	4.2	65.2	O K
720 min Summer	0.651	0.651	0.0	4.1	4.1	61.9	O K
960 min Summer	0.588	0.588	0.0	3.9	3.9	55.9	O K
1440 min Summer	0.486	0.486	0.0	3.6	3.6	46.1	O K
2160 min Summer	0.375	0.375	0.0	3.1	3.1	35.6	O K
2880 min Summer	0.297	0.297	0.0	2.8	2.8	28.2	O K
4320 min Summer	0.195	0.195	0.0	2.3	2.3	18.5	O K
5760 min Summer	0.120	0.120	0.0	2.1	2.1	11.4	O K
7200 min Summer	0.097	0.097	0.0	1.9	1.9	9.2	O K
8640 min Summer	0.085	0.085	0.0	1.6	1.6	8.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	136.659	16
30 min Summer	88.315	31
60 min Summer	54.281	60
120 min Summer	32.230	116
180 min Summer	23.456	144
240 min Summer	18.621	176
360 min Summer	13.418	244
480 min Summer	10.633	312
600 min Summer	8.872	380
720 min Summer	7.649	448
960 min Summer	6.048	578
1440 min Summer	4.339	836
2160 min Summer	3.108	1212
2880 min Summer	2.451	1584
4320 min Summer	1.752	2296
5760 min Summer	1.379	2952
7200 min Summer	1.145	3672
8640 min Summer	0.983	4408

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Summer	0.076	0.076	0.0	1.4	1.4	7.3	O K
15 min Winter	0.589	0.589	0.0	3.9	3.9	56.0	O K
30 min Winter	0.740	0.740	0.0	4.4	4.4	70.3	Flood Risk
60 min Winter	0.861	0.861	0.0	4.7	4.7	81.8	Flood Risk
120 min Winter	0.924	0.924	0.0	4.9	4.9	87.8	Flood Risk
180 min Winter	0.916	0.916	0.0	4.9	4.9	87.0	Flood Risk
240 min Winter	0.900	0.900	0.0	4.8	4.8	85.5	Flood Risk
360 min Winter	0.853	0.853	0.0	4.7	4.7	81.0	Flood Risk
480 min Winter	0.800	0.800	0.0	4.6	4.6	76.0	Flood Risk
600 min Winter	0.747	0.747	0.0	4.4	4.4	71.0	Flood Risk
720 min Winter	0.697	0.697	0.0	4.3	4.3	66.3	O K
960 min Winter	0.608	0.608	0.0	4.0	4.0	57.8	O K
1440 min Winter	0.469	0.469	0.0	3.5	3.5	44.5	O K
2160 min Winter	0.329	0.329	0.0	2.9	2.9	31.2	O K
2880 min Winter	0.238	0.238	0.0	2.5	2.5	22.6	O K
4320 min Winter	0.112	0.112	0.0	2.0	2.0	10.6	O K
5760 min Winter	0.086	0.086	0.0	1.6	1.6	8.2	O K
7200 min Winter	0.074	0.074	0.0	1.4	1.4	7.0	O K
8640 min Winter	0.066	0.066	0.0	1.2	1.2	6.3	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
10080 min Summer	0.864	5136
15 min Winter	136.659	16
30 min Winter	88.315	30
60 min Winter	54.281	60
120 min Winter	32.230	116
180 min Winter	23.456	164
240 min Winter	18.621	186
360 min Winter	13.418	262
480 min Winter	10.633	338
600 min Winter	8.872	410
720 min Winter	7.649	482
960 min Winter	6.048	618
1440 min Winter	4.339	880
2160 min Winter	3.108	1256
2880 min Winter	2.451	1640
4320 min Winter	1.752	2252
5760 min Winter	1.379	2936
7200 min Winter	1.145	3672
8640 min Winter	0.983	4392

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Winter	0.061	0.061	0.0	1.0	1.0	5.7	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
10080 min Winter	0.864	5104

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.600	Shortest Storm (mins)	15
Ratio R	0.437	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time / Area Diagram

Total Area (ha) 0.203

Time (mins)	Area (ha)
0-1	0.203

Model Details

Storage is Online Cover Level (m) 1.000

Cellular Storage Structure

Invert Level (m) 0.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)
0.000	100.0	100.0

Hydro-Brake® Outflow Control

Design Head (m) 1.000 Hydro-Brake® Type Md7 Invert Level (m) 0.000
Design Flow (l/s) 5.0 Diameter (mm) 87

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.9	1.200	5.5	3.000	8.8	7.000	13.4
0.200	2.3	1.400	6.0	3.500	9.5	7.500	13.9
0.300	2.8	1.600	6.4	4.000	10.1	8.000	14.3
0.400	3.2	1.800	6.8	4.500	10.7	8.500	14.7
0.500	3.6	2.000	7.2	5.000	11.3	9.000	15.2
0.600	3.9	2.200	7.5	5.500	11.9	9.500	15.6
0.800	4.5	2.400	7.8	6.000	12.4		
1.000	5.1	2.600	8.2	6.500	12.9		