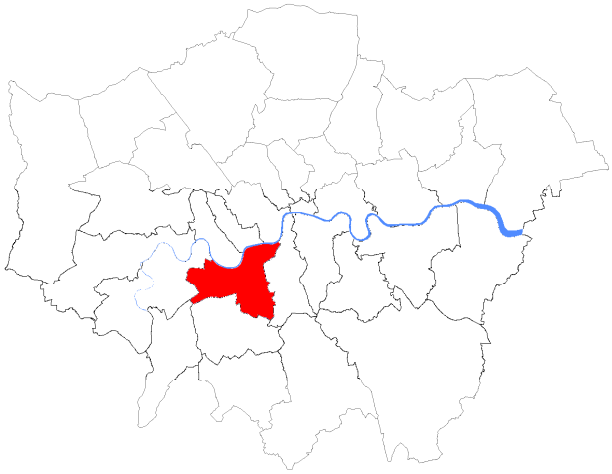
PRELIMINARY FLOOD RISK ASSESSMENT



DRAIN LONDON

LONDON BOROUGH OF WANDSWORTH

GREATER LONDON AUTHORITY

Thames Water

LONDON COUNCILS

Environment Agency

THE BRIGHTER BOROUGH

Wandsworth

Quality Management

DOCUMENT INFORMATION

Title:	London Borough of Wandsworth PFRA
Owner:	
Version:	1.0
Status:	Draft Final Report
Project Number:	D134785
File Name:	DLT2-GP7-PFRA-WandsworthReport-v1pt0.doc

REVISION HISTORY

Summary of Changes	Completed By	Date of Issue	Version
Interim Draft Report	Sarah Kelly	18-03-2011	0.1
Final Draft including comments from Wandsworth BC	Sarah Kelly	19-04-2011	0.2
Final Report, incorporating comments from Wandsworth BC	Sarah Kelly	12-05-2011	1.0

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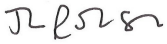
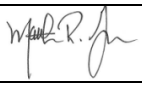
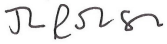
Jon Robinson	PD of URS / Scott Wilson		12-05-2011
Sarah Kelly	PM of URS / Scott Wilson		12-05-2011
Michael Arthur	Tier 1 PM		
Kevin Reid	GLA PM		
Mathew Graham	URS / Scott Wilson Reviewer		17-03-2011
Jon Robinson	URS / Scott Wilson Approver		19-03-2011

DISTRIBUTION

Name	Organisation and Role
	Wandsworth Borough Council, Drain London Project Lead

RELATED DOCUMENTS

Doc Ref	Document Title	Author	Date of Issue	Version

Executive Summary

This document forms a Preliminary Flood Risk Assessment (PFRA) report for the London Borough of Wandsworth as required in accordance with the Flood Risk Regulations 2009.

The PFRA provides a high level summary of significant flood risk, based on available and readily derivable information, describing both the probability and harmful consequences of past and future flooding. The scope of the PFRA is to consider flooding from the following sources; surface runoff, groundwater, sewers and ordinary watercourses and any interaction these have with main rivers and the sea.

According to readily available datasets, the London Borough of Wandsworth has experienced a number of past surface water flood events (some of which affected local infrastructure), however only the flood event of the 20th of July 2007 has been found to have significant harmful consequences for human health, economic activity, the environment and cultural heritage and has therefore been recorded in Annex 1 of the PFRA spreadsheet.

It has been agreed, in conjunction with the Environment Agency and the London Borough of Wandsworth, that the Surface Water Management Plan outputs from the Drain London Project will form the locally agreed surface water information for the London Borough of Wandsworth. A review of locally agreed surface water information demonstrates that 44,840 residential properties and 3,600 non-residential properties in the London Borough of Wandsworth could be at risk of surface water flooding of greater than 0.03m depth during a rainfall event with a 1 in 200 annual chance of occurring. Of those, 1,070 residential properties and 130 non-residential properties are estimated to be at risk of flooding to a depth of greater than 0.5m during the same modelled rainfall event.

The London Borough of Wandsworth is included in the Flood Risk Area for Greater London. No changes are proposed to this Flood Risk Area.

Glossary

Term	Definition
AEP	Annual Exceedance Probability
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
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 below the level of the ground.
Defra	Department for Environment, Food and Rural Affairs
DEM	Digital Elevation Model
DG5 Register	A water-company held register of properties which have experienced sewer flooding due to hydraulic overload, or properties which are 'at risk' of sewer flooding more frequently than once in 20 years.
DTM	Digital Terrain Model
EA	Environment Agency
Indicative Flood Risk Areas	Areas determined by the Environment Agency as indicatively having a significant flood risk, based on guidance published by Defra and WAG and the use of certain national datasets. These indicative areas are intended to provide a starting point for the determination of Flood Risk Areas by LLFAs.
FMfSW	Flood Map for Surface Water
Flood defence	Infrastructure used to protect an area against floods as floodwalls and embankments; they are designed to a specific standard of protection (design standard).
Flood Risk Area	An area determined as having a significant risk of flooding in accordance with guidance published by Defra and WAG.
Flood Risk Regulations	Transposition of the EU Floods Directive into UK law. The EU Floods Directive is a piece of European Community (EC) legislation to specifically address flood risk by prescribing a common framework for its measurement and management.
Floods and Water Management Act	Part of the UK Government's response to Sir Michael Pitt's Report on the Summer 2007 floods, the aim of which is to clarify the legislative framework for managing surface water flood risk in England.
Fluvial Flooding	Flooding resulting from water levels exceeding the bank level of a main river
FRR	Flood Risk Regulations
IDB	Internal Drainage Board
IUD	Integrated Urban Drainage
LB	London Borough
LDF	Local Development Framework

Term	Definition
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 responsible for taking the lead on local flood risk management
LiDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority
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 has responsibilities and powers
NRD	National Receptor Dataset – a collection of risk receptors produced by the Environment Agency
Ordinary Watercourse	All watercourses that are not designated Main River, and which are the responsibility of Local Authorities or, where they exist, IDBs
Partner	A person or organisation with responsibility for the decision or actions that need to be taken.
PFRA	Preliminary Flood Risk Assessment
Pitt Review	Comprehensive independent review of the 2007 Summer floods by Sir Michael Pitt, which provided recommendations to improve flood risk management in England.
Pluvial Flooding	Flooding from water flowing over the surface of the ground; often occurs when the soil is saturated and natural drainage channels or artificial drainage systems have insufficient capacity to cope with additional flow.
PPS25	Planning and Policy Statement 25: Development and Flood Risk
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
Resilience Measures	Measures designed to reduce the impact of water that enters property and businesses; could include measures such as raising electrical appliances.
Resistance Measures	Measures designed to keep flood water out of properties and businesses; could include flood guards for example.
Risk	In flood risk management, risk is defined as a product of the probability or likelihood of a flood occurring, and the consequence of the flood.
Risk Management Authority	As defined by the Floods and Water Management Act
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
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
WaSC	Water and Sewerage Company

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Annexes

1. Introduction

1.1 What is a Preliminary Flood Risk Assessment?

1.1.1 A Preliminary Flood Risk Assessment (PFRA) is a high level screening exercise to identify areas of significant flood risk within a given study area. The PFRA involves collecting information on past (historic) and future (potential) floods, assembling the information into a preliminary flood risk assessment report, and identifying Flood Risk Areas.

1.1.2 This preliminary assessment report for the London Borough of Wandsworth provides a high level summary of significant flood risk, based on available and readily derivable information, describing both the probability and harmful consequences of past and future flooding. The development of new information is not required, but new analysis of existing information may be needed.

1.1.3 This PFRA has been based on existing and readily available information and brings together information from a number of available sources such as the Environment Agency's national information (for example Flood Map for Surface Water) and existing local products such as Strategic Flood Risk Assessments (SFRAs) and Surface Water Management Plans (SWMPs). The methodology for producing this PFRA has been based on the Environment Agency's Final PFRA Guidance and Defra's Guidance on selecting Flood Risk Areas, both published in December 2010.

1.2 Background

1.2.1 The primary driver behind the PFRA is the Flood Risk Regulations 2009, which came into law on the 10th December 2009 and seek to transpose the EC Floods Directive (Directive 2007/60/EC on the assessment and management of flood risks) into domestic law in England and Wales and to implement its provisions.

1.2.2 In particular the Regulations place duties on the Environment Agency and Lead Local Flood Authorities (LLFAs) to prepare a number of documents including:

- Preliminary Flood Risk Assessments;
- Flood hazard and flood risk maps; and
- Flood Risk Management Plans.

1.2.3 The purpose of the PFRA report under the Regulations is to provide the evidence for identifying Flood Risk Areas. The report will also provide a useful reference point for all local flood risk management and inform local flood risk strategies.

1.2.4 The scope of the PFRA is to consider past flooding and potential future flooding from the sources of flooding other than main rivers, the sea and reservoirs. In particular this includes surface runoff, flooding from groundwater and ordinary watercourses and any interaction these have with local drainage systems.

1.3 OBJECTIVES

1.3.1 The key objectives of the PFRA are summarised as follows:

- Collect information on past (historic) and future (potential) floods within the study area and record it within the PFRA spreadsheet;
- Assemble the information into a PFRA report;
- Review the indicative Flood Risk Areas delineated by the Environment Agency and, where necessary, provide explanation and justification for any amendments required to these;
- Provide a summary of the systems used for data sharing and storing and the provision for quality assurance, security and data licensing arrangements;
- Describe arrangements for partnership and collaboration for ongoing collection, assessment and storage of flood risk data and information;
- Identify relevant partner organisations involved in future assessment of flood risk; and summarise means for future and ongoing stakeholder engagement; and
- Provide a useful reference point for all local flood risk management and inform future local strategies.

1.4 STUDY AREA

1.4.1 The study area is defined by the administrative boundary of the London Borough of Wandsworth. It is located in the southern part of Greater London and covers an area of approximately 34km^2. Wandsworth has five town centres of Clapham Junction, Balham, Tooting, Wandsworth, and Putney, with smaller district centres including Earlsfield, Southfields, and Roehampton. One third of the borough comprises residential land, whilst one quarter comprises open space, namely Battersea Park, Wandsworth Common, Tooting Common, the west boundary of Clapham Common and the northern boundary of Wimbledon Common. Two main river watercourses run through the Borough: the River Wandle and the Beverley Brook.

1.4.2 The borough contains a resident population of approximately 280,000, and around 130,000 households, of which 21% comprise public sector housing. There are 112 schools in the borough. The most significant commercial and industrial employers in the borough include distribution, retail, hotel and restaurant and, banking, finance and insurance. Most industrial and commercial activity is concentrated at Nine Elms and East Battersea, the Wandle Valley and in Town Centres and Local Centres[1].

1.4.3 Strategic road and rail networks, controlled by the Mayor for London via Transport for London (TfL) and rail operators, traverse the borough providing direct links to central London. There are eight overland railway stations and 6 underground stations in the borough.

1.4.4 The majority of the borough is low lying except the area in the south west which contains Wimbledon and Wimbledon Common. The borough is bisected by the River Wandle which runs south to north through the borough and forms a natural valley, with higher elevations to the east and west.

[1] Best available estimates at time of publication. See London Councils Website for further information.

1.4.5 The bedrock geology is predominantly London Clay, with the superficial geology overlying the bedrock River Terrace deposits. A ribbon of Alluvium is distributed through the centre of the borough, along the course of the River Wandle.

1.4.6 The study area falls into the Thames River Basin District (RBD) (as defined by the Environment Agency) and is located in the Environment Agency Thames Region. The water utility provider is Thames Water Utilities Ltd.

2. LLFA Responsibilities

2.1 LEGISLATIVE BACKGROUND

2.1.1 The key drivers behind the preliminary flood risk assessment are two pieces of new legislation, the Flood Risk Regulations 2009 which came into law on the 10th December 2009, and the Flood & Water Management Act (FWMA) which gained Royal Assent on the 8th April 2010.

2.1.2 The Flood Risk Regulations 2009 was created to transpose the EC Floods Directive (Directive 2007/60/EC) into domestic law in England and Wales. The Floods Directive provides a framework to assess and manage flood risks in order to reduce adverse consequences for human health, the environment (including cultural heritage) and economic activity.

2.1.3 The Flood and Water Management Act 2010 makes specific provision for the recommendations provided by Sir Michael Pitt in his independent review of the flooding experienced across much of England and Wales in 2007.

2.1.4 Under these pieces of legislation, all Unitary Authorities are designated 'Lead Local Flood Authorities' (LLFAs) and have formally been allocated a number of key responsibilities with respect to local flood risk management.

2.2 LEADERSHIP & PARTNERSHIP

2.2.1 The Flood and Water Management Act 2010 defines the unitary authority, in this case the London Borough of Wandsworth, as the LLFA. As such, the London Borough of Wandsworth is responsible for leading local flood risk management, including establishing effective partnerships within their local authority as well as with external stakeholders such as the Environment Agency, Thames Water Utilities Ltd, Transport for London, Network Rail and London Underground as well as others. Ideally these working arrangements should be formalised to ensure clear lines of communication, mutual co-operation and management through the provision of Level of Service Agreements (LoSA) or Memorandums of Understanding (MoU).

Existing Flood Risk Management within the London Borough of Wandsworth

2.2.2 At present the responsibility for flood risk management at Wandsworth is shared across three departments:

- **Planning** – deals with all strategic flood issues and planning related issues;
- **Emergency Planning** – react to flooding incidences under the Wandsworth Council Immediate Response call out arrangements, which covers all emergencies including flooding and will usually involve assistance with Operational Services. Also required to assess potential risks and what actions could be taken to alleviate or mitigate flood risk; and
- **Operational Services** – deal with attendance on site, with gully sucker, sandbags, signing and traffic management measures, including liaison with emergency services.

2.2.3 Discussions are currently underway to determine future governance arrangements for local flood risk management in the London Borough of Wandsworth. However, it is anticipated that the above arrangements will continue in the short term until the Emergency Planning Function is transferred to Operational Services who will then assume total responsibility for all elements of emergency response to flooding incidences.

Strategic Flood Group

2.2.4 As part of the Drain London Project, the London Borough of Wandsworth have been working closely with neighbouring boroughs to forge partnerships with respect to local flood risk management as part of the preparation of Surface Water Management Plans for all 33 London Boroughs.

2.2.5 As part of this work, suggestions have been put forward for a South West London Strategic Flood Group that would report to the Regional Flood Defence Committee through Councillor Osborne at Royal Borough of Kingston. A potential structure may look something like that shown in Figure 2-1.

Figure 2-1 - Organogram of Potential South West London Flood Partnership

2.3 STAKEHOLDER ENGAGEMENT

2.3.1 As part of the preparation of PFRAs and SWMPs across London, stakeholders have been engaged representing the following organisations and authorities:

- Environment Agency
- Thames Water Utilities Ltd
- Neighbouring London Boroughs
- British Waterways
- London Fire Brigade
- Network Rail
- London Underground
- Transport for London (TfL)
- Highways Agency
- Natural England

2.4 PUBLIC ENGAGEMENT

2.4.1 Members of the public may also have valuable information to contribute to the PFRA and to an improved understanding and management of local flood risk within the study area. Public engagement can afford significant benefits 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.

2.4.2 However it is also recognised that it is crucial to plan the level and timing of engagement with communities predicted to be at risk of flooding from surface water, groundwater and ordinary watercourses. This is to ensure that the potential for future management options and actions is adequately understood and costed without raising expectations before solutions can reasonably be implemented.

2.4.3 It is important to undertake some public engagement when formulating local flood risk management plans, following the designation of Flood Risk Areas within the study area as this will help to inform future levels of public engagement. It is recommended that the London Borough of Wandsworth follow the guidelines outlined in the Environment Agency's "Building Trust with Communities" 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

2.5.1 Aside from forging partnerships and coordinating and leading on local flood management, there are a number of other key responsibilities that have arisen for LLFAs from the Flood and Water Management Act 2010, and the Flood Risk Regulations 2009. These responsibilities include:

- **Investigating flood incidents** – LLFAs have a duty to investigate and record details of significant flood events within their area. This duty includes identifying which authorities have flood risk management functions and what they have done or intend to do with respect to the incident, notifying risk management authorities where necessary and publishing the results of any investigations carried out.
- **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** – LLFAs are designated the Sustainable Drain age Systems (SuDS) Approving Body (SAB) for any new drainage system, and therefore must approve, adopt and maintain any new SuDS within their area. This responsibility is anticipated to commence from April 2012.
- **Local Flood Risk Management (LFRM) strategies** – LLFAs are required to develop, maintain, apply and monitor a strategy for local flood risk management in its area. The LFRM 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 flood risk from surface runoff and groundwater, consistent with the LFRM strategy for the area.

- **Designation powers** – LLFAs, as well as district councils and the Environment Agency have powers to designate structures and features that affect flooding in order to safeguard assets that are relied upon for flood risk management. Once a feature is designated, the owner must seek consent from the authority to alter, remove or replace it.

3. Methodology & Data Review

3.1 Data Sources & Availability

3.1.1 Table 3-1 provides a summary of the data sources held by partner organisations including a description of the dataset and its availability at the time of writing.

Table 3-1 Data Sources

	Dataset	Description
Environment Agency	Environment Agency Flood Map (Fluvial)	Shows the extent of flooding from rivers with a catchment of more than 3km^2 and from the sea.
	Areas Susceptible to Surface Water Flooding	A national outline of surface water flooding held by the EA and developed in response to Pitt recommendations.
	Flood Map for Surface Water	A second generation of surface water flood mapping which was released at the end of 2010.
	Areas Susceptible to Groundwater Flooding	Mapping showing areas susceptible to groundwater flooding.
	National Receptors Dataset	A nationally consistent dataset of social, economic, environmental and cultural receptors including residential properties, schools, hospitals, transport infrastructure and electricity substations.
	Indicative Flood Risk Areas	National mapping highlighting key flood risk areas, based on the definition of 'significant' flood risk agreed with the Defra.
	Historic Flood Map	Attributed spatial flood extent data for flooding from all sources.
London Borough of Wandsworth	Strategic Flood Risk Assessments (SFRA)	The London Boroughs of Wandsworth, Merton, Sutton and Croydon Level 1 SFRA (December 2008) contains useful information on historic flooding within Wandsworth, including local sources of flooding from surface water and groundwater.
	Historical flooding records	Historical records of flooding from surface water, groundwater and ordinary watercourses. These are predominantly based on the surface water flooding records collected during the July 2007 flooding event.
	Anecdotal information relating to local flood history and flood risk areas	Anecdotal information from authority members regarding areas known to be susceptible to flooding from excessive surface water, groundwater or flooding from ordinary watercourses.
	Local Climate Impacts Profiles (LCLIP) Report for London Local Authorities	The LCLIP report for the London Borough of Wandsworth (March 2010), identifies weather-related impacts and their associated consequences on infrastructure and services across the London Borough of Wandsworth.
Thames Water	DG5 Register for Thames Water Utilities area	DG5 Register logs and records of sewer flooding incidents in the London Borough of Wandsworth.
London Fire Brigade	Historical flooding call-out records	Records of all London Fire Brigade callouts for 'flooding' events since 2000. However, no flooding source is provided, so could be a result of water mains bursting as well as heavy rainfall / surface water flooding.
Network Rail	Areas Prone To Flooding	A list of areas prone to flooding across their South East Territory. One record for Wandsworth (Clapham Junction to Battersea Rise) where runoff from highway is known to cause flooding issues.
London Underground	Flooding records – July 2007	Records relating to station closures (location and duration) on 20th July 2007 due to heavy rainfall

3.2 LIMITATIONS

3.2.1 A number of issues arose during the data collection process, as described below:

Incomplete Datasets / Lack of Data

3.2.2 The London Borough of Wandsworth holds digital records (in GIS) of locations affected by flooding from the 20th July 2007 flood event and locations known to regularly flood during heavy rainfall. The London Fire Brigade also have records of flooding in August 2002, however the source and extent of flooding is not known. However, there are limited records of flooding either prior to or following this event in council records. There is evidence that flooding has occurred on numerous other occasions (supported by local newspaper articles) but little information is available regarding the severity of impact of these events. This has resulted in incomplete flood record datasets and corresponding gaps in flood data.

Recording of Flooding Incidents

3.2.3 Information regarding flood incidents in the past have been collated and recorded as part of the Strategic Flood Risk Assessment but there are no formal arrangements in place for recording flood incidents comprehensively. Operational Services record all flooding call out incidents on a digital database and paper file however this record does not include an investigation into causes or proposed mitigation measures.

3.2.4 Discussions are currently underway to determine future governance arrangements for local flood risk management in the London Borough of Wandsworth; this will include how recording of flood incidents will be undertaken in the future.

Records of Consequences of Flooding

3.2.5 No data providers were able to provide comprehensive details of the consequences of specific past flood events, which made accurately assessing the consequences of historic flooding difficult.

3.3 SECURITY, LICENSING AND USE RESTRICTIONS

3.3.1 A number of datasets used in the preparation of this PFRA are subject to licensing agreements and use restrictions.

3.3.2 The following national datasets provided by the Environment Agency are available to local authorities and their consultants for emergency planning and strategic planning purposes:

- Flood Map for Rivers and the Sea
- Areas Susceptible to Surface Water Flooding
- Flood Map for Surface Water
- National Receptor Database

3.3.3 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.

3.3.4 A number of the data sources used are publicly available documents, such as:

- Strategic Flood Risk Assessment
- Catchment Flood Management Plan
- Surface Water Management Plan

3.3.5 The use of some of the datasets made available for this PFRA has been restricted and is time limited, licensed to the London Borough of Wandsworth via the Greater London Authority for use under the Drain London project, which includes the production of a PFRA for the London Borough of Wandsworth. The restricted datasets include records of property flooding held by the Council and by Thames Water Utilities Ltd, and data licensed by the Environment Agency. Necessary precautions must be taken to ensure that all information given to third parties is treated as confidential. The information must not be used for anything other than the purpose stated in the agreement. No information may be copied, reproduced or reduced to writing, other than what is necessary for the purpose stated in the agreement.

3.4 QUALITY ASSURANCE

3.4.1 The datasets used to inform this PFRA were collected centrally for all London Boroughs as part of the Tier 1 Drain London work package of works. All data received was subject to quality assurance measures to monitor and record the quality and accuracy of the data and information. A data quality score was given to all the data which is a qualitative assessment based on the Data Quality System provided in the SWMP Technical Guidance (March 2010). This system is explained in Table 3-2.

Table 3-2 Data Quality System (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	2D Pluvial Modelling Outputs
2	Data with known deficiencies	Best replaced as soon as new data is available	Historic Flood Records
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	Impact of a historic flood event

3.4.2 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 3.2, some of the datasets collected for this PFRA were of poor quality, and this has been identified and recorded using this system.

4. Past Flood Risk

4.1 SUMMARY OF PAST FLOODS

4.1.1 Table 4-1 provides a summary of past flood incidents in the study area.

Table 4-1 Past Floods & Consequences

Flood Event (Source of flooding provided in brackets)	Description
7th August 2002 (*Source unknown*)	Flooding incidents were recorded by the London Fire Brigade across the London Borough of Wandsworth. The exact source of these incidents in unknown.
20th July 2007 (*Surface water*)	Intense periods of rainfall caused flash floods and the capacity of the existing drainage system to be exceeded in several locations across the borough. This caused overland flow and ponding in low lying areas and impacted residents, businesses and the Council. The equivalent of three months of rain fell in just two hours.
	London Underground records report Tooting Bec and Tooting Broadway railway stations being closed due to flooding during 20th July 2007.
	The council depot site containing technical services equipment flooded with around 18 inches of flood water at the gate running up close to council buildings. Damage was incurred to council equipment and vehicles.
	The emergency response centre took over 400 calls from the public.
	The total costs of repairs for the Council amounted to over £400,000, much of which was covered by insurance. Schools, public buildings, residential properties and the transport network, and council vehicles all suffered damage.
20th July 2009 (*Surface water*)	Heavy rainfall event reported to have impacted the London Borough of Wandsworth. Southside Shopping Centre in Wandsworth and South Thames College were evacuated, with significant disruptions to transport and other damage caused, as a result of torrential downpours.
Regular Flooding (*Groundwater*)	There have been several groundwater flooding incidents reported in Wandsworth 2000 and 2010, the majority of these being clustered in the areas of Putney, Wandsworth, Balham, Battersea and Upper Tooting.

4.1.2 The following figures show records of past flooding within the London Borough of Wandsworth:

- Figure 1 - Surface Water Flooding and Fluvial Flooding Incidents
- Figure 2 - Groundwater Flooding Incidents and Increased Potential for Elevated Groundwater (iPEG) (*See Section 5.2 for further information*)
- Figure 3 - Sewer Flooding Incidents (DG5 data provided by Thames Water, June 2010)

4.2 SIGNIFICANT HARMFUL CONSEQUENCES

4.2.1 The Flood Risk Regulations require PFRAs to report detailed information on past flood events that had 'significant harmful consequences'. There is no national definition of what constitutes 'significant harmful consequences'; it is a matter for local decision based on local information collected through the PFRA process.

4.2.2 Due to the lack of information available, in the case of the London Borough of Wandsworth, only the flood event of 20th July 2007 described in Table 4-1 is considered to have had significant harmful consequences, in terms of significant human health, economic activity, environment or cultural heritage impacts and has therefore been included in Annex 1 of the PFRA spreadsheet.

4.2.3 A complete record of locations where flooding has occurred will be kept by the London Borough of Wandsworth as a future evidence base. This base will be built up in the future through ensuring full details of flood events are recorded; this will then be used to support and inform future PFRA cycles as well as Wandsworth's Local Flood Risk Management Strategy.

4.3 INTERACTIONS WITH OTHER FLOODING SOURCES

4.3.1 Flooding is often the result of water from more than one source, or water building up because another source (such as a river, or the sea) has prevented it from discharging normally. Information about past flooding will often be about an unknown source (i.e. it is not clear where the water came from), or flooding as a result of interactions between sources (in which case more than one source may be recorded).

4.3.2 Where flood records within the study area are known to be from more than one flood source, this has been recorded in the PFRA spreadsheet. Where the source of flooding is not known this has also been recorded.

5. Future Flood Risk

5.1 Summary of Future Flood Risk

5.1.1 Information about future flood risk, or potential flooding, is usually produced by computer models. The Environment Agency has several national datasets showing risk of flooding from surface water, groundwater, main rivers and ordinary watercourses that are available to LLFAs. These datasets have been used to undertake an assessment of the number of properties and any important receptors that may be at risk of future flooding. Further details are provided in Annex 2 of the PFRA spreadsheet.

Surface Water Flooding

5.1.2 The Environment Agency has undertaken a property count for each LLFA for both their national Flood Map for Surface Water (FMfSW) and Areas Susceptible to Surface Water Flooding (AStSWF) datasets. It is intended that these are used to provide an indication of the number of residential and non-residential properties that are a risk from surface water flooding within each LLFA.

5.1.3 Using the Environment Agency's property count information for the FMfSW dataset, it is estimated that 44,200 residential properties and 5,000 non-residential properties in the London Borough of Wandsworth could be at risk of surface water flooding of greater than 0.1m depth during a rainfall event with a 1 in 200 annual chance of occurring. Of those, 11,300 residential properties and 1,700 non-residential properties are estimated to be at risk of flooding to a depth of greater than 0.3m during the same modelled rainfall event.

5.1.4 Details are provided in Annex 2 of the PFRA spreadsheet.

Ordinary Watercourses

5.1.5 The Detailed River Network has been used to identify the ordinary watercourses and the Environment Agency Flood Map, showing flooding from rivers and the sea, has been used to identify the risk of future flooding from ordinary watercourses.

5.1.6 However there is insufficient data in the Flood Map regarding ordinary watercourses within the study area to make an accurate assessment of the future flood risk associated with these watercourses.

5.2 Locally Agreed Surface Water Information

Surface Water

5.2.1 In addition to these national datasets more locally specific surface water information is available for the study area. The London Borough of Wandsworth is currently undertaking a Surface Water Management Plan as part of the Drain London Programme. As part of this study, direct rainfall modelling has been undertaken to simulate surface water flooding in the study area.

5.2.2 It has been agreed, in conjunction with Environment Agency and Council members, that the SWMP outputs will form the locally agreed surface water information for the London Borough of Wandsworth.

5.2.3 Figures 4 and 5 show the results from this modelling for a rainfall event with a 1 in 200 annual chance of occurring. For a full methodology, the reader is referred to the Surface Water Management Plan for the London Borough of Wandsworth.

- Figure 4 - Maximum Flood Depth – 1 in 200 chance of rainfall event occurring in any given year (0.5% AEP)
- Figure 5 - Flood Hazard – 1 in 200 chance of rainfall event occurring in any given year (0.5% AEP)

5.2.4 Surface water modelling completed as part of Tier 2 of the Drain London Project affords an improved understanding of the level of flood risk facing the London Borough of Wandsworth. As part of the SWMP produced for each LLFA, a property count has been undertaken using the Environment Agency's National Receptors Dataset (NRD). Using the Drain London property count, it is estimated that 44,840 residential properties and 3,600 non-residential properties in the London Borough of Wandsworth could be at risk of surface water flooding of greater than 0.03m depth during a rainfall event with a 1 in 200 annual chance of occurring (assuming a property threshold of 100mm). Of those, 1,070 residential properties and 130 non-residential properties are estimated to be at risk of flooding to a depth of greater than 0.5m during the same modelled rainfall event. Further information on the property count methodology and property counts for other rainfall events are provided in the London Borough of Wandsworth SWMP.

5.2.5 The pluvial modelling undertaken as part of the Drain London project shows that the areas of Balham, Summerstown, Wandsworth Town, Tooting Graveney, Putney and Southwest Battersea could be at risk of surface water flooding.

Groundwater Flooding

Background

5.2.6 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.

5.2.7 The following four data sources have been utilised to produce the increased Potential for Elevated Groundwater map:

- 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.

5.2.8 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.

5.2.9 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.

How to Use and Interpret the Map

5.2.10 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.

5.2.11 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.

5.2.12 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. Additional areas within the London Boroughs have permeable geology and therefore could also produce elevated groundwater levels. However, to produce a realistic map, only where there is the highest degree of confidence in the assessment are the areas 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.

5.2.13 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.

5.2.14 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 runoff/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, in conjunction with the surface water mapping, to identify those areas where groundwater may emerge and if so what would be the major flow pathways that water would take.

Results

5.2.15 Figure 2 shows the iPEG mapping for the London Borough of Wandsworth, alongside groundwater flooding incidents reported in the borough in the last ten years. The iPEG mapping shows that there is increased potential for elevated groundwater along river valleys, namely the River Wandle through the centre of the borough, and in areas to the northeast and northwest of the borough.

- Figure 2 - Groundwater Flooding Incidents and Increased Potential for Groundwater Elevation (iPEG)

5.3 Impacts of Climate Change

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

5.3.2 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 line with projections from climate models.

5.3.3 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.

5.3.4 We have 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 can't 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%.

Key Projections for Thames River Basin District

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

- Winter precipitation increases of around 15% (very likely to be between 2 and 32%);
- Precipitation on the wettest day in Winter up by around 15% (very unlikely to be more than 31%);
- Relative sea level at Sheerness very likely to be up between 10 and 40cm from 1990 levels (not including extra potential rises from polar ice sheet loss);
- Peak river flows in a typical catchment likely to increase between 8 and 18%.

Implications for Flood Risk

5.3.6 Climate changes can affect local flood risk in several ways. Impacts will depend on local conditions and vulnerability.

5.3.7 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.

5.3.8 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.

5.3.9 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.

5.3.10 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.

Adapting to Change

5.3.11 Past emission 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.

5.3.12 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.

Pluvial Modelling Including Allowance for Climate Change

5.3.13 As part of the pluvial modelling completed for the SWMP for the London Borough of Wandsworth, a model scenario has been undertaken including an allowance for climate change. Figure 6 shows the results for the maximum flood depth during the rainfall event with a 1 in 100 annual chance of occurrence, including an allowance for climate change. Figure 7 shows the flood hazard rating and general flow direction for the same return period.

- Figure 6 Maximum Flood Depth – 1 in 100 Chance of rainfall event occurring in any given year (1% AEP) plus Climate Change
- Figure 7 Flood Hazard – 1 in 100 Chance of rainfall event occurring in any given year (1% AEP) plus Climate Change

5.3.14 As part of the SWMP produced for each LLFA, a property count has been undertaken using the Environment Agency's National Receptors Dataset (NRD). Using the Drain London property count, it is estimated that 45,920 residential properties and 3,700 non-residential properties in the London Borough of Wandsworth could be at risk of surface water flooding of greater than 0.03m depth during a rainfall event with a 1 in 100 annual chance of occurring including an allowance for climate change (assuming a 100mm building threshold). Of those, 1,270 residential properties and 160 non-residential properties are estimated to be at risk of flooding to a depth of greater than 0.5m during the same modelled rainfall event. Further information on the property count methodology and property counts for other return periods are provided in the London Borough of Wandsworth SWMP.

5.4 MAJOR DEVELOPMENTS

5.4.1 The London Borough of Wandsworth Core Strategy provides an indication of the housing capacity that is required to meet demand throughout the borough. A review of these housing targets will be undertaken following the publication of any replacement London Plan which sets significantly higher housing targets during the plan period. Currently, the London Borough of Wandsworth has identified the need to deliver 7,500 homes by 2016/17, with a further 3,750 between 2017/18 and 2021/22.

5.4.2 Growth is concentrated in the following areas (these are updated figures for the period to 2016/17 based on the figures in the Annual Monitoring Report Housing Trajectory (low scenario):

- Nine Elms – 1,300 homes;
- Central Wandsworth and the Wandle Delta – 1,800 homes;
- Thames Riverside – excluding Nine Elms and the Wandle Delta – 1,500 homes;

- Wandle Valley – 400 homes;
- Clapham Junction – 300 homes;
- East Putney and Upper Richmond Road – 100 homes; and
- A further 4,800 homes are expected to be delivered in the rest of the Borough.

5.4.3 The number of new homes in Nine Elms (part of the Vauxhall Nine Elms Battersea Opportunity Area) is expected to exceed 12,500 units over the 20 – 25 year development lifetime of the area.

5.5 LONG TERM DEVELOPMENTS

5.5.1 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.

5.5.2 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."*

5.5.3 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).

6. Review of Indicative Flood Risk Areas

6.1 Extent of Flood Risk Areas

6.1.1 The figure included in Annex 5 shows the Indicative Flood Risk Areas that have been identified by the Environment Agency.

6.1.2 The administrative area of Greater London, including the London Borough of Wandsworth, is shown to be included in an Indicative Flood Risk Area.

6.2 Review Comments

6.2.1 No changes are proposed to the Greater London Indicative Flood Risk Area. On a London Borough by London Borough basis, the Flood Risk Area would not exceed the national threshold, however no changes are proposed given that the Flood Risk Area for Greater London will be managed as a whole.

7. Identification of Flood Risk Areas

7.1 AMENDMENTS TO FLOOD RISK AREAS

7.1.1 The London Borough of Wandsworth is not proposing any amendments to the Indicative Flood Risk Area for Greater London.

7.2 NEW FLOOD RISK AREA

7.2.1 The London Borough of Wandsworth is not proposing any new Flood Risk Areas.

8. Next Steps

8.1 Scrutiny & Review

8.1.1 As the Local Lead Flood Authority, the London Borough of Wandsworth is required to review and approve this PFRA in accordance with their own internal processes, such as consideration by Cabinet, Council or an overview and scrutiny committee.

8.1.2 The PFRA will be reviewed by the Council's Strategic Planning and Transportation Overview and Scrutiny Committee and any recommendations will be considered by the Council's Executive for approval.

8.1.3 The PFRA process will be reviewed on a 6-year cycle and for future iterations of the PFRA for the London Borough of Wandsworth an increasing level of information will be required including information which was optional for this first cycle relating to past flooding.

8.1.4 In order to ensure that this information is available for future reviews, a number of steps have been implemented as part of the Action Plan for the Surface Water Management Plan for the London Borough of Wandsworth. A number of key actions have been identified in the following sections.

8.2 Data Collection & Management

8.2.1 At the present time there is no consistent approach across the Local Authority for recording flood risk incidents and managing historic datasets including details of the sources and consequences of flood events.

8.2.2 Operational Services will set up and maintain a flooding incident database which will include details of all flooding incidents from blocked gullies to full scale flooding incidents such as in 2007.

8.3 Other Requirements under the Flood Risk Regulations 2009

8.3.1 Table 8-1 provides a summary of the elements of work required from the London Borough of Wandsworth under the Flood Risk Regulations 2009, along with the timescales of their respective delivery. The first two elements of work are covered by the preparation of this PFRA report.

Table 8-1 Elements of Work required under the Flood Risk Regulations 2009

22nd June 2011	**Prepare Preliminary Assessment Report.**	*The PFRA should focus on local flood risk from surface water, groundwater, ordinary watercourses and canals.*
22nd June 2011	On the basis of the PFRA, identify **Flood Risk Areas.**	*Flood Risk Areas are areas of significant risk identified on the basis of the findings of the PFRA, national criteria set by the UK Government Secretary of State and guidance provided by the Environment Agency.*
22nd June 2013	Prepare **Flood Hazard Maps** and **Flood Risk Maps** for each Flood Risk Area.	*Used to identify the level of hazard and risk of flooding within each Flood Risk Area to inform Flood Risk Management Plans.*
22nd June 2015	Prepare **Flood Risk Management Plans** for each Flood Risk Area.	*Plans setting out risk management objectives and strategies for each Flood Risk Area.*

8.3.2 As part of the next phase of work, due for submission in June 2013, the London Borough of Wandsworth will be required to prepare Flood Hazard Maps and Flood Risk Maps for their local authority area; these are being produced as part of the Drain London project, but may require slight amendments or upgrading prior to submission to the European Commission in June 2013. The maps will be required to inform the Flood Risk Management Plan which will be due for submission in June 2015 setting out risk management objectives and strategies for the Flood Risk Area. The findings of this PFRA as well as that of the Surface Water Management Plan for the London Borough of Wandsworth should form the basis of the local flood risk management strategy for the area.

8.3.3 Further information can be found on the Environment Agency PFRA e-Learning module http://learning.environment-agency.gov.uk/courses/FCRM/capacity which has been developed as part of Defra's Capacity Building Strategy and is designed to provide users with an increased knowledge of the background and methodology involved in carrying out a Preliminary Flood Risk Assessment.

Figure 8-1 Environment Agency e-Learning module

9. References

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Annex 1 – Past Floods

Please refer to Annex 1 of the Preliminary Assessment Spreadsheet, which has been supplied alongside this report. As discussed in Section 4.2, only the 20th of July 2007 flooding event is considered to have significant harmful consequences and has been recorded in Annex 1 of the Preliminary Assessment Spreadsheet.

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Annex 2 – Future Floods

Please refer to Annex 2 of the Preliminary Assessment Spreadsheet, which has been supplied alongside this report.

Annex 3 – Flood Risk Areas

Please refer to Annex 3 of the Preliminary Assessment Spreadsheet, which has been supplied alongside this report.

Annex 4 – Review Checklist

Please refer to Annex 4 spreadsheet, which has been supplied alongside this report. Annex 4 contains the Review Checklist that has been provided by the Environment Agency to act as a checklist for reviewing PFRA submissions.

Annex 5 – GIS Layer of Flood Risk Areas

Please refer to Annex 5 GIS layer, which has been supplied alongside this report. This GIS layer is the same as the Environment Agency Indicative Flood Risk Area layer.

Annex 6 – Figures

Please refer to Annex 6 pdf document, which has been supplied alongside this report. The figures provided are as follows:

Figure 1 - Surface Water Flooding and Fluvial Flooding Incidents

Figure 2 - Groundwater Flooding Incidents and Increased Potential for Elevated Groundwater (iPEG)

Figure 3 - Sewer Flooding Incidents

Figure 4 - Maximum Flood Depth – 1 in 200 chance of rainfall event occurring in any given year (0.5% AEP)

Figure 5 - Flood Hazard – 1 in 200 chance of rainfall event occurring in any given year (0.5% AEP)

Figure 6 - Maximum Flood Depth – 1 in 100 Chance of rainfall event occurring in any given year (1% AEP) plus Climate Change

Figure 7 - Flood Hazard – 1 in 100 Chance of rainfall event occurring in any given year (1% AEP) plus Climate Change