Strategic Flood Risk Assessment Update

London Borough of Havering

Level 1 Strategic Flood Risk Assessment

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04	21/11/16	Addresses client comments	M Leung & M Aspin	M White & M Symons	R Collins

Contents

Annex A – Growth Areas

List of Tables

Glossary and Abbreviations

Term	Definition
Adaptation	Adjustments to natural or human systems in response to actual or expected climatic factors or their effects, including from changes in rainfall and rising temperatures, which moderate harm or exploit beneficial opportunities *(NPPF definition).*
AEP	Annual Exceedance Probability e.g. 1% AEP is equivalent to 1% (1 in 100) probability of flooding occurring in any one year (or, on average, once in every 100 years)
Anthropogenic	Originating in human activity (particularly in relation to climate change)
Climate Change	Long term variations in global temperature and weather patterns caused by natural and human actions.
Core Strategy	Part of the current Local Plan for the London Borough of Havering, which sets the long-term vision and objectives for the area. It contains a set of strategic policies that are required to deliver the vision including the broad approach to development. The Core Strategy forms part of the 'Core Strategy and Development Control Policies Development Plan Document'.
CLG	Department of Community and Local Government
Defra	Department of Environment, Food and Rural Affairs
Development	The carrying out of building, engineering, mining or other operations, in, on, over or under land, or the making of any material change in the use of a building or other land.
Development Plan	This includes the adopted London Plan, adopted local plans and neighbourhood plans, and is defined in Section 38 of the Planning and Compulsory Purchase Act 2004 *(NPPF definition).*
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 with an annual probability of 1 in 20 (5%) or more.
EA	Environment Agency
Flood & 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 (partly) is to clarify the legislative framework for managing surface water flood risk in England.
Flood Storage Area	Land which provides a function of flood conveyance and/or storage, either through natural processes, or by design
Flood Map for Planning (Rivers and Sea)	Nationally consistent delineation of 'high', 'medium' and 'low' probability of fluvial flooding, published on a quarterly basis by the Environment Agency
Formal Flood Management Asset	A feature or structure built and maintained specifically for the purpose of flood risk management

Term	Definition
Functional Floodplain (Zone 3b)	NPPF Flood Zone, defined as areas in which water *has* to flow or be stored in times of flood.
GLA	Greater London Authority – higher tier of government for the whole Greater London area.
Green Infrastructure	A network of multi-functional green space, urban and rural, which is capable of delivering a wide range of environmental and quality of life benefits for local communities *(NPPF definition)*.
Habitable Room	A room used as living accommodation within a dwelling but excludes bathrooms, toilets, halls, landings or rooms that are only capable of being used for storage. All other rooms, such as kitchens, living rooms, bedrooms, utility rooms and studies are included in this definition.
Havering Critical Drainage Areas	Areas which are likely to be most at risk of flooding from local sources (surface water, groundwater and ordinary watercourses) and where sustainable drainage solutions should be a priority. These areas have been termed Havering Critical Drainage Areas or HCDAs to differentiate them from Critical Drainage Areas that can be designated by the Environment Agency. The Environment Agency has not designated any Critical Drainage Areas in the London Borough of Havering.
Informal Flood Management Asset	A feature or structure that provides a flood defence function, however has not been built and/or maintained for this purpose (e.g. boundary wall)
LBH	London Borough of Havering – the borough council and local planning authority for Havering. Under the Flood & Water Management Act 2010 and the Flood Risk Regulations 2009, LBH is also the Local Authority responsible for taking the lead on local flood risk management in its administrative area
Local Plan	The plan for the future development of the local area, drawn up by the local planning authority in consultation with the community. In law this is described as the development plan documents adopted under the Planning and Compulsory Purchase Act 2004. Current core strategies or other planning policies, which under the regulations would be considered to be development plan documents, form part of the Local Plan. The term includes old policies which have been saved under the 2004 Act. *(NPPF definition)*
Main River	A watercourse shown as such on the Main River Map, and for which the Environment Agency has responsibilities and powers. N.B. Main River designation is not an indication of size, although it is often the case that they are larger than Ordinary Watercourses.
National Flood Risk Assessment (NaFRA)	An assessment of flood risk for England and Wales produced using local data and expertise. It shows the chance of flooding from rivers and the sea presented in categories taking account of flood defences and the condition they are in.
National Planning Policy Framework (NPPF)	National planning policy, published by the Government in March 2012. It replaces most of the previous Planning Policy Statements, including that regarding flood risk (PPS25).

Term	Definition
National Planning Practice Guidance (NPPG)	Supporting guidance to the NPPF, published by the Government in March 2014 as an online resource, available at: (http://planningguidance.planningportal.gov.uk/). It replaces previously published Government guidance, including that regarding flood risk.
Neighbourhood Plans	A plan prepared by a Parish Council or Neighbourhood Forum for a particular neighbourhood area (made under the Planning and Compulsory Purchase Act 2004).*(NPPF definition)*
Ordinary Watercourse	All watercourses that are not designated Main River, and which are the responsibility of Local Authorities or, where they exist, Internal Drainage Boards. Note that Ordinary Watercourse does not imply a "small" river, although it is often the case that Ordinary Watercourses are smaller than Main Rivers.
Planning Policy Statement (PPS)	A series of statements issued by the Government, setting out policy guidance on different aspects of planning. The majority of PPSs have now been replaced by the National Planning Policy Framework, including PPS25 regarding flood risk.
PPS25	Planning Policy Statement 25: Development and Flood Risk – previous government planning policy regarding flood risk, which has now been replaced by the National Planning Policy Framework.
Permitted Development (PD)	Permitted Development rights allow for some minor development, such as certain sizes of building extension, without the requirement to submit an application for planning permission.
Previously Developed (Brownfield) Land	Land which is or was occupied by a permanent structure, including the curtilage of the developed land (although it should not be assumed that the whole of the curtilage should be developed) and any associated fixed surface infrastructure. This excludes: land that is or has been occupied by agricultural or forestry buildings; land that has been developed for minerals extraction or waste disposal by landfill purposes where provision for restoration has been made through development control procedures; land in built-up areas such as private residential gardens, parks, recreation grounds and allotments; and land that was previously-developed but where the remains of the permanent structure or fixed surface structure have blended into the landscape in the process of time. *(NPPF definition)*
Residual Risk	A measure of the outstanding flood risks and uncertainties that have not been explicitly quantified and/or accounted for as part of the design process
Strategic Environmental Assessment (SEA)	A procedure (set out in the Environmental Assessment of Plans and Programmes Regulations 2004) which requires the formal environmental assessment of certain plans and programmes which are likely to have significant effects on the environment. *(NPPF definition)*
Supplementary Planning Document (SPD)	Documents which add further detail to the policies in the Local Plan. They can be used to provide further guidance for development on specific sites, or on particular issues, such as design. Supplementary planning documents are capable of being a material consideration in planning decisions but are not part of the development plan. *(NPPF definition)* SPDs are not subject to independent examination before adoption by a local planning authority.

Term	Definition
Sustainability Appraisal (SA)	Appraisal of plans, strategies and proposals to test them against broad sustainability objectives. The SEA forms part of the SA.
Sustainable Development	"Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (*The World Commission on Environment and Development, 1987*).
Sustainable Drainage System (SuDS)	Term covers the whole range of sustainable approaches to surface drainage management. They are designed to control surface water run off close to where it falls and mimic natural drainage as closely as possible. *(Based on NPPF flood risk guidance text)*
Thames Tidal Defences (TTD)	Tidal flood defences downstream (east) of the Thames Barrier.
Updated Flood Map for Surface Water (uFMfSW)	Under their strategic overview role for flood risk in England and Wales the EA produced and then in 2013 updated the map of flood risk from surface water In 2010 the Flood and Water Management Act (FWMA) defined 'surface runoff' in the following terms: *"The flooding that takes place from the 'surface runoff' generated by rainwater (including snow and other precipitation) which: (a) is on the surface of the ground (whether or not it is moving), and (b) has not yet entered a watercourse, drainage system or public sewer."*
Zone 1 Low Probability	NPPF Flood Zone, defined as areas outside of Zone 2 Medium Probability. This zone comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%).
Zone 2 Medium Probability	NPPF Flood Zone which comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%) in any year.
Zone 3a High Probability	NPPF Flood Zone which comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) in any year.

Executive Summary

An SFRA was developed for the London Borough of Havering (LBH) in 2007 and updated in 2014. The 2014 update incorporated new techniques for flood risk mapping and updates to planning policy and guidance including the introduction of the National Planning Policy Framework and the National Planning Practice Guidance. The SFRA set out criteria that would necessitate the update of the SFRA including: "*Has the EA or LBH (as LLFA) issued any amendments to their flood risk mapping and/or guidance since the previous policy review?*" In February 2016 the Environment Agency issued updated guidance on climate change allowances for SFRA's. This requires the uplift factors to be applied to consider the location, design life and vulnerability classification of the development, producing a range of potential factors to be applied rather than a single figure as included in the previous SFRA. Furthermore updated hydraulic modelling by the Environment Agency has been incorporated to delineate flood zones on Blacks Brook and the River Thames.

This report updates the SFRA to reflect those developments.

The primary objective of the Havering SFRA is to inform the emerging Local Plan in respect of the development and review of policies related to flood risk management and also policies for the allocation of land for future development. The SFRA has a broader purpose however, and in providing a robust depiction of flood risk across the Borough, it can:

- Inform the development of LBH policy that will underpin decision making within the Borough, particularly within areas that are affected by (and/or may adversely impact upon) flooding;
- Assist the development management process by providing a more informed response to development proposals which may be affected by flooding, influencing the acceptability and design of future development within the Borough;
- Identify and implement strategic solutions to flood risk, providing the basis for possible future flood attenuation works by a range of agencies with responsibility for flood risk management;
- Support LBH in their role as Lead Local Flood Authority; and
- Support and inform the Council's emergency planning response to flooding.

This is a Level 1 SFRA and as such addresses the requirements of the Sequential Test, which will assist the council to guide development to areas of lower flood risk. LBH intend to progress with their development allocation sites in 2016, which will then be likely to require preparation of a Level 2 SFRA if required to address the requirements of the Exception Test. In discussion with the Environment Agency, it has been agreed that an annex to this Level 1 SFRA be included in order to inform the Local Plan in respect of potential flood risk implications of Rainham and Beam Park (which forms part of the London Riverside Opportunity Area) and Romford Metropolitan Centre, both of which are identified in the London Plan for development over the Plan period.

The following actions have been undertaken to assess flood risk within Havering:

- The identification of flood risk zones 1, 2, 3a and 3b (functional floodplain);
- Identification of locations of flood risk from other sources (ordinary watercourses, groundwater, sewers, reservoirs and canals);
- Identification of locations at risk of surface water flooding (termed Havering Critical Drainage Areas or HCDA), particularly outside fluvial or tidal risk areas;
- The consideration of the impact of climate change upon flood risk within Havering;

- Identification of areas protected by existing flood defences and that could be at risk should they fail.

The SFRA makes a number of planning policy recommendations in Section 7 for adoption by LBH when considering development and flood risk. The SFRA also provides guidance for actions that local communities could take to reduce flood damage. In addition, the report provides guidance for emergency planning within the Borough on infrastructure and vulnerable institutions within Flood Zones.

Finally in Section 7.14 the report provides guidance on how the SFRA should be monitored and reviewed to ensure it remains current.

Figures are provided of the fluvial Flood Zones and other sources of flood risk to classify the risk of flooding across the Borough.

Supporting Figures

Figure Number	Figure Contents
101	Location Plan
102	Historical Flood Extents
103	Flood Zone 3
104	Flood Zone 2
105a	Climate Change Impact (+10%)
105b	Climate Change Impact (+15%)
105c	Climate Change Impact (+25%)
105d	Climate Change Impact (+35%)
105e	Climate Change Impact (+70%)
106	Defences
107a	Thames Breach – Hazard (Locations 5 and 6)
107b	Thames Breach – Depth (Location 5)
107c	Thames Breach – Level (Location 5)
107d	Thames Breach – Velocity (Location 5)
107e	Thames Breach – Depth (Location 6)
107f	Thames Breach – Level (Location 6)
107g	Thames Breach – Velocity (Location 6)
108	Culverts
109	Surface Water
110	Sewer Flooding
111	Groundwater Flood Risk
112	Infrastructure Flood Risk
113	Flood Warning and Alert Areas
114	Emergency Planning

1. Introduction

1.1 Overview

The London Borough of Havering (LBH) is situated in the north east of London. The Borough covers an area of approximately 11,200 hectares and has a population of approximately 245,974 (2015 Demographic Information). It is adjoined by the London Boroughs of Barking and Dagenham, Bexley and Redbridge and by the Essex Districts of Brentwood, Epping Forest and Thurrock.

There are four distinct watercourses in Havering (please refer to Figure 101):

- The River Beam forms a part of the western boundary of the Borough with the London Borough of Barking and Dagenham to the West. It has three tributaries. The River Rom drains the north-western area of the Borough and is joined by Blacks Brook at Romford. The Emerson Park Stream joins the River Ravensbourne which joins the River Rom at Heath Park, Elm Park. From this point the watercourse is known as the River Beam;

- The Ingrebourne, including its tributaries the Weald Brook and the Paines Brook, drain the centre, east and north of the Borough;

- The River Mardyke drains the eastern area of the Borough although for most of its length it flows through Thurrock, outside Havering;

- The final watercourse is the River Thames into which the above watercourses drain. This forms the southern boundary of the Borough.

Havering has a large proportion of London's floodplains (source: Core Strategy p.152). In addition to the areas of the Borough at risk of flooding from rivers, other areas may also be at risk from flooding from groundwater, surface water runoff, ordinary watercourses and/or culvert blockage, which may result in localised flooding at any location, resulting in damage to property and severe disruption. Flooding has received widespread media attention in recent years and potential associated issues with the cost of and obtaining property insurance as well as the fear of future flooding are well-known. Organisational responsibilities for managing flood risk have changed substantially in the last few years. The following text box provides definitions produced by Jacobs of the principal local sources of flooding referred to in this SFRA.

Local Flood Risk

The London Borough of Havering and their partners have responsibilities for managing local flood risk, i.e. flood risk from sources other than Main Rivers, the sea and reservoirs, principally meaning surface runoff, groundwater and ordinary watercourses.

Surface runoff – 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. Note that the term 'surface water' is used generically to refer to water on the surface and is often associated with periods of intense rainfall.

Groundwater – water which is below the surface of the ground and in direct contact with the ground or subsoil. It is most likely to occur in areas underlain by permeable rocks, called aquifers. These can be extensive, however are of limited risk in Havering as the geology is predominantly Clayey.

Ordinary watercourse – all watercourses that are not designated Main River, and which are the responsibility of local authorities

It is essential that future planning decisions do not inadvertently increase the potential risk of localised flooding and, where possible, seek to improve flood management. Specific recommendations have been provided within the SFRA to guide the design of future development accordingly.

The National Planning Policy Framework (NPPF) requires that local planning authorities prepare a Strategic Flood Risk Assessment (SFRA) in consultation with the Environment Agency (EA) and others. The primary purpose of a Level 1 SFRA is to determine the variation in flood risk across the Borough, based upon data from a variety of sources. Robust information on flood risk is essential to inform and support the Council's revised flooding policies in its emerging Local Plan and to inform the decision making process in the allocation of sites for development. It also provides guidance to developers on planning requirements and recommendations for council policy.

A Level 2 SFRA assesses the flood risk at potential development sites in more detail than that covered at Level 1. This SFRA update only covers Level 1 as LBH are yet to allocate development sites. LBH is currently beginning the process of preparing its new Local Plan. In this respect, Jacobs has been commissioned to update the Level 1 SFRA.

A Level 1 and more detailed Level 2 SFRA were prepared for LBH and published in a joint document in November 2007 to inform the development of the Council's current suite of Development Plan Documents, which were adopted in 2008. The Level 1 SFRA was updated in 2014 to reflect new flood risk information and changes to National Planning Policy. The SFRA forms part of the evidence base being used to inform the emerging Havering Local Plan.

This report (and the supporting mapping) represents the Level 1 SFRA[1], and should be used by the Council to inform the application of the Sequential Test (see Section 3.1). Following the application of the Sequential Test, it may be necessary to develop a more detailed SFRA[2] should it be shown that any further proposed allocations fall within a flood affected area of the Borough. The more detailed SFRA should consider the risk of flooding in greater detail within a local context to ensure that the site can be developed in a safe and sustainable manner.

1.2 SFRA Approach and Update

The primary objective of the Havering SFRA is to inform the development and review of policies related to flood risk management and also policies for the allocation of land for future development, within the emerging Local Plan. The SFRA has a broader purpose however, and in providing a robust depiction of flood risk across the Borough, it can:

- inform the development of Council policy that will underpin decision making within the Borough, particularly within areas that are affected by (and/or may adversely impact upon) flooding;
- assist the development management process by providing a more informed response to development proposals which may be affected by flooding, influencing the acceptability and design of future development within the Borough;
- help to identify and implement strategic solutions to flood risk, providing the basis for possible future flood attenuation works by a range of agencies with responsibility for flood risk management;
- support and inform the Council's emergency planning response to flooding.

1 The requirements of a Level 1 SFRA are further detailed in the 'Flood Risk and Coastal Change' section of the national Planning Practice Guidance available online at http://planningguidance.planningportal.gov.uk/

2 The requirements of a Level 2 SFRA are further detailed in the 'Flood Risk and Coastal Change' section of the national Planning Practice Guidance available online at http://planningguidance.planningportal.gov.uk/

Government provides no specific methodology for the SFRA process. Therefore, to meet these broader objectives, the SFRA has been developed in a pragmatic manner in close consultation with the LBH and the EA.

Knowledge exists with respect to flood risk within the Borough, provided largely in the form of records of observed flooding and provided from a variety of sources. The Havering SFRA has gathered and built upon this existing knowledge, underpinning the delineation of the Borough into zones of 'high', 'medium' and 'low' probability of fluvial flooding, in accordance with the NPPF, and together with Havering Critical Drainage Areas (HCDA). These zones have then been used to provide a robust and transparent evidence base for the development of flooding related policy, and the allocation of sites for new development as part of the Local Plan.

1.3 The Need for an Updated SFRA

As stated above, an up-to-date SFRA is required to support planning policy development in Havering. The 2014 SFRA requires updating because:

- In February 2016 the EA published updated guidance[3] on the consideration of the potential impact of climate change upon flood risk for Flood Risk Assessments and SFRA. This SFRA provides the necessary information for these updated factors to be included in the application of the Sequential Test; and

- Since 2014 the EA has completed updates to its hydraulic modelling of the River Thames and the Blacks Brook. The updated modelling has resulted in changes to the extent of Flood Zones adopted in this SFRA.

1.4 Consultation and Co-operation

Consultation and co-operation has formed a key part of the development of the updated Havering SFRA. This is particularly important in light of the 'Duty to Cooperate' brought in by the Localism Act 2011 (Section 110). In addition, paragraph 157 of the NPPF states that Local Plans should *"be based on co-operation with neighbouring authorities, public, voluntary and private sector organisations"*. One of the roles of this SFRA is to support the production of the new Local Plan.

The National Planning Practice Guidance (NPPG) (2014) states that the following organisations / roles should be involved in preparing the SFRA:

- Environment Agency;

- Lead local flood authorities (role within LBH);

- Emergency response (role within LBH);

- Drainage authority (role within LBH under the Land Drainage Act 1991);

- Internal drainage boards (where appropriate).

The NPPG also requires consultation with Thames Water and Anglian Water as the sewerage undertakers, so that the SFRA *'takes account of any specific capacity problems and of the undertaker's drainage area plans'*. We have requested information from them on areas that have experienced flooding.

An internal consultation process with LBH and the EA in relation to the draft of this updated SFRA was undertaken in Summer 2016 to seek their feedback on the document.

[3] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

In addition, the Development Planning and Emergency Planning functions of LBH were consulted to seek their feedback on specific issues throughout the development of the SFRA and have co-operated fully in the process. The key roles played by the EA and LBH's Emergency Planning function with regard to fluvial flooding and flooding from local sources, respectively, are such that they are in a key position to lead in providing advice on such issues. LBH and the EA were closely involved in ensuring that this SFRA integrates with the advice, guidance and services they already provide and are proposing to provide with respect to flooding.

Most rivers within Havering drain to the Thames without leaving the Borough so there is no need for particular cross boundary consultation. While future development could impact upon the flow regimes in these rivers their impact upon the River Thames is likely to be minimal, given the comparison in flows, so consequently consultation with local authorities downstream on the Thames would not be required. The River Mardyke enters Thurrock from Havering but only a small part of the overall catchment is within the Borough. In this respect LBH should consider consulting with Thurrock Council should they receive planning applications for development within the Mardyke catchment in order for Thurrock Council to be able to assess the potential impact downstream.

Although no issues with cross border management of flows are known to LBH or were highlighted through the consultation on this updated SFRA, it is imperative that all local authorities clearly understand the core issues that flood risk raises within their respective areas and the potential knock on effects to other local authority areas, and adapt their decision making accordingly. They must be aware of the impact that planning policies and development management decisions may have, not only locally, but upon adjoining Boroughs.

2. The Planning Framework

2.1 Introduction

This Section provides a brief overview of the strategy and policy context relevant to flood risk in the Havering area.

The success of the SFRA is heavily dependent upon the ability of the Council to implement the recommendations put forward for future sustainable flood risk management, both with respect to planning policies and development management recommendations (refer to Section 7). The National Planning Policy Framework (NPPF) provides guidance and direction to local planning authorities. Ultimately however, it is the responsibility of the Council to establish 'sound' planning policies that will ensure future sustainability with respect to flood risk.

The policy framework informing the development of this Level 1 SFRA has changed significantly since the previous SFRA was published in November 2007. At the national level, Planning Policy Statement 25 (PPS25) (regarding flood risk) and its supporting guidance has been replaced with the NPPF in 2012 and associated guidance. At the regional level, the London Plan has since been updated, published in 2016. At the local level, Unitary Councils, such as LBH, have been given new responsibilities through the Flood & Water Management Act 2010 with regard to managing local flood risk and best practice and knowledge with regard to the production of SFRAs continues to evolve.

2.2 National Planning Policy

National planning policy is set out in the NPPF, which was published by the Government in March 2012. It forms a more succinct replacement for numerous topic-specific Planning Policy Statements (PPSs), including PPS25 on flood risk. The NPPF is accompanied by online National Planning Practice Guidance (NPPG)[4], first published in March 2014, which provides further guidance on specific issues, including flood risk, and replaces all previously published national planning guidance. The NPPF covers a full range of planning issues drawing on the central issue of sustainable development. Central themes include the re-use of previously developed land of low environmental value, promoting economic growth and high quality design, and transitioning to a low carbon future, including taking full account of flood risk.

The NPPF underpins the process by which local planning authorities are to account for flood risk as an integral part of the planning process. The overarching aims set out by the NPPF for the management of flood risk at a planning authority level are encapsulated in Paragraph 100 of the document:

"Local Plans should apply a sequential, risk-based approach to the location of development to avoid where possible flood risk to people and property and manage any residual risk, taking account of the impacts of climate change, by:

- applying the Sequential Test;
- if necessary, applying the Exception Test;
- safeguarding land from development that is required for current and future flood management;
- using opportunities offered by new development to reduce the causes and impacts of flooding; and

4 http://planningguidance.planningportal.gov.uk/

- where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking opportunities to facilitate the relocation of development, including housing, to more sustainable locations."

The Sequential Test and Exception Test are further explained in Section 3.1.

These aims effectively set the scope for the specific outcomes of the SFRA process. The SFRA in turn then informs planning and development management decisions to ensure that the aims set out above can be achieved.

The NPPF states that '*a sustainability appraisal which meets the requirements of the European Directive on strategic environmental assessment should be an integral part of the plan preparation process, and should consider all the likely significant effects on the environment, economic and social factors*' (paragraph 165). The purpose of Sustainability Appraisal (SA) is to promote sustainable development through better integration of sustainability considerations in the preparation and adoption of plans. The SA developed in conjunction with the new planning policy documents for Havering will be informed by the information and recommendations contained in this updated SFRA.

It is important to reiterate that the NPPF covers a range of planning issues – not just flood risk. The formulation of council policy and the allocation of land for future development must also meet the requirements of other elements of the NPPF, including (for example) with regard to environmental protection, housing and economic growth. The provision of sustainable development requires the balancing of a range of social, economic and environmental factors.

The SFRA aims to assist in this process through the provision of a clear and robust evidence base upon which informed decisions can be made.

In December 2014, the Secretary of State for Communities and Local Government published a written statement (HCWS161) setting out the Government's continuing commitment to protect people and property from flood risk. Local planning policies and decisions on planning applications relating to major development are required to ensure that sustainable drainage systems for the management of run-off are put in place, unless demonstrated to be inappropriate. The policies contained in the written statement came into effect on 6th April 2015.

2.3 London-wide Planning Policy – The London Plan

The London Plan forms part of the Development Plan for Havering. The latest version of the plan was adopted in 2016 and contains a range of policies of relevance to this SFRA. It consolidates all alterations made since the previous adopted version in 2011 including Revised Early Minor Alterations to the London Plan which were published in October 2013 to ensure consistency with the NPPF. In addition, Minor Alterations have been prepared to bring the London Plan in line with national housing standards and car parking policy. Both sets of alterations have been considered by an independent inspector at an examination in public and were published on 14 March 2016

The key London Plan policy regarding flood risk management is **Policy 5.12**, which seeks *'to address current and future flood issues and minimise risks in a sustainable and cost effective way'*. The policy requires planning decisions to *'comply with the flood risk assessment and management requirements set out in the NPPF and associated Technical Guidance [(since replaced with the NPPG)] on flood risk over the lifetime of the development and have regard to measures proposed in Thames Estuary 2100 [(regarding tidal flood risk)] and Catchment Flood Management Plans'*, both produced by the EA. The policy also builds on that set out at a national level, requiring that *'developments which are required to pass the Exception Test set out in the NPPF and the technical guidance [(since replaced with the NPPG)] … address flood resilient design and emergency planning by demonstrating that:*

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

In support of this, the Greater London Authority's **Housing Supplementary Planning Guidance (SPG) (2016)** requires as **Standard 38** that *'Where development is permitted in an area at risk of flooding, it should incorporate flood resilient design in accordance with the NPPF'*.

Policy 5.12 further states that *'Development adjacent to flood defences will be required to protect the integrity of existing flood defences and wherever possible should aim to be set back from the banks of watercourses and those defences to allow their management, maintenance and upgrading to be undertaken in a sustainable and cost effective way'*.

With regard to policy development, Policy 5.12 requires boroughs *'utilise Strategic Flood Risk Assessments to identify areas where particular flood risk issues exist and develop actions and policy approaches aimed at reducing these risks, particularly through redevelopment of sites at risk of flooding and identifying specific opportunities for flood risk management measures'*. This SFRA will contribute toward the achievement of this requirement.

Policy 5.13 regarding sustainable drainage states that *'Development should utilise sustainable urban drainage systems (SUDS) unless there are practical reasons for not doing so, and should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible in line with the … drainage hierarchy'*, which is summarised in Table 2-1.

Table 2-1 : London Plan SuDS Hierarchy

Preference	Technique
HIGH	Store rainwater for later use
↓	Use infiltration techniques, such as porous surfaces in non-clay areas
↓	Attenuate rainwater in ponds or open water features for gradual release
↓	Attenuate rainwater by storing in tanks or sealed water features for gradual release
↓	Discharge rainwater direct to a watercourse
↓	Discharge rainwater to a surface water sewer/drain
LOW	Discharge rainwater to the combined sewer

Based on Table 2-1, in principle planning authorities should prefer development proposals which retain or infiltrate runoff at source rather than discharging them off-site.

In support of this, the **Housing Supplementary Planning Guidance (2016)** requires as **Standard 39** that *'New development should incorporate Sustainable Urban Drainage Systems … where practical with the aim of achieving a Greenfield run-off rate, increasing bio-diversity and improving water quality. Surface water run-off is to be managed as close to source as possible'*.

Policy 5.13 further states that *'Drainage should be designed and implemented in ways that deliver other policy objectives of this Plan, including water use efficiency and quality, biodiversity, amenity and recreation'*.

With regard to plan preparation, the Policy 5.13 states that, within their plans, boroughs should, *'in line with the Flood and Water Management Act 2010, utilise Surface Water Management Plans to identify areas where there are particular surface water management issues and develop actions and policy approaches aimed at reducing these risks'*. This SFRA will contribute toward the achievement of this requirement.

The supporting text to Policy 5.13 notes that green roofs, the subject of Policy 5.11, *'can also make a contribution to sustainable urban drainage by absorbing a proportion of surface water and therefore reducing rates of water flow'*.

Policy 5.11 regarding green roofs states that *'major development proposals should be designed to include roof, wall and site planting, especially green roofs and walls where feasible'*.

In support of this, the **Housing Supplementary Planning Guidance (2016)** requires as **Standard 39** that *'New development should incorporate … green roofs where practical with the aim of achieving a Greenfield run-off rate, increasing bio-diversity and improving water quality'*.

Policy 5.11 states that, with regard to plan development, '*boroughs may wish to develop more detailed policies and proposals to support the development of green roofs and the greening of development sites. Boroughs should also promote the use of green roofs in smaller developments, renovations and extensions where feasible'*.

Policies 5.11 and 5.12 also overlap with London Plan **Policy 5.10** which seeks to encourage *'urban greening'*.

Policy 5.3 regarding sustainable design and construction requires major development proposals to meet the minimum standards outlined in the Mayor's supplementary planning guidance on the topic[5], including with regard to *'avoiding impacts from natural hazards (including flooding)'*.

The policy further states that, in developing their plans, boroughs should *'consider the need to develop more detailed policies and proposals' on such issues that are 'specific to their local circumstances'*.

Policy 2.18 seeks *'to protect, promote, expand and manage the extent and quality of, and access to, London's network of green infrastructure'* – the network of green spaces across London. The policy recognises the importance of green infrastructure for flood mitigation and reducing flood risk through sustainable urban drainage systems, particularly in light of climate change.

The policy states that, in making planning decisions, *'Enhancements to London's green infrastructure should be sought from development and where a proposal falls within a regional or metropolitan park deficiency area'*, which is shown to include London Riverside Conservation Park, within the Borough, *'it should contribute to addressing this need'*. In addition, *'Development proposals should: (a) incorporate appropriate elements of green infrastructure that are integrated into the wider network; and (b) encourage the linkage of green infrastructure, including the Blue Ribbon Network, to the wider public realm to improve accessibility for all and develop new links, utilising green chains, street trees, and other components of urban greening (Policy 5.10)'*.

[5] Sustainable Design and Construction Supplementary Planning Guidance (2014)

The policy currently notes that, in developing their plans, Boroughs should:

a) plan positively for the creation, protection, enhancement and management of networks of green infrastructure. This should be achieved by producing green infrastructure which identify priorities for addressing deficiencies and should set out positive measures for the design management of all forms of green and open space;

b) ensure that in and through Local Plan policies, green infrastructure needs are planned and managed to realise the current and potential value of open space to communities and to support delivery of the widest range of linked environmental and social benefits; and

c) support through appropriate initiatives, the vision of creating and protecting an extensive and valued recreational landscape of well-connected and accessible countryside around London for both people and for wildlife.

It should be noted that a requirement to positively plan for green infrastructure is also stated in paragraph 114 of the NPPF.

Policy 2.18 is supported by more detailed guidance in the form of the '**Green Infrastructure and Open Environments: The All London Green Grid SPG**', which highlights the vital role that green infrastructure can play in managing flood risk.

Policy 7.24 highlights the importance of the Blue Ribbon Network, a strategically important series of linked water-spaces, for drainage and flood management. An element of the network is found in every London borough, including Havering.

Policy 7.29 regarding the River Thames states that, *'following appraisal in accordance with the criteria in paragraph 7.90, Thames-side boroughs should identify a Thames Policy Area within their* [Local Plans] *and formulate policies and a strategy for this area covering the matters set out in paragraphs 7.93 and 7.94 [which include indicative flood risk]. Boroughs are encouraged to work in sub-regional partnerships to progress this work. The existing Thames Strategies have identified a range of actions and planning priorities that should be reflected in relevant* [Local Plans]*'*).

Paragraph 7.90 states that *'Setting the boundary of the Thames Policy Area should be done in consultation with neighbouring authorities, including those across the river'*. In defining the boundaries, the paragraph states that boroughs should have regard to the maps contained within that chapter of the London Plan, which highlight the Thames Policy Area, and a range of specific criteria.

The existing **Thames Strategy East (2008)** already covers the Havering area and was created in partnership with LBH; its policies are therefore of relevance to this SFRA and are discussed later in this section.

Paragraph 7.96 also notes that importance of allowing a margin of land for future flood defences where there are larger areas of development along the Thames.

Policy 2.13 identifies London Riverside, which is on the Thames and falls within both the Boroughs of Havering and Barking and Dagenham, as an Opportunity Area for development. Table A1.1 of the London Plan states that London Riverside covers an area of 3,000 hectares and is noted to have an indicative employment capacity of 16,000 and could provide a minimum of 26,500 new homes. It should be noted that the January 2014 draft amendments to the London Plan envisage increasing the area of London Riverside from 2,500 to 3,000 hectares, the indicative employment capacity from 14,000 to 16,000, and the minimum new homes figure from 25,000 to 26,500 – all increases on current figures. As the area falls within two London Boroughs, not all of this growth will be provided within Havering.

A London Riverside Opportunity Area Planning Framework was also published in 2015. This document forms Supplementary Planning Guidance (SPG) to the London Plan and sits alongside the London Plan's strategic policies. It does not establish new policies but does set the direction of travel for the emerging Local Plan and is a material consideration for decisions on planning applications that fall within its area.

It should be noted that flood risk will be an important consideration for development in London Riverside, with parts in Flood Zones 2 and 3.

Policy 2.15 identifies Romford, as a Metropolitan Centre in London's town centre network, with Medium growth potential. Other towns within the Borough are identified as District Centres with Medium growth potential.

Housing targets for each borough are set out under **Policy 3.3** of the Plan. Havering's target is 1,170 per annum (on average) – a total of 11,700 over the ten year plan period to 2025; this figure is acknowledged by LBH and supersedes the housing figures noted in local policy CP1 below.

2.4 Adopted Local Planning Policy

2.4.1 Adopted Havering Core Strategy and Development Control Policies DPD

The Core Strategy and Development Control Policies Development Plan Document (DPD), covering the period to 2020, was adopted in 2008, with the original SFRA (2007) forming part of the evidence base.

Policy CP1 regarding housing supply seeks to provide a minimum of 535 new homes per year within the borough, prioritising brownfield land and utilising sites identified in the Romford Area Action Plan and the Site Specific Allocation DPD, including sites within the London Riverside Opportunity Area; sites were selected utilising the results of the previous SFRA. A significant number of new homes on 'windfall' sites are also expected.

It should be noted that the Mayor's target for the borough has since increased significantly to new homes 1,170 per annum. As noted above, this figure is acknowledged by LBH and supersedes the housing figure noted in Policy CP1. It is indicative of an upward trajectory of housing demand in the Borough, in common with the rest of London.

The key policy with regard to flood risk is **Policy DC48**, which states that *'Development must be located, designed and laid out to ensure that the risk of death or injury to the public and damage from flooding is minimised whilst not increasing the risk of flooding elsewhere and ensuring that residual risks are safely managed'*.

The policy further states that: *'Planning permission therefore will only be granted for development where it can be demonstrated that:*

- Through a sequential test it is located in the lowest appropriate flood risk zone with regard to the advice in PPS25 and Havering's Strategic Flood Risk Assessment;
- It would not constrain the natural function of the flood plain, either by impeding flood flow or reducing storage capacity;
- With regard to the London Plan drainage hierarchy, surface water is controlled as near to its source as possible to Greenfield rates attenuated up to the 1% annual probability plus climate change, and that the use of Sustainable Urban Drainage Systems (SUDS) has been considered. Where SUDS have not been used the applicant should justify these reasons'.

Policy DC48 requires that 'a Flood Risk Assessment (FRA) which satisfies the requirements in Havering's Strategic Flood Risk Assessment must be submitted with planning applications:

- For major developments in Flood Risk Zone 1 and all developments in Flood Risk Zones 2 and 3. With regard to PPS25, the Flood Risk Assessment must demonstrate that the sequential test has been undertaken and in addition, where the vulnerability classification of the development is not compatible to the flood zone, the exception test has been passed;

- In areas at risk from surface water, sewer, groundwater and lake flooding;

- Where drainage problems are identified by the Environment Agency or the Council'.

The policy specifically states that 'Development will not be permitted where it would undermine or breach flood defences'.

Policy DC48 is supported within the Core Strategy by high-level **Policy CP15** regarding environmental management. This states that new development should 'reduce and manage fluvial, tidal and surface water and all other forms of flood risk through spatial planning, implementation of emergency and other strategic plans and development control policies' and have 'sustainable … drainage infrastructure'.

Policy DC42 on minerals extraction requires there to be 'no significant adverse effect' on flooding from such works. It further states that 'Planning permission for minerals extraction will be granted within the specific sites/preferred areas shown on the proposals map' provided that the various provisions regarding environmental impact and site restoration have been met, including that in relation to flooding noted above. Minerals Safeguarding Areas are indicated on the North and South Proposals Maps. Policy DC42 indicated that a Specific Sites/Preferred Areas for Mineral Extraction DPD was envisaged, but this document is no longer going to be produced.

2.4.2 Adopted Havering Site Specific Allocations DPD

The Havering Site Specific Allocations (SSA) DPD was adopted in 2008 and sets out the specific development allocations for individual sites across the Borough except for sites in Romford Town Centre and those for minerals and waste, which are covered in separate planning policy documents, discussed below.

The majority of development, outside of Romford Town Centre, is proposed to be located at London Riverside, which was, and continues to be, designated in the London Plan as an Opportunity Area.

Each site allocation indicates whether a site-specific Flood Risk Assessment is required.

The development of the SSA DPD was informed by the previous Level 1 and more detailed Level 2 SFRA published in 2007. It includes sites in Flood Zones 2 and 3.

2.4.3 Adopted Romford Area Action Plan

LBH adopted the Romford Area Action Plan in 2008. In addition to a number of specific policies for the Romford area, the plan contains several site allocations.

Each site allocation indicates whether a site-specific Flood Risk Assessment is required.

The River Rom runs through Romford town centre, presenting associated flood risks. This is recognised in **Policy ROM18**, which seeks opportunities, through new development, to improve the river and reduce flood risk. The policy states that:

'The Council will work in conjunction with other bodies, including the Environment Agency, to restore the River Rom through the town centre. The Council will use development opportunities to enhance the River Rom and will place significant emphasis on improving public accessibility through the creation of a river pedestrian route, opening up culverts and naturalising the river channels. Where appropriate, contributions may be sought from developers to enable this'.

The supporting text to the policy states that *'the River Rom has been identified by the Environment Agency as a priority location for river restoration and deculverting'*, which should *'reduce flood risk by making space on site for flood waters to be stored'*, in addition to providing recreational, public realm and wildlife benefits.

2.4.4 Minerals and Waste Planning

Waste developments are considered in accordance with the Joint Waste Development Plan (2012), which was produced in partnership with the London Boroughs of Barking and Dagenham, Newham and Redbridge and covers all four local authority areas. Policy W5 of that plan requires consideration of drainage and flood risk when determining applications for waste management developments. Three sites in Havering are allocated in the plan for waste development, all of which were assessed for flood risk prior to allocation.

Applications for minerals developments are considered in accordance with policies contained in the LBH Adopted Havering Core Strategy and Development Control Policies DPD, flood-related policies from which are detailed in Section 2.4.1 above. With regard to minerals site allocations, as noted in Section 2.4.1 above, the DPD envisages that minerals sites would be allocated in a separate Minerals DPD. Policy CP13 of the Core Strategy states that LBH *'will identify specific sites/preferred areas in a separate dedicated Minerals DPD'*. However, this document is no longer going to be produced and no minerals sites have yet been allocated. Any planning applications for new mineral extraction will be considered in accordance with the policies in Havering's Core Strategy and Development Control Policies DPD, the London Plan (Policy 5.20) and the NPPF. More specifically, applications will be considered against the criteria in Havering's Core Policy CP13 and Development Control Policy DC42 on minerals extraction; the latter includes consideration of flood risk as previously discussed in Section 2.4.1

2.4.5 Adopted Havering Supplementary Planning Documents

LBH has issued a range of topic-specific Supplementary Planning Documents (SPDs) in support of their planning policies, several of which have links to flood management:

- Planning Obligations SPD (2013)
- Landscaping SPD (2011)
- Heritage SPD (2011)
- Residential Extensions and Alterations SPD (2011)
- Residential Design SPD (2010)
- Designing Safer Places SPD (2010)
- Protecting and Enhancing the Borough's Biodiversity SPD (2009)
- Sustainable Design and Construction SPD (2009)

Area-specific SPDs have also been produced for Emerson Park and Hall Lane, but these relate to landscape and townscape character, so are not of direct relevance to flooding. Environment Agency Flood Policy.

2.4.6 Thames Catchment Flood Management Plan (2008)

The Thames Catchment Flood Management Plan (Thames CFMP) assesses flood risk within the Thames catchment, within which the Havering area is situated. It considers all sources of flooding, but acknowledges a lack of available data in relation to surface and groundwater flooding. The CFMP finds that 1,000 to 2,000 homes within the Havering area have a 1% annual probability river flood.

The CFMP uses four key messages to summarise how future flood risk needs to be managed:

- 'Flood defences cannot be built to protect everything'.
- 'Climate change will be the major cause of increased flood risk in the future'.
- 'The floodplain is our most important asset in managing flood risk'.
- 'Development and urban regeneration provide a crucial opportunity to manage the risk'.

Havering lies within the Beam and the Ingrebourne CFMP sub-areas, which are within Sub-Area 9 'London Catchments'. These are identified as areas of low, moderate or high flood risk areas in which the EA are already managing the flood risk effectively but where further action may be needed to keep pace with climate change. The plan states that *'The most sustainable approach to managing future flood risk will be to bring about adaptation of the urban environment. There are some major opportunities to reduce flood risk through the appropriate location, layout and design of redevelopment. This will make properties more resilient or resistant to flood water, therefore reducing the consequences of flooding.'*

The EA state that they will develop their emergency response planning *'to deal with extreme floods, including raising public awareness and working with key partners to identify critical infrastructure at flood risk'*. The EA further note that they *'want to continue to maintain the existing flood defences and when redevelopment takes place, replace and improve them so that they are more effective against the impacts of climate change'*. The EA will also be seeking *'to remove culverts and other structures that cause significant conveyance problems'*. With their partners, the EA state that they *'will look for opportunities to reduce flood risk by recreating river corridors in urban areas'*. The EA note that *'opening up culverts and re-creating river corridors through redevelopment will result in more space for the river to flow, more floodplain where water can be stored and reduced flood risk'*. Regeneration is cited as a key means through which flood risk can be reduced.

2.4.7 South Essex Catchment Flood Management Plan (2008)

The South Essex CFMP includes the River Mardyke catchment. The Mardyke falls under Policy Unit PU11 for which the preferred policy is "*P6 – Take action with others to store water or manage runoff*". The EA have advised that care should be exercised with regard to this policy as the later Mardyke Flood Risk Study (2011) identified limited flood risk to people and property in the downstream policy unit. However the underlying philosophy of the policy is supported by the use of SuDS, promoted by Havering as part of their LLFA role.

2.4.8 Thames Estuary 2100 Plan

The Thames Estuary 2100 (TE2100) Plan, published in 2012, is part of the TE2100 Project, which was set up by the EA in 2002 to pro-actively plan for future flood events on the River Thames from Teddington in the west to its mouth of the estuary, having climate change adaptation at its core. The Plan sets out the EA's recommendations for flood risk management for London and the Thames estuary through to 2100 and beyond, with a range of short, medium and long-term actions.

The TE2100 Plan divides the floodplains of the tidal Thames into 23 separate policy units. These are generally independent flood cells, where tidal flooding could occur from overtopping or failure of defences in the policy unit but not from adjacent policy units. The policy units are grouped into 8 action zones. There is also an estuary-wide action zone (zone 0).

Havering contains most of the TE2100 Rainham policy unit. The western boundary of the LBH area runs along the Beam River and the eastern boundary crosses Wennington Marshes.

The flood risk management policy set out in the TE2100 Plan for Rainham policy unit is as follows:

- Rainham policy unit: Policy P4, to *take further action to keep up with climate and land use change so that flood risk does not increase*. This will be achieved by improvements to the defences including river walls/banks and flood control gates.

Specific actions in the TE2100 Plan that refer to LBH are as follows:

- To maintain, enhance or replace the existing river defence walls/banks and flood control structures;
- Implement a major improvement to the flood risk management system, probably between 2050 and 2070;
- To incorporate the Riverside Strategy concept into local plans, strategies and guidance documents;
- To agree a programme of managing flooding from other sources in the defended tidal floodplain;
- To inform the development and revision of local council strategic flood risk assessments (SFRAs) and flood plans;
- To agree partnership arrangements and principles to ensure that new development in the tidal flood risk area is safe and where possible applies the NPPF to reduce the consequences of flooding;
- To agree partnership arrangements for floodplain management;
- To agree a programme of floodplain management;
- To agree a programme for habitat enhancement and replacement.

The implementation of flood defence improvements has already commenced under the EA's Thames Estuary Asset Management (TEAM) 2100 programme.

It is important that requirements for safeguarding land are incorporated into strategic plans, in particular site allocation documents for Thames riverside development. Most of the hard Thames Tidal Defences (TTD) within Havering could be raised within the existing defence footprint (or with only a small increase in width) but the structures would be tall, unattractive and would restrict public access and views of the estuary. The embankments could accommodate a small amount of raising on the existing footprint but larger amounts of raising would require widening of the embankment. Additional space will be needed when the defences are raised both for the defence engineering works and also for other enhancements such as suitable public access. Land is also required for maintaining, replacing and improving the flood defences along the Thames. To increase the height of a 'soft' embankment significant extra width will be required of approximately 20-30 meters. Without this space it will not be possible to raise the height of the embankment without adding 'hard' structural elements to the top. This is likely to increase costs of future raising and the structures would be tall, unattractive and would restrict public access and views of the estuary.

Corridors of land along the existing defence lines should therefore be safeguarded. This should include space for vehicle access for maintenance and repair of the defences. We suggest that the width of land that should be safeguarded for future flood risk management interventions on the Thames could be of the order of 10 metres. More space may be required especially if wider enhancements are to be achieved. However the land requirements will depend on the particular site, the defence type and proposed riverside improvements, and should be discussed and agreed with the EA.

2.5 Emerging Local Planning Policy

LBH is currently preparing a new Havering Local Plan to replace the adopted Core Strategy and Site Specific Allocations DPDs. The Local Plan will include strategic and development control policies, including broad locations for growth, but will not include site allocations (which will be the subject of a separate Local Plan to follow on). Public consultation on the key issues and priorities for the Local Plan took place in February 2015 however no information on specific policies is available at this time.

2.6 Regional and Local Flood Plans

2.6.1 London Strategic Flood Response Framework (London Resilience Partnership, Version 3, 2015)

The Framework covers flooding with London-wide impacts – either severe flooding in one location requiring a London-wide response or several less severe flooding incidents in multiple locations within London.

The Framework *'aims and objectives are to:*

- Provide strategic direction to London responders, before, during and after a significant flooding incident in London;
- Provide the necessary links to existing plans and procedures;
- Identify triggers and mechanisms for invoking a London-wide response;
- Provide responders with guidance about warning the public before, during and after a flood;
- Confirm the actions responders should take at each stage of a flooding incident'.

2.6.2 Multi-Agency Flood Plan for London Borough of Havering (Havering Borough Resilience Forum / LBH Emergency Planning and Business Continuity Service, 2016)

The Borough Resilience Forum for Havering consists of the following key partners:

- London Fire Brigade;
- Metropolitan Police Service;
- London Ambulance Service;
- Environment Agency;
- NHS E (L) (London);
- London Borough of Havering;
- Barking, Havering & Redbridge University Trust;
- North East London Foundation Trust;
- Public Health England; and
- Port of London Authority

The Plan seeks to provide 'a coordinated multi-agency response framework to mitigate the impact of a large-scale flood event in the London Borough of Havering', through achieving following objectives:

- 'Prepare key parts of the community susceptible to flooding through the provision of advice and information;
- To prioritise the identification and required responses to protect the vulnerable within the community;
- To support the Environment Agency in the provision of warnings to communities at flood risk, where technically feasible;
- Manage precautionary actions to preserve life for the highest impact flood risks;
- Provide accurate and timely information to public and local business on flood response;
- Manage the wider impact of borough flooding events to reduce disruption to the utilities, communities and environment;
- Lead recovery activity to support the recovery of communities and business;
- Maintain critical services within each organisation as part of business continuity arrangements'.

2.6.3 Havering Preliminary Flood Risk Assessment

In order to provide better and more comprehensive management of flood risk, the Flood & Water Management Act 2010 assigned new responsibilities to local authorities. As a result, LBH works in partnership with the EA, water companies and others to manage various aspects of flood risk.

The Preliminary Flood Risk Assessment (PFRA) for Havering was published in April 2011[6] as part of the Drain London[7] programme. The PFRA reviews existing available flood data and seeks to predict the location and likelihood of local sources of flooding, from a range of sources, in the future, taking into account factors such as climate change.

In addition to enabling LBH to comply with their legal requirements as the Lead Local Flood Authority, the PFRA sought to establish productive working partnerships with a range of organisations in relation to flood risk to ensure a co-ordinated approach to the management of local flood risk across London.

The PFRA forms a key data source for this updated SFRA.

2.6.4 Havering Surface Water Management Plan

The Surface Water Management Plan (SWMP) for Havering was developed in 2011 as part of the Drain London[7] programme. The SWMP uses data and modelling to seek to understand the causes and effects of surface water flooding – that from sewers, drains, groundwater, and runoff from land, small watercourses and ditches that occurs as a result of heavy rainfall. The plan also seeks to manage surface water over the longer-term through the work of a range of bodies, including LBH, the EA, Thames Water and Transport for London. It includes potential high-level solutions to the flooding problems identified.

The SWMP collated historic records of flooding within Havering which has been utilised as part of this SFRA. Additionally, as part of the SWMP a hydraulic model was developed in order to assess the potential impact of rainfall generated surface water flooding. However the modelling methodology was not the same as the EA's

6 Available at: http://www.havering.gov.uk/Pages/Services/Flooding-advice.aspx?l1=100001&l2=200039
7 Drain London: http://www.london.gov.uk/priorities/environment/looking-after-londons-water/drain-london

uFMfSW. We have therefore chosen to adopt the uFMfSW for this SFRA to identify areas at risk of surface-water flooding.

The SWMP also divided the borough into Critical Drainage Areas; these delineated the borough into sub-areas and estimated the damages that could result from flooding. However these are not the same as the CDAs that could be defined by the EA or the HCDA defined as part of this study (see Section 4.8). The Drain London CDAs include flood risk from rivers and therefore is not limited to surface-water which is the aim of the HCDA as under this SFRA the fluvial flood risk is incorporated by the inclusion of Flood Zones.

2.6.5 Havering Flood Risk Management Strategy

The Havering Flood Risk Management Strategy (FRMS) was developed in June 2011 and published in 2015. Under the Flood and Water Management Act (2010), each Lead Local Flood Authority is required to develop a FRMS. The objective of the FRMS is to tackle 'local' flood risk (e.g. surface water, groundwater and ordinary watercourses) as opposed to Main River fluvial flooding. In addition it will identify short-term (2 years) measures to tackle flood risk and agree the principles for the longer-term management of flooding in the Borough. The FRMS seeks to bring together all the Flood Risk Management Authorities that contribute to the mitigation of flood risk within Havering.

2.7 Other Relevant Plans and Policies

2.7.1 Thames Strategy East (Thames Estuary Partnership, 2008)

The Thames Estuary Partnership consists of major stakeholders with an interest in the Thames. These include the Department for Communities and Local Government, EA, Natural England, English Heritage, the Royal Society for the Protection of Birds (RSPB), Groundwork UK, the Greater London Authority, the Port of London Authority and relevant local councils, including LBH.

Study area covers land in close proximity to the River Thames, including within the Havering area. The document contains strategic guidance on a range of issues, including planning, flood risk and climate change, with the aim of achieving the 'Vision for the River'. The Vision is to achieve: *'A world class river where the diverse social, economic, cultural and environmental legacy is recognised through:*

- conserving and enhancing the natural assets of the area and making a positive contribution to its character;
- balancing the competing demands placed on the river - the region's greatest physical asset;
- creating vibrant, sustainable communities alongside the Thames that include and benefit new and existing residents;
- creating a high quality, multi-functional, well-connected network of river-related spaces and places that are accessible to all, and are managed and maintained to the highest standards for people and wildlife;
- promoting the use of the river as an artery for public, commercial, industrial, leisure and recreational transport and use'.

Strategic Guidance (SG) 24 to 27 considers flood risk.

SG24 states that *'Development proposals for riverside sites and for existing parks and open spaces should investigate the potential for full or part realigned flood defences prior to commencement of site planning. Flood defences should then be realigned as and when appropriate by following Environment Agency guidance. Even in cases where flood defences are not re-aligned, development should be set back from*

existing flood defences to allow space for their future maintenance and upgrade. It will not be appropriate to set back some river dependent uses such as wharves, boatyards and passenger piers'.

SG25 states that *'Development proposals should seek to improve the visual appearance and ecological value of existing sheet piling and concrete slab river defences following Environment Agency guidance contained in 'Partnership in Planning - Riverbank Design Guidance for the Tidal Thames''*.

SG26 recommends that *'Existing open space infrastructure should be re-assessed in terms of its flood storage potential as part of a multi-functional environmental infrastructure resource. Environment Agency initiatives should identify areas where managed retreat for flood risk management can provide opportunities for habitat creation'*.

SG27 states that *'Development proposals should aim to minimise surface water run-off through incorporation of sustainable drainage systems and should generally avoid discharging clean surface water into the combined sewer system'*.

The Strategy also recognises the increasing risk of flooding resulting from climate change.

Parts of Reach 5 and Reach 6 identified within the Strategy are within the Havering area. Each Reach has specific policy guidance with regard to flood risk management and climate change.

For Reach 5, 'Halfway and Erith Reach', Reach Guidance RG5.10 and part of RG5.12 are of relevance to Havering.

RG5.10 states *'Undertake a hydrological study of Rainham Creek and investigate opportunities to reconnect the Creek to the western edge of Rainham Marshes through intermediary channels and generally enhance the flood management function and biodiversity of the Ingrebourne, Beam and Goresbrook rivers, through creation of floodplain habitat adjacent to the rivers'*.

RG5.12 states *'Seek opportunities for creative realignment of flood defences and making space for water in all riverside development proposals, where defences are being replaced and at riverside open spaces …'*.

For Reach 6, 'Erith Reach, Erith Rands and Long Reach', Reach Guidance RG6.13 and part of RG6.12 are of relevance to Havering.

RG6.12 states *'Continue the research into strategic tidal flood risk management options at Rainham [and] Wennington … Marshes and explore opportunities for flood storage along … marsh watercourses and ditches as part of a multi-functional green space infrastructure designed to enhance biodiversity value'*.

In common with RG5.12, **RG6.13** states *'Seek opportunities for creative flood defence realignment and making space for water in all riverside development proposals, where defences are being replaced and at riverside open spaces'*.

2.7.2 Rainham and Beam Park Planning Framework

In 2015 Rainham and Beam Park was identified as one of Greater London Authority's (GLA's) new housing zones. In January 2016 the Rianham and Beam Park Planning Framework was published which will form part of the evidence base of the emerging Local Plan and will inform area specific policies. It will also be used as a material planning consideration in the assessment of planning applications.

The illustrative masterplan set out in the Framework establishes the following development headlines for the area:

- 3,250 homes, of which 1,000 are houses;

- 3,500 – 4,000m^2 new town centre uses in Beam Park including 2,000 m^2 of retail floor space and a new railway station;
- A new 2-Form Entry Primary School;
- Health and community facilities at Beam Park Centre; and
- Expansion of Havering College.

The Environment Agency Flood Map indicates that the majority of the Rainham and Beam Park Planning Framework area is within Flood Zone 3. However, some areas are located within 'Areas Benefitting from Defences' due to flood protection provided by the TTD, and the flood defences along the River Beam and the Ingrebourne River. A Flood Management and Drainage Strategy has been developed to inform the production of the Planning Framework. The strategy identifies a number of development sites within the Framework area at fluvial flood risk from river flooding in the 1 in 100 year event including climate change and identifies a number of recommendations to mitigate the identified flood risk including:

- 'Dovers Corner / Havering College: Open up the culverted section of the Havering New Sewer which flows through the Dovers Corner site, and provide an open channel with a width of 5m and a bed and bank height the same as the open channel upstream and downstream.
- Suttons Industrial Park: It is suggested to open up the culvert in the Sutton Industrial Park site and provide an open channel with a width of 5m and a bed and bank height the same as the open channel up-stream and downstream to reduce the flood risk at this site.
- Beam Park: Upgrading the existing Washlands Flood Storage Area (FSA) may reduce the risk from flooding at the Beam Park site. It is recommended that the area of the site still shown to be at risk from flooding during the 1 in 100 year event including climate change (when the Washlands FSA is upgraded) is designated as green open space. Planning applications for this site should follow the new Environment Agency guidance on climate change, once published.'

Policy PG28 states that for any planning application '*Applicants are expected to*:

- Limit surface water runoff rate and volume to the peak Greenfield runoff rate and volume;
- Follow a Sustainable Drainage System (SuDS) management train, a set out by the SuDS Manual, CIRIA Report C753, to ensure that natural catchment management processes are replicated as closely as possible;
- Demonstrate how the use of green roofs and rain water harvesting systems have been considered where appropriate;
- Demonstrate how Water Sensitive Urban Design (CIRIA C723, C724) has informed the design and development of the proposals;
- Demonstrate how SuDS are an integral aspect of the development layout and design, its open spaces, public realm and gardens and how they deliver wider community benefits, including improvements in health, wellbeing and quality of life, as well as supporting the provision of habitats and places for wildlife to live and flourish.'

2.7.3 Romford Town Centre

The Romford Town Centre Development Framework will be used to inform the policies and land allocations in the emerging Local Plan. The planning recommendations for development in various flood zones (see

Section 7.12) will help inform decisions on land use policies and site specific land allocations contained in the emerging Local Plan. In summary Romford Town Centre has been identified as:

- A metropolitan Centre, which will continue to be the main focus for retail growth'
- An area with the potential to bring forward high-density residential and mixed use development'
- A focus for office development within Romford Town Centre. The majority of which is included in the Office Quarter and the preferred location for large-scale office development''
- An area to promote cultural and arts uses to diversify the evening economy; and
- An area where accessibility should be increased by considering the potential to introduce a Park and Ride facility as part of a wider strategy to encourage modal shift.

3. Approach to Strategic Flood Risk Assessment

3.1 Role of the SFRA

The important role of SFRAs in the local plan process is set out in the National Planning Practice Guidance (NPPG) (2014). It states that *'local planning authorities should use the Assessment to:*

- determine the variations in risk from all sources of flooding across their areas, and also the risks to and from surrounding areas in the same flood catchment;
- inform the sustainability appraisal of the Local Plan, so that flood risk is fully taken into account when considering allocation options and in the preparation of plan policies, including policies for flood risk management to ensure that flood risk is not increased;
- apply the Sequential Test and, where necessary, the Exception Test when determining land use allocations;
- identify the requirements for site-specific flood risk assessments in particular locations, including those at risk from sources other than river and sea flooding;
- determine the acceptability of flood risk in relation to emergency planning capability;
- consider opportunities to reduce flood risk to existing communities and developments through better management of surface water, provision for conveyance and of storage for flood water'.

The ideal solution to effective and sustainable flood risk management is a planning led one, i.e. where possible prioritise development away from areas that are susceptible to flooding. The NPPF stipulates the application of a sequential approach to site allocation – seeking development sites within areas of lowest flood risk in the first instance (Flood Zone 1 – low probability of flooding). Only if it can be demonstrated that there are no suitable sites within these areas should alternative sites (i.e. within areas that may potentially be at greater risk of flooding – Zones 2 (medium probability), 3a (high probability) or 3b (functional floodplain)) be contemplated, taking account of the vulnerability of the proposed land use.

The Sequential Test, which is set out in the NPPF with further detail provided in the NPPG, must be utilised in both allocating sites and determining applications. Tables 1 to 3 in the NPPG stipulate 'appropriate' land uses for each Flood Zone. Land uses are divided into five 'vulnerability classifications', detailed in Table 2 of the NPPG:

- Essential Infrastructure
- Highly vulnerable
- More vulnerable
- Less vulnerable
- Water-compatible development.

Table 3 of the NPPG (reproduced as Table 3-1) identifies types of development (by vulnerability classification) that should not be permitted in particular Flood Zones. It also identifies circumstances in which the 'Exception Text' must be passed for development not initially permissible in that zone , where, following application of the Sequential Test, no sites are available in zones with lower flood risk.

Table 3-1: NPPG Table 3 - Flood Risk Vulnerability and Flood Zone Compatibility

Flood Zone	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
1	Appropriate	Appropriate	Appropriate	Appropriate	Appropriate
2	Appropriate	Exception Test required	Appropriate	Appropriate	Appropriate
3a	Exception Test required*	Not Appropriate	Exception Test required	Appropriate	Appropriate
3b	Exception Test required*	Not Appropriate	Not Appropriate	Not Appropriate	Appropriate*
* Conditions may be applicable (refer to NPPG)					

Paragraph 102 of the NPPF states that 'For the Exception Test to be passed: *it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh the flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared; and a site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.'*

The latter point includes a requirement to take account of the future risk from climate change over the lifetime of the development.

This Level 1 SFRA provides the information required to enable LBH to apply the Sequential Test and to identify whether the Exception Test will be required.

The Planning Practice Guidance (SFRA guidance, paragraph 012) states that *'where a Level 1 Assessment shows that land outside flood risk areas cannot appropriately accommodate all the necessary development, it may be necessary to increase the scope of the Assessment to a Level 2 to provide the information necessary for application of the Exception Test where appropriate'*. The requirement for a Level 2 SFRA will be determined once LBH have confirmed their planning allocation sites. In the interim period, a Level 1 SFRA annex is included in order to consider the potential flood risk implications of Rainham and Beam Park (part of the London Riverside Opportunity Area) and Romford Metropolitan Centre, both of which are identified in the London Plan for development in Havering over the Plan period. The annex provides recommendations to inform a Level 2 SFRA (should it be required).

In addition to providing the information required to apply the Sequential Test, this document also contains a series of general recommendations for local planning policy and development management. Overlaps with emergency planning are also discussed.

3.2 Methodology for the Level 1 SFRA

In accordance with the NPPF a Level 1 SFRA should collect and refine data in order to define the flood zones. The SFRA should provide the basis of applying the Sequential Test based on this identification of Flood Zones.

The adopted methodology for this Level 1 SFRA is summarised in the subsequent sections.

3.2.1 Data Collection

This involves the collection and review of data pertaining to known and perceived flood risk and current planning policy within Havering. This has been collected from a number of sources including LBH, EA Anglian Water and Thames Water.

3.2.2 Assessment of Flood Risk

The extent and probability of flood risk within Havering has been categorised and assessed for the SFRA. The following actions have been undertaken:

- The identification of flood risk zones 1, 2, 3a and 3b (functional floodplain);
- Identification of locations of flood risk from other sources (ordinary watercourses, groundwater, reservoirs, canals);
- Identification of locations at risk of surface water flooding (termed Havering Critical Drainage Areas or HCDA), particularly outside fluvial or tidal risk areas;
- Identification of areas protected by existing flood defences and that could be at risk should they fail.

3.2.3 Climate Change

Climate change has the potential to significantly increase the consequences of flooding within Havering. The assessment of flood risk has taken into account the estimated impact of climate change up to the year 2115[8]. This has been assessed for both changes in rainfall leading to an increase in fluvial flood risk due to higher river levels and the impact of higher tidal flood levels on the River Thames. This has the potential to increase the current risk of flooding through an increase in rainfall frequency and intensity. The frequency of high water levels on the River Thames is also expected to increase.

3.2.4 Outputs

The following outputs have been produced as part of this SFRA:

- Delineation of Flood Risk Zones (to comply with the Sequential Test);
- Flood maps indicating areas at risk of flooding;
- Assessment of residual risk of flooding;
- Maps of Havering Critical Drainage Areas;
- SFRA Report;
- Suggested policies and guidance for the local planning authority on the management of flood risk in the Borough;
- Guidance for developers and LBH planning officers dealing with applications.

8 This is based on the BIM and river Mardyke detailed modelling increasing the existing 1% (1 in 100) event peak flow rates by factors specified in the Environment Agency's guidance issued in February 2016

4. Data Collection and Methodology

4.1 Overview

This Section details the data used to develop this SFRA and the methodology used to analyse the flood risk.

The flood risk knowledge within Havering includes (but is not limited to):

- experience of council engineers and staff, local councillors and others;
- records and information on past flooding from all sources (primarily river, surface water, groundwater and sewers);
- Flood Map for Planning (Rivers & Sea) and the uFMfSW showing areas most susceptible to local flooding. We have used the latest information, updated by the EA in January 2014;
- Previous studies such as the Drain London project.

The application of this data has facilitated the delineation of zones of 'high', 'medium' and 'low' probability of fluvial flooding, HCDA and the formulation of planning and development management recommendations. A summary of the findings based on the analysis is provided in Section 5.

An overview of the core datasets, including their source and their applicability to the SFRA process, is outlined here. It should be noted that information on flood risk is continually changing as new flooding events occur and further modelling and analysis is undertaken. Therefore, whilst the datasets used are the best available at the time of publication, the SFRA should be reviewed periodically (see Section 7 for a checklist), with LBH contacted in the meantime for the latest information.

4.2 Information from Historic Flooding

Please refer to Figure 102 for fluvial flooding and Figure 110 for surface water flooding

Information on previous flooding incidents within LBH has been collated from a variety of sources. A number of fluvial flood events have been identified dating back to 1707.

Data on previous flood events has been sourced from:

- Previous LBH (2007 and 2014) SFRA's;
- Drain London Preliminary Flood Risk Assessment;
- LBH Records;
- EA records;
- Thames Water records; and
- Anglian Water records.

Thames Water provided information on flooding resulting from surcharge and blockage of surface, combined and foul water sewers for the Drain London project in 2011. Up-to-date information has been provided by Thames Water and Anglian Water for this update of the SFRA. This data, known as DG5 flooding data, is subject to confidentially issues and specific incidences where individual properties were affected cannot be

divulged. However, Thames Water is allowed to confirm how many properties have been subject to DG5 flooding per postcode area (the first four digits of the postcode are provided only).

4.3 Delineation of Flood Zones 1, 2 and 3

The risk of an event (in this instance a flood event) is a function of both the probability that the flood will occur, and the severity of the consequences. This SFRA endeavours to assess the likelihood (or probability) of fluvial (river) flooding, categorising the Borough into zones of low, medium and high probability. It should be noted that this delineation does not incorporate the risk of flooding from other sources, which also pose a risk. It then provides recommendations to assist LBH to manage the consequence of flooding in a sustainable manner, for example through the restriction of vulnerable development in areas of highest flood risk.

To this end, a key outcome of the SFRA process is the establishment of the Sequential Test in accordance with the NPPF. To inform the planning process, it is necessary to review flood risk across the area, categorising the area in terms of the likelihood (or probability) that flooding will occur. The Borough has been delineated into the fluvial Flood Zones summarised below, in line with the NPPF. The delineation of Zones 1, 2 and 3a is based on the EA's Flood Map for Planning (Rivers & Sea), whereas Zone 3b has been derived separately.

The EA's Flood Map for Planning (Rivers and Sea), available on its website[9], shows the natural floodplain, ignoring the presence of defences, and therefore areas potentially at risk of flooding from rivers. The Flood Map shows the area that is susceptible to a 1% (1 in 100) annual chance of flooding from rivers in any one year. It also indicates the area that has a 0.1% (1 in 1000) annual chance of flooding from rivers in any given year. This is also known as the Extreme Flood Outline. The Flood Map outlines for Havering have been produced from a combination of a national generalised computer model and available historic flood event outlines. The EA's knowledge of the floodplain is continually being improved by a variety of studies, detailed models, data from river flow and level monitoring stations, and actual flooding information. The EA has an ongoing programme of improvement, and updates are made on a quarterly basis.

The derivation of Flood Zone 3b is summarised below and presented in Figure 103. Changes to the delineation of flood zones since the 2014 SFRA are summarised in Section 5.6.

Flood Zone 1 – Low Probability

Flood Zone 1 (FZ1) Low Probability comprises land assessed as having a less than 1 in 1,000 annual probability of river flooding (<0.1%). For SFRA purposes, this incorporates all land that is outside of the Zone 2 and Zone 3 flood risk areas. It is important to note that land within Flood Zone 1 may still be vulnerable to flooding from other, non-fluvial, sources.

Flood Zone 2 – Medium Probability

Flood Zone 2 (FZ2) Medium Probability comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%) in any year. In other words, land situated between Zones 1 and 3a. Zone 2 Medium Probability is based on the most recent (February 2016) EA Flood Map for Planning (Rivers and Sea).

Flood Zone 3a - High Probability

Flood Zone 3a High Probability comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) in any year. Zone 3a High Probability is based on the most recent (February 2016) EA Flood Map for Planning (Rivers and Sea).

9 http://www.environment-agency.gov.uk/

Flood Zone 3b – Functional Floodplain

Flood Zone 3b (FZ3b) Functional Floodplain is defined in Table 1 of the NPPG as those areas in which "water *has* to flow *or be stored in times of flood"*. The definition of functional floodplain remains somewhat open to subjective interpretation, but the NPPG requires that the boundaries shown in the SFRA should be as agreed with the EA. The NPPG states that *"the identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. However, land which would flood with an annual probability of 1 in 20 (5%) or greater in any year, or is designed to flood (such as a flood alleviation scheme) in an extreme (0.1% annual probability) flood, should provide a starting point for consideration and discussion to identify the functional floodplain"* (NPPG, SFRA guidance, paragraph 015). The guidance (paragraph 015) further clarifies that:

'The area identified as function floodplain should take into account the effects of defences and other flood risk management infrastructure. Areas which would naturally flood, but which are prevented from doing so by existing defences and infrastructure or solid buildings, will not normally be identified as function floodplain.'

In addition, the guidance states that areas intended to flood, such as upstream flood storage areas (FSA) (e.g. The Washlands FSA), should also be identified as functional floodplain.

In 2011 the EA completed the Mardyke Flood Risk Study (JBA, March 2011). This included the development of a hydraulic model of the watercourse which was run to develop predicted flood outlines for the Mardyke. The 5% (1 in 20) AEP undefended flood extent developed as part of this study has been adopted as the extent of FZ3b on the Mardyke.

No detailed modelling is available to define the extent of FZ3b on Emerson Park Stream, Paines Brook and Weald Brook. Therefore following consultation with the EA; areas identified as 'high' risk on these watercourses in the National Flood Risk Assessment (NaFRA) have been classified as the FZ3b. It should be noted the NaFRA data identifies 'high risk' as a 3.3% (1 in 30) AEP risk or greater.

The EA completed a project in 2013 to update the hydraulic modelling of the Rivers Beam, Ingrebourne and Marshes (BIM; please refer to Figure 103). One output of this study was detailed flood extent maps of these watercourses for a range of storm events. The 5% (1 in 20) annual chance event extent has been adopted as Zone 3b.

The EA completed a flood mapping study of the Blacks Brook in 2015. The outputs of the hydraulic modelling for the 5% (1 in 20) annual chance event extent have been adopted as Zone 3b.

The open land surrounding existing solid buildings in areas designated as Zone 3b form important flow paths and FSAs. It must be protected from development by appropriate planning policies and decisions. Zone 3b should be interpreted in terms of:

- 'existing development' and
- 'new development' (including all new development on previously undeveloped land, or on surfaces that are currently permeable, or on surfaces that are currently impermeable but not designed to flood).

It is important to recognise that all areas within Zone 3b are subject to relatively frequent flooding – on average, 5% (1 in 20) annual chance. There are clear safety, sustainability and insurance implications associated with future development within these areas, and informed planning decisions must be taken with care. This is reflected in Section 7.

4.4 Dry Islands

There are areas within Havering which, while in Zone 1, would be surrounded by floodwater during a flood event. For this reason, development proposals in these 'dry island' areas should be accompanied by a flood evacuation plan suitable for the NPPF category into which the surrounding area falls. For example, a development proposal on a dry island site that is categorised as Zone 1 Low Probability, but wholly surrounded by the 1% (1 in 100) annual chance floodplain, should be accompanied by a flood evacuation plan appropriate to Zone 3a High Probability.

4.5 Consideration of Climate Change

There is clear scientific evidence that global climate change is happening now and cannot be ignored. Further information is provided in Section 5.5. Changes in the extent of inundation due to climate change are likely to be negligible in well-defined valleys, but could be dramatic in very flat areas. Changes in the depth of flooding under the same allowance will increase the probability of a given flood. This means that a site currently located within a lower risk zone (e.g. Zone 2) could in future be re-classified as lying within a high risk zone (e.g. Zone 3a). This in turn could have implications for the type of development that is appropriate according to its vulnerability to flooding.

In February 2016 the Environment Agency updated its guidance on the allowances to be made for the predicted impact of climate change. Of particular relevance to this SFRA is the revised guidance on:

- Peak river flow
- Peak rainfall intensity; and
- Sea levels.

4.5.1 Peak River Flow and Fluvial Flood Risk

The allowance to be made for the predicted impact of climate change on peak river flows throughout the UK is subject to the location (river basin district[10]), timescale (design-life) to be considered and the vulnerability classification (see Paragraph 66 of the NPPG) of the proposed development. For Havering the uplift factors to be applied are summarised in Table 4-1.

Table 4-1 : Recommended Climate Change allowances for Peak River Flow

Allowance	2015 to 2039	2040 2069	2070 2115
Upper End	25%	35%	70%
Higher Central	15%	25%	35%
Central	10%	15%	25%

The following data and assumptions have been made to estimate the extent of the flood zones as a result of climate change to the year 2115:

- In the absence of detailed modelling FZ3b will broadly become the extent of the current FZ3a (subject to the free passage of water through urban areas; see Section 0);

[10] https://www.gov.uk/government/publications/flood-risk-assessments-river-basin-district-maps

- Future FZ3a has been estimated based on the modelled impact of climate change on the BIM model, Blacks Brook model, the TE2100 hydraulic model and the Mardyke Flood Risk Mapping Study model based on the uplift factors required by EA guidance;

- Analysis of ground levels should be made to determine whether a site currently in FZ1 (<0.1% AEP flood) should be considered as lying within FZ2 (the 0.1% AEP flood) at the end of this century.

Please refer to Figures 105A to E for a comparison of the impact of Climate Change on FZ3 for the full range of potential allowance factors. The predicted flood extents are based upon the undefended scenario i.e. the removal of raised flood defences, for the Mardyke and BIM models.

For certain watercourses the extent of the current hydraulic model used to generate the 'with climate change' predicted flood extents does not cover the full extent of published Flood Zones (for an example see the upper reaches of the tributaries to the River Ingrebourne in Figure 105e). The extent of the published Flood Zones in such areas was developed using a different model to the watercourse model. Should a site be proposed for development in such areas the developer would need to consider the potential impact of climate change through a site-specific flood risk assessment.

It is not possible to extrapolate these assessments of climate change impact to estimate the potential changes to Zone 2. Detailed modelling has not been undertaken to estimate the impact of climate change on such an extreme event. However, given the statistical rarity of a 0.1% (1 in 1000) annual probability event it is likely that the increase in extent due to climate change will be relatively small as the likely increase in rainfall is smaller as a portion of the total.

4.5.2 Peak Rainfall Intensities

The updated guidance requires the testing of two uplift factors across all of England as summarised in Table 4-2. SFRAs and site-specific FRAs are expected to test the impact of both allowances to understand the potential range of impact based on the design-life of the proposed development.

Table 4-2 : Recommended Climate Change allowances for Peak Rainfall Intensity

Allowance	Total potential change (1961 90 baseline)		
	2015 to 2039	2040 2069	2070 2115
Upper End	10%	20%	40%
Central	10%	10%	20%

4.5.3 Sea Level Rise

The allowances for the predicted impact of climate change upon sea level rise is summarised in Section 5.3.2.

4.6 Flood Defences

Please refer to Figure 106 for Tidal/Fluvial defences and Figure 108 for culverts

The EA's Flood Map for Planning (Rivers and Sea) does not take account of the presence of raised defences. The NPPF states that defended areas are still at risk of flooding and therefore the adequacy of these defences must be considered when considering the development of a site in these areas. This will be

included when the Level 2 SFRA is developed for allocation sites, if required. This aspect should also be considered when developing a FRA for a windfall site.

The extent of formal flood defences is indicated in Figure 106. This figure additionally indicates the areas that benefit from these defences (ABDs) in the event of a 1% (1 in 100) annual chance fluvial or a 0.5% (1 in 200) annual chance tidal flood event.

In the complex rural and built environments in which we live, many natural and manmade structures and features can affect the routing of flood waters. Some of these may have been specifically constructed (i.e. known as 'formal') for the purposes of managing water flow and reducing flooding (e.g. flood embankments, culverts and sluices) and are maintained by their respective owner. This could be the EA, Local Authority, or an individual. Others may have been built for a different purpose (i.e. known as 'informal') but which also affect the spread of floods (e.g. buildings, garden walls, railway embankments) but are not maintained for this specific purpose. The structures and features have not necessarily been used in modelling used to generate the flood maps used in this SFRA. However, the location of these assets are mapped and described here since it is important to recognise their function and to ensure that their functionality is not impaired by any development.

The EA has no statutory responsibility to maintain Main Rivers (and/or flood management assets) within the UK. This remains the responsibility of the riparian land owner. The EA retains 'permissive powers' however, and using these powers may carry out a programme of monitoring and maintenance.

Other flood management infrastructure (e.g. culverts) has also been identified across Havering. It is important to recognise the function of these assets and to ensure that their functionality is maintained. Assets should be carefully reviewed in a local context as part of the detailed site based Flood Risk Assessment (see Table 7-1).

Within protected areas there will always be a residual risk of flooding. This may be due to an extreme event that exceeds the design of the asset, changing climatic conditions that increases the frequency and severity of flooding, a structural failure, or flooding behind the asset e.g. due to elevated groundwater levels. It is incumbent on both LBH and developers to ensure that the level and integrity of flood management assets provided within new developments can be assured for the lifetime of the developments.

4.6.1 Flood Storage Areas

Please refer to Figure 107

FSAs have been identified at the following locations within Havering:

River Beam

With reference to the BIM modelling report the Washlands FSA was originally constructed in 1961 to attenuate 430,000m^3 of flood water. A series of modifications have been made to the FSA; the most recent being in 2010 which included works to the spillways and embankments. Subsequently in 2011, landscaping works were undertaken to increase the available storage by 25,000m^3. The FSA is located on the border with Barking and Dagenham.

River Ravensbourne

Harrow Lodge Park reservoirs on the Ravensbourne attenuate a significant amount of flood water (40,000m^3) based on the BIM Modelling study.

There is a FSA upstream of the Main River extent on the Ravensbourne, north of Gallows Corner. The FSA receives flows from the public surface water sewer and attenuates it in a grassed open area south of Faringdon Avenue (NGR TQ 5352 9093) before returning flows to the public sewer. Thames Water has

confirmed the operation of this FSA but no details are available. This area has been designated as a HCDA and as FZ3b.

River Rom

The River Rom Flood Alleviation Scheme built between 1981 and 1984 included the Cross Road FSA (NGR: TQ 4943 9013). The FSA was designed to attenuate peak flows upstream of Romford. The previous SFRA report stated that a timetable of remedial works were proposed after it was inspected in 2006 and found to be below standard. Information provided for this study however stated that the downstream embankment was discontinued in December 2010.

River Ingrebourne

The Dovers Corner FSA (NGR: TQ 5219 8262) is located on the Ingrebourne in Rainham, immediately upstream and downstream of the A1306. There is no control structure at the outlet; the FSA is designed to fill as the water level backs up when Rainham Creek is tidally locked by high levels in the River Thames.

4.6.2 Fluvial Defences

Please refer to Figure 106

Based on the information provided by the EA the majority of fluvial flood defences within the Borough are classified as high ground. There are lengths of raised embankment on the Ingrebourne in Rainham. There are no raised embankments on the upper reaches of the Mardyke.

There are 14 control gates identified on the EA records. These are predominantly located on the lower reaches of the rivers before they outfall into the Thames.

4.6.3 Tidal Defences

Please refer to Figure 107

The Borough is protected from flooding by the River Thames by a series of tidal defences to a Standard of Protection (SoP) of in excess of the 0.1% (1 in 1000) annual chance event. These defences are typically steel piles with concrete capping or concrete walls. In some cases flood gates are provided where access to the riverward side of the defence is maintained. A number of the smaller gates are manually operated and require closing in advance of a tidal event. There are four such gates within Havering. The defences are maintained to a minimum level of between 7.1 and 6.9m AOD along the Borough's boundary.

The flood zone maps (see Figure 103) do not take the protection provided by the TTD into account in accordance with the published mapping of Flood Zones by the Environment Agency. However, when reviewing the suitability of development in such areas the protection provided by the defences should be considered because it is anticipated that the Environment Agency will continue to maintain the defences for the foreseeable future based on the Thames CFMP (see Section 2.5). Proposed Development in these areas would require a site-specific flood risk assessment which would need to take into account of the potential for a breach of the defences and the subsequent flood hazard for future users.

As part of the EA's Thames Tidal Breach Modelling (2013), the impact of breaches in the TTD was assessed. Three locations were tested in Havering and the resultant flood extent and flood hazard (see Section 5.4.1) are included in Figures 107a-g.

4.7 Flood Warning

Please refer to Figure 113

The EA operates the Floodline Warnings Direct[11] service to warn homes and businesses of potential flooding. There are Flood Warning areas on the Beam, Rom and Ingrebourne. The upper reaches of these watercourses are within Flood Alert areas. Section 5.3.1 summarises the extent of fluvial flood risk in the Borough. At present there is only one tidal flood risk warning area within Havering: '062FWB55Dagenham'; The River Beam at Dagenham. Section 5.3.2 summarises the degree of tidal flood risk in Havering.

4.8 Havering Critical Drainage Areas

Please refer to Figure 109

Based on the uFMfSW (2013), a number of residential and commercial properties in Havering could be at risk of flooding from local sources (principally surface runoff generated by intense rainfall, groundwater and ordinary watercourses). In areas susceptible to local flooding, the volume of runoff and sufficiency of the drainage, ordinary watercourse and sewer systems are critical to determining the degree of flood risk. For this reason, this SFRA has delineated HCDA across the Borough. The EA has the ability to delineate Critical Drainage Areas (CDA) to cover such areas, but as is the case across much of the country, has not currently done so within the Borough. Although HCDA and CDA would both cover areas with critical drainage problems, the variation in name has been used to differentiate between those areas delineated by LBH's SFRA and those which may be notified by the EA. Therefore because the HCDAs are locally designated they are subject to local policy requirements and do not necessarily require EA consultation unless they meet other pre-existing criteria.

In the 2007 SFRA, areas at risk of surface water flooding were identified using JFLOW flood mapping, but no further significance was attached to them. Guidance was provided for proposed developments, and that LBH should take responsibility for ensuring flood risk is addressed, in these areas. Since then LBH has become the LLFA and has formally been assigned this responsibility. The identification of the HCDA indicates to LBH where this is required.

Since the 2007 SFRA the EA has produced the FMfSW which was further updated in December 2013 (uFMfSW). This provides refinements over the previously defined areas. The uFMfSW outline of a 1% (1 in 100) annual chance flood event is used in this SFRA as a basis to define HCDA in Havering. Because the HCDA represent flood risk from different sources, no indication of the likely duration of flooding is given.

4.9 Dam Breach

Following a recommendation in the Pitt Review, the EA has provided Reservoir Flood Maps[12] for those reservoirs which it regulates under the Reservoirs Act 1975. These show the likely extent of flooding resulting from a dam breach which could be caused by extreme rainfall or floods, as well as structural failure. For this SFRA a review has been undertaken of the information available on the EA's website to assess the potential area of risk of a reservoir embankment breach, please see Section 5.3.3 0.

4.10 Previous Flood Risk Studies

In developing this SFRA we have drawn upon other studies to provide information on sources of flooding within the Borough.

11 https://fwd.environment-agency.gov.uk/app/olr/home
12 http://watermaps.environment-agency.gov.uk/wiyby/wiyby.aspx?topic=reservoir#x=357683&y=355134&scale=2

4.10.1 Havering SFRA (2007 and 2014)

The first LBH SFRA was completed in November 2007 and was updated in 2014. This SFRA updates and replaces these studies with current information. Instances of historic recorded flooding have been used from that report augmented with the most recent data.

4.10.2 Drain London

A key conclusion of the Mayor of London's consultation on the draft Regional Flood Risk Appraisal (RFRA) in 2007 was that the threat of surface water flooding in the capital was poorly understood. Furthermore the management responsibility was split between a number of organisations. To address these issues Defra funded the Drain London project to produce Surface Water Management Plans for each London Borough.

Through the enactment of the Flood and Water Management Act 2010 (FWMA) the boroughs are also required to produce a Preliminary Flood Risk Assessment (PFRA), also delivered through Drain London.

4.10.3 Havering Surface Water Management Plan (2011)

Surface Water Management Plans (SWMP) identify sustainable responses to manage local flooding and contain Action Plans that provide an evidence base for future decisions. As part of the Drain London[13] project a SWMP was developed for Havering. A hydraulic model was developed to simulate overland flood flows to identify flood prone areas. The project has delivered the following:

- Maps showing predicted flood depth and velocity in different flood event scenarios, including consideration of climate change;
- Development of a number of options to improve management of local flooding, both through changes to policy and practice, as well as location-specific actions including individual property protection, control of runoff close to source and design of urban environments to make space for water. An estimate of their cost is included.

The SWMP made a number of location-specific and policy related recommendations to improve management of local flooding in Havering. LBH are progressing works to investigate the potential options further.

4.10.4 Preliminary Flood Risk Assessment (2011)

A PFRA was required to be completed by December 2011 under the European Floods Directive by each LLFA (including LBH), implemented in the UK as the Flood Risk Regulations 2009. It is a high level screening exercise that identifies areas of significant flood risk from all sources, and summarises the probability and harmful consequences of past (historical) and future (potential) flooding.

Data utilised from this study for the present SFRA includes recorded instances of Surface Water flooding and areas identified to be at increased risk of groundwater flooding.

4.10.5 Environment Agency FRA Database

The EA has developed a database of all the FRAs they have reviewed.

4.10.6 Beam, Ingrebourne and Mayes Brook FRM Study (2013)

This EA study has developed an updated hydraulic model of the three catchments. The model will be used to update the flood extent maps of these watercourses for a variety of storm events. The flood extents have

13 http://www.london.gov.uk/priorities/environment/looking-after-londons-water/drain-london

been used to identify FZ3b and the potential impact of climate change on the Beam and Ingrebourne for this SFRA.

4.10.7 Mardyke Flood Risk Strategy (2011)

The EA undertook a study to update the prediction of flood risk in the Mardyke catchment in 2011. The project included the development of a hydraulic model to update the EA's flood mapping in the catchment. The results from this model have been used to determine FZ3b and the potential impact of climate change on the Mardyke in this SFRA.

4.10.8 Blacks Brook Mapping Study (2015)

The EA undertook a study to develop a hydraulic model of the Blacks Brook and to produce updated flood extents for the watercourse. The study also undertook a number of sensitivity analyses to test a variety of scenarios.

5. Flood Risk in Havering

5.1 Overview

The following maps accompany this SFRA:

- **Figure 101** is a general location plan of the Borough which also indicates the topography and rivers;
- **Figure 102** provides a summary of historic flooding locations, including fluvial flood extents and local incidents of flooding recorded by the EA. It also includes instances of flooding recorded by LBH for Drain London and their likely source which may also be found in Table 5-1;
- **Figure 103** focuses on fluvial flooding and shows the river centrelines, extent of Main Rivers and FZ3a and FZ3b. The map provides an initial indication of the probability of flooding at a proposed development site;
- **Figure 104** focuses on fluvial flooding and shows the river centrelines, extent of Main Rivers, FZ2. The map provides an initial indication of the probability of flooding at a proposed development site;
- **Figures 105A-E** provide an indication of the impact of climate change on the extent of FZ3 in relation to new development or redevelopment in the current FZ2 based on the available hydraulic modelling and the latest peak flow allowances to be applied (see Section 4.5);
- **Figure 106** identifies the location of flood defences within Havering. It also indicates the Areas Benefitting from Defences (ABDs), in other words the areas subject to tidal/coastal flood risk that would flood under a 0.5% (1 in 200) annual chance tidal flood event without the defences;
- **Figures 107A-G** provide an indication of the areas at risk of tidal flooding should the TTD be breached and the impact on the full extent as a result of climate change. They include an assessment of the flood hazard, depth, level and velocity due to a breach at two separate locations;
- **Figure 108** Identifies culverted watercourses within the Borough, as the risk of blockage could lead to flooding not indicated by the identified flood zones;
- **Figure 109** identifies area at risk of flooding from surface water. This is based on the uFMfSW produced by the EA in November 2013. In addition this plan identifies HCDA as a result of non-fluvial flooding;
- **Figure 110** identifies the number of properties that have experienced sewer flooding, by post code based on records provided by Thames Water;
- **Figure 111** indicates the risk of groundwater flooding. This information has been obtained from the EA and work undertaken for Drain London;
- **Figure 112** identifies critical infrastructure in relation to the flood zones. The intention is to identify those that could be at risk of flooding;
- **Figure 113** indicates the EA's Flood Warning and Alert areas within the Borough;

- **Figure 114** indicates emergency services and vulnerable institutions in relation to Flood Zones. This is intended to provide emergency planning with an indication of those institutions that could be at risk of flooding within Havering;

5.2 Historic Flooding

Records of historic flooding within Havering have been collected from a variety of sources. A schedule of recorded flood events is included in Table 5-1.

Table 5-1 : Recorded Historic Flooding in Havering

Date	Type of flooding	Location	Source of information
Easter 1448	Tidal	Rainham Marshes	http://www.british-history.ac.uk/report.aspx?compid=42827
Dec 1707	Tidal	Dagenham Breach / Hornchurch Marshes	Environment Agency Historic Flood Extents
Aug 1888	Fluvial	Beam and Ingrebourne catchment - Romford, Upminster, Hornchurch	http://www.romfordrecorder.co.uk/news/the_125_year_anniversary_of_the_flood_that_devastated_havering_1_2305546
1914	Fluvial	Ingrebourne	“Rainfall observer at Upminster (High House) noted p[7] "Heavy rain throughout the night amounting to 3.35 in. ... The fields along the banks of the Ingrebourne, which flows through the lower part of the village, were flooded. The storm seems to have been a local one” (4)
Mar 1947	Fluvial	Widespread flooding in River Thames catchment	Environment Agency Washlands FSA Improvement Works Report / Previous (2007) SFRA
Feb 1953	Tidal	Extensive flooding of areas adjacent to the River Thames at South Hornchurch, Rainham and the marshes	Environment Agency Historic Flood Extents / Previous (2007) SFRA
Sep 1958	Fluvial	Unknown	Environment Agency Washlands FSA Improvement Works Report / Previous (2007) SFRA
Sep 1968	Fluvial	Ingrebourne catchment – Harold Park, Upminster, Hornchurch	Environment Agency Historic Flood Extents and Washlands FSA Improvement Works Report / Previous (2007) SFRA
Nov 1974	Fluvial	Beam and Ingrebourne catchments – mostly Romford.	Environment Agency Historic Flood Extents and Washlands FSA Improvement Works Report / Previous (2007) SFRA
Aug 1987	Fluvial	Intense thunderstorm caused flooding on River	River Rom Hydraulic Study / Previous (2007)

Date	Type of flooding	Location	Source of information
		Rom at Romford.	SFRA
Oct 1992	Fluvial	Ingrebourne catchment – Isolated flooding in Upminster and Hornchurch	Environment Agency Historic Flood Extents / Previous (2007) SFRA
Dec 2000	Fluvial	Lower Beam at Dagenham	Environment Agency Historic Flood Extents / Previous (2007) SFRA
Jan 2003	Fluvial	Ingrebourne at Rainham (Dover's Corner)	Environment Agency Historic Flood Extents / Previous (2007) SFRA
June/July 2007	Sewer	Romford and Hornchurch	London Borough of Havering flooding record spreadsheet / Previous (2007) SFRA
June 2016	Surface waterand fluvial	River Rom and numerous locations across Havering	Section 19 investigations are to be progressed by LBH

In addition a record of observed flooding as recorded by LBH was included in the Drain London SWMP and is included in Figure 102.

5.3 Predicted Flooding

5.3.1 Fluvial Flooding

The Borough has been delineated into Flood Zones in line with the NPPF. The risk shown by the Flood Zones (Figures 103 and 104) is interpreted here for the key areas in Havering. Generally flood risk is limited to the southern area of the Borough in the vicinity of the Thames and the valleys of the Rivers Beam and Ingrebourne and their tributaries.

It is important to note that even shallow flood waters can be extremely dangerous. Some people will be at risk when the water depth is only 0.5m if the velocity is 1m/s (about 2 mph). If the velocity increases to 2m/s (about 4mph) some people will be unable to stand in a depth of water of only 0.3m. Most people will be unable to stand when the velocity is 2m/s and the depth is 0.6m[14].

River Beam Catchment

The River Beam rises in Wattons Green and flows through the western area of the Borough to the Thames at Dagenham. Its tributaries are the River Rom (which flows through Romford) and Blacks Brook and further south the Ravensbourne whose confluence is south of Romford. The upper reaches are predominantly rural with significant urban development further downstream. The Wantz Stream joins the Beam further downstream at the Washlands FSA.

River Rom and Blacks Brook

The first urban area the Rom reaches is Havering Park where properties in Carter Drive, which back on to the Rom, are within the extent of FZ3. From this point downstream the Rom flows through undeveloped areas which are within FZ2. The Cross Road FSA is identified as FZ3 (although there is uncertainty to its

14 Further information is contained in the Defra Report "Flood Risks to People" "Flood Risks to People" Phase 1 (July, 2003) and Phase 2 Project Records (FD2321/PR), March 2006)

operation; see Section 4.6.1). The extent of FZ3b is predominantly within the river channel with the exception of a few areas in the vicinity of Como Street which are also designated as FZ3. There are developed areas defined as FZ2 between Mawney Road and Como Street.

Blacks Brook rises in Rise Park and is designated Main River at Brook Road, South of the A12. Based on the NaFRA data there are areas within FZ3b north of Main Road although this does not affect property. Upstream of the A12 there are properties within FZ3 and on Millbrook Gardens to the South. From this point the flood zones are within parks and open areas, until a few properties within FZ3 on Kingston Road and Sims Road, Romford. At this point the flood zones runs between the railway and the main retail area of Romford Town Centre, there is an extensive area of FZ3 which affects properties along Eastern Road. It is understood that the Brook is flashy; responding quickly to rainfall, which limits the time available to prevent flooding.

Downstream of Romford Town Centre the extent of FZ3b and FZ3 is retained within the river corridor and open parks to the confluence with the Ravensbourne.

River Ravensbourne

The Ravensbourne rises in Harold Wood where there is an extensive urban area within FZ3, upstream (north) of the railway. The predicted flood extents suggest the railway crossing is acting as a constraint on the passage of floodwaters. From the railway the Ravensbourne flows through Ardleigh Green in open areas. There are properties at Slewins Lane within FZ3b. To the confluence with the Emerson Park Stream the flood zones are within gardens and not predicted to affect property directly.

From the confluence of the Emerson Park Stream the flood zones are within rear gardens (Lyndhurst Drive and Boscombe Avenue, Hornchurch) or open areas further downstream to the confluence with the Beam.

Emerson Park Stream

The Emerson Park Stream is predominantly culverted; however based on the NaFRA data there are isolated properties within FZ3b along its path at Wakefield Close, Brookside, Woodlands Avenue and Warrington Gardens at the confluence with the Ravensbourne.

River Beam

The Beam starts at the confluence of the Rom and Ravensbourne and forms the western boundary of the Borough. The flood extents are extensive, however, as the river flows through The Chase nature reserve, there are few properties affected.

Upstream of Beam Bridge (A1306) FZ3b extends eastwards and includes properties on Lower Mardyke Avenue, South Street and Walden Avenue. From this point the flood zones are influenced by the Thames.

River Ingrebourne Catchment

Carters Brook, Paines Brook and Weald Brook

Two tributaries of the Ingrebourne: Carters Brook (which becomes Paines Brook) and Weald Brook are located on the north-eastern boundary of the Borough. Carters Brook flows south-easterly through Harold Hill, where there are properties within FZ3 at Dorking Road, St Neots Road, the A12 and an industrial estate at the confluence with the Ingrebourne. Potentially, more significantly, Brookside Primary School is within FZ3.

The NaFRA data does identify an area of FZ3b on Dagnam Park Drive which does place part of Brookside Infants School within FZ3b. There are small areas of FZ3b upstream of the confluence with the Ingrebourne but they do not encompass property.

The Weald Brook is rural in character with no properties at risk of flooding. Its confluence with the Ingrebourne is to the west of Junction 28 of the M25.

River Ingrebourne

The River Ingrebourne flows through rural areas until it reaches Upminster. There are properties at risk (FZ3) to the north of the railway line on Frimley Avenue. Downstream (south) of the railway the River remains in an essentially rural valley with only properties at Derby Avenue and Hornchurch Stadium with FZ3 to Rainham and the confluence with the Thames. There are areas defined as FZ3b but no property is affected. The Ingrebourne becomes the Rainham Creek downstream of the A1306 where flood risk is driven primarily by the Thames.

Rainham Main Sewer

The Rainham Main Sewer is located in the south-eastern corner of the Borough. The floodplain is rural, with three small areas designated as Zone 3b to the west of Rainham Marshes. The watercourse outfalls into the River Thames at Purfleet. The watercourse is protected from tidal flooding by a sluice at its outfall.

River Mardyke

The River Mardyke rises to the east of Upminster and the M25 and flows southwards and then westwards to its confluence with the Thames at Purfleet. The river is predominantly in the neighbouring authority of Thurrock. The catchment is at the far eastern edge of Havering and is predominantly rural, although there are some existing properties within FZ3 to the east of Upminster. Anglian Water's Bury Farm treatment works is alongside the West Branch of the Mardyke (NGR TQ 6071 8672) but is not within FZ3.

5.3.2 Tidal Flooding

The southern area of Havering is at risk of flooding from the River Thames which is tidal at this point. The Borough is protected by the TTD which run along both banks of the river downstream (east) of the Thames Barrier. Typically tidal flooding in the Thames is caused by a storm surge in the North Sea as experienced in 1953. The delineation of flood zones in these areas is the same as for fluvial flooding.

There are tidal sluices at Beam Tidal Sluice, Havering Tidal Sluice and Frog Island Tidal Sluice which prevent ingress of the River Thames. These control structures are complemented by a pumping station at Beam Tidal Sluice to discharge during tidal locking. There is a risk of fluvial flooding resulting from the closure of these sluices if a fluvial flood event coincides with a high tide on the Thames. Consequently FSAs have been constructed to mitigate this risk (see Section 4.6.1).

Dry Islands

Please refer to Figure 103.

In Havering the majority of the area to the south of the A1306 is at risk of tidal flooding. The extent is a worst-case scenario, and does not take account of the tidal flood defences.

Between the River Thames and the A1306 there are areas of land designated as FZ1, which are surrounded by areas designated as FZ2 and 3. Therefore in an extreme flood event there is the possibility that they could become islands, potentially preventing safe access and egress. These include the CEME Conference Centre, Ford Car Compounds, Freightmaster Estate, the Tilda Rice site and the Fairview Industrial Park. These areas were recorded as flooded in 1953.

Impact of Climate Change upon Tidal Levels

One output of the EA Thames Estuary 2100 project (TE2100) was hydraulic modelling to estimate the impact climate change would have on predicted water levels in the Thames. These are summarised in Table 5-2.

Table 5-2: Thames Estuary Tidal Water Levels

Node	Present Day 0.1% (1 in 1000) Annual Chance Level	Predicted 0.1% (1 in 1000) Annual Chance Water Level with Climate Change by Year				
		2040	2070	2100	2120	2170
3.10	5.98	6.19	6.37	6.70	6.90	7.40
3.11	5.97	6.18	6.37	6.70	6.90	7.39
3.12	5.97	6.18	6.36	6.70	6.89	7.38
3.13	5.97	6.18	6.35	6.69	6.88	7.37
3.14	5.98	6.19	6.34	6.67	6.87	7.35

NB: All levels are in mAOD

The EA provided 0.1% (1 in 1000) annual chance water levels which equates to FZ2. The nodes have been selected as representative of the water levels in Havering; 3.10 being upstream/west and 3.14 downstream/east. Please refer to Figure 105 for their location.

Subsequent to the development of these levels the EA has updated the predicted impact of climate change on changes to sea levels. The predicted impact on sea levels is spit by location and epoch as indicated in Table 5-3 as sea level rise allowance for each epoch and the cumulative rise for the next century.

Table 5-3: Sea Level Allowance Guidance for London and the South East

	Epoch				Cumulative (1990 2115)
	1990 2025	2026 2050	2051 2080	2081 2115	
Yearly	4	8.5	12	15	1.24
Cumulative	140	212.5	360	525	

NB: Figures for Epochs and in millimetres, the cumulative figure is in metres.

The EA guidance provides details of how these figures are to be applied when considering the impact of sea level rise for an individual year over the full time scale if required. Based on this guidance the predicted sea levels for the TE2100 model nodes as listed in Table 5-2 are summarised in Table 5-4.

Table 5-4: Predicted Peak Sea Levels Based on Latest EA Guidance

Node	Present Day 0.1% (1 in 1000) Annual Chance Level	Predicted 0.1% (1 in 1000) Annual Chance Water Level with Climate Change by Year			
		2025	2050	2080	2115
3.10	5.98	6.12	6.33	6.69	7.22
3.11	5.97	6.11	6.32	6.68	7.21
3.12	5.97	6.11	6.32	6.68	7.21
3.13	5.97	6.11	6.32	6.68	7.21
3.14	5.98	6.12	6.33	6.69	7.22

Based on the revised guidance from the EA the peak sea level that needs to be considered for a 100 year timescale in Havering has increased from 5.98 to 7.22m AOD.

Tidal and Fluvial Interaction

The Beam, Ingrebourne, Rainham Main Sewer and Mardyke all drain to the tidal estuary of the River Thames. The EA do not consider there to be any tidal interaction on these watercourses unless the TTD are overtopped. The tidal influence is greater on the Mardyke primarily due to its lower gradient, but this is within neighbouring Thurrock and does not affect the area of the catchment within Havering.

In addition to the watercourses referred to above, a number of other ditches and drains are located in the area. Generally the outfalls of these to the Thames are controlled by sluice gates to maintain the TTD. The sluices effectively defend these areas from flooding from the Thames, however when they are in operation, their closure prevents the watercourses from draining to the Thames. If high water levels are maintained on the Thames then fluvial flooding from these watercourses could result. Figures 103 and 104 identify the areas at risk of tidal and fluvial flooding.

There are two areas at risk of fluvial flooding as a result of tidal interaction as indicated as ‘tidal/fluvial’ in Figure 103. These are the lower reaches on the River Beam, south of the railway bridge in Elm Park and the Rainham Main Sewer.

5.3.3 Other Sources of Flood Risk

Ordinary Watercourses

Where the supplied hydraulic model flood extents do not extend to cover Non-Main River the uFMfSW has bene utilised to identify areas of potential flood risk. The key locations where the ordinary watercourse coincides with predicted flooding in the uFMfSW are as follows:

- Havering Park, west of the River Rom;
- Harold Hill, north-west of Carter’s Brook
- Upstream of the Mardyke, east of Upminster

Surface Water

The EA's uFMfSW was utilised to determine areas at risk of flooding from surface water runoff resulting from rainfall exceeding the capacity of the drainage network.

We have used the uFMfSW to identify HCDA which may be most susceptible to local flooding. These areas are shown on Figure 109. A summary of the larger HCDA lying outside fluvial Flood Zones is provided below.

The EA provide a suitability classification with the uFMfSW data. For the majority of Havering it is classified as "County to Town". This means that the data is suitable to identify which areas are at risk but is unlikely to be reliable at the local scale and individual properties. As recommended in Section 7.5; development within HCDAs will have to consider surface water flood risk in greater detail via a site-specific FRA. There are two small areas classified as "National to County" south of Upminster that are less reliable but there are no HCDAs identified in these areas.

Romford

The extent of FZ3 within the Romford area is mainly within the river channel. However the uFMfSW identifies three areas beyond the area of fluvial flood risk in FZ3 that are at risk of flooding from surface water:

- Upstream of the A12;
- Immediately upstream of the town centre;
- Between the town centre and the A124.

In each case there are extensive areas at risk from surface water flooding under the 3.33% (1 in 30) annual chance event.

Rise Park

The uFMfSW identifies two areas at risk of flooding upstream (north) of the A12 at Rise Park. There is an extensive area at risk from the 3.3% (1 in 30) and 1% (1 in 100) annual chance events in the vicinity of Pettits Lane North, Heather Gardens and Linton Court. The flow path upstream is contained on the highway but its passage appears to be blocked by the A12. The predicted flooding closely matches that predicted by the Drain London SWMP. The second main flow path follows a route through Rise Park itself, following the direction of the watercourse before ponding against the A12 embankment.

Harold Hill

The uFMfSW identifies a flow path to the north of Harold Hill running eastwards towards Carters Brook. There is an extensive area of flooding predicted under the 3.33% (1 in 30) annual chance event. The properties at risk are centred upon Taunton Road and North Hill Drive. Upstream a number of flow paths converge from the rural areas at Noak Hill Road. The Drain London SWMP predicts a similar flow path but with a narrower extent in the urban area.

Gallows Corner

The uFMfSW identifies a flow path running southwards towards Gallows Corner on the A12, north-east of Romford. This closely matches the flood mapping produced by the Drain London SWMP. The flow path affects properties to the south of Myrtle Road and then appears to be impeded by the Gallows Corner roundabout as there is extensive predicted flooding immediately to the north.

Upminster

The uFMfSW identifies two main branches of surface water flood risk upstream of the Main River extent of the western branch of the River Mardyke in Upminster.

The northern flood path rises south of the A127 in Pot Kiln Wood and then flows southwards potentially placing properties at risk in Frin Lane, Waycross Road, and Brunswick Avenue. There is a second smaller branch which places properties at risk on Roseberry Gardens and Cranham Gardens. These flow paths combine to flow southwards along Front Lane and then eastwards along Moor Lane to the Mardyke.

The southern flow path is to the south of St. Marys Lane (B187). This is currently a rural area and consequently few properties are at risk of flooding. But should development be proposed in this area this risk should be considered.

Hacton

There is an Ordinary Watercourse which flows south-westwards from Upminster towards the Ingrebourne through Hacton. This is identified on the uFMfSW but is not designated as FZ3. The watercourse is predominantly rural, however, at its head; the uFMfSW does identify roads in Upminster: Maple Avenue, Oak Avenue and South View Drive as at risk of flooding.

Elm Park and South Hornchurch

Elm Park lies between the Beam and the Ingrebourne and the uFMfSW identifies a flow path running south-westwards towards South Hornchurch where it joins a drain to the Beam. The flow path places properties at risk of flooding on a number of roads and flows through the grounds of Brittons Academy.

There is a second area of flood risk from surface water to the east potentially affecting properties on a number of roads in South Hornchurch. The route initially follows South End Road and then Nelson Road.

Groundwater

The EA have developed a map which identifies the Susceptibility to Groundwater flooding. This is indicated for Havering on Figure 111. This is based on the British Geological Survey Groundwater Flood Susceptibility Map. The map shows the proportion of each 1km^2 grid square where geological and hydrogeological conditions show that groundwater might emerge.

Sewer Flooding

Thames Water has provided information on the number of properties that have experienced sewer flooding In Havering for this updated SFRA, which is summarised in Table 5-5.

Table 5-5: Thames Water Sewer Flooding Records

Postcode	Internal Flooding			External Flooding			TOTAL
	2 in 10	1 in 10	1 in 20	2 in 10	1 in 10	1 in 20	
RM1	0	2	23	6	12	47	**90**
RM2	0	3	13	4	16	30	**66**
RM3	0	0	9	0	2	30	**41**
RM4	0	0	0	0	0	2	**2**
RM5	1	0	47	2	5	85	**140**
RM7	0	0	25	0	3	27	**55**
RM11	1	1	0	0	4	9	**15**
RM12	0	2	22	1	15	21	**61**
RM13	0	0	0	0	2	17	**19**
RM14	0	0	5	0	1	9	**15**
Total	**2**	**8**	**144**	**13**	**60**	**277**	**504**

In addition to the number of properties flooded in Havering Table 5-5 also provides an indication of severity and frequency. Internal flooding is generally considered more disruptive than external or curtilage flooding. For each classification a frequency is provided; for example whether the property has been flooded twice in a ten year period, once in ten, or once in twenty.

The total number of properties flooded from overloaded sewers in Havering are summarised by postcode in Figure 110. The highest risk areas are in the north-west of the borough.

There are other postcodes within the Borough not included in Table 5-5. However they are only partly within Havering and therefore it is not possible to attribute the flooding within those postcodes to the Borough as they may lie outside.

There are a few areas to the east of the Borough that fall into the area served by Anglian Water. They have confirmed that there is one DG5 property within LBH at Rectory Gardens, Upminster, which has experienced external flooding.

Reservoirs

The requirement for regular inspections by a Supervising Panel Engineer means that the likelihood of structural failure of reservoirs is considered to be minimal. The risk of failure remains, however, and the EA has mapped the potential extent of flooding resulting from the failure of a covered water supply reservoir to the west of Harold Hill. However this does not place additional property at risk of flooding. Should the reservoir fail the floodwater will follow the topography, as the reservoir is at the head of the Blacks Brook; once it reaches the A12 it will follow its course to Romford town centre and then the path of the River Rom.

This flow path is indicated by the uFMfSW (see Figure 109) and once it reaches the Main River the flow path remains within FZ3. There are no properties between the reservoir and the A12 / FZ3 extent[15].

It is understood that ground level has been modified locally on the golf course adjacent to the A12 in recent years which may not be represented on the published reservoir flood risk map. If this is the case it is thought that these changes may direct the flow further West placing properties at risk in the vicinity of Petits Lane (which could include Romford Fire Station and Marshalls Park Lower School). From this point the flood water would flow southwards towards Blacks Brook through a residential area.

The Childerditch Hall reservoir (NGR TQ 6069 8672) is non-EA maintained and located outside Havering within Brentwood Borough Council's area. However the risk area published by the EA does include part of the Anglian Water Bury Farm treatment works, which is within Havering. Form this point downstream the risk area is within Thurrock and the Mardyke's FZ3.

There is the possibility that Flood Storage Areas with raised embankments within Havering could fail leading to flooding. The Washlands FSA is located on the River Beam to the east of Dagenham (NGR: TQ5030 8322) and is operated by the Environment Agency, its embankments are approximately 3 metres higher than the surrounding ground level. The embankments were overtopped during an event on 31 December 2001 which resulted in bank erosion. The FSA falls under the auspices of the Reservoirs Act as it has a storage volume greater than 25,000m^3 consequently annual inspections by a Supervising Engineer each year are required and an Inspecting Engineer at least once every ten years. Should the FSA embankment fail the flow path would be expected to follow the course of the River Beam placing the industrial properties south of the A1306 at risk.

5.4 Residual Flood Risk

The 'residual flood risk' is the risk of flooding that remains with a defence in place. This would occur if the defence was overtopped or it failed.

5.4.1 Tidal

The TTD are regulated and maintained by the EA using permissive powers under the Water Resources Act 1991, but the primary maintenance duty rests with the riparian landowner. The tidal defences along Havering's frontage are currently maintained to a crest level of 7.1 – 6.9m AOD (see Figure 107). Given the consequences of failure, the TTD are well maintained. Furthermore, it is unlikely that these would be overtopped by an event considered as part of an SFRA; typically they are designed to exceed the 0.1% AEP flood level and, with reference to Table 5-2, they currently provide approximately 1m of freeboard above this level.

The EA have undertaken modelling to determine the impact of three separate breaches to the TTD. The subsequent combined flood extent is included on Figure 107.

Flood Hazard

The extents of the breaches provided by the EA include an assessment of flood hazard based on the predicted flood depth and velocity, following their guidance[16].

A summary of the flood hazard classifications and their description is included in Table 5-6.

15 http://watermaps.environment-agency.gov.uk/wiyby/wiyby.aspx?topic=reservoir#x=357683&y=355134&scale=2
16 Flood Risks to People Phase 2, Defra, March 2006FD2321/TR2

Table 5-6: Flood Hazard Classification

Classification	Degree of Hazard	Description
Low	Caution	Flood Zone with shallow flowing or deep standing water
Moderate	Dangerous for some (i.e. children)	Danger: flood zone with deep or fast flowing water
Significant	Dangerous for most	Danger: flood zone with deep fast flowing water
Extreme	Dangerous for all	Extreme danger: flood zone with deep fast flowing water

Based on FD2321/TR2 Table 4.2

The areas at greatest risk are the Ford motor works and the western area of Rainham Marshes. There are extensive areas of 'Significant' risk to the south-eastern area of the borough, but these are the currently undeveloped marsh areas south of the A1306.

5.5 Impact of Climate Change

There is clear scientific evidence that global climate change is happening now. It cannot be ignored. Over the past century around the UK we have seen sea level rise and more of our winter rain falling in intense wet spells. Seasonal rainfall is highly variable. It seems to have decreased in summer and increased in winter, although winter amounts changed little in the last 50 years. Some of the changes might reflect natural variation; however the broad trends are in accordance with projections from climate models, suggesting partly anthropogenic causes.

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

There is enough confidence in large scale climate models to say that we must plan for change. There is more uncertainty at a local scale but model results can still help us plan to adapt. For example we understand rain storms may become more intense, even if we cannot be sure about exactly where or when. By the 2080s, the latest UK climate projections (UKCP09) are that there could be around three times as many days in winter with heavy rainfall (defined as more than 25 mm in a day). It is plausible that the amount of rain in extreme storms (with a 20% (1 in 5) annual chance or less) could increase locally by 40%. If emissions follow a medium future scenario, UKCP09 projected changes for Havering by the 2050s relative to the recent past are that winter precipitation will increase by around 15% (central estimate).

Climate changes can affect local flood risk in several ways. Impacts will depend on local conditions and vulnerability. Wetter winters and more of this rain falling in wet spells may increase river flooding in both rural and 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 river levels may increase local flood risk away from major rivers because of interactions with drains, sewers and smaller watercourses. There is unlikely to be significant change to groundwater flood risk in Havering because the geology is predominantly Clay.

Changes in the extent of inundation due to climate change on fluvial flooding are likely to be negligible in well-defined valleys, but could be dramatic in very flat areas. Changes in the depth of flooding under the same allowance will increase the probability of a given flood. For example, a site currently located within a lower risk zone (e.g. Zone 2) could in future be re-classified as lying within a high risk zone (e.g. Zone 3a).

This in turn could have implications for the type of development that is appropriate according to its vulnerability to flooding. In the absence of detailed flood modelling to define the impact of climate change on Flood Zones in this SFRA, the anticipated extent of Zone 3a (the 1% AEP flood) at the end of the century may be approximated by the current Zone 2 (the 0.1% AEP flood). In the same way, the HCDA could increase in extent and/or depth of flooding with climate change.

It is essential that developers consider the possible change in flood risk over the lifetime of the development as a result of climate change. For planning purposes, the EA assume that the 'lifetime of development' equates to 100 years for residential development, and 60 years for commercial development.

In planning terms, it is essential that Havering consider their response to the potential impacts of climate change within the Borough. While the impact of climate change may in some areas not markedly increase the extent of, for example, Zone 3a, within that Zone the extent of lower severity flood events could increase significantly. Furthermore, there could be an increase in localised surface water issues. It is essential therefore that the development management process (influencing the design of future development within the Borough) carefully mitigates against the potential impact that climate change may have upon the risk of flooding.

For this reason, all of the development management recommendations set out in Section 7.12 require all floor levels, access routes, drainage systems and flood mitigation measures to be designed with an allowance for climate change within Zones 3b, 3a and 2, as well as within HCDA in Zone 1. This provides a robust and sustainable approach to the potential impacts that climate change may have upon the Borough over the next 100 years, ensuring that future development is considered in light of the possible increases in flood risk over time.

It is highlighted that, for planning purposes within the context of the current local planning policy, Zone 3a High Probability is defined on the basis of existing (i.e. 2016) flood level predictions.

5.6 Changes from Previous SFRA

5.6.1 Fluvial Flood Risk

The assessment of fluvial flood risk and the delineation of Flood Zones in Havering is based on the EA's published flood zones of February 2016. There have been minor changes to the extent of the flood zones since the previous SFRA in 2014 due to updated data. This section summarises the key changes.

Flood Zone 3b

The only change in the extent of FZ3b is on the Blacks Brook. As a result of the Environment Agency's update of their hydraulic model this extent is based on detailed modelling rather than NaFRA data used in the previous SFRA (see Section 4.3) which has resulted in a reduction in the extent of this Flood Zone.

Flood Zone 3

There are localised amendments (generally a reduction) to the extent of FZ3 on the Emerson Park Stream, the Paines Brook in Harold Hill and the River Mardyke, west of the M25. The extent of FZ3 at the head of the Blacks Brook; north of the A12, has reduced compared to that in the previous SFRA. The extent of FZ3 has increased at the head of the Emerson Park Stream between Gallows Corner and the railway line at Ardleigh Green.

The main change to FZ3 is at Romford, where the extent has significantly reduced. There remain pockets of FZ3 in the town centre, upstream (north) of Cross Road and the Blacks Brook, but the rest of the previously identified FZ3 is no longer within the zone. This is based on the information provided by the EA (see Section 4.3).

Flood Zone 2

The upper reaches of the Rom are unchanged but downstream of the Cross Road FSA there is a significant reduction in the extent of FZ2 through Romford Town Centre.

On the Blacks Brook the extent is unchanged except for upstream of A12 where it has increased, identifying more properties on Beauly Way as at risk.

The rest of FZ2 is largely unchanged with minor variations except for the upper reaches of the Mardyke and the Paines Brook where the extent has significantly reduced between the A12 and the railway.

5.6.2 Tidal Flood Risk

The extent of Havering at risk from tidal flooding is largely unchanged since 2007 with the exception of the filling-in of three dry islands south of Rainham; other dry islands remain (see Section 4.4).

5.6.3 Surface Water

The surface water flow paths included in this assessment continue to rely on the uFMfSW, therefore the extents have not changed since the previous version of the SFRA in 2014.

5.6.4 Other Sources

No re-assessment of flood risk from other sources has been made in the update of this SFRA as it is not anticipated that they have changed since 2014.

6. Sustainable Flood Risk Management

6.1 Overview

This Section highlights the role of various parties in relation to flood risk and offers recommendations for each to ensure that flood risk is managed in a sustainable manner into the future.

The risk of flooding can never be completely eliminated, but the likelihood and consequences of flooding can be minimised through good management. One of the key aims of the EA's National Flood and Coastal Erosion Risk Management Strategy is to improve flood risk management in a sustainable way. In other words, the risk of flooding must be reduced now, but in a way which does not compromise the interconnected needs of the economy, society and environment in the future. Indeed, one of the defined roles of local authorities in the Flood & Water Management Act 2010 is for them to aim to make a contribution towards the achievement of sustainable development.

The primary purpose of the SFRA is to inform decision making as part of planning policy and development management processes, taking due consideration of the scale and nature of flood risk affecting the Borough. Responsibility for flood risk management resides with all tiers of government, and indeed individual landowners and applicants, as outlined below.

6.2 Responsibility for Flood Risk Management

There is no statutory requirement for the Government to protect property against the risk of flooding. Nevertheless, the Government recognises the importance of safeguarding the wider community and, in doing so, the economic and social well-being of the nation. Following the Pitt Review into the flooding of summer 2007 and subsequent Flood Risk Regulations 2009 and Flood & Water Management Act 2010, new responsibilities for managing flood risk have been assigned to local authorities, the EA and others.

A number of partners manage flood risk within Havering, the key responsibilities of the primary groups relevant to this SFRA are:

- **Environment Agency:** Provides a strategic overview of all sources of flooding. Under its permissive powers, it is responsible for flood risk management activities on Main Rivers, regulating reservoir safety, and working in partnership with the Met Office to provide flood forecasts and warnings. It assists the spatial planning and development management process through the provision of information and advice regarding flood risk and related issues.

- **London Borough of Havering:** As Lead Local Flood Authority, LBH is responsible for coordination of local flood risk management across its administrative area. This includes development, maintenance, application and monitoring of a strategy for local flood risk management, a duty to maintain a register of structures or features which have a significant effect on flood risk and a duty to aim to contribute towards the achievement of sustainable development. LBH is also the Local Planning Authority for the borough and so is responsible for carrying out a SFRA which should consider the risk of flooding throughout the borough and inform the allocation of land for future development, development management policies and sustainability appraisals. LBH is responsible for determining local planning applications and must consult with the EA, where appropriate, when making planning decisions.

- **Landowners** have the primary responsibility for protecting their land against the risk of flooding. They are also responsible for managing the drainage of their land such that they do not adversely impact upon adjoining properties.

The EA has updated its "Living on the Edge" guide in 2013 that provides specific advice regarding the rights and responsibilities of property owners, the EA and other bodies. The guide is targeted at owners of land

situated alongside rivers or other watercourses, and is a useful reference point outlining who is responsible for flood defence, and what this means in practical terms. It also discusses how stakeholders can work collaboratively to protect and enhance the natural environment of our rivers and streams. This guide can be found on the EA's website[17].

17 https://www.gov.uk/government/organisations/environment-agency

7. Recommendations and Policy for the Planning Authority

7.1 Revisions to Local Planning Policy Regarding Flooding

Current LBH planning policy in relation to flooding detailed in Section 2 of this SFRA, pre-dates this SFRA and relevant policy contained in the NPPF, the London Plan and TE2100 Plan (also detailed in Section 2).

RECOMMENDATION: LBH should review their current planning policy in relation to flooding to ensure it is consistent with the NPPF, the London Plan and the TE2100 Plan, including in relation to flood risk assessments, sustainable drainage, green infrastructure and flood resilience. New or revised policy should reflect the findings and recommendations of this SFRA, including requiring applicants to consider the SFRA and its mapping, taking into account the impacts of climate change, as a starting point for the assessment of flood risk in relation to development or redevelopment proposals. Later in this report, section 7.7 focuses on the need to seek opportunities and reduce flood risk where possible.

7.2 Site Allocations

The ideal solution to effective and sustainable flood risk management is a planning led one, i.e. where possible steer urban development towards the areas of lowest flood risk. The NPPF stipulates the application of a sequential approach to site allocation, utilising the Sequential Test. A flow diagram demonstrating the application of the Sequential Test for a local plan site allocation is provided in the NPPG (Diagram 2 in Flood Risk and Coastal Change, Paragraph 021) and this diagram is reproduced in Annex B of this report. Development sites should be allocated within areas of lowest flood risk in the first instance – in Flood Zone 1 (which relates to flooding from river and sea), but the NPPG stipulates that other sources of flooding must be considered, so HCDAs in Flood Zone 1 must be taken into account. Only if it can be demonstrated that there are no suitable sites within areas with the lowest flood risk (taking into account all sources of flooding) should alternative sites (i.e. within areas that may potentially be at greater risk of flooding) be contemplated, taking account of the vulnerability of the proposed land use. Tables 2 and 3 in the NPPG stipulate 'appropriate' land uses for each Flood Zone.

The priority is to allocate sites in areas with the lowest level of flood risk taking account of all sources of flooding, so sites in Flood Zone 1 unaffected by flooding from any source should be the priority for allocations. If sufficient sites in the most sustainable locations for development are not available in Flood Zone 1 (taking into account all sources of flooding), then sites with the lowest flood risk available within Flood Zone 2 should then be sought. If sufficient sites are also not available in Flood Zone 2, only then should sites within Flood Zone 3 be sought, with priority given to those with the lowest flood risk. The Exception Test should be applied where necessary.

Table 3 in the NPPG identifies types of development that should not be permitted in particular Flood Zones via the application of the Sequential Test (see Table 3-1). It also identifies types of development which may be allocated in zones of higher flood risk (from rivers and sea) via the application of the Exception Test.

Paragraph 102 of the NPPF states that 'For the Exception Test to be passed:

- it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh the flood risk, informed by a SFRA where one has been prepared; and
- a site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.'

The latter point includes a requirement for account to be taken to the future risk from climate change over the lifetime of the development.

The NPPG (SFRA guidance, paragraph 012) states that "where a Level 1 Assessment shows that land outside flood risk areas cannot appropriately accommodate all the necessary development, it may be necessary to increase the scope of the Assessment to a Level 2 to provide the information necessary for application of the Exception Test where appropriate".

RECOMMENDATION: Any future site allocations must be determined via the application of the Sequential Test, and the Exception Test if required, in line with Government guidance. The evaluation of potential sites should be guided by the mapping (taking into account climate change) and the findings presented within this Level 1 SFRA, including with regard to HCDA and, if necessary, supplemented by a more detailed Level 2 SFRA which covers all potential sources of flooding. Full account should be taken of all sources of flooding including from rivers, groundwater, sewerage and surface water, together with the potential effects of climate change on flood risk and impacts on and from existing flood management infrastructure (see Sections 4 and 5). The NPPG highlights that a Level 2 SFRA may be required to provide the information necessary for the application of the Exception Test, but a Level 2 SFRA may also be required to assess flood risk from non-fluvial sources on some sites where the information in this Level 1 SFRA provides insufficient detail to enable the allocation to be determined. In this regard, whilst not a Level 2 SFRA, the information provided as Annex A of this SFRA will help inform these decisions.

7.3 Relocation of Unsuitable Existing Development

Paragraph 100 of the NPPF recommends that, where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, local authorities should seek to facilitate the relocation of development, including housing, to more sustainable locations.

RECOMMENDATION: LBH, working in partnership with the EA and others, should seek to identify both existing development which is potentially at risk from future impacts of climate change and, if necessary, potential sites for relocating that development, taking into account the Sequential Test. More suitable alternative uses for such sites should be sought, taking account of Table 3 in the NPPG. The information contained in the SFRA can be used to assist this process.

7.4 Safeguarding

Paragraph 100 of the NPPF states that local authorities should safeguard land from development that is required for current and future flood management. Such land may take the form of multi-function green infrastructure.

The TE2100 Plan also highlights the importance of safeguarding land for future flood management needs, stating that each flood risk management option in the TE2100 Plan *"will require land for new defences, enlarged defences, new barriers, new areas of habitat creation, and in some cases flood storage. Land allocations through the spatial planning system must be guided and informed by the requirements of the TE2100 options to ensure they remain possible"* (p.39).

RECOMMENDATION: In partnership with the EA, LBH should seek to identify land required for current and future flood management, taking account of the TE2100 Plan, and, if justified, safeguard it through planning policy. This can include areas within or adjoining allocated development sites which are particularly suitable for flood management purposes. The information contained in the SFRA can be used to assist this process.

7.5 Havering Critical Drainage Areas

The NPPF requires a site-specific flood risk assessment for all development proposals "*in an area within Zone 1 which has critical drainage problems (as notified to the local planning authority by the Environment Agency)"*. The EA has not specified any CDA in the Havering area. However, areas which are likely to be most at risk of flooding from local sources have been identified as part of this SFRA. They have been termed 'Havering Critical Drainage Areas' to differentiate them from those areas which could potentially be notified by the EA. The wording of the NPPF is such that it is not clear that an FRA would be required in an Area of

Critical Drainage because they were not 'notified to the local planning authority by the Environment Agency'. However, current LBH policy DC48 includes a requirement for an FRA for sites 'w*here drainage problems are identified by the Environment Agency or the Council'*, which would include the HCDA.

RECOMMENDATION: LBH should retain a local policy requiring a site-specific flood risk assessment for all development on sites where drainage problems are identified by the EA or LBH, which would include development in the HCDA identified in this SFRA. FRAs are particularly important in such areas as they have known localised flooding problems which can cause significant damage.

7.6 Washlands Development

It is understood that the Greater London Authority is proposing to develop part of the Washlands FSA for housing. This has flood risk implications for the proposed development and potentially the area currently benefitting from the FSA.

RECOMMENDATION: LBH should retain a local policy requiring a site-specific flood risk assessment for all development on the Washlands FSA specifically requiring demonstration of resilience measures, safe access and egress or places of refuge as well as the potential implications of increasing flood risk elsewhere.

7.7 Best Practice

The London Plan contains detailed policies with regard to SuDS, which is echoed by current LBH policy. In their role as Lead Local Flood Authority, LBH are responsible for managing flooding from local sources and will be the SuDS approval body (SAB). It is important that applicants are made aware of current best practice guidance with regard to sustainable drainage solutions to ensure that such information can be taken into account in development proposals. Best practice guidance on flood management is also published by the EA, National Flood Forum and others. In addition, this SFRA contains links to key information with regard to minimising flood risk in new and existing development. LBH are developing their own SuDS guide for developers which will provide applicants with a summary of what is expected of their application and the approval process.

RECOMMENDATION: Although links to some information are already publicised on the LBH website, this should be extended to provide links of sources of current best practice with regard to SuDS and flood management to be utilised by applicants. It could also be utilised by LBH officers seeking to evaluate FRAs and development proposals. It is anticipated that this information will also be included in the SuDS guide for developers.

7.8 Opportunities to Reduce Flooding

Paragraph 100 of the NPPF recommends that local plans should seek to reduce the causes and impacts of flooding by *'using opportunities offered by new development'*.

The NPPF requires local authorities to work with other local authorities and providers to assess infrastructure needs in their area, including with regard to flood risk (Paragraph 162).

Opportunities to reduce flood risk can be informed by the TE2100 Plan and Havering's Local Flood Risk Management Strategy (see Section 2 of this document).

Section 106 agreements and Community Infrastructure Levy charges provide potential mechanisms for securing new flood risk reduction infrastructure or contributions towards it. However, account should be taken of the potential impact on the financial viability of development proposals and developers should be pro-active and innovative in managing flood risk.

RECOMMENDATION: LBH should:

- Work with other authorities and bodies, as appropriate, to identify specific flood risk infrastructure required within the Borough. The TE2100 Plan, Havering's Local Flood Risk Management Strategy, the information contained in the SFRA, and the potential solutions to surface water drainage problems identified in the SWMP, can be used to assist this process, although more detailed studies are likely to be required.

- In identifying and allocating potential development sites seek reasonable opportunities for flood risk reduction measures; taking into account the Level 2 SFRA which will be prepared in due course.

- Give consideration to a suitable generic policy to be contained within the emerging Local Plan in respect of non-allocated sites where flood risk reduction measures should be sought.

- Continue to seek adoption of the Community Infrastructure Levy charges as a potential additional tool for securing contributions towards the delivery of flood risk reduction measures where a need has been identified. If appropriate, include wording to this effect in a local plan policy, supported by evidence and SPD if necessary.

This section may also be relevant to any neighbourhood plans proposed in future in the Borough.

7.9 Planning Applications – LBH and Applicants

Planning applications can be submitted both for sites allocated within development plans and other sites, known as windfall sites. Flood risk at windfall sites may not have been previously considered in detail by the local planning authority.

The NPPF[18] stipulates that a site-specific flood risk assessment is required for:

- Development proposals on sites of 1 hectare or greater in FZ1;

- all proposals for new development (including minor development and change of use) in FZ2 and FZ3;

- all proposals for new development (including minor development and change of use) in an area within FZ1 which has critical drainage problems (as notified to the local planning authority by the EA); and

- Where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding (groundwater or surface water flooding).

Table 7-1 summarises LBH's requirements for site-specific flood risk assessments (FRAs). It is noted that the EA has not notified LBH of any areas within FZ1 with critical drainage problems at present. However, areas which are likely to be most at risk of flooding from local sources, and where sustainable drainage solutions should be a priority, have been identified in this SFRA and have been delineated as HCDA. This is different from the CDA terminology used by the EA but nevertheless effectively means the same thing.

Flooding from local sources also occurs outside the mapped HCDAs within FZ1, but a FRA is not always required. In this respect, the NPPF requires a FRA for all sites greater than 1ha in area within Zone 1. FRAs for sites in Zone 1 should be proportionate to the level of risk and focus on records of past flooding and sustainable drainage solutions.

18 Footnote 20, page 24

The EA provides detailed Standing Advice, available online[19], to assist with both the development and evaluation of flood risk assessments. This includes information on what FRAs should cover and what accompanying plans should be submitted. In addition to a Flood Risk Stranding Advice Tool for Local Planning Authorities, advice specific to the fluvial flood zone in which the proposed development lies and the broad size of the development is provided. For example, there is specific standing advice for proposed developments in fluvial FZ1 which are less than 1ha in size. It is also noted that a homeowner's guide to flood resilience has been published at http://www.knowyourfloodrisk.co.uk.

Table 7-1 : Requirements of Flood Risk Assessments

Zone 3b Functional Floodplain		Zone 3a High Probability	Zone 2 Medium Probability	Havering Critical Drainage Areas	Zone 1 Low Probability
Existing Development	New Development				
Detailed FRA required				FRA required (proportionate to level of risk), should focus on records of past flooding and SuDS	FRA required (proportionate to level of risk) for all sites greater than 1ha in area, but should focus on records of past flooding and SuDS. Recommend that sites of 1ha or less carry out an assessment of localised flood risks

The site-specific FRA must follow the Sequential Test, and if required the Exception Test, as noted above and detailed in the NPPF and its accompanying NPPG. The NPPF[20] stipulates that the FRA must demonstrate that:

- the development is appropriate in its proposed location, considering the proposed use and all potential sources of flooding;
- within the site, the most vulnerable development is located in areas of lowest flood risk unless there are overriding reasons to prefer a different location;
- the development is appropriately flood resilient and resistant, including safe access and escape routes where required, and that any residual risk can be safely managed, including by emergency planning; and it gives priority to the use of sustainable drainage systems; and
- The development will not increase flood risk elsewhere.

Paragraph 104 of the NPPF notes the following exceptions to this:

- The Sequential Test need not be applied where the proposed site is allocated in the development plan.
- The Sequential and Exception Tests should not be applied for applications for minor development and changes of use, 'except for any proposal involving a change of use to a caravan, camping or

19 www.gov.uk/planning-applications-assessing-flood-risk
20 Paragraph 103

chalet site, or to a mobile home or park home site, where the Sequential and Exception Tests should be applied as appropriate'.

The NPPF requirements are supplemented by planning policies in relation to flooding set out in the London Plan and in local planning documents produced by LBH, including with regard to FRAs, sustainable drainage and flood resilience. Relevant policies at the time of writing are set out in Section 2 of this SFRA. In its role as a statutory consultee for planning applications, the EA will provide comment on applications for sites at higher risk of flooding, although their role is set to decrease in future.

A Site-Specific Flood Risk Assessment Checklist is provided by the Government as part of the Planning Practice Guidance and should be used as the starting point for all site-specific FRAs. It is available online at:

http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastalchange/site-specific-flood-risk-assessment-checklist/

It should be noted that since the policies outlined in DCLG Written Statement HCSWS161 on sustainable drainage systems came into effect on 6th April 2015, the local planning authority is required to consult the relevant lead local flood authority on the management of surface water in planning applications, and satisfy themselves that the proposed minimum standards of operation are appropriate. This policy applies to all developments of 10 homes or more and to major commercial development.

Developers should be aware that the Environment Agency are continually refining and updating the flood zone mapping. They should therefore consult with the EA to ensure that the latest extents are used when assessing the risk of flooding.

RECOMMENDATION: Applicants should use the Government's FRA checklist as the starting point for any flood risk assessment to be submitted with their planning application, utilising the information contained within this SFRA in both their FRA and design proposals; this will provide the evidence required to enable LBH to undertake the Sequential Test if necessary. In this respect, as noted above, LBH should consider a policy in the Local Plan which would require developers to utilise the checklist and review the SFRA as a starting point in relation to flood risk guidance. Equally, planning officers should use the information contained in the checklist, the NPPG and this SFRA to inform their evaluation of planning applications and any accompanying flood risk assessments. It should be noted that, in line with the NPPF, ALL sources of flooding must be considered, including from surface water and groundwater. When granting planning permission, the use of planning conditions and Section 106 agreements should be considered, where necessary, to prevent any increase in flood risk and to assist in securing flood risk reduction measures.

The SFRA mapping will be of particular use in identifying key information for the FRA, including Flood Zones, HCDA and flood management assets, but must be read in conjunction with the SFRA text. Sections 4 and 5 provide further information on flood risk in specific locations and highlight key issues to consider, including the potential effects of climate change on flood risk and location of flood management infrastructure. Further issues to take in to consideration in developing or evaluating an FRA are noted below.

There is some uncertainty as to the extent of FZ3b on Blacks Brook, Emerson Park Stream, Paines Brook and Weald Brook. Proposed development on these watercourses will need to demonstrate via a suitable site-specific FRA, that the site is outside the functional floodplain.

However, it is important to note that the SFRA provides the most up-to-date information at the time of writing, but the data could change with time. The SFRA mapping is also taken at a borough-wide level and more localised mapping and flood history information will be needed to determine flood risk at particular sites. The EA and LBH will be important sources for the latest data.

Compliance with current planning policy in relation to flooding contained in the NPPF, the London Plan and in planning policy documents produced by LBH should be demonstrated by applicants in their planning

applications and considered by planning officers in their determination of applications, including with regard to FRAs, sustainable drainage and flood resilience.

Key contacts:

National Planning Policy Framework and Planning Practice Guidance – http://planningguidance.planningportal.gov.uk/

Environment Agency – https://www.gov.uk/government/organisations/environment-agency

London Borough of Havering – https://www.havering.gov.uk/Pages/Services/Flooding-advice.aspx

Know Your Flood Risk - http://www.knowyourfloodrisk.co.uk

7.10 Restriction of Permitted Development Rights

Permitted Development (PD) rights allow for some minor development, such as certain sizes of building extension, without planning permission. The NPPG (Flood risk guidance, paragraph 047) states that minor developments, some of which are covered by PD rights such as small extensions, are *'unlikely to raise significant flood risk issues unless they would:*

- have an adverse effect on a watercourse, floodplain or its flood defences;
- impede access to flood defences and management facilities; or
- where the cumulative impact of such developments would have a significant effect on local flood storage capacity or flood flows'.

Minor developments subject to PD rights, such as some extensions or paving over of gardens, therefore have the ability to raise flood risk and increase surface water run off.. Article 4 of the Town and Country Planning General Permitted Development Order provides a possible vehicle for the removal of PD rights in exceptional circumstances, which the NPPF (Paragraph 200) notes to be *'limited to situations where this is necessary to protect local amenity or the wellbeing of the area'*. This could include situations where minor permitted development has the potential to add to localised flood risk as highlighted above, such as from the cumulative impact of extensions within an area.

If there are areas of the Borough where Permitted Development could lead to an increase in flooding an Article 4 Direction could be explored with the Development Management team. For example, the HCDA's may be locations where this could be considered. There would need to be a strong justification to support this and therefore the implementation of an Article 4 direction would need to be subject to further detailed investigation.

7.11 General Recommendations – Minimising Flood Risk and Impacts

When evaluating the flood risk of an existing or proposed development it is important to consider issues of flood resilience and flood resistance – minimising the likelihood of flooding, minimising impacts if the site does flood, and allowing a quick recovery after flooding. Such measures should also be included in the development of design proposals in planning applications, as relevant to the likely level of flood risk at a site. As noted above, the NPPF requires that planning applications demonstrate that the *'development is appropriately flood resilient and resistant'*, that *'any residual risk can be safely managed'* and *'it gives priority to the use of sustainable drainage systems'*. Potential considerations include:

- A change in land use to reduce the vulnerability of the proposed development;
- Placing uses with greater vulnerability to flooding in higher areas within the site to limit the risk or extent of flood damage;
- Minimising / reducing impermeable surfaces (building footprints and areas of hardstanding);
- Raising internal floor levels above the predicted flood level to reduce the likelihood of the property flooding, taking into account any increase in flood level likely in future as a result of climate change;
- Arranging buildings and solid walls on site to remove obstructions to the overland flow paths of flood waters;
- Identifying potential sources of pollution in the event of flood and seeking to contain them;
- Ensuring there is a safe means of access and escape in the event of a flood;
- Developing a flood evacuation plan in the event of the threat of flood;
- Subject to matters relating to Building Control, raising electrical wiring and sockets to avoid damage to electrical systems in the event of flood, use of tiled or stone flooring etc.

Sustainable Drainage Systems (SuDS) is a term used to describe the various approaches that can be used to manage surface water drainage in a way that mimics the natural environment. The management of rainfall (surface water) is considered an essential element of reducing future flood risk to both the site and its surroundings.

LBH and the EA all strongly advocate the use of SuDS. Policy 5.13 of the London Plan and Policy DC48 of the LBH Core Strategy and Development Control Policies DPD require the use of SuDS unless there are practical reasons for not doing so (see Section 2 of this SFRA).

Schedule 3 of the Flood and Water Management Act (FWMA) 2010, which is yet to be fully enacted, deals with SuDS. In particular, the Act calls for the establishment of a SuDS Approving Body (SAB) to be set up within Lead Local Flood Authorities (LLFAs).As a LLFA LBH will be expected to review and approve SuDS proposed as part of some developments. This includes prior to determination; consultation with other bodies such as the EA, sewerage undertaker, highway authorities, British Waterways and Internal Drainage Boards. Additionally the SAB will need to agree a non-performance bond with the developer. The SAB will have a duty (and the power) to adopt the SuDS which satisfy the conditions of the Act. This SFRA will be updated to reflect these changes when they are enacted. In line with this requirement DCLG Written Statement HCWS161 on sustainable drainage systems requires that SuDS are put in place on all major developments, unless they can be demonstrated to be inappropriate. Local planning authorities are required to consult the relevant LLFA on these proposals.

A wide variety of SuDS techniques are available, potentially providing both water quality and water quantity improvement benefits on a site by site basis throughout LBH. Wherever possible within brownfield areas, the developer should seek to reduce the rate of runoff from the site to the equivalent Greenfield runoff rates (i.e. the rate of runoff generated from the site assuming it were an open grassed area). This is usually within the range of 5 to 9 litres per second per hectare (l/s/ha), depending on site slope and soil porosity. Collectively, the effective application of SuDS as part of all future development has the potential to reduce the risk of flooding within Havering.

Indeed reducing the rate of discharge from urban sites to Greenfield runoff rates is one of the most effective ways of reducing and managing flood risk within the Borough. Although any reduction in the amount of water that originates from any given site is likely to be small, if applied to sites across the Borough in a consistent

way, the cumulative effect could be significant. There are numerous different ways that SuDS can be incorporated into a development and the most commonly found components of a SuDS system are described in the following table. The appropriate application of a SuDS scheme to a specific development is heavily dependent upon the topography and geology of the site.

It should be noted that the London Plan contains a drainage hierarchy, detailed in Section 2.3 of this SFRA, which must be taken into account.

Table 7-2: Summary of Potential SuDS Measures to Reduce Flood Risk

SuDS Measure	Description
Pervious surfaces	Surfaces that allow inflow of rainwater into the underlying construction or soil.
Green roofs	Vegetated roofs that reduce the volume and rate of runoff and remove pollution.
Filter drain	Linear drains consisting of trenches filled with a permeable material, often with a perforated pipe in the base of the trench to assist drainage, to store and conduct water; they may also permit infiltration.
Filter strips	Vegetated areas of gently sloping ground designed to drain water evenly off impermeable areas and to filter out silt and other particulates.
Swales	Shallow vegetated channels that conduct and retain water, and may also permit infiltration; the vegetation filters particulate matter.
Basins, Ponds and Wetlands	Areas that may be utilised for surface runoff storage.
Infiltration Devices	Sub-surface structures to promote the infiltration of surface water to ground. They can be trenches, basins or soakaways.
Bioretention areas	Vegetated areas designed to collect and treat water before discharge via a piped system or infiltration to the ground.

Table 7-3: Summary of Potential SuDS Measures to Reduce Flood Risk

It should be noted that SuDS can have other benefits, depending upon the system installed, in addition to helping to minimise flood risk; these include helping to improve water quality by reducing pollutants, helping to recharge groundwater supplies, reducing the demand for potable water, improving wildlife habitats and helping to provide green corridors and improving local amenity. The cumulative benefits of numerous SuDS schemes over a number of sites in the Borough could therefore be significant.

Table 7-4: Summary of Benefits of SuDS Measures

	SuDS technique	Flood Reduction	Water Quality Improvement	Landscape & Wildlife Benefit
Most Sustainable	Living roofs	✓	✓	✓
	Basins and ponds - Constructed wetlands - Balancing ponds - Detention basins - Retention ponds	✓	✓	✓
	Filter strips and swales	✓	✓	✓
	Infiltration devices - soakaways - infiltration trenches and basins	✓	✓	✓
	Permeable surfaces and filter drains - gravelled areas - solid paving blocks - porous paving	✓	✓	
Least Sustainable	Tanked systems - over-sized pipes/tanks - storms cells	✓		

There are numerous sources of best practice advice with regard to flood resilience and flood resistance measures, including SuDS. Examples are the EA standing advice for development of Flood Risk Assessments and the Know Your Flood Risk guide to flood resilience. These should be consulted in the production of all FRAs.

Key contacts:

- Environment Agency – https://www.gov.uk/government/organisations/environment-agency
- London Borough of Havering – https://www.havering.gov.uk/Pages/Services/Flooding-advice.aspx
- CIRIA[21] – www.susdrain.org
- Know Your Flood Risk - http://www.knowyourfloodrisk.co.uk

21 Construction Industry Research and Information Association

RECOMMENDATION: LBH should encourage developers to consider flood resilience in their developments to permit a quick recovery post-flooding. LBH should continue to mandate the use of SuDS in developments where practicable, as indicated in the London Plan, current LBH policy and by the EA.

7.12 Summary – Development Management Recommendations

The following table summarises the recommendations made in this SFRA regarding spatial planning and development management. It is important to note that the table is designed as a summary of issues covered elsewhere in the SFRA, NPPF and other guidance documents. It should not be relied upon in isolation when writing or evaluating a FRA.

The table is not intended to replace current planning policies within existing development plans prepared by LBH, but it may be useful in their preparation of future planning policies relating to flood risk.

Requirements	NPPF Flood Zone					
	Zone 3b Functional Floodplain (See Section 0)		Zone 3a High Probability (See Section 0)	Zone 2 Medium Probability (See Section 0)	HCDAs [1] (See Section 4.8)	Zone 1 Low Probability (See Section 0)
	Existing Development[22]	New Development				
Important Considerations	Opportunities should be sought: to reduce overall level of flood risk in the area through layout and form of development and appropriate application of SuDS; and to relocate existing inappropriate development to land with lower probability of flooding. Sequential Test required (unless para.104 of NPPF applies) All existing 'solid buildings' that would otherwise be in Zone 3b, unless designed to allow the passage of water, together with any other land prevented from flooding in a 5% (1 in 20) AEP event by the presence of solid buildings and existing infrastructure, are considered to be within Zone 3a for planning purposes. Existing buildings and other land designed to flood will continue to be in Zone 3b.	Includes all new development on previously undeveloped land, or on surfaces that are currently permeable, or on surfaces that are currently impermeable but not designed to flood.	Opportunities should be sought: to reduce overall level of flood risk in the area through layout and form of development and appropriate application of SuDS; to relocate existing inappropriate development to land with lower probability of flooding; and to create space for flooding to occur.	Opportunities should be sought to reduce overall level of flood risk in the area through layout and form of development and appropriate application of SuDS. Sequential Test required (unless para.104 of NPPF applies)	Important to check whether site is a 'dry island' (see Section 3.3.5). HCDA have been identified which are likely to be most at risk of flooding from local sources. Local flooding must be considered as in integral part of the design process for all development. Opportunities should be sought to reduce overall level of flood risk in the local area through layout and form of development and appropriate application of SuDS. (See guidance provided by EA on Critical Drainage Areas - equally applicable here - and best practice guidance on SuDS)	Important to check whether the site is a 'dry island' (see Section 3.3.5). It is important to recognise that sites within Zone 1 may be susceptible to flooding from other sources. Development may contribute to an increase in flood risk elsewhere if not carefully mitigated. Opportunities should be sought to reduce overall level of flood risk in the area and beyond through layout and form of development and appropriate application of SuDS.
Appropriate Land Use (refer to Tables 2 and 3 of the NPPG)	Proactively seek a reduction in risk by reducing the vulnerability of the existing land use.	Water Compatible uses Essential Infrastructure, if passes Exception Test.	Water Compatible or Less Vulnerable uses. More Vulnerable uses or Essential Infrastructure, if passes Exception Text.	Water Compatible, More Vulnerable or Less Vulnerable uses. Highly Vulnerable uses, if passes Exception Test.	No restrictions upon land use.	No restrictions upon land use.
Flood Risk Assessment (FRA) (all sources of flooding)	Detailed FRA required		Detailed FRA required	Detailed FRA required	FRA required (proportionate to level of risk) for a sites in Flood Zone 1,but should focus on records of past flooding and SuDS. Detailed FRA required for sites in Flood Zones 2 and 3	FRA required (proportionate to level of risk) for all sites greater than 1ha in area, but should focus on records of past flooding and SuDS. Recommend that sites of 1ha or less carry out an assessment of localised flood risks

Notes

General This table should be referred to in conjunction with reference to the rest of this SFRA report.

1 This includes areas in Flood Zone 1 that Havering have identified as being at risk of surface water flooding

22 Existing development specifically designed to allow the passage of flood water, such as buildings on stilts or car parks designed to flood

7.13 Local Community Action to Reduce Flood Damage

It is important to ensure a broad awareness with respect to flood risk, to enable communities to help themselves should a flood event occur. Advice is available on several websites, in particular those of the EA, the Mayor of London and LBH.

Key contacts:

- Environment Agency – https://www.gov.uk/government/organisations/environment-agency
- Mayor of London – www.london.gov.uk/mayor-assembly/mayor/london-resilience
- London Borough of Havering –www.havering.gov.uk/Pages/Services/Flooding-advice.aspx

The EA advises everyone to check whether their property is at risk of flooding; this includes both residential and business premises. For those whose properties are at risk of flooding, the EA advises:

- sign up to their flood warnings;
- make a flood plan;
- prepare the property for flooding; and
- prepare a flood kit.
- Information on all of the above can be found on the EA's website.

It is also important for property owners to ensure that they have sufficient insurance to cover their property if damaged by flood.

7.14 Emergency Planning – London Borough of Havering

The Council is designated as a Category 1 Responder under the Civil Contingencies Act 2004. As such, the Council has defined responsibilities to assess risk, and respond appropriately in case of an emergency, including (for example) a major flooding event. The Council's primary responsibilities are[23]:

- from time to time assess the risk of an emergency occurring;
- from time to time assess the risk of an emergency making it necessary or expedient for the person or body to perform any of his or its functions;
- maintain plans for the purpose of ensuring, so far as is reasonably practicable, that if an emergency occurs the person or body is able to continue to perform his or its functions;
- maintain plans for the purpose of ensuring that if an emergency occurs or is likely to occur the person or body is able to perform his or its functions so far as necessary or desirable for the purpose of:
    - preventing the emergency,
    - reducing, controlling or mitigating its effects, or
    - taking other action in connection with it.

23 Civil Contingencies Act 2004

In addition to the EA fluvial flood warning service, the Flood Forecasting Centre is a partnership between the EA and the Met Office. The centre forecasts for all natural forms of flooding - river, surface water and groundwater. A daily Flood Guidance Statement provides information for Category 1 and 2 responders to help with emergency planning and resourcing decisions. It presents an overview of the flood risk across five days and identifies possible severe weather, which could cause flooding and significant disruption to normal life. These forecasts, combined with understanding of the areas at highest risk of local flooding through the HCDA maps, can inform emergency planning for all sources of flooding.

As water levels rise and begin to pose a risk to life and/or livelihood, it is the responsibility of the emergency services to coordinate the evacuation of residents. This evacuation will be supported by the Council. It is essential that a robust plan is in place that clearly sets out (as a minimum):

- roles and responsibilities;
- paths of communication;
- evacuation routes;
- community centres to house evacuated residents;
- contingency plans in case of loss of power and/or communication.

Dry access (i.e. above flood level) should be sought wherever possible to ensure that all residents can be safely evacuated in times of flood. A Flood Evacuation Plan must be in place, suitable to the type of development, where there is no safe dry access to/from the site (i.e. access through Zone 1).

Emergency Planners have a role through the planning approval process to assess the adequacy of safe access plans for new developments. This will be particularly important for instances where developments pass the Exception Test and are located in a zone of higher flood risk than they would otherwise be. The emergency planners will have to take this into account to ensure the developer has considered this carefully in their proposals and that the plans are appropriate for future users.

Coordination with the emergency services and the EA is imperative to ensure the safety of residents in time of flood. Relatively few areas within Havering are at risk of river flooding (as indicated by the shaded NPPF flood risk zones in the adjoining maps). Flooding of this nature will typically occur following relatively long duration rainfall events, and consequently forewarning will generally be provided to encourage preparation in an effort to minimise property damage and risk to life. It is worth highlighting however that the benefits of flood warning are often compromised to a large degree by the lack of ‘take up’ within the local community. This emphasises the extreme importance of raising local awareness with respect to the potential risks of flooding.

Areas suffering from localised flooding issues may be at greater risk due to the difficulty of forecasting intense rainfall which may lead to surface water flooding and the response of aquifers to above average long-term rainfall which may lead to groundwater flooding. Localised flooding caused by intense rainfall can occur rapidly and pose a risk to life, particularly in confined spaces e.g. basement properties. Furthermore, the blockage of gullies and culverts as a result of litter and/or leaves is commonplace, and this will inevitably lead to localised problems that can only realistically be addressed by reactive maintenance.

It is noted, however, that the EA has recently introduced a Groundwater Flood Warning Service as an extension to its existing Floodline Warnings Direct service. This new service is available to areas which have previously been affected and already receive local information about groundwater flooding. The service will issue Flood Alerts when there is the possibility of flooding from groundwater, Flood Warnings in some areas when flooding of property is expected and support the dissemination of information through the website, flood wardens, flood action groups etc. The areas within Havering that are covered by both the Flood Warning and Flood Alert services are indicated in Figure 113.

It is recommended that the Council advises the Havering Borough Resilience Forum of the risks raised in light of the updated LBH SFRA, ensuring that the planning for future emergency response can be reviewed accordingly. This will inform the Havering Borough Risk Register[24].

7.14.1 Essential Infrastructure

Essential infrastructure has been identified within Havering to provide information to emergency planners. Infrastructure and critical services and vulnerable institutions at risk of flooding have been identified in Figures 112 and 114 respectively. Table 7-5 summarises services at risk of flooding.

Table 7-5: Summary of Flood Risk to Vulnerable Institutions, Emergency Services and Utilities

Type	No. in Flood Zone 3	No. in Flood Zone 2	Comments
Hospitals	0	0	
Ambulance Stations	0	1	Old Church Road Romford
Fire Stations	1	0	Wennington FS
Police Stations	0	0	
Schools	2	0	Newtons Primary School Brookside Infants School
Community Centres	1	1	(3) Mardyke Youth and Community Assoc. (2) Wennington Village Assoc.
Care Homes	0	0	
Telephone Exchanges	1	1	Rainham Road, Rainham
Thames Water Sites	0	2	Riverside STW and Final Sludge Pumping Station
Anglian Water Sites	0	1	Bury Farm Treatment Works
Gas Pipelines	0	1	8171 2430 Fords Branch off Rom/Baker St
Electricity Sub-stations	16	11	*Individual site information not available*

7.14.2 Transport

Figure 112 indicates the location and flood risk to key transport routes in Havering. It should be noted that although some routes appear to be within a Flood Zone, they may be elevated or on an embankment which would mean they would not be at risk of flooding from such an event.

24 http://www.havering.gov.uk/Documents/Emergencies/BoroughRiskRegister.pdf

7.15 Updating this SFRA

This SFRA provides a strategic overview of the spatial variation of flood risk throughout the Borough at a particular point in time, building upon the best available information at that time.

The SFRA has been developed building heavily upon existing knowledge with respect to flood risk within the Borough; with data continually changing as new flooding events occur and further modelling is undertaken, this knowledge is continually evolving. In addition, Government policy on flood risk continues to change, with significant changes to national and local policy evident between the publication of the previous SFRA in 2007 and the production of this update in 2014. Given that this is the case, a periodic review of this SFRA is imperative and it must be treated as a living document.

The following key questions should again be addressed as part of the SFRA review process:

Question 1

Has any flooding been observed within the Borough since the previous review? If so, the following information should be captured as an addendum to the SFRA:

- Location of flooding (grid reference or street name);
- Date(s) of flooding;
- Source of flooding (e.g. surface water, main river, sewers etc);
- Pathway of floodwaters (e.g. along the particular streets);
- Receptors (e.g. properties flooded internally, road, gardens etc);
- Frequency of flooding (e.g. once a year, during heavy rainfall etc).

Question 2

Have any amendments to the NPPF or the accompanying National Planning Practice Guidance (NPPG) or the London Plan been issued since this document was published? If so, does it materially affect any relevant LBH policy or the assessment or recommendations of this SFRA?

Question 3

Has the EA or LBH (as LLFA) issued any amendments to their flood risk mapping and/or guidance since the previous policy review? If so:

- Has any further detailed flood risk mapping been completed within the Borough, resulting in a change to the 5% (1 in 20) AEP, 1% (1 in 100) AEP or 0.1% (1 in 1000) AEP flood outline? If yes, then the Zone 3b and Zone 3a flood outlines should be updated accordingly;
- Has any further detailed or revised mapping been produced for the Borough resulting in a change to the HCDA? If so, then relevant maps should be altered accordingly;
- Has the assessment of the impacts that climate change may have upon rainfall and/or river flows over time altered? If yes, then a review of the impacts that climate change may have upon the Borough is required;
- Do the development management recommendations provided in the SFRA in any way contradict emerging EA advice with respect to (for example) the provision of emergency access, the setting of floor levels and the integration of sustainable drainage techniques? If yes, then a discussion with the EA is required to ensure an agreed suite of development control requirements are in place.

It is highlighted that the EA updates the Flood Map for Planning (Rivers and Sea) on a quarterly basis[25]. If this has been revised within the Borough, the updated Flood Zones will be automatically forwarded to the Council for their reference. It is recommended that only those areas that have been amended by the EA since the previous SFRA review are reflected in Zone 3 and Zone 2 of the SFRA flood maps. This ensures that the more rigorous analyses carried out as part of the SFRA process are not inadvertently lost by a simple global replacement of the SFRA flood maps with the Flood Map for Planning (Rivers and Sea).

Question 4

Has the implementation of the SFRA within the spatial planning and/or development management functions of the Council raised any particular issues or concerns that need to be reviewed as part of the SFRA process?

[25] Available here: http://maps.environment-agency.gov.uk/wiyby/wiybyController?x=357683.0&y=355134.0&scale=1&layerGroups=default&ep=map&textonly=off&lang=_e&topic=floodmap

Figures

Annex A: Strategic Development Areas Summary