

# PRELIMINARY FLOOD RISK ASSESSMENT



***DRAIN LONDON***

LONDON  
BOROUGH OF  
HARROW

GREATER LONDON AUTHORITY



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Term	Definition
Aquifer	A source of groundwater comprising water bearing rock, sand or gravel capable of yielding significant quantities of water.
Asset Management Plan, (AMP)	A plan for managing water and sewerage company (WaSC) infrastructure and other assets in order to deliver an agreed standard of service.
AStSWF	Areas Susceptible to Surface Water Flooding
Catchment Flood Management Plan, (CFMP)	A high-level planning strategy through which the Environment Agency works with their key decision makers within a river catchment to identify and agree policies to secure the long-term sustainable management of flood risk.
CIRIA	Construction Industry Research and Information Association
Civil Contingencies Act	This Act delivers a single framework for civil protection in the UK. As part of the Act, Local Resilience Forums must put into place emergency plans for a range of circumstances including flooding.
CLG	Government Department for Communities and Local Government
Climate Change	Long term variations in global temperature and weather patterns caused by natural and human actions.
Critical Drainage Area, (CDA)	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 (e.g. sewer, river system), and the receptors (people, properties and infrastructure) that may be affected.
Culvert	A channel or pipe that carries water below the level of the ground.
Defra	Department for Environment, Food and Rural Affairs
DEM	Digital Elevation Model
DG5 Register	A water-company held register of properties which have experienced sewer flooding due to hydraulic overload, or properties which are 'at risk' of sewer flooding more frequently than once in 20 years.
DTM	Digital Terrain Model
EA	Environment Agency
FAS	Flood Alleviation Scheme
FCERM	Flood and Coastal Erosion Risk Management (FCERM)
Indicative Flood Risk Areas	Areas determined by the Environment Agency as indicatively having a significant flood risk, based on guidance published by Defra and WAG and the use of certain national datasets. These indicative areas are intended to provide a starting point for the determination of Flood Risk Areas by LLFAs.
FMfSW	Flood Map for Surface Water
Flood defence	Infrastructure used to protect an area against floods as floodwalls and embankments; they are designed to a specific standard of protection (design standard).
Flood Risk Area	An area determined as having a significant risk of flooding in accordance with guidance published by Defra and WAG.

Term	Definition
Flood Risk Regulations	Transposition of the EU Floods Directive into UK law. The EU Floods Directive is a piece of European Community (EC) legislation to specifically address flood risk by prescribing a common framework for its measurement and management.
Floods and Water Management Act	Part of the UK Government's response to Sir Michael Pitt's Report on the Summer 2007 floods, the aim of which is to clarify the legislative framework for managing surface water flood risk in England.
Fluvial Flooding	Flooding resulting from water levels exceeding the bank level of a main river
FRR	Flood Risk Regulations
IDB	Internal Drainage Board
IUD	Integrated Urban Drainage
LB	London Borough
LBH	London Borough of Harrow
LDF	Local Development Framework
Lead Local Flood Authority, (LLFA)	Local Authority responsible for taking the lead on local flood risk management
LiDAR	Light Detection and Ranging
Local Resilience Forum, (LRF)	A multi-agency forum, bringing together all the organisations that have a duty to cooperate under the Civil Contingencies Act, and those involved in responding to emergencies. They prepare emergency plans in a co-ordinated manner.
LPA	Local Planning Authority
Main River	A watercourse shown as such on the Main River Map, and for which the Environment Agency has responsibilities and powers
NRD	National Receptor Dataset – a collection of risk receptors produced by the Environment Agency
Ordinary Watercourse	All watercourses that are not designated Main River, and which are the responsibility of Local Authorities or, where they exist, IDBs
PAR	Preliminary Assessment Report
Partner	A person or organisation with responsibility for the decision or actions that need to be taken.
PFRA	Preliminary Flood Risk Assessment
Pitt Review	Comprehensive independent review of the 2007 summer floods by Sir Michael Pitt, which provided recommendations to improve flood risk management in England.
Pluvial Flooding	Flooding from water flowing over the surface of the ground; often occurs when the soil is saturated and natural drainage channels or artificial drainage systems have insufficient capacity to cope with additional flow.
PPS25	Planning and Policy Statement 25: Development and Flood Risk

Term	Definition
Resilience Measures	Measures designed to reduce the impact of water that enters property and businesses; could include measures such as raising electrical appliances.
Resistance Measures	Measures designed to keep flood water out of properties and businesses; could include flood guards for example.
Risk	In flood risk management, risk is defined as a product of the probability or likelihood of a flood occurring, and the consequence of the flood.
Risk Management Authority, (RMA)	As defined by the Floods and Water Management Act
Sewer flooding	Flooding caused by a blockage or overflowing in a sewer or urban drainage system.
SFRA	Strategic Flood Risk Assessment
Stakeholder	A person or organisation affected by the problem or solution, or interested in the problem or solution. They can be individuals or organisations, includes the public and communities.
Sustainable Drainage Systems, (SuD)s	Methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques.
Surface water	Rainwater (including snow and other precipitation) which is on the surface of the ground (whether or not it is moving), and has not entered a watercourse, drainage system or public sewer.
SWMP	Surface Water Management Plan
TfL	Transport for London
TWUL	Thames Water Utilities Ltd
WAG	Welsh Assembly Government
WaSC	Water and Sewerage Company

## Executive Summary

This Preliminary Assessment Report (PAR) is a key document informing the preparation of future Local Flood Risk Management Strategies as required by the Flood and Water Management Act 2010 (FWMA)<sup>i</sup>. This PAR identifies key flood risk areas within the London Borough of Harrow (LBH). This document fulfils the LBH's obligations as a Lead Local Flood Authority (LLFA) under the requirements of the Flood Risk Regulations 2009 (FRR)<sup>ii</sup>.

The PAR along with the supporting Annex spreadsheets and figures fulfil the first stage Preliminary Flood Risk Assessment (PFRA) requirements of the Regulations. The PFRA is a high level screening exercise that brings together easily available information from a number of sources to assess local flood risk. As LLFA, LBH are required to submit their PFRA to the Environment Agency by the 22<sup>nd</sup> June 2011.

The Department for Environment, Food and Rural Affairs (DEFRA) and the Welsh Assembly Government (WAG) have established a series of significance and threshold criteria to define flood risk areas in the UK. Guidance on applying these thresholds has been provided by DEFRA<sup>iii</sup>. The Environment Agency used the DEFRA criteria to develop a national dataset which identified Indicative Flood Risk Areas. The LBH falls within the Greater London Indicative Flood Risk Area.

For the PFRA all readily available data was collated from key stakeholders within the LBH. This allowed for the identification of significant historic flood events within the borough. A number of the older records were found to be inconsistent and incomplete; however LBH does have significantly more up to date records than most other Boroughs. These have been summarised in Annex 1 of the Preliminary Assessment spreadsheet.

Future flood risk within LBH has been assessed by looking at the borough as a whole and assessing potential risk areas based on a variety of local flooding sources. The Environment Agency's Areas Susceptible to Surface Water Flooding (AStSWF), Flood Map for Surface Water (FMfSW), Fluvial Flood Zones and the British Geological Society's Groundwater Susceptibility Maps were used to identify areas at risk. Based on the FMfSW approximately 40,051 properties are at risk of flooding to a depth of 0.3 metres in a 1 in 200 year rainfall event. Future flood risk has been summarised in Annex 2 of the Preliminary Assessment spreadsheet.

# 1 Introduction

## 1.1 What is a Preliminary Flood Risk Assessment?

The Preliminary Flood Risk Assessment (PFRA) is a high level screening exercise that brings together easily available information from a number of sources to assess local flood risk. The key stages of PFRA involve:

- Collecting information on past (historic) and future (potential) floods and flood risk.
- Assembling the information into a Preliminary Assessment Report (PAR).
- Identification of Flood Risk Areas by reviewing the national indicative areas produced by the Environment Agency alongside local information from the Preliminary Assessment Report.

This PAR is a key document informing the preparation of future Local Flood Risk Management Strategies as required by the Flood and Water Management Act 2010 (FWMA)<sup>iv</sup>. This PAR identifies key flood risk areas within the London Borough of Harrow (LBH). This document fulfils the LBH’s obligations as a Lead Local Flood Authority (LLFA) under the requirements of the Flood Risk Regulations 2009 (FRR)<sup>v</sup>.

## 1.2 Background

The FRR came into force in December 2009 with the aim of implementing the requirements of the European Floods Directive<sup>vi</sup> in England and Wales. The aim of the Directive is to provide a consistent approach to managing flood risk across Europe. It establishes four stages of activity within a six year flood management cycle (Table 1-1).

Stages	Delivery Date
Preliminary Assessment Report (PFRA)	22 <sup>nd</sup> June 2011
Develop Flood Risk Areas based on the PFRA findings	22 <sup>nd</sup> June 2011
Derive Flood Hazard and Risk Mapping for each Flood Risk Area	22 <sup>nd</sup> June 2013
Develop an effective Flood Risk Management Plan for each Flood Risk Area	22 <sup>nd</sup> June 2015

**Table 1-1 Summary of stages of activity required as part of the European Floods Directive**

The FRR define new responsibilities for flood risk management based on the recommendations of the Pitt Review<sup>vii</sup> and included within the FWMA. Under these legislative items, all Upper Tier Authorities (including the London Boroughs) are designated a LLFA. As such, LBH has been allocated a number of key responsibilities with respect to local flood risk management. A fuller description of these responsibilities is given in Chapter 2.

The scope of the PFRA is to consider past flooding and possible future flooding from surface water runoff, groundwater and ordinary watercourses in LBH.

The PFRA must consider floods which have **SIGNIFICANT** harmful consequences for human health, economic activity and the environment. The work will also assess the existing Indicative

Flood Risk Areas as designated by the EA and determine if any amendments should be made to this dataset.

As identified in Part 2 of the FRR, flooding associated with the sea, main rivers and reservoirs is the responsibility of the Environment Agency and does not need to be considered by the LLFA as part of the PFRA process, unless it is considered that it may affect flooding from local flood sources.

## 1.3 Objectives

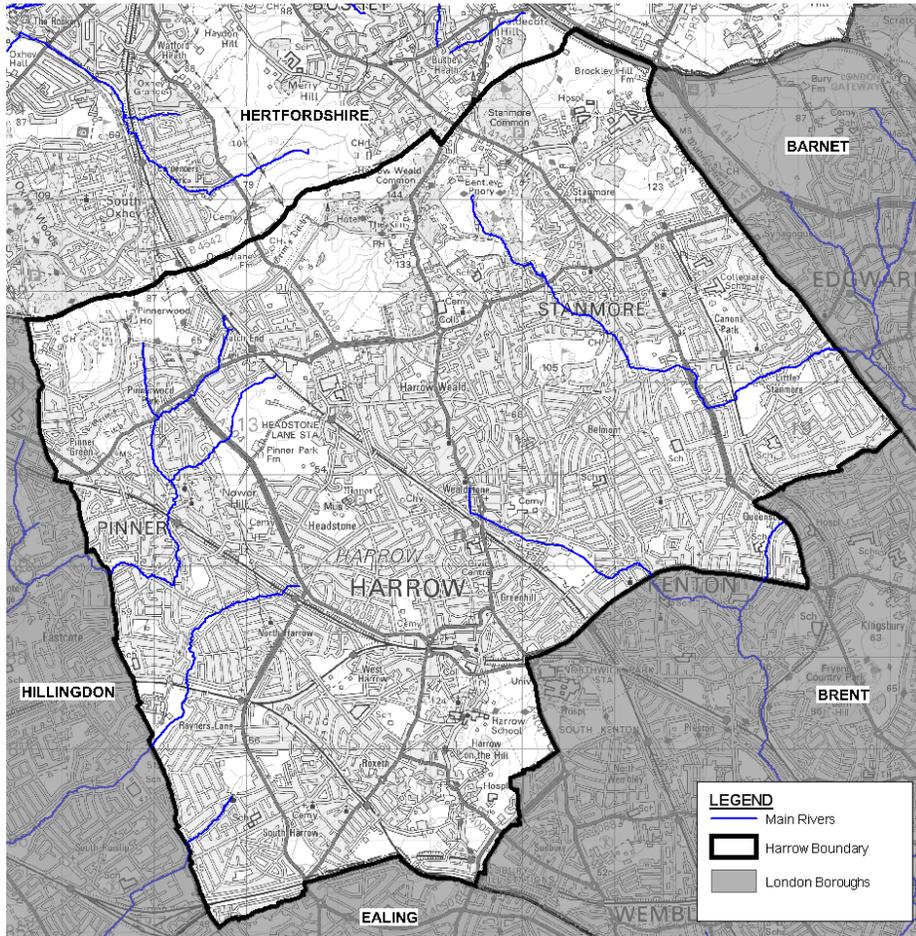
The aim of this document is to fulfil LBH's obligations as the LLFA under the requirements of the FRR. The PFRA aims to locate areas in which the risk of surface water and groundwater flooding is significant and warrants further examination through the production of maps and management plans.

The aim of this PFRA is to provide an assessment of local flood risk across the study area, including information on past floods and the potential consequences of future floods. The key objectives can be summarised as follows:

- Identify relevant partner organisations involved in future assessment of flood risk; and summarise means of future and ongoing stakeholder engagement;
- Describe arrangements for partnership and collaboration for ongoing collection, assessment and storage of flood risk data and information;
- Provide a summary of the systems used for data sharing and storing, and provision for quality assurance, security and data licensing arrangements;
- Summarise the methodology adopted for the PFRA with respect to data sources, availability and review procedures;
- Assess historic flood events within the study area from local sources of flooding (including flooding from surface water, groundwater and ordinary watercourses), and the consequences and impacts of these events;
- Establish an evidence base of historic flood risk information, which will be built up on in the future and used to support and inform the preparation of LBH's Local Flood Risk Strategy;
- Assess the potential harmful consequences of future flood events within the study area;
- Review the provisional national assessment of indicative Flood Risk Areas provided by the Environment Agency and provide explanation and justification for any amendments required to the Flood Risk Areas.

## 1.4 Study Area – Geographic Extent

The Harrow PFRA study area covers approximately 5,046 hectares of North West London covering the administrative boundary for LBH (Figure 1-1). The study area includes the urban area of Harrow, consisting of 21 Wards.



**Figure 1-1 London Borough of Harrow Boundary**

Harrow is bordered to the east, south and west by the London Boroughs of Barnet, Brent, Ealing and Hillingdon. To the north, Harrow is bordered by Hertfordshire County Council.

The study area falls within the Thames River Basin District and is served by two water companies – Veolia Water Central Limited who provides potable drinking water and collects sewage rates on behalf of Thames Water Utilities Limited who are the Sewerage Authority. The study area is served by the Environment Agency South East Region and is part of the South East Regional Flood and Coastal Committee.

## 1.5 Study Area – Demographics

The population of Harrow in 2009 was approximately 228,100, an increase of 8.6% since 2001<sup>viii</sup>. There are approximately 79,112 households in the borough<sup>ix</sup>, this is expected to increase as regeneration in Wealdstone and South Harrow gets under way (Figure 1-2).

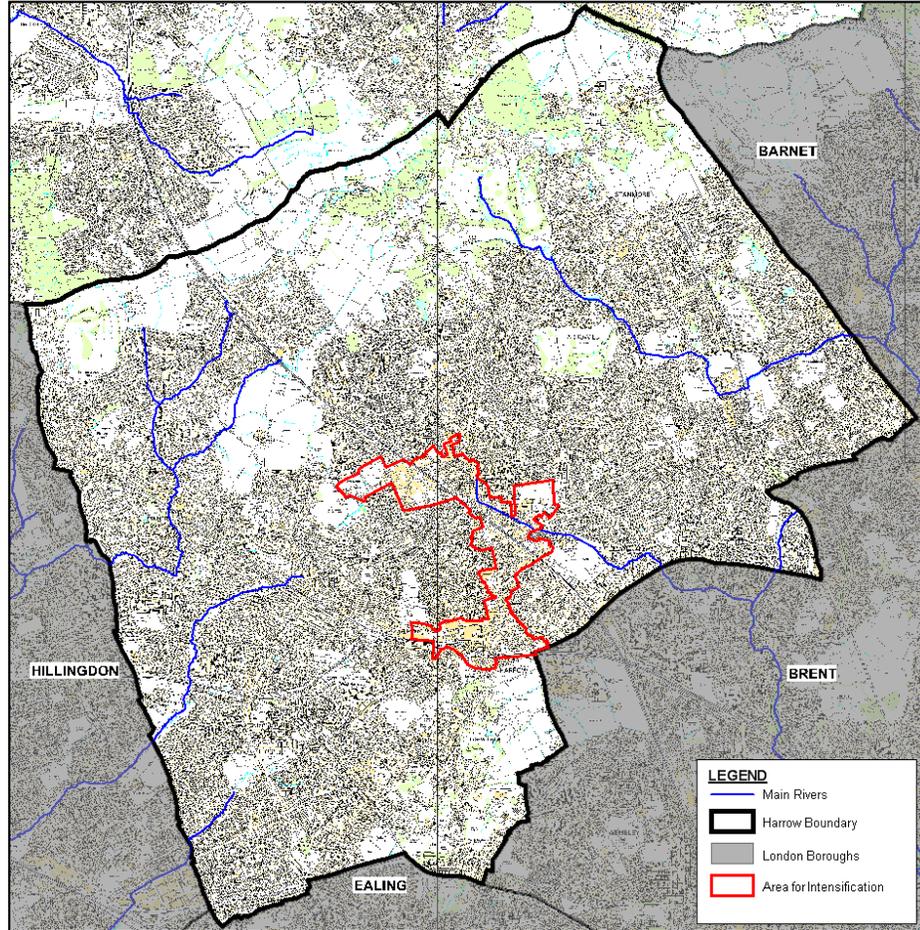


Figure 1-2 Area for Intensification

## 2 Lead Local Authority Responsibilities

One of the main responsibilities of the LLFA is to produce a PFRA. They are also responsible for the coordination of flood risk management.

### 2.1 Legislative Background

The Flood Risk Regulations 2009 transposes the requirements of the European Floods Directive into UK law in England and Wales. The aim of the Directive is to provide a consistent approach to managing flood risk across Europe. It establishes four stages of activity within a six year flood risk management cycle.

The Flood and Water Management Act, (FWMA) 2010 defines new responsibilities for flood risk management based on the recommendations of the Pitt Review. As the LLFA, Harrow Council is responsible for managing risk from the following local flood sources in the LBH: surface water,

groundwater and ordinary watercourses. (The Environment Agency is responsible for managing risk from main rivers, the sea and large raised reservoirs)

The aim of this PFRA is to fulfil Harrow Council's obligations as the LLFA, to meet their duties to manage local flood risk and deliver the requirements of the Flood Risk Regulations.

## 2.1.1 Links to other Legislative Background

The FWMA aims to improve flood risk management and the way we manage our water resources. The Act gives the Environment Agency the responsibility for producing a national strategy for Flood and Coastal Erosion Risk Management (FCERM). The Welsh Assembly Government (WAG) are responsible for producing the national strategy in Wales.

The national strategies will provide the framework for local strategies which LLFAs are to develop and implement under the Act. These will be based on an assessment of risk which should incorporate evidence gathered as part of the PFRA process.

SWMP's consider flood risk from surface runoff, groundwater and ordinary watercourses and the interaction with flooding from main rivers, the sea and sewers. The aim of a SWMP is to provide a greater understanding of local flood risk and to develop action plans to manage the risks. This will help inform development, detail where more detailed work is required and assist in the preparation of flood risk management plans. There is a Surface Water Management Plan currently underway for the LBH area as part of the Drain London Tier 2 works, where all 33 London Boroughs are undertaking the development of SWMPs. The outputs from both of these studies will be used to support and inform the next stages of the requirements of the FRR and the FWMA.

The Strategic Environmental Assessment (SEA) Directive (2001/42/EC) is implemented in the UK by 'The Environmental Assessment of Plans and Programmes Regulations 2004. Its objective is 'to provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view to promoting sustainable development'.

The flood risk management plans required under the Flood Risk Regulations fall under the scope of the SEA Directive. The Flood Risk Regulations to a large extent build in the consideration of the environment as the preliminary assessment report and the selection of Flood Risk Areas must consider significant consequences of flooding on the environment. Information collected during the PFRA can be used to develop the SEA documentation later in the process.

The INSPIRE Directive (2007/2/EC) is implemented in the UK by the INSPIRE Regulations 2009. Its main aim is to improve the quality, consistency and accessibility of spatial data sets and services for environmental data to ensure they can be shared and integrated seamlessly into applications with minimal manual intervention. The PFRA should be carried out in accordance with the general principles of INSPIRE.

## 2.2 Leadership and Partnership

As the designated LLFA, Harrow Council is responsible for leading local flood risk management across the borough. Much of the local knowledge and technical expertise necessary for the LBH to fulfil their duties as LLFA lies with partner organisations. It is therefore crucial that Harrow Council works alongside these partner organisations to ensure effective and consistent management of local flood risk throughout the borough, which contributes to the provision of a coordinated and holistic approach to flood risk management across the borough.

As the LLFA, Harrow Council is responsible for forging effective partnerships with Thames Water and the Environment Agency, as well as other key stakeholders and risk management authorities.

Ideally the working arrangements should be formalised to ensure clear lines of communication, mutual co-operation and management through the provision of Level of Service Agreements (LoSA) or Memorandums of Understanding (MoU).

Currently LBH have internal relationships across a number of departments to deal with surface water flooding issues. As part of the SWMP process they intend to formalise their influence on external groups.

## 2.3 Stakeholder Engagement

As part of the PFRA, the Drain London Group 2 sought to engage stakeholders representing the following organisations and authorities.

Stakeholders	Contact Number
Harrow Council	020 8863 5611
British Waterways	01923 201120
Environment Agency	08708 506 506
Highways Agency	0300 123 5000
London Fire Brigade	020 8555 1200
Network Rail	0845 711 4141
Thames Water	0845 9200 800
Transport for London	0845 330 9876

**Table 2-1 Stakeholders involved in the developing PFRA process**

All the above stakeholders were made aware of the study and were encouraged to provide input into the study where possible. There have been regular meetings which involved the group 2 borough councils and key stakeholders to keep them up to date with progress and to encourage discussions between the stakeholders.

## 2.4 Public Engagement

It is important to incorporate public engagement into local flood risk management planning. The public can provide invaluable information which can aid the development of more effective management strategies. By keeping the public informed of future flood risk management plans trust can be built between the public and the local government.

Subsequent stages of this process, will require increasing levels of public engagement, particularly during the formulation of the local flood risk management plans (for the Flood Risk Areas within LBH) as this will help to inform future levels of public engagement. It is recommended that Harrow Council follow the guidelines outlined in the Environment Agency's 'Building Trust with Communities' document<sup>x</sup> which provides a useful process of how to communicate risk including the causes, probability and consequences to the general public and professional forums such as local resilience forums.

## 2.5 Other Responsibilities

Aside from forging partnerships and coordinating and leading on local flood management, there are a number of other key responsibilities that have arisen for LLFA from the FWMA and FRR. These responsibilities include:

Responsibility	Details
Asset Register	<p>LLFAs have a duty to maintain a register of structures or features which are considered to have an effect on flood risk, including details on ownership and condition as a minimum. The register must be available for inspection and the Secretary of State will be able to make regulations about the content of the register and records.</p> <p>LBH already has in place a well developed, digitally based system for managing drainage assets.</p>
Designation powers	<p>LLFAs, as well as the Environment Agency have powers to designate structures and features that affect flooding or coastal erosion in order to safeguard assets that are relied upon for flood or coastal erosion risk management.</p>
Investigating flood incidents	<p>LLFAs have a duty to investigate and record details of <b>significant</b> flood events within their area. This duty includes identifying which authorities have flood risk management functions and what they have done or intend to do with respect to the incident, notifying risk management authorities where necessary and publishing the results of any investigations carried out. Further information with respect to this duty is provided in Chapter 7.</p> <p>LBH intend to further develop its MS Access Flood Defence Register to include the reporting of and investigating all future flood events. This will also include the transfer and rationalizing of previous flood event data from internal sources.</p>
Local Strategy for Flood Risk Management	<p>LLFAs are required to develop, maintain, apply and monitor a local strategy for flood risk management in its area. The local strategy will build upon information such as national risk assessments and will use consistent risk based approaches across different local authority areas and catchments</p>
SUDS Approval Body	<p>LLFAs are designated the SUDS Approving Body (SAB) for any new drainage system, and therefore must approve, adopt and maintain any new sustainable drainage systems (SUDS) within their area once SuDs guidance is published.</p>
Works powers	<p>LLFAs have powers to undertake works to manage flood risk from surface runoff and groundwater, consistent with the local flood risk management strategy for the area</p> <p>LBH have their own Land Drainage Bylaws made using the powers in the Land Drainage Act 1991.</p>

Table 2-2 LLFA Responsibilities under the FRR and FWMA (Grey boxes indicate duties that have yet to be commenced into UK law)

### 3 Methodology and Data Review

The approach for producing this PFRA was based upon the Environment Agency’s PFRA Final Guidance<sup>xi</sup>, which was released in December 2010, and as required within the guidance this PFRA is based on readily available or derivable data.

#### 3.1 Information Sharing & Data Sources

A number of stakeholders were consulted and provided information used to inform this PFRA. A list of the stakeholders is below along with a summary of the data provided:

Stakeholder	Information Provided	
	Publicly Available	Not Publicly Available
British Geological Society		Susceptibility to ground water flooding maps, permeability maps
British Waterways		BW canals network
Harrow Council	Harrow SFRA (June 2009), North London SFRA (August 2008), North Brent IUD Study (May 2008) Kenmore Avenue Initial Report (November 2010) River Brent FAS (May 1982)	Ordinary watercourses, critical infrastructure (fire stations, schools etc), historical flooding locations, transport infrastructure
London Fire Brigade		Flood incident database
London Underground		Pump site data, station flood risk summary
Greater London Authority		Administrative boundaries, OS Mapping, Master Maps, LiDAR, London Plan data including proposed regeneration and intensification areas
Highways Agency		Asset data, flood hot spot locations
Environment Agency		National Receptor Databases, historical flood outlines, modelled flood event outlines, flood affected properties, main rivers, detailed river network, groundwater flooding incidents
Natural England	SACs, SSSIs, SPAs, Ancient woodland, LNRs, NNRs, RAMSARs, woodland, agricultural land classifications	

National Health Service	Health Trust Maps
Network Rail	National Rail Network map
Thames Water	Sewerage networks, asset information, DG5 sewers database
Transport for London	Main transport links within the Greater London area

**Table 3-1 Stakeholders contacted and the information provided**

## 3.2 Availability

All relevant stakeholders within the LBH were contacted to collate as much readily available information as possible about the borough. There were several limitations with the available data which are outlined below.

## 3.3 Limitations

There are a number of limitations with the data provided for this PFRA. The intention of the report is to collect readily available data which has been used in this PAR. It is recommended that the issues identified below will act as a reminder to those involved in local Flood Risk Management to improve the quality of flood risk information going forward. A number of issues that are common across London Boroughs are summarised below:

### 3.3.1 Incomplete and inconsistent recording of data

The most significant limitation relates to the lack of specific event information provided within the older flood incident records. There was a lack of consistency regarding the amount of detail provided across all the stakeholders involved with Flood Risk Management for the study area. The amount of detail provided regarding each incident is not consistent.

Specifically:

- There is limited knowledge related to flooding from ordinary watercourses within the borough boundary.
- Information regarding the source of flooding.
- Information regarding the dates of flood events

As such, it is felt that the evidence collated to date is not complete and that they are unlikely to accurately represent the whole picture for flood risk issues across the study area. This will have a follow on effect of hindering the identification or alteration of the indicative flood risk areas proposed by the Environment Agency.

### 3.3.2 Quality of data recorded

As a result of the inconsistent recording of data, the quality of data varied within the datasets collated during the PFRA process. For example, a comprehensive dataset was received from

the London Fire Brigade containing dates of call outs from a 'Flood'. However, this dataset was of little use in its current format as the dataset does not provide any detail about each recorded event and 'flood' could refer to a multitude of causes ranging from minor internal flooding from domestic appliances to a major flood event.

The EA groundwater flooding incident database contained a lot of isolated incidents of groundwater flooding. Within the LBH a majority of the events logged related to waterlogging/ponding in peoples gardens. It is difficult to determine if this is a localised drainage issue or a genuine groundwater flooding incident.

A number of the older records were found to be inconsistent and incomplete, however LBH does have significantly more up to date records than most other Boroughs.

### 3.3.3 Consequences

Very few details were provided as to the consequences of specific historic flood events, making the assessment of the past significant events difficult to undertake.

## 3.4 Security, Licensing and Use Restrictions

A majority of the data has been specifically provided for this study (for use by the LLFA and their consultants) is not publicly available; therefore there are restrictions on data use. A number of specific agreements have been put in place for the PFRA and SWMP to facilitate the sharing of data between partners:

- GIS licences for mapping and data supplied by Harrow Council
- British Geological Society (BGS) licence for geological data supplied by GIS
- Environment Agency Standard data licence
- Environment Agency surface water susceptibility maps licence
- Environment Agency LIDAR licence.

## 3.5 Quality Assurance

Flood historical data was assessed for its data quality and suitability for use in the Assessment of Significant Risk as per the Environment Agency's PFRA Guidance. Further quality checks were undertaken as part of the SWMP in accordance with DEFRA guidance<sup>xii</sup>.

## 4 Past Flood Risk

Information provided by the stakeholders in Section 3 was collated and assessed to identify significant past flood events. The information was reviewed to establish the economic, environmental and cultural consequences of each event. This section summarises past floods with significant harmful consequences within LBH.

Existing datasets, reports and anecdotal information from the stakeholders listed above were collated and reviewed to identify details of major past flood events and associated consequences including economic damage, environmental and cultural consequences and impact on the local population.

It was anticipated that information would be provided in a geo-referenced format. However, where this was not the case for some datasets, this data was geo-referenced where possible. This made it possible to display this information using GIS software and overlay layers to identify the spatial distribution of historic flood events and relate these datasets to receptor information, in order to assess the overall flood risk.

### 4.1 Summary of Past Floods

In a majority of locations there was either property or critical infrastructure reportedly affected however little to no detail was given regarding property numbers or flood extent. The table below summarises reported significant past flooding events in the LBH.

Location	Date (month/year)	Property Affected (number)	Critical Infrastructure Affected (name)	Source of Flooding	Annex 1 Flood ID
Kenmore Avenue (Daintry Close and Cullington Close) High street Wealdstone, Headstone Drive.	1900, 1927, 1928, 1939, 1944, 1947, 1952, 1953, 1956, 1957, 1958, 1963, 1970, 1971, 1977, 1979, 1981, 1982, 1987, 1988, 1992, 2000 (above), 2004, 2006, 2007	Yes (up to 420)	No	Foul/Surface Water sewer network + Main River	1, 2, 3, 9,10
Numerous roads in Pinner	08/1977	Yes (over 375)	Unknown	Surface runoff	4
Lawn Vale, Pinner	1987	Yes	Unknown	Surface runoff	5

Honeypot Lane, Wolverton Road, Golf Close and Courdens MS	05/1988	Yes (76)	Unknown	Fluvial/Surface runoff	6
Avenue Road, Bridge Street, Marsh Road, Eastcote Road, Cannon Lane, Vale Court, Ashridge Gardens and Howell Place	05/1988	Yes (398)	Unknown	Fluvial/Surface runoff	7
Bentley Way, Wolverton Road, Golf Close, Belmont Lane, Abercorn Road, Buckingham Gardens, Buckingham Road and Chandos Crescent	09/1992	Yes (295)	Unknown	Fluvial/Surface runoff	8
Hillview Road	08/2008	Yes (unknown)	No	Culvert and Main River	
Honeypot Lane	07/2007	Yes (unknown)	No	Stored Water System problem (Thames Water)	
Kenton Lane	07/2007	No	Yes (Kenton Road)	Unknown	
Kenmore Avenue	10/2000	Yes (>25)	No	Surface Water, fluvial and sewer network	
Hillview Close,	10/2000	Yes (unknown)	No	Culvert and Main River	

Kenton Lane	10/2000	Yes (unknown)	No	Surface water and sewer network (Thames Water)
Felbridge Avenue	Unknown (Frequent)	Yes (4)	No	Surface water and sewer network
Ashburnham Gardens,	Unknown	Yes (2)	No	Surface water and sewer network issue (Thames Water)
Berry Hill	Unknown	Yes (unknown)	Yes (A4040)	Surface water and sewer network
Yeading Avenue	Unknown	Yes (1)	No	Surface water and Main River
Prestwood Close	Unknown	Yes (1)	No	Surface water, highway drain
Willows Close	Unknown	Yes (unknown)	No	Surface water, culvert and watercourse
Brockley Hill	Unknown	No	Yes (Brockley Hill)	Highway ditch/pipe reconstructed 2009/10
Honeypot Lane (junction with Crowshott Avenue)	Unknown	Yes (unknown)	Yes (A4140)	Surface water and sewer network
Bentley Way	Unknown	Yes (1)	No	Surface water and Main River

Uxbridge Road	Unknown	No	Yes (Junction of A4008, A410 and Uxbridge Road)	Surface water. (TWUL resolved)
St Michaels Crescent	Unknown	Yes (1)	No	Sewer network and Main River
Belmont Road	Unknown	Yes (1)	No	Sewer network foul and surface water.
High Street, Wealdstone	Unknown	Yes (unknown)	No	Foul/Surface water, sewer network capacity problems + Wealdstone Brook
Kenton Lane	Unknown	Yes (unknown)	No	Foul/Surface water

\* Repairs have been undertaken in Brockley Hill at the manhole junction with Julius Caesar Way. Area still rated as 'significant'.

**Table 4-1 Significant Flood Events London Borough of Harrow**

More detailed records of past floods with significant harmful consequences are contained in Annex 1.

There have been a number of studies which have assessed the flood risk within the borough. These have predominantly focussed on fluvial flood risk from the main rivers, rather than looking at flooding from other sources. These include:

- Harrow Strategic Flood Risk Assessment (SFRA), June 2009, Volumes 1-3<sup>xiii</sup>,
- North London SFRA, August 2008<sup>xiv</sup>,
- North Brent Integrated Urban Drainage (IUD) Study, May 2008<sup>xv</sup>,
- Kenmore Avenue Initial Report, November 2010<sup>xvi</sup>,
- River Brent Flood Alleviation Scheme (FAS), May 1982<sup>xvii</sup>,
- Colindale SWMP<sup>xviii</sup>.

### **Surface Water Runoff**

Surface water flooding occurs when heavy rainfall exceeds the capacity of local drainage networks and water flows across the ground. Figure 4-1 summarises the historic surface water flooding incidents for LBH. The mapped incidents were provided by a number of different sources including LBH's Drainage Department records, the Environment Agency and anecdotal information. The recorded incidents were predominantly the result of drainage issues leading to surface water ponding. The majority of the surface water incidents are located at road intersections.

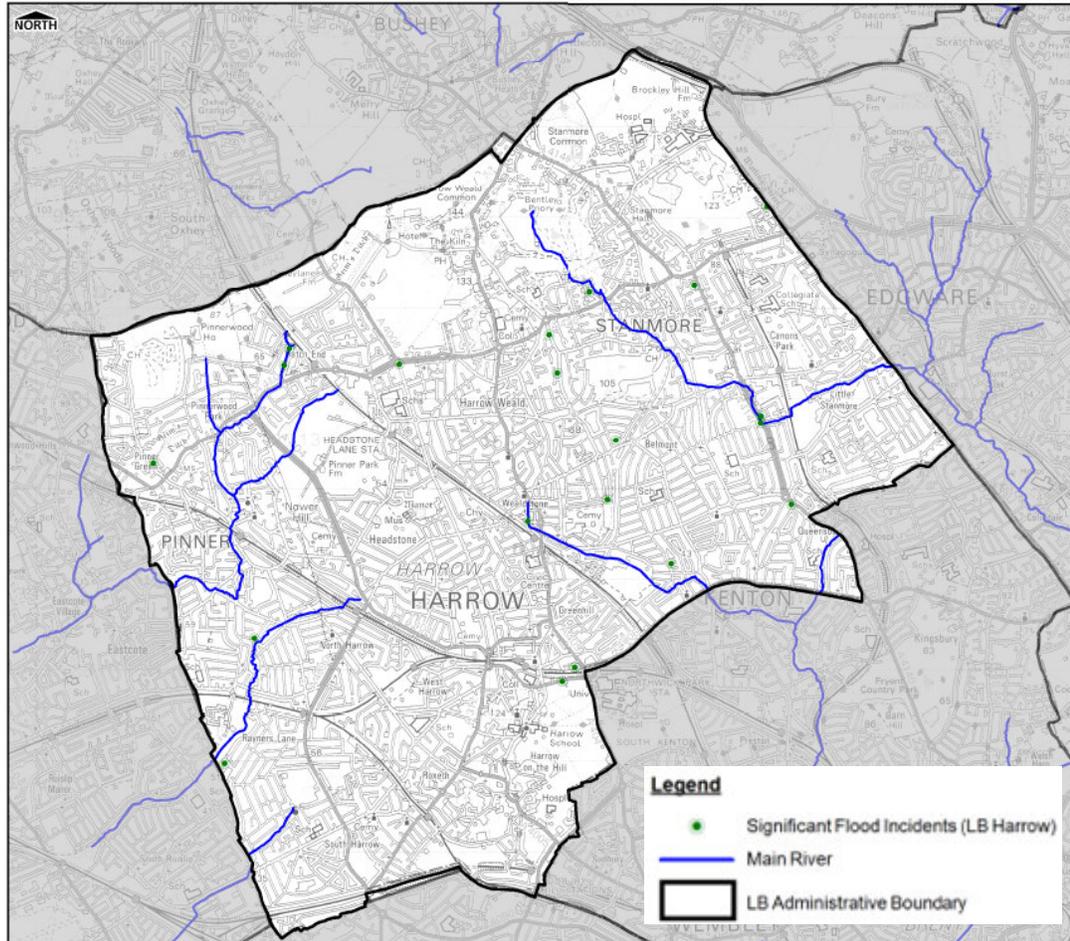
The LBH SFRA tabulates a number of historic surface water flood events however specific roads are not detailed. The SFRA pays particular attention to Wealdstone Brook which frequently surcharges causing flooding to properties at Headstone Drive, Kenton Lane, Kenmore Avenue and Daintry Close. General records of surface water flooding are reported in Wealdstone, Stanmore, Pinner, Kenton and Hatch End, with frequent links to fluvial surcharging notably along the Wealdstone Brook, River Pinn, Yeading Brook and Edgware Brook,

The River Brent FAS details that fluvial and surface water flooding contributed to 13 flood events between 1928 and 1981 caused by Wealdstone Brook overflowing. Very little information is provided about specific locations affected.

The North Brent IUD study highlights 11 major floods in the catchment which correlates well with the River Brent FAS noted incidents. Major floods are recorded between 1900 and 2007; however specific roads and areas affected are not divulged. The IUD notes that the most serious flood event occurred in August 1977 with over 420 homes affected.

An Initial Report into the causes of flooding at Kenmore Avenue specifies properties 1-24 have experienced flooding between 2004 and 2007 and the infilling of an old sewage treatment works left Kenmore Avenue in a topographical Basin and prone to flooding from surface water runoff. Daintry Close and Cullington Close which cross with Kenmore Avenue would also be affected by repeated flooding by raw sewage mixed with surface water.

Assuming that Kenmore Avenue, High Street Wealdstone and Headstone Drive are the main locations for all past historical flood events associated with Wealdstone Brook, an entry has been added to Table 4-1 detailing the frequency of flood events.



**Figure 4-1 Significant Historical Flood Incidents**

**Ordinary Watercourses**

The North London SFRA mentions several fluvial flooding events within the London Borough of Harrow, notably along Silk Stream and Edgware Brook, however very little information is provided about surface water events in Harrow or specific locations affected.

The Colindale SWMP report also stated that there was significant property flooding in the area in 1947, 1963, 1977, 1982, 1992, 1999, 2007 and 2008. Even though Colindale is in the London Borough of Barnet, the flooding associated with Edgware Brook that falls within the LBH could contribute to the flooding along Silk Stream. It is difficult to establish if any of the flooding reported came from the ordinary watercourses that connect to Edgware Brook and the Silk Stream system.

The Environment Agency historic fluvial flood outline maps are displayed in Figure 4-2. The EA historic maps contain flooding records for the Edgware Brook in the north east of the catchment and the River Pinn and associated tributaries to the west.

The largest flood extent on Edgware Brook was recorded in June 1992 flooding woodland downstream of The Summerhouse, at a culvert inlet affecting properties along Bentley Way, a culvert outlet (upstream) and culvert inlet (downstream) affecting properties in between along Wolverton Road, Golf Close, Belmont Lane and Abercorn Road, at a culvert outlet flooding a football ground and properties along Buckingham Road and Chandos Crescent before feeding into Silk Stream. The properties around Wolverton Road and Golf Close were also affected by a smaller flood event in 1988.

The largest flood extent on the River Pinn was recorded in 1977 where there was widespread flooding along the length of the watercourse. The 1987 was a small event that affected properties beside Woodridings Stream and at the confluence with the River Pinn. The 1988 was a larger extent affecting properties along the stretch of the River Pinn downstream of Woodridings Stream.

No historic outlines were available in GIS for the Wealdstone Brook where frequent historic flood events are well documented.

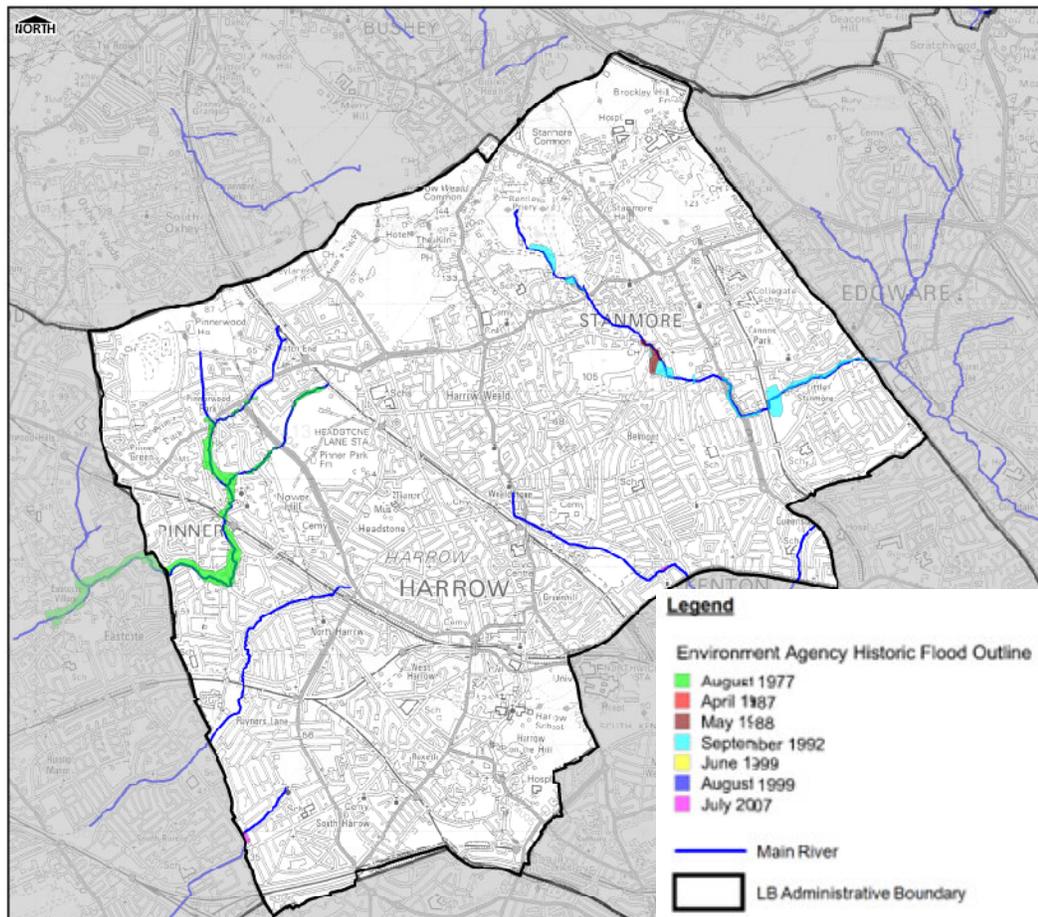


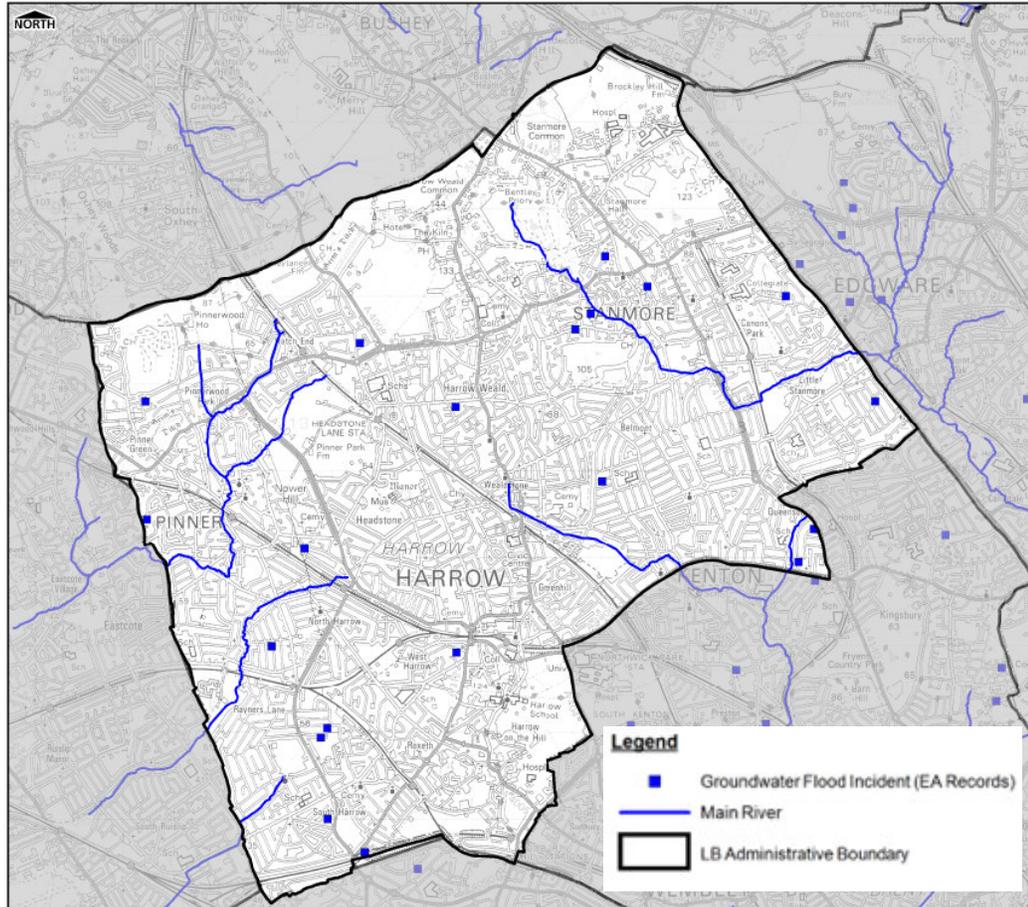
Figure 4-2 Historic Fluvial Flood Incidents

## Groundwater

Groundwater flooding occurs as a result of water rising up from the underlying aquifer or from water flowing from abnormal springs. This tends to occur after long periods of sustained high rainfall, and the areas at most risk are often low-lying where the water table is more likely to be at shallow depth. Groundwater flooding is known to occur in areas underlain by major aquifers, although increasingly it is also being associated with more localised floodplain sands and gravels.

The solid geology of LBH is underlain by a thick layer of London Clay which makes the majority of the borough impermeable and is situated in the geological area known as the 'London Basin', which creates ideal conditions for runoff and surface water flooding during storm conditions. The London clay is about 100m to over 125m in depth across the Harrow borough. The geology surrounding the River Pinn and parts of Pinner and North Harrow consist of Lambeth clay, silts and sands. These localised areas may be susceptible to groundwater flooding along with the majority of the borough. There is a sand outcrop within the solid geology at Harrow on the Hill which lies close to the surface surrounded by a Claygate bed of sand, silt and clay which has a high permeability and at less risk from groundwater flooding.

The Environment Agency historic ground water flood incidents are displayed in Figure 4.3. The dataset shows a number of ground water incidents spread across the LBH with one cluster of five incidents in the Stanmore area. There is no particular correlation between the flooding incidents, and the majority seem to be individual instances of flooding. This makes it difficult to tie the ground water incidents in with any of the other historic flooding incident records.



**Figure 4-3 Historic Groundwater Flood Incidents**

### Sewer Flooding

Sewer flooding is often caused by excess surface water entering the drainage network. Thames Water have provided their DG5 database for this area which shows the total number of internal and external flood records for each postcode and these are shown on Figure 4-4. The DG5 register is a performance indicator used by Water Companies to report the number of properties at risk of flooding due to overloaded sewers to Ofwat. The database records flooding if it falls within one of the following two categories:

- Once every ten years
- Twice or more every ten years.

Once a property is identified on the water companies DG5 register it typically means that the water company can put funding in place to take properties off the DG5 register and the property may not be at risk of future flooding.

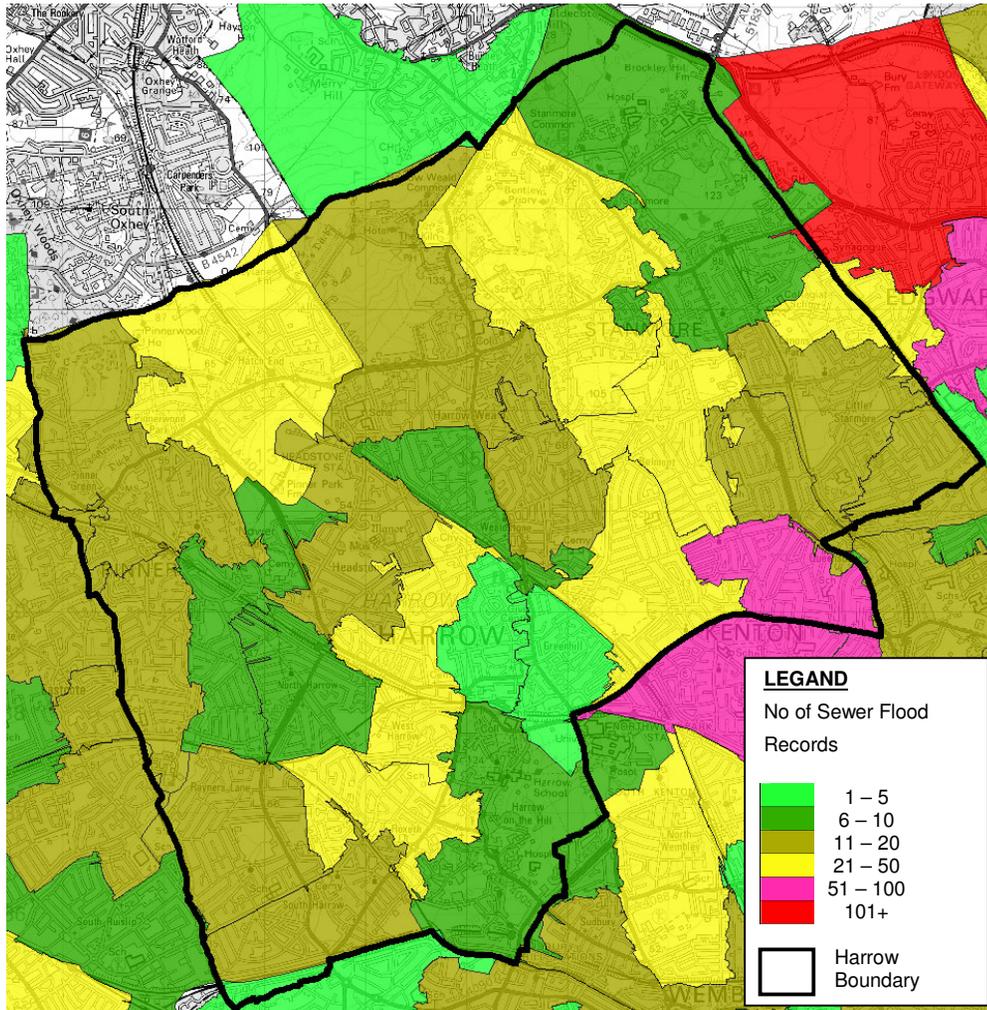


Figure 4-4 Thames Water DG5 Records

## 4.2 Significant Harmful Consequences

For the purpose of reporting past floods; a flood is deemed significant if it:

- caused internal flooding to five or more residential properties, or
- flooded two or more business premises, or
- flooded one or more items of critical infrastructure, or
- caused a transport link to be totally impassable for a significant period.

The definition of “significant period” is dependent on the transport link affected as follows (Highway categories are as set out in Table 1 of the UKRLG Code of Practice for Highway Maintenance).

- Category 1 highways (motorways) and major rail links – 2 hours or more
- Category 2 and 3a highways and other railway links – 4 hours or more
- Category 3b and 4a highways – 10 hours or more
- Category 4b highways – 24 hours or more

As a result of the issues discussed in section 3.3, insufficient data is available to draw definitive conclusions on the impacts and consequences of historic flood events on people, the economy and the environment. There was no requirement to record such data at that time.

## 4.3 Interactions with Other Flooding Sources

Insufficient data was available to draw definitive conclusions at this point and due to the complex nature of flooding that occurs in the study area it is considered impossible to solely attribute flooding on these scales to single sources. Anecdotally, there is significant evidence to suggest that surface water flooding is exacerbated in some areas of LBH during periods of high water levels within the main rivers as the surface water system is unable to freely discharge water. An integrated and holistic approach to assessing flood risk from multiple sources has not been undertaken in the LBH as there has been no requirement to undertake such work.

## 5 Future Flood Risk

Future flood risk within LBH has been assessed as part of the PFRA. This involved looking at the borough as a whole and assessing potential risk areas based on flooding from a variety of local sources. The key aim of this assessment is to identify areas which are not currently known from past flood incidents.

## 5.1 Summary of Future Flood Risk

The following datasets were used to determine the Future Flood Risk in LBH.

1. Areas Susceptible to Surface Water Flooding (AStSWF) including 200 year more, intermediate and less susceptible outlines (Figure 5-1)
2. Flood Map for Surface Water (FMfSW) including 200 year and 30 year deep and shallow outlines (Figure 5-2)
3. Fluvial Flood Zone 2 & 3 (Figure 5-3)
4. British Geological Society Groundwater Susceptibility Maps (Figure 5-4).

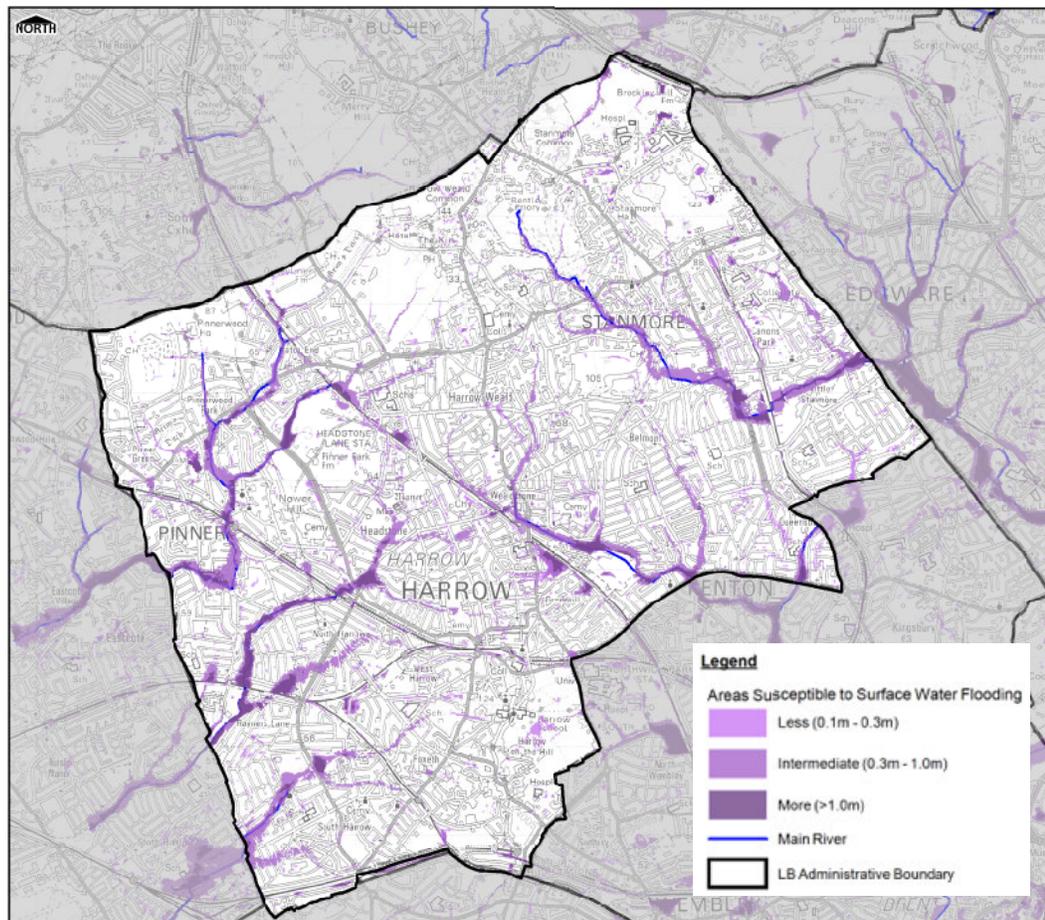


Figure 5-1 Areas Susceptible to Surface Water Flooding

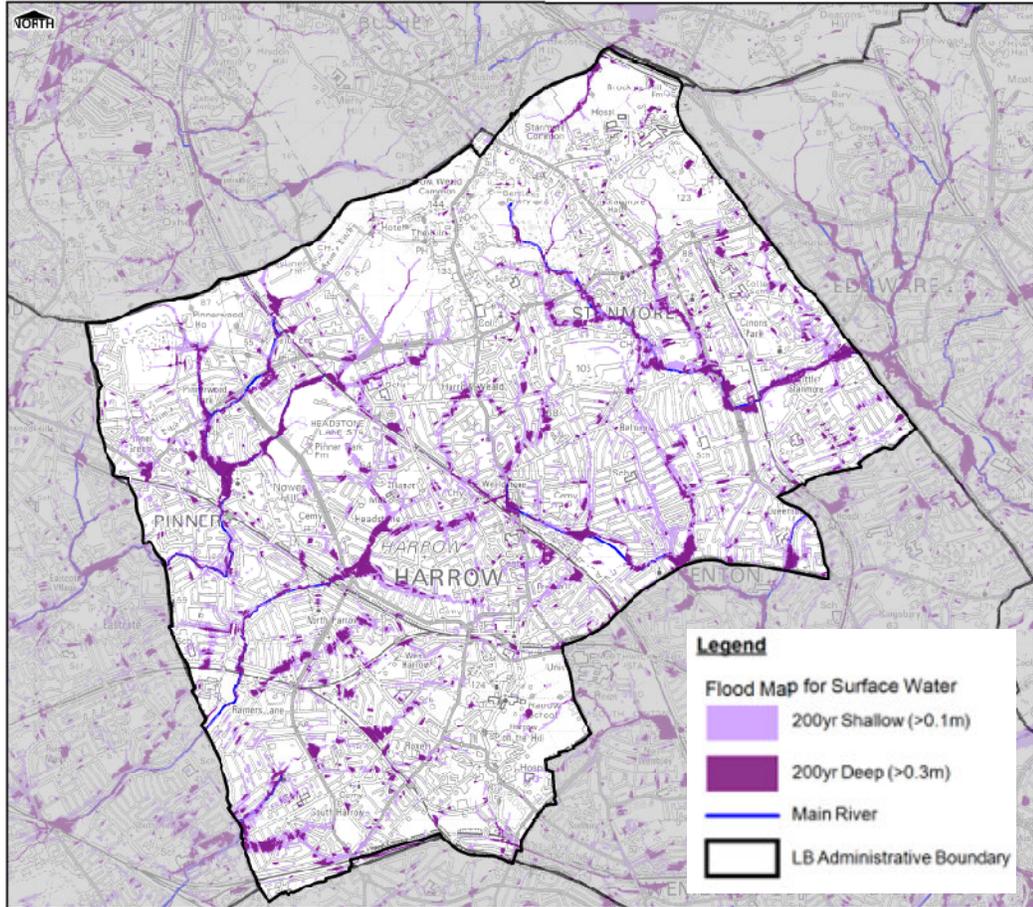


Figure 5-2 Flood Map for Surface Water

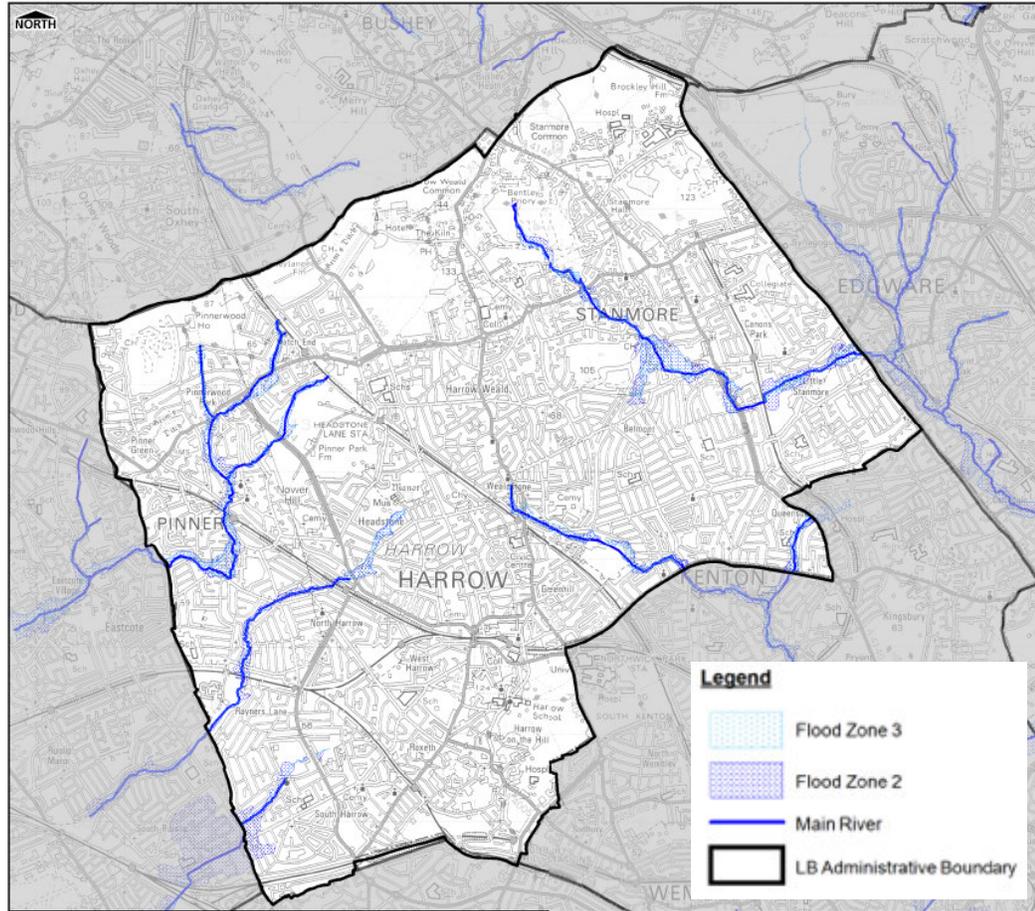


Figure 5-3 Flood Zones

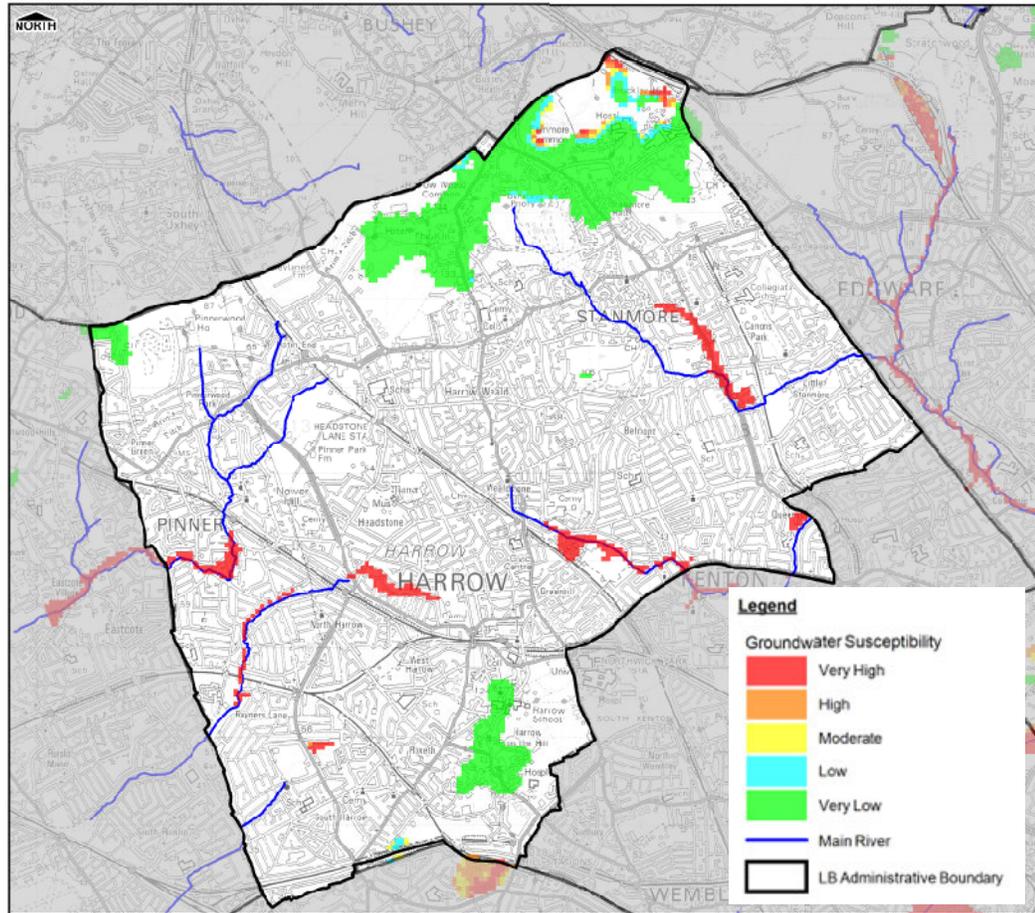


Figure 5-4 Groundwater Susceptibility Maps

### Surface Water Runoff

The Environment Agency has produced a series of mapping based on a national assessment of surface water flood risk. The AStSWF are a series of maps made up of three probability bandings for a 1 in 200 year rainfall event (Less, Intermediate and More). The AStSWF was released in August 2008. The FMfSW are the second generation maps which were generated using improved modelling techniques in November 2010. The FMfSW represents two return periods the 1 in 30 year and 1 in 200 year. The mapping for each return period has been split based on depth of flooding: shallow (0.1m-0.3m) and deep (>0.3m). Table 5-1 summarises surface water runoff in LBH.

Source	Residential Affected	PropertyNon-Residential property Affected
AStSWF - Less	18,000	2,400
AStSWF - Intermediate	7,600	1,300
AStSWF - More	600	200
FMfSW - 1 in 30 shallow	2,400	0
FMfSW - 1 in 30 deep	400	0
FMfSW - 1 in 200 shallow	23,700	2,800
FMfSW - 1 in 200 deep	8,400	1,300

**Table 5-1 Summary of properties at risk of surface water runoff**

### Groundwater

There is no local information available which provides evidence on future groundwater flood risk across LBH and groundwater rebound is not believed to be an issue in this particular area. The Environment Agency, Areas Susceptible to Groundwater Flooding, is a national dataset which highlights areas at risk of groundwater flooding. This dataset has been used to assess future flood risk in Harrow. Table 5-2 below summarises the number of properties at risk of groundwater flooding in LBH.

Source	Residential Affected	PropertyNon-Residential Property Affected
Areas Susceptible to Groundwater Flooding (AStGWF)	3168	806

**Table 5-2 Summary of properties at risk of groundwater flooding**

### Ordinary Watercourses

The Environment Agency national fluvial flood map has been used to assess future flood risk from ordinary watercourses in Harrow. Table 5-3 below summarises the number of properties at risk of fluvial flooding.

Source	Residential Affected	Property Non-Residential Property Affected
Flood Map (for rivers and sea) - flood zone 3	1039	285
Flood Map (for rivers and sea) - flood zone 2	2525	489

**Table 5-3 Summary of properties at risk of future flooding from multiple sources**

Detailed records of future floods and their possible consequences are given in Annex 2. Note that some properties fall within areas at risk of multiple sources of flooding so may have been double counted.

A majority of the surface water mapped risk is similar to that outlined by the flood zones. There are isolated patches of surface water flooding predicted in other areas of the borough but these are small pockets of risk.

## 5.1.1 Potential Consequences of Future Flooding

The Environment Agency has used the Flood Map for Surface Water mapping and the National Receptor Database to identify a number of areas across the country that exceed a given threshold, described in Table 5-4 below.

### 'Significant harmful consequences' defined as greater than...

200 people or	<i>Flooded to a depth of 0.3m during a rainfall event with a 1 in 200 chance of occurring (or 0.5%)</i>
20 businesses or	
1 Critical service	

**Table 5-4 Flood risk threshold used to identify future consequences of flooding**

This assessment was carried out based on 1km<sup>2</sup> national grid squares, and the grid squares that exceed this criterion were identified. The grid squares within London where flood risk is considered to exceed this threshold are illustrated on Figure 6-1. These areas represent where flood risk is considered to be the most severe across LBH.

The potential consequences on key flood risk indicators (as discussed in Table 3-1) have been assessed by the Environment Agency; this information has been included in Annex 2 of the Preliminary Assessment Spreadsheet.

## 5.2 Locally Agreed Surface Water Information

Locally agreed surface water information is defined as surface water flood risk data that has been reviewed and discussed by the LLFA in conjunction with the Environment Agency, Thames Water and any other interested parties. The locally agreed surface water information being used for this PFRA is the Environment Agency FMfSW.

Where coverage was available the surface water mapping generated as part of the Drain London project has been used to verify the FMfSW outlines.

The LBH does not have any records of the local drainage capacity.

## 5.3 Impact of Climate Change

The impact of climate change on local flood risk is poorly understood. Several national flood maps have informed the preliminary assessment report – specifically the Flood Map for Surface Water (surface runoff), Areas Susceptible to Surface Water flooding (surface runoff), Areas susceptible to Groundwater Flooding (groundwater) and Flood Map (ordinary watercourses). These do not show the impact of climate change on local flood risk.

There was a consensus amongst climate model projections presented in the IPCC fourth assessment report for northern Europe suggesting that in winter high extremes of precipitation are very likely to increase in magnitude and frequency. These models project drier summers with increased chance of intense precipitation – intense heavy downpours interspersed with longer, relatively dry periods (Solomon et al., 2007)<sup>xix</sup>.

### UKCP09

United Kingdom Climate Projections 2009 (UKCP09) provides the most up to date projections of future climate change for the UK (<http://ukclimateprojections.defra.gov.uk/>). In terms of precipitation, the key findings are:

By the 2080s, under Medium emissions, over most of lowland UK

- Central estimates are for heavy rain days (rainfall greater than 25mm) to increase by a factor of between 2 and 3.5 in winter, and 1 to 2 in summer.

By the 2080s, under Medium emissions, across regions in England & Wales

- The central estimate (50% probability) for winter mean precipitation % change ranges from +14 to +23.
- Central estimate for summer mean precipitation % change from -18 to -24.

Certain key processes such as localised convective rainfall are not represented within this modelling so there is a still considerable uncertainty about rarer extreme rainfall events for the UK. We can be more certain that heavy rainfall will intensify in winter compared to summer. The proportion of summertime rainfall falling as heavy downpours may increase. The impact of these changes on local flood risk is not yet known.

### Appraisal Guidance

Current project appraisal guidance (DEFRA, 2006)<sup>xx</sup> provides indicative sensitivity ranges for peak rainfall intensity, for use on small catchments and urban/local drainage sites. These are due to be updated following the UKCP09 projections above. They describe the following changes in peak rainfall intensity; +5% (1990-2025), +10% (2025-2055), +20% (2055-2085) and +30% (2085-2115). This was reviewed by the Met Office in 2008 using UKCP09 models (Brown et al., 2008)<sup>xxi</sup>. They suggest that, on the basis of our current understanding, these levels represent a pragmatic but not a precautionary response to uncertainty in future climate impacts. In particular for a 1 in 5 year event, increases in precipitation intensity of 40% or more by the 2080s are plausible across the UK at the local scale.

## 5.4 Impact of Future Development

It is possible that long term developments might affect the occurrence and significance of flooding. However current planning policy aims to prevent new development from increasing flood risk.

In England, Planning Policy Statement 25 (PPS25)<sup>xxii</sup> on development and flood risk aims 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. Where new development is, exceptionally, necessary in such areas, policy aims to make it safe without increasing flood risk elsewhere and where possible, reducing flood risk overall. “

Adherence to the Government policy by the Local Planning Authority should ensure that new development does not increase local flood risk, although decisions can be overridden by the Planning Inspectorate at appeal. However, in exceptional circumstances the Local Planning Authority may accept that flood risk can be increased contrary to Government policy, usually because of the wider benefits of a new or proposed major development. Any exceptions would not be expected to increase risk to levels which are “significant” (in terms of Governments criteria), but should be recorded here so that they can be reviewed in future.

Within LBH there is 1 regeneration area, listed in the table below along with a summary of flood risk based on three of the datasets listed in Section 5.1 of this report.

ID	Location	Area (km <sup>2</sup> )	Flood Risk (FZ2)	Flood Risk (FZ3)	FMfSW shallow	FMfSW deep	AStGWF
Harrow 028D	Roxbourne	0.15	N	N	Y	N	Y

**Table 5-5 Regeneration areas in Harrow**

As can be seen in the table above the Roxbourne regeneration area is at risk of flooding from surface water and groundwater. This analysis highlights the importance of ensuring that any new development takes flood risk into account to prevent exacerbating the situation. This regeneration area provides an opportunity to reduce the flood risk in the local vicinity and the downstream Hillingdon Borough in which The Roxbourne watercourse crosses into.

ID	Location	Area (km2)
38	Harrow & Wealdstone	N/A

**Table 5-6 Areas for intensification**

The Wealdstone area is notoriously known as a surface water flood risk area, notably along Kenmore Avenue, therefore mitigation measures should be incorporated into the intensification plans in this area and Harrow and Wealdstone generally, to minimise the impact of future development.

## 6 Review of Indicative Flood Risk

In order to ensure a consistent national approach, DEFRA and WAG have established a series of significance and threshold criteria to define flood risk areas in the UK. Guidance on applying these thresholds has been provided from DEFRA<sup>xxiii</sup>. The Environment Agency used the DEFRA criteria to develop a national dataset which identified Indicative Flood Risk Areas. An Indicative Flood Risk Area was defined in areas where more the 30,000 people are at risk of flooding.

The Indicative Flood Risk Area for Greater London incorporates a majority of the administrative area of LBH. There is an area to the north of the borough which falls just outside of the Flood Risk Area boundary. This is a rural area to the south of Bushey and South Oxhey and is at low risk of flooding from surface runoff, ordinary watercourse, groundwater and sewers.

## 6.1 Extent of FRA

The Greater London Indicative Flood Risk Area extent is shown in Figure 6-1 below.

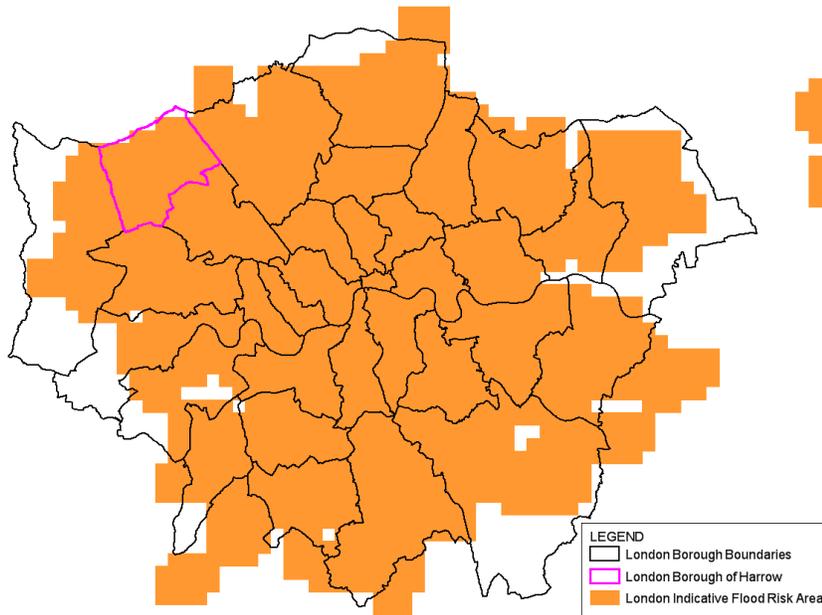


Figure 6-1 London Indicative Flood Risk Area

## 6.2 Review of FRA

Although there are several areas within the borough that have been identified as being at a high level of risk from a variety of sources no further Flood Risk Areas were identified as the threshold criteria was not met. Flood risk in these smaller areas will be managed most effectively at a local scale using Local Flood Risk Management Strategies.

No changes are proposed to the Greater London Indicative Flood Risk area as the area will be managed as a whole rather than on a London Borough basis. There is a Surface Water Management Plan currently underway for the LBH area as part of the Drain London Tier 2 works, where all 33 London Boroughs are undertaking the development of SWMPs. The outputs from both of these studies will be used to support and inform the next stages of the requirements of the FRR and the FWMA.

## 7 Identification of Flood Risk Areas

### 7.1 Amendments to FRA

No amendments are required to the Greater London FRA.

### 7.2 New FRA

None proposed.

## 8 Next Steps

### 8.1 Scrutiny and Review

The scrutiny and review procedures that are to be undertaken during the production of the PFRA outputs are set out by the European Commission to assist in allowing the identification of the level of flood risk across the UK and EU and for the identification of the most significant flood risk areas. The scrutiny process will comprise two steps for this iteration of the PFRA:

#### **Local Authority Review.**

The first element is for LBH to undertake an internal review of the PFRA, in accordance with LBH's review procedures, to both ensure the quality and accuracy of the output. In addition, this process will signal, as identified in the FRR, for LBH to deliver further requirements up to 2015. This is associated with being within the Indicative Flood Risk Area of London.

The PFRA was approved by the LBH Cabinet in May 2011

#### **Environment Agency Review**

Under the FRR, the Environment Agency has been given a role in reviewing, collating and publishing all of the PFRAs once submitted.

The Environment Agency will undertake a technical review (area review and national review) of the PFRA, which will focus on instances where Flood Risk Areas have been amended and ensure the format of these areas meets the required standard. If satisfied, they will recommend submission to the relevant Regional Flood Defence Committee (RFDC) for endorsement. RFDCs will make effective use of their local expertise and ensure consistency at a regional scale. Once the RFDC has endorsed the PFRA, the relevant Environment Agency Regional Director will sign it off, before all PFRAs are collated, published and submitted to the European Commission.

#### **Future Iterations**

To aid the review of the PFRA in six years time the LLFAs within the Greater London Flood Risk Area should form a committee to provide an active forum for discussion. Regular discussions between LLFAs will aid the development of a comprehensive flood risk strategy which is achievable and addresses risk at all levels across London.

LBH should review what is needed to assist future PFRA based on the key findings of this Preliminary Assessment Report, emerging SWMPs and Local Flood Risk Management Strategies for the borough. The key findings and observations of the LLFAs, the Environment Agency and the National Scrutiny Committees across the UK as part of the 1st cycle of the PFRA process over the next few months will be vital in determining future requirements.

## 8.2 Data Collection and Management

In order to continue to fulfil their role as LLFA, LBH are required to investigate future flood events and ensure continued collection, assessment and storage of flood risk data and information.

### 8.2.1 Incident Recording

As such, it is recommended that LBH develop and maintain an incident register, recording future flood records as per the Annex 1 PFRA spreadsheet. This will ensure a consistent level of detail is recorded for each significantly harmful event and will aid the next PFRA in six years time. At the very least for each flood event with significant consequences, provision should be made to record:

- Flood location
- Flood type
- Date of each flood
- Duration of flood
- Estimated adverse consequences on the population, economic damage, cultural heritage and environment.

Below is an example data collection spreadsheet that could be used by LBH to collate flood event data. The spreadsheet is split into four stages; the first two stages allow the LBH to record basic flood event data. Stage 3 outlines the event review process undertaken by the LBH. Stage 4 should only be used where further investigation into an event has taken place.

LONDON BOROUGH									
					Compulsory	Preferred	Optional		
3	Record Kept From	01/09/1992							
4	Record Kept To	01/03/2011							
<b>Stage 1 - Initial details of contact on flooding</b>									
Unique Reference	Time and Date of Call	Brief Description	Date of Event	Location (Address, Town)	Location (Postcode)	Depth of flooding (m)	Flooding Source	Additional Notes	Recorded by
<i>New Sequential Reference</i>	<i>Note time and date of call</i>	<i>Provide brief description of event (causes, impacts, issues)</i>	<i>Note date of event (may be different to time of call)</i>	<i>Note location (specific)</i>		<i>Perceived depth of flooding at</i>	<i>Perceived source of flooding</i>	<i>provide additional information</i>	
2011-LBB-01	15/02/2011 15:23								

Figure 8-1 Stage 1 – Basic flood event data collection

	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
2																
3																
4																
5																
6	Stage 2 - What Evidence is there ?						Stage 3 - Initial Review of Event									
7	Type of Evidence Collated	Photo File Location/ Reference	Rainfall Depth (mm)	Rainfall Duration (hours)	Rainfall Station Name/Location	Extent of Flooding (m <sup>2</sup> )	Residential Properties Affected (No)	Commercial Properties Affected (No)	Critical Infrastructure elements affected (type)	Damage Caused	Event Duration (hours)	Estimated Return Period of Event	Further investigation required ?			
8	<i>Select from drop down list</i>	<i>Where has the file been stored?</i>												<i>Yes/No/Pending</i>		
9																
10																

Figure 8-2 Stage 2 & 3 – Entry of more detailed flood event information and initial investigation log

	Z	AA	AB	AC
1				
2				
3				
4				
5				
6	Stage 4 - Investigation Details			
7	Details of any Actions Taken	Issue Resolved	Additional Notes or Information	
8				
9				
10				

Figure 8-3 Stage 4 – Allows for the inclusion of more detailed flood event investigation/ information or follow up

It is important that all partners in Local Flood Risk Management keep more detailed records of significant future asset flooding incidents. It is critical at this stage that the records of flood events are documented consistently and in accordance with the INSPIRE Directive (2007/2/EC).

It is advised that LBH maintains a centralised database, receiving regular updates from members of the partnership. This data can then be used to help inform future assessments and reviews and for input into the mapping and planning stages of the FRR requirements.

## 8.2.2 Asset Registers

Additionally, although not yet required as part of the FWMA, it is advised that LBH maintain and develop a simple asset register in accordance with the FRR and the DEFRA SWMP guidance. The asset register should contain records of all existing assets within the borough and should be updated as more data becomes available.

Stakeholders and partners should be encouraged to use GIS formats to store their data in order to facilitate exchange and management of data. A data management plan would be valuable in ensuring data sets were kept up to date and consistent across all stakeholders. A future consideration could be the development of an online GIS asset register database. This would enable a wider range of organisations to contribute information.

Responsibility for the overall management of the data should lie with LBH, as the LLFA, who should coordinate updating the databases either using internal systems or via a web based interface.

## 8.3 Other FRR Requirements

Local Flood Risk Management Strategies came into force as part of the FWMA. As LLFA, LBH must develop a strategy for local flood risk management. The strategy must be consistent with the National Flood and Coastal Erosion Risk Management Strategy for England, and should be developed and maintained with consultation from other stakeholders, such as the public and other risk management authorities.

The strategy must specify:

- the risk management authorities in the authority's area,
- the flood and coastal erosion risk management functions that may be exercised by those authorities in relation to the area,
- the objectives for managing local flood risk (including any objectives included in the authority's flood risk management plan prepared in accordance with the FRR),
- the measures proposed to achieve those objectives,
- how and when the measures are expected to be implemented,
- the costs and benefits of those measures, and how they are to be paid for,
- the assessment of local flood risk for the purpose of the strategy,
- how and when the strategy is to be reviewed, and
- how the strategy contributes to the achievement of wider environmental objectives.

The Harrow Local Flood Risk Management Strategy should involve ongoing and future activities of a Flood Risk Management Partnership (FRMP) (including SWMPs above and improved data collection and management). This will help to better coordinate and manage local flood risk in the borough and will help with the preparation of the 2nd PFRA cycle in six years time.

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