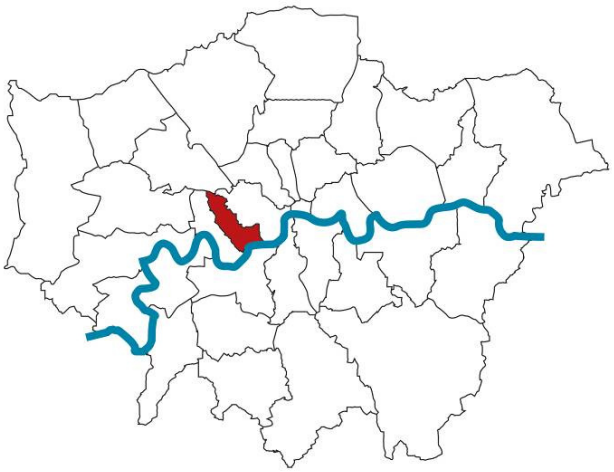
# PRELIMINARY FLOOD RISK ASSESSMENT



***DRAIN LONDON***

THE ROYAL BOROUGH OF KENSINGTON AND CHELSEA

GREATER LONDON AUTHORITY

Thames Water

LONDON COUNCILS

Environment Agency

THE ROYAL BOROUGH OF KENSINGTON AND CHELSEA

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## RELATED DOCUMENTS

| Doc Ref | Document Title | Author | Date of Issue | Version |
|---|---|---|---|---|
| SWMP | Draft Surface Water Management Plan for The Royal London Borough of Kensington & Chelsea | Isabel Felstead/Laura Markeson | July 2011 | V0.8 |

# Acknowledgments

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Patricia Cuervo, the Royal London Borough of Kensington & Chelsea
Matt Akers, Flood Risk Mapping & Data Management Technical Specialist, Environment Agency
Andrew Crawshaw, Principal Engineer Pumps & Drainage, London Underground Limited
David Harding, Asset Condition Consultant, Thames Water

# Executive Summary

This report summarises the Preliminary Flood Risk Assessment undertaken for the Royal Borough of Kensington & Chelsea. The study forms part of the wider Drain London project, which involves the delivery of the draft Surface Water Management Plans (SWMP) and Preliminary Flood Risk Assessments (PFRA) for each of the thirty two London Boroughs and the Corporation of the City of London. The PFRA has been undertaken to assist the Royal Borough of Kensington & Chelsea to meet its duties as a Lead Local Flood Authority, with the delivery of the first stage of the Flood Risk Regulations (2009). These regulations implement the EU Floods Directive in the UK.

The PFRA is a high level screening exercise that compiles information on significant local flood risk (any flood risk that does not originate from main rivers, the sea or large reservoirs) from past and future floods, based on readily available and derivable information. The PFRA also includes the identification of flood risk areas where the subsequent two stages of the Flood Risk Regulations apply; stage two delivers Flood Risk Maps and stage three delivers Flood Risk Management Plans.

This study has not identified any past floods that are considered to have had significant harmful consequences. This is based on the following local definition of harmful consequences: 'Memorable past floods or otherwise registered on a national scale (such as the summer 2007 event) even if only occurring over a relatively small area.'

Future flood risk from extreme events is estimated to be high in the Borough. Based on the Drain London surface modelling outputs, approximately 22,250 properties are estimated to be at risk from flooding during a rainfall event with a 1 in 200 annual chance of occurring.

The indicative flood risk areas provided by the Environment Agency have been reviewed based on the local knowledge of past and future floods. The outcome of this review is that the indicative flood risk areas can be used as the flood risk areas, for the undertaking of stages three and four of the regulations.

# Glossary

| Term | Definition |
|---|---|
| Aquifer | A source of groundwater comprising water bearing rock, sand or gravel capable of yielding significant quantities of water. |
| AMP | Asset Management Plan |
| Asset Management Plan | A plan for managing water and sewerage company (WaSC) infrastructure and other assets in order to deliver an agreed standard of service. |
| AStSWF | Areas Susceptible to Surface Water Flooding |
| BGS | British Geological Survey |
| Catchment Flood Management Plan | A high-level planning strategy through which the Environment Agency works with their key decision makers within a river catchment to identify and agree policies to secure the long-term sustainable management of flood risk. |
| CDA | Critical Drainage Area |
| Critical Drainage Area | A discrete geographic area (usually a hydrological catchment) where multiple and interlinked sources of flood risk (surface water, groundwater, sewer, main river and/or tidal) cause flooding in one or more Local Flood Risk Zones during severe weather thereby affecting people, property or local infrastructure. |
| CFMP | Catchment Flood Management Plan |
| CIRIA | Construction Industry Research and Information Association |
| Civil Contingencies Act | This Act delivers a single framework for civil protection in the UK. As part of the Act, Local Resilience Forums must put into place emergency plans for a range of circumstances including flooding. |
| CLG | Government Department for Communities and Local Government |
| Climate Change | Long term variations in global temperature and weather patterns caused by natural and human actions. |
| Culvert | A channel or pipe that carries water or sewage at or below the level of the ground. |
| Defra | Department for Environment, Food and Rural Affairs |
| DEM | Digital Elevation Model |
| DG5 Register | A water-company held register of properties which have experienced sewer flooding due to hydraulic overload, or properties which are 'at risk' of sewer flooding more frequently than once in 20 years. |
| DTM | Digital Terrain Model |

| Term | Definition |
|---|---|
| EA | Environment Agency |
| Indicative Flood Risk Areas | Areas determined by the Environment Agency as indicatively having a significant flood risk, based on guidance published by Defra and WAG and the use of certain national datasets. These indicative areas are intended to provide a starting point for the determination of Flood Risk Areas by LLFAs. |
| FMfSW | Flood Map for Surface Water |
| Flood defence | Infrastructure used to protect an area against floods such as floodwalls and embankments; they are designed to a specific standard of protection (design standard). |
| Flood Risk Area | An area determined as having a significant risk of flooding in accordance with guidance published by Defra and WAG. |
| Flood Risk Regulations | Transposition of the EU Floods Directive into UK law. The EU Floods Directive is a piece of European Community (EC) legislation to specifically address flood risk by prescribing a common framework for its measurement and management. |
| Floods and Water Management Act | Part of the UK Government's response to Sir Michael Pitt's Report on the Summer 2007 floods, the aim of which is to clarify the legislative framework for managing surface and groundwater flood risk in England. |
| Fluvial Flooding | Flooding resulting from water levels exceeding the bank level of a main river |
| FRR | Flood Risk Regulations |
| IDB | Internal Drainage Board |
| IUD | Integrated Urban Drainage |
| LB | London Borough |
| LDF | Local Development Framework |
| LFRZ | Local Flood Risk Zone |
| Local Flood Risk Zone | Local Flood Risk Zones are defined as discrete areas of flooding that do not exceed the national criteria for a ‘Flood Risk Area’ but still affect houses, businesses or infrastructure. A LFRZ is defined as the actual spatial extent of predicted flooding in a single location |
| Lead Local Flood Authority | Local Authority as defined in the FWMA responsible for taking the lead on local flood risk management |
| LiDAR | Light Detection and Ranging |
| LLFA | Lead Local Flood Authority |

| Term | Definition |
|---|---|
| Local Resilience Forum | A multi-agency forum, bringing together all the organisations that have a duty to cooperate under the Civil Contingencies Act, and those involved in responding to emergencies. They prepare emergency plans in a co-ordinated manner. |
| LPA | Local Planning Authority |
| LRF | Local Resilience Forum |
| Main River | A watercourse shown as such on the Main River Map, and for which the Environment Agency have duties and powers |
| NRD | National Receptor Dataset – a collection of risk receptors produced by the Environment Agency |
| Ordinary Watercourse | All watercourses that are not designated Main River, and which are the responsibility of Local Authorities or, where they exist, IDBs |
| Partner | A person or organisation with responsibility for the decision or actions that need to be taken. |
| PFRA | Preliminary Flood Risk Assessment |
| Pitt Review | Comprehensive independent review of the 2007 summer floods by Sir Michael Pitt, which provided recommendations to improve flood risk management in England. |
| Pluvial Flooding | Flooding generated from a rainfall event and from water flowing over the surface of the ground; often occurs when the soil is saturated and natural drainage channels or artificial drainage systems have in sufficient capacity to cope with additional flow. |
| PPS25 | Planning and Policy Statement 25: Development and Flood Risk |
| PA | Policy Area |
| Policy Area | One or more Critical Drainage Areas linked together to provide a planning policy tool for the end users. Primarily defined on a hydrological basis, but can also accommodate geological concerns where these significantly influence the implementation of SuDS |
| Receptor | In flood risk management, receptor is defined as anything that is affected by flooding such as people, property, transport links and habitats. |
| Resilience Measures | Measures designed to reduce the impact of water that enters property and businesses; could include measures such as raising electrical appliances. |
| Resistance Measures | Measures designed to keep flood water out of properties and businesses; could include flood guards for example. |
| Risk | In flood risk management, risk is defined as a product of the probability or likelihood of a flood occurring, and the consequence of the flood. |

| Term | Definition |
|---|---|
| Risk Management Authority | As defined by the Floods and Water Management Act;<br>(a) the Environment Agency,<br>(b) a lead local flood authority,<br>(c) a district council for an area for which there is no unitary authority,<br>(d) an internal drainage board,<br>(e) a water company, and<br>(f) a highway authority. |
| RMA | Risk Management Authority |
| Sewer flooding | Flooding caused by a blockage or overflowing in a sewer or urban drainage system. |
| SFRA | Strategic Flood Risk Assessment |
| Significant harmful consequences | Memorable past floods or otherwise registered on a national scale (such as the summer 2007 event) even if only occurring over a relatively small area |
| Stakeholder | A person or organisation affected by the problem or solution, or interested in the problem or solution. They can be individuals or organisations, includes the public and communities. |
| SuDS | Sustainable Drainage Systems |
| Sustainable Drainage Systems | Methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques. |
| Surface water | Rainwater (including snow and other precipitation) which is on the surface of the ground (whether or not it is moving), and has not entered a watercourse, drainage system or public sewer. |
| SWMP | Surface Water Management Plan |
| TfL | Transport for London |
| TWUL | Thames Water Utilities Ltd |
| WAG | Welsh Assembly Government |
| WaSC | Water and Sewerage Company |

# Contents

# 1.0 Introduction

## 1.1 What is a Preliminary Flood Risk Assessment?

This report summarises the Preliminary Flood Risk Assessment (PFRA) undertaken for the Royal Borough of Kensington and Chelsea. It has been carried out to assist the Royal Borough of Kensington & Chelsea to meet its duties as a Lead Local Flood Authority, with the delivery of the first stage of the Flood Risk Regulations (2009). These regulations implement the EU Floods Directive in the UK.

The PFRA is a high level screening exercise that compiles information on significant local flood risk from past and future floods, based on readily available and derivable information. The PFRA also includes the identification of flood risk areas where the subsequent two stages of the Flood Risk Regulations apply; stage two delivers Flood Risk Maps and stage three delivers Flood Risk Management Plans.

Local flood risk is defined as flood risk originating from sources other than main rivers, the sea and large reservoirs and principally meaning flood risk from surface runoff, groundwater and ordinary watercourses. This main definition of local flood risk requires further clarification: a) it includes lakes and ponds, b) it does not consider flooding from sewers unless this is wholly or partly caused by rainwater or other precipitation entering or otherwise affecting the system, c) it does not include flooding from water supply systems (for example burst water mains) and d) it considers the interaction with flooding from main rivers, the sea and sewers.

The main scope of this report is to summarise the work undertaken to comply with Part 2 of the Flood Risk Regulations 2009 (see **Table 1** in **Section 1.3** below and the following link: http://www.legislation.gov.uk/uksi/2009/3042/contents/made).

## 1.2 Background

This study for the Royal Borough of Kensington & Chelsea forms part of the wider Drain London project, which is a wider initiative that involves the undertaking of draft Surface Water Management Plans and Preliminary Flood Risk Assessments for each of the thirty two London Boroughs and the Corporation of the City of London.

Halcrow Group Ltd is undertaking the SWMP and PFRA for the London boroughs Camden, Hammersmith & Fulham, City of London, Islington, Kensington & Chelsea and Westminster (Group 3) and the London Boroughs of Bexley, Bromley, Lewisham and Greenwich (Group 6). Other consultants are concurrently undertaking the PFRA and draft SWMP for the other London Boroughs and as part of the same Drain London project working group.

## 1.3 Objectives

The main aim of this study was to undertake stage one of the Flood Risk Regulations 2009, Part 2 (the PFRA).

The timescales for undertaking the three stages of the flood risk regulations are summarised in **Table 1** below.

**Table 1 – Main requirements of the Flood Risk Regulations 2009 for LLFAs**

| *FRR2009 ref.* | **Task** | **Description** |
|---|---|---|
| *Part 2* | **1** | LLFAs to undertake PFRAs on local flood risk by ***22 June 2011***, within their administrative boundaries.<br>LLFAs or groups of LLFAs to confirm or to propose alternative Flood Risk Areas from indicative flood risk areas already identified in national datasets by ***22 June 2011***. |
| *Part 3* | **2** | LLFAs to prepare Flood Hazard and Flood Risk Maps by ***22 June 2013*** for the flood risk areas and in relation to local flood risk. |
| *Part 4* | **3** | LLFAs to prepare Flood Risk Management Plans of the identified flood risk areas by ***22 June 2015***. |

**Note 1:** This table does not cover the tasks undertaken by the Environment Agency to comply with the Flood Risk Regulations in relation to flooding from main rivers, the sea and large reservoirs.

**Note 2:** Tasks 2 and 3 have not been undertaken as part of this study.

The key objectives for the PFRA are summarised as follows:

- Identify relevant partner organisations involved in future assessment of flood risk; and summarise means of future and ongoing stakeholder engagement;
- Describe arrangements for ongoing collection, assessment and storage of flood risk data and information (see **Section 8.3**);
- Summarise the methodology adopted for the PFRA with respect to data sources, availability and review procedures;
- Assess historic flood events within the study area from local sources of flooding (including flooding from surface water, groundwater and ordinary watercourses), and the consequences and impacts of these events;
- Assess the potential harmful consequences of future flood events within the study area;
- Review the provisional national assessment of indicative Flood Risk Areas provided by the Environment Agency and provide an explanation and justification for any amendments required to the Flood Risk Areas;

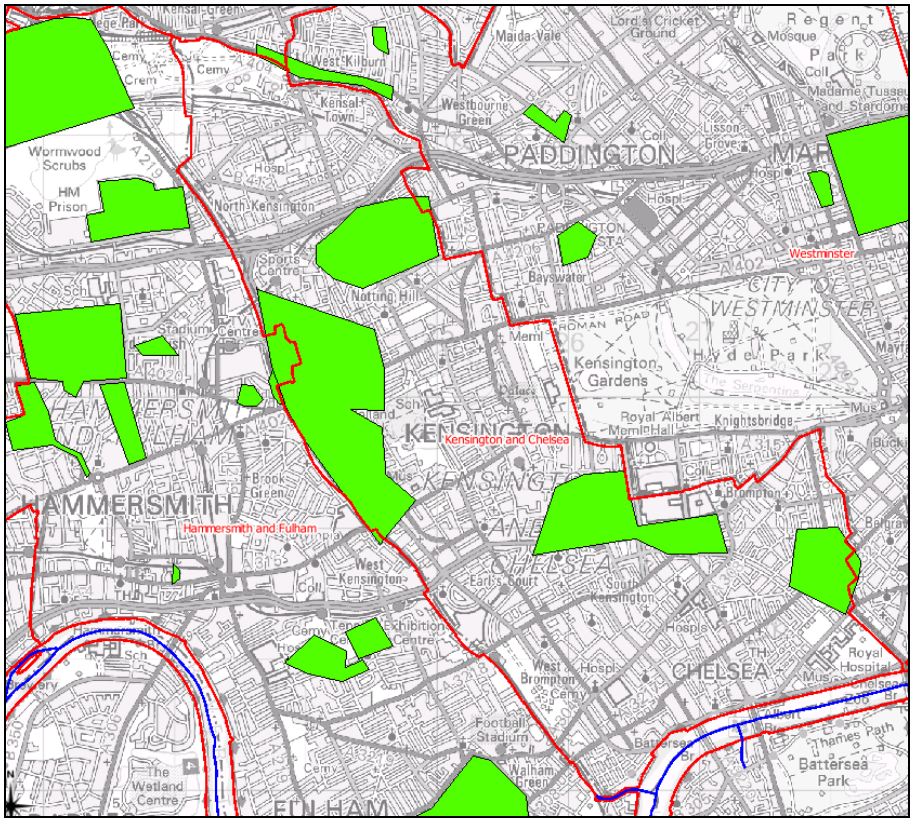
- Provide a summary of the systems used for data sharing and storing, and provision for quality assurance, security and data licensing arrangements;

- Provide advice on the next steps required to ensure that the Royal Borough of Kensington & Chelsea complies with its role as the LLFA.

## 1.4 Study Area

The study area covers the administrative boundary of the Royal Borough of Kensington & Chelsea. It however needs to take account of interactions with adjacent boroughs and in particular if floods are identified as covering more than one borough. **Figure 1.1** shows the study area and the coverage of past floods. These past floods coincide with Local Flood Risk Zones (LFRZs) which have been identified for the draft Kensington & Chelsea Surface Water Management Plan (SWMP) which is currently under development.

**Figure 1.1 - Study Area and Locations of Past Floods (highlighted in green)**



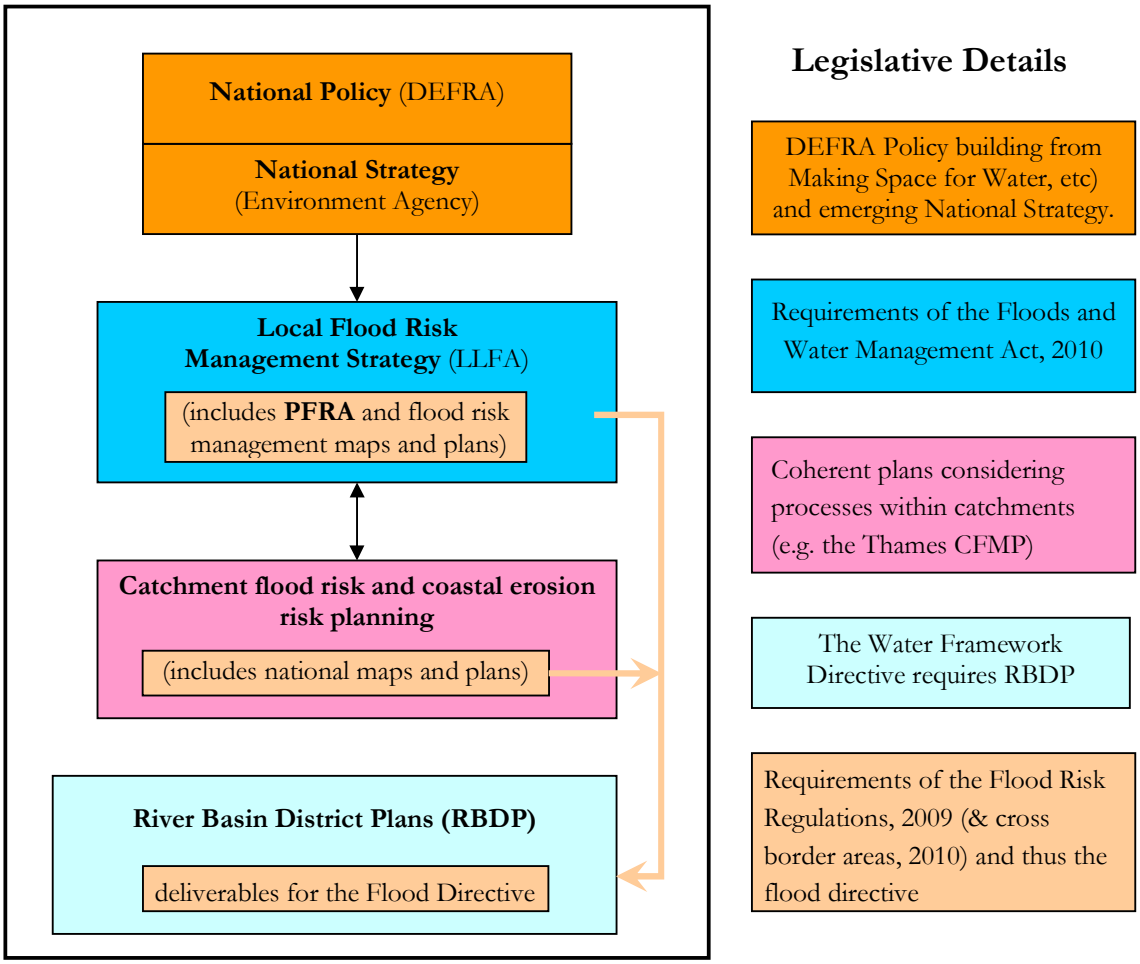

| Legend | |
|---|---|
| | Areas identified as having historical flooding |
| | Borough administrative boundary |
| | Environment Agency main river |

# 2.0 LLFA Responsibilities

## 2.1 Legislative Background

The legislative background showing how the PFRA fits within this context is summarised in **Figure 2.1** below:

**Figure 2.1 – Legislative Background**




FCERM = National strategy for Flood and Coastal Erosion Risk Management

DEFRA = Department of the Environment of Food and Rural Affairs

MSfW = Making Space for Water

CFMP = Catchment Flood Management Plan

SMP = Shoreline Management Plan

The **Floods and Water Management Act** was brought into UK law in 2010 to improve flood risk management and support continuity of water supply. A key feature of the Act is the implementation of recommendations from the Pitt Review into the summer 2007 flooding, thus increasing the emphasis on sources of flooding other than fluvial and tidal, in particular surface water which featured heavily in the 2007 flooding.

The Act gives a number of responsibilities and powers to both the Environment Agency and the Lead Local Flood Authorities. As mentioned in **Section 1.1**, the LLFA are made responsible for local flood risk and main rivers, the sea and large reservoirs are the responsibility of the Environment Agency. The Environment Agency will also be responsible for producing a **National strategy for Flood and Coastal Erosion Risk Management** (**FCERM**) for England.

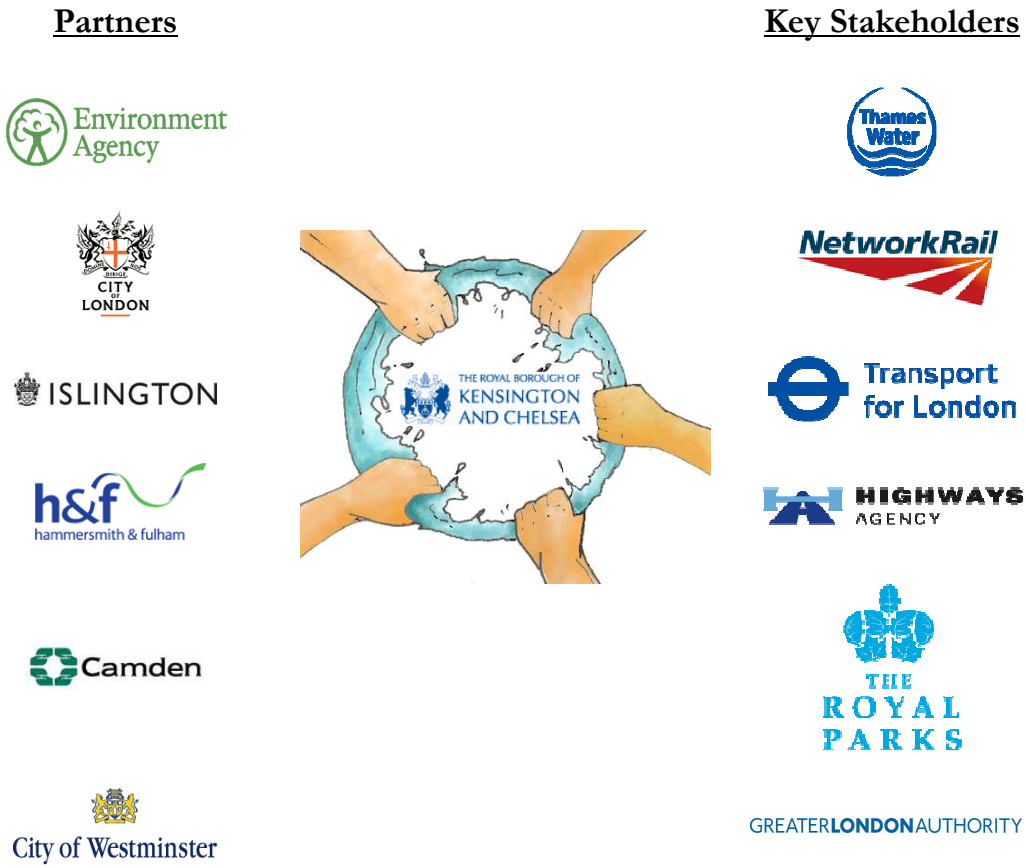
The PFRA and draft SWMP for the Royal Borough of Kensington & Chelsea will inform the future Local Flood Risk Management Strategy and the future update of the Strategic Flood Risk Assessment (**SFRA**) and other high level documents, such as the Thames Catchment Flood Management Plan (**CFMP**).

## 2.2 Leadership and Partnership

As Lead Local Flood Authority, it is the role of the Royal Borough of Kensington & Chelsea to forge effective partnerships with the adjacent LLFA and the Environment Agency (this is currently the case with the Drain London project) as well as other key stakeholders – Thames Water, Network Rail, Transport for London and the Highways Agency. Some progress has been made towards establishing these partnerships already, although Network Rail and the Highways Agency have not yet fully engaged with the process. The Council, through the Lead Local Flood Authority duties, will work to formalise these arrangements to ensure clear lines of communication, mutual co-operation and management through the provision of Level of Service Agreements (LoSA) or Memorandums of Understanding (MoU).

**Figure 2.2** provides a schematic of the recommended partnership and stakeholder arrangements:

**Figure 2.2 – Partnership and Main Stakeholder Schematic Diagram**




## 2.3 Stakeholder Engagement

A stakeholder engagement workshop took place in March 2011 to clarify roles and responsibilities and to initiate discussions on the way forward for: a) data sharing, b) communication with partners, c) SuDs approval (see **Section 2.5**), d) future approaches to local flood risk and e) public engagement.

In addition to the main partners, the following stakeholders were invited: a) Thames Water, b) Network Rail, c) Transport for London, d) the Highways Agency, e) consultants currently involved in the London Green Grid initiative, f) the fire and rescue service and g) the police service. Those stakeholders that were unable to attend have been provided with details of the outcomes of the workshop and included in subsequent discussions.

## 2.4 Public Engagement

It is recommended that the best vehicle for engaging the public is by integrating the management of local flood risk with other borough initiatives, such as integrating with emerging development proposals and improving the amenity of parks and open spaces. This approach will require a sustained coordinated approach within the Borough.

It is recognised that members of the public may also have valuable information to contribute to future cycles of the PFRA by way of flood incident reporting in the interim period, and to local flood risk management. Stakeholder engagement can be of significant benefit to local flood risk management including building trust, gaining access to additional local knowledge and increasing the chances of stakeholder acceptance of options and decisions proposed in future flood risk management plans.

It is important to undertake some public engagement when formulating local flood risk management plans as this will help to inform future levels of public engagement. It is recommended that the Royal Borough of Kensington & Chelsea follow the guidelines outlined in the Environment Agency's 'Building Trust with Communities' document which provides a useful process of how to communicate risk including the causes, probability and consequences to the general public and professional forums such as local resilience forums.

## 2.5 Other responsibilities

Aside from forging partnerships and coordinating and leading on local flood management, there are a number of other key responsibilities that have arisen for Lead Local Flood Authorities from the Flood & Water Management Act and the Flood Risk Regulations. These responsibilities include:

- **Investigating flood incidents** – LLFAs have a duty to investigate and record details of significant flood events within their area (Flood Risk Regulations 2009, Part 2, Section 12).

- **Asset Register** – LLFAs also have a duty to maintain a register of structures or features which are considered to have an effect on flood risk, including details on ownership and condition as a minimum. The register must be available for inspection and the Secretary of State will be able to make regulations about the content of the register and records.

- **SUDS Approving Body** – The Floods and Water Management Act, 2010 establishes a Sustainable Urban Drainage system (SUDS) Approval Body at county or unitary local authority level (in this case the Royal Borough of Kensington & Chelsea) to ensure national standards of sustainable drainage are enforced. Developers will be required to gain approval of their proposed drainage systems before they can begin construction, and the SUDS Approving Body will then be responsible for adopting and maintaining SUDS which serve more than one property (other than on public roads which are the responsibility of the Highways authorities). Defra will be releasing further guidance on the SuDS Approving Body at the end of 2011.

- **Local Strategy for Flood Risk Management** – LLFAs are required to develop, maintain, apply and monitor a local strategy for flood risk management in its area. The local strategy will build upon information such as national risk assessments and will use consistent risk based approaches across different local authority areas and catchments.

- **Works powers** – LLFAs have powers to undertake works to manage local flood risk, consistent with the local flood risk management strategy for the area.

- **Designation powers** – LLFAs, as well as the Environment Agency have powers to designate structures and features that affect flooding or coastal erosion in order to safeguard assets that are relied upon for flood or coastal erosion risk management.

# 3.0 Methodology and Data Review

## 3.1 Data Sources

Most of the required data has been made available from the previous stage (Tier 1) of the Drain London project. The key information that was obtained is listed in **Table 3.1** below (a full list of the information is included in the Data Gap and Licensing Report issued by Tier 1 Consultants in October 2010):

**Table 3.1 – Summary of Key Drain London Tier 1 Data**

| Source | Data/Studies |
|---|---|
| **Environment Agency** | Environment Agency Asset Data;<br>Water Studies (including Thames Catchment Flood Management Plan, Thames Catchment Abstraction Management Strategy and Thames River Basin Management Plan;<br>Historic flood data (GIS flood event outlines extracted from NFCDD);<br>Geostore data including Main River details, flood data for areas vulnerable to surface water flooding and Digital River Network (DRN) data for London;<br>Numerous fluvial and surface water models located in the Greater London area;<br>London hydrometric data including groundwater level data, rainfall data and river flow data; and<br>Details of Flood Warning Areas in London |
| **The Royal Borough of Kensington & Chelsea** | Kensington & Chelsea Multi Agency Flood Plan;<br>RBK&C response to flooding report 20th July 2007;<br>Record of flood calls from fire brigade (July 2007);<br>Record of flooded properties (July 2007);<br>LCLIP data;<br>SFRA Report & maps (included surface water mapping);<br>Core Strategy;<br>RBK&C Sequential Test |
| **Thames Water** | Foul water and surface water sewer network models in GIS format;<br>Pumping station and manhole locations. |
| **Other** (Highways Agency, Transport for London, Network Rail, Local flood groups, fire brigade, etc) | Various assets;<br>Flood records;<br>GIS layers for land use types;<br>BGS Susceptibility to Groundwater Flooding |

Additional information has been obtained from the Council through an initial site visit followed by a more detailed virtual site visit/workshop of areas at risk of flooding.

Particular care has been taken by using the SFRA for the Borough as the primary document from which local flood risk information has been obtained. The reasoning behind this is that: a) the SFRA for this Council is relatively recent (completed in August 2009), b) it has been thoroughly reviewed more than once by the Council and the Environment Agency, c) it has informed the LDF planning process and d) it has gathered relevant local information.

The virtual site visits/workshops have proved to be a highly valuable process which involved 'virtual walks' by technical staff from the Environment Agency, the Council and Halcrow identifying many local flood risk areas, using a GIS environment and the use of Google Street View for 3D images.

The virtual site visits process involved the overlaying of the following GIS layers: a) OS maps, b) the Thames Water pipe network system, c) the river networks, d) the flood zones, e) groundwater incident records, f) surface water flood incident records, g) local flood risk data from strategic data providers (for example the fire brigade), h) the Environment Agency national Flood Map for Surface Water (FMfSW), h) the Drain London surface water hazard and flood depth maps produced by Halcrow for the Council, e) the SFRA surface water flood depth maps, f) a digital terrain model to identify catchment boundaries and terrain gradients, etc.

The virtual site visits assisted in achieving a number of SWMP and PFRA objectives and these are listed in **Table 3.2** below:

**Table 3.2 – Objectives of the Virtual Site Visit**

| No | Objective | Informs the SWMP | Informs the PFRA |
|---|---|---|---|
| 1 | Identify the source of flooding of past events (from readily available records) | ✓ | ✓ |
| 2 | Identify the pathways of past events and better understand the mechanism of flooding | ✓ | ✓ |
| 3 | Identify the receptors of past events | ✓ | ✓ |
| 4 | Identify which past events had significant consequences to human health, economic activity and/or the environment | ✓ (to a lesser extent) | ✓ |
| 5 | Verify the Drain London surface water map outputs against past events | ✓ | ✓ (to a lesser extent) |
| 6 | Compare past events against surface water maps originating from: a) Drain London, b) the SFRA and c) the Environment Agency. | ✓ (to a lesser extent) | ✓ |
| 7 | Locally agree surface water information ** | ✓ (to a lesser extent) | ✓ |
| 8 | Identify the source of flooding of future events (from modelling outputs) | ✓ | ✓ |
| 9 | Identify the pathways of future events and better understand the mechanism of flooding | ✓ | ✓ |
| 10 | Identify the receptors of future events | ✓ (to a lesser extent) | ✓ |
| 11 | Confirm which future flooding events are considered to be significant, affecting either or a combination of: a) human health, b) economic activity and c) the environment | ✓ (to a lesser extent) | ✓ |
| 12 | Consider a number of structural and non structural solutions for each flood risk area | ✓ | ✓ (to a lesser extent) |
| 13 | Enhance stakeholder engagement which is considered to be very important for this project | ✓ | ✓ |

** This is mainly a requirement of the PFRA as more than one modelling output could be available for local flood risk (this is the case for this borough in relation to surface water modelling outputs). It was agreed that the Drain London surface water mapping outputs should be used to inform the PFRA as the outputs better verify past flood events and also because it provides more extended information in relation to flood risk (a range of return period events, flood depth and hazard mapping).

## 3.2 Availability

All available data was collected from key strategic data providers on behalf of the GLA for Tier 1. Data availability for the Royal Borough of Kensington & Chelsea was relatively good, however subsequent data requests were made for data such as the GIS layers from the recent SFRA. This was obtained directly from Patricia Cuervo in the Planning Policy Team.

## 3.3 Limitations

The data acquired from the strategic providers were all in the required format, however some of the data needed additional processing in order for it to be used for the Drain London Project.

The analyses to prepare the indicative Flood Risk Areas issued to accompany the final PFRA Guidance were based on the National Receptors Database (NRD) version 1.0 (for the counts of properties and other receptors). Receptor information was prepared for all London Boroughs in December 2010 in order to undertake property counts required for the SWMPs, also using NRD version 1.0. Version 1.1 of the NRD has subsequently been issued and contains modifications and corrections since version 1.0. However, in order to avoid repetition of work, and ensure consistency between the SWMP and the PFRA, it was decided to complete the PFRA using NRD version 1.0.

The local information provided by the Royal Borough of Kensington & Chelsea was in the form of flood incident records (primarily from the 20th July 2007 event) and text within the SFRA report. However, this information lacked desirable detail, for example, flood dates and flood extents and in distinguishing the source between surface water and sewer flooding.

The DG5 Register for Thames Water Utilities areas was made available during Tier 2 detailing records of sewer flooding incidents in the Royal Borough of Kensington and Chelsea. However, our analysis of sewer flooding incidents has been limited as we have only been provided with records at the '4' digit postcode level, so limited comments can be made about their spatial extent and distribution. The data has also limited our ability to distinguish between past flooding (particularly of basements) from flooding of raw sewage caused solely, for example, by a sewer blockage or sewer flooding which has arisen from severe surface water runoff events which we are required to report on as part of the PFRA.

## 3.4 Security, Licensing and Use Restrictions

In addition to the individual organisations licensing agreements, the Data gap and licensing Report from the Tier 1 Stage Consultants list three 'Golden rules' applicable under the Drain London framework:

- Any data received for any use in Tier 2 or 3 of the Drain London programme may not, under any circumstances, be provided to any third party or used for any other purpose whatsoever without the explicit written permission of the data provider;
- All rights to the data are reserved by and to the data provider; and
- The right of the data provider to commercially exploit the data must be protected at all times.

Any information provided to the Council or partners has been through highly secure channels and the management plan for the project has clearly specified a unique location for storing the data.

**Table 3.3**, below, gives an overview of the data restrictions and licensing details for key Drain London Tier 1 data outlined in **Table 3.1**. The full licensing information for the strategic data providers is included in the Data Gap and Licensing Report, October 2010.

**Table 3.3 – Data restrictions and licensing details for strategic data providers**

| Organisation | Restrictions on data and licensing agreements |
|---|---|
| **Environment Agency** | The use of some data is restricted to the GLA, Local Authorities and their Consultants. Specific data, such as the Indicative Surface Water Flood Risk Areas, are supplied to the consultants via the Local Authorities, as per the Agency's licensing agreement. This data can only be used for surface water management plans, strategic flood risk assessments of preliminary flood risk assessments. |
| **The Royal Borough of Kensington & Chelsea** | See 'Golden Rules' outlined under ***section 3.4*** |
| **Thames Water** | • Necessary precautions must be taken to ensure that all information given to third parties is treated as confidential<br>• The information must not be used for anything other than the purpose stated in the agreement<br>• No information may be copied, reproduced or reduced to writing, other than what is necessary for the purpose stated in the agreement<br>• If Thames Water request, the details of any third party to whom information has been disclosed must sign a confidentiality agreement acceptable to Thames Water<br>• Information is provided without a warranty; therefore Thames Water excludes any liability for any inaccuracy or incompleteness of disclosed information |
| **Other** (Highways Agency, Transport for London, Network Rail, Local flood groups, fire brigade, etc) | Other organisations hold similar agreements for data supplied to the project. A number of organisations, such as fire brigade and Network Rail have no formal agreement in place. |

## 3.5 Quality Assurance

Data collected was subject to quality assurance measures to monitor and record the quality and accuracy of acquired information and datasets. A data quality score was given, which is a qualitative assessment based on the Data Quality System provided in the SWMP, Technical Guidance document (Defra, March 2010). This system is explained in **Table 3.4**.

**Table 3.4: Data Quality System from SWMP Technical Guidance (March 2010)**

| Data Quality Score | Description | Explanations | Example |
|---|---|---|---|
| 1 | Best available | No better available; not possible to improve in the near future | High resolution LiDAR, river flow data, raingauge data |
| 2 | Data with known Deficiencies | Best replaced as soon as new data is available | Typical sewer or river model that is a few years old |
| 3 | Gross assumptions | Not invented but based on experience and judgement | Location, extent and depth of surface water flooding |
| 4 | Heroic assumptions | An educated guess | Ground roughness for 2D models |

The use of this system provides a basis for analysing and monitoring the quality of data that is being collected and used in the preparation of the PFRA. As mentioned in **Section 3.3** the information provided lacked in level of detail (an average data quality score of 2 was given) which was however then improved as part of the virtual site visits.

# 4.0 Past flood risk

## 4.1 Summary of Past Floods

This **Chapter** focuses on past floods that had *significant harmful consequences* to human health, the local economy, local environmental sensitive areas and cultural heritage. It also report floods with no *significant harmful consequences*.

**Table 4.1** below provides a summary of local past floods, with or without significant harmful consequences (based on Environment Agency guidance), identified by the Council as part of the virtual site visit (see **Section 3.1**) and through historical records. **Map 4.1** provides a visual representation of past floods for different sources of flood risk; it shows flood incident data as well as the past floods listed in **Table 4.1**. The information provided does not include dates when the flood events occurred, as many of these have happened more than once at the same location.

**Table 4.1 – Summary of Past Floods**

| Location | Source of flooding (? indicates uncertainty) | Description: Source, Pathway and Receptor information and Interactions with Other Flooding Sources | Consequence |
|---|---|---|---|
| Holland Road / Elsham Road area *(along boundary with the London Borough of Hammersmith and Fulham)* | Surface water Sewer flooding? | Counters Creek sewer unable to cope as too much water is delivered too quickly to the sewer. Basement flooding occurring. | Properties affected. |
| Sloane Street / Sloane Square area | Surface water / Sewer flooding? | Basement flooding occurring. Could be caused by trunk sewer problems? | Properties affected. |
| Gloucester Road / South Kensington area | Surface water /Sewer flooding? | Basement flooding occurring. | Properties affected. Gloucester Road and South Kensington Stations flooded |
| Old Church Street | Surface water | Basement flooding occurring. | Properties affected. |

## 4.2 Significant Harmful Consequences

**The Royal Borough of Kensington & Chelsea does not have any past floods with** *significant harmful consequences* to report to the European Union (EU), based on the following definition of significance (based on Environment Agency guidance):

'Memorable past floods or otherwise registered on a national scale (such as the summer 2007 event) even if only occurring over a relatively small area.' **Annex 1** has therefore no local information to report.

An example that fits with the definition above would be the floods in the summer of 2007 if considered on a national, rather than local scale. This event was characterised by unusually unsettled weather and above average rainfall through the month of July, peaking on 20 July, when an active frontal system deposited more than 100 millimetres (3.9 in) of rain in parts of England in a 24 hour period. The City of Hull experienced extensive surface water flooding effecting approximately 8700 homes.

The above definition of *significant harmful consequence* has been defined locally by the LLFA and it is based on a recent Environment Agency briefing paper on reporting information on past floods (Feb 2011).

Although there are no significant past floods to report to the EU, the Council has identified three locations within the Borough which have flooded in the past and are considered to be sufficiently important to be distinguished from other locations impacted by past floods with lesser consequences. These are the past floods in the Holland Road / Elsham Road area (along the boundary with the London Borough of Hammersmith and Fulham), the Sloane Street / Sloane Square area and the Gloucester Road / South Kensington area (see rows highlighted in orange in **Table 4.1** above).

The PFRA guidance requires LLFAs to assess flooding from sewers where it is caused by rainwater or other precipitation entering or otherwise affecting the system. The DG5 register from Thames Water was analysed to investigate the occurrence of sewer flooding incidents in the Royal Borough of Kensington & Chelsea (see **Map 4.1a**). It was found that there were a total of 772 properties flooded from sewer flooding events (key events identified by Thames Water as August 2004, September 2005 and July 2007) that have been recorded by Thames Water over the past decade. There are no records of properties affected by sewer flooding with significant harmful consequences within The Royal Borough of Kensington & Chelsea.

## 4.3 Interactions with Other Flooding Sources

Interactions with sewer flooding have been observed in the Royal Borough of Kensington and Chelsea. For example basement flooding observed in Holland Park, likely to be caused by a combined surface water and sewer issue as the entire drainage system at this point is over capacity.

# 5.0 Future flood risk

## 5.1 Summary of Future Flood Risk

Future flood risk for extreme events is estimated to be high in the Borough as it is anticipated in many highly urbanised areas throughout the Country.

**Table 5.1** summarises the number of properties at risk of surface water flooding based on the Drain London and the Flood Map for Surface Water (FMfSW) model outputs (this information has been copied in **Annex 2** for reporting to the EU).

**Table 5.1 – Number of properties at risk of Flooding**

| Location | Drain London 200 year event | Drain London 30 year event | FMfSW 200 year event |
|---|---|---|---|
| **Kensington & Chelsea** | 22,250 | 15,150 | 21,700 |

Different methods were used to calculate the number of properties at risk of flooding in the Drain London and Environment Agency Flood Map for Surface Water (FMfSW) 200 year event which is why the property numbers in Table 5.1 differ. A consistent property threshold of 0.10m was applied in both methodologies. The Drain London methodology provides a more recent and detailed approach to calculating the flood envelope and as a result the number of properties at risk.

Approximately 600 properties identified as being at risk of sewer flooding in the Counters Creek area have had anti-flooding devices know as flooding local improvement projects (FLIPS) installed. The FLIPS prevent sewage 'back-surging' into basements in times of heavy rain and allow the property's sewage to flow properly into the sewer network. This solution has not been rolled out across the Borough.

No other schemes have been undertaken at the locations of past floods identified in **Table 4.1** all these locations can be considered as areas where similar floods could still occur. Much of the flooding of the locations identified in **Table 4.1** are confirmed by the following modelling outputs: a) as part of the Drain London surface water modelling undertaken, b) surface water modelling undertaken as part of the SFRA and c) from the two Environment Agency national datasets. These national datasets are the Areas Susceptible to Surface Water (AStSWF) and the Flood Map for Surface Water (FMfSW).

## 5.2 Locally Agreed Surface Water Information

A comparison of surface water model outputs from the three sources identified in **Section 5.1** was undertaken as part of the virtual workshops. A lack of historical flood data meant that the model outputs could not be verified, however, the agreed conclusion

was that the surface water modelling outputs (Drain London model outputs) were most representative of the study area as they represent the most up to date modelling.

**Maps 5.1** and **5.2** provide information of the 1 in 200 year rainfall event depths and hazard grids respectively.

## 5.3 Increased Potential for Elevated Groundwater (iPEG) Mapping

### *5.3.1 Background*

Large areas within the Drain London area are underlain by permeable substrate and thereby have the potential to store groundwater. Under some circumstances groundwater levels can rise and cause flooding problems in subsurface structures or at the ground surface. The mapping technique described below aims to identify only those areas in which there is the greatest potential for this to happen and in which there is the highest possible confidence in the assessment.

The following four data sources have been utilised to produce the increased Potential for Elevated Groundwater map **(Map 5.3)**:

- British Geological Survey (BGS) Groundwater Flood Susceptibility Map;
- Jacobs Groundwater Emergence Maps (GEMs);
- Jeremy Benn Associates (JBA) Groundwater Flood Map; and
- Environment Agency/Jacobs Thames Estuary 2100 (TE2100) groundwater hazard maps.

To produce the iPEG map for consolidated aquifers, an area was defined as having increased potential for elevated groundwater levels if at least two of the three mapping techniques listed above produced a corresponding area. For the permeable superficial deposits, only Band 1 Very High of the BGS and the TE2100 data were used as this was judged to best represent the hazard.

The techniques used to generate the iPEG map produced some small areas of increased potential and some dry islands within increased potential areas. These have not been cleaned in order to best represent the original data.

### *5.3.2 How to Use and Interpret the Map*

The increased Potential for Elevated Groundwater map shows those areas within the Borough where there is an increased potential for groundwater to rise sufficiently to interact with the ground surface or be within 2 m of the ground surface.

Groundwater may become elevated by a number of means:

- Above average rainfall for a number of months in Chalk outcrop areas;

- Shorter period of above average rainfall in permeable superficial deposits;
- Permeable superficial deposits in hydraulic continuity with high water levels in the river;
- Interruption of groundwater flow paths; and
- Cessation of groundwater abstraction causing groundwater rebound.

With the exception of groundwater rebound which is not covered, the iPEG map will identify those areas most prone to the mechanisms described above. The map shows those areas considered to have the greatest potential for elevated groundwater. However, to produce a realistic map, only where there is the highest degree of confidence in the assessment are the areas actually delineated. This ensures resources are focused on the most susceptible areas. In all areas underlain by permeable substrate, groundwater should still be considered in planning developments.

Groundwater flood risk depends on location specific conditions at a given time and is therefore subject to uncertainty. In all areas underlain by permeable substrate, groundwater should still be considered in planning developments.

Within the areas delineated, the local rise of groundwater will be heavily controlled by local geological features and artificial influences (e.g. structures or conduits) which cannot currently be represented. This localised nature of groundwater flooding compared with, say, fluvial flooding suggests that interpretation of the map should similarly be different. The map shows the area within which groundwater has the potential to emerge but it is unlikely to emerge uniformly or in sufficient volume to fill the topography to the implied level. Instead, groundwater emerging at the surface may simply runoff to pond in lower areas. The localised nature of groundwater flooding and the different interpretation of the maps required is illustrated in the cartoon in **Figure 5.1**

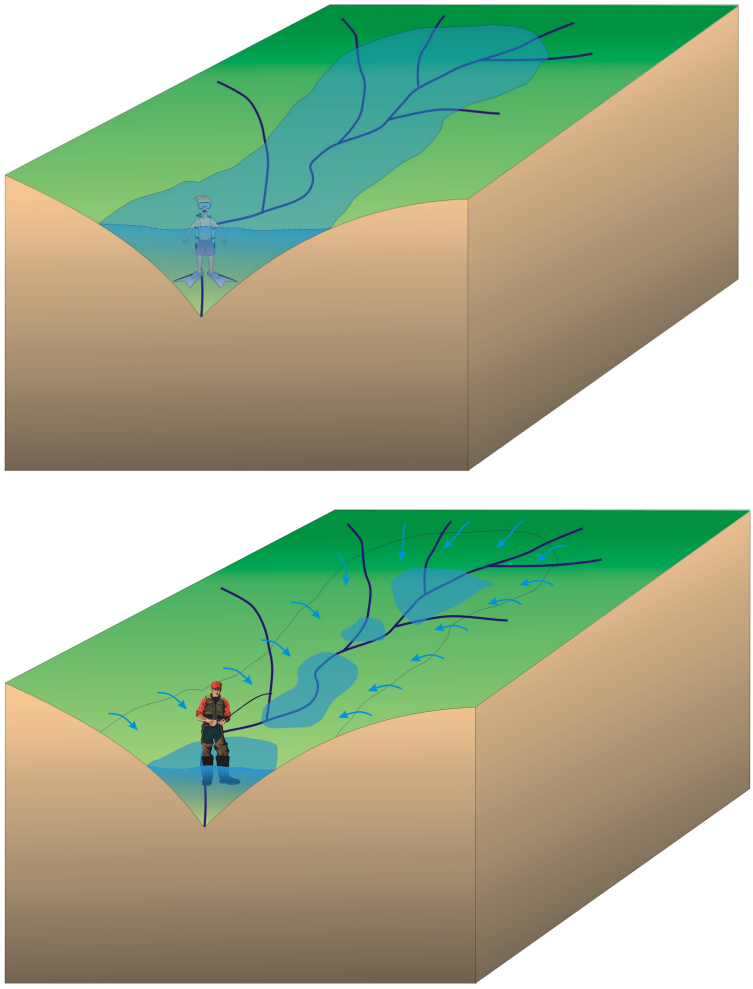


**Figure 5.1** Cartoon illustrating the difference between fluvial (top image) and groundwater (bottom image) flood mapping.

For this reason within iPEG areas, locations shown to be at risk of surface water flooding are also likely to be most at risk of ponding caused by groundwater flooding. Therefore the iPEG map should not be used as a "flood outline" within which properties at risk can be counted. Rather it is provided, and should be read in conjunction with surface water mapping, so that those areas where groundwater may emerge can also be identified and the two sources of possible flooding can be considered together. The mapping can also identify the major flow pathways that water would take.

### *5.3.3* *Results*

The iPEG mapping is presented in **Map 5.3**.

This modelling indicates that elevated groundwater from permeable superficial soils are located in the southern part of the Borough from around Holland Park down towards Chelsea.

This area has an increased potential for groundwater to rise sufficiently to interact with or be within 2m of the ground surface. This could result in the flooding of basements of buildings below ground level, buried surfaces and other assets held below ground level, inundation of roads, commercial, residential and amenity areas as well as flooding of ground floors of buildings above ground level and overflowing of sewers and drains.

This map has been taken into account when identifying the past and future flood areas.

## 5.4 Impact of Climate Change

**Maps 5.4** and **5.5** provide information of the 1 in 100 year rainfall event, with climate change, depths and hazard grids respectively.

### *5.4.1* *The Evidence*

There is clear and scientific evidence that climate change is happening now. It cannot be ignored.

Over the past century around the UK we have seen the sea level rise and more of our winter rain failing in intense wet spells. Seasonal rainfall is highly variable. It seems to have decreased in summer and increased in winter, although winter amounts have changed little in the last 50 years. Some of the changes might reflect natural variation; however the broad trends are in line with projections from climate models.

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

We have enough confidence in the 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 25mm in a day). It is plausible that the amount of rain in extreme storms (with a 1 in 5 annual chance, or rarer) could increase locally by 40%.

### *5.4.2 Key Projections for Thames River Basin District*

If emissions follow a medium future scenario, UKCP09 projected changes by the 2050s relative to the recent past are predicted as follows:

- Winter precipitation increases of around 15% (very likely to be between 2 and 32%)
- Precipitation on the wettest day in the winter up by around 15% (very unlikely to be more than 13%)
- Relative sea level at Sheerness (Kent) very likely to be up between 10 and 40cm from 1990 levels (not including extra potential rises from polar ice sheet loss)
- Peak river flow in a typical catchment likely to increase between 8 and 18%

**Implications for Flood Risk**

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 heavily urbanised catchments. More intense rainfall causes more surface runoff, increasing localised flooding and erosion. In turn, this may increase pressure on drains, sewers and water quality. Storm intensity in summer could increase even in drier summers, so we need to be prepared for the unexpected.

Rising sea or river levels may increase local flood risk inland or away from major rivers because of interactions with drains, sewers and smaller watercourses.

There is a risk of flooding from groundwater-bearing chalk and limestone aquifers across the district. Recharge may increase in wetter winters, or decrease in drier summers.

Where appropriate, we need local studies to understand climate impacts in detail, including effects from other factors like land use. Sustainable development and drainage will help us adapt to climate change and manage the risk of damaging floods in future.

### *5.4.3 Adapting to Change*

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

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

## 5.5 Long Term Developments

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

In England, Planning Policy Statement 25 (PPS25) on development and flood risk aims to "ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk. Where new development is, exceptionally, necessary in such areas, policy aims to make it safe without increasing flood risk elsewhere and where possible, reducing flood risk overall."

Adherence to Government policy ensures that new development does not increase local flood risk. However, in exceptional circumstances the Local Planning Authority may accept that flood risk can be increased contrary to Government policy, usually because of the wider benefits of a new or proposed major development. Any exceptions would not be expected to increase risk to levels which are "significant" (in terms of the Government's criteria), but should be recorded so that they can be reviewed in the future.

# 6.0 Review of Indicative Flood Risk Areas

## 6.1 Extent of Indicative Flood Risk Areas

The Environment Agency map showing the indicative flood risk areas for the Greater London area is provided in **Map 6.1**.

These have been obtained as a result of adopting a consistent and proportionate approach at national level, taking account of: a) the number of people (based on property numbers x 2.34), b) the number of critical services and c) the number of non-residential properties. The national datasets used were: a) the FMfSW, b) the AStSWF (not in London), c) the National Receptor Database (NRD) and d) the Areas Susceptible to Groundwater Flood Map.

An important principle of the method is that the assessment of significance is based on flooding in the order of a 1 in 100 chance in any given year.

The threshold for the significance criteria is set at 30,000 people at risk of surface water flooding.

## 6.2 Review Comments

The indicative flood risk areas have been reviewed within the Borough area and include most of the Borough. These areas cover a large number of the past and future floods identified in Chapters 4 and 5. This is not surprising as the Drain London surface water maps provide similar however more accurate extents to the FMfSW. There is no reason therefore to believe that there will be additional areas outside the indicative flood risk areas which will reach the national threshold

# 7.0 Identification of Flood Risk Areas

## 7.1 Amendments to FRA

Based on the comments in **Section 6.2** no changes are proposed for the Greater London Indicative Flood Risk Areas. All of the Royal Borough of Kensington and Chelsea is assumed to be within the Greater London Indicative Flood Risk Area.

## 7.2 New FRA

The new FRA proposed is therefore the same as the Indicative FRA.

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# 8.0 Next Steps

## 8.1 Scrutiny and Review

The scrutiny and review procedures that must be adopted when producing a PFRA are set out by the European Commission. Meeting quality standards is important in order to ensure that the appropriate sources of information have been used to understand flood risk and the most significant flood risk areas are identified. Another important aspect of the review procedure is to ensure that the guidance is applied consistently; a consistent approach will allow all partners to understand the risk and manage it appropriately.

The scrutiny and review procedure will comprise two key steps:

The first part of the review procedure is through an internal Local Authority review of the PFRA, in accordance with appropriate internal review procedures. Internal review and approval should be obtained to ensure the PFRA meets the required quality standards, before it is submitted to the Environment Agency.

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

The first review cycle of the PFRA will be led by the Royal Borough of Kensington & Chelsea and must be submitted to the Environment Agency by the 22nd of June 2011. They will then submit it to the European Commission by the 22nd of December 2011 using the same review procedure described above.

## 8.2 Data Collection and Management

Data gaps that will require future collection activities are listed as follows:

1) A systematic approach to recording local flood risk is recommended, in particular for locations where there are interactions with other sources of flooding and locations where significant hazards have been identified.

There is an opportunity to work with the Environment Agency in developing an integrated system for collecting and managing data, based on the systems that are already in place for fluvial and tidal flooding.

2) A better understanding of how the drainage system operates will be gained by obtaining and interrogating the relevant Thames Water models. These models will be critical for the further stages of the draft SWMP which will also benefit the PFRA.

## 8.3 Incident Recording

An action plan for the recording of incidents is likely to cover all London boroughs by using a secure website, which could be developed to assist in the logging of information consistently.

It is recommended that the recording of flood incidents should follow the principles given in the INSPIRE European Directive (these are listed in the final guidance document for PFRA). The use of a spreadsheet similar to the PFRA spreadsheet (the spreadsheet that will be used for reporting significant flood risk to the EU) is proposed to the borough for consideration as the vehicle for recording flood incidents. A template has been provided by the GLA. The reason is that this format are fully aligned to the INSPIRE directive.

## 8.4 Other Flood Risk Regulation Requirements

Other planned actions that will be required to comply with Schedule 3 of the Flood & Water Management Act are:

1) Development of an action plan on how the borough will perform its duties as the SuDS approval body (approval, adoption and maintenance of SuDS which serve more than one property).

2) Links with Flood Risk Assessments and SuDS approvals to be developed as an integrated approach to the approval of SuDS proposals.

The above actions can not be progressed until Defra guidance on the SuDS approval body is released at the end of 2011.

# 9.0 References

The Royal Borough of Kensington & Chelsea Strategic Flood Risk Assessment, Final Report (August 2009) at http://www.rbkc.gov.uk/PDF/RBKCSFRA_Final_reduced.pdf

Brown, S. Beswick, M. et al. (2008) Met Office Submission to the Pitt Review - Executive Summary, The extreme rainfall of Summer 2007 and future extreme rainfall in a changing climate

Defra (2006) Flood and Coastal Defence Appraisal Guidance, FCDPAG3 Economic Appraisal, Supplementary Note to Operating Authorities – Climate Change Impacts. October 2006. Available from http://www.defra.gov.uk/environment/flooding/documents/policy/guidance/fcdpag/fcd3cl

Defra / WAG (2010) Selecting and reviewing Flood Risk Areas for local sources of flooding – Guidance to Lead Local Flood Authorities. Available from http://www.defra.gov.uk/environment/flooding/documents/research/flood-risk-method.pdf

Defra (2010) Surface Water Management Plan Technical Guidance

Environment Agency (2009) Thames Catchment Flood Management Plan

Environment Agency (2010) Preliminary Flood Risk Assessment - Final Guidance (Report – GEHO1210BTGH-E-E). Available from http://publications.environment-agency.gov.uk/pdf/GEHO1210BTGHe-e.pdf

Environment Agency (2010) Preliminary Flood Risk Assessment – Annexes to the Final Guidance (Report – GEHO1210BTHF-E-E). Available from http://publications.environment-agency.gov.uk/pdf/GEHO1210BTHFe-e.pdf

Environment Agency Building Trust with Communities

Miller, H.L. (eds.). Summary for Policymakers. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. 9. Available for download from http://www.ipcc.ch/ipccreports/ar4-wg1.htm

The Pitt Review (2008) Learning lessons from the 2007 floods

# Annex A – Records of past floods and their significant consequences (Preliminary Assessment Spreadsheet)

Please refer to Annex A of the Preliminary Assessment Spreadsheet which has been supplied alongside this report.

# Annex B – Records of future floods and their significant consequences (Preliminary Assessment Spreadsheet)

Please refer to Annex B of the Preliminary Assessment Spreadsheet which has been supplied alongside this report.

# Annex C – Records of Flood Risk Area and its rationale (Preliminary Assessment Spreadsheet)

Please refer to Annex C of the Preliminary Assessment Spreadsheet which has been supplied alongside this report.

# Annex D – Review Checklist

Please refer to Annex D spreadsheet which has been supplied alongside this report.

# Annex E – GIS Layer of Flood Risk Area(s)

Please refer to Annex E GIS layer which has been supplied alongside this report. This GIS layer is the same as the Environment Agency Indicative Flood Risk Area layer.