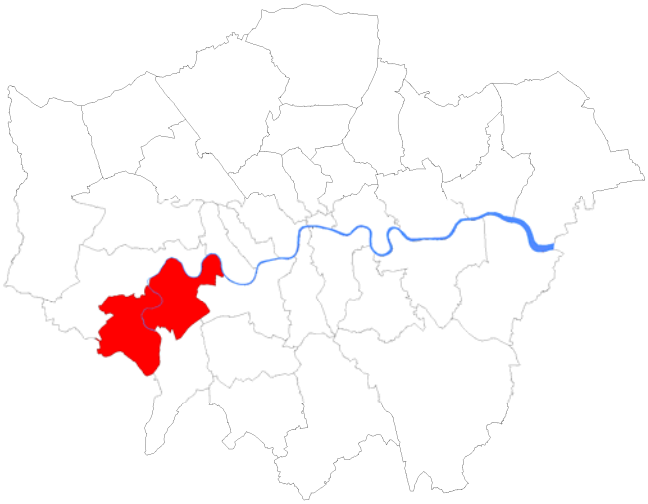
PRELIMINARY FLOOD RISK ASSESSMENT



DRAIN LONDON

LONDON BOROUGH OF RICHMOND UPON THAMES

GREATERLONDONAUTHORITY

Thames Water

LONDON COUNCILS

Environment Agency

LONDON BOROUGH OF RICHMOND UPON THAMES

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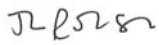
Jon Robinson	PD URS/Scott Wilson		17-05-11
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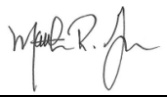
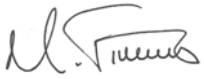
Matthew Graham	Scott Wilson Reviewer		14/03/11
Michael Timmins	Scott Wilson Approver		17/03/2011

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Executive Summary

This document forms a Preliminary Flood Risk Assessment (PFRA) report for London Borough of Richmond upon Thames 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 Richmond has experienced a number of past surface water flooding events, however they have not been deemed to have had significant consequences for human health, economic activity, the environment and cultural heritage and have therefore not been recorded in Annex 1 of the PFRA spreadsheet.

It has been agreed, in conjunction with Environment Agency and Council members, that the Drain London Surface Water Management Plan (SWMP) outputs from the Drain London Project will form the locally agreed surface water information for the London Borough of Richmond. A review of this information demonstrates that an estimated 28,770 residential properties and 2,170 non-residential properties in the London Borough of Richmond 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. Approximately 100 residential properties and 15 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. Details of these consequences are recorded in Annex 2 of the PFRA spreadsheet.

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

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
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
LFRZ	Local Flood Risk Zone

Term	Definition
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 PFRA report, and identifying Flood Risk Areas.

1.1.2 This PFRA report for London Borough of Richmond upon Thames 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 became 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 (LLFA) to prepare a number of documents including:

- Preliminary Flood Risk Assessments;
- Flood Hazard and Flood Risk Maps;
- 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;
- 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 Richmond upon Thames. LB of Richmond upon Thames is located in west London and covers an area of approximately 60km^2.

1.4.2 A large proportion of the borough comprises green and open spaces including Richmond Park, designated a National Nature Reserve and Site of Special Scientific Interest. Key fluvial systems in the study area include the Beverley Brook and the River Crane which feed into the River Thames which also passes through the borough.

1.4.3 The underlying geology is primarily impermeable London Clay, which is overlain by Alluvium and River Terrace deposits to the north of the River Thames. The borough is served by a Thames Water Utilities surface water drainage network.

1.4.4 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 PFRA are two pieces of new legislation, the Flood Risk Regulations 2009 which became 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 were 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' (LLFA) 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 London Borough of Richmond upon Thames, as the Lead Local Flood Authority (LLFA). As such, the London Borough of Richmond upon Thames 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).

2.2.2 The flood group is divided into a Strategic Management Group which is responsible for making overall decisions about flood risk management such as severe weather incident management, operational maintenance, future flood risk investments and planning; and the Operational Management Group which serves as the 'day-to-day' flood risk group delivering the flood risk system operations and maintenance on the ground.

2.2.3 The Strategic Flood Group was set up during the Drain London project, meets every 3 months (first meeting held on the 29th March 2011) and will continue with the aim of ensuring collaborative working across relevant stakeholders as described above.

2.2.4 Responsibility for flood risk management at the London Borough of Richmond upon Thames is shared across several departments; however Jon Freer, Assistant Director of Environment (Development & Street Scene) takes on the overall lead on local flood risk management activities within the Council and is representing the borough on the South London Strategic Flood Group.

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
- London Fire Brigade
- Network Rail
- London Underground
- Transport for London
- 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 Richmond upon Thames follow the guidelines outlined in the Environment Agency's "Building Trust with Communities" [1] 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 Lead Local Flood Authorities from the Flood & 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 SuDS Approving Body (SAB) for any new drainage system, and therefore must approve, adopt and maintain any new sustainable drainage systems (SuDS) within their area. 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 local flood risk management 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.

[1] Environment Agency, Building Trust with Communities
http://www.ncl.ac.uk/ihs/research/environment/rehmarc/pdfs/workingwithothers.pdf

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 with responsibility for local flood risk management in London Borough of Richmond upon Thames. The table includes 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 Richmond	Strategic Flood Risk Assessments (SFRA)	SFRAs may contain useful information on historic flooding, including local sources of flooding from surface water and groundwater.
	Historical flooding records	Historical records of flooding from surface water, groundwater and ordinary watercourses.
	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.
	Highways Flooding Reports	Highways Flooding Reports for a number of locations including analysis of the flood risk at each location.
Thames Water	DG5 Register for Thames Water Utilities areas	DG5 Register logs and records of sewer flooding incidents in each area.
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.
	Areas Prone To Flooding	A list of areas prone to flooding across their South East Territory.

	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:

3.2.2 The London Borough of Richmond log all incidents of flooding that are reported, however this only captures the incidents that they hear about and does not include specific details about the flooding incidents such as the individual areas that experience flooding or details about the source and consequences of the flooding. Furthermore, there is no standard method for the type of method of recording information that is received, and to whom it is circulated.

3.2.3 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 publically 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 Richmond upon Thames via the Greater London Authority for use under the Drain London project, which includes the production of a PFRA for the London Borough of Richmond upon Thames. 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. Not all of these events are considered to have had 'significant harmful consequences' and therefore not all have been included within Annex 1 of the PFRA spreadsheet.

4.1.2 It is noted that to date it has not been the duty of Local Authorities to record flooding incidents, and as such Table 4-1 is not a comprehensive list of historic flooding events in the Borough.

Table 4-1 Past Floods & Consequences

Flood Event	Description
Surface water flooding July 2007	Property and road flooding in Barnes including the following locations; Arundel Terrace, Castelnau, Lonsdale Road, Madrid Road, The Terrace.
Surface water flooding July 2007	Property and road flooding in Hampton; including Gloucester Road, Longford Close, Lower Teddington Road, Hammond Close, Warwick Close.
Surface water flooding July 2007	Property and road flooding in Heathfield, including Ellerman Avenue, Powder Mill Lane.
Surface water flooding July 2007	Flooding of Lower Richmond Park Road, Mortlake High Street, Queens Ride and Worple Street in the Mortlake and Barnes Common area.
Surface water flooding July 2007	Flooding of Cross Deep, Heath Road and Strawberry Vale in South Twickenham.
Surface water flooding July 2007	Flooding of Montague Road and Paradise Road in South Richmond
Surface water flooding July 2007	Flooding of Arlington Road, Beaconsfield Road and Whitton Road in North Twickenham.
Surface water flooding July 2007	Flooding of the following locations in Teddington; Albert Road, Broad Street, Elfin Grove, Ferry Road, High Street, Luther Road, Park Road, Stanley Road, Teddington Park, Thelma Grove.
Surface water flooding July 2007	Flooding of the following locations in Twickenham; Amyand Park Road, First Cross Road, Twickenham Road and Willow Way.
Surface water flooding July 2007	Flooding of the following locations in Whitton; Kneller Road, Nelson Road, Wills Crescent and Redway Drive.

4.1.3 The following figures (maps) are included in Annex 6 and show records of past flooding:

- 1 Surface Water & Fluvial Flooding Incidents;
- 2 Groundwater Flooding Incidents;
- 3 Sewer Flooding Incidents (DG5 Register 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 Although there is an indication of some loss of property economic loss in the floods in July 2007, the events described in Table 4.1 are not overall considered to have significant harmful consequences for human health, economic activity, the environment or cultural heritage and therefore have not 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 Richmond 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 Richmond'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 Flood Map for Surface Water (FMfSW) dataset, it is estimated that 22,100 residential properties and 2,800 non-residential properties in London Borough of Richmond upon Thames 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. Approximately 3,400 residential properties and 500 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 critical 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

5.2.1 Surface Water Flooding

5.2.2 In addition to these national datasets more locally specific surface water information is available for the study area. The London Borough of Richmond upon Thames 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.

5.2.3 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 London Borough of Richmond upon Thames.

5.2.4 Figures 4 and 5 included in Annex 6 show the results from this modelling for the rainfall event with a 1 in 200 annual chance of occurrence. For a full methodology, the reader is referred to the Surface Water Management Plan for London Borough of Richmond upon Thames.

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

5.2.5 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 Richmond. 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 28,770 residential and 2,170 non-residential properties in the London Borough of Richmond could be at risk of surface water flooding of greater than 0.03m^2 depth during a rainfall event with a 1 in 200 annual chance of occurring. Approximately 100 residential and 16 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 Richmond's SWMP.

Groundwater Flooding

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.

[2] Building thresholds have been represented in the modelling as 'stubs' raised 100mm above the average ground level within the building footprint. A depth of >0.03m will result in a water level 0.03m above the property threshold, which is therefore considered to flood.

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.

5.2.15 The iPEG mapping is presented in Figure 2.

5.3 Impact 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 Surface Water Management Plan for London Borough of Richmond upon Thames, a model scenario has been undertaken including an allowance for climate change. Figure 5 in Annex 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 6 shows the flood hazard rating 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 29,690 residential properties and 2,230 non-residential properties in the London Borough of Richmond could be at risk of surface water flooding of greater than 0.03m[3] depth during a rainfall event with a 1 in 100 annual chance of occurring including an allowance for climate change. Approximately 130 residential properties and 20 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 Richmond SWMP.

5.4 MAJOR DEVELOPMENTS

5.4.1 Recent or upcoming major development sites that may have the potential to affect local surface water flood risk have been listed below.

5.4.2 Sites as identified in the Richmond upon Thames Housing Land Supply (large sites)[4]:

[3] Building thresholds have been represented in the modelling as 'stubs' raised 100mm above the average ground level within the building footprint. A depth of >0.03m will result in a water level 0.03m above the property threshold, which is therefore considered to flood.

[4] The majority of these sites have been taken from the Housing Land Supply (large sites) analysis from the 2009/10 London Borough of Richmond upon Thames Annual Monitoring Report. Further relevant updates are noted for information in italics. *Note that the number of units is taken from the Housing Land Supply assessment; the higher figure has been taken where a range was provided.

- Budweiser Stag Brewery, Mortlake (90 units) – work on draft Planning Brief has suggested could reach 500 units as part of a mixed use development;
- Twickenham Sorting Office, 109 London Road, Twickenham (170 units);
- Twickenham Station (75 units);
- Twickenham Stadium / Rugby Football Union (RFU) Site (115 units);
- Former Inland Revenue Sorting Office, Ruskin Avenue, Kew (50 units);
- Former Seeboard Site, Sandy Lane, Teddington, Hampton Wick (198 units) – part completed;
- Sainsbury's, Manor Road/Lower Richmond Road (255 units);
- Platts Eyott, Hampton (70 units);
- Air Sea House, West Twickenham (67 units) - phase 1 (14 units) completed;
- Gordon Court, Fulwell, Hampton Hill (28 units);
- 1-5 And Outbuildings The Maples, Hampton Wick (10 units);
- Becketts Wharf and Osbourne House, Becketts Place, Hampton Wick (26 units) – part completed;
- Normansfield Hospital, Hampton Wick (89 units);
- 29 Sheen Lane, Mortlake, Barnes Common, (15 units);
- Norcutt House, South Twickenham (22 units);
- 14a King Street Coach House The Old Workshop and CP, South Richmond (13 units);
- 361 to 376 St Margarets Road, St Margaret's & North Twickenham (27 units);
- 209 Waldegrave Road, Teddington (22 units);
- 38-48 High Street, Whitton (12 units);
- Former Goods Yard Land At Queens Ride, Mortlake, Barnes Common (14 units);
- 293 Lower Richmond Road, North Richmond (52 units);
- Friars Lane Car Park, South Richmond (20 units);
- Richmond College, Egerton Road, St Margaret's & North Twickenham (50 units);
- 121 Heath Road, Twickenham (22 units);
- Land at Williams Lane Bowling Green, Mortlake (76 units);
- Royal Star & Garter, Richmond (60 units);
- The Avenue Centre, 1 Normansfield Avenue, Hampton Wick (17 units);
- Lower Richmond Road, Richmond (100 units) – International Mail Express: permission granted for mixed use including 77 units, other sites in locality may come forward for development;
- Greggs Bakery, Gould Road, Twickenham (200 units);
- Hampton Water Treatment Works, Hampton (55 units);
- Gifford House, Popes Avenue, Twickenham (29 units);
- Council Depot, Langhorn Drive, Twickenham (55 units);
- Richmond Station (20 units).

5.4.3 Sites as identified in the Richmond upon Thames Employment Land Supply:

- St Margarets Business Centre, Winchester Rd/ Moor Mead Rd, Twickenham;
- Heathlands Industrial Estate, Heath Rd, Twickenham;
- The Twickenham Centre, Norcutt Rd, Twickenham;
- Mereway Centre, Mereway Road/ Rowntree Rd, Twickenham;
- St George's Industrial Estate, The Green, Twickenham;
- Teddington Business Park, Station Rd, Teddington;
- St Clare Business Park, Holly Rd, Hampton Hill;
- Old Power House, Kew Gardens Station/ Station Approach;
- Sandycombe Centre, Sandycombe Lane, Kew;
- Port Hampton, Platts Eyot, Hampton;
- Kingsway Business Park/ Sandfield Industrial Estate, Oldfield Rd, Hampton;
- Mount Mews, 13-25 High Street, Hampton;
- Third Cross Road, Twickenham;
- Tideway Yard, Mortlake High Street;
- Marlborough Trading Estate, 159 Mortlake Road, Kew TW9.

5.4.4 It is noted that the above lists are not in any order of priority (i.e. in its relevance to surface water flood risk, size or number of housing units) and not exhaustive. There may be additional sites where a (re)development could have the potential to affect local surface water flood risk.

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 London Borough of Richmond upon Thames 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 with respect to the area covered by London Borough of Richmond upon Thames.

7. Identification of Flood Risk Areas

7.1 Amendments to Flood Risk Areas

7.1.1 London Borough of Richmond upon Thames is not proposing any amendments to the Indicative Flood Risk Area for Greater London.

7.2 New Flood Risk Area

7.2.1 London Borough of Richmond upon Thames is not proposing any new Flood Risk Areas.

8. Next Steps

8.1 Scrutiny & Review

8.1.1 As the Local Lead Flood Authority, London Borough of Richmond upon Thames 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 has been through internal management process within London Borough of Richmond Council and subsequently to the Cabinet Member for Environment to be agreed.

8.1.3 The PFRA process will be reviewed on a 6-year cycle and for future iterations of the PFRA for London Borough of Richmond upon Thames 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 London Borough of Richmond upon Thames. 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 During the course of the discussions on future governance for flood risk management it will be necessary to identify and detail ownership of the processes that will need to be embedded to ensure robust data collection and management arrangements are in place.

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 London Borough of Richmond upon Thames 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.

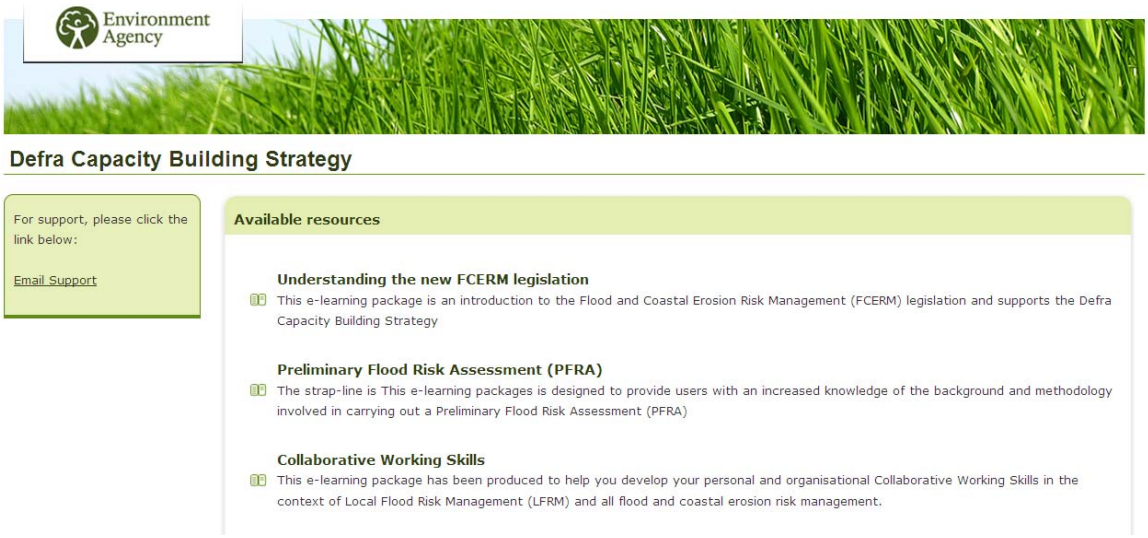
Table 8-1 Elements of Work required under the Flood Risk Regulations 2009

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, London Borough of Richmond upon Thames will be required to prepare Flood Hazard Maps and Flood Risk Maps for their local authority area. These will be required to inform 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 London Borough of Richmond upon Thames 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 PFRA.

Figure 8-1 Environment Agency e-Learning module



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Annex 1 – Past Floods

Please refer to Annex 1 of the Preliminary Assessment Spreadsheet. As discussed in Section 4.3, due to the lack of data available regarding the consequences of past flooding, no flood events have been considered to have 'significant harmful consequences', and therefore none have been recorded in this section.

ANNEX 1: Records of past floods and their significant consequences (preliminary assessment report spreadsheet)

Field:	Flood ID	Summary description	Name of Location	National Grid Reference	Location Description	Start date	Days duration	Probability	Main source of flooding	Additional source(s) of flooding	Confidence in main source of flooding
Mandatory / optional:	**Mandatory**	**Mandatory**	**Mandatory**	**Mandatory**	Optional	Optional for first cycle	Optional for first cycle	Optional for first cycle	Optional for first cycle	Optional	Optional
Format:	Unique number between 1-9999	Max 5,000 characters	Max 250 characters	12 characters: 2 letters, 10 numbers	Max 250 characters	'yyyy' or 'yyyy-mm' or 'yyyy-mm-dd'	Number with two decimal places	Max 25 characters	Pick from drop-down	Max 250 characters, same source terms	Pick from drop-down
Notes:	A sequential number starting at 1 and incrementing by 1 for each record.	Description of the flood and its adverse or potentially adverse consequences. Where available, information from other fields (Start date, Days duration, Probability, Main source, Main mechanism, Main characteristics, Significant consequences) should be repeated here.	Name of the locality associated with the flood, using recognised postal address names such as streets, towns, counties. If the flood affected the whole LLFA, then record the name of the LLFA.	National Grid Reference of the centroid (centre point, falls within polygon) of the flood extent, or of the area affected if there is no extent information.	A description of the general location that was flooded.	The date when the flood commenced - when land not normally covered by water became covered by water.	The number of days (duration) of the flood - that land not normally covered by water was covered by water. Values should be within the range 0.01 - 999.99 (permitting records to the nearest quarter of an hour, where appropriate).	The chance of the flood occuring in any given year - record X from "a 1 in X chance of occurring in any given year". Where this is difficult to estimate, a range can be recorded.	Pick the source from which the majority of flooding occurred. Refer to the PFRA guidance for definitions of sources.	If flooding occurred from, or interacted with, any other sources (other than the Main source of flooding), report the source(s) here, using the same source terms.	Pick a broad level of confidence in the Main source of flooding from; 'High' (compelling evidence of source - about 80% confident that source is correct), 'Medium' (some evidence of source but not compelling - about 50% confident that source is correct) 'Low' (source assumed - about 20% confident that source is correct) or 'Unknown'.
Example:	1	On the 14 April 1998 an intense storm system produced surface water flooding across Essex, concentrated in the west of the county. The flooding lasted about 6 hours, and 23 residential properties were recorded as suffering internal flooding, in Epping and North Weald. The surface runoff exceeded the drainage capacity in several places, and so probably had a 1 in 30 to 1 in 50 chance of occuring in any given year.	Essex	SX1234512345	Several towns and villages across west Essex	1998-04-15	0.25	20-50	Surface runoff		High
Records begin here:											

Annex 1 Past floods

Main mechanism of flooding	Main characteristic of flooding	**Significant consequences to human health**	Human health consequences - residential properties	Property count method	Other human health consequences	**Significant economic consequences**	Number of non-residential properties flooded	Property count method	Other economic consequences	**Significant consequences to the environment**	Environment consequences	**Significant consequences to cultural heritage**	Cultural heritage consequences
Optional for first cycle	Optional for first cycle	**Mandatory**	Optional	Optional	Optional	**Mandatory**	Optional	Optional	Optional	**Mandatory**	Optional	**Mandatory**	Optional
Pick from drop-down	Pick from drop-down	Pick from drop-down	Number between 1-10,000,000	Pick from drop-down	Max 250 characters	Pick from drop-down	Number between 1-10,000,000	Pick from drop-down	Max 250 characters	Pick from drop-down	Max 250 characters	Pick from drop-down	Max 250 characters
Pick a mechanism from; 'Natural exceedance' (of capacity), 'Defence exceedance' (floodwater overtopping defences), 'Failure' (of natural or artificial defences or infrastructure, or of pumping), 'Blockage or restriction' (natural or artificial blockage or restriction of a conveyance channel or system), or 'No data'.	Pick a characteristic from; 'Flash flood' (rises and falls quite rapidly with little or no advance warning), 'Natural flood' (due to significant precipitation, at a slower rate than a flash flood), 'Snow melt flood' (due to rapid snow melt), 'Debris flow' (conveying a high degree of debris), or 'No data'. Most UK floods are 'Natural floods'.	Were there any significant consequences to human health when the flood occurred, or would there be if it were to re-occur?	Record the number of residential properties where the building structure was affected either internally or externally by the flood, or that would be so affected if the flood were to re-occur.	Where residential or non-residential properties have been counted, it is important to record the method of counting, to aid comparisons between counts. Choose from; 'Detailed GIS' (using property outlines, as per Environment Agency guidance), 'Simple GIS' (using property points), 'Estimate from map', or 'Observed number'.	If there were other Significant consequences to human health, describe them including information such as the number of critical services flooded.	Were there any significant economic consequences when the flood occurred, or would there be if it were to re-occur?	Record the number of non-residential properties where the building structure was affected either internally or externally by the flood, or that would be so affected if the flood were to re-occur.	Where residential or non-residential properties have been counted, it is important to record the method of counting, to aid comparisons between counts. Choose from; 'Detailed GIS' (using property outlines, as per Environment Agency guidance), 'Simple GIS' (using property points), 'Estimate from map', or 'Observed number'.	If there were other Significant economic consequences, describe them including information such as the area of agricultural land flooded, length of roads and rail flooded.	Were there any significant consequences to the environment when the flood occurred, or would there be if it were to re-occur?	If there were Significant consequences to the environment, describe them including information such as national and international designated sites flooded, and pollution sources flooded.	Were there any significant consequences to cultural heritage when the flood occurred, or would there be if it were to re-occur?	If there were Significant consequences to cultural heritage, describe them including information such as the number and type of heritage assets flooded.
Natural exceedance	Natural flood	Yes	23	Observed number		No				No		No	

Comments	Data owner	Area flooded	Flood event outline confidence	Flood event outline source	Survey date	Photo ID	Lineage	Sensitive data	Protective marking descriptor	European Flood Event Code
Optional Max 1,000 characters Any additional comments about the past flood record.	Optional Max 250 characters	Optional Number with two decimal places The total area of the land flooded, in km^2	Optional Pick from drop-down Choose from; 'High' (data includes one of: Aerial video, Aerial photos, Professional survey, Flood level information, EA flood data recording staff notes), 'Medium' (data includes one of: EA/LA ground video, EA/LA ground photos, EA/LA flood event outline map, LA/professional partner officer site records, Public ground video), 'Low' (not confident) or 'Unknown'.	Optional Pick from drop-down	Optional 'yyyy' or 'yyyy-mm' or 'yyyy-mm-dd'	Optional Max 50 characters Provide references to relevant specific photographs, or to a set of relevant photographs. It may not be practical to reference all relevant photographs for each flood event.	Optional Max 250 characters Lineage is how and what the data is made from. Has this data been created by using data owned or derived from data owned by 3rd party (external) organisations? If yes please give details.	Optional Pick from drop-down Has the information been classified under the Government's Protective Marking Scheme? Include protective marking time limit where known. Note: If "Approved for Access" then report "Unmarked".	Optional Max 50 characters For use where organisations apply the Government's Protective Marking Scheme.	Auto-populated Max 42 characters This field will autopopulate using the LLFA name provided on the "Instructions" tab, and the Flood ID. It is an EU-wide unique identifier and will be used to report the flood information. Format: UK<ONS Code><P or F><LLFA Flood ID>. "ONS Code" is a unique reference for each LLFA. "P or F" indicates if the event is past or future. "LLFA Flood ID" is a sequential number beginning with 0001.
	Epping Forest District Council		Medium	Site survey	1998-04-20		Ordnance Survey AddressPoint; CEH 1:50k River Centreline; NextMap DTM.	Unmarked	Private	UKE10000012P0001

Annex 2 – Future Floods

Please refer to Annex 2 of the Preliminary Assessment Spreadsheet.

ANNEX 2: Records of future floods and their consequences (preliminary assessment report spreadsheet)

Field:	Flood ID	Description of assessment method	Name of Location	National Grid Reference	Location Description	Name	Flood modelled	Probability	Main source of flooding	Additional source(s) of flooding	Confidence in main source of flooding
Mandatory / optional:	**Mandatory**	**Mandatory**	**Mandatory**	**Mandatory**	Optional	Optional	Optional	**Mandatory**	**Mandatory**	Optional	Optional
Format:	Unique number between 1-9999	Max 1,000 characters	Max 250 characters	12 characters: 2 letters, 10 numbers	Max 250 characters	Max 250 characters	Max 250 characters	Max 25 characters	Pick from drop-down	Max 250 characters, same source terms	Pick from drop-down
Notes:	A sequential number starting at 1 and incrementing by 1 for each record.	Description of the future flood information and how it has been produced. Cover Regulation 12(6) requirements of (a) topography, (b) the location of watercourses, (c) the location of flood plains that retain flood water, (d) the characteristics of watercourses, and (e) the effectiveness of any works constructed for the purpose of flood risk management. Information from other relevant fields (Probability, Main source, Name) should be repeated here.	Name of the locality associated with the flood, using recognised postal address names such as streets, towns, counties. If the flood affects the whole LLFA, then record the name of the LLFA.	National Grid Reference of the centroid (centre point, falls within polygon) of the flood extent, or of the area affected if there is no extent information. If the flood affects the whole LLFA, then record the centroid of the LLFA.	A description of the general location that could be flooded.	Name of the model or map product or project which produced the future flood information	Background, or additional information on the probability of the flood modelled - such as whether Probability refers to probability of rainfall or water on the ground.	The chance of the flood occuring in any given year - record X from "a 1 in X chance of occurring in any given year".	Pick the source which generates the majority of flooding. Refer to the PFRA guidance for definitions of sources.	If the flood is generated by, or interacts with, any other sources (other than the Main source of flooding), report the source(s) here, using the same source terms.	Pick a broad level of confidence in the Main source of flooding from; 'High' (compelling evidence of source - about 80% confident that source is correct), 'Medium' (some evidence of source but not compelling - about 50% confident that source is correct) 'Low' (source assumed - about 20% confident that source is correct) or 'Unknown'.
Example:	1	See records below for examples of description of assessment method.	Essex	SX1234512345		Flood Map for Surface Water - 1 in 200 deep	Probability refers to the probability of the rainfall event, in this case producing flooding of greater than 0.3m depth.	200	Surface runoff		High
Records begin here:	1	• Topography is derived from LIDAR (in larger urban areas, on 1, 2 and 3m grids; original accuracy ± 0.15m) and Geoperspective data (original accuracy ± 1.5m), processed to remove buildings and vegetation, then degraded to a composite 5m DTM. Manual edits applied where flow paths clearly omitted e.g. below bridges. • Flow routes dictated by topography; no allowance made for manmade drainage. The DTM may miss flow paths below bridges. • Areas that may flood are defined by dynamically routing a 6.5 hour duration storm with 1 in 200 chance of occurring in any year, over the DTM using JBA's JFLOW–GPU model. • Manning's n of 0.1 is used throughout, to allow broad scale effects of buildings and other obstructions to be approximated. • No allowance made for drainage, pumping or other works constructed for the purpose of flood risk management. • The 'less susceptible' layer shows where modelled flooding is 0.1-0.3m deep; you must not interpret this as depth of flooding, rather as indicative of susceptibility to flooding	Richmond	TQ1772072687		Areas Susceptible to Surface Water Flooding (AStSWF) - Less	Probability refers to the probability of the rainfall event. This identifies areas which are 'less susceptible' to surface water flooding. For more information refer to "What are Areas Susceptible to Surface Water Flooding" Environment Agency December 2010.	200	Surface runoff		High
	2	• Topography is derived from LIDAR (in larger urban areas, on 1, 2 and 3m grids; original accuracy ± 0.15m) and Geoperspective data (original accuracy ± 1.5m), processed to remove buildings and vegetation, then degraded to a composite 5m DTM. Manual edits applied where flow paths clearly omitted e.g. below bridges. • Flow routes dictated by topography; no allowance made for manmade drainage. The DTM may miss flow paths below bridges. • Areas that may flood are defined by dynamically routing a 6.5 hour duration storm with 1 in 200 chance of occurring in any year, over the DTM using JBA's JFLOW–GPU model. • Manning's n of 0.1 is used throughout, to allow broad scale effects of buildings and other obstructions to be approximated. • No allowance made for drainage, pumping or other works constructed for the purpose of flood risk management. • The 'intermediate susceptibility' layer shows where modelled flooding is 0.3-1.0m deep; you must not interpret this as depth of flooding, rather as indicative of susceptibility to	Richmond	TQ1772072687		Areas Susceptible to Surface Water Flooding (AStSWF) - Intermediate	Probability refers to the probability of the rainfall event. This identifies areas with 'intermediate susceptibility' to surface water flooding.	200	Surface runoff		High
	3	• Topography is derived from LIDAR (in larger urban areas, on 1, 2 and 3m grids; original accuracy ± 0.15m) and Geoperspective data (original accuracy ± 1.5m), processed to remove buildings and vegetation, then degraded to a composite 5m DTM. Manual edits applied where flow paths clearly omitted e.g. below bridges. • Flow routes dictated by topography; no allowance made for manmade drainage. The DTM may miss flow paths below bridges. • Areas that may flood are defined by dynamically routing a 6.5 hour duration storm with 1 in 200 chance of occurring in any year, over the DTM using JBA's JFLOW–GPU model. • Manning's n of 0.1 is used throughout, to allow broad scale effects of buildings and other obstructions to be approximated. • No allowance made for drainage, pumping or other works constructed for the purpose of flood risk management. • The 'more susceptible' layer shows where modelled flooding is >1.0m deep; you must not interpret this as depth of flooding, rather as indicative of susceptibility to flooding	Richmond	TQ1772072687		Areas Susceptible to Surface Water Flooding (AStSWF) - More	Probability refers to the probability of the rainfall event. This identifies areas which are 'more susceptible' to surface water flooding.	200	Surface runoff		High

4	• Topography is derived from 64.5% LIDAR (on 0.25m-2m grids; original accuracy ± 0.15m) and 35.5% NEXTMap SAR (on 5m grid; original accuracy ± 1.0m), processed to remove buildings & vegetation, then combined on a 2m grid; buildings added with an arbitrary height of 5m based on OS MasterMap 2009 building footprints, then resampled to a 5m grid DTM. Manual edits applied where flow paths clearly omitted e.g. below bridges. • Flow routes dictated by topography; a uniform allowance of 12mm/hr has been made for manmade drainage in urban areas. Infiltration allowance reduces runoff to 39% in rural areas and 70% in urban areas. • Areas that may flood are defined by dynamically routing a 1.1 hour duration storm with 1 in 30 chance of occurring in any year over the DTM using JBA's JFLOW–GPU model. • Manning's n of 0.1 in rural areas; 0.03 in urban areas, to reflect explicit modelling of buildings in urban areas. • No allowance made for local variations in drainage, pumping or other works constructed	Richmond	TQ1772072687	Flood Map for Surface Water (FMfSW) - 1 in 30	Probability refers to the probability of the rainfall event, in this case producing flooding of greater than 0.1m depth.	30 Surface runoff		High
5	• Topography is derived from 64.5% LIDAR (on 0.25m-2m grids; original accuracy ± 0.15m) and 35.5% NEXTMap SAR (on 5m grid; original accuracy ± 1.0m), processed to remove buildings & vegetation, then combined on a 2m grid; buildings added with an arbitrary height of 5m based on OS MasterMap 2009 building footprints, then resampled to a 5m grid DTM. Manual edits applied where flow paths clearly omitted e.g. below bridges. • Flow routes dictated by topography; a uniform allowance of 12mm/hr has been made for manmade drainage in urban areas. Infiltration allowance reduces runoff to 39% in rural areas and 70% in urban areas. • Areas that may flood are defined by dynamically routing a 1.1 hour duration storm with 1 in 30 chance of occurring in any year over the DTM using JBA's JFLOW–GPU model. • Manning's n of 0.1 in rural areas; 0.03 in urban areas, to reflect explicit modelling of buildings in urban areas. • No allowance made for local variations in drainage, pumping or other works constructed	Richmond	TQ1772072687	Flood Map for Surface Water (FMfSW) - 1 in 30 deep	Probability refers to the probability of the rainfall event, in this case producing flooding of greater than 0.3m depth.	30 Surface runoff		High
6	• Topography is derived from 64.5% LIDAR (on 0.25m-2m grids; original accuracy ± 0.15m) and 35.5% NEXTMap SAR (on 5m grid; original accuracy ± 1.0m), processed to remove buildings & vegetation, then combined on a 2m grid; buildings added with an arbitrary height of 5m based on OS MasterMap 2009 building footprints, then resampled to a 5m grid DTM. Manual edits applied where flow paths clearly omitted e.g. below bridges. • Flow routes dictated by topography; a uniform allowance of 12mm/hr has been made for manmade drainage in urban areas. Infiltration allowance reduces runoff to 39% in rural areas and 70% in urban areas. • Areas that may flood are defined by dynamically routing a 1.1 hour duration storm with 1 in 200 chance of occurring in any year over the DTM using JBA's JFLOW–GPU model. • Manning's n of 0.1 in rural areas; 0.03 in urban areas, to reflect explicit modelling of buildings in urban areas. • No allowance made for local variations in drainage, pumping or other works constructed	Richmond	TQ1772072687	Flood Map for Surface Water (FMfSW) - 1 in 200	Probability refers to the probability of the rainfall event, in this case producing flooding of greater than 0.1m depth.	200 Surface runoff		High
7	• Topography is derived from 64.5% LIDAR (on 0.25m-2m grids; original accuracy ± 0.15m) and 35.5% NEXTMap SAR (on 5m grid; original accuracy ± 1.0m), processed to remove buildings & vegetation, then combined on a 2m grid; buildings added with an arbitrary height of 5m based on OS MasterMap 2009 building footprints, then resampled to a 5m grid DTM. Manual edits applied where flow paths clearly omitted e.g. below bridges. • Flow routes dictated by topography; a uniform allowance of 12mm/hr has been made for manmade drainage in urban areas. Infiltration allowance reduces runoff to 39% in rural areas and 70% in urban areas. • Areas that may flood are defined by dynamically routing a 1.1 hour duration storm with 1 in 200 chance of occurring in any year over the DTM using JBA's JFLOW–GPU model. • Manning's n of 0.1 in rural areas; 0.03 in urban areas, to reflect explicit modelling of buildings in urban areas. • No allowance made for local variations in drainage, pumping or other works constructed	Richmond	TQ1772072687	Flood Map for Surface Water (FMfSW) - 1 in 200 deep	Probability refers to the probability of the rainfall event, in this case producing flooding of greater than 0.3m depth.	200 Surface runoff		High
8	• Modelling developed from combination of national (2004) and local (generally 1998-2010) modelling. • Topography derived from LIDAR (on 0.25m-2m grids; original accuracy ± 0.15m), NEXTMap SAR (on 5m grid; original accuracy ± 1.0m), processed to remove buildings & vegetation. For local modelling, topography may include ground survey. • Location of watercourses and tidal flow routes dictated by topographic survey. • Areas that may flood are defined for catchments >3km² by routing appropriate flows for that catchment through the model to ascertain water level and thus depth and extent. • Manning's n of 0.1 used for national fluvial modelling; variable (calibrated) values for national tidal modelling; appropriate values selected for local modelling. Channel capacity assumed as QMED for national fluvial modelling; local survey methods used for local modelling. • For the purpose of flood risk management, models assume that there are no raised defences	Richmond	TQ1772072687	Flood Map (for rivers and sea) - flood zone 3	Fluvial 1 in 100, tidal 1 in 200	100 Main rivers	Sea, ordinary watercourses	Medium

9	• Modelling developed from combination of national (2004) and local (generally 2004-2010) modelling. • Topography derived from LIDAR (on 0.25m-2m grids; original accuracy ± 0.15m), NEXTMap SAR (on 5m grid; original accuracy ± 1.0m), processed to remove buildings & vegetation. For local modelling, topography may include ground survey. • Location of watercourses and tidal flow routes dictated by topographic survey. • Areas that may flood are defined for catchments >3km² by routing appropriate flows for that catchment through the model to ascertain water level and thus depth and extent. • Manning's n of 0.1 used for national fluvial modelling; variable (calibrated) values for national tidal modelling; appropriate values selected for local modelling. Channel capacity assumed as QMED for national fluvial modelling; local survey methods used for local modelling. • For the purpose of flood risk management, models assume that there are no raised defences	Richmond	TQ1772072687	Flood Map (for rivers and sea) - flood zone 2	Extreme flood outline is 1 in 1000, and includes some historic where judged that this gives an indication of areas at risk of future flooding.		1000 Main rivers	Sea, ordinary watercourses	Medium
10	• Topography derived from LIDAR (1m grid; original accuracy ±0.15m). Buildings added with arbitrary height of 0.1m based on OS MasterMap 2010 building footprints. Manual edits applied where flow paths clearly omitted e.g. below bridges. • Design rainfall generated using FEH methodology. Parameters set on 10km2 grid across Greater London area. • Uniform allowance of 6.5mm/hr made for manmade drainage in urban areas, as directed by Thames Water. • Runoff coefficients and Manning's N set for each OS MasterMap land classification as defined in Drain London Data & Modelling Framework, GLA, December 2010. • Areas that may flood defined by dynamically routing 3 hour duration storm with 1 in 200 chance of occurring in any year over the DTM using TuFLOW modelling software. • No allowance made for local variations in drainage, pumping or other works constructed for purpose of flood risk management. • '>0.03m' layer shows where modelled flooding is greater than 0.03m deep	Richmond	TQ1772072687	Pluvial Modelling - 1 in 200	Probability refers to the probability of the rainfall event, in this case producing flooding of greater than 0.03m depth.		200 Surface runoff		High
11	• Topography derived from LIDAR (1m grid; original accuracy ±0.15m). Buildings added with arbitrary height of 0.1m based on OS MasterMap 2010 building footprints. Manual edits applied where flow paths clearly omitted e.g. below bridges. • Design rainfall generated using FEH methodology. Parameters set on 10km2 grid across Greater London area. • Uniform allowance of 6.5mm/hr made for manmade drainage in urban areas, as directed by Thames Water. • Runoff coefficients and Manning's N set for each OS MasterMap land classification as defined in Drain London Data & Modelling Framework, GLA, December 2010. • Areas that may flood defined by dynamically routing 3 hour duration storm with 1 in 200 chance of occurring in any year over the DTM using TuFLOW modelling software. • No allowance made for local variations in drainage, pumping or other works constructed for purpose of flood risk management. • '>0.5m' layer shows where modelled flooding is greater than 0.5m deep	Richmond	TQ1772072687	Pluvial Modelling - 1 in 200	Probability refers to the probability of the rainfall event, in this case producing flooding of greater than 0.5m depth.		200 Surface runoff		High
12	• Topography derived from LIDAR (1m grid; original accuracy ±0.15m). Buildings added with arbitrary height of 0.1m based on OS MasterMap 2010 building footprints. Manual edits applied where flow paths clearly omitted e.g. below bridges. • Design rainfall generated using FEH methodology. Parameters set on 10km2 grid across Greater London area. • Uniform allowance of 6.5mm/hr made for manmade drainage in urban areas, as directed by Thames Water. • Runoff coefficients and Manning's N set for each OS MasterMap land classification as defined in Drain London Data & Modelling Framework, GLA, December 2010. • Areas that may flood defined by dynamically routing 3hr duration storm with 1 in 100 chance of occurring in any year+30% allowance for climate change over DTM using TuFLOW modelling software. • No allowance made for local variations in drainage, pumping or other works constructed for purpose of flood risk management. • '>0.03m' layer shows where modelled flooding is greater than 0.03m deep	Richmond	TQ1772072687	Pluvial Modelling - 1 in 100 + 30% Climate Change allowance	Probability refers to the probability of the rainfall event, in this case producing flooding of greater than 0.03m depth.	100 + 30%	Surface runoff		High
13	• Topography derived from LIDAR (1m grid; original accuracy ±0.15m). Buildings added with arbitrary height of 0.1m based on OS MasterMap 2010 building footprints. Manual edits applied where flow paths clearly omitted e.g. below bridges. • Design rainfall generated using FEH methodology. Parameters set on 10km2 grid across Greater London area. • Uniform allowance of 6.5mm/hr made for manmade drainage in urban areas, as directed by Thames Water. • Runoff coefficients and Manning's N set for each OS MasterMap land classification as defined in Drain London Data & Modelling Framework, GLA, December 2010. • Areas that may flood defined by dynamically routing 3hr duration storm with 1 in 100 chance of occurring in any year+30% allowance for climate change over the DTM using TuFLOW modelling software. • No allowance made for local variations in drainage, pumping or other works constructed for purpose of flood risk management. • '>0.5m' layer shows where modelled flooding is greater than 0.5m deep	Richmond	TQ1772072687	Pluvial Modelling - 1 in 100 + 30% Climate Change allowance	Probability refers to the probability of the rainfall event, in this case producing flooding of greater than 0.5m depth.	100 + 30%	Surface runoff		High

14	The following data sources have been utilised to produce the increased Potential for Elevated Groundwater (iPEG) map (areas where there is an increased potential for groundwater to rise sufficiently to interact with the ground surface or be within 2m of the ground surface): • BGS Groundwater Flood Susceptibility Map; • Jacobs Groundwater Emergence Maps; • JBA Groundwater Flood Map; • EA/Jacobs Thames Estuary 2100 (TE2100) groundwater hazard maps. For consolidated aquifers, an area was defined as having increased potential for elevated groundwater levels if at least 2 of the mapping techniques produced a corresponding area. For 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 dry islands within increased potential areas. These have not been cleaned in order to best represent the original data.	Richmond	TQ1772072687	Increased Potential for Elevated Groundwater (iPEG)	Does not describe a probability, but shows places where groundwater emergence more likely to occur.	Unknown	Groundwater	High

Main mechanism of flooding	Main characteristic of flooding	Adverse consequences to human health	Human health consequences - residential properties	Property count method	Other human health consequences	Adverse economic consequences	Number of non-residential properties flooded	Property count method	Other economic consequences	Adverse consequences to the environment	Environment consequences	Adverse consequences to cultural heritage	Cultural heritage consequences
Mandatory	**Mandatory**	**Mandatory**	Optional	Optional	Optional	**Mandatory**	Optional	Optional	Optional	**Mandatory**	Optional	**Mandatory**	Optional
Pick from drop-down	Pick from drop-down	Pick from drop-down	Number between 1-10,000,000	Pick from drop-down	Max 250 characters	Pick from drop-down	Number between 1-10,000,000	Pick from drop-down	Max 250 characters	Pick from drop-down	Max 250 characters	Pick from drop-down	Max 250 characters
Pick a mechanism from; 'Natural exceedance' (of capacity), 'Defence exceedance' (floodwater overtopping defences), 'Failure' (of natural or artificial defences or infrastructure, or of pumping), 'Blockage or restriction' (natural or artificial blockage or restriction of a conveyance channel or system), or 'No data'.	Pick a characteristic from; 'Flash flood' (rises and falls quite rapidly with little or no advance warning), 'Natural flood' (due to significant precipitation, at a slower rate than a flash flood), 'Snow melt flood' (due to rapid snow melt), 'Debris flow' (conveying a high degree of debris), or 'No data'. Most UK floods are 'Natural floods'.	Would there be any significant consequences to human health if the future flood were to occur?	Record the number of residential properties where the building structure would be affected either internally or externally if the flood were to occur.	Where residential or non-residential properties have been counted, it is important to record the method of counting, to aid comparisons between counts. Choose from; 'Detailed GIS' (using property outlines, as per Environment Agency guidance), 'Simple GIS' (using property points), 'Estimate from map', or 'Observed number'.	If there would be other Significant consequences to human health, describe them including information such as the number of critical services flooded.	Would there be any significant economic consequences if the future flood were to occur?	Record the number of non-residential properties where the building structure would be affected either internally or externally if the flood were to occur.	Where residential or non-residential properties have been counted, it is important to record the method of counting, to aid comparisons between counts. Choose from; 'Detailed GIS' (using property outlines, as per Environment Agency guidance), 'Simple GIS' (using property points), 'Estimate from map', or 'Observed number'.	If there would be other Significant economic consequences, describe them including information such as the area of agricultural land flooded, length of roads and rail flooded.	Would there be any significant consequences to the environment if the future flood were to occur?	If there would be Significant consequences to the environment, describe them including information such as national and international designated sites flooded, and pollution sources flooded.	Would there be any significant consequences to cultural heritage if the future flood were to occur?	If there would be Significant consequences to cultural heritage, describe them including information such as the number and type of heritage assets flooded.
Natural exceedance	Natural flood	Yes	12000	Detailed GIS		No				No		No	
Natural exceedance	Natural flood	Yes	31600	Detailed GIS		Yes	3900	Detailed GIS		Yes			
Natural exceedance	Natural flood	Yes	12600	Detailed GIS		Yes	1600	Detailed GIS		Yes			
Natural exceedance	Natural flood	Yes				Yes				Yes			

Comments	Data owner	Area flooded	Confidence in modelled outline	Model date	Model Type	Hydrology Type	Lineage	Sensitive data	Protective marking descriptor	European Flood Event Code
Optional Max 1,000 characters Any additional comments about the future flood record.	Optional Max 250 characters	Optional Number with two decimal places The total area of the land flooded, in km^2	Optional Pick from drop-down Pick a broad level of confidence in the modelled flood outline from; 'High' (good match to past flood extents - about 80% confident that outline is correct), 'Medium' (reasonable match - about 50% confident that outline is correct), 'Low' (poor match, sparse data - about 20% confident that outline is correct) or 'Unknown'.	Optional 'yyyy' or 'yyyy-mm' or 'yyyy-mm-dd'	Optional Max 250 characters Type of software used to create future flood information.	Optional Max 250 characters Type of hydrology method used to create future flood information.	Optional Max 250 characters Lineage is how and what the data is made from. Has this data been created by using data owned or derived from data owned by 3rd party (external) organisations? If yes please give details.	Optional Pick from drop-down Has the information been classified under the Government's Protective Marking Scheme? Include protective marking time limit where known. Note: If "Approved for Access" then report "Unmarked".	Optional Max 50 characters For use where organisations apply the Government's Protective Marking Scheme.	Auto-populated Max 42 characters This field will autopopulate using the LLFA name provided on the "Instructions" tab, and the Flood ID. It is an EU-wide unique identifier and will be used to report the flood information. Format: UK<ONS Code><P or F><LLFA Flood ID>. "ONS Code" is a unique reference for each LLFA. "P or F" indicates if the event is past or future. "LLFA Flood ID" is a sequential number beginning with 0001.
	Epping Forest District Council		Medium-Low	2008-08	2D-TuFlow	FEH (Revised Rainfall Runoff)	Ordnance Survey AddressPoint; CEH 1:50k River Centreline; NextMap DTM.	Unmarked	Private	UKE10000012F0001
	JBA Consulting (distributed by Environment Agency under licence)		Low	2009-07	JFLOW-GPU	Depth-duration-frequency curves derived from FEH CD-ROM, from centre of each 5km model, with areal reduction factor applied to convert point rainfall estimate to more representative figure. Curve then used to derive 6.5 hr, 1:200 chance rainfall depth; this is converted to hyetograph, using summer rainfall profile.		Protect	Commercial	UKE09000027F0001
	JBA Consulting (distributed by Environment Agency under licence)		Low	2009-07	JFLOW-GPU	Depth-duration-frequency curves derived from FEH CD-ROM, from centre of each 5km model, with areal reduction factor applied to convert point rainfall estimate to more representative figure. Curve then used to derive 6.5 hr, 1:200 chance rainfall depth; this is converted to hyetograph, using summer rainfall profile.		Protect	Commercial	UKE09000027F0002
	JBA Consulting (distributed by Environment Agency under licence)		Low	2009-07	JFLOW-GPU	Depth-duration-frequency curves derived from FEH CD-ROM, from centre of each 5km model, with areal reduction factor applied to convert point rainfall estimate to more representative figure. Curve then used to derive 6.5 hr, 1:200 chance rainfall depth; this is converted to hyetograph, using summer rainfall profile.		Protect	Commercial	UKE09000027F0003

	Environment Agency	Medium-Low	2010-11	JFLOW-GPU	Depth-duration-frequency curves derived from FEH CD-ROM, from centre of each 5km model, with areal reduction factor applied to convert point rainfall estimate to more representative figure. Curve then used to derive 1.1 hr, 1:30 chance rainfall depth; this is converted to hyetograph, using summer rainfall profile. See "Description of assessment method" for allowances for infiltration and drainage.	Rainfall Hyetograph, EA 2m Composite DTM, OSMM Topography	Unmarked		UKE09000027F0004
	Environment Agency	Medium-Low	2010-11	JFLOW-GPU	Depth-duration-frequency curves derived from FEH CD-ROM, from centre of each 5km model, with areal reduction factor applied to convert point rainfall estimate to more representative figure. Curve then used to derive 1.1 hr, 1:30 chance rainfall depth; this is converted to hyetograph, using summer rainfall profile. See "Description of assessment method" for allowances for infiltration and drainage.	Rainfall Hyetograph, EA 2m Composite DTM, OSMM Topography	Unmarked		UKE09000027F0005
	Environment Agency	Medium-Low	2010-11	JFLOW-GPU	Depth-duration-frequency curves derived from FEH CD-ROM, from centre of each 5km model, with areal reduction factor applied to convert point rainfall estimate to more representative figure. Curve then used to derive 1.1 hr, 1:200 chance rainfall depth; this is converted to hyetograph, using summer rainfall profile. See "Description of assessment method" for allowances for infiltration and drainage.	Rainfall Hyetograph, EA 2m Composite DTM, OSMM Topography	Unmarked		UKE09000027F0006
	Environment Agency	Medium-Low	2010-11	JFLOW-GPU	Depth-duration-frequency curves derived from FEH CD-ROM, from centre of each 5km model, with areal reduction factor applied to convert point rainfall estimate to more representative figure. Curve then used to derive 1.1 hr, 1:200 chance rainfall depth; this is converted to hyetograph, using summer rainfall profile. See "Description of assessment method" for allowances for infiltration and drainage.	Rainfall Hyetograph, EA 2m Composite DTM, OSMM Topography	Unmarked		UKE09000027F0007
Data updated quarterly. To understand the likelihood of future flooding, taking account of defences, refer to Areas Benefitting from Defences and National Flood Risk Assessment (NaFRA) data. Marked 'Protect' for complete national dataset only	Environment Agency	Medium	2010-11	Varies but mainly JFLOW, ISIS, HEC-RAS, TUFLOW for fluvial, and HYDROF for tidal.	National methodology described in "National Generalised Modelling for Flood Zones - Fluvial & Tidal Modelling Methods - Methodology, Strengths and Limitations". A national dataset (for England and Wales) of fluvial flood peak estimates was derived from the Flood Estimation Handbook (FEH) to generate a 1 in 100 chance fluvial flood. Local fluvial modelling uses FEH methods. Peak tidal water levels from either Dixon & Tawn (DT3) or local data sets to derive 1 in 200 chance tide levels including surge from POL CSX model.	NextMap SAR DTMe, UKHO Admiralty Charts, 1:50K CEH River Centre Line, CEH FEH Q(T) Grids, POL CSX Peak Extreme Water Levels, POL CS3 Astronomical Tides, UKHO Admiralty Tide Time-Series Calibration Locations, OS 1:10 Boundary Line MHW	Protect	Commercial	UKE09000027F0008

Data updated quarterly. To understand the likelihood of future flooding, taking account of defences, refer to National Flood Risk Assessment (NaFRA) data. Marked 'Protect' for complete national dataset only.	Environment Agency	Medium	2010-11	Varies but mainly JFLOW, ISIS, HEC-RAS, TUFLOW for fluvial, and HYDROF for tidal.	National methodology described in "National Generalised Modelling for Flood Zones - Fluvial & Tidal Modelling Methods - Methodology, Strengths and Limitations". A national dataset (for England and Wales) of fluvial flood peak estimates was derived from the Flood Estimation Handbook (FEH) to generate a 1 in 1000 chance fluvial flood. Local fluvial modelling uses FEH methods. Peak tidal water levels from either Dixon & Tawn (DT3) or local data sets to derive 1 in 1000 chance tide levels including surge from POL CSX model.	NextMap SAR DTMe, UKHO Admiralty Charts, 1:50K CEH River Centre Line, CEH FEH Q(T) Grids, POL CSX Peak Extreme Water Levels, POL CS3 Astronomical Tides, UKHO Admiralty Tide Time-Series Calibration Locations, OS 1:10 Boundary Line MHW, Historic	Protect	Commercial	UKE09000027F0009
Modelling produced as part of the Drain London Project delivering SWMPs and PFRAs for all 33 London Boroughs.	Greater London Authority	Medium	2010-11	TUFLOW	Depth-duration-frequency curves derived from FEH CD-ROM from centre of 10km2 grid squares covering Greater London. Curve used to derive 3hr storm duration 1:200 chance rainfall event, Converted to hyetograph using summer rainfall profile.	Rainfall Hyetograph, EA 1m Composite DTM, OSMM Topography	Restricted	Commercial	UKE09000027F0010
Modelling produced as part of the Drain London Project delivering SWMPs and PFRAs for all 33 London Boroughs.	Greater London Authority	Medium	2010-11	TUFLOW	Depth-duration-frequency curves derived from FEH CD-ROM from centre of 10km2 grid squares covering Greater London. Curve used to derive 3hr storm duration 1:200 chance rainfall event, Converted to hyetograph using summer rainfall profile.	Rainfall Hyetograph, EA 1m Composite DTM, OSMM Topography	Restricted	Commercial	UKE09000027F0011
Modelling produced as part of the Drain London Project delivering SWMPs and PFRAs for all 33 London Boroughs.	Greater London Authority	Medium	2010-11	TUFLOW	Depth-duration-frequency curves derived from FEH CD-ROM from centre of 10km2 grid squares covering Greater London. Curve used to derive 3hr storm duration for 1:100 chance+30% CC rainfall event. Converted to hyetograph using summer rainfall profile.	Rainfall Hyetograph, EA 1m Composite DTM, OSMM Topography	Restricted	Commercial	UKE09000027F0012
Modelling produced as part of the Drain London Project delivering SWMPs and PFRAs for all 33 London Boroughs.	Greater London Authority	Medium	2010-11	TUFLOW	Depth-duration-frequency curves derived from FEH CD-ROM from centre of 10km2 grid squares covering Greater London. Curve used to derive 3hr storm duration for 1:100 chance+30% CC rainfall event. Converted to hyetograph using summer rainfall profile.	Rainfall Hyetograph, EA 1m Composite DTM, OSMM Topography	Restricted	Commercial	UKE09000027F0013

Data developed specifically for Drain London PFRAs and SWMPs, and is unlikely to be suitable for any other purposes.	Medium-Low	2010-11	ArcGIS	The following four data sources have been utilised to produce the iPEG map: • BGS Groundwater Flood Susceptibility Map; • Jacobs Groundwater Emergence Maps; • JBA Groundwater Flood Map; • EA/Jacobs Thames Estuary 2100 groundwater hazard maps.	Restricted	UKE09000027F0014

Annex 3 – Flood Risk Areas

Please refer to Annex 3 of the Preliminary Assessment Spreadsheet.

ANNEX 3: Records of Flood Risk Areas and their rationale (preliminary assessment report spreadsheet)

Field:	Flood Risk Area ID	Name of Flood Risk Area	National Grid Reference	Main source of flooding	Additional source(s) of flooding	Confidence in main source of flooding	Main mechanism of flooding	Main characteristic of flooding
Mandatory / optional:	**Mandatory**	**Mandatory**	**Mandatory**	**Mandatory**	Optional	Optional	**Mandatory**	**Mandatory**
Format:	Unique number between 1-9999	Max 250 characters	12 characters: 2 letters, 10 numbers	Pick from drop-down	Max 250 characters, same source terms	Pick from drop-down	Pick from drop-down	Pick from drop-down
Notes:	A sequential number starting at 1 and incrementing by 1 for each record.	Name of the locality associated with the Flood Risk Area; a town, city, or county.	National Grid Reference of the centroid (centre point, falls within polygon) of the Flood Risk Area.	Pick the source from which there is a significant flood risk. Refer to the PFRA guidance for definitions of sources.	If there is also significant flood risk generated by another source (other than the Main source of flooding), report the source(s) here, using the same source terms.	Pick a broad level of confidence in the Main source of flooding from; 'High' (compelling evidence of source - about 80% confident that source is correct), 'Medium' (some evidence of source but not compelling - about 50% confident that source is correct) 'Low' (source assumed - about 20% confident that source is correct) or 'Unknown'.	Pick a mechanism from; 'Natural exceedance' (of capacity), 'Defence exceedance' (floodwater overtopping defences), 'Failure' (of natural or artificial defences or infrastructure, or of pumping), 'Blockage or restriction' (natural or artificial blockage or restriction of a conveyance channel or system), or 'No data'.	Pick a characteristic from; 'Flash flood' (rises and falls quite rapidly with little or no advance warning), 'Natural flood' (due to significant precipitation, at a slower rate than a flash flood), 'Snow melt flood' (due to rapid snow melt), 'Debris flow' (conveying a high degree of debris), or 'No data'. Most UK floods are 'Natural floods'.
Example:	1	London	SX1234512345	Surface runoff	NA	High	Natural exceedance	Natural flood
Records begin here:	1	London	TQ3276278392	Surface runoff	NA	High	Natural exceedance	Natural flood

Significant consequences to human health	Human health consequences - residential properties	Property count method	Other human health consequences	**Significant economic consequences**	Number of non-residential properties flooded	Property count method	Other economic consequences	**Significant consequences to the environment**	Environment consequences	**Significant consequences to cultural heritage**	Cultural heritage consequences
Mandatory	Optional	Optional	Optional	**Mandatory**	Optional	Optional	Optional	**Mandatory**	Optional	**Mandatory**	Optional
Pick from drop-down	Number between 1-10,000,000	Pick from drop-down	Max 250 characters	Pick from drop-down	Number between 1-10,000,000	Pick from drop-down	Max 250 characters	Pick from drop-down	Max 250 characters	Pick from drop-down	Max 250 characters
Has the Flood Risk Area been identified as a result of significant consequences to human health?	Record the number of residential properties where the building structure would be affected either internally or externally by the flood.	Where residential or non-residential properties have been counted, it is important to record the method of counting, to aid comparisons between counts. Choose from; 'Detailed GIS' (using property outlines, as per Environment Agency guidance), 'Simple GIS' (using property points), 'Estimate from map', or 'Observed number'.	If the Flood Risk Area has been identified as a result of other Significant consequences to human health, describe them (such as information about the number of critical services flooded).	Has the Flood Risk Area been identified as a result of significant economic consequences?	Record the number of non-residential properties where the building structure would be affected either internally or externally by the flood.	Where residential or non-residential properties have been counted, it is important to record the method of counting, to aid comparisons between counts. Choose from; 'Detailed GIS' (using property outlines, as per Environment Agency guidance), 'Simple GIS' (using property points), 'Estimate from map', or 'Observed number'.	If the Flood Risk Area has been identified as a result of other Significant economic consequences, describe them (such as information about the area of agricultural land flooded, length of roads and rail flooded).	Has the Flood Risk Area been identified as a result of significant consequences to the environment?	If the Flood Risk Area has been identified as a result of Significant consequences to the environment, describe them (such as information about national and international designated sites flooded, and pollution sources flooded).	Has the Flood Risk Area been identified as a result of significant consequences to cultural heritage?	If the Flood Risk Area has been identified as a result of Significant consequences to cultural heritage, describe them (such as information about the number and type of heritage assets flooded).
Yes	50000	Detailed GIS		No				No		No	
Yes	50000	Detailed GIS		No				No		No	

Origin of Flood Risk Area	Amended Flood Risk Area rationale	New Flood Risk Area rationale	Rationale detail	European Flood Risk Area Code
Mandatory Pick from drop-down Pick the origin from either; 'Indicative' Flood Risk Area, 'Amended' Flood Risk Area (in which case Amended Flood Risk Area rationale is mandatory), or 'New' Flood Risk Area (in which case New Flood Risk Area rationale is mandatory).	**Mandatory** Pick from drop-down Pick the main rationale from either; 'Geography', 'Past floods', or 'Future floods'. Then provide further detail in Rationale detail. This is not mandatory if the Flood Risk Area was an indicative Flood Risk Area and has not been amended, or is a new Flood Risk Area.	**Mandatory** Pick from drop-down Pick the main rationale from either 'Past floods', or 'Future floods'. Then provide further detail in Rationale detail. This is not mandatory if the Flood Risk Area was an indicative Flood Risk Area.	**Mandatory** Max 1,000 characters Summarise the rationale for amending an indicative Flood Risk Area, or identifying a new Flood Risk Area. Refer to Defra & WAG guidance to LLFAs on "Selecting and reviewing Flood Risk Areas for local sources of flooding". If the Flood Risk Area was an indicative Flood Risk Area and has not been amended, record "indicative Flood Risk Area".	Auto-populated Max 42 characters This field will autopopulate using the LLFA name provided on the "Instructions" tab, and the Flood Risk Area ID. It is an EU-wide unique identifier and will be used to report the Flood Risk Area information. Format: UK<ONS Code><A><LLFA Flood ID>. "ONS Code" is a unique reference for each LLFA. "A" indicates it is a Flood Risk Area. "LLFA Flood ID" is a sequential number beginning with 0001.
Indicative	NA	NA	indicative Flood Risk Area	UKE10000012A0001
Indicative	NA	NA	Indicative Flood Risk Area	UKE09000027A0001

Annex 4 – Review Checklist

Preliminary Flood Risk Assessment Checklist					
LLFA Name:					
	Checklist questions	**Notes for completion**	**LLFA**	**Environment Agency area review**	**Environment Agency national review**
Step 1	**Set up governance and develop partnerships**				
1.1	Have appropriate governance and partnership arrangements been set up?	Refer to section 2.3 of guidance. Governance and partnership arrangements should be to the satisfaction of the LLFA.	Yes		
1.2	Who in the LLFA reviewed the PFRA and when was it done?	Please state the review and approval process and when approval was gained e.g. Officer, Scrutiny Committee, Cabinet. Refer to Section 5 of the guidance.			
Step 2	**Determine appropriate data systems**				
2.1	Has a data management system been established and implemented?	See Annex 5 for information about data standards	No		
Step 3	**Collate information on past and future floods and their consequences**				
3.1	Has information been requested from all relevant partners?	See Flood Risk Regulations Part 6 Co-operation.	Yes		
3.2	Are there any gaps in available information? (This could include gaps which could have been filled but weren't, or gaps which couldn't be filled because the information wasn't available)	LLFAs - Are there gaps in certain locations, or for certain events that you are aware of, or for certain sources of flooding (such as groundwater). Respond with Yes/No and provide comments on any missing information. EA Review - Has all available information has been gathered and included?	Yes - All available datasets were collated, but flood records are not comprehensive with respect to the type of data recorded and the impacts of the event. There are no available details on local		
Step 4	**Determining locally agreed surface water information**				
4.1	Which dataset (or combination of datasets) has been determined as "locally agreed surface water information"?	LLFAs - Select from drop down. Refer to "Locally agreed surface water information" text box in section 3.5.1 (p.17) of guidance. EA review - Has this been agreed?	Other local information		
4.2	Has the locally agreed surface water information been clearly stated and presented (on a map) in the Preliminary Assessment Report?	LLFAs - Select Yes/No from drop down list. Refer to "locally agreed surface water information" text box in section 3.5.1 (p.17) of guidance.	Yes		
4.3	If available, what is the total property count for locally agreed surface water information in the LLFA?	If known, please enter the total number of properties at risk in the LLFA.	30,940 (1 in 200 annual chance of occurrence in any given year 0.5% AEP)		
4.4	If applicable, has the method for counting properties been described in the Preliminary Assessment Report?	Refer to text box on page 17 of guidance	No		
4.5	Has available information on local drainage capacity (where used to inform the determination of locally agreed surface water information) been included in the report?	Refer to text box on page 17 of guidance. Information provided on drainage may inform options for any future improvements to the Flood Map for Surface Water.	No		

Preliminary Flood Risk Assessment Checklist					
LLFA Name:					
	Checklist questions	**Notes for completion**	**LLFA**	**Environment Agency area review**	**Environment Agency national review**
Step 5	**Complete Preliminary Assessment Report Document**				
5.1	Does the Preliminary Assessment Report cover all the content described in Annex 1 of the Environment Agency's PFRA guidance?	LLFAs - If the Preliminary Assessment Report contains all the content described in Annex 2 of the PFRA guidance, respond with a 'Yes'. If there are some elements missing, please provide a brief explanation. EA Review - Include comments on any missing content.	Yes		
5.2	Has a summary table of flood events been produced?	Refer to section 3.4 and 3.5 of guidance	Yes		
5.3	Has a description of past flood events been included?	Refer to section 3.4 and 3.5 of guidance	Yes		
5.4	Has additional information been included on climate change and long term developments?	Refer to 3.6 of guidance. Standard text has been provided for Preliminary Assessment Reports which meets the minimum requirements of the Flood Risk Regulations. Please respond with Yes or No, and if additional information has been included, please state the information source(s)	Yes - information has been provided on areas of major development in Sutton alongside property count and Food Depth and Hazard maps provided from the Drain London 1 in 100 Year + Climate Change (+30%) pluvial		
Step 6	**Record information on past and future floods with significant consequences in spreadsheet**				
6.1	Are records of past flooding with significant harmful consequences recorded on the Preliminary Assessment Report spreadsheet (Annex 1 of Prelminary Assessment Report) ?	LLFAs - past flooding should be recorded on the spreadsheet and included as Annex 1 of the Preliminary Assessment Report. EA review - Are all the mandatory fields complete?	Yes		
6.2	Are there any past floods with significant harmful consequences that have not been recorded? If so, please explain why not.	LLFAs - Respond with Yes or No. If No, provide additional information e.g. anecdotal information on flood, but not enough evidence to include EA review - Do you agree with LLFA response and comments?	Yes - anecdotal information on other flood events, but not enough to conclude whether they had significant harmful consequences.		
6.3	Have any additional records of future flooding (other than the national dataset information which is already completed) been recorded on the future flooding Preliminary Assessment Report spreadsheet (Annex 2 of Preliminary Assessment Report)	LLFAs - future flooding information should be recorded on the spreadsheet and included as Annex 2 of the Preliminary Assessment Report. EA review - Are all mandatory fields complete?	Yes		
Step 7	**Illustrate information on past and future floods**				
7.1	Have summary maps been produced for past and future floods?	Refer to section 3.4 and 3.5 of guidance	Yes		
Step 8	**Review indicative Flood Risk Areas**				
8.1	Is your LLFA within an indicative Flood Risk Area?	Indicative Flood Risk Areas were provided to LLFAs by the Environment Agency in December 2010.	Yes		
8.2	If the answer to 8.1 is yes, have you reviewed it using the locally agreed surface water information, and relevant local information in the Preliminary Assessment Report?	Refer to section 4 of guidance. LLFAs should identify whether they have reviewed against local information or just used the indicative Flood Risk Area information provided by the Environment Agency.	Yes		

Preliminary Flood Risk Assessment Checklist					
LLFA Name:					
	Checklist questions	**Notes for completion**	**LLFA**	**Environment Agency area review**	**Environment Agency national review**
Step 9	**Identify Flood Risk Areas**				
9.1	Is a Flood Risk Area proposed?	LLFA - select a response from the drop down list and then complete the relevant questions 9.1.1 - 9.1.5. (NB. Indicative Flood Risk Areas can be amended due to Geography, past flooding and/or future flooding.)	Yes - it is exactly the same as the indicative Flood Risk Area (go to question 9.1.1)		
9.1.1	If the proposed Flood Risk Area is exactly the same as the indicative Flood Risk Area, please confirm.	LLFA - please confirm that the boundary of the indicative Flood Risk Area has not been changed and no change has been made to the flood risk indicators. EA review - please confirm	Yes		
9.1.2	If changes have been made to the indicative Flood Risk Area because of geography, please identify what changes have been made.	Use the drop down list to identify the reasons for the change. Options are the same as the table on page 26 of the PFRA guidance. EA review - please confirm evidence supports change			
9.1.3	If changes have been made to the indicative Flood Risk Area because of past / historic flooding, please indicate the changes and the reasons why.	LLFA - identify the scale of the changes made e.g. major/minor increase or decrease in size of Flood Risk Area and the source of information used e.g. records of historic flooding. EA review - confirm scale of the changes made and provide indication of confidence in the evidence provided e.g. anecdotal evidence versus detailed report on flooding event.			
9.1.4	If changes have been made to the indicative Flood Risk Areas because of future flooding, please indicate the changes and the reasons why.	LLFA - identify the scale of the changes made e.g. major/minor increase or decrease in size of Flood Risk Area and the source of information used e.g. detailed modelling as part of SWMP. EA review - confirm scale of the changes made and indication of confidence in the evidence			
9.1.5	If a new Flood Risk Area is being proposed, does it meet the Defra / WAG thresholds?	Criteria and thresholds are set out in the Defra/WAG guidance on selecting and reviewing Flood Risk Areas for local sources of flooding EA review - identify the evidence provided to support this and indicate degree of confidence in the evidence.			
9.2	Does the proposed Flood Risk Area include flooding from interactions with main river, reservoirs or the sea?	LLFAs should respond with Yes or No. EA Review - Summarise the location and nature of interactions i.e. river or sea.	Yes		
9.3	Has an indicative Flood Risk Area been deleted?	LLFA - Respond with Yes/No and if an indicative Flood Risk Area has been deleted please provide a short description why. EA - confirm the evidence presented to support this is aligned to 'locally agreed surface water information'	No		
Step 10	**Record information including rationale - ONLY COMPLETE IF ANSWER TO 9.1 IS YES**				
10.1	If proposing Flood Risk Areas, have the mandatory fields in the spreadsheet been completed?	LLFAs - the spreadsheet indicates mandatory columns to be completed. EA Review - Are all mandatory fields complete?	Yes		
10.2	Has a rationale and evidence for amending/adding/deleting Flood Risk Areas been included in the Preliminary Assessment Report?	LLFAs - Refer to Table 5 on page 26 of the PFRA guidance and Annexes A-D of the Defra/WAG Guidance. Rationale should be included in "Identification of Flood Risk Areas" section of Preliminary Assessment Report. EA Review - Confirm that supporting evidence for any amendments/additions/deletions has been provided in the Preliminary Assessment Report and annexes	N/A		

Annex 5 – GIS Layer of Flood Risk Areas

Indicative flood risk areas based on clusters formed from all 3km squares that contain 5 or more Places above the Flood Risk Thresholds (1km squares) that are touching.

Indicative flood risk areas are labelled with their location and the number of people at risk. Clusters with fewer than 30,000 people at risk have not been designated as indicative flood risk areas.

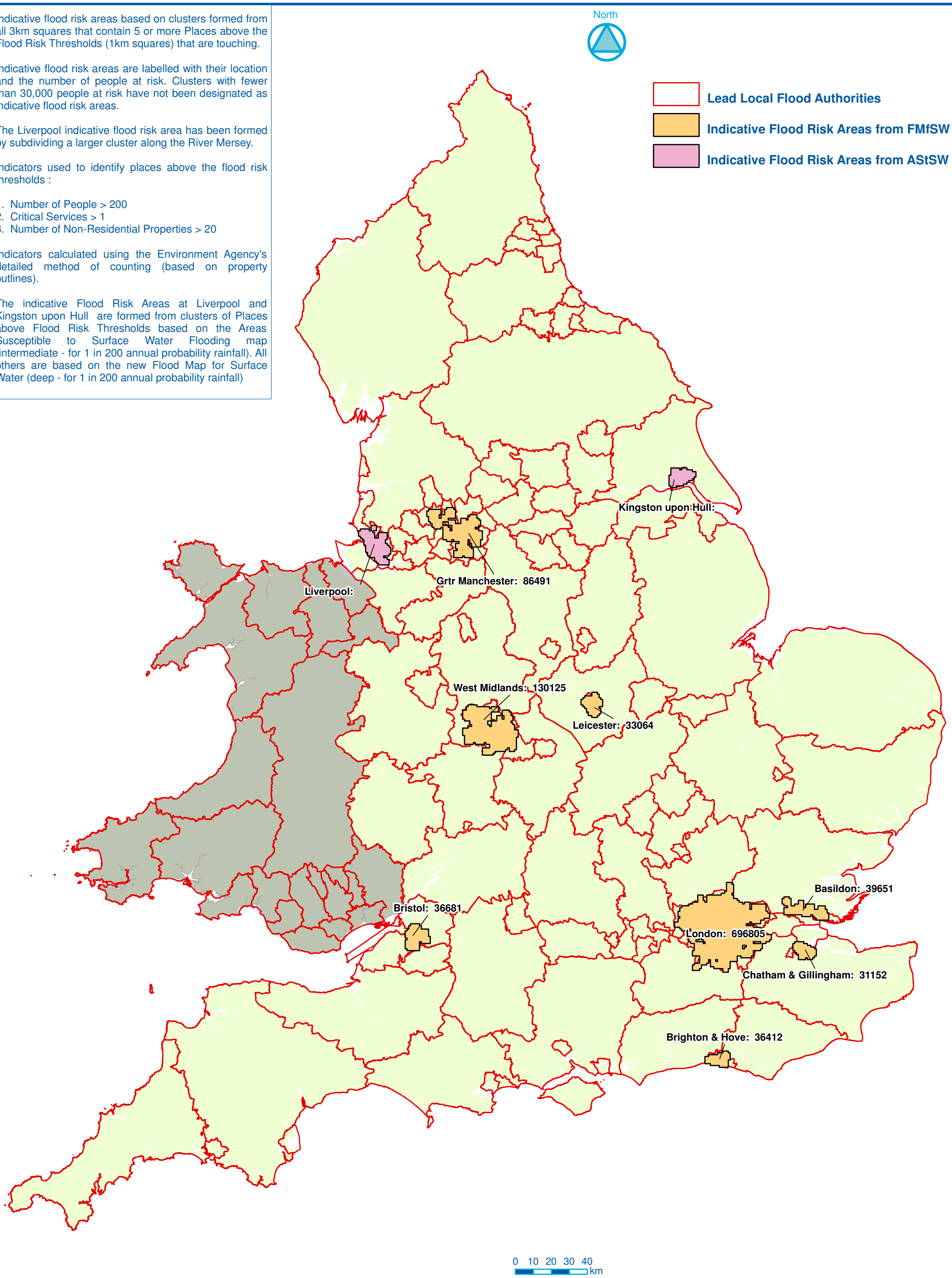
The Liverpool indicative flood risk area has been formed by subdividing a larger cluster along the River Mersey.

Indicators used to identify places above the flood risk thresholds :

1. Number of People > 200
2. Critical Services > 1
3. Number of Non-Residential Properties > 20

Indicators calculated using the Environment Agency's detailed method of counting (based on property outlines).

The indicative Flood Risk Areas at Liverpool and Kingston upon Hull are formed from clusters of Places above Flood Risk Thresholds based on the Areas Susceptible to Surface Water Flooding map (intermediate - for 1 in 200 annual probability rainfall). All others are based on the new Flood Map for Surface Water (deep - for 1 in 200 annual probability rainfall)



Indicative Flood Risk Areas for England

These are to be used by Lead Local Flood Authorities as part of the process for identifying Flood Risk Areas under the Flood Risk Regulations as set out in the Environment Agency and Defra & WAG guidance on PFRAs.

Drawn by:	Peter Robinson
Date:	15/12/2010
Status:	DRAFT
File Name:	...\ArcGIS\Projects\IFRA Maps England.mxd
Drawing Number:	IFRA_EE

Scale: 1:2,000,000

Original @ A3

Environment Agency

Annex 6 – Mapping

1 Surface Water & Fluvial Flooding Incidents

2 Groundwater Flooding Incidents & increased Potential for Elevated Groundwater (iPEG)

3 Sewer Flooding Incidents

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

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

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

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

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NORTH

London Borough of Hounslow

London Borough of Wandsworth

London Borough of Merton

Royal Borough of Kingston upon Thames

0 0.25 0.5 1 2 Kilometres

Legend

- Borough Administrative Boundary
- Fluvial Flooding Incidents
- Surface Water Flooding Incidents

London Borough of Richmond

LONDON BOROUGH OF RICHMOND UPON THAMES

Preliminary Flood Risk Assessment

Scale at A3	Date	Drawn by	Approved by
1:45,000	13/05/2011	D.SKILTON	E.CRAVEN

Surface Water Flooding Incidents and Fluvial Flooding Incidents

Consultants
CAPITA SYMONDS Flood Risk Management
Scott Wilson
URS / Scott Wilson
6 - 8 Greencoat Place
London
SW1P 1PL

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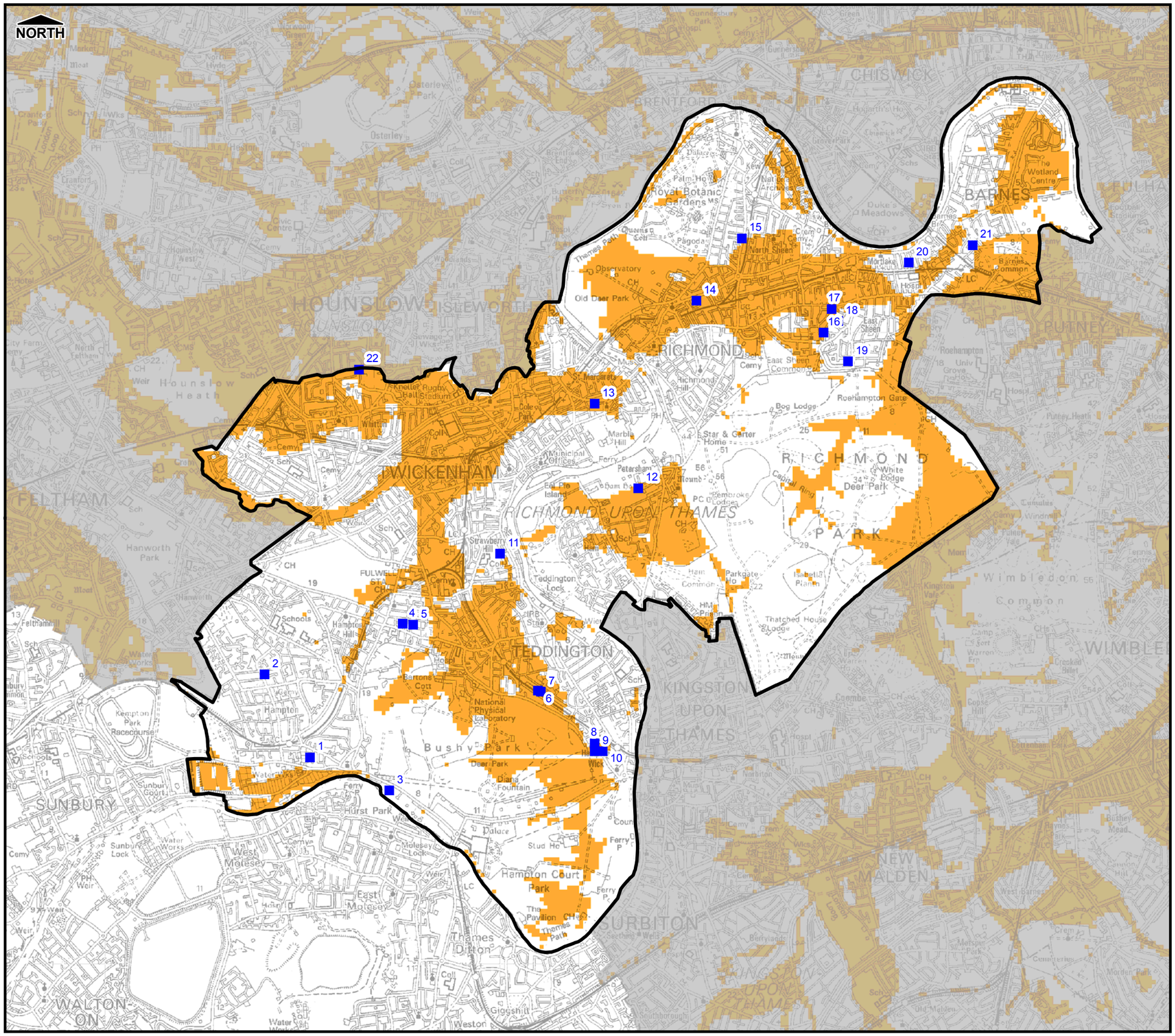
FIGURE 1

Filepath: N:\Water\Current Projects\D134785 D134786 DRAIN LONDON Tier 2\02 Group 8 (D134786)\05 GIS



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Legend

- Richmond Borough Council
- Groundwater Flood Incident (EA Records)

Increased Potential for Elevated Groundwater in

- Permeable Superficial Deposits
- Consolidated Aquifers

Notes

1.The increased Potential for Elevated Groundwater map shows those areas within the London Boroughs where there is an increased potential for groundwater to rise sufficiently to interact with the ground surface or be within 2m of the groundsurface. Such groundwater rise could lead to the following:

-Flooding of basements of buildings below ground level;
-Flooding of buried services or other assets below ground level;
-Inundation of farmland, roads, commercial, residental and amenity areas;
-Flooding of ground floors of buildings above ground level; and Overflowing of sewers and drains

2.Incident records shown are generally unconfirmed and may include issues such as water main bursts or non-groundwater related problems.
3.Areas not shown to have increased potential for elevated groundwater should be considered to have a low potential for elevated groundwater - Lack of information does not imply 'no potential' of elevated groundwater in that area.
4.Includes groundwater flood mapping provided by JBA consulting, Copyright. Jeremy Benn Associates Limited 2008-2011, partially derived from data supplied by the Environment Agency.

London Borough Richmond

LONDON BOROUGH OF RICHMOND UPON THAMES

Preliminary Flood Risk Assessment

Scale at A3	Date	Drawn by	Approved by
1:50,000	22/03/2011	C.Woolhouse	S.Cox

Increased Potential For Elevated Groundwater

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FIGURE 2

Filepath: D:\134786 Drain London_Tier 2_Group 8\700 Technical\711 GIS\01 Layout\Richmond\Increased Potential for Elevated GW.mxd

THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

NORTH

TW8 0
TW9 3
TW9 4
TW9 2
TW9 1
SW138
SW139
SW130
SW151
SW147
SW148
SW156
SW155
SW154
SW153
TW106
TW105
TW107
TW1 1
TW1 2
TW1 3
TW1 4
TW3 2
TW7 7
TW4 5
TW2 7
TW2 6
TW2 5
TW136
TW121
TW123
TW118
TW119
TW110
TW165
TW122
KT2 5
KT2 7
KT1 4
KT8 9
KT8 1
KT7 0

London Borough of Hounslow
London Borough of Wandsworth
London Borough of Merton
Royal Borough of Kingston upon Thames

RICHMOND
RICHMOND UPON THAMES
PARK
BARNES
TWICKENHAM
TEDDINGTON

0 0.25 0.5 1 2 Kilometres

Legend

- Borough Administrative Boundary
- Sewer Flooding Incidents

No. of Sewer Flood Records

- None
- 1 - 5
- 6 - 10
- 11 - 20
- 21 - 50
- 51 - 100
- 101+

Notes

1. Sewer flood records relate to internal and external flooding of properties
2. Data supplied by Thames Water Ltd and is correct as at June 2010
3. Point data supplied by Borough Council

London Borough of Richmond

LONDON BOROUGH OF RICHMOND UPON THAMES

Preliminary Flood Risk Assessment

Scale at A3	Date	Drawn by	Approved by
1:45,000	13/05/2011	D.SKILTON	E.CRAVEN

Sewer Flooding Incidents

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London
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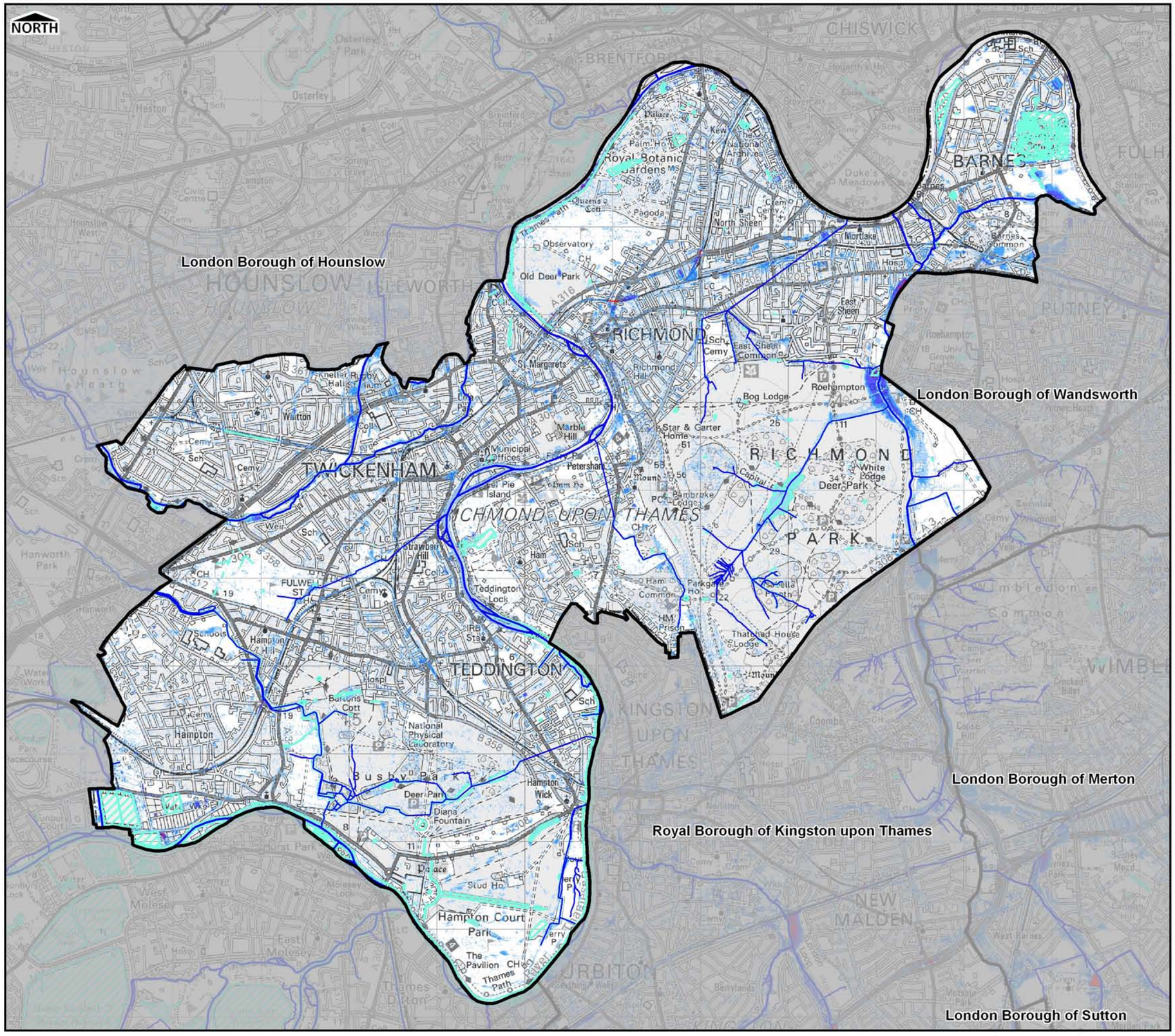
FIGURE 3

Filepath: N:\Water\Current Projects\D134785 D134786 DRAIN LONDON Tier 2\02 Group 8 (D134786)\05 GIS



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Legend

- Borough Administrative Boundary
- Permanent Water Bodies
- Main River
- Ordinary Watercourse

Flood Depth

- <0.1m
- 0.1m to 0.25m
- 0.25m to 0.5m
- 0.5m to 1.0m
- 1.0m to 1.5m
- >1.5m

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
2. Users of this map should refer to section 3.2 of the Surface Water Management Plan for a complete description of limitations and accuracy of the flood/hazard extents shown.
3. This map provides a strategic overview of surface water flood risk and may be subject to further analysis in the future.

London Borough of Richmond

LONDON BOROUGH OF RICHMOND UPON THAMES

Preliminary Flood Risk Assessment

Scale at A3	Date	Drawn by	Approved by
1:45,000	13/05/2011	D.SKILTON	J.ROBINSON

Surface Water Depth (m) 1 in 200 Chance of rainfall event occuring in any given year (0.5% AEP)

Consultants
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London
SW1P 1PL

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FIGURE 4

Filepath: N:\Water\Current Projects\D134785 D134786 DRAIN LONDON Tier 2\02 Group 8 (D134786)\05 GIS

THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

NORTH

London Borough of Hounslow

London Borough of Wandsworth

London Borough of Merton

Royal Borough of Kingston upon Thames

0 1 2km

Legend

- Borough Administrative Boundary
- Permanent Water Bodies
- Main River
- Ordinary Watercourse

Flood Hazard

- <0.75 Caution (Very low hazard)
- 0.75 - 1.25 Moderate (Danger for some)
- 1.25 - 2.0 Significant (Danger for most)
- <2.0 Extreme (Danger for all)

Notes

1. Flood Hazard has been defined based upon the joint EA and Defra R&D Technical Report FD2320 (January 2006).
2. Degree of flood hazard can be interpreted as follows:
- Caution: Flood zone with shallow flowing water or deep standing water
- Moderate: Flood zone with deep or fast flowing water. Dangerous for children, the elderly and the infirm
- Significant: Flood zone with deep fast flowing water. Dangerous for most people.
- Extreme: Flood zone with deep fast flowing water. Dangerous for all (including emergency services)

London Borough of Richmond

LONDON BOROUGH OF RICHMOND UPON THAMES

Preliminary Flood Risk Assessment

Scale at A3	Date	Drawn by	Approved by
1:45,000	13/05/2011	D.SKILTON	J.ROBINSON

Surface Water Flood Hazard Rating
1 in 200 Chance of rainfall event occuring in any given year (0.5% AEP)

Consultants
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URS / Scott Wilson
6 - 8 Greencoat Place
London
SW1P 1PL

Drain London Programme Board Members

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FIGURE 5

Filepath: N:\Water\Current Projects\D134785 D134786 DRAIN LONDON Tier 2\02 Group 8 (D134786)\05 GIS

NORTH

London Borough of Hounslow

London Borough of Wandsworth

London Borough of Richmond

London Borough of Merton

Royal Borough of Kingston upon Thames

0 1 2km

Legend

- Borough Administrative Boundary
- Permanent Water Bodies
- Main River
- Ordinary Watercourse

Flood Depth

- <0.1m
- 0.1m to 0.25m
- 0.25m to 0.5m
- 0.5m to 1.0m
- 1.0m to 1.5m
- >1.5m

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
2. Users of this map should refer to section 3.2 of the Surface Water Management Plan for a complete description of limitations and accuracy of the flood/hazard extents shown.
3. This map provides a strategic overview of surface water flood risk and may be subject to further analysis in the future.

London Borough of Richmond

LONDON BOROUGH OF RICHMOND UPON THAMES

Preliminary Flood Risk Assessment

Scale at A3	Date	Drawn by	Approved by
1:45,000	13/05/2011	D.SKILTON	J.ROBINSON

Surface Water Depth (m) 1 in 100 Chance of rainfall event occuring in any given year (1% AEP) plus Climate Change

Consultants
CAPITA SYMONDS Scott Wilson
Flood Risk Management
URS / Scott Wilson
6 - 8 Greencoat Place
London
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Drain London Programme Board Members

Environment Agency · Thames Water · LONDON COUNCILS · GREATERLONDONAUTHORITY

FIGURE 6

Filepath: N:\Water\Current Projects\D134785 D134786 DRAIN LONDON Tier 2\02 Group 8 (D134786)\05 GIS

THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

NORTH

London Borough of Hounslow

London Borough of Wandsworth

London Borough of Merton

Royal Borough of Kingston upon Thames

0 1 2km

Legend

- Borough Administrative Boundary
- Permanent Water Bodies
- Main River
- Ordinary Watercourse

Flood Hazard

- <0.75 Caution (Very low hazard)
- 0.75 - 1.25 Moderate (Danger for some)
- 1.25 - 2.0 Significant (Danger for most)
- <2.0 Extreme (Danger for all)

Notes

1. Flood Hazard has been defined based upon the joint EA and Defra R&D Technical Report FD2320 (January 2006).
2. Degree of flood hazard can be interpreted as follows:
- Caution: Flood zone with shallow flowing water or deep standing water
- Moderate: Flood zone with deep or fast flowing water. Dangerous for children, the elderly and the infirm
- Significant: Flood zone with deep fast flowing water. Dangerous for most people.
- Extreme: Flood zone with deep fast flowing water. Dangerous for all (including emergency services)

London Borough of Richmond

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FIGURE 7

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