Resilience and Flood Risk

228 Belsize Road, London, NW6 4BT

FLOOD RISK ASSESSMENT

7th October 2015
Final Version
RAB: B1049

Leisurecorwn Ltd
228 Belsize Road
London,
NW6 4BT

Resilience and Flood Risk

Revision history

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Action	Signature	Date
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Abbreviations

Abbreviation	Definition
DEFRA	Department for Environment, Food and Rural Affairs
EA	Environment Agency
FEH	Flood Estimation Handbook
FRA	Flood Risk Assessment
m AOD	metres Above Ordnance Datum
NPPF	National Planning Policy Framework
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems

1.0 Introduction

1.1. Terms of Reference

RAB Consultants was appointed by Dipu Saha to undertake this flood risk assessment (FRA) in support of a proposed re-development located at 228 Belsize Road, NW6 4BT. The National Planning Policy Framework requires a Flood Risk Assessment to be carried out to ensure flood risk to the proposed development is considered as well as the impact the development will have elsewhere on people and property.

This FRA has been prepared in accordance with the Environment Agency's Flood Risk Assessment (FRA) Guidance Note 1 (Development within a Critical Drainage Area or greater than 1 hectare (ha) in Flood Zone 1).

1.2. FRA Requirements

It is a requirement for development applications to consider the potential risk of flooding to a proposed development over its expected lifetime and any possible impacts on flood risk elsewhere, in terms of its effects on flood flows and runoff.

Where appropriate, the following aspects of flood risk should be addressed in all planning applications in flood risk areas:

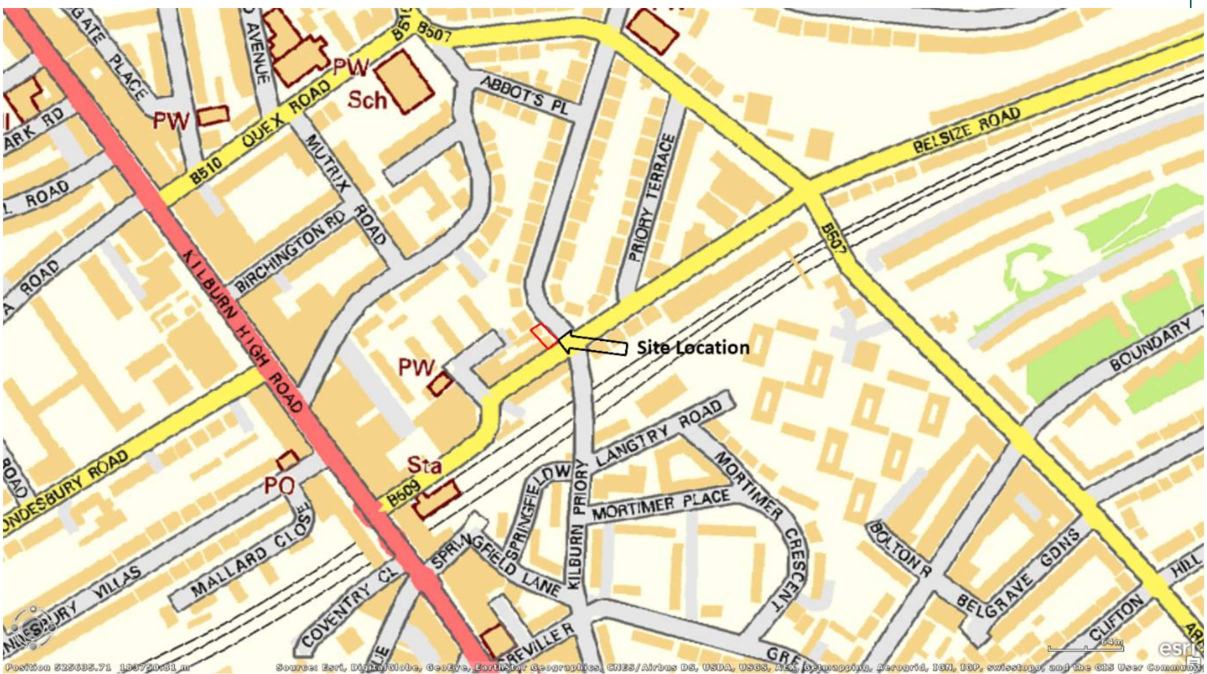
- The area liable to flooding.
- The probability of flooding occurring now and over time.
- The extent and standard of existing flood defences and their effectiveness over time.
- The rates of flow likely to be involved.
- The likelihood of impacts to other areas, properties and habitats.
- The effects of climate change.
- The nature and currently expected lifetime of the development proposed and the extent to which it is designed to deal with flood risk.

This FRA follows government guidance on development and flood risk (National Planning Policy Framework).

1.3. Site Details

Figure 1 - Summary of site details

Site name	228 Belsize Road, NW6 4BT
Site footprint	Approximately 220m²
Existing land-use	Commercial
Purpose of development	Commercial and residential
Estimated lifespan	100 years
OS NGR	525270, 183749
Country	England (NPPF applies)
Local planning authority	London Borough of Camden
Other Authorities	Environment Agency



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1.4. Site Description

The site is located at 228 Belsize Road, grid reference: 525270 183682, and is currently a restaurant. The existing building footprint is approximately 220m^2.

1.5. Development Proposals

The proposed development involves the demolition of the existing single storey structure and re-development of a three-storey plus basement building; including the provision of an A3 unit at ground and basement levels and four flats over the first and second floors. The proposals will not increase the impermeable area.

1.6. Existing Drainage Network

The existing development actively manages surface water via rainwater pipes and gullies which presumably discharge to the local surface water sewer network.

2.0 Site Visit

2.1. General Site Observations

The site visit was undertaken by RAB Consultants on the 20th March 2015, a sunny and dry day. The restaurant is located on the cross road of Belsize Road and Priory Road (Figure 1) and at the end of a row of shops and businesses. The site is located on a small incline, meaning there are three steps into the restaurant from the pavement. The site was accessed directly off Belsize Road (Figure 2) and the side and rear of the property can be accessed via Priory Road. Figure 3 and Figure 4 show the side of the property, highlighting pedestrian access for workers and delivery of goods to the restaurant.

Figure 2 – Front view of existing restaurant, access from Belsize Road

Figure 3 – Side view of the restaurant from Priory Road

Figure 4 – Rear and side view of the property

Figure 5 - Access via Belsize Road

Figure 6 - Belsize Road leading to Priory Road

3.0 Development and Flood Risk Policy

3.1. Planning Context

3.1.1. Applicable Planning Policy

National Planning Policy Framework (NPPF) was issued by the Department for Communities and Local Government in March 2012. NPPF deals specifically with development planning and flood risk using a sequential characterisation of risk based on planning zones and the Environment Agency Flood Map. The main study requirement is to identify the Flood Zones and vulnerability classification relevant to the proposed development, based on an assessment of current and future conditions.

3.1.2. Flood Zones

The Environment Agency has developed a Flood Map that shows the risk of flooding in England and Wales for different return period events. It should be noted that the Environment Agency's Flood Map is based on broad scale hydraulic modelling and is an indication of the potential flood risk to a site and the actual risk may differ. The Flood Zone Maps (without climate change) provide the information required by NPPF for planning purposes, as described in Section 3.2. The Flood Zones do not take account of the effect of flood defences.

The entire site lies within Flood Zone 1 (low probability of flooding), as described in Table 1 of the Planning Practice Guidance to the National Planning Policy Framework, on Land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding in any year (<0.1%). The proposed mixed use development is categorised as a 'more vulnerable' development in accordance with Table 3 of the Planning Practice Guidance to the National Planning Policy Framework.

3.1.3. Sequential Test

The Sequential and Exception Tests should be applied when choosing the location of new development and the layout of the development site. The Sequential Test aims to promote development in areas with low flood risk. The Exception Test is used where no suitable development areas can be found in low risk areas, the risk of flooding is clearly outweighed by other sustainability factors, and the development will be safe for its lifetime, taking climate change into account.

Since the development is located within Flood Zone 1, the Sequential Test evaluation for the development can be considered successful. The aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding.

3.1.4. Exception Test

Despite the fact that the Sequential Test application can be considered successful, it is good practice to ensure that the development meets the requirements of the Exception Test:

'A site-specific Flood Risk Assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall'.

This FRA goes on to demonstrate that the development will remain safe for its lifetime and not increase flood risk elsewhere.

3.2. NPPF Flood Zones

Table 1 shows how the Flood Zones relate to a sequential planning process.

Table 1 - NPPF Flood Zones and Requirements

Zone 1: Low Probability	
Land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding in any year (<0.1%).	**Appropriate uses** All uses of land are appropriate in this zone. **FRA requirements** For development proposals on sites comprising one hectare or above the vulnerability to flooding from other sources as well as from river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water run-off, should be incorporated in a FRA. **Policy aims** Developers and local authorities should seek opportunities to reduce the overall level of flood risk through the layout and form of the development, and the appropriate application of sustainable drainage techniques.
Zone 2: Medium Probability	
Land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% - 0.1%) or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% - 0.1%) in any year.	**Appropriate uses** The water-compatible, less vulnerable and more vulnerable uses of land and essential infrastructure in Table2-2 are appropriate in this zone. Highly vulnerable uses in Table 2-2 are only appropriate in this zone if the Exception Test is passed. **FRA requirements** All proposals in this zone should be accompanied by a FRA. **Policy aims** Developers and local authorities should seek opportunities to reduce the overall level of flood risk through the layout and form of the development, and the appropriate application of sustainable drainage techniques.
Zone 3a: High Probability	
Land assessed as having a 1 in 100 or greater annual probability of river flooding (<1%) or a 1 in 200 or greater annual probability of flooding	**Appropriate uses** The water-compatible and less vulnerable uses of land in Table 2-2 are appropriate in this zone.

from the sea (>0.5%) in any year.	The highly vulnerable uses (Table 2-2) should not be permitted in this zone. The more vulnerable and essential infrastructure uses in Table 2-2 should only be permitted in this zone if the Exception Test is passed. **FRA requirements** All proposals in this zone should be accompanied by a FRA. **Policy aims** Developers and local authorities should seek opportunities to: • reduce the overall level of flood risk through the layout and form of the development and the appropriate application of sustainable drainage techniques; • relocate existing development to land with a lower probability of flooding; • create space for flooding to occur by allocating and safeguarding open space for flood storage.
Zone 3b: Functional Floodplain	
Land where water has to flow or be stored in times of flood. (Land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood, or at another probability to be agreed between the local planning authority and the Environment Agency, including water conveyance routes).	**Appropriate uses** Only the water-compatible uses and the essential infrastructure listed in Table 2-2 that has to be there should be permitted. It should be designed and constructed to: • remain operational and safe for users in times of flood; • result in no net loss of floodplain storage; • not impede water flows; • not increase flood risk elsewhere. **FRA requirements** All proposals in this zone should be accompanied by a FRA. **Policy aims** In this zone, developers and local authorities should seek opportunities to: • reduce the overall level of flood risk through the layout and form of the development and the appropriate application of sustainable drainage techniques; • relocate existing development to land with a lower probability of flooding.

Source: NPPF Planning Practice Guidance Table 1

Table 2 - Flood Risk Vulnerability Classification

Essential Infrastructure	Essential transport infrastructure and strategic utility infrastructure, including electricity generating power stations and grid and primary substations.
Highly Vulnerable	Police stations, Ambulance stations and Fire stations and Command Centres and telecommunications installations and emergency dispersal points. Basement dwellings, caravans, mobile homes and park homes intended for permanent residential use. Installations requiring hazardous substances consent.
More Vulnerable	Hospitals, residential institutions such as residential care homes, children's homes, Social services homes, prisons and hostels. Buildings used for: dwelling houses, student halls of residence, drinking establishments, nightclubs, hotels and sites used for holiday or short-let caravans and camping. Non–residential uses for health services, nurseries and education. Landfill and waste management facilities for hazardous waste.
Less Vulnerable	Buildings used for shops, financial, professional and other services, restaurants and cafes, offices, industry, storage and distribution, and assembly and leisure. Land and buildings used for agriculture and forestry. Waste treatment (except landfill and hazardous waste facilities), minerals working and processing (except for sand and gravel). Water treatment plants and sewage treatment plants (if adequate pollution control measures are in place).
Water-compatible Development	Flood control infrastructure, water transmission infrastructure and pumping stations. Sewage transmission infrastructure and pumping stations. Sand and gravel workings. Docks, marinas and wharves, navigation facilities. MOD defence installations. Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location Water-based recreation (excluding sleeping accommodation). Lifeguard and coastguard stations. Amenity open space, nature conservation and biodiversity, outdoor sports and recreation. Essential sleeping or residential accommodation for staff required by uses in this category, subject to a warning and evacuation plan.

Source: NPPF Planning Practice Guidance Table 2

Table 3 - Flood Risk Vulnerability and Flood Zone 'compatibility'

Vulnerability Classification (Table 3)		**Essential Infrastructure**	**Water Compatible**	**Highly Vulnerable**	**More Vulnerable**	**Less Vulnerable**
Flood Zone (Table 2)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test	✓	✓
	Zone 3a	Exception Test	✓	✗	Exception Test	✓
	Zone 3b	Exception Test	✓	✗	✗	✗

Source: NPPF Planning Practice Guidance Table 3

Key:

✓ Development is appropriate

✗ Development should not be permitted

3.3. Critical Drainage Areas

Critical Drainage Areas are areas of significant flood risk, characterised by the amount of surface runoff that drains into the area, the topography and hydraulic conditions of the pathway and the receptors (people, properties and infrastructure) that may be affected by surface water flooding.

The National Planning Policy Framework defines “areas at risk of flooding” as land within Flood Zones 2 and 3; or land within Flood Zone 1 which has critical drainage problems and which has been notified to the local planning authority by the Environment Agency.

The 2011 London Borough of Camden Surface Water Management Plan (SWMP) defined Critical Drainage Areas within the Borough. The site is located within a Critical Drainage Area.

3.4. Policy 5.13 of the London Plan (2011)

The drainage strategy for any proposed development at the site should follow the drainage hierarchy of Policy 5.13 of The London Plan (2011).

The London Plan Policy states:

A) Development should utilise sustainable urban drainage systems(SuDS) unless there are practical reasons for not doing so, and should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible in line with the following drainage hierarchy:

1. *store rainwater for later use;*
2. *use infiltration techniques, such as; Porous surfaces in non-clay areas;*
3. *attenuate rainwater in ponds or open water features for gradual release;*

4. *attenuate rainwater by storing in tanks or sealed water features for gradual release;*
5. *discharge rainwater direct to a watercourse;*
6. *discharge rainwater to a surface water sewer/drain;*
7. *discharge rainwater to the combined sewer.*

Drainage should be designed and implemented in ways that deliver other policy objectives of this Plan, including water use efficiency and quality, biodiversity, amenity and recreation.

3.5. Camden Development Policies

The proposed development should comply with policies in the Local Plan for the Camden Council with respect to management of surface water and flooding as follows:

3.5.1. DP23 - Water

The Council will require developments to reduce their water consumption, the pressure on the combined sewer network and the risk of flooding by:

a) incorporating water efficient features and equipment and capturing, retaining and re-using surface water and grey water on-site;

b) limiting the amount and rate of run-off and waste water entering the combined storm water and sewer network through the methods outlined in part a) and other sustainable urban drainage methods to reduce the risk of flooding;

c) reducing the pressure placed on the combined storm water and sewer network from foul water and surface water run-off and ensuring developments in the areas identified by the North London Strategic Flood Risk Assessment and shown on Map 2 as being at risk of surface water flooding are designed to cope with the potential flooding;

d) ensuring that developments are assessed for upstream and downstream groundwater flood risks in areas where historic underground streams are known to have been present; and

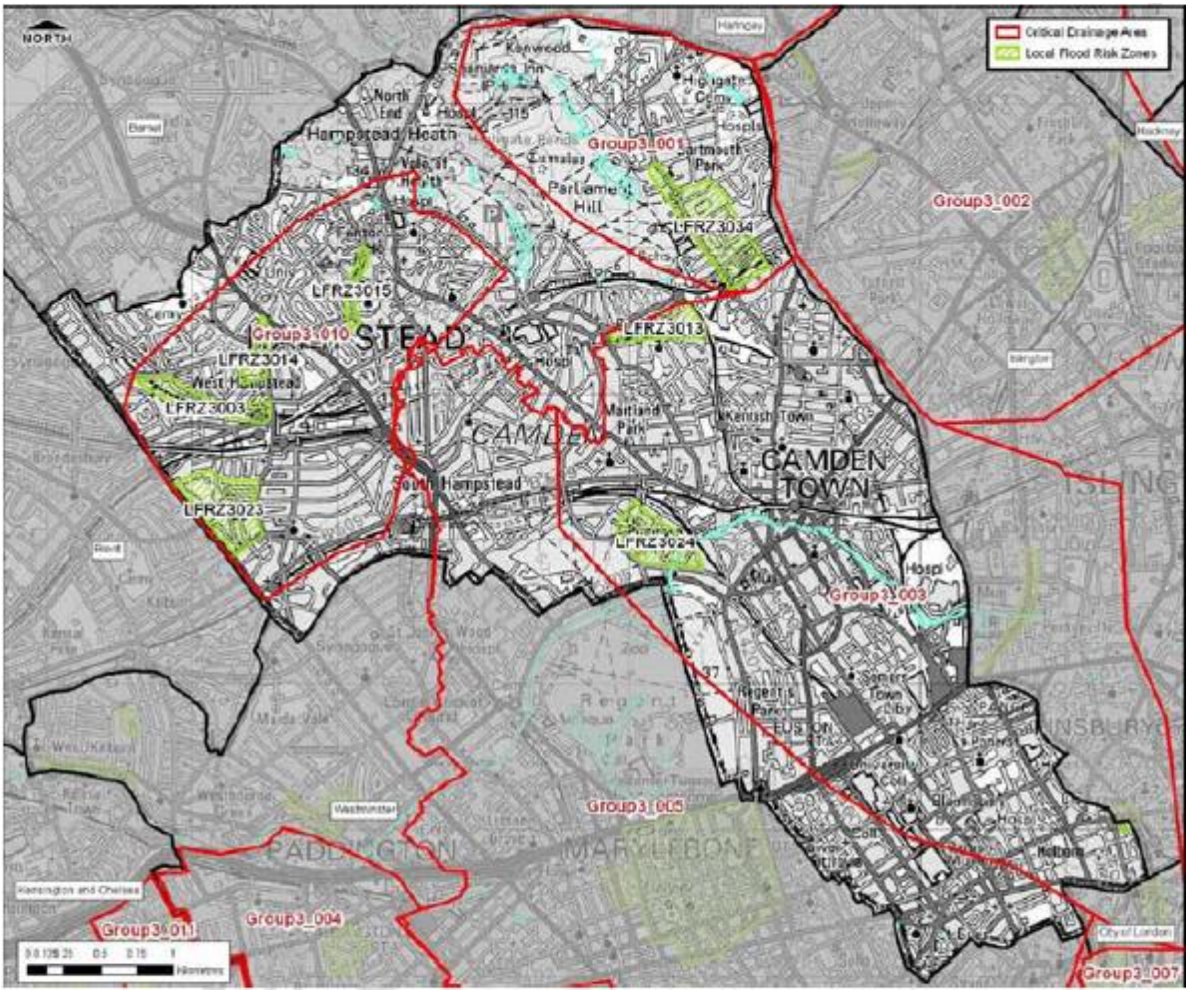
d) encouraging the provision of attractive and efficient water features.

4.0 Assessment of Flood Risk

4.1. Previous Flood History

According to the 2011 London Borough of Camden Surface Water Management Plan (SWMP) and the 2008 Strategic Flood Risk Assessment (SFRA) there have been floods in the local area. Belsize Road experienced surface water flooding in 1975 and 2002. The flooding was caused by high rainfall levels which lead to the main sewer system becoming overwhelmed leading to ground level and basement dwelling flooding. The SWMP sates that Thames Water confirmed that the flooding was caused by its sewer system reaching maximum capacity very quickly so that surface water could not be drained at the rate the rain fell. According to the SWMP 2011 the site is located in a critical drainage area (Group3_005) due to the history of surface water flooding in this area.

Figure 7 - Critical Drainage Area (SWMP 2011)



4.2. Fluvial/Tidal Flood Risk

According to the Environment Agency's Risk of Flooding from Rivers and Sea, the site is not at risk of fluvial or tidal flooding. The site is therefore shown to be in Flood Zone 1.

There are no formal flood defences protecting the proposed development site. Consequently there is no risk of flooding from this source.

4.3. Canal Flood Risk

Regent's Canal is located at a considerable distance away from the proposed site. Therefore, this source of flooding is not considered significant concerning the development.

4.4. Reservoir Flood Risk

The site is not at risk of reservoir flooding according to the EA reservoir flood map.

The reservoir flood map provided by the Environment Agency is a worst case scenario and in reality reservoir flooding is extremely unlikely with no loss of life attributed to dam failure in the UK since 1925, which was prior to reservoir safety legislation being introduced to ensure high standards in reservoir maintenance.

4.5. Groundwater/Geology

Geological maps of the area show that the bedrock found at this location is made up of London clay formation, clay and sand and silt. According to the British Geological Survey no superficial deposits can be found here.

According to the 2008 SFRA, no incidences of groundwater flooding have been recorded for the site location. Groundwater flooding usually occurs following a prolonged period of low intensity rainfall and although there are no records of significant groundwater flooding in the region, it is still a possibility. The future risk from this source is more uncertain than surface water as the climate change predictions indicate that although sea levels will rise, thus possibly raising groundwater levels, overall summer rainfall will decrease, therefore having a long-term effect of lowering the groundwater levels. However, long periods of wet weather are predicted to increase: these are the type of weather patterns that can cause groundwater flooding to occur.

4.6. Surface Water Flood Risk

When the infiltration capacity of land or the drainage capacity of a local sewer network is exceeded, excess rainwater flows overland; this water will collect in topographic depressions and at obstructions, and can inundate development downslope. The severity of the rainfall event, the degree of saturation of the soil before the event, the permeability of soils and geology, hill slope steepness and the intensity of land use all contribute to and affect the severity of overland flow.

The Environment Agency's most recent flood map for surface water published in December 2013 is freely available online at their website and can be used to see the approximate areas that would experience surface water flooding from a variety of rainfall return periods. The risk is categorised based on annual probability of occurrence. The different risk categories are displayed below in Table 4.

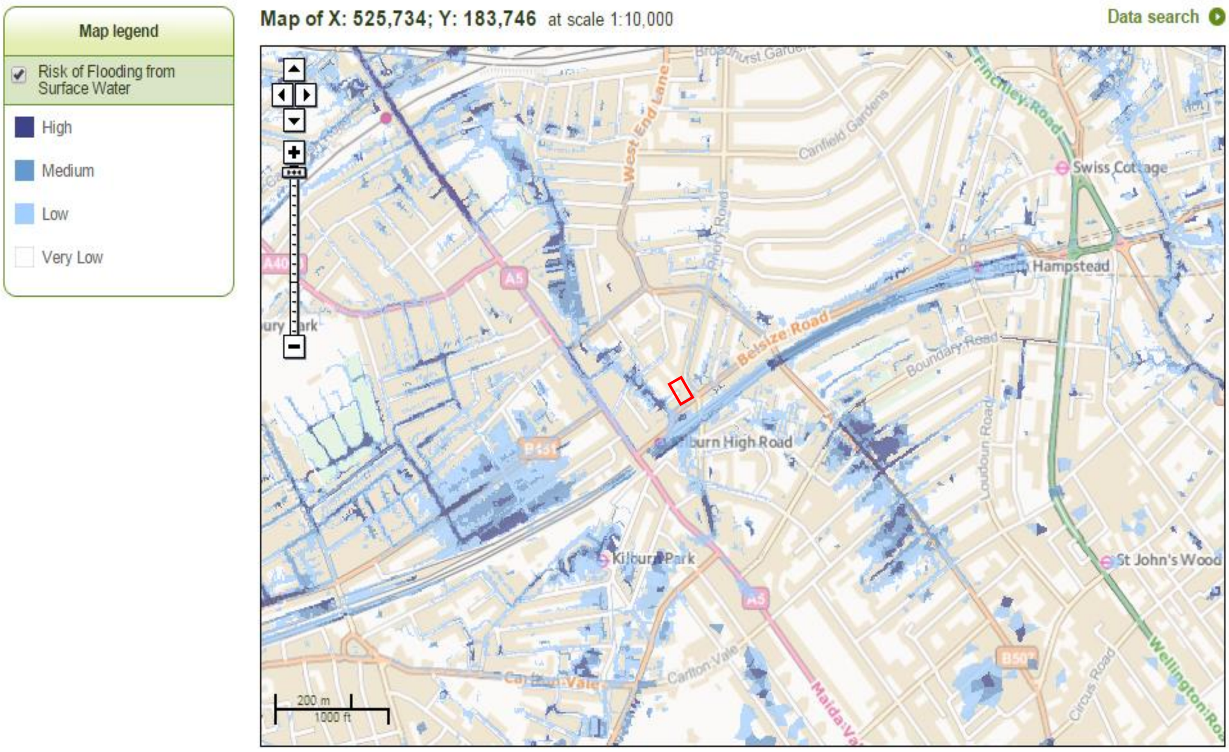
Table 4 - Environment Agency Surface Water Risk Categories

Environment Agency Surface Water Risk Category	Surface water flooding annual probability of occurrence
Very Low	Less than 0.1% (1 in 1,000 years)
Low	Between 1% and 0.1% (1 in 100 years and 1 in 1,000 years)
Medium	Between 1% and 3.3% (1 in 100 years and 1 in 30 years)
High	Greater than 3.3% (1 in 30 years)

This type of flooding can be difficult to predict as it is hard to forecast where or how much rain will fall in any storm. The Environment Agency's flood map indicates that the risk of surface water flooding to the site is low (Figure 10). The flood map is based on the best information available to them, such as ground levels and drainage assumptions.

The flood map for surface water as shown in Figure 8 identifies that there is a low risk of surface water flooding on Belsize Road and Priory Road at this location.

Figure 8- Surface Water Flood Risk Map (EA website)



4.7. Drainage and Sewage Infrastructure

Flooding is often caused by excess surface water entering the drainage network causing sewers to surcharge. Thames Water, who are responsible for the management of urban drainage and sewerage within the District, maintain a DG5 register of sites affected by sewer flood incidents on a post code by post code basis.

Due to policy within Thames Water it is not possible to provide detailed locations of identified flooding areas at a street level. According to the 2008 SFRA, sewer flooding has been identified in the area. However it is important to note that previous sewer flood incidents do not indicate the current or future risk to the site as upgrade work could have been carried out to alleviate any issues or conversely in areas that have not experienced sewer flooding incidents the local drainage infrastructure could deteriorate leading to future flooding.

4.8. Climate Change

There is clear scientific evidence that global climate change is happening now. In the UK sea level has risen and more winter rain has fallen in intense wet spells over the past century. Seasonal rainfall is highly variable. It seems to have decreased in summer and increased in winter, although winter amounts changed little in the last 50 years. Some of the changes might reflect natural variation; however the broad trends are in line with projections from climate models.

Looking ahead, greenhouse gas (GHG) levels in the atmosphere are likely to cause higher winter rainfall in future. Past GHG emissions mean some climate change is inevitable in the next 20-30 years. Lower emissions could reduce the amount of climate change further into the future, but changes are still projected at least as far ahead as the 2080s.

The Department for Environment, Food and Rural Affairs FCDPAG3 Economic Appraisal Supplementary Note to Operating Authorities – Climate Change Impacts (October 2006) provided information on sensitivity ranges for peak rainfall intensities and peak river flows (Table 5). This report also provides information on net sea level rise relative to 1990 (Table 6).

Table 5 - Defra recommended national precautionary sensitivity ranges for peak rainfall intensities and peak river flows

Parameter	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak Rainfall Intensity	+5%	+10%	+20%	+30%
Peak River Flow	+10%	+20%		

On a more localised scale, if emissions follow a medium future scenario, UKCP09 projected changes by the 2050s relative to the recent past are:

- Winter precipitation increases of around 14% (very likely to be between 3 and 31%);
- Precipitation on the wettest day in winter up by around 14% (very unlikely to be more than 29%);
- Peak river flows in a typical catchment likely to increase between 8 and 16%.

Climate changes can affect local flood risk in several ways. Impacts will depend on local conditions and vulnerability. More wet winters and more rain falling in wet spells may increase river flooding. More intense rainfall causes more surface runoff, increasing localised flooding and erosion. In turn, this may increase pressure on drains, sewers and water quality. Storm intensity in summer could increase even in drier summers, so we need to be prepared for the unexpected. Drainage systems in the district have been modified to manage water levels and could help in adapting locally to some impacts of future climate on flooding, but may also need to be managed differently. Rising sea or river levels may also increase local flood risk inland or away from major rivers because of interactions with drains, sewers and smaller watercourses. Even small rises in sea level could add to very high tides so as to affect places a long way inland.

Table 6 - Defra recommended national precautionary sensitivity ranges for net sea level rises

Region	Net sea level rise (mm per year) relative to 1990			
	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
East of England, east midlands, London, south-east England (south of Flamborough Head)	4.0	8.5	12.0	15.0
South-west England	3.5	8.0	11.5	14.5
North-west England, north-east England (north of Flamborough Head)	2.5	7.0	10.0	13.0

According to the 2008 SFRA, climate change will result in an 18% increase in estimated damages due to surface water flooding. In addition, the total estimated properties at risk of surface water flooding and a flood depth above existing ground in excess of 150mm would increase by approximately 10%.

5.0 Mitigation Measures

5.1. Recommended Finished Floor Levels

In order to afford a level of protection against flooding it is normally recommended that finished floor levels are set a nominal 300mm above the 1 in 100 year fluvial flood (1% in any year); or the 1 in 200 year tidal flood (0.5% in any year) including an allowance for climate change. With no fluvial or tidal risk of flooding, this measure is not necessary. Raising finished floor levels above ground level would in normal circumstances reduce the risk of flooding from other sources such as drainage infrastructure flooding.

5.2. Basement Protection

This FRA considers how the basement can be made safe in the event of flooding and that the risks can be mitigated.

In order to avoid flooding in the basement of the proposed development various measures can be taken. Ideally, the basement should be tanked up to the existing finished floor level; this usually includes the installation of a membrane system and basement sump tank and pump to manage water ingress. A warning device can be fitted to the pump in the event of a failure of the pump.

The key to an effective basement are moisture control (a water-managed foundation system to drain rainwater and groundwater away from foundations), airtight construction (sealing all air leaks between the conditioned space and the outside prior to insulation installation) and complete insulation coverage (properly installing the correct insulation levels, making sure the insulation coverage is continuous and complete, and aligning the insulation barrier with the air barrier).

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6.0 Surface Water Runoff

The development will not increase the impermeable area at the site. This will not result in additional surface water run-off loading to the public sewer. However, in order to minimise the effect of the increased run-off downstream and to increase the aesthetic value of the site, the installation of SuDS should be incorporated to the development.

6.1. SuDS

Paragraph 1.3.2 from the SuDS manual (C697) discusses the SuDS 'management train' which is intended to mimic the natural catchment process as closely as possible. The hierarchy of techniques used to achieve the management train are shown below in Table 7.

Table 7 - Hierarchy of SuDS techniques

Technique	Description
Prevention	The use of good site design and housekeeping measures to prevent runoff and pollution (e.g. rainwater harvesting/reuse).
Source control	Control of runoff at or very near its source (e.g. soakaways, porous and pervious surfaces, green roofs).
Site control	Management of water in a local area or site (e.g. routing water to large soakaways, infiltration or detention basins)
Regional control	Management of runoff from a site or several sites (e.g. balancing ponds, wetlands).

There is an opportunity for the application of SuDS techniques:

Table 8 - Feasible SuDS techniques for the site

Technique	Issues	Feasible? Y/N
Prevention Good site design and housekeeping/rainwater harvesting/infiltration devices/education.	• The proposed development could utilise water butts for rainwater harvesting to reduce runoff. • Education to prospective owners about how to manage flood risk could be implemented.	Yes Yes
Source Control Porous and pervious materials/soakaways/green roof/infiltration trenches/disconnect downpipes to drain to lawns or infiltrate to soakaway.	• Ground testing has not been conducted at the site and consequently the potential for infiltration SuDS is unknown. The underlying geology suggests this may not be feasible. • Green roofs may be possible dependant in design constraints.	Possibly, subject to infiltration tests. Yes
Site and Regional Control Infiltration/detention basins/ balancing ponds/ wetlands/swales/retention ponds.	• Ground testing has not been conducted at the site and consequently the potential for infiltration SuDS is unknown. The underlying geology suggests this may not be feasible. • There is sufficient room at the site for an attenuation pond/tank to be accommodated.	Possibly, subject to infiltration tests. No

Whilst there will be no increase in impermeable area, there are several SuDS features that could potentially be employed in the final design layout.

6.2. Attenuation – Storage Requirements

The local Council's planning policy suggests that all new developments should be ideally able to provide attenuation/storage to any possible extent (depending on the site's layout) in respect of surface water runoff. The proposed development will have an impermeable area of 110m^2.

Since the nature of the development (residential) does not promote polluted runoff, one treatment stage in the SuDS management train should be sufficient. This first stage could be the use of filter drains or the use of a small vegetated attenuation pond (10-20m^2). These features will decrease the presence of pollutants related to roofs and ensure that the outflow water quality is of innocuous standard.

Using the IH124 method, the attenuation/storage volume (987.98m^3/ha; 10.86m^3 for the 110m^2 proposed building footprint) along with the greenfield runoff rate (16.33 l/s/ha – 1 in 100 plus climate change storm) in respect of the site were calculated (Appendix B); the greenfield runoff rate for the site (1:100 +CC) is 0.18l/s. This is in line with the Defra report SC030219, "Rainfall Runoff Management for Developments" (2013). According to the calculations, the proposed development will require storage/attenuation which can be expressed as 0.098 (m^3/m^2). This gives a guideline value as to how much surface water should be attenuated per square meter of impermeable area at site level. The total storage required for the site is 10.78m^3. This can be accommodated by a pond with a plan area of 11m^2 and a depth of 1m. Since the area is not suitable for infiltration SuDS this option seems to be feasible. If there is not enough space to accommodate a pond other measures should be employed to control stormwater runoff, such as an underground tank (ideally in combination with a green roof).

The surface water runoff should discharge to the public sewer at a controlled 5l/s rate to minimise flood risk downstream. This can be achieved by using appropriate flow control devices at the outlet of the pond/underground tank such as a hydro-brake flow control chamber.

7.0 Conclusion

The proposed development at 228 Belsize Road London NW6 4BT, is located within Flood Zone 1 (low probability flooding; 0.1% annual probability) as described in Table 1 of the Planning Practice Guidance to the National Planning Policy Framework. Due to the site being located in a critical drainage area (Group3_005), a flood risk assessment is required to be submitted to the local planning authority.

Planning consent is sought for the demolition of the existing single storey structure and re-development of a three-storey plus basement building, along with provision of an A3 unit at ground and basement levels and four flats over the first and second floors. There will be no change in impermeable area as a result of the proposed development.

The existing understanding of flood risk is based on all available information and data from the relevant SWMP, SFRA and the EA flood maps.

On the basis of the findings in respect of this proposed development, it is concluded that the site is at low risk of flooding from all sources.

There is no proposed increase in hard-standing and consequently no increase in surface water runoff. There is the potential for implementation of suitable SuDS at the site to improve water quality due to the nature of the proposed development. These should be considered as they would provide an improvement to the existing situation.

It can be concluded that the proposed development is suitable at this location, at low risk of flooding from all sources and will not impact on flood risk elsewhere.

8.0 Recommendations

- Surface water should ideally be managed by SuDS techniques in order to promote sustainability, amenity, and bio-diversity. Use of SuDS to manage surface water should be examined and incorporated into the design where possible as outlined in Chapter 6.0.

- Consideration should be given to the use of permeable access roads and footpaths so that they allow surface water to flow into the ground and mimic the natural surface water flow path provided that the infiltration test demonstrates efficient soil permeability.

Appendix A Development Proposals

Resilience and Flood Risk

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Resilience and Flood Risk

Appendix B Surface Water Storage Calculations

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