INLAND HOMES LTD

HILLINGDON GARDENS

Flood Risk Assessment

September 2019

Rev C

icis design limited
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Hillingdon Gardens

Contents

Appendices

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1.0 Executive Summary

ICIS Design Limited have been commissioned to prepare a Flood Risk Assessment (FRA) for a new residential; commercial; and retail development at Former Master Brewer Site, Freezeland Way, Hillingdon, London UB10 9PQ, which is in the London Borough of Hillingdon (LBH).

The development site located within a commercial and residential area; is approximately 2km north-east of Uxbridge town centre; 300m south east of Hillingdon train station; and is bound by the A40 Western Avenue to the north; undeveloped land to the east; Freezeland Way to the south; and Long Lane to the west. The existing site is currently unoccupied, following the demolition of a motel building which had associated hard standing and soft landscaping areas.

The proposed development is "Construction of a residential-led, mixed-use development comprising buildings of between 2 and 11 storeys containing 514 units (Use Class C3); flexible commercial units (Use Class B1/A1/A3/D1); associated car (164 spaces) and cycle parking spaces; refuse and bicycle stores; hard and soft landscaping including a new central space, greenspaces, new pedestrian links; biodiversity enhancement; associated highways infrastructure; plant; and other associated ancillary development."

This Flood Risk Assessment (FRA) has been prepared to the requirements of the National Planning Policy Framework (NPPF) Paragraphs 149-150 and 155-165, and the National Planning Practice Guidance (NPPG), which still sets out the guidance for preparation of site specific FRA's and reducing flood risk in general by using sustainable drainage systems (SuDS).

The FRA has also been prepared to the requirements of the local planning policies of the London Plan (2016) Policies 5.12 and 5.13; The London Plan (Draft Version 2019); Greater London Authority: Sustainable Design and Construction Supplementary Planning Guidance – Mayor of London (2014); and LBH Preliminary Flood Risk Assessment (May 2011); LBH Local Planning Policy LPP1 (2012) Policy EM6; LBH Local Planning Policy LPP2 (Main Modification 2019) Policy DMEI 9.

The Flood Map (Risk of Flooding from Rivers and Sea) sourced from the Environment Agency and LBH Preliminary flood risk assessment identifies that all of the development site lies within Flood Zone 1, which is a low probability of flooding (less than 1 in 1000 annual probability of river or sea flooding in any year).

The proposed development buildings are to be used for retail; commercial and residential purposes at ground floor level, which in accordance with Table 2 of the NPPF is classified as 'Less and More Vulnerable'. Table 3 of the NPPF identifies that is a site is within Flood Zone 1, and is classed as 'Less and / or More Vulnerable', then it is appropriate for development, and an exception will not be required.

An assessment of all potential sources of flood risk has been carried out including fluvial; coastal; pluvial; drains and sewers, groundwater; overland surface water; and artificial sources. It is considered that there is a low risk of flooding to the site from these sources, without any flood reliance / flood resistance measures in place.

Safe access and egress has been considered for the development with the site being suitable for safe access and egress to be gained.

2.0 Introduction

ICIS Design Limited have been commissioned to prepare a Flood Risk Assessment (FRA) for a new residential; commercial; and retail development at Former Master Brewer Site, Freezeland Way, Hillingdon, London UB10 9PQ, which is in the London Borough of Hillingdon (LBH).

The proposed development is the construction of a residential-led, mixed-use development comprising of buildings to provide homes; retail floor space; and commercial floor space, as well as associated car and cycle parking, hard and soft landscaping, and planting areas.

The development site is located approximately 2km north-east of Uxbridge town centre; 300m south east of Hillingdon train station; and is bound by the A40 Western Avenue to the north; undeveloped land to the east; Freezeland Way to the south; and Long Lane the west.

The development site has been identified to be in Flood Zone 1, but as the total area of the development is over 1 hectare a Flood Risk Assessment (FRA) is required.

The EA and LBH need to be satisfied that the granting of planning permission will address the risk of flooding to the development site and that the proposals will not in turn increase the risk of flooding to neighbouring land and property.

This Flood Risk Assessment (FRA) has been prepared to the requirements of the National Planning Policy Framework (NPPF) Paragraphs 149-150 and 155-165, and the National Planning Practice Guidance (NPPG), which still sets out the guidance for preparation of site specific FRA's and reducing flood risk in general by using sustainable drainage systems (SuDS).

The FRA has also been prepared to the requirements of the local planning policies of the London Plan (2016) Policies 5.12 and 5.13; The London Plan (Draft Version 2019); Greater London Authority: Sustainable Design and Construction Supplementary Planning Guidance – Mayor of London (2014); and LBH Preliminary Flood Risk Assessment (May 2011); LBH Local Planning Policy LPP1 (2012) Policy EM6; LBH Local Planning Policy LPP2 (Main Modification 2019) Policy DMEI 9.

The FRA will also propose flood resistance / flood resilience measures to mitigate against flooding from any source, if found necessary.

The report will also look at a surface water drainage strategy for the proposed new development (further document prepared by ICIS Design Limited, and to be read in conjunction with this FRA) to establish constraints and design requirements and to promote the use of sustainable drainage systems (SuDS).

The surface water management strategy will demonstrate a scheme of SuDS which will be achieved as part of the development in accordance with the Ministerial Statement dated 18th December, which sets out the government policy to SuDS schemes; the NPPF; The London Plan Paragraph 5.13; and Supplementary Planning Guidance (SPG) produced by the Greater London Authority.

This Flood Risk Assessment has therefore been prepared in order to identify and evaluate the various possible sources of flood risk, to which the proposed site might be subjected to, and identify any mitigation; protection; or compensation measures deemed necessary or feasible.

3.0 Existing and Proposed Site

Site Location

The proposed development is located at Former Master Brewer Site, Freezeland Way, Hillingdon, London UB10 9PQ, which is in the London Borough of Hillingdon (LBH).

The development site is located within a commercial and residential area; is approximately 2km north-east of Uxbridge town centre; 300m south east of Hillingdon train station; and is bound by the A40 Western Avenue to the north; undeveloped land to the east; Freezeland Way to the south; and Long Lane the west.

The OS coordinates for the centre of the site are - E: 507770, N: 184901.

Existing Site Description

The site is 2.53 ha in area, and the existing site is currently vacant with vegetation growth across the entire site area.

The development site was previously occupied by a motel building with associated hard standing and soft landscaping areas.

Proposed Development

The proposed site plans are shown in Appendix A, with a full description of the development site being stated by the Architect. In brief, and in relation to this FRA, the proposal is:

"Construction of a residential-led, mixed-use development comprising buildings of between 2 and 11 storeys containing 514 units (Use Class C3); flexible commercial units (Use Class B1/A1/A3/D1); associated car (164 spaces) and cycle parking spaces; refuse and bicycle stores; hard and soft landscaping including a new central space, greenspaces, new pedestrian links; biodiversity enhancement; associated highways infrastructure; plant; and other associated ancillary development."

Site Topography

Details of the topography can be found in Appendix B.

The site has a general fall from west to east with the highest point of the development site being to the south west corner at approximately 36.04m AOD, and the lowest point of the development site being along the east boundary at an approximate level of 34.04m AOD.

There are notable low-lying areas within the centre of the site which are believed to be around the perimeter of the former motel building at approximate general level of 34.50m AOD.

Watercourses / Rivers / Estuary / Canals

There are no watercourses, rivers, estuaries or canals within the direct vicinity of the development site.

The nearest watercourse to the site is the Yeading Brook which is approximately 650m to the east, and the nearest river is the River Pinn which is approximately 750m to the west.

Ground Conditions

A ground investigation report was produced by Delta-Simons in June 2015 that states that the:

Ground conditions either comprised of Made Ground consisting of tarmac/concrete over sandy gravel to depths between 0.3 m and 0.9 m below ground level (bgl), or Made Ground comprising grass overlying sandy gravelly clay (Topsoil) to depths of between 0.3 m bgl and 0.6 m bgl. These all overlay possible Weathered London Clay comprising predominantly firm to stiff, occasionally silty clay to depths between 1.7 m and 3.5 m bgl, overlying firm to stiff, multi-coloured clays of the Woolwich and Reading Beds (Upper Mottled Beds) to depth between 9.5 m and 16.2 m bgl, overlying Woolwich and Reading Beds (Laminated Beds) comprising firm brown laminated clay and slightly clayey sand layers proven to a maximum depth of 20.0 m bgl.

Resting groundwater levels recorded during the return monitoring visits were between 0.90 m and 2.36 m bgl, considered representative of confined groundwater struck within the Laminated Beds.

Existing On-Site Drainage

Topographical survey information (Appendix B) has identified foul and surface water drainage within the development site boundary. The surface water network runs around the perimeter of the previous motel building and consists of 150mm to 225mm pipes, with approximate depths of between 1.0m to 1.5m. The discharge point of the surface water sewer is unknown, but it is believed to discharge to a pump station located to the south west of the site (adjacent to Freezeland Way).

Thames Water Assets and Survey

The Thames Water Asset records and CCTV drainage survey of the sewers (Appendix C) show that the nearest sewers to the site are surface and foul water sewers within Long Lane (west of site) and Freezeland Way (south of site).

The surface water sewers directly adjacent to the site are in Freezeland Way, and consist of a 1000mm diameter surface water sewer running in a west to east direction, at an approximate depth of 3.40m deep (approximate invert level of 32.64m AOD); a 300mm diameter surface water sewer also running in a west to east direction, at an approximate depth of 1.40m deep (approximate invert level of 34.05m AOD); and a 600mm – 750mm diameter foul water sewer again running in a west to east direction at an approximate depth of 4.50m (approximately invert level of 30.79m AOD).

4.0 Environment Agency Flood Maps

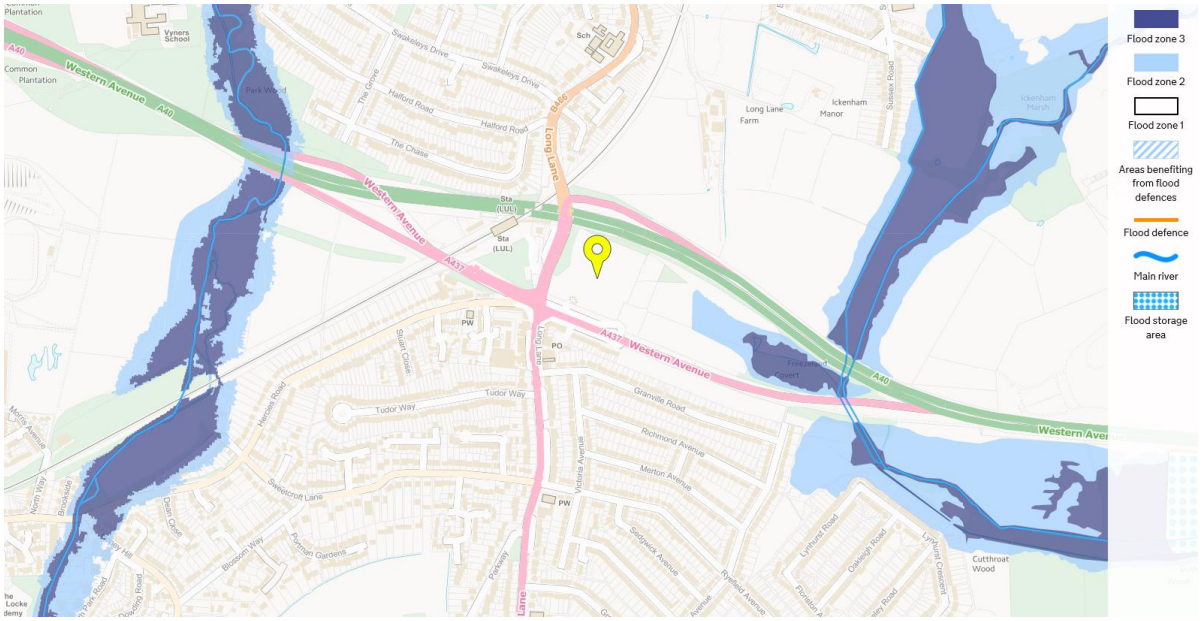


Figure 1 – EA Flood Map

The Flood Map (Risk of Flooding from Rivers and Sea) on the EA website (see Figure 1) identifies that fluvial flooding occurs from the Yeading Brook (east of development), and the River Penn (west of development). These flood areas are not in the development location, and therefore the development site lies within Flood Zone 1.

Sites within Flood Zone 1 are deemed to have a low probability of flooding (less than 1 in 1000 annual probability of river or sea flooding in any year).

5.0 National and Local Planning Policies

This site-specific flood risk assessment has been prepared to the requirements set out in the national and local planning guidance.

National Planning Policy Framework and the National Planning Practice Guidance

NPPF 2019 set out the Government's national policy on development and flood risk, and seeks to provide clarity on what is required at regional and local levels, to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk.

NPPF Paragraphs 149 to 150 provide guidance for developments for the plans to take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk.

NPPF Paragraphs 155 to 165 provides guidance for planning and flood risk, where are plans should apply a sequential, risk-based approach to the location of development taking into account current and future impacts of climate change; to ensure that flood risk is not increased elsewhere due to the development; and to incorporate sustainable drainage systems.

NPPG, Paragraph 030, outlines that the objectives of this FRA are to establish whether a proposed development is likely to be affected by current or future flooding from any source; whether it will increase flood risk elsewhere; whether the measures proposed to deal with these effects and risks are appropriate; whether the evidence for the local planning authority to apply (if necessary) the Sequential Test; and whether the development will be safe and pass the Exception Test, if applicable.

Flood Water Management Act

The Flood and Water Management Act takes forward some of the proposals from three previous strategy documents published by the UK Government - Future Water (2008), Making Space for Water (2008) and the UK Government's response to the Sir Michael Pitt's Review of the summer 2007 floods. In doing so it gives the EA a strategic overview role for flood risk, and gives local authorities responsibility for preparing and putting in place strategies for managing flood risk from groundwater, surface water and ordinary watercourses in their areas.

Hillingdon Gardens

London Plan (2016)

The London Plan Policy 5.12 and 5.13 state:

POLICY 5.12 FLOOD RISK MANAGEMENT

Strategic

A The Mayor will work with all relevant agencies including the Environment Agency to address current and future flood issues and minimise risks in a sustainable and cost effective way.

Planning decisions

B Development proposals must comply with the flood risk assessment and management requirements set out in the NPPF and the associated technical Guidance on flood risk[1] over the lifetime of the development and have regard to measures proposed in Thames Estuary 2100 (TE2100 – see paragraph 5.55) and Catchment Flood Management Plans.

C Developments which are required to pass the Exceptions Test set out in the NPPF and the Technical Guidance will need to address flood resilient design and emergency planning by demonstrating that:

- a the development will remain safe and operational under flood conditions
- b a strategy of either safe evacuation and/or safely remaining in the building is followed under flood conditions
- c key services including electricity, water etc will continue to be provided under flood conditions
- d buildings are designed for quick recovery following a flood.

D Development adjacent to flood defences will be required to protect the integrity of existing flood defences and wherever possible should aim to be set back from the banks of watercourses and those defences to allow their management, maintenance and upgrading to be undertaken in a sustainable and cost effective way.

LDF preparation

E In line with the NPPF and the Technical Guidance, boroughs should, when preparing LDFs, utilise Strategic Flood Risk Assessments to identify areas where particular flood risk issues exist and develop actions and policy approaches aimed at reducing these risks, particularly through redevelopment of sites at risk of flooding and identifying specific opportunities for flood risk management measures.

POLICY 5.13 SUSTAINABLE DRAINAGE

Planning decisions

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.

LDF preparation

B Within LDFs boroughs should, in line with the Flood and Water Management Act 2010, utilise Surface Water Management Plans to identify areas where there are particular surface water management issues and develop actions and policy approaches aimed at reducing these risks.

Supplementary Planning Guidance

Sustainable Design and Construction Supplementary Planning Guidance (SPG) produced by the Greater London Authority offers recommendations for developers. Clauses 3.4.2, 3.4.12 and 3.4.14 set out the expectation of SuDS to be incorporated into the design of new developments to prevent increasing volumes of surface water runoff and reduce flood risk.

LBH – Preliminary Flood Risk Assessment

The London Borough of Hillingdon Preliminary Flood Risk Assessment (PFRA) process is aimed at providing a high-level overview of flood risk from all sources within a local area, including consideration of surface water, groundwater, ordinary watercourses and canals. The London Borough of Hillingdon was required to submit their PFRA to the Environment Agency for review by 22nd June 2011. The PFRA was produced as part of a coordinated programme of work across Greater London facilitated by the Drain London Forum and the GLA. The methodology for producing the PFRA is consistent with other London Boroughs and has been based on the Environment Agency's Final PFRA Guidance and Defra's Guidance on selecting Flood Risk Areas, both published in December 2010.

6.0 NPPF - Flood Risk and Vulnerability

The NPPG Paragraphs 065 to 067 sets out the flood risk for a site by assessing the flood zones, flood risk vulnerability classification, and flood risk vulnerability and flood zone 'compatibility'.

Flood Zones

NPPG Paragraph 065, Table 1 indicates that the flood zones are:

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

Table 1

As stated, and shown above, the flood map (risk of flooding from rivers and sea) on the EA website (see Figure 1) suggests that the development site lies within Flood Zone 1.

Sites within Flood Zone 1 are deemed to have a low probability of flooding (less than 1 in 1000 annual probability of river or sea flooding in any year).

Hillingdon Gardens

Flood Risk Vulnerability Classification

NPPG Paragraph 066, Table 2 stated the flood risk vulnerability classifications as:

Table 2 - Flood Risk Vulnerability Classification
Essential Infrastructure • Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. • Wind turbines.
Highly Vulnerable • Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent • (http://planningguidance.communities.gov.uk/blog/guidance/hazardous-substances/planning-for-hazardous-substances/). (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as 'Essential Infrastructure').
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 and hotels.** • Non–residential uses for health services, nurseries and educational establishments. • Landfill* and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less Vulnerable • Police, ambulance and fire stations which are not required to be operational during flooding. • **Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'More Vulnerable' class; 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 working). • Water treatment works which do not need to remain operational during times of flood.

Table 2

Hillingdon Gardens

In accordance with NPPG Paragraph 066 Table 2, the proposed buildings with retail and commercial areas at ground floor are classed as 'Less Vulnerable', and the proposed buildings within the development that will comprise of the residential units being classed as 'More Vulnerable'.

Flood Risk Vulnerability and Flood Zone 'Compatibility'

NPPG Paragraph 067 Table 3, gives guidance on flood risk vulnerability compared with flood zone, to determine the compatibility.

NPPG – Flood Risk Vulnerability and Flood Zone 'Compatibility'					
Flood Zones	**Flood Risk Vulnerability Classification**				
	Essential Infrastructure	Highly Vulnerable	**More Vulnerable**	**Less Vulnerable**	Water Compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	† Exception Test required	X	Exception Test required	✓	✓
Zone 3b*	* Exception Test required	X	X	X	✓*

Table 3

The development site is in Flood Zone 1 and is classed as 'Less Vulnerable' and 'More Vulnerable', therefore according to NPPG Paragraph 067 Table 3, the site is appropriate for development. Full details of the flood zones are detailed in Sections 9; 10 and 11 of this report.

7.0 The Sequential Test and Exception Test

Sequential and Exception Test Guidance

The Sequential Test is a risk-based test that should be applied at all stages of development and aims to steer new development to areas with the lowest probability of flooding (Zone 1). This is applied by the Local Authority by means of a Strategic Flood Risk Assessment (SFRA) / LBH Preliminary Flood Risk Assessment.

Furthermore, large sites partially affected by Flood Zones 2 and 3 should be developed sequentially, placing the most vulnerable land uses in the areas with lowest risk of flooding.

The SFRA may require the Exception Test to be applied to certain forms of new development. The test considers the vulnerability of the new development to flood risk and, to be passed, must demonstrate:

There are sustainability benefits that outweigh flood risk. It is on previously developed land or there are no other reasonably developable sites.

Sequential and Exception Test Requirement for Development

The new development site is located within Flood Zone 1, and therefore has the lowest probability of flooding.

This site will not require a sequential or exception test as it is in Flood Zone 1, and in accordance with NPPG guidelines, is classed as an appropriate development.

8.0 Sources of Flooding

In accordance with the NPPF, flood risk must be assessed for all sources of flooding and development of the site should be carried out in such a way as to mitigate any potential flood risk to both the site and third parties and their property. This section identifies all possible sources of flooding.

Fluvial Flooding

Fluvial flooding results from watercourses / rivers surcharging and flooding the surrounding areas.

Coastal Flooding

Coastal flooding results from high tides from the sea.

Pluvial Flooding

'Pluvial' flooding is that which results from rainfall generated overland flow before the run-off enters any watercourse, drain or sewer. It is more often linked to high intensity rainfall events (typically in excess of 30mm per hour). However, it can also result from lower intensity rainfall or melting snow where the ground is saturated, frozen, developed or has low permeability. This results in overland flow and ponding in depressions in the topography. In urban areas 'pluvial' flows are likely to follow the routes of highways and other surface connectivity to low spots where flooding can occur. In some cases, it can deviate from this route into adjacent developments via dropped kerbs (either for access to driveways or disability access).

Groundwater Flooding

Groundwater flooding is caused by the emergence of water from sub-surface permeable strata. Fluctuations in the groundwater table can cause flooding should the table rise above the existing ground level. Groundwater flooding events tend to have long durations, lasting days or weeks.

Flooding from Drains and Sewers

Flooding from drains and sewers is caused when the capacity of the drains and sewers is exceeded, and will result in flooding from the manholes.

Canals, Reservoirs and Other Artificial Sources

Flooding from canals, reservoirs and artificial sources is caused when the capacity of the sources are exceeded, or if there is an infrastructure failure.

9.0 Envirocheck Data Maps

Flood map data has been produced by Landmark Envirocheck, which details flood information gathered from several parties to show the flood extent within the site from various flood sources. Details of the flood maps can be found in Appendix D, and a summary of which are as follows:

Flood Data Map

The Envirocheck (EA/NRW) Flood Data Map identifies that the site lies within Flood Zone 1.

Pluvial, Fluvial and Coastal Flooding

The Envirocheck (JBA) 75-year return period flood map indicates that there is no fluvial flooding or coastal flooding within the site, but pluvial flooding occurs within the low-lying central areas of the site to a depth of up to 0.1m.

The Envirocheck (JBA) 100-year return period flood map indicates that there is no fluvial flooding or coastal flooding within the site.

The Envirocheck (JBA) 200-year return period flood map indicates that there is no fluvial flooding or coastal flooding within the site, but pluvial flooding occurs within the low-lying central areas of the site to a depth of between 0.1m and 0.30m.

The Envirocheck (JBA) 1000-year return period flood map indicates that there is no fluvial flooding or coastal flooding within the site, but pluvial flooding occurs within the low-lying central areas of the site to a depth of between 0.1m and 0.30m.

Canal Failure

The Envirocheck (JBA) canal failure map indicates that there are no canals and no flooding from canals within the vicinity of the site.

Surface Water / Pluvial Flood Depths

The Envirocheck (EA/NRW) 30-year return period flood map indicates that there is no surface water / pluvial flooding within the development site.

The Envirocheck (EA/NRW) 100-year return period flood map indicates that there is no surface water / pluvial flooding within the development site.

The Envirocheck (EA/NRW) 1000-year return period flood map indicates that there is a surface water / pluvial flood depth of between 0.1m to 0.30m within the low-lying central areas of the site.

Surface Water Flood Velocities and Flow Direction

The Envirocheck (EA/NRW) 30-year return period flood map indicates that there is no surface water flood velocity within the development site boundary.

The Envirocheck (EA/NRW) 100-year return period flood map indicates that there is no surface water flood velocity within the development site boundary.

Hillingdon Gardens

The Envirocheck (EA/NRW) 1000-year return period flood map indicates that there is a surface water flood velocity of between 0.00 m/s and 0.25 m/s in the central areas of the site where the pluvial / surface water flooding occurs.

Hazard Rating

The Envirocheck (EA/NRW) 30-year return period flood map indicates that there is no surface water hazard rating within the development site.

The Envirocheck (EA/NRW) 100-year return period flood map indicates that there is no surface water hazard rating within the development site.

The Envirocheck (EA/NRW) 1000-year return period flood map indicates that there is a low surface water hazard rating in the central areas of the site where the pluvial / surface water flooding occurs.

The areas of pluvial / surface water flooding; flow velocities; and hazard rating are consistent with the low-lying / areas of depression shown on topographical survey. Pluvial / surface water flooding areas are isolated within the development site, with no flooding encroaching onto the site from outside the site boundary.

It is deemed that 'ponding' of the rainwater occurs in these low-lying areas only, and it is not caused by overland flow outside the development boundary. Therefore, levels within the site can be such that this does not occur for the post development site.

Historic Flood Map

The Envirocheck historic flood map indicates that there has been no flooding within the site or any areas within the vicinity of the development site, with the nearest historical flooding being from the River Pinn (750m from development) due to the exceedance of the channel capacity.

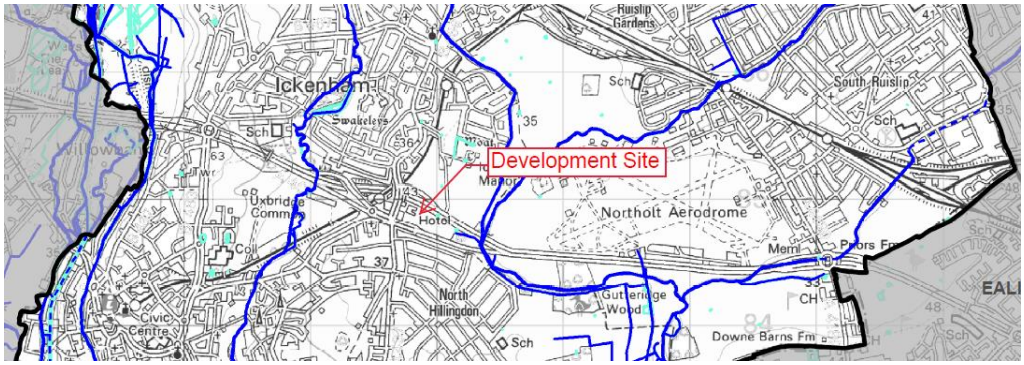
Ground Water Flooding

The Envirocheck / BGS flood data map indicates that there is limited potential for ground water flooding at surface for the majority of the site area.

The Envirocheck / ESI flood data map indicates that there is a negligible risk of flooding at the site location.

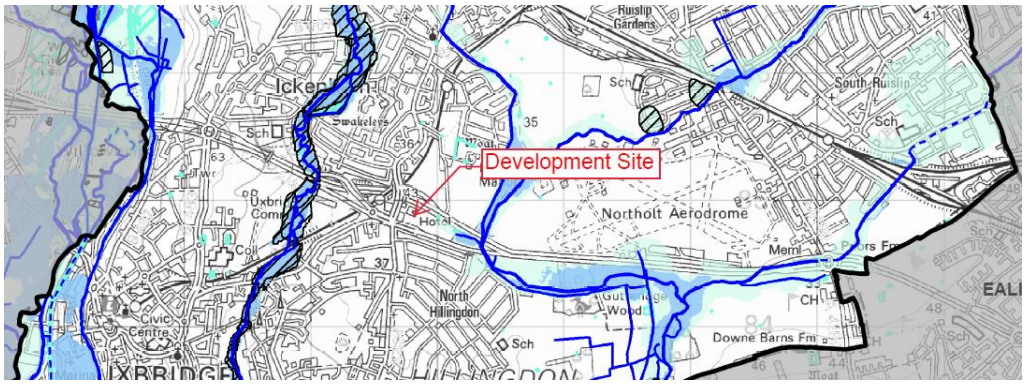
10.0 LBH Flood Data Maps

The LBH - PFRA identifies specific areas within the borough that have the potential to be affected by flooding in a series of flood maps. The flood map produced by LBH and the flood risk affecting the development site are as follows:



Extract from LBH PFRA Figure A-1.1 – Summary Map of Past Floods – Surface Water Incidents.

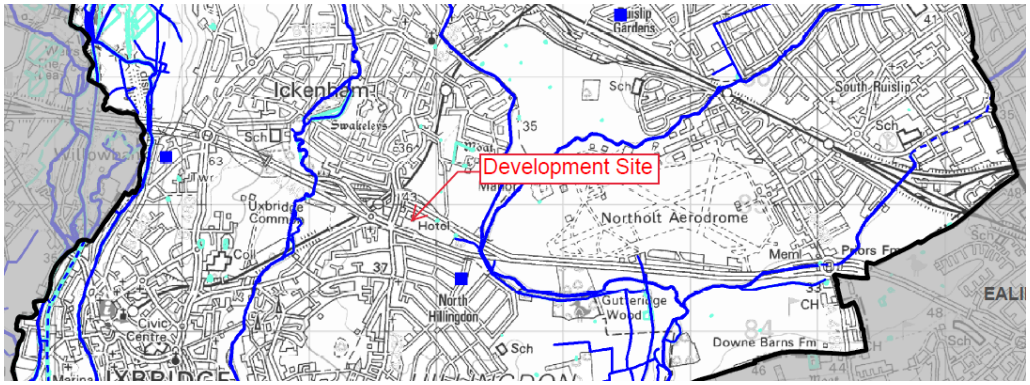
Figure A-1.1 identifies that there has been no past flood or surface water incidents at the development site.



Extract from LBH PFRA Figure A-2.1 – Summary Map of Past Floods – Main River / Fluvial / Tidal Incidents.

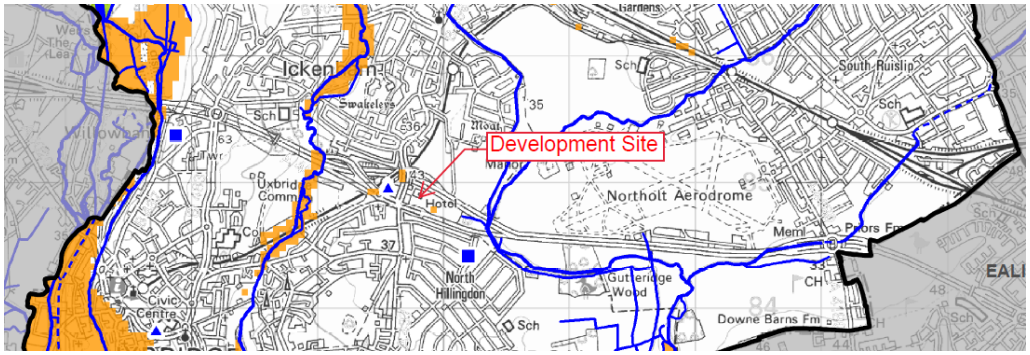
Figure A-2.1 identifies that there has been no past main river; fluvial; or tidal incidents flooding at the development site.

Hillingdon Gardens



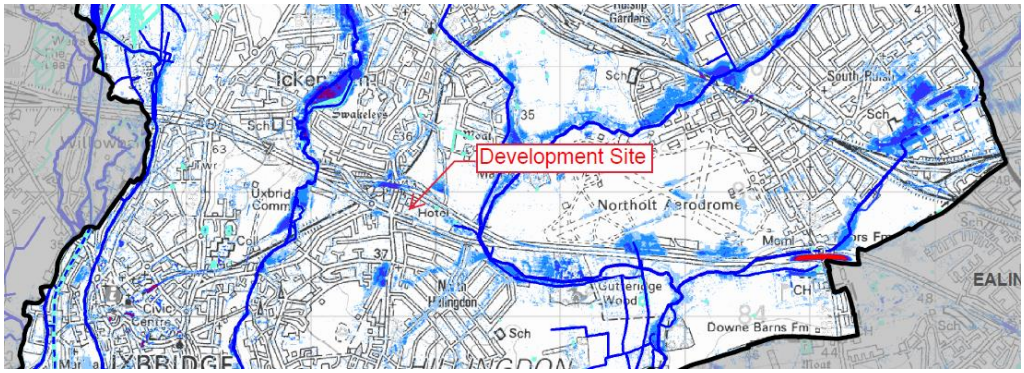
Extract from LBH PFRA Figure A-3.1 – Summary Map of Past Floods – Ground Water Incidents.

Figure A-3.1 identifies that there has been no past ground water flooding at the development site.



Extract from LBH PFRA Figure A-5.1 – Increased Potential for Elevated Ground Water Map.

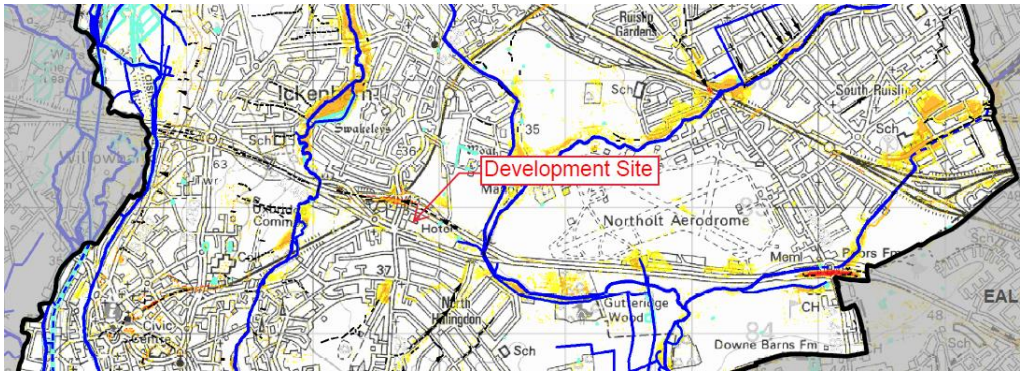
Figure A-5.1 identifies that the development site is not in an area of increased potential for ground water flooding.



Extract from LBH PFRA Figure B-1.1 – Surface Water Depth – 1 in 200 chance of rainfall event occurring in any given year.

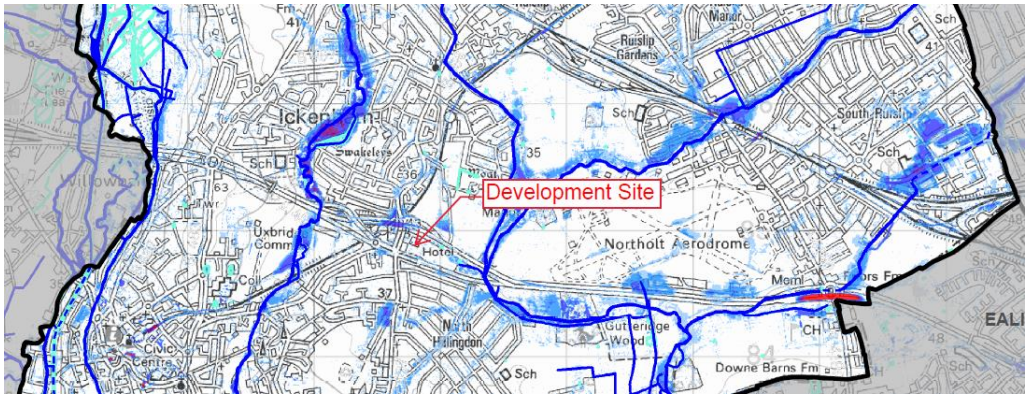
Figure B-1.1 identifies that the site will have a rainwater flood depth of between 0.1m and 0.25m within the low-lying areas of development, which is consistent with other data maps.

Hillingdon Gardens



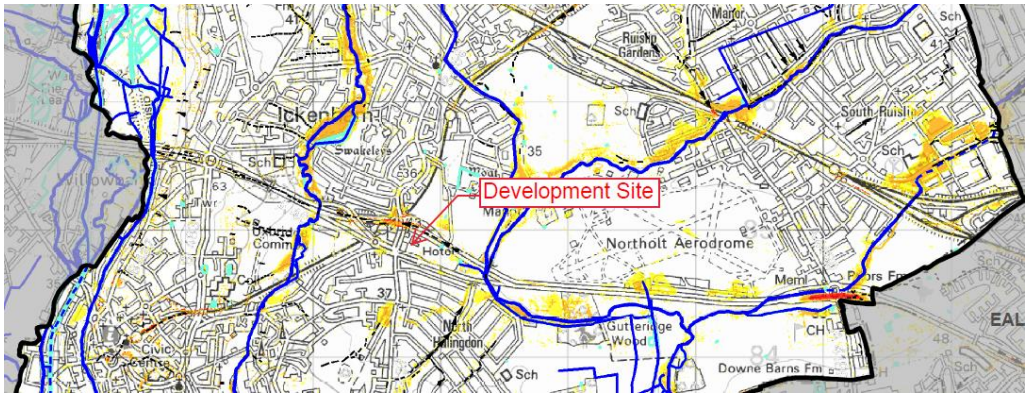
Extract from LBH PFRA Figure B-2.1 – Surface water flood hazard rating – 1 in 200 chance of rainfall event occurring in any given year.

Figure B-2.1 identifies that there will be no flood hazard within the development site for a 1 in 200 chance of rainfall event.



Extract from LBH PFRA Figure B-3.1 – Surface Water Depth – 1 in 100 plus climate change chance of rainfall event occurring in any given year.

Figure B-3.1 identifies that the site will have a rainwater flood depth of between 0.1m and 0.25m within the low-lying areas of development, which is consistent with other data maps.



Extract from LBH PFRA Figure B-4.1 – Surface water flood hazard rating – 1 in 100 plus climate change chance of rainfall event occurring in any given year.

Figure B-4.1 identifies that there will be no flood hazard within the development site for a 1 in 100 plus climate chance of rainfall event.

11.0 Probability of Flooding

Now that the sources of flooding are known, an assessment is to be made of the probability of flooding from each of the sources to the development.

Fluvial Flooding
Flood Probability - Low

The EA map; Envirocheck data map; and LBH data shows that all the site lies within Flood Zone 1.

There are no watercourses or rivers within the direct vicinity of the site, with the nearest watercourse being the Yeading Brook which is approximately 650m to the east, and the nearest river is the River Pinn which is approximately 750m to the west.

Based on the flood map data, the probability of fluvial flooding for the development site is deemed to be low.

Pluvial Flooding
Flood Probability - Low

The Envirocheck and LBH – PFRA data indicates that there is no pluvial flooding within the development site for up to the 1 in 100 annual probability storm event, and pluvial flood depths within the central areas of the site up to 0.25m for up to the 1 in 200 annual probability storm event, and 0.30m for up to the 1 in 1000 annual probability storm event.

The areas of pluvial / surface water flooding; flow velocities; and hazard rating are consistent with the low-lying / areas of depression shown on topographical survey. Pluvial / surface water flooding areas are isolated within the development site, with no flooding encroaching onto the site from outside the site boundary.

It is deemed that 'ponding' of the rainwater occurs in these low-lying areas only, and it not caused by overland flow outside the development boundary.

The finished floor levels of the new buildings, and the access routes to the buildings will be at least 300mm above the general low-lying levels of the site, and therefore will be greater than the anticipated 1 in 1000 annual probability storm event flood level.

As pluvial flooding only occurs for the 1 in 200 and 1 in 1000 annual probability storm event, and the finished floor levels and access routes will be raised to 300mm above the general level of the low-lying areas of the site, the probability of pluvial flooding within the post development site is deemed to be low.

Groundwater Flooding
Flood Probability - Low

The Envirocheck / BGS flood data map there is limited potential for flooding at surface level; the Envirocheck / ESI flood data map indicates that there is a negligible risk of flooding; and the LBH – PFRA map indicated that the site is outside the elevated ground water area.

Therefore, based on this data it is deemed that the probability of ground water flooding for the development site is low.

Flooding from Drains and Sewers
Flood Probability - Low

The nearest drain and sewer is the Thames Water sewers are the surface water and foul water sewers within Freezeland Way that are directly south of the development site.

The historical flood map indicates that there has been no flooding from the drains and sewers. Thames Water have confirmed that the foul and surface water sewers have capacity in their system for the foul discharge, and restricted (greenfield) surface water run-off from the site, as stated in their letter on the 30th May 2017 (Appendix E).

Therefore, the probability of flooding from drains and sewers for the site is deemed to be low.

Canals, Reservoirs and Other Artificial Sources
Flood Probability - Low

There are no canals, reservoirs, or other artificial sources within the vicinity of the site.

Therefore, the probability of flooding from these sources is deemed to be low.

12.0 Safe Access / Egress and Hazards

When looking at the development and the potential sources of flooding, safe egress and access needs to be considered as well as the associated hazard.

Advice on safe egress and access and associated hazards from the site has been sought from the Defra / Environment Agency – Technical Report FD2320/TR2. The report states that:

New developments are required to provide safe access and exit during a flood and the measures by which this will be achieved should be clear in the Flood Risk Assessment (FRA). Safe access and exit is required to enable the evacuation of people from the development, provide the emergency services with access to the development during a flood and enable flood defence authorities to carry out any necessary duties during the period of flood.

A safe access or exit route is a route that is safe for use by occupiers without the intervention of the emergency services or others.

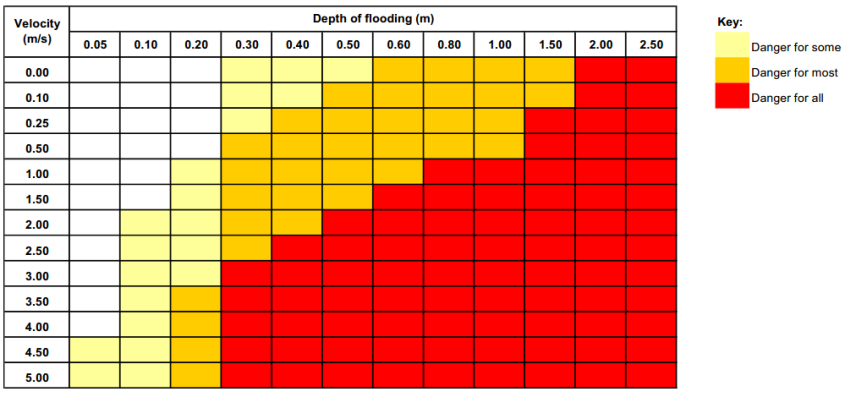
Safe routes should be identified both inside and beyond the boundary of the new development. Even where a new development is above the floodplain and considered acceptable with regard to its impact on flood flows and flood storage, it should be demonstrated that the routes to and from the development are also safe to use.

A route can only be completely safe in flood risk terms if it is dry at all times.

There are three levels of complexity in approach to ensuring safe egress and access. These are the simple approach, intermediate approach, and detailed approach.

The most appropriate for this site is the simple approach, as it is based on providing a dry route up to an acceptable flood level, and is for small developments with a relatively low risk of flooding.

The danger to people table (as below) in the technical report has also been reviewed, which states the danger levels in flood events depending upon the flood water levels and the velocity of the water.



The finished floor levels and access routes will be raised to 300mm above the general level of the low-lying areas of the site, which is greater than the 1 in 1000 annual probability storm event level.

Therefore, safe access and egress can be gained to and from the proposed buildings within the development.

13.0 Rainfall Intensity Increase (Climate Change)

The NPPF makes it a planning requirement to account for climate change in the proposed design. The recommended allowances are taken from the Environment Agency guidance (Table 2) summarised in Table 4 below.

Applies across all of England	Total change anticipated for the 2020's	Total change anticipated for the 2050's	Total change anticipated for the 2080's
Upper End	10%	20%	**40%**
Central	5%	10%	20%

The baseline year is 1961 to 1990. It is anticipated the life span of the proposed buildings will be approximately 80 years, and therefore will fall at least into the 2080's and will have rainfall intensity increase of 40%.

This increase in rainfall is to be taken into consideration for the surface water management of the proposed development site, to ensure that the probability of flooding remains low.

14.0 Surface Water Management Plan

Key design principles in the following guidance documents steer the approach to managing surface water runoff at the site:

- The London Plan Paragraph 5.13 (2015);
- Supplementary Planning Guidance (SPG) produced by the Greater London Authority;
- LBH – Preliminary Flood Risk Assessment;
- Building Regulations hierarchy of drainage (H3);
- Interim Code of Practice for SUDS;
- CIRIA best practice guidance, including the use of the 'SUDS management train';
- Flood and Water Management Act 2010 (Part 1 – Clause 27 (1));
- Flood and Water Management Act 2010 (Part 1 – Clause 9 (1));

This proposed surface water management will also adhere to the requirements of the National Planning Policy Framework (NPPF) Paragraphs 149-150 and 155-165, and the National Planning Practice Guidance (NPPG), which still sets out the guidance for preparation of site specific FRA's and reducing flood risk in general by using sustainable drainage systems (SuDS).

The surface water management strategy will demonstrate a scheme of SuDS which will be achieved as part of the development in accordance with the Defra – Non-statutory technical standards for sustainable drainage, March 2015 which sets out the government policy to SuDS schemes.

In particular, the surface water run-off is to be managed so it conforms to The London Plan (2016) Paragraph 5.13, and Sustainable Design and Construction Supplementary Planning Guidance (SPG) produced by the Greater London Authority, where:

- *Development should aim to deliver Greenfield runoff on Greenfield sites up to a 1 in 100-year storm event, considering climate change;*
- *Development should aim for a minimum reduction in surface water runoff rates of 50% for Brownfield sites, with an aim of reducing runoff to Greenfield rates up to a 1 in 100-year storm event, considering climate change;*
- *Development should be designed so that there is no flooding to the development in a 1 in 30-year event and so that there is no property flooding in a 1 in 100 year plus climate change event.*

The surface water management of the development site has aimed to meet the above requirements, as detailed in ICIS Design Ltd Surface Water Management (SuDS) report. The summary of the surface water management is as follows:

- All SuDS methods have been assessed to establish whether they are feasible for the development in order to reduce the surface water run-off to the preferred greenfield rate;
- Due to the nature of the site, and as well as the ground conditions, the use of wetlands, ponds, detention basins or infiltration devices are not feasible SuDS options for the development site. Therefore, the only alternative would be use living roofs; raingardens; and potentially permeable paving in the car parking areas;
- As the surfaced water cannot infiltrate to the ground, the only alternative would be to discharge the surface water to the existing surface water sewer within Freezeland Way. However, due to the ground levels, and the depth of the existing sewer, the surface water is to be restricted prior to discharge to an outfall manhole and in to the existing 1000mm diameter surface water sewer;
- The surface water is to be restricted to a rate of 11.70 l/s, which is the equivalent to the QMED greenfield rate. This is greater than the rate approximated greenfield rate stated by Thames Water of 5 l/s/ha (1.983 x 5 l/s = 9.92 l/s), but as it is the equivalent to the actual greenfield run-off rate, which is deemed to be acceptable.
- In order to prevent / reduce the risk of flooding for area within or in the vicinity of the site, suitable attenuation is to be provided for all storms up to and including the 1 in 100-year (Inc 40% RII) in the form of a various SuDS methods; below ground cellular structure; oversized pipes; and manholes.
- The drainage network and storage structures have been designed so that no flooding occurs in the site during the 1 in 30-year storm event, and controlled flooding occurs within the site for the 1 in 100-year storm event including 40% RII;
- The surface water management of the post development site adheres to all current regulations.

15.0 Residual Risk

It is difficult to completely guard against flooding since extreme events greater than the design standard event are always possible, however, there are practicable ways to minimise the risk such as by allowing a freeboard (safety margin) and by using suitable construction and management techniques.

This flood risk assessment has been prepared in accordance with the NPPF, Local Planning Policy and the NPPG. Any recommendations regarding floor levels are based on the relevant British Standards (BS8533), the standing advice provided by the EA or based on common practice.

It will be the owner's/occupier's responsibility to regularly upkeep the drainage network on site throughout the lifetime of the development to ensure that flood risk on and off site is managed effectively.

16.0 Conclusion

The EA; Envirocheck; and LBH – PFRA flood data maps identify that all the site lies within Flood Zone 1, which has a less than 1 in 1000 annual probability of river or sea flooding in any year.

The proposed development buildings are to be used for retail; commercial and residential purposes at ground floor level, which in accordance with Table 2 of the NPPF is classified as 'Less and More Vulnerable'. Table 3 of the NPPF identifies that if a site within Flood Zone 1, and is classed as 'Less and / or More Vulnerable', then it is appropriate for development, the probability of fluvial flooding is deemed to be low, and an exception will not be required.

No pluvial flooding occurs within the development site for up to the 1 in 100-year annual probability event, and pluvial flooding only occurs in the central development site in the low-lying area for the 1 in 200 and 1 in 1000-year annual probability event to a maximum depth of 0.30m.

The buildings and access routes will be at least 300mm above the general low-lying area levels of the exiting site, and therefore the probability of pluvial flooding is deemed to be low.

An assessment of all potential sources of flood risk has been carried out including coastal; drains and sewers; groundwater; overland surface water; and reservoirs. It is considered that there is a low risk of flooding to the site from these sources, without any flood reliance / flood resistance measures in place.

Safe access and egress has been considered for the development with the site being suitable for safe access and egress to be gained.

The surface water run-off is to be managed so it conforms to The London Plan Paragraph 5.13, and Sustainable Design and Construction Supplementary Planning Guidance (SPG) produced by the Greater London Authority.

This FRA confirms that the development is safe; it does not increase flood risk; and does not detrimentally affect third parties, in accordance with the objectives of the NPPF.

Hillingdon Gardens

Appendix A – Proposed Development Plan

Hillingdon Gardens

Appendix B – Topographical Survey

Appendix C – Thames Water Asset Records and Drainage Survey

Appendix D – Envirocheck Flood Map Data

Appendix E – Thames Water Correspondence