HARROW COUNCIL

LOCAL FLOOD RISK MANAGEMENT STRATEGY

May 2016

Document Tracking

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1.0 Executive Summary

After the floods of 2007 the Government asked Sir Michael Pitt to review the lesson learned from the summer floods. Over the 10 months the review team examined over 1000 written submissions consulting with many communities and flood risk responders to what was the largest peacetime emergency since World War II. http://webarchive.nationalarchives.gov.uk/20100807034701/http:/archive.cabinetoffice.gov.uk/pittreview/_/media/assets/www.cabinetoffice.gov.uk/flooding_review/pitt_review_full%20pdf.pdf
The Flood Risk Regulations 2009 http://www.legislation.gov.uk/uksi/2009/3042/pdfs/uksi_20093042_en.pdf and the Flood and Water Management Act 2010 http://www.legislation.gov.uk/ukpga/2010/29/pdfs/ukpga_20100029_en.pdf have increased the statutory responsibilities Local Authorities including a new role of Lead Local Flood Authority.

In 2009 the Government transposed the European Floods Directive 2007/60/EC http://ec.europa.eu/environment/water/flood_risk/ into a Statutory Instrument called the Flood Risk Regulations which required Council's to undertake a Preliminary Flood Risk Assessment to measure and subsequently identify and manage flood risk and hazard from all sources within a Flood Risk Management Plan. Harrow has submitted their measures to the Environment Agency to include in the FRMP https://www.gov.uk/government/collections/flood-risk-management-plans-frmps-2015-to-2021 for the Thames River Basin District which was published on 17th March 2016.

The Flood and Water Management Act 2010 builds on the FRR to include developing this Local Flood Risk Management Strategy with the aim to provide a more comprehensive and holistic approach to flood risk management for our communities, businesses and infrastructure.

This LFRMS brings together this holistic approach by aligning with the Council Local Plans such as our Strategic Flood Risk Assessments, Develop Management Policies and Surface Water Management Plan which has provided us with the modelled flood risk and Critical Drainage Areas.

The LFRMS details our actions and linkage to the LFRMP to improve the understanding of the risk and provide clear information, setting out the roles and responsibilities of all Risk Management Authorities and to ensure that our Multi Agency Flood Plan and response to floods is effective.

2.0 INTRODUCTION

2.1 Overview

Harrow Council is the Lead Local Flood Authority (LLFA) for the London Borough of Harrow. The LLFA is the statutory body responsible for the management of local flood risk under the Flood and Water Management Act. Local Flood Risk is defined in the Act as flooding from surface runoff, ordinary watercourses and groundwater.

This Local Flood Risk Management Strategy will enable the Council to formalise our longer term vision and flood risk management priorities to shape a Strategy that delivers the greatest benefit to our residents and environment in Harrow.

The Borough is located approximately 12 miles north west of central London and covers an area of 19 square miles (55kms). It is situated between Barnet, Ealing, Hillingdon, Brent, Hertsmere and Three Rivers Councils as shown in *figure1.2.1 page 36* and has a population circa 242,377 (ONS 2012).

The Borough is divided into 3 distinct river catchments, the Pinn catchment lies across the North West, the Brent catchment lies in the east and the Crane in the south west.

Although Harrow as a borough has a relatively low susceptibility to surface water flooding, complex interactions exist between the pluvial (surface water), fluvial (river) and sewer systems which do pose a risk. The Council has been working closely with communities and other flood risk management authorities including neighbouring boroughs, the Environment Agency, Affinity and Thames Water, to improve our understanding of flood risk in the borough. In developing this Strategy, we have consulted with communities, businesses, neighbouring boroughs and risk management authorities to develop a coordinated Strategy for local flood risk management across Harrow.

Meeting Harrow's Vision

The Local Flood Risk Management Strategy will meet the Council's vision for Harrow: a place to live and work and be proud of. This vision will be delivered by making a difference:

- For the vulnerable;
- For communities;
- For local businesses; and,
- For families

The Council's Infrastructure Team asset manages 67 flood defence structures, 3 reservoirs, one of which is a dry impounding reservoir, 17 flood storage areas, 82kms of watercourse and a number of other water bodies shown in *figure 2.2.2 page 42.* Other managed assets include 19,509 road drainage gullies, highway drain and kerb drainage systems. Based on the Preliminary Flood Risk Assessment

there are approximately 40,051 properties on the Flood Map for Surface Water at risk of flooding to a depth of 0.3 metres in a 1 in 200 (0.5%) chance in any given year rainfall event which can be viewed at http://www.harrow.gov.uk/info/200074/planning/283/flood_zones_and_rivers/2

2.2 Context of the Strategy

The Strategy outlines the priorities for local flood risk management and provides a delivery plan to manage the risk over the next five years. It identifies roles and responsibilities of other risk management authorities including the Environment Agency and Thames Water, who have responsibility for managing the risk arising from Main Rivers and sewer flooding respectively.

This Local Flood Risk Management Strategy complements and supports the *National Strategy* *https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/228898/9780108510366.pdf* published by the Environment Agency which outlines a National framework for flood and coastal risk management. In addition, the Local Strategy is aligned with the Harrow Council Corporate Plan, Surface Water Management Plan and designated Critical Drainage Areas which can be viewed at https://www.harrow.gov.uk/www2/documents/s95652/SWMP%20-%20Vol%201.pdf

The Strategy is accompanied by an Action Plan setting out how we will deliver the objectives of the Strategy over the next five years. The Action Plan outlines the measures identified through this Strategy and the outcomes of each action are linked to the objectives of the Strategy so that we can monitor how we are delivering our local flood risk management measures.

Over the next five years we will continue to work with communities and businesses to help them understand the potential risks they face from all sources of flooding and what can be done to manage them. The development plan for the Borough and the development management process will ensure that development across Harrow both on existing built sites and new buildings; will integrate considerations of flood risk and sustainable drainage.

The Local Flood Risk Management Strategy will be updated the six year cycle to ensure that its content and emphasis remains relevant.

2.3 Document Structure

This strategy document contains the following chapters:

Chapter 2 describes the Councils objectives for managing local flood risk

Chapter 3 identifies responsibilities for dealing with local flood risk

Chapter 4 contains the assessment of local flood risk in Harrow

Chapter 5 reports on the delivery of the local flood risk management including the action plan

3.0 OBJECTIVES FOR MANAGING LOCAL FLOOD RISK

3.1 Local Objectives

Harrow Council's objectives for managing local flood risk are set out below:

- To develop and to improve the understanding of flood risk across the borough;
- To better inform residents and profile flood risk including flood prevention, preparedness, resilience and resistance;
- To improve the way in which we provide long term sustainability and flood risk reduction and mitigation through development to ensure the economic prosperity and protection of residents, business and infrastructure;
- To encourage residents, businesses and local landowners to take action and contribute to the management and reduction of flood risk; and
- To be compliant with statutory obligations and to play a positive role to combat climate change and to deal with the impacts of climate change.

3.2 National Flood Risk Management Objectives

The objectives for the Harrow Council Strategy have been developed in line with the Environment Agency's National Flood and Coastal Erosion Risk Management Strategy for England.[1] This sets out the following national objectives for flood risk management;

- Understanding the risks of flooding and coastal erosion, working together to put in place long-term plans to manage these risks and making sure that other plans take account of them;
- avoiding inappropriate development in areas of flood and coastal erosion risk and being careful to manage land elsewhere to avoid increasing risks;
- building, maintaining and improving flood and coastal erosion management infrastructure and systems to reduce the likelihood of harm to people and damage to the economy, environment and society;
- increasing public awareness of the risk that remains and engaging with people at risk to encourage them to take action to manage the risks that they face and to make their property more resilient;

1 Environment Agency (2011) National Flood and Coastal Erosion Risk Management Strategy for England

- improving the detection, forecasting and issue of warnings of flooding, planning for and co-ordinating a rapid response to flood emergencies and promoting faster recovery from flooding.

https://www.gov.uk/government/publications/national-flood-and-coastal-erosion-risk-management-strategy-for-england

3.3 Guiding Principles for Local Flood Risk Management

The National Flood Risk Management Strategy aims and objectives are supported by six high-level principles, to guide decisions on risk management activities, and the delivery process at both a national and local level. Harrow Council has used these to guide our objectives and identification of measures to deliver local flood risk management.

Proportionate and risk based approach

Flood risk management activities should be proportionate to the risk that is faced. It is not possible to prevent flooding altogether. A risk based approach to managing flooding targets investment to areas where the risk is greatest by examining both the likelihood and consequences of a flood occurring.

A catchment based approach

It is important to understand the interactions with the wider area to manage flood risk effectively, This means ensuring that activities are coordinated and working closely with neighbouring authorities to ensure that activities do not adversely affect other areas.

Community focus and partnership working

Working closely with communities provides a clearer understanding of the issues, appreciation of the community perspective of flooding and will result in more efficient and deliverable decisions. Working in partnership with other authorities is vital to ensure that risk is managed in a coordinated way beyond the boundaries and responsibilities of individual authorities.

Beneficiaries encouraged to Invest

Flood risk management activities limited by the funds available from central and local government. Beneficiaries other than Harrow Council should be encouraged to invest in order to maximise flood risk management activity and allow innovative solutions to take place.

Sustainability

More sustainable approaches to flood risk management should be sought to consider wider sustainability issues such as the environment, whole-life costs, and the impact of climate change. Wherever possible, solutions to flooding problems should work with natural processes and aim to enhance the environment.

Multiple benefits

Flood risk management solutions can often provide additional social, economic and environmental benefits e.g. sustainable urban drainage systems can reduce the pollution of watercourses by minimising urban storm water runoff. The potential to achieve multiple benefits should be considered in all flood risk management activities.

3.4 Environmental Objectives

The Council completed its Core Strategy in 2012 http://www.harrow.gov.uk/info/856/local_plan/596/core_strategy and its suite of associated Local Plan documents in 2013, all of which were subject to a Sustainability Appraisal incorporating the requirements of a Strategic Environmental Assessment (SEA) to estimate the environmental impact of the provisions of those documents in the Borough. As the LFRMS reflects the principles and requirements outlined in the Local Plan, as well as relevant national / sub-regional and catchment strategies (all of which have been subjected to SEA), negative environmental impacts on the Borough's environment are viewed as negligible.

The LLFA has a close relationship with the EA and has provided a response to River Basin Management Plans for both the Brent and Crane Catchment. Each of these catchments has Partnerships in place which are hosted by Thames 21 and Green Corridor respectively. Harrow Council is a founding member.

Additionally the LLFA have close working relationships with the Council's Planning Services and Biodiversity Officer. This ensures that all development and all projects consider biodiversity issues in the borough as a whole and take account of aims and objectives of the Harrow Biodiversity Action Plan and the Harrow Green Grid.

There are 44 green spaces in the borough designated as Sites of Importance for Nature Conservation (SINCs). These include five Sites of Metropolitan Importance, three of which are Local Nature Reserves (LNRs) and one (Bentley Priory Open Space) - a Site of Special Scientific Interest (SSSI).

Biodiversity in the borough as a whole and within its SINCs will be enhanced and the resilience of sites and connecting green and blue corridors strengthened by the LFRMS by making space for water, exploiting new opportunities for habitat creation and protection of existing diverse wildlife both in the Greenbelt in and within the urban setting.

4.0 LOCAL FLOOD RISK MANAGEMENT RESPONSIBILITIES

4.1 Overview

The responsibility for managing flood events lies with a number of different organisations whose roles may vary according to the severity of the flood event. For instance, the 1 in 10 (10%) year chance in any given year a flood may be dealt with by the sewerage undertaker and the LLFA, whereas a 1 in 200 (0.5%) year event in the same location could involve all Risk Management Agencies, emergency responders and central government. Hence this Local Flood Risk management Strategy sets out responsibilities and effective communication across these organisations.

The Flood and Water Management Act 2010 designates the following organisations as RMAs and sets out the legal responsibilities these organisations have for managing local flood risk:

- Lead Local Flood Authority – Harrow Council
- Environment Agency
- Sewerage undertaker i.e. Thames Water Utilities
- Highways Authority – Harrow Council

All RMAs have a duty to cooperate with the LLFA, and other RMAs when exercising their flood risk management functions. In addition, other legislation (such as the Highways Act 1980[2], Land Drainage Act 1991[3], Water Resources Act 1991[4], Civil Contingencies Act 2004) place duties and powers upon specific organisations and individuals of relevance to local flood risk management.

4.2 Responsibilities of Risk Management Authorities

Table 4.1 summarises the legal responsibilities and functions held by different organisations and individuals under all the legislation.

Table 4.1 Responsibilities of Risk Management Authorities

Organisation	Role & Responsibilities
Harrow Council	As a **RMA** under the Flood and Water Management Act 2010 as both the LLFA and the Highways Authority.
	Under the Highways Act 1980, is responsible for the effectual drainage of surface water from adopted roads insofar as ensuring that drains, including kerbs, road gullies and ditches and the pipe network which

[2] HSMO (1980) Highways Act http://www.legislation.gov.uk/ukpga/1980/66/contents

[3] HSMO (1991) Land Drainage Act http://www.legislation.gov.uk/ukpga/1991/59/contents

[4] HMSO (1991) Water Resources Act http://www.legislation.gov.uk/ukpga/1991/57/contents

	connect to the sewers, are maintained.
	As a **Category 1 Responder** under the Civil Contingencies Act 2004[5] and therefore has a responsibility, along with other organisations for developing emergency plans, contingency plans and business continuity plans to help reduce, control or ease the effects of any emergency.
	As a **Local Planning Authority**, have a responsibility to consider flood risk and sustainable drainage in our strategic land use planning documents and in the development of our Local Plan and take account of flood risk when making decisions on planning applications. The LLFA is now also a Statutory Consultee for managing surface water disposal and flood risk for development.
	As the **Regulator of Ordinary Watercourses** under the Land Drainage Act 1991[6], has the powers of ordinary watercourse works (either temporary or permanent), that may alter or impact the flow or storage of water within an ordinary watercourse will require consent from the Council prior to any work being carried out.
Environment Agency	As a **RMA** under the Flood and Water Management Act 2010, the Environment Agency has a strategic overview of all sources of flooding and coastal erosion (rivers, the sea, groundwater, reservoirs and surface water).
	As a **Category 1 Responder** under the Civil Contingencies Act 2004[7] and therefore has a responsibility, along with other organisations for developing emergency plans, contingency plans and business continuity plans to help reduce, control or ease the effects of any emergency.
	The Environment Agency has permissive powers to manage flood risk from 'main rivers', the sea and reservoirs. Can use enforcement powers to require landowners to take action to minimise flood risk to others.
	A statutory Consultee on flood risk in the planning process.
Thames Water Utilities Ltd	As a **RMA**, under the Flood and Water Management Act 2010, being the Sewerage undertaker serving the Borough.
	Responsible for removing wastewater from premises and draining surface water from the roofs and yards and outbuildings appurtenant to premises
Transport for London (Tfl)	As a Highways Authority, is designated a **RMA** under the Flood and Water Management Act 2010. It should be noted that there are no TFL roads in the Borough at present.

Table 4.2 Summarises the responsibilities of the identified RMA's in Harrow.

[5] HSMO (2004) Civil Contingencies Act http://www.legislation.gov.uk/ukpga/2004/36/contents

[6] HMSO (1991) Land Drainage Act http://www.legislation.gov.uk/ukpga/1991/59/contents

[7] HSMO (2004) Civil Contingencies Act http://www.legislation.gov.uk/ukpga/2004/36/contents

Table 4.2 Summary of RMA Responsibilities

Risk Source	Risk Management Authorities (RMA)		
	Lead Local Flood Authority	Environment Agency	Thames Water
Highway Drainage	YES		
Main Rivers		YES	
Ordinary Watercourses	YES		
Public Sewers			YES
Groundwater	YES		
Reservoirs	YES	YES	YES
Strategic Overview of all Sources of Flood Risk		YES	
Reservoirs		YES	

4.3 Responsibilities of Other Organisations / Individuals

Harrow Council recognises the vital role individuals, communities and businesses have in managing flood risk and the requirement for more information to be available to support these initiatives. The Strategy, therefore, aims to promote and encourage personal responsibility by raising awareness of flood risk and how this can be reduced and by supporting community-based actions.

Individuals, communities and businesses have an important role to play in managing local flood risk, alongside defined Risk Management Authorities.

Property Owners and Residents - It is the responsibility of householders and businesses to look after their property, including protecting it from flooding. It is important that householders, whose homes are at risk of flooding, take steps to ensure that their home is protected. Practical guidance can be found in the publication 'Prepare your property for flooding' available on the Environment Agency website[8] and in Part H of the Building Regulations. http://www.harrow.gov.uk/info/200074/planning/283/flood_zones_and_rivers/2

Riparian Owners – landowners of land which is adjacent to a watercourse or land which has a watercourse running through it, are a riparian owner and have certain legal responsibilities to maintain the watercourse, this includes piped and buried watercourses. Where a watercourse marks the boundary between adjoining properties, it is normally presumed the riparian owner owns the land up to the centre line of the watercourse.

[8] Environment Agency website - 'Prepare your property for flooding' https://www.gov.uk/prepare-for-a-flood

https://www.gov.uk/government/publications/riverside-ownership-rights-and-responsibilities

RMAs have powers and responsibilities to manage flood risk and work with others to improve river environments. This may often affect riparian owners, who must also adhere to certain responsibilities including maintaining the watercourse and to clear any obstructions (natural or otherwise), maintaining the banks and bed of the watercourse and any flood defences that exist and to accept the natural flow from the upstream neighbour and transfer it downstream without obstruction, pollution or diversion.

5.0 ASSESSMENT OF LOCAL FLOOD RISK

5.1 What is Flood Risk?

Flood Risk is a combination of the probability and the potential consequences of flooding from all sources – including from rivers and the sea, directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources. Assessing risk in quantifiable, financial terms can help prioritise where available funding should be directed.

> Flood Risk is the a combination of 2 components; the chance (or probability/likelihood) that a location will flood from any source or type of flooding, and the impact (or consequence) that the flooding would cause if it i.e. if there is a 1 in 100 (1%) chance of flood in any given year in this location, multiplied by the impact or consequence that will result if the flood occurs.

Probability can also be expressed as a fraction, percentage, decimal or description and should always make reference to a period of time. For example the industry refers to a 1 in 100 year chance of flooding in any given year or a 1% annual probability of flooding which both refer to the same likelihood.

However, it should also be borne in mind that the consequences of flooding can be far reaching and not always easy to value, particularly the social impacts of and fear of repeat events considered in developing our objectives for managing future flood risk.

The evaluation of risk takes into account the severity of impacts from a flood event which can be highly variable in terms of social, economic and environmental consequences. Consequences are often measured by number of properties flooded and level of economic damage. It will also be influenced by vulnerability (i.e. a petrol filling garage is more vulnerable than a commercial warehouse)

5.2 Communities at Risk

This LFRMS covers our administrative boundary of 55kms² and includes 21 Wards, approximately 80kms of rivers and watercourses. There are 3 spring fed river catchments in Harrow with various tributaries that drain through urban areas which have inter connectivity with both the foul and surface water sewer network.

The Brent catchment drains from high open space land in the north and east of the borough through highly urbanised areas covering approximately 153kms² and subsequently through Barnet, Brent and Ealing. There are 2 Ordinary Watercourses, the Edgware Brook and Wealdstone Brook that become Main River downstream, and also 1 main river the Kenton Brook that pose the main flood risk.

The River Pinn catchment lies in the north-west of the borough covering and area of 370kms² and joins the River Colne beyond the borough boundary in Hillingdon. There are a number of tributaries that confluence with the River Pinn, most notably the Woodridings Stream and Woodhall Gate Ditch that pose the main flood risk.

The Crane River catchment comprises an area of approximately 124km² and forms part of five London Boroughs (Harrow, Hillingdon, Ealing, Hounslow and Richmond upon Thames). It lies in the South-West of the borough. The tributaries of the River Crane within the London Borough of Harrow include the Yeading Brook East, Yeading Brook West, the Roxbourne, Greenhill Stream, Elmshot Stream and Smarts Brook.

All of these rivers respond very rapidly to rainfall and the close connectivity with the sewer network exacerbates flooding to the communities, businesses and infrastructure that are built along these river corridors.

To provide some additional mitigation through development opportunities Harrow commissioned an Addendum to its Level 2 SFRA to provide the evidence base and mechanism within the Harrow and Wealdstone Area Action Plan. The Site Allocation Development Plan Documents review and revise the risk within the Intensification Area and undertake sequential and exception tests.

As such there have been a number of flood defences and alleviation projects constructed to manage these risks, most notably George V Dry Impounding Reservoir (River Pinn), Summerhouse Reservoir and Silk Stream, Prince Edward FSA (both Edgware Brook), Oxhey Farm FSA (Woodridings Stream), New River Pinn FSA and Queensbury Recreation Ground River Restoration and FSA (Kenton Brook).

New projects are currently in design at Newton Park (Roxbourne Stream), Headstone Manor (Yeading Brook), Stanmore Marsh (Edgware Brook) and a multi-agency project on the Wealdstone Brook river corridor led by Harrow Council that causes major flooding in Wealdstone and North Kenton, an area which covers both Harrow and Brent. This project is on the Thames Regional Flood & Coastal Committee 6 year program and is named as Wealdstone Flood Alleviation Scheme.

5.3 Preliminary Flood Risk Assessment

In 2011 a Preliminary Assessment Report (PAR) was the key document informing the preparation of future LFRMS required by the Flood and Water Management Act and is the first stage of the Preliminary Flood Risk Assessment. The PAR identifies key flood risk areas which fulfils our obligations as a LLFA under the requirements of the Flood Risk Regulations.
http://www.harrow.gov.uk/www2/documents/s87416/PFRA.pdf

In 2011 the Council Cabinet approved and published its Preliminary Flood Risk Assessment which is a key document in the preparation of this strategy and fulfils the Lead Local Flood Authority obligations and requirements for the Flood Risk Regulations and Flood & Water Management Act.

The PFRA is a high level screening exercise that brings together information from a number of sources to assess local flood risk which includes key stages:

- Collecting information on past (historic) and future (potential) floods and flood risk
- Collating the information into a Preliminary Assessment Report
- Identification of flood risk areas by reviewing national indicative areas produced by the EA alongside local information in the PAR

The Council uses the PFRA as part of its toolkit to justify and provide the evidence base to support its role as a LLFA and defend its position and determination of planning applications and local plan documents using a risk based approach.

5.4 Surface Water Management Plan

In 2012 the Council Cabinet approved and published its Surface Water Management Plan which outlines the surface water management strategy from all sources after heavy rainfall.

The SWMP was delivered in partnership with other RMA's and stakeholders including the GLA Drain London, Environment Agency, TFL and Thames Water. This document identified 15 Critical Drainage Areas (CDA's) and established a long term action plan to manage surface water in the most cost effective way and will influence future capital investment, maintenance, and public engagement, land use planning, new development and emergency planning.
https://www.harrow.gov.uk/www2/documents/s95652/SWMP%20-%20Vol%201.pdf

The Council uses the SWMP as part of its toolkit to justify and provide the evidence base to support its role as a LLFA and defend its position and determination of planning applications, local plan documents and Land Drainage Bylaws using a risk based approach.

5.5 Environment Agency Flood Map for Surface Water

The Environment Agency Flood Map for Surface Water was first published 12th December 2013. This was the third national surface water flood map produced by the EA with improved modelling techniques and also included local mapping.

Although managing the risk of flooding from surface water is the responsibility of Lead Local Flood Authorities the EA produced these maps under their Strategic Overview role given to them by government following the recommendations of Sir Michael Pitt's review of the 2007 summer floods and also to meet the requirements of the Flood Risk Regulations to publish flood risk maps by December 2013.

Due the complexity of the river and sewer networks in Harrow and a lack of confidence in both the Level 1 & 2 Strategic Flood Risk Assessment modelling results Harrow LLFA and Planners reviewed the EA FMfSW results comparing against our own internally held data Appendix *figure 3.5.1 page 39.*

This review concluded that the EAFMfSW was more representative of known historic flooding than our Surface Water Management Plan modelling results and therefore took the decision to use a combination of the EA fluvial flood extents and FMfSW *figure 4.5.2 page 40* for development and planning purposes. http://www.harrow.gov.uk/info/200074/planning/283/flood_zones_and_rivers/2

5.6 The Impact of Climate Change

Current predictions of future rainfall indicate that we should expect increasing numbers of severe and extreme weather events in the future. Intense storms are the main cause of surface water flooding, which would also increase in frequency. It is predicted that the frequency of heavy rainfall events could double by the 2080s according to the UK Climate Projections 2009[9]. By the 2080s, it is predicted that there could be around three times as many days in winter with heavy rainfall (defined as more than 25mm in a day) and that the amount of rain in extreme storms (with a 1 in 5 (20%) annual chance or rarer) could increase locally by 40%. Consequently, the number of properties, business and critical infrastructure at risk will also increase.

Implications for Flood Risk

Climate changes can affect local flood risk in several ways. Impacts will depend on local conditions and vulnerability. It is likely wetter winters and more rain falling in wet spells may increase river flooding in both rural and heavily urbanised catchments. More intense rainfall causes more surface runoff, increasing localised flooding and erosion. In turn, this may increase pressure on drains, sewers and water quality. Storm intensity in summer could increase even in drier summers, so we need to be prepared for the unexpected.

Rising sea or river levels may increase local flood risk inland or away from major rivers because of interactions with drains, sewers and smaller watercourses. Recharge of the aquifers may increase in wet winters, or decrease in drier summers.

Where appropriate, local studies are needed to understand climate impacts in detail, including effects from other factors like land use. Sustainable development

[9] United Kingdom Climate Projections 2009 http://ukclimateprojections.defra.gov.uk//

and drainage will help to adapt to climate change and manage the risk of damaging floods in the future.

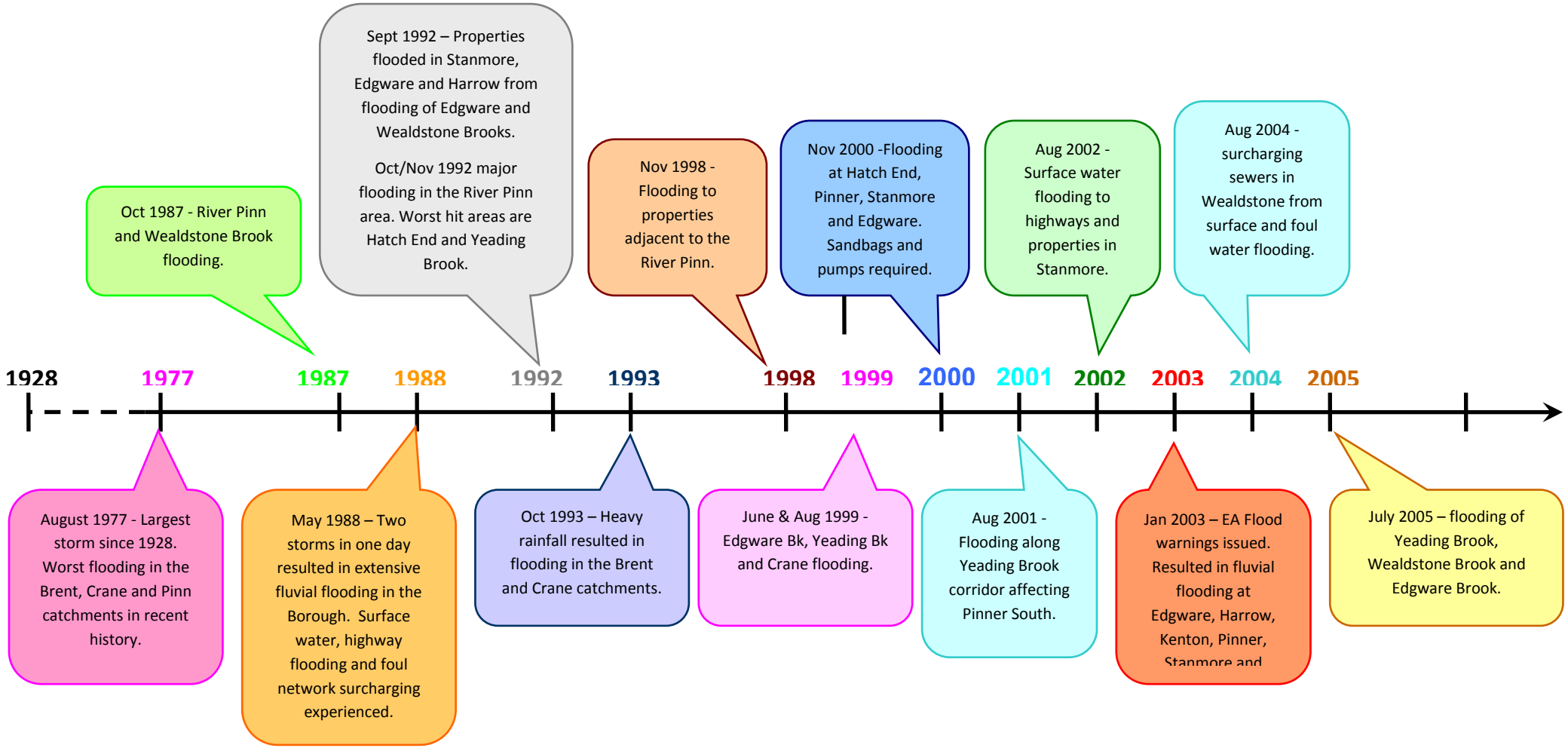
Adapting to a changing climate

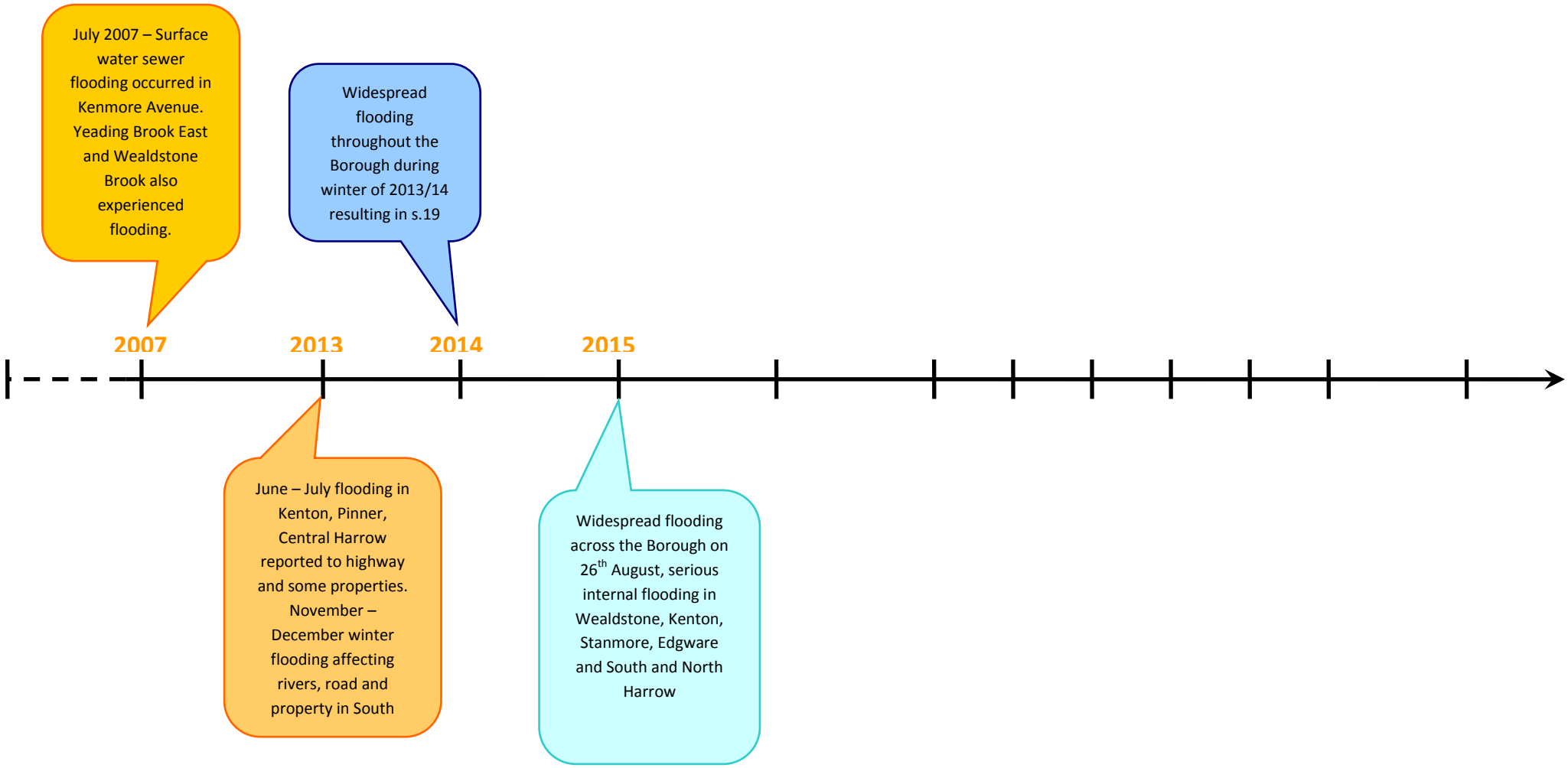
It is essential we respond and adapt to a changing climate by planning ahead. We can prepare by understanding our current and future vulnerability to flooding, developing plans for increased resilience and building the capacity to adapt. Regular review and adherence to these plans is key to achieving long-term, sustainable benefits.

Although the broad climate change picture is clear, we have to make local decisions against deeper uncertainty. We will therefore consider a range of measures and retain flexibility to adapt. This approach, embodied within flood risk appraisal guidance, will help to ensure that we do not increase our vulnerability to flooding.

5.7 Timeline of Historic Flood Risk

figure 5.1.3 shows a timeline of historic flooding that has taken place in Harrow.




July 2007 – Surface water sewer flooding occurred in Kenmore Avenue. Yeading Brook East and Wealdstone Brook also experienced flooding.
Widespread flooding throughout the Borough during winter of 2013/14 resulting in s.19
2007
2013
2014
2015
June – July flooding in Kenton, Pinner, Central Harrow reported to highway and some properties. November – December winter flooding affecting rivers, road and property in South
Widespread flooding across the Borough on 26th August, serious internal flooding in Wealdstone, Kenton, Stanmore, Edgware and South and North Harrow

This section sets out the assessment of flood risk from all sources of flooding i.e. surface water, groundwater, sewer and river. For each of these sources a description of the source and mechanism of flooding has been provided and an assessment of the risk has been made drawing on historical records outcomes and from technical studies addressing both current and future risk.

Flooding from Local Sources – Surface Water Flooding	
Description of Source	Surface water flooding usually occurs when high intensity rainfall generates runoff, when the ground is saturated and water can no longer infiltrate. This is exacerbated by the underlying impermeable London Clay which has a relatively slow infiltration rate. In rural areas or open spaces rainfall runoff flows over the surface of the ground and either ponds in low lying areas, goes very rapidly directly to a river, watercourse or sewer. It can be exacerbated when the soil is saturated and natural drainage channels or artificial drainage systems have insufficient capacity to cope with the additional flow.
At Risk Locations	There have been numerous historic major flood events, most recently dating from 1977 to 2015. Such is the relationship between surface water sewer networks and rivers, watercourses in a high density urban environment it is difficult to distinguish between pluvial and fluvial flooding. Refer to fig 4.5.2
Future Flood Risk	Harrow LLFA and LPA is working with a number of partners including the EA, GLA, TWUL to manage existing capacity issues in sewer, river and watercourse networks to mitigate the risk of increased flooding from climate change and growth.

Flooding from Local Sources – Groundwater Flooding	
Description of Source	Groundwater flooding occurs as a result of water rising up from an underlying aquifer or from water flowing from springs. This tends to occur after much longer periods of sustained high rainfall and can be sporadic in both location and time often lasting longer than a fluvial or surface water sewer flood. High groundwater level conditions may not always lead to widespread groundwater flooding; however, they have the potential to exacerbate the risk of pluvial, fluvial and tidal flooding by reducing rainfall infiltration capacity, and to increase the risk of sewer flooding through sewer/groundwater interactions. In permeable substrates, groundwater levels can rise, causing flooding problems in subsurface structures or at the ground surface.
At Risk Locations	Refer to figure 5.5.3 page 42
Future Flood Risk	Harrow LLFA and LPA is aware of what is minimal ground water risk and monitor information from the EA & BGS. Problems that arise are managed on a responsive basis and consideration is given to improvements where necessary through new development.

Flooding from Local Sources – Ordinary Watercourses (incl. small ditches & land drains)	
Description of Source	Ordinary watercourses include every river, stream, ditch (whether dry or not), drain, cut, dyke, sluice, sewer (other than a public sewer) and passage through which water flows, above ground or culverted, which is not designated as a Main River.

	The responsibility for ordinary watercourses fall to riparian owners who typically own land on either bank and therefore are deemed to own the land to the centre of the watercourse however; Harrow LLFA are the Regulator for ordinary watercourses
At Risk Locations	There have been numerous historic major flood events, most recently dating from 1977 to 2015. Such is the relationship between surface water sewer networks and watercourses in a high density urban environment it is difficult to distinguish between pluvial and fluvial flooding. Refer to fig 4.5.2
Future Flood Risk	Harrow LLFA and LPA is working in a number of partnerships with the EA, GLA, TWUL and other stakeholders to manage existing flood and capacity issues with the river and watercourse networks and mitigate the risk of increased flooding from climate change and growth.

Flooding from Local Sources – Main Rivers	
Description of Source	River flooding occurs when water levels rise as a result of high or intense rainfall which flows into them, resulting in watercourses overtopping their banks. A Main River is defined by the Environment Agency on its Main River Map and is usually a larger river or stream such as The Rive Pinn, Edgware Brook and Yeading Brook.
At Risk Locations	There have been numerous historic major flood events, most recently dating from 1977 to 2015. Such is the relationship between surface water sewer networks and rivers, watercourses in a high density urban environment it is difficult to distinguish between pluvial and fluvial flooding. Refer to fig 4.5.2
Future Flood Risk	Harrow LLFA and LPA is working in a number of partnerships with the EA, GLA, TWUL and other stakeholders to manage existing flood and capacity issues with the river and watercourse networks and mitigate the risk of increased flooding from climate change and growth.

Flooding from Local Sources – Sewer Flooding	
Description of Source	During heavy rainfall, flooding from the sewer system may occur if; (a) the rainfall event exceeds the capacity of the sewer system / drainage system, (b) the system becomes blocked by debris or sediment, (c) the system surcharges due to high water levels in receiving watercourses, and/or (d) the system surcharges due to the ingress of ground water, either through the fabric of the sewer or due to inundation above the surface. Sewer flooding generally results in localised short term flooding. Management of sewer flooding from public sewers (but not from private drains or land drainage) is the responsibility of Thames Water as the sewerage undertaker, although it is often difficult to distinguish from surface water runoff and groundwater flooding. The majority of the sewer network across the Borough is by way of a dual manhole system that allows surface water to use spare capacity in the foul sewers to the sewage treatment works. The capacity of the surface water sewer system is therefore limited and was only designed to accommodate a 1 in 10 or 1 in 15 year storm event. Any rainfall event exceeding this probability will likely result in overland flow, or overflow into the foul sewers sometimes

	overloading the trunk mains causing combined foul and surface water flooding. High river levels due to rainfall can surface water sewer outfalls by submerging the outlet into the river. Surcharging can occur when pipes become blocked or rainfall entering the drainage system exceeds the capacity of the drains. Water may overflow into streets and houses if water is unable to drain.
At Risk Locations	Refer to Thames Water DG5 Register
Future Flood Risk	Harrow LLFA is working in a number of partnerships with the EA, GLA, TWUL to manage existing flood and capacity issues within the sewer networks, particularly the trunk mains which are overloaded with surface water during intense rain events, mitigating the risk of increased flooding from climate change and growth.

Flooding from Local Sources – Artificial Sources	
Description of Source	Artificial sources include any water bodies not covered under other categories and typically include canals, lakes and reservoirs.
At Risk Locations	Please refer to figure 7.5.5
Future Flood Risk	

5.8 Flood Forecasting and Warning

The Environment Agency provides an online flood warning service that can be viewed at http://apps.environment-agency.gov.uk/flood/31618.aspx.
This service provides a flood risk summary for up to 3 days ahead by County, live river level date and warning map. There is also a link to register for Floodline Warnings Direct to receive direct flood warning messages for eligible communities. What to do in the event of a flood is also available on the Harrow Council website at http://www.harrow.gov.uk/info/200199/severe_weather?WT.ac=severe_weather.
Harrow Council Emergency Planners have published a Multi-Agency Flood Plan covering flood events and are able to provide assistance during and after a severe flood event including recovery. Harrow LLFA and Emergency Planners are also working together with the EA Flood Resilience Team and National Flood Forum to build local Flood Action Groups who will host local flood plans for those communities at most risk.

5.9 Critical Infrastructure

The following list of infrastructure in the borough is not an exhaustive list but will be made a priority when dealing with a flood incident, emergency flood planning, flood response and recovery. For flood protection it is incumbent on those infrastructure, utility or buildings owners who are at risk of flooding to ensure that their assets are resilient and resistant to flooding and that there is an up to date Emergency Flood Plan inclusive of emergency evacuation arrangements.

Critical Infrastructure	
Educational Establishments	Nurseries, schools and colleges
Healthcare and Nursing Homes	Hospitals-Northwick Park Hospital, Edgware Hospital, Stanmore Orthopaedic Hospital
	Surgeries/Health care centres
	Residential Care Homes
Emergency Services	Fire Stations-Stanmore, Northolt and Pinner
	Police Station-South Harrow
	Ambulance Station –Pinner
Utility Services	Thames Water Sewage Treatment
	Affinity Water
	UKPN Electricity
	National Grid Gas
	BT Telecommunications
Transport Infrastructure	Tfl Borough Roads
	National Rail & Tube Networks

5.10 Planning & Development

The Council has published its Local Development Framework in (2013) which contains a suite of local plan documents including a Level 1 (2009) and Level 2 (2011) Strategic Flood Risk Assessments and Development Management Policies (2013) which supports this strategy by placing development within areas of least flood risk and also setting building drainage thresholds, source control measures such as limiting surface water discharge rates to greenfield rates for all development and on site storage and attention.

http://www.harrow.gov.uk/info/856/local_plan/609/development_management_policies

The Council has since reviewed the flood modelling in both SFRA's in 2014 and in agreement with the Environment Agency now uses combination of EA Fluvial Maps and Flood Map for Surface Water (EA FMfSW) to determine the extent of flood risk for new development.
http://www.harrow.gov.uk/www2/documents/s126795/Item%2010%20-%20tabled%20document%20-%20Flood%20Zone%20policy%20statement.pdf

The review by the Drainage Engineers included looking back at historical records, correspondence, photos, videos and anecdotal information from resident and both past and present engineers.

In light of the publication of the FMfSW which was also similar to the modelling results in the Surface Water Management Plan Engineers and Planners agreed that this was more representative of the combined risk of both fluvial and pluvial flood risk in the borough due the close linkage of the river and sewer networks.

6.0 DELIVERY OF LOCAL FLOOD RISK MANAGEMENT

6.1 Overview

This section describes the measures and actions that form the basis of Harrow Council's Local Flood Risk Management Strategy. There is an overlap and interaction between the delivery of specific local flood risk management measures and the general exercising of duties and powers by Harrow Council under the Flood and Water Management Act 2010.

6.2 Delivery of Duties under the Act

Forge Partnerships and Leadership on Local Flood Risk Management

North West London Strategic Flood Group
The North West London Strategic Flood Group comprises the 6 LLFAs covering North West London, namely, Harrow, Barnet, Brent, Ealing Hounslow and Hillingdon and the Environment Agency. The Group currently chaired by the host borough meets quarterly to share best practice and understanding of flood risk across North West London, and, where possible, provide coordinated and collaborative management of flooding.

Local Stakeholders

The LLFA is working with many local and regional stakeholders and partners to continue evolving existing strategies and develop new projects and opportunities combining flood risk principles with river restoration, habitat creation and GISuDS. These partnerships will put in place longer term objectives of education and improvements in amenity spaces that will encourage more use and healthier lifestyles.

Investigate Flood Incidents

Section 19 of the Flood and Water Management Act states that, on becoming aware of a flood in its area, a lead local flood authority, must to the extent that it considers is necessary or appropriate, investigate the cause and notify the relevant authority who have the duty to resolve the flooding. The Council will therefore carry out an initial appraisal where internal flooding of a single residential property, business or office premises has occurred, or where a flooding incident impacted on an identified item of critical infrastructure as detailed in Section 4.5.

This initial appraisal will determine the main source of flooding and therefore the risk management authority responsible for resolving the incident, which will then be notified.

Where the source of flooding is deemed to be the responsibility of Harrow Council i.e. flooding from ordinary watercourses, surface water or groundwater, a full investigation will be carried out, except where the source of flooding is ground water and where this only affects one single property.

A summary of the results of the full flood investigations will be published on the Council's website. All s.19 flood reports will be recorded to extend the Council's historic incident records.

Maintain an Asset Register

Prior to the FWMA Harrow LLFA had already developed its own flood defence and gulley cleaning and repair database including GiS layers showing locations, grid reference, ownership, maintenance schedules and photos.

This data provides an asset management system to record maintenance visits, asset defects, repairs and provides the evidence to show that the LLFA is complying with its duties for flood risk management.

A further web based register; 'Floodstation' for flood defences only was developed in partnerships with other London Drainage Engineers Group, Boroughs and the GLA Drain London partnership https://www.london.gov.uk/what-we-do/environment/climate-change-weather-and-water/drain-london.

SUDS Approving Body

Sustainable urban drainage systems will now be a planning requirement for developments of ten dwellings or more and equivalent non-residential schemes from April 2015 unless developers can demonstrate that SuDS would be inappropriate.

Schedule 3 of the Flood & Water Management Act and the approval of SuDS by a SuDS Approving Body is now replaced by changes to the National Planning Policy Framework.

The Government laid a Statutory Instrument making LLFA's a Statutory Consultee by adding the consultation requirements to Schedule 4 of the Development Management Procedure Order coming into effect from 15 April 2015.
This confirms that in considering planning applications, local planning authorities should consult the relevant Lead Local Flood Authority on the management of surface water; satisfy themselves that the proposed minimum standards of operation are appropriate and ensure through the use of planning conditions or planning obligations that there are clear arrangements in place for ongoing maintenance over the lifetime of the development.
The changes will strengthen existing planning policy to ensure that sustainable drainage systems will be provided in new major developments where appropriate.

Powers to do Works and Designate Structures

Schedule 1 of the Flood & Water Management Act provides a form of legal protection reserved for key structures or features that are privately owned and maintained and that contribute to the management of flood and coastal erosion risks

A designation is a legally binding notice served by the designating authority to the owner of the structure or feature and the notice is also a local land charge.
Designation makes no physical change to the structure or feature concerned and does not increase the risk of flooding or coastal erosion.

The owner of the property can continue to have full use of the structure or feature and the only restriction is that the structure is not allowed to be altered, removed or replaced without careful consideration and the consent of the responsible authority.

Harrow has not designated any flood defence structures, instead uses its Land Drainage Bylaws, Development Management Policies in a partnership approach to control fluvial, pluvial flooding and the management of surface water.

Harrow will continue this partnership approach with other RMA's and Developers and if necessary designate future flood defence assets in cooperation with new development.

Regulation of Ordinary Watercourses

Harrow Council has powers of ordinary watercourse consent under the Land Drainage Act 1991, where any works (either temporary or permanent), that may alter or impact the flow or storage of water within an ordinary watercourse will require consent from the Council prior to any work being carried out. The Council also published a Policy Statement of Flood Defence in 2001 and Land Drainage Bylaws in 2002. Should you need further advice or apply for land drainage consent you can contact the Infrastructure Team at infrastructure@harrow.gov.uk

6.3 Local Flood Risk Management Action Plan

For each of the local flood risk management objectives, potential measures were identified. The measures are set out in the Action Plan in Table 5.1. LFRMS projects are reported in Table 5.2.

Table 6.1 Harrow Flood Risk Management Action Plan Measures

LFRMP Objective	Action Reference	Action Plan	Flood Risk Source					Timescale	Cost Benefit
			Flooding from Main Rivers	Flooding from Non Main Rivers	Flooding from Main and Non Main Rivers	Flooding from Reservoirs	Flooding from Surface Water		
To better inform residents and profile flood risk including flood prevention, preparedness, resilience and resistance	HR1 Communication and reputation	Enhance information on website regarding emergency flooding; resistance and resilience measures	Y	Y	Y	N	Y	On-going	Low
	HR2 Communication and reputation	On-going development to enhance the public viewing portal through 'my harrow' website which provides a local map with rivers, watercourse, flood zones and flood defences inclusive of information: asset name, address, owner, river/watercourse name and designation and flood zone	Y	Y	Y	N	Y	On-going	Low
	HR3 Communication and reputation	Ensure that all latest flood risk management publications/ reports/ planning documents are available on website as baseline data for developers and single applicants	Y	Y	Y	N	Y	On-going	Low

LFRMP Objective	Action Reference	Action Plan	Flood Risk Source					Timescale	Cost Benefit
			Flooding from Main Rivers	Flooding from Non Main Rivers	Flooding from Main and Non Main Rivers	Flooding from Reservoirs	Flooding from Surface Water		
To improve the way in which we provide long term sustainability and flood risk reduction and mitigation by development to ensure the economic prosperity and protection of residents, business and infrastructure	HR4 Planning	Working with planners and local development framework (LDF) team to keep pace with Planning Legislation and how it affects flood risk management including updating the information that is provided to developers and single applicants	Y	Y	Y	N	Y	On-going	Medium
	HR5 Planning	Develop an online standing local advice for flood risk assessment, SuDS matrix for developers and single applicants	Y	Y	Y	N	Y	On-going	Medium
	HR6 Planning	Continue to support the concept of flood risk reduction through sustainable development by undertaking a more holistic and inclusive approach to river, surface water and sewer modelling	Y	Y	Y	N	Y	On-going	Medium

LFRMP Objective	Action Reference	Action Plan	Flood Risk Source					Timescale	Cost Benefit
			Flooding from Main Rivers	Flooding from Non Main Rivers	Flooding from Main and Non Main Rivers	Flooding from Reservoirs	Flooding from Surface Water		
To improve the way in which we provide long term sustainability and flood risk reduction and mitigation by development to ensure the economic prosperity and protection of residents, business and infrastructure	HR7 Planning	Continue dialogue with Planners and EA to move to a more consistent and accurate use of the latest available data for flood risk mapping inclusive of surface water and sewer modelling to use as the evidence base for planning applications	Y	Y	Y	N	Y	On-going	Low
	HR8 Planning	To work with Planners and other internal and external partners in promoting SuDS and how they will affect flood risk management locally	Y	Y	Y	N	Y	On-going	Medium
To ensure emergency planning have the latest data for the Multi-Agency Flood Plan	HR9 Planning	Provide updated information for Harrow emergency planning and the Multi-Agency Flood Plan	Y	Y	Y	N	Y	On going	High

LFRMP Objective	Action Reference	Action Plan	Flood Risk Source					Timescale	Cost Benefit
			Flooding from Main Rivers	Flooding from Non Main Rivers	Flooding from Main and Non Main Rivers	Flooding from Reservoirs	Flooding from Surface Water		
To provide a single point contact for all flood risk management, flood zone and development control drainage enquiries	HR10 LLFA	Provide the internal and external hub for all flood risk management activities	Y	Y	Y	N	Y	On-going	Low
Meet statutory obligations	HR11 LLFA	Ensure compliance with EU and UK flood and surface water management legislation	Y	Y	Y	N	Y	On going	High
Provide solutions to local flood issues	HR12 LLFA	Works with other RMA's on shared risk projects to resolve local flooding problems	Y	Y	Y	N	Y	On going	High
Update and use of the latest data	HR13 LLFA	Rationalise/review all of flood modelling data in Strategic Flood Risk Assessment (SFRA), Surface Water Management Plan (SWMP), Preliminary Flood Risk Assessment (PFRA) and reconcile against latest EA flood zones and updated Flood Map for Surface Water (uFMfSW)	Y	Y	Y	N	Y	On going	Medium

LFRMP Objective	Action Reference	Action Plan	Flood Risk Source					Timescale	Cost Benefit
			Flooding from Main Rivers	Flooding from Non Main Rivers	Flooding from Main and Non Main Rivers	Flooding from Reservoirs	Flooding from Surface Water		
Share costs with other stakeholders and promote community engagement	HR14 LLFA	Seek out all opportunities to access internal and external funding for flood risk management projects whilst on individual projects ensure all constraints and opportunities for partnership activities are met	Y	Y	Y	N	Y	On-going	Medium
Meet statutory obligations	HR15 LLFA	Continue to deliver Harrow Capital Flood Defence Program	Y	Y	Y	N	Y	On going	High
	HR16 LLFA	Continue to deliver Harrow Drainage Revenue Maintenance program to protect all of the Borough drainage infrastructure							
Share costs and objectives	HR17 LLFA	Work with other RMA's to apply for grants, added burdens funding and all other sources of income to fund any project where there is a flood risk benefit	Y	Y	Y	N	Y	On going	High

LFRMP Objective	Action Reference	Action Plan	Flood Risk Source					Timescale	Cost Benefit
			Flooding from Main Rivers	Flooding from Non Main Rivers	Flooding from Main and Non Main Rivers	Flooding from Reservoirs	Flooding from Surface Water		
Share information and promote Pitt Review objectives	HR18 LLFA	Continue to work with Barnet, Brent, Ealing, Hillingdon and Hounslow as the West London flood risk management partnership	Y	Y	Y	N	Y	On going	Medium
	HR19 LLFA	Continue work with internal partners for Brent Catchment Partnership, Crane Valley Partnership, Harrow Nature Conservation Forum and Greener Harrow							
Solve local flooding issue	HR20 LLFA	Continue to work with the Greater London Authority, EA, Thames Water and Brent on Wealdstone Brook Catchment flood group	Y	Y	Y	N	Y	On going	High
Meet statutory obligations	HR21 LLFA	Continued development and support of flood defence and flood reporting database 'Flood Station'	Y	Y	Y	N	Y	On going	Medium

LFRMP Objective	Action Reference	Action Plan	Flood Risk Source					Timescale	Cost Benefit
			Flooding from Main Rivers	Flooding from Non Main Rivers	Flooding from Main and Non Main Rivers	Flooding from Reservoirs	Flooding from Surface Water		
Modernise gulley cleaning operations streamlining the data entry system and moving toward a more targeted approach to this service	HR22 LLFA	Development of a road gulley cleaning smart phone app that will provide a real time download onto a web based database of cleaning activity including asset condition information that can be linked to our corporate mapping system.	Y	Y	Y	N	Y	On-going	High
Develop and improve the understanding of flood risk across the borough	HR23 LLFA	Investigate severe flood incidents under Section 19 of the Flood and Water Management Act 2010	Y	Y	Y	N	Y	On going	High
LFRMP Projects	**HR24-28**	**See next table**							

LFRMP Objective	Action Reference	Action Plan	Flood Risk Source					Timescale	Cost Benefit
			Flooding from Main Rivers	Flooding from Non Main Rivers	Flooding from Main and Non Main Rivers	Flooding from Reservoirs	Flooding from Surface Water		
Inclusion of all aspects of the environment within flood risk management projects and to use suitable public land to make space for water	HR29 Harrow - parks and open spaces	To comply with the Harrow Biodiversity Action Plan objectives	Y	Y	Y	N	Y	On going	Medium
	HR30 Harrow - parks and open spaces	To comply with Harrow Parks and Open Spaces Strategy	Y	Y	Y	N	Y	On going	Medium

Table 6.2 Harrow Flood Risk Management Action Plan – Projects

LFRMP Objective	Action Reference	Action Plan	Flood Risk Source					Priority	Funded
			Flooding from Main Rivers	Flooding from Non Main Rivers	Flooding from Main and Non Main Rivers	Flooding from Reservoirs	Flooding from Surface Water		
To provide flood risk reduction downstream on Wealdstone Brook; restore the Kenton Brook, bring river into park for use as an amenity and educational asset	HR24 Projects	Completion of Queensbury Recreation Ground River Restoration and Flood Storage Area Phase II	Y	Y	Y	N	Y	High	TRFCC
To reduce flooding downstream on Edgware Brook improve amenity, river restoration and restore the marsh to its original status improving water quality, improving habitat and biodiversity and making space	HR25 Projects	Construct Stanmore Marsh River Restoration, Flood Storage and Amenity Improvement Project (225k s.106, 175k GLA & Harrow Capital)	Y	Y	Y	N	Y	High	YES
To reduce the requirement of invasive de-siltation works within the historic moat whilst improving water quality, improving habitat and biodiversity and making space for water from the Kodak Housing development	HR26 Projects	Construct Headstone Manor sedimentation and reed bed project aligned with Kodak housing development and Headstone Manor Museum Project	Y	Y	Y	N	Y	High	YES
	HR27 Projects	Complete construction of Newton Park flood storage area and Roxbourne River restoration	Y	Y	Y	N	Y	High	YES

LFRMP Objective	Action Reference	Action Plan	Flood Risk Source					Priority	Funded
			Flooding from Main Rivers	Flooding from Non Main Rivers	Flooding from Main and Non Main Rivers	Flooding from Reservoirs	Flooding from Surface Water		
To combine individual links by walks to all parks and open spaces and where possible add a route that follows or meets a water environmental element, and to roll out a circular walk that is linked by a combination of green/blue assets	HR28 Projects	Work with the Harrow Green Grid project to include as many blue/green objectives within the overall scheme	Y	Y	Y	N	Y	Low	NO

Prioritisation of Measures

It is not possible to prevent all flooding, and with limited resources and funding flood risk management work will need to be prioritised. Each measure in this strategy has been split into a number of actions (as outlined in the Action Plan). The majority of actions are based on improving communication and education of residents and property owners to enable them to help themselves, and putting procedures in place within the Council to improve understanding and future management of local flood risk across the Borough.

As understanding of flood risk improves specific mitigation schemes and activities will be developed to address flood risk in those areas at greatest risk. This will require a clear protocol in terms of identifying which actions or schemes should be taken forward given the limited local and national funding streams. In these cases the following will be important considerations:

- Risk – the risk of doing nothing in terms of economic, social and environmental terms,
- Consequence – how many people or properties the measure or scheme could impact, e.g. an individual property, ward or the Borough as a whole, and
- Deliverability – including costs and technical deliverability, e.g. providing information on flood resilience measures via the Council website would be cheaper and technically easier to implement than designing and implementing a large flood alleviation scheme.

Moving forward, to ensure funding and resources are targeted to those areas and actions of highest importance we will prioritise our activities based on the following, where:

- There is a historic and on-going flood risk from local flooding sources (surface water, groundwater and smaller watercourses and ditches),
- Funding is available,
- There is an identified benefit to properties, communities, businesses and / or infrastructure,
- Funding is made available by partners, where perhaps traditional funding sources are not available or cannot fully fund the cost of the measure including funding for biodiversity and ecology drivers,
- The measure delivers benefit and mitigation to areas identified as being at risk through Harrow Councils Local Flood Risk Strategy, and
- Schemes deliver multiple benefits, including wider environmental benefits.

6.4 Community Engagement and Partnerships

Dating back to 1929 the Hatch End Association had campaigned to raise flood protection levels from the Woodridings Brook. After a number of serious floods between 1980 to1997 residents restarted their campaign to provide better flood resilience to homes and businesses.

Initially National Rivers Authority later to become the Environment Agency undertook an economic assessment which did not meet the qualifying criteria for a flood alleviation scheme.

This was finally concluded in 2009 with the construction of a new section of river in Hatch End Playing Fields and flood defences in Grimsdyke Golf Course and Oxhey Farm where there is a 3000m^3 flood storage area.

There have been a number of other partnerships to provide property level flood protection to homes in Kenmore Avenue where the Wealdstone Brook has caused internal flood damage.

Harrow LLFA is working collaboratively with our neighbouring Boroughs within a North West London Partnership to provide a consistent approach to flood risk on a regional and catchment wide basis. We are also working closely with other Risk Management Authorities such as Thames Water, the Environment Agency and the Greater London Authority who host the Drain London group.

We are also engaged with third tier charitable groups, Thames 21 http://www.thames21.org.uk/ and Green Corridor who respectively host the Brent Catchment Partnership http://www.thames21.org.uk/brent-catchment-partnership/ and Crane Valley Partnership http://cranevalley.org.uk/.

These organisations remit is to develop community and friends groups, locally and through schools to raise awareness of flood risk and how it can better managed with the cooperation of our communities.

They will reach out to provide outdoor water environmental activities for schools and volunteer groups that will take responsibility for managing river corridors, reporting on water quality, pollution, habitat, wildlife and biodiversity.

They will assist us in collaboratively collecting the evidence that can be used to find funding elsewhere to reduce flood risk by making space for water in our parks and open spaces that will lessen the financial burden on our residents.

6.5 Funding Sources

Harrow Council's Local Flood Risk Management measures will require funding from a variety of sources, both internal and external to the Council. The primary funding sources to date have been through central government funding called Added Burdens and have been provided through a number of different grants, however, there are significant pressures to reduce this in the current economic climate, and in

future there will be greater emphasis on LLFAs to fund activities and schemes from their own or alternative local sources of partnership and private sector funding.

The LLFA are currently working with a number of stakeholders, partners to seek funding opportunities that will combine flood storage and GISuDS objectives with river restoration and open space improvements that will provide benefits to habitat, biodiversity, water quality and accessibility for education and healthier lifestyles by encouraging more outdoor activity.

Harrow will continue to robustly review all planning applications and seek opportunities to fund surface water management and flood resilience through developer contributions. The LLFA has also made it clear to the Planning Policy Team the importance of including the multiple benefits of flood resilience and surface water management in the Community Infrastructure Levy priorities.

To provide a complete holistic approach to funding of surface water flooding and flood resilience it is intended to widen the internal flood working group to include the Economic Development and Regeneration Teams so there is understanding across the Council on the financial and economic benefits to businesses, utilities and transport infrastructure and the importance to continue investment in resilience planning.

The Council has in place a strong and robust network of flood defence structures, planning policies, bylaws and maintenance schedules. This LFRMS sets out a commitment from the LLFA to continue and develop this work during the 6 year cycle.

New projects to make space for water and to deliver them with other internal and external stakeholder funding will also continue over this period and make use of government guidance at https://www.gov.uk/government/publications/flood-and-coastal-resilience-partnership-funding-an-introductory-guide.

6.6 Multi Agency Flood Plan

Harrow has recently updated its Multi Agency Flood Plan (MAFP) v.4.2 in 2014 and covers our requirements for a multi-agency response to a flood event. The MAFP includes a community level assessment of flood risk from rivers, reservoirs, surface water and reservoir failure. This covers a borough based response however; as flooding has no regard to political boundaries this plan is shared and liaison arrangements are in place with other neighbouring boroughs.

7.0 A Sustainable Approach

7.1 Sustainability Appraisal

This Strategy sets out how the Council will manage flood risk and climate change in the future. The LLFA is currently developing partnerships with other 3rd Tier

stakeholders and RMA's to improve water quality, groundwater stability, replenishing the river networks to prevent future droughts which will improve the level of biodiversity in the borough.

Partnerships are in place to roll out and develop environmental educations activity centres which will link to schools and volunteer groups. Prior to this strategy a Sustainability Appraisal (SA) included a Strategic Environmental Assessment and Habitats Regulation Assessment within the Core Strategy and other Local Plans.

7.2 Strategic Environmental Assessment (SEA)

The Council completed its Core Strategy in 2012 and its other Local Plan documents in 2013, all of which were subject to SA (incorporating the requirements of SEA) to measure the environmental impact of the provisions of those documents in the Borough. This LFRMS has been informed by the SA carried out as part of the preparation of the Local Plan documents to ensure there will be no negative impact resulting from adopting this LFRMS as a guidance document.

7.3 Habitats Regulations Assessment (HRA)

The Council completed its Core Strategy in 2012 and its other Local Plan documents in 2013, all of which were subject to a HRA measure to protect against any negative impact whilst developing local plans. This LFRMS has referred to the HRA screening document in appendix E and F in the Core Strategy to ensure the proposals in this document are not likely to have a significant negative impact on any Special Areas of Conservation (SAC), Special Protection Areas (SPA) i.e. Natura 2000 sites, or Ramsar Sites.

8.0 Review

8.1 Reviewing the Strategy

The strategy has been consulted on with both the public and other Risk Management Authorities under the terms of the clauses set out in the Flood and Water Management Act. This is a living document which will be updated from time to time as policies; events and understanding on how best to manage flooding evolve. Therefore the strategy will be review according to the following:

- Every six years in line with the FRM Plans
- Where there are significant changes in available modelling information through development or flood risk management projects
- Changes to legislation or other regional and local policies
- Opportunities that are achieved through regeneration and changes to NPPF and SuDS

Appendices

Figure 1.2.1 Location of Harrow Council

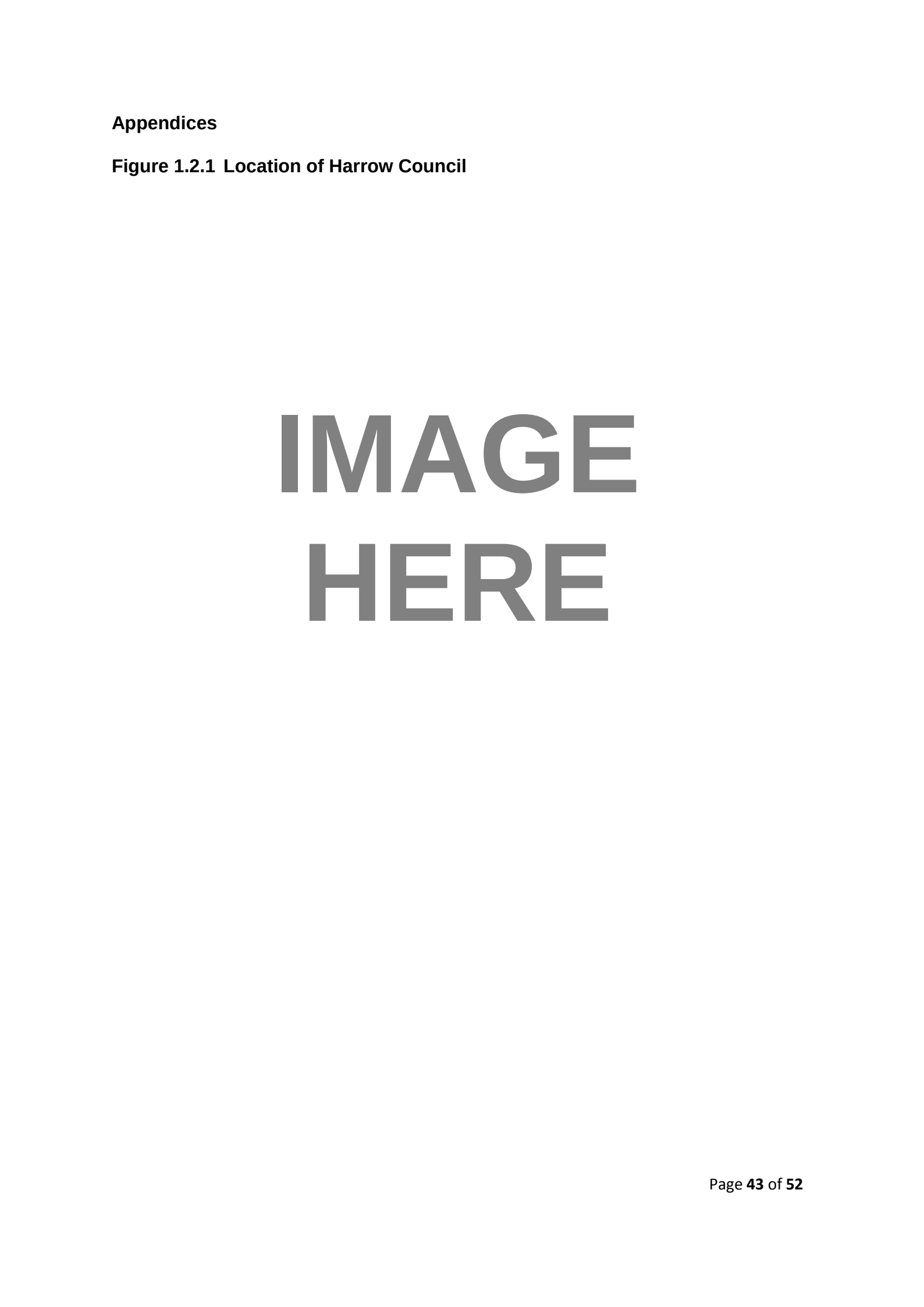


Figure 2.2.2 Rivers and Flood Defences

Figure 3.5.1 Historic Internal Held Flooding Data

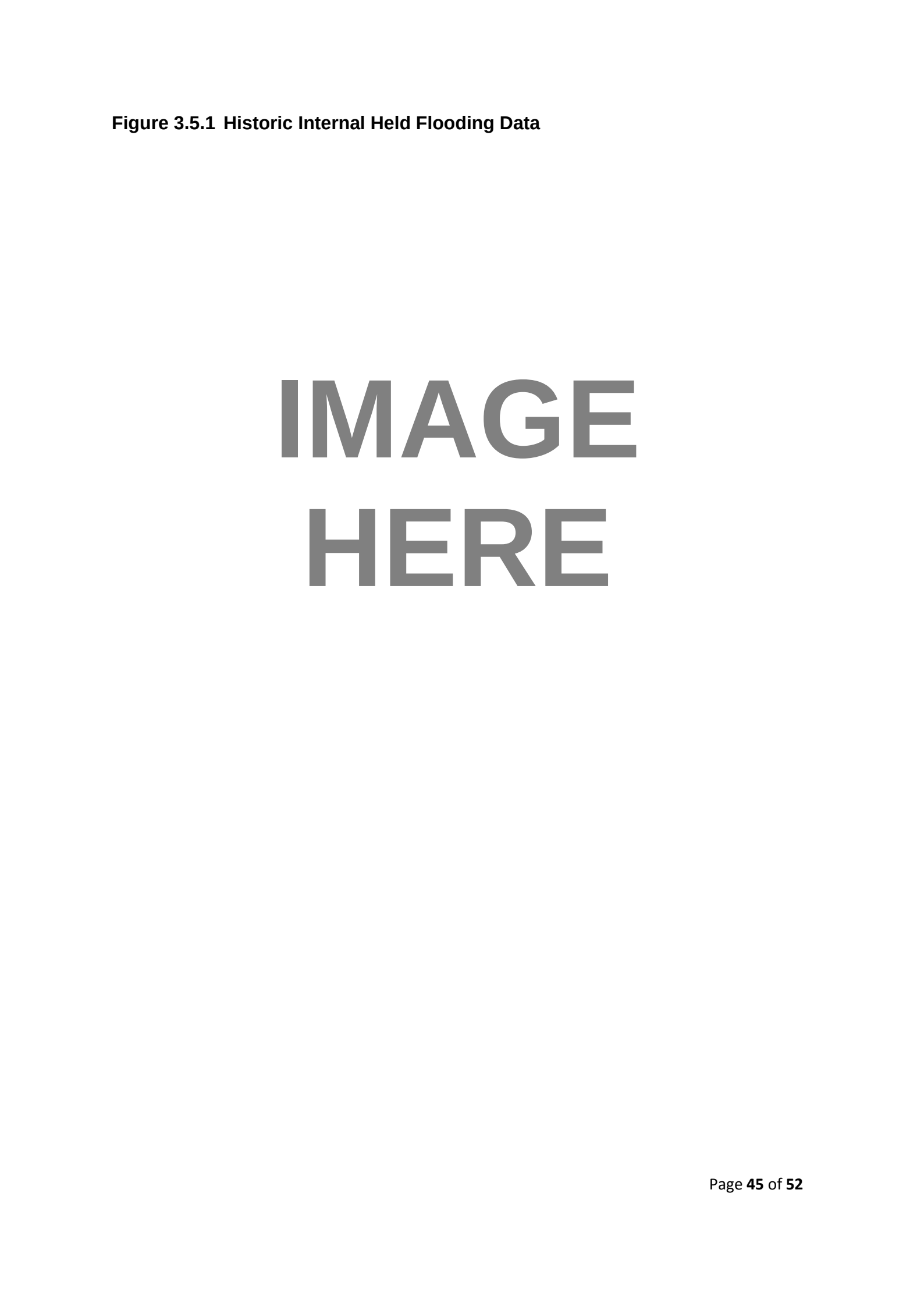


Figure 4.5.2 EA Updated Flood Map for Surface Water (uFMfSW) & Fluvial Flood Zones

Figure 5.5.3 Groundwater flood zones

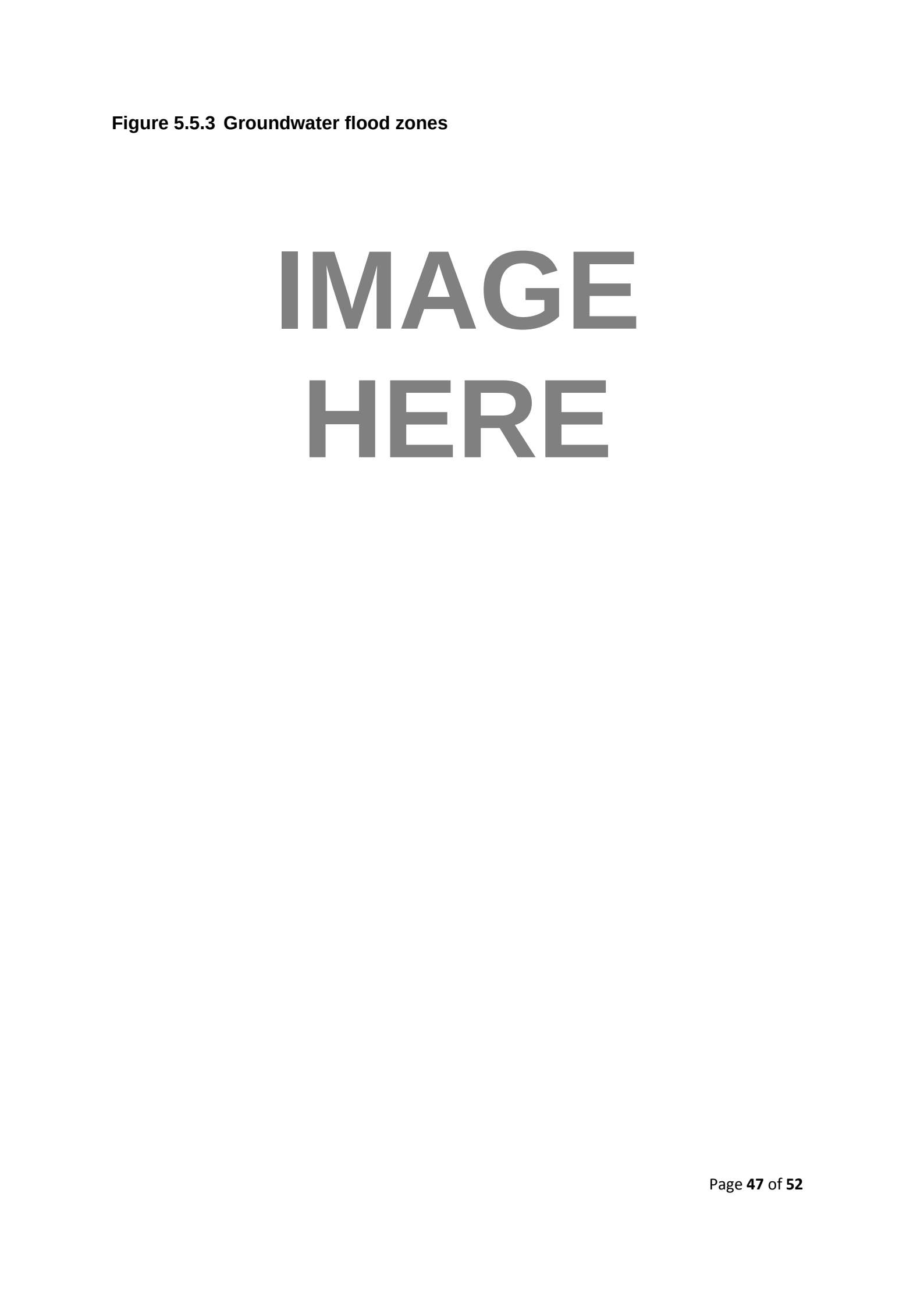


Figure 7.5.5 Water Bodies, Reservoirs and Flood Storage Areas

Glossary

CAA — Civic Contingencies Act

The **Civil Contingencies Act 2004** (c 36) is an **Act** of the Parliament of the United that establishes a coherent framework for emergency planning and response ranging from local to national level. It also replaces former **Civil** Defence and Emergency Powers legislation.

CDA — Critical Drainage Area

A **Critical Drainage Area** is a designated area within a unitary, county or district council boundary as an area with drainage or flood risk as shown in a surface water management plan

DM — Development Management

Development Management Policies sit beneath the Council Core Strategy in the hierarchy of the Local Development Framework. These policies set out the detailed implementation of planning policies for development and form the basis for planning decision making.

EA — Environment Agency

The **Environment Agency** is a non-departmental public body, established in 1996 and sponsored by the Department for **Environment** Food and Rural Affairs (DEFRA), with responsibilities relating to the protection and enhancement of the **environment**.

EU — European Union

The European Union is an economic-political union of 28 member states that are located primarily in Europe. It covers an area of 4,324,782 km², with an estimated population of over 508 million

FAS — Flood Alleviation Scheme

A flood alleviation scheme is an infrastructure project using both traditional civil engineering methods and use of land to store and slow down the response of rivers to rainfall to raise the levels of protection from flooding.

FCERM — Flood & Coastal Erosion Risk Management

Flood and Coastal Erosion Risk Management is identifying and taking reasonable steps to reduce the likelihood of them happening including forecasting warning of flooding so that people, businesses, infrastructure providers and public services can take effective action to minimise the consequences of floods, and • adapting to coastal change and acting to reduce the risk to life, damage and disruption caused by flooding.

FMfSW — Flood Map for Surface Water

In 2013 the Environment Agency, working with Lead Local Flood Authorities (LLFAs), produced the updated **Flood Map for Surface Water** to meet the strategic overview role.

FRM — Flood Risk Management

Flood risk management aims to reduce the likelihood and/or the impact of floods. Flood Risk is the a combination of 2 components; the chance (or probability/likelihood) that a location will flood from any source or type of flooding, and the impact (or consequence) that the flooding would cause if it i.e. if there is a 1 in 100 (1%) chance of flood in any given year in this location, multiplied by the impact or consequence that will result if the flood occurs.

FRR	**Flood Risk Regulations** The **Flood Risk Regulations** were transposed into UK law to meet the requirements of the EU Floods Directive 2007/60/EC requiring the UK to produce flood risk and hazard maps.
FSA	**Flood Storage Area** A **Flood storage area** is a natural or manmade **area** or basins that temporarily fill with water during periods of high river levels.
FWMA	**Flood & Water Management Act** The **Flood & Water Management Act** builds on previous legislation and the Pitt Review recommendations to improve flood risk and protect water supplies.
GI	**Green Infrastructure** **Green Infrastructure** or **blue-green infrastructure** is solutions for urban and climatic challenges by building with nature. The approach includes storm water management, climate adaptation, less heat stress, more biodiversity, better air quality, sustainable energy, clean water and healthy soils. Green infrastructure also serves to provide an ecological framework for social, economic and environmental health of the surroundings.
GiS	**Geographical Information Systems** A **geographic information system** (**GIS**) is a computer system for capturing, storing, checking, and displaying data related to positions on Earth's surface.
GLA	**Greater London Authority** The **Greater London Authority** is the top-tier administrative body for Greater London and consists of a directly elected executive Mayor and elected 25 members Assembly.
HRA	**Habitats Risk Assessment** The **Habitats Risk Assessment** is a 4 stage screening process to identify the likely significant impacts of a project either alone or in combination with other plans and projects.
LA	**Local Authority** A **Local Authority** is a collective term made up of locally elected members which deliver a wide range of services. There are member in Harrow.
LDA	**Land Drainage Authority** A **Land Drainage Authority** was a type of operating authority responsible for special drainage needs with permissive powers to undertake work to secure clean water drainage and water level management. LDA's have now been replaced by Lead Local Flood Authorities (LLFA)
LDF	**Local Development Framework** A **Local Development Framework** is the spatial planning strategy for each Council.
LLFA	**Lead Local Flood Authority** **Lead Local Flood Authorities** are County Councils and Unitary Authorities that have been given certain responsibilities to coordinate flood risk management outlined in the Flood & Water Management Act.
LFRMP	**Local Flood Risk Management Plan** **Flood Risk Management Plans** must focus on the reduction of potential adverse consequences of flooding for human health, the environment, cultural heritage and economic activity.

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LFRMS	**Local Flood Risk Management Strategy** Lead local flood authorities must develop **Local Flood Risk Management Strategies** for flood and coastal erosion risk management that are consistent with the national strategy for FCERM which includes surface, groundwater and river flooding.
LoDEG	**London Drainage Engineers** **London Drainage Engineers** is an independent organisations representing local authority drainage engineers.
LPA	**Local Planning Authority** A **Local Planning Authority** is the **local authority** or council that is empowered by law to exercise statutory town **planning** functions.
MAFP	**Multi Agency Flood Plan** The Civil Contingencies Act (2004) requires Category One Responders to have plans in place to respond to all emergencies. The **Multi Agency Flood Plan** will provide flood response planning, including recovery planning where it relates to flooding.
NPPF	**National Planning Policy Framework** The **National Planning Policy Framework** was published by the UK's Department of Communities and Local Government in March 2012, consolidating over two dozen previously issued documents called Planning Policy Statements (PPS) and Planning Policy Guidance Notes (PPG) for use in England.
PAR	**Preliminary Assessment Report** A **Preliminary Assessment Report** provides an evidence base to assess local flood risk. The report considers flood risk from surface water run-off, groundwater, ordinary watercourses and other sources of flooding.
PFRA	**Preliminary Flood Risk Assessment** A **Preliminary Flood Risk Assessment** is the first of 4 stages in a 6 year cycle to manage flood risk and identify areas at risk of significant flooding called flood risk areas.
RBMP	**River Basin Management Plan** A **River Basin Management Plan** covers an entire river system, including river, lake, groundwater, estuarine and coastal water bodies. The RBMPs are designed to protect and improve the quality of our water environment.
RMA	**Risk Management Authority** A **Risk Management Authority** has operational responsibility for managing the risk of flooding from rivers, reservoirs, estuaries and the sea and coastal erosion.
SEA	**Strategic Environment Assessment** **Strategic environmental assessment** (SEA) is a systematic decision support process, aiming to ensure that environmental and possibly other sustainability aspects are considered effectively in policy, plan and programme making.
SAB	**SuDS Approval Body** The **SUDS Approval Body** or SAB will be an organisation within County Councils and Unitary Authorities specifically established to deal with the design, approval and adoption of sustainable urban drainage systems (**SUDS**) within any new development consisting of two or more properties.

SA	Sustainability Appraisal A **Sustainability Appraisal** is a tool used to appraise planning policy documents in order to promote sustainable development taking social, environmental and economic aspects into consideration.
SINC	Site of Interest for Nature Conservation A **Site of Nature Conservation Interest** is a designation used by local authorities for sites of substantive local nature conservation and geological value.
SPA	Special Protection Area A **Special Protection Area** is a designation under the European Union Directive on the Conservation of Wild Birds. Under the Directive, Member States have a duty to safeguard the habitats of migratory birds and certain particularly threatened birds
SAC	Special Area of Conservation A **Special Area of Conservation** is a site designated under the Habitats Directive. These sites, together with **Special** Protection **Areas** (or SPAs), are called Natura sites and they are internationally important for threatened habitats and species.
SMI	Site of Metropolitan Importance A **Site of Metropolitan Importance** is a sub division of a SINC in Greater London.
SSSI	Site of Special Scientific Interest A **Site of Special Scientific Interest** is a conservation designation denoting a protected area in the United Kingdom.
SFRA	Strategic Flood Risk Assessment A **Strategic Flood Risk** Assessment is a study carried out by the local planning authority to assess the risk to an area from flooding from all sources, now and in the future, taking account of the impacts of climate change, and to assess the impact of land use development.
SuDS	Sustainable Urban Drainage Systems A **Sustainable Urban Drainage System** is designed to reduce the potential impact of new and existing developments with respect to surface water drainage discharges.
SWMP	Surface Water Management Plan **Surface water management plans** are projects to investigate local flooding issues such as flooding from sewers, drains, groundwater, and runoff from land, small watercourses and ditches that occurs as a result of heavy rainfall.
Tfl	Transport for London **Transport for London** is a local government body responsible for the transport system in Greater London. Its head office is in Windsor House in the City of Westminster
TWUL	Thames Water Utilities Limited **Thames Water Utilities Ltd**, known as **Thames Water**, is the private utility company responsible for public water supply and sewerage treatment in London and other areas across the south of England.