Annex 1:

Preliminary Flood Risk Assessment Document inc. Annexes

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Preliminary Flood Risk Assessment

June 2011

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Surrey County Council
Asset Planning Group (Building G)
Merrow Lane
Guildford
Surrey
GU4 7BQ

By fax
01483 517445

By phone
03456 009 009
Minicom: 020 8541 9698

Online
Email: assetplanninggroup@surreycc.gov.uk
www.surreycc.gov.uk/

Preliminary Flood Risk Assessment

Surrey County Council

June 2011

Executive Summary

This report has been prepared to help Surrey County Council meet their duties to manage local flood risk and deliver the requirements of the Flood Risk Regulations 2009. Surrey County Council, defined as a Lead Local Flood Authority (LLFA) under the Regulations, is a large two-tier authority with eleven district and borough councils. The Preliminary Flood Risk Assessment (PFRA), comprising of this document, the supporting spreadsheet and GIS layer represents the first stage of the requirements of the Regulations.

The PFRA process is aimed at providing a national high-level overview of flood risk from local flood sources, including surface water, groundwater, ordinary watercourses and canals. As an LLFA, Surrey County Council must submit their PFRA to the Environment Agency (EA) for review by 22nd June 2011. The methodology for producing this PFRA has been based on guidance documents from both Defra and the EA, published in December 2010.

The EA has used a national methodology, which was set out by Defra, to identify Indicative Flood Risk Areas (IFRA) across England. Of the ten IFRAs that have been identified nationally, only one affects part of the County Council's administrative area – The London IFRA. Within this Flood Risk Area, the Regulations require Surrey County Council to carry out two subsequent key stages:

- Produce flood hazard maps and flood risk maps; and
- Produce flood risk management plans.

The London IFRA extends into the north of Surrey and covers parts of Tandridge, Reigate and Banstead, Elmbridge, Epsom and Ewell and Mole Valley.

In order to develop a clear overall understanding of the flood risk across Surrey, flood risk data and records of historic flooding were collected from both local and national sources including the eleven district and borough councils, the Environment Agency, water companies, emergency services and other risk management authorities.

Information relating to four particular flood events, caused by flooding from local sources, was collected and analysed. Although, it was considered relatively good data, the elements relating to the consequences of these events, wasn't of sufficient quality to complete the sections required by the Annex 1 of the PFRA.

Analysis of the national surface water modelling maps, indicate there is considerable risk of flooding from surface water across Surrey, particularly in the North, where the London IFRA extends. Based on figures from the Environment Agency, approximately 46,500 properties are estimated to be at risk from flooding to a depth of 0.3m during a rainfall event with a 1 in 200 annual chance of occurring.

Having compared flood risk information with locally observed flooding, this report proposes two minor extensions of the London IFRA. These extensions will include areas in both Banstead and Leatherhead, where substantial flooding has been recorded, including the internal flooding of properties.

Glossary of Terms

Term	Definition
ALC	Agricultural Land Classification
AStSWF	Areas Susceptible to Surface Water Flooding
CFMP	Catchment Flood Management Plan
Defra	Department for Environment, Food and Rural Affairs
DG5	A document produced by water companies that indicate recorded sewer flooding events in postcode areas
EA	Environment Agency
EC	European Commission
FMfSW	Flood Map for Surface Water *Deep = 0.3m deep flooding* *Shallow = 0.1m deep flooding*
FWMA	Flood & Water Management Act 2010
GIS	Geographic Information Systems
IDB	Internal Drainage Board
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NRD	National Receptor Dataset
PFRA	Preliminary Flood Risk Assessment
PPS25	Planning and Policy Statement 25: Development and Flood Risk
RBD	River Basin District
Regulations	Flood Risk Regulations 2009
SAC	Special Areas of Conservation
SCC	Surrey County Council
SFRA	Strategic Flood Risk Assessment
Significant	An event or item that is important at a national level
SPA	Special Protected Area
SSSI	Sites of Special Scientific Interest
SuDS	Sustainable Drainage Systems
SW	Southern Water
SWMP	Surface Water Management Plan
TW	Thames Water
WAG	Welsh Assembly Government

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1 Introduction

1.1 Background and Scope

1.1.1 This Preliminary Flood Risk Assessment has been prepared by Surrey County Council in response to the Flood Risk Regulations 2009, which require all unitary and county councils, (where two tier systems exist) to become Lead Local Flood Authorities. The Flood Risk Regulations tasks Lead Local Flood Authorities, in conjunction with the Environment Agency, with producing three tracts of work;

- Preliminary Flood Risk Assessments,
- Flood Hazard and Risk Maps
- Flood Risk Management Plans.

1.1.2 The Flood Risk Regulations transpose the EU Floods Directive into UK law. These confirm the LLFA role and require specific tasks to be undertaken by these authorities. The Regulations set in motion a six yearly assessment, mapping and planning cycle that begins with the Preliminary Flood Risk Assessment.

1.1.3 The Directive needs to be implemented in coordination with the Water Framework Directive by aligning flood risk management plans with river basin management plans and by consulting with the public on the content of the flood risk management plans.

Task	Organisation	Completion
Preliminary Flood Risk Assessment Report	SCC	22 June 2011
Review Preliminary Flood Risk Assessment Report and publish	EA	22 December 2011
Produce Flood Risk and Flood Hazard Maps	SCC	22 June 2013
Review Flood Risk and Flood Hazard Maps and publish	EA	22 December 2013
Flood Risk Management Plans	SCC	22 June 2015
Review Flood Risk Management plans and publish	EA	22 December 2015

Table 1-1: Risk Regulation Timetable

1.2 Aims and Objectives

1.2.1 The aim of the PFRA is to provide a broad overview of flooding over the administrative area of Surrey so that along with information from other unitary and county councils, a national picture of flooding can be developed by the Environment Agency.

1.2.2 The objectives are:

- Assess past flooding through a data gathering and mapping exercise.
- Identify and map possible future flooding sites
- Produce a PFRA report
- Identify future steps to be taken with respect to the future management of flooding

1.2.3 Both the Flood Risk Regulations and the Flood and Water Management Act work in tandem and apply to all sources of Flooding. The Flood and Water Management Act 2010 gives Local Authorities a new role to manage local flood risk in their area, which includes surface water flooding, groundwater flooding, flooding from ordinary

watercourses and canal flooding. River flooding still lies within the remit of the Environment Agency.

- Surface water flooding generally relates to rainfall running off surfaces before it enters a drainage system or a watercourse
- Groundwater flooding occurs when the water table below ground level rises and breaks through onto the surface
- Ordinary watercourses are any watercourse (including ditches and streams) that are not identified as Main Rivers on the Defra register.

1.3 PFRA Administrative Boundary

1.3.1 The County of Surrey has 11 boroughs and districts. These are Elmbridge, Epsom and Ewell, Guildford, Runnymede, Reigate & Banstead, Waverley and Woking Borough Councils and Mole Valley and Tandridge District Councils.

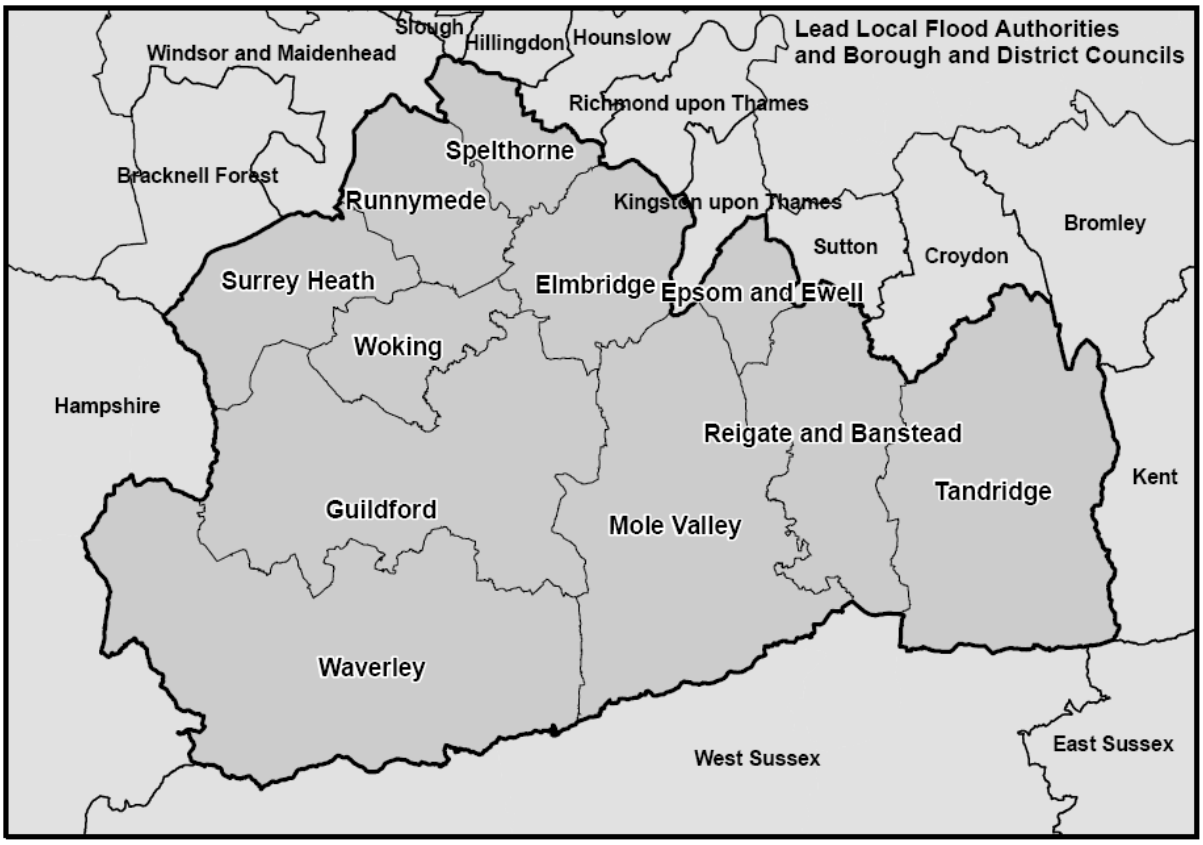

Figure 1-1: Surrey Boundary

1.3.2 Surrey shares its boarder with Hampshire, West Sussex, East Sussex and Kent County authorities; Bracknell Forest, Windsor and Maidenhead and Slough unitary authorities and the London Boroughs of Hillingdon, Hounslow, Richmond Upon Thames, Kingston Upon Thames, Sutton, Croydon and Bromley.

1.4 Topography and geology

1.4.1 The principal topographical features in the county are the North Downs, which run through the centre of the county from east to west. To the north of the Downs, the relief gives way to the flood plain of the River Thames.

1.4.2 In the northwest, a spur off the Downs runs northwards to the border with Berkshire, commonly referred to as Chobham Ridges. To the south of the North Downs, the topography generally drops shallowly away toward Sussex and the Weald Valley.

1.4.3 However areas of the competent rocks within the Lower Greensand geological strata just south of the Downs give rise to high relief structures such as Box Hill and Leith Hill in the centre of the county and Gibbet Hill to the south west, on the border with Hampshire.

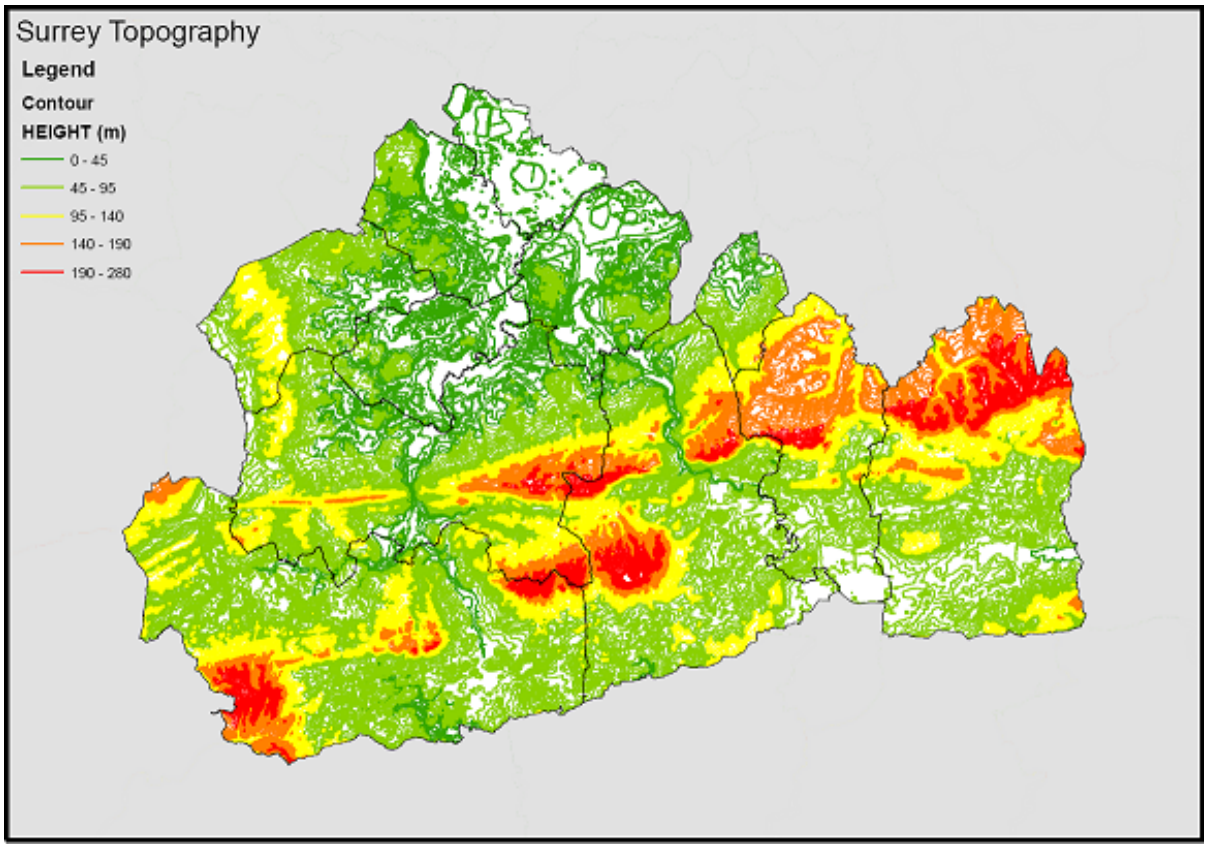

Figure 1-2: Surrey Topography

1.4.4 The geology of the area is mixed. The Downs are part of the Weald–Artois anticline (a big fold in the rocks), which created a competent chalk layer, which forms the majority of the high ground. The northern lowlands comprise clay, sandy clays & silty sands and extensive gravel in the Thames flood plain.

1.4.5 The southern lowlands comprise clays and silty sands.

1.4.6 Overall, in general terms of flooding, the lowlands are prone to river type flooding whereas along the base of the Downs and the Lower Greensand hills, flash flooding from surface water is a major concern.

2 LLFA Responsibilities

2.1 Governance and Partnerships

2.1.1 In order to gather the data to take the process forward, it was necessary to work with all organisations which either affect or are effected by the flooding within or adjacent to the county boundary. The Regulations states, under Section 35, *"Any relevant authority must co-operate with any other relevant authority which is exercising any functions under the regulations"*. Also in the Regulations, under Section 36 (2), it states that *"The Environment Agency and an authority listed in paragraph (3) must comply with a request of a lead local flood authority to provide information reasonably required in connection with the lead local flood authority's functions under these regulations."*

2.1.2 Through the work carried out by the SCC Flooding Task Group, (described in 3.1) Surrey County Council had already implemented extensive partnership arrangements with stakeholders, especially with the Borough and District Council's drainage/engineering sections which meet through several different forums and ultimately work to prioritise the Counties capital drainage programme.

2.1.3 In addition the County's Highways section, working with the County's Emergency Planning Unit, have established relationships with the emergency services and utilities companies through the Surrey Resilience Forum working on the multi agency flood plan.

2.2 Surrey Flood Risk Partnership Board

2.2.1 The Surrey Flood Risk Partnership Board is currently being developed. It is likely to include representatives from the Environment Agency, boroughs and districts, utility companies and emergency services.

2.2.2 The Board will take on the role of developing flood strategies within the County. In addition to looking at technical processes, the board will also develop funding strategies with Districts and Boroughs and other asset holders to ensure that drainage assets are maintained and local flooding strategies brought to fruition.

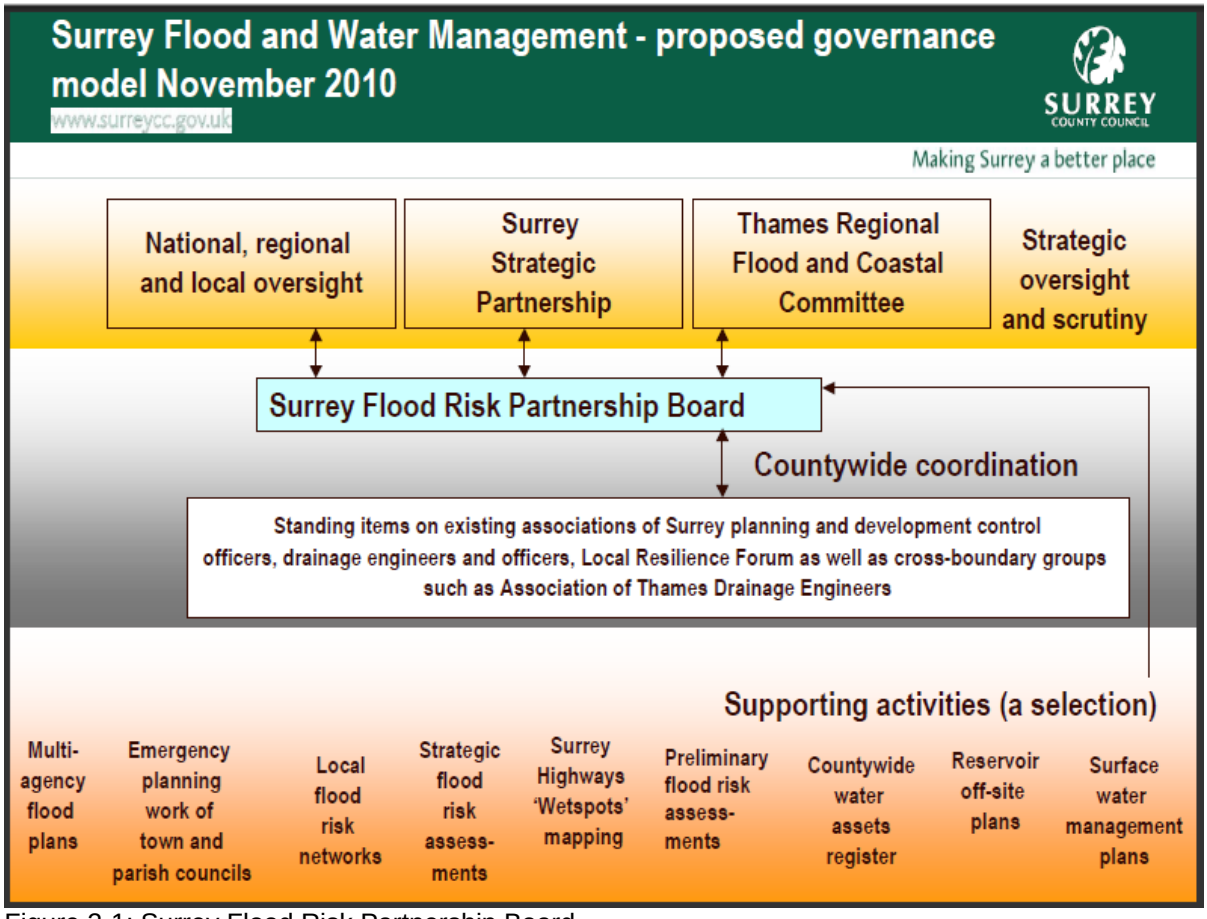

Figure 2-1: Surrey Flood Risk Partnership Board

3 Methodology and Data Review

3.1 Availability and limitations of gathered data

3.1.1 In 2007, Surrey County Council members formed a Flooding Task Group to review the implications of flooding in the county and to identify short, medium and long term solutions. Information requests were sent to all districts and boroughs, all parishes and all councillors. All information returned to the Flooding Task Group was recorded in the wet spot flooding database. The database is annually reviewed and updated. In light of the recent flooding legislation, the last database review was particularly robust.

3.1.2 As such, the wet spot flooding database has proven to be an invaluable tool in both reviewing past flood events, and validating assessments on future flood risk.

3.1.3 In addition web pages have been created on the county's website to enable the public to provide information on historic flooding.

3.1.4 External flooding information, such as the Strategic Flood Risk Assessment documents and various GIS datasets from the Environment Agency were readily available. However, specific details of historic flooding areas required face-to-face meetings with the engineers from each of the districts and boroughs within Surrey.

3.1.5 The National Receptors Dataset provided by the Environment Agency contains the property points layer for Surrey and the surrounding areas. These property points contain information on residential properties, critical services and non-residential properties. An issue with the non-residential properties in this dataset was that it included significant number of records relating to non-building locations such as ponds. 17759 non-building locations were identified from the "OS Class" field and removed from the dataset before any GIS analysis was performed. The following table shows the various organisations contacted for flooding information relevant to the PFRA, along with a breakdown of the individual datasets received.

Dataset	Description
Surrey County Council	
Wet Spot Flooding Database	The Wet Spot database has been developed and is continually being updated with current information to produce a comprehensive map and records of all the identified Wet spot in Surrey. The Wet Spot database was used to highlight significant flood events and to determine which of the Flood Maps provided by the Environment Agency best represented flooding in Surrey.
Surrey GIS layers	A selection of GIS layers that include specific critical infrastructure within Surrey and geographical strata. This data was used to understand the likelihood of groundwater flooding to affect areas of Surrey.
CONFIRM database	CONFIRM is a database of calls from stakeholders within Surrey including data from Surrey Police. The specific area of CONFIRM used for this report were the calls specific to flooding, both highway and property. This data was used to determine consequences of historic flood events.

Environment Agency	
Areas Susceptible to Surface Water Flooding	The AStSWF maps show outlined areas at risk from surface water flooding and are based on our understanding of surface water flooding at the time of the original publication in 2008. The three bandings are less, intermediate and more. These maps have been used to determine areas at risk of flooding in England and Wales.
Flood Map for Surface Water	The next step from the AStSWF maps. These maps indicate a more defined flow and are split into four bandings. Shallow and Deep flooding for 1 in 30yr and 1 in 200yr events. These maps have also been used to determine areas at risk of flooding. Both these maps and AStSWF maps have been compared to historic event locations to determine which map is more representative of flooding in Surrey.
Flood Map	Shows the extent of flooding from rivers with catchments of more than $3km^2$ ($1.2\ Miles^2$). This map was used to determine which flood events may be partly due to flooding of main rivers, which are not to be included in this report.
Areas Susceptible to Groundwater Flooding	Course grids indicating areas that may be susceptible to groundwater flooding and may require further investigation. This map was used in a broad analysis of future flood risk with other flood maps.
National Receptors Dataset	NRD is a spatial dataset which contains a number of GIS layers categorised into themes of information including buildings, environment, heritage, transport, utilities. This dataset was used when analysing the IFRAs provided by the Environment Agency.
Indicative Flood Risk Areas	Indicative flood risk areas based on clusters formed from all $3km^2$ squares that contain 5 or more Places above the Flood Risk Thresholds ($1km^2$ squares) that are touching. This map has been used to determine whether there are any IFRAs within the Surrey boundary.
Historic Flood Map	The Historic Flood Map shows the combined extents of known flooding from rivers, the sea, and groundwater. Recorded historic events have been compared to this map.
Thames, Medway and Arun Catchment Flood Management Plan (CFMP)	CFMPs consider all types of inland flooding, from rivers, ground water, surface water and tidal flooding, but not flooding directly from the sea. They also take into account the likely impacts of climate change, the effects of how the land is used and managed, and how areas could be developed to meet our present day needs. These reports have been used as part of the process to determine areas at risk of flooding but also to compare areas within Surrey to areas located outside of the county.
District and Borough Councils	
Strategic Flood Risk Assessment (SFRA)	Strategic Flood Risk Assessments have been completed for all Boroughs and Districts and include information on historic flooding from all types of flooding. Most of the historic events within these reports are already part of the Wet Spot database held by SCC. GIS layers provided with the reports were compared to the Wet Spot data and included if data was not duplicated.
Historical flooding records	Historical records of flooding events collected by the local council. This data was compared to other historic data and included in the analysis
Anecdotal information relating to local flood history and flood risk areas	Anecdotal information from different council employees including Engineers and Planning Officers. This data was compared to other historic data and included in the analysis
National Trust	
Flood History of the River Wey Navigation	No Information Available - We were informed that the Environment Agency kept records of flood events along the Wey Navigation.

Basingstoke Canal Authority	
Anecdotal information relating to flood history along the Basingstoke Canal	Anecdotal information from Basingstoke Canal Authority representatives indicating areas that have flooding, works that have been taken out to reduce likelihood of repeat flooding, and areas most likely to flood. Unfortunately, all events provided have had work completed to reduce the risk of further flooding so no extra data could be included in the report
Wey and Arun Canal Trust	
Records of flood events in the Surrey section of the Wey and Arun Canal	No Information Readily Available at time of publishing
Upper Medway Internal Drainage Board	
Records of flood events in the Surrey section of the Medway Catchment	Information held by Environment Agency
Anecdotal Information related to flooding of ordinary watercourses in the Medway Catchment	Anecdotal information from Upper Medway Internal Drainage Board representatives, indicating areas within their boundary affected by flooding of ordinary watercourses This data was compared to other historic data and included in the analysis
Thames & Southern Water	
DG5 Register for Thames Water	DG5 Register logs and records sewer-flooding incidents in postcodes for the last 10 years. The data was allocated to a postcode shapefile to display the data for historic flooding. As is represented in postcodes, the lack of accuracy of the data reduces its use.
DG5 Register for Southern Water	No Information Readily Available at time of publish
Surrey Fire and Rescue Service	
Records of historic flood events with Surrey	No Information Readily Available at time of publish
Highways Agency	
Records of flooding involving highways within Surrey	No Information Readily Available at time of publish
Network Rail	
Records of flooding involving railways within Surrey	No Information Readily Available at time of publish
Natural England	
GIS layers indicating Environmentally important sites within Surrey	GIS layers indicating the locations of Sites of Special Scientific Interest (SSSI), Special Protected Areas (SPAs), Special Areas of Conservation (SAC), and Ramsar Sites as well as the Agricultural Land Classification (ALC) These GIS layers have been used to determine where there are possible environmental impacts from flooding.
Historic Data on Flooded SSSIs and their consequences	No Information Readily Available at time of publish

Table 3-1: Preliminary Flood Risk Assessment Sources

3.1.6 The quality and coverage of the data does vary. The main factors being the amount of local knowledge and experience available, the historical records, and the resources available. (See section 4.3 for more information on the limitations of historic flooding data)

3.1.7 For example, in the borough of Epsom & Ewell the flooding information is fairly limited. However, a Surface Water Management Plan is currently underway in this borough, and the outputs of this project will include much more detailed information on past floods, future flood risk and possible flood risk mitigation options. As a significant portion of Epsom & Ewell lies with the London Indicative Flood Risk Area, this information will be extremely useful in the development of the Flood Risk and Hazard maps required by the EU flood directive in 2013.

3.2 Future Data Storage

3.2.1 Currently, the wet spots flooding database serves as the master database for all types of flooding reported to Surrey County Council. The diverse nature of this data, such as different sources of flooding and the varying methods of reporting, can cause complications when combined into a single dataset. Therefore, a review of the way that observed flooding is recorded and stored will need to be undertaken by the Surrey Flood Risk Partnership Board, along with proposals for new systems that will allow specific information to be shared with the relevant partners.

3.3 Flooding Information: Security, Licensing and Restrictions

3.2.2 All received flooding information was transferred onto the internal servers, where only the relevant personnel have access. Some data is freely available to the public, and therefore has no restrictions regarding publication. Other data, from sources such as the water companies and some of the datasets from the Environment Agency were provided with specific licenses, which restrict the use of their data. All of these restrictions must be followed closely when referencing the data in this report, whether in the form of quoted figures, or information displayed on a map or plan.

4 Historic Flood Data

4.1 Overview of Historic Flooding in Surrey

4.1.1 Data collected directly by Surrey County Council is held in a wet spots flooding database. The wet spots flooding database also includes sites that have had remedial work carried out. These sites have been excluded from this report. Data provided by borough and district authorities has been consolidated into the wet spots flooding database.

4.1.2 Data was also collected from other stakeholders. For more information on the variety and the collection of data, see section 3.1.

4.2 Significant Harmful Consequences

4.2.1 The Preliminary Flood Risk Assessment is based on using existing information to produce readily derivable information.

4.2.2 The data required to assess the consequences for past flooding is stipulated as human health, the economy, the environment and cultural heritage. The indicators for consideration are given below:

Impacts of Flooding on:	Flood Risk Indicators
Human Health	• Number of people (based on residential properties) • Number of critical infrastructure (schools, hospitals, nursing homes, police / fire / ambulance stations etc)
Economic Activity	• Number of non-residential properties (e.g. shops, offices and churches) • Length of road or rail • Areas of agricultural land
Environment	• Designated sites (SSSIs, SACs, SPAs, etc) and BAP habitats
Cultural Heritage	• World Heritage Sites

Table 4-1: Flood Risk Indicators

4.3 Quality of Historic Flooding in Surrey

4.3.1 The main problem with the data gathered is with the exception of the 4 identified events; much of the data does not have a date or time allocation. Therefore, it was not possible to determine which of these floods were attributed to any flood event in particular. In addition, the lack of homogeneity in the data means that comparison of flood data between areas is unlikely to provide reliable results.

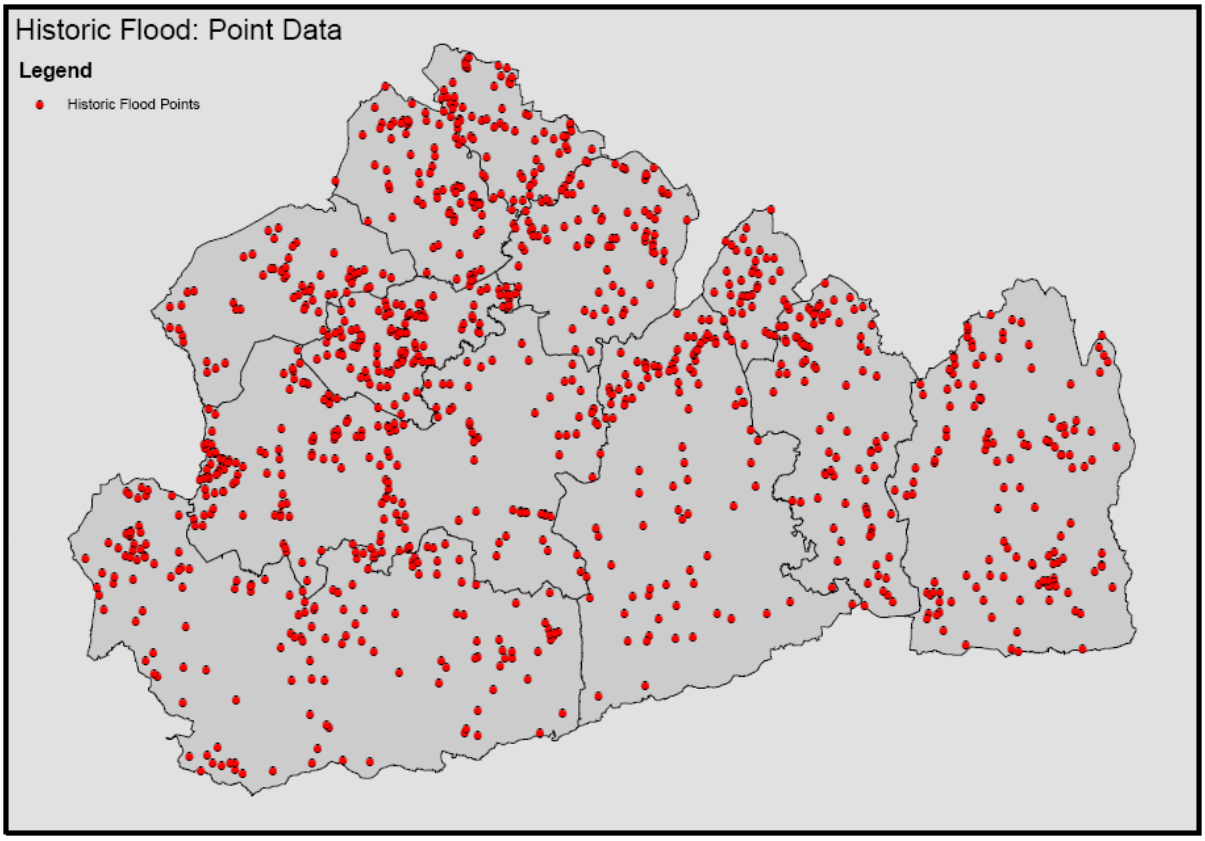

Figure 4-1: Point Data for Historic Floods

4.3.2 The variety of data can be attributed to the ways different organisations and individuals hold their flooding data. For example, records held for the flood events witnessed by the Borough and District authorities vary, The range of data varies from one authority that has recorded floods back to July 2000, and some who have limited or no records of flooding at all within their boundary. Another issue with the data collected was the validity of the records. Some boroughs have computer-based records of flood events, some information was delivered to Surrey County Council as a GIS layer. Other data was collected from the memories of employees of the council authorities

4.3.3 Thames Water data, referred to as DG5 data, is held in postcode format. Comparison of Figure 4-1 and Figure 4-2 shows clearly the difference in the different methods in storing the data.

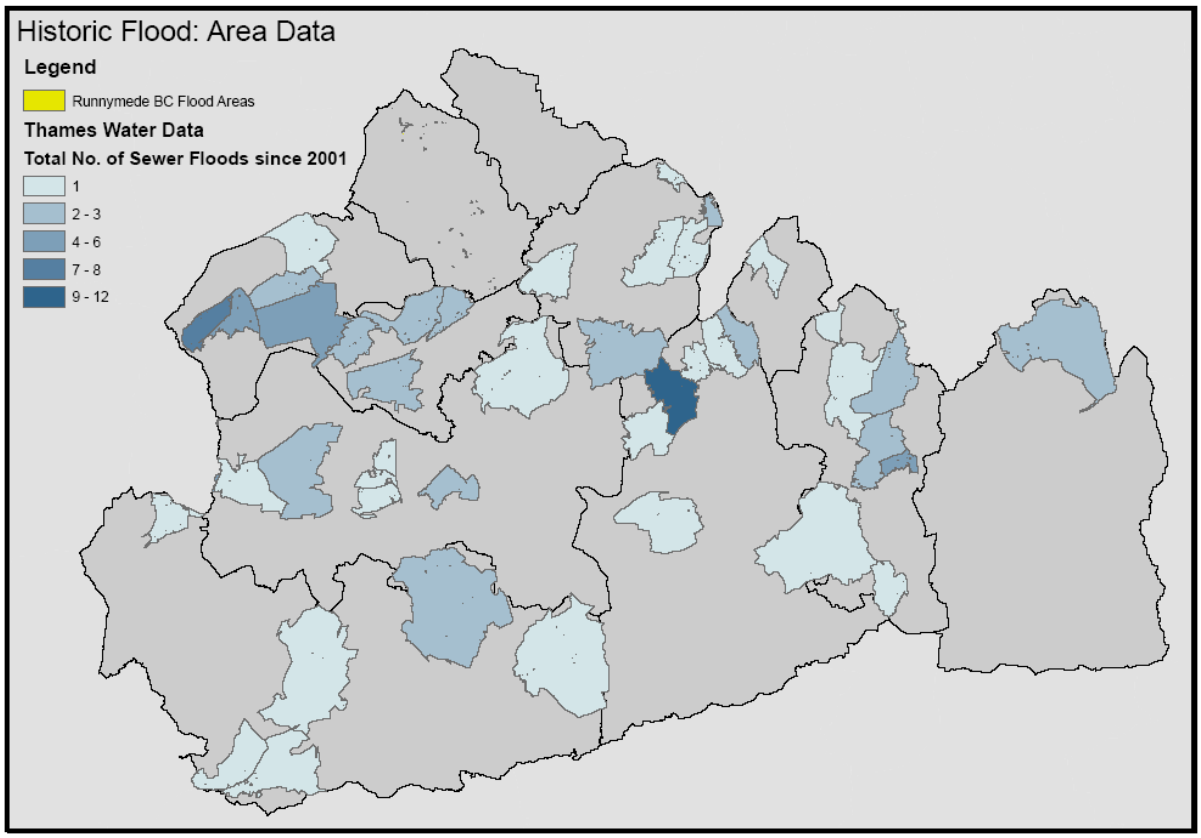

Figure 4-2: Area Data for Historic Flood Events

4.4 Consequences of Historic Flooding

Flood	Information	Consequences	Source
Autumn 1968	Little accurate data	Not enough data	Anecdotal newspaper articles from archives
Autumn 2000	1 in 300yr storm "Wettest Autumn since records began" (in 234 yrs)	500+ properties flooded, 260 residents evacuated Flooding closed M25 Flooding incidents occurred outside floodplain due to infrastructure deficiencies	Surrey County Council "Highway Management of Flooding and Drainage" Doc No. 3499/doc/02
Winter 2002-3	Flooding in Runnymede and Spelthorne during December 2002 was due to river flooding and is not applicable to this report.	11 property floods reported to Council	Surrey County Council 2007: "Highway Management of Flooding and Drainage". SCC CONFIRM system

Flood	Information	Consequences	Source
August 2006	Two months of rainfall (85mm) fell in the space of 6 hours over North West Surrey. Flooding was experienced in Aldershot, Ash, Ash Vale, Windlesham, Lightwater, Chobham, West End and Addlestone.	190 properties flooded internally. 325 properties flooded externally. Estimated 57 roads were affected. Surrey Police set up and controlled temporary road closures following reports of flooding. Surrey Fire Brigade received 395 calls, 80 were within their capability to answer. Hampshire Fire and Rescue Service carried more out. No data was collected on the disturbances to transportation within Surrey. These consequences do not cover those required for a flood to be considered significant.	Environmental Agency Flood Event Report – Report into the river flooding on 13 and 14 August 2006 in North West Surrey and North East Hampshire Published by Environment Agency
July 2007	Rainfall in July: *actual (percentage of usual)* Byfleet = 141mm(255%) Guildford = 151.6mm(342%) 660 calls from Residents during and between the two heavy rainfalls	Surrey County Council was informed of 61 property floods.	http://www.environment-agency.gov.uk/static/documents/Research/rainfall_1897354.pdf (07/04/2011) Surrey County Council Confirm System

Table 4-2: Information and Consequences on Past Floods

4.4.1 Early guidance on the figure to use for significant harmful consequences affecting the population was indicated to be 3,000 people being affected. This is one magnitude lower than the 30,000 people figure used for Indicative Flood Risk Areas and can be considered as a relative progression based on a national scale. Therefore, for the purpose of this report, the figure of 3,000 people has been used to assess past flooding. The new Surrey Flood and Risk Management Board may want to review this figure in the future.

4.4.2 Areas in Surrey which don't reach this national based figure, but under go 'regular serious flooding incidents', will be addressed in Local Flood Risk Reduction Plans that will be introduced by the Surrey Flood Risk Partnership Board.

4.4.3 Surrey has no international or nationally acknowledged Cultural Heritage sites.

4.4.4 Surrey currently has 62 Sites of Specific Scientific Interest (SSSIs). Of these, there are also a number of Special Areas of Conservation (SACs), Special Protection Areas (SPAs) or Ramsar sites. At present, it is not known how these sites would individually react to flooding.

4.4.5 The Autumn 2000 flood event is considered the worst flood event for which records are held. Between 500 and 600 properties were recorded as flooding in Surrey. This is equivalent to approximately 0.1% of the total number of properties in Surrey and significantly below the 3000 figure.

4.4.6 No historic flood events have been considered for inclusion in Annex 1 of the Preliminary Assessment Spreadsheet. This is because the information available does not indicate that the floods have fulfilled the criteria that is required for an event to be included in the spreadsheet

5 Future Flood Risk

5.1 Locally agreed surface water flooding information

5.1.1 There are several different flood maps available from the Environment Agency, showing surface water flood risk from different flood events. Whilst not a specific requirement of the Flood Risk Regulations, it is recommended that Lead Local Flood Authorities review the different flood maps and select the one that best describes the local flood conditions observed and recorded thus far. This flood risk map is to be referred to as the "Locally Agreed Surface Water Flooding Information"

5.1.2 Local information on future surface water flood risk is very limited in Surrey, and the only available datasets come from some of the Strategic Flood Risk Assessments conducted by the districts and boroughs (Surrey Heath West and Waverley). These surface water flood risk maps were compared to the surface water flood risk maps provided by the EA. The comparison of these maps with the wet spot flooding database, which are records of actual floods, showed that the EA's modelled flood maps were more accurate. Information on the drainage capacity across the Surrey area is also extremely limited, and it was decided that there was insufficient data for this to feed into the locally agreed surface water information.

5.1.3 The best set of recorded flooding incidents in Surrey is the wet spot flooding database. This dataset was used when comparing the different flood maps, to see which best agrees with the flooding incidents observed to this day.

5.1.4 Based on our reviews, the Flood Map for Surface Water (FMfSW) 1 in 200yr deep (0.3m depth) flood map agreed with the observed wet spots flooding better than the any of the others. (See figure 5.1)

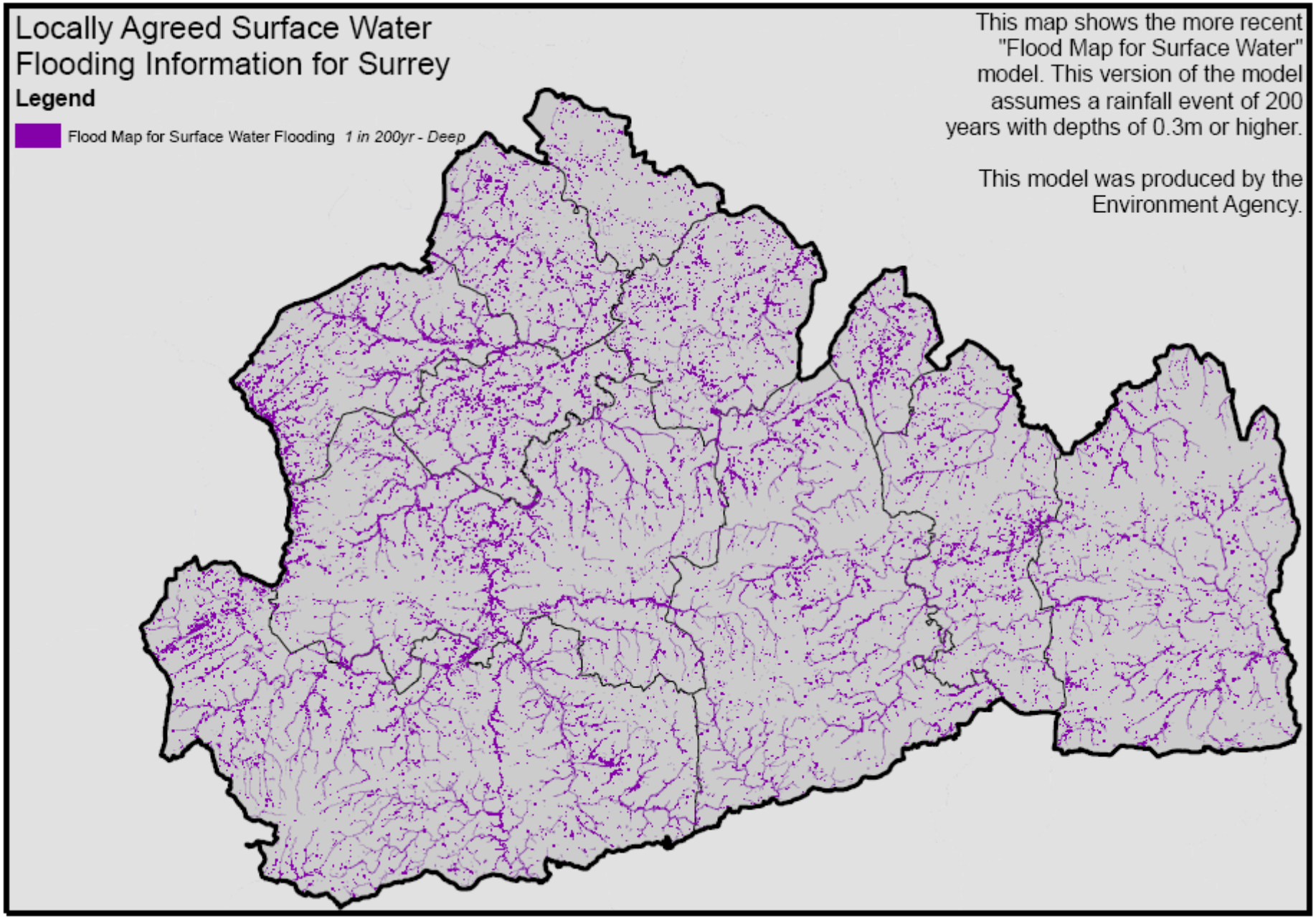

Figure 5-1: Locally Agreed Surface Water Information

5.1.5 Another key point to consider was that the newer Flood Map for Surface Water data has included considerations on surface water entering drainage systems. Whilst this would be a valid assumption for most of the County, some areas on the chalk bedrock rely more on ground infiltration rather than drainage systems that carry the water to watercourses. These areas were inspected in detail, but found that the Flood Map for Surface Water maps still agreed closely with the wet spot data. This too, supported the decision to nominate the FMfSW 1 in 200 yr deep as the "Locally agreed surface water flood information" for Surrey.

5.1.6 The detailed GIS analysis, provided by the Environment Agency, show that 46500 of the property points within the National Receptors Database lie within the FMfSW 1 in 200 yr deep.

5.2 Summary table and description of Future Flood Risk in Surrey

5.2.1 An initial assessment of flood risk was carried out by Defra by way of calculating the number of properties at risk of flooding in areas relating to the various cities, towns and villages across the country. These areas were then given a national ranking based upon these property numbers and this list was used to determine which areas would receive funding for local Surface Water Management Plans.

5.2.2 A more detailed national analysis of flood risk was then carried out by Defra, which yielded the "Places above flood risk thresholds" the English Clusters and the Indicative Flood Risk Areas.

5.2.3 The Environment Agency description for the "Places above flood risk thresholds" is given below:

Places above the Flood Risk Thresholds are 1km grid squares where at least one of the following flood risk indicators is above the threshold given below:

- Number of People – 200 or more (based on an average of 2.34 people residing in a property)
- Critical Services – 1 or more
- Number of Non-Residential Properties – 20 or more

5.2.4 Indicators were calculated using the Defra detailed method of counting (based on property outlines) on the FMfSW 1 in 200 yr deep.

5.2.5 The areas of greatest risk from surface water flooding were found by selecting the clusters of 8 or more touching "Places above flood risk thresholds" squares. These areas were designated the "Surrey Clusters".

5.2.6 The Surrey clusters were named based on the major towns they covered. The GIS data for the Places above flood risk thresholds contains the numbers for the different flood risk indicators in the FMfSW 1 in 200 yr deep areas contained in each 1km grid square:

- Number of people refers to the number of residential properties multiplied by 2.34
- Number of critical services refers to the number of properties classified as critical services in the EA PFRA guidance document. These include hospitals,

nursing/care/retirement homes, police/fire/ambulance stations, prisons, sewerage treatment works and electricity installations.

- Number of non-residential properties refers to properties not classified as a residence. Defra believes this gives an indication of the number of properties associated with economic activity.

5.2.7 The number of “Places above flood risk thresholds” simply shows the number of 1km grid squares making up each Surrey Cluster.

5.2.8 The sum of these numbers for all the squares in each Surrey Cluster is shown in the table below.

Surrey Cluster	No. of People	No. of Critical services	No. of Non-residential properties	No. of Places above flood risk thresholds
Reigate & Redhill	5900	14	623	16
Guildford	5689	15	539	15
Woking & Byfleet	5677	12	394	14
Epsom & Ewell	4070	13	453	10
Camberley	3988	16	629	12
Caterham & Warlingham	3085	7	297	8
Leatherhead	2734	12	292	8
Farnham	2479	21	418	12
Banstead	2291	6	155	8
Dorking	2252	8	289	8
Thames Ditton	2055	10	135	7

Table 5-1: Areas at risk of flooding

5.2.9 There is an obvious correlation between the figures listed, and the number of squares that make up each area. However, the Defra squares were generated by a national level analysis on the FMfSW 1 in 200 yr deep which itself will not take may local factors into account – such as flood defences and new developments. In order to better understand the severity of flood risk consequences without the bias of large numbers of adjacent blue squares, the figures above were divided by the number of blue squares to show the density of flood risk receptors for each area.

5.2.10 As the higher density areas have their flood risk receptors clustered into relatively small areas, even the more localised rainfall events can affect the majority of them and generate considerable risk of surface water flooding. Conversely, a more widespread rainfall event is required to affect a similar number of flood risk receptors in the larger, lower density areas.

Area	No. of People per 1km square	No. of Critical services per 1km square	No. of Non residential properties per 1km square
Epsom & Ewell	407	1.30	45.30
Woking & Byfleet	405.5	0.86	28.14
Caterham & Warlingham	385.63	0.88	37.13
Guildford	379.27	1.00	35.93
Reigate & Redhill	368.75	0.88	38.94
Leatherhead	341.75	1.50	36.50
Camberley	332.33	1.33	52.42
Thames Ditton	293.57	1.43	19.29
Banstead	286.38	0.75	19.38
Dorking	281.5	1.00	36.13
Farnham	206.58	1.75	34.83

Table 5-2: Alternate List of Areas at Risk of Flooding

5.2.11 These lists stand well with both the local strategy projects that have already been implemented in Woking and Epsom & Ewell, and the indicative flood risk areas that lie within the London cluster.

5.2.12 In terms of defining the significance of each of the Surrey clusters, the Indicative Flood Risk Areas require a total number of people at risk of flooding to be greater than 30,000. Given that the largest figure for number of people at risk of flooding in the Surrey clusters is 5900, this confirms that these areas are well below the threshold for being classified as significant on a national level for this report.

5.3 Preliminary Assessment Report Spreadsheet

5.3.1 Many of the fields in the spreadsheet required data that was either provided to the Lead Local Flood Authorities by the Environment Agency, or were easily obtainable using simple GIS analysis.

5.3.2 The key mandatory fields in the spreadsheet require the Lead Local Flood Authorities to decide whether the consequences listed can be deemed “Significant” for each flood event based on a national level assessment, which will be presented to the European Commission.

5.3.3 The guidance states that whilst there are no steadfast rules in terms of determining what is and isn’t significant, the Lead Local Flood Authorities should bear in mind the criteria and thresholds used by Defra in generating the Indicative Flood Risk Areas.

5.3.4 To assist in deciding on a threshold to determine whether the consequences are significant on a national level assessment, it was decided to use the Surrey Indicative Flood Risk Areas as an acceptable point of reference.

5.3.5 Through GIS analysis, the percentage of flood risk receptors that fall within the Indicative flood risk areas was calculated and used as the thresholds for the various flood events.

5.3.6 The same analysis was done for the Surrey County area, for the various flood events and these percentages were compared with the thresholds to use as evidence to support the completion of the mandatory fields for human health and economic consequences.

5.3.7 In terms of the consequences for environment and cultural heritage, section 4.2 highlights the key factors to be considered.

5.3.8 Whilst Surrey currently has 62 Sites of Special Scientific Interests, there is no readily available information on determining which of these would experience harmful consequences because of flooding. There are also no nationally acknowledged cultural heritage sites within Surrey.

5.3.9 Whilst some of the flood events have been identified as having significant consequences on a countywide level and will be dealt with by the local strategy, none of these flood events exceed the threshold criteria to qualify as significant on a national level. Therefore, the flood events in the annex 2 Future Floods spreadsheet have been deemed as not having significant consequences at this strategic level.

5.4 River Basin Districts and Climate Change

The Evidence

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

5.4.2 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.

5.4.3 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.

5.4.4 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 rainstorms 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

5.4.5 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

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

5.4.7 Wetter winters and more of this rain falling in wet spells may increase river flooding in both rural and heavily urbanized catchments. More intense rainfall causes more surface runoff, increasing localized 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.

5.4.8 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.

5.4.9 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.

5.4.10 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

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

5.4.12 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.

Long Term Developments

5.4.13 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.

5.4.14 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."

5.4.15 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 that are "significant" (in terms of the Government's criteria).

6 Review of Indicative Flood Risk Areas

6.0.1 The Indicative Flood Risk Area (IFRA) for London crosses the Surrey administrative border in four separate locations. These areas are relatively small when compared to the total area of the London IFRA, with their combined area making up approximately 5%.

6.0.2 In order to carry out the analysis they have been treated as four individual areas and have been designated as:

1 Elmbridge Section
2 Leatherhead Section
3 Banstead Section
4 Tandridge Section

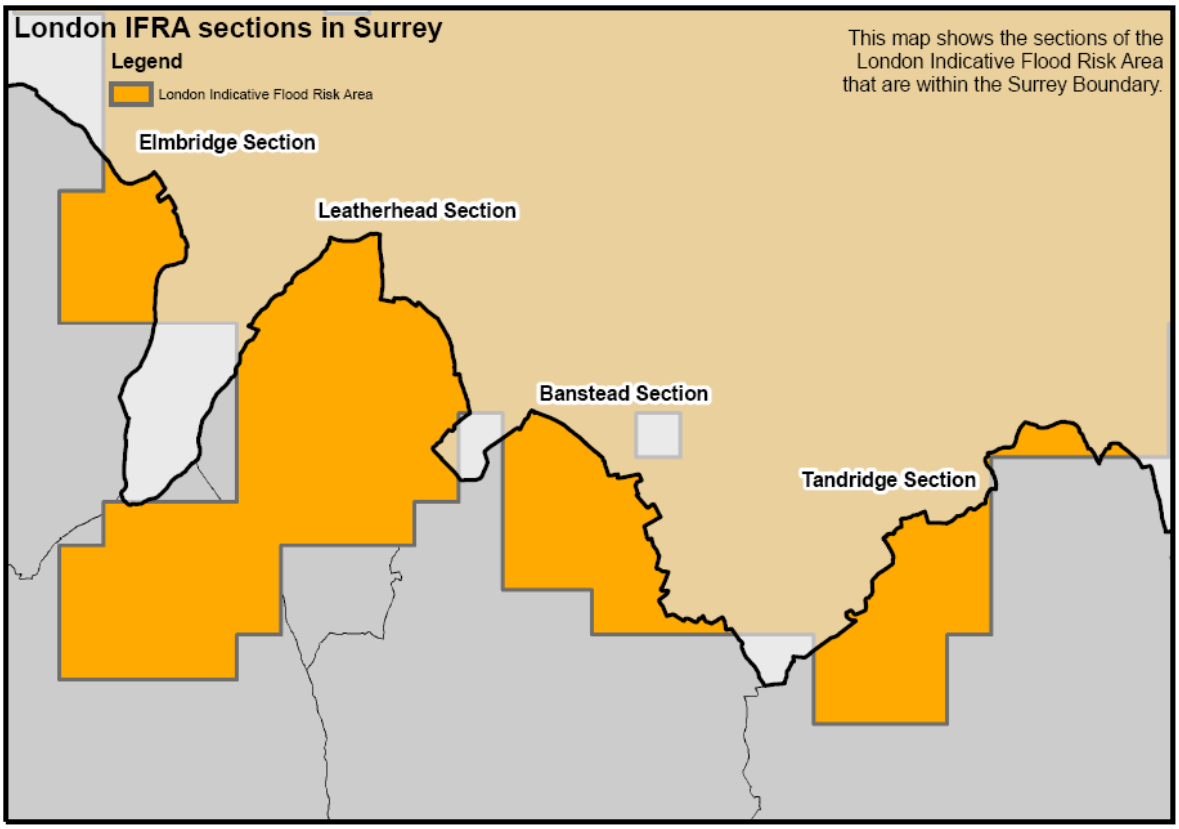

Figure 6-1: London Indicative Flood Risk Area sections in Surrey

6.0.3 The first part of the review process was to evaluate each of these areas against the locally agreed surface water information, which is the FMfSW 1 in 200 yr deep, and any other relevant local information such as the historic flooding information recorded in the wet spots flooding database.

6.0.4 From the analysis, the Surrey sections of the London IFRA contain obvious surface water flow routes leading towards the Greater London area. The only exception to this is the area covering Leatherhead, which shows the surface water routes heading towards the River Mole, rather than into Epsom & Ewell.

6.0.5 In addition, these areas have already been identified as having enough residential or business properties and/or critical services at risk of future flooding, as shown by the blue squares provided by the Defra.

6.0.6 Finally, these areas were compared with the wet spot flooding database, and this comparison confirms that significant local flooding had been observed in all of these areas.

6.0.7 Therefore, this review agrees that considerable risk exists in the Surrey sections of the London IFRA proposed by Defra.

6.0.8 The next stage of the review involved analysis of the areas immediately surrounding the Surrey sections of the IFRA to assess whether any amendments based on local historic information should be proposed.

6.0.9 It was decided to limit the proposed extensions to 1km grid squares, so as to maintain consistency with Defra's method.

6.0.10 The main features that were looked for in these surrounding areas, was the existence of wet spots showing that internal property floods had been observed. Where these were identified, the information contained in the wet spots flooding database was analysed to confirm that the likely cause of the flooding was from overwhelmed drainage systems (as opposed to maintenance issues).

6.0.11 Finally, these identified areas were compared against the locally agreed surface water information to both confirm that the source of flooding is surface water, and that the surface water flow routes do lead into the London IFRA.

A summary of the individual areas is given below:

Elmbridge section of London IFRA - This area covers around 7.5 km^2 (2.9 square miles) in the Thames Ditton Area. The area is centred on the Rythe, a tributary of the Thames.

The area contains 8 recorded locations that have experienced flooding in the past, with one known property flood. No other types of flooding have been recorded.

Leatherhead section of London IFRA - This area is the largest of the 4 and covers 45km^2 (17.4 square miles). The area covers Leatherhead town and most of the Epsom & Ewell borough.

The area contains 63 recorded locations that have experiences flooding in the past, with 3 known property floods. A further 3 have experienced foul water sewer flooding.

Banstead section of London IFRA - This area covers roughly 11km^2 (4.2 square miles). The area covers the east section of Banstead and Woodmansterne.

The area contains 12 recorded locations that have experienced flooding in the past, with 3 known property floods, one of which included foul water sewer flooding.

Tandridge section of London IFRA - This area covers roughly 15km^2 (5.8 square miles). The area covers the section of Caterham and the west and centre section of Warlingham.

This area contains 17 recorded locations that have experienced flooding in the past, with 4 known property floods, one of which is affected by foul water sewer flooding.

7 Amendments to London Indicative Flood Risk Area

7.0.1 While carrying out the review for section 6, it became apparent that it was necessary to consider the area surrounding Leatherhead and make a decision as to whether it should remain part of the London IFRA. The primary reason for this is that when it was reviewed against the locally agreed surface water flooding information, it was revealed that the area of Leatherhead contains surface water flow routes that run towards the River Mole, and it is therefore not directly hydraulically linked to the rest of the London IFRA.

7.0.2 After considering all relevant flooding information for area, it was decided that it would be of greater benefit to keep Leatherhead as part of the London IFRA, and include it in the next stage of the process.

7.0.3 Despite the fact that it is not directly hydraulically linked to Greater London, a large number of significant historic flood events have occurred which include internal property flooding. As it is also a highly urbanised area, the future flood risk is considerable, as shown by the “Places above flood risk thresholds”, identified by Defra.

7.0.4 Following the review of the areas surrounding the London IFRA, two minor amendments are proposed.

7.0.5 Given that the Leatherhead section of the London IFRA remains in effect, it is proposed that the region around Leatherhead be extended to include the areas shown in figure 7.1, and the Banstead section be extended as shown in figure 7.2

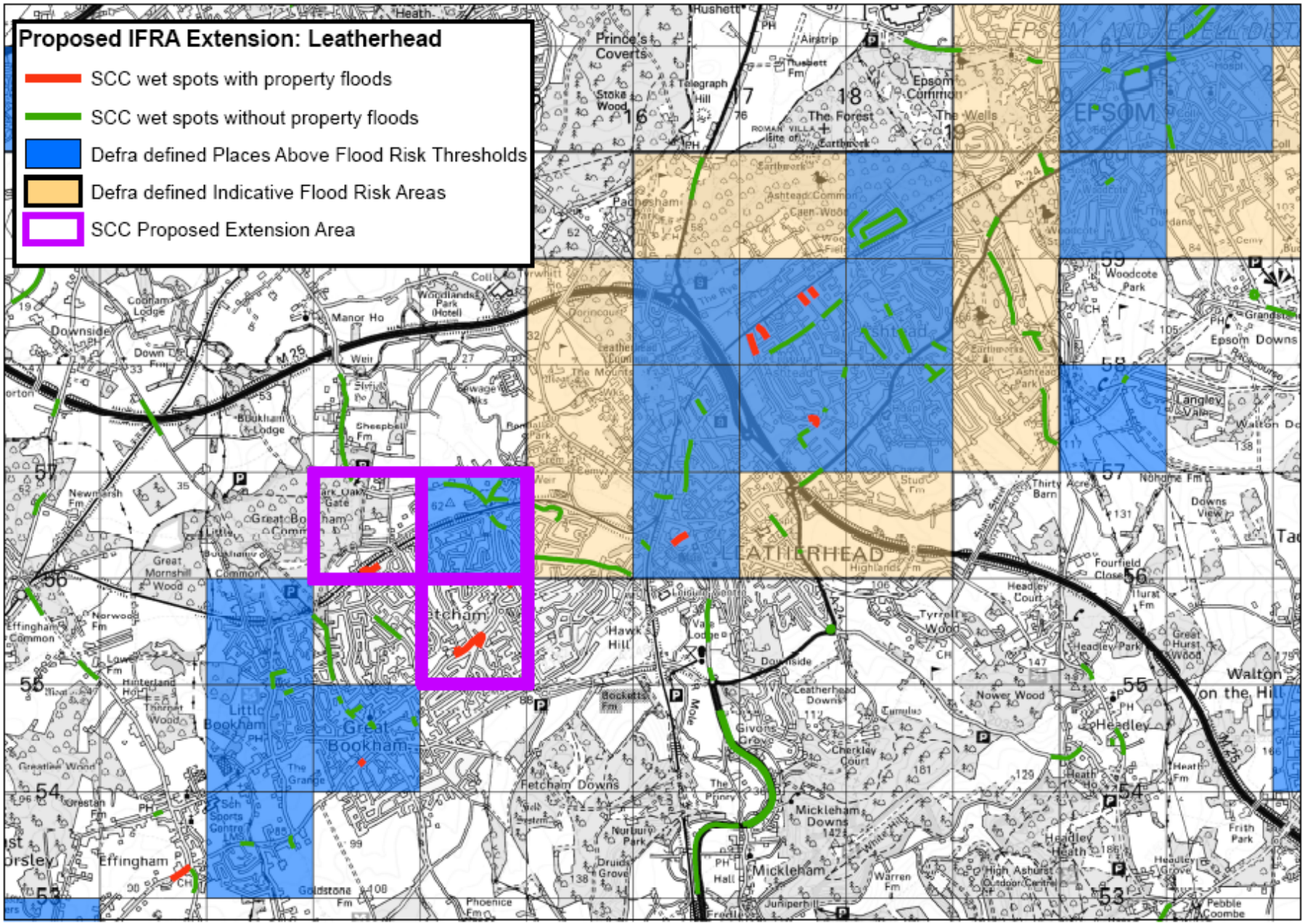

Figure 7-1: Proposed IFRA extension: Leatherhead area

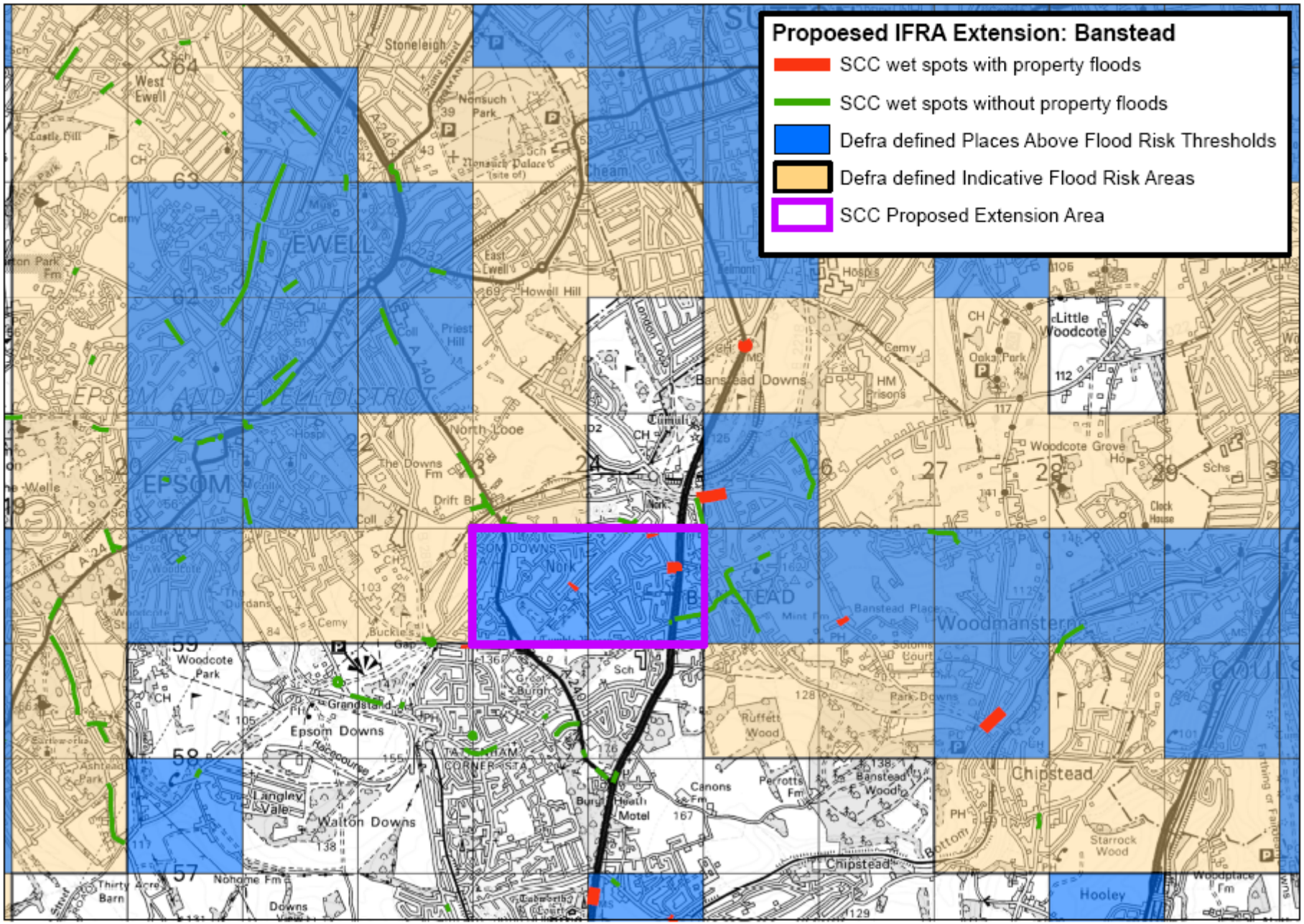

Figure 7-2: Proposed IFRA extension: Banstead area

7.0.6 The main factors for both these proposals are that the wet spots show significant local flooding (Including internal property floods) has been observed and also that the “Places above flood risk thresholds” highlight significant future flood risk in these areas.

7.0.7 The surface water flow routes from the locally agreed surface water information confirm that the flooding in these areas are directly connected to the areas that have already been identified as part of the London IFRA.

7.0.8 In order to propose any new flood risk areas, it would be necessary to identify a large area of flood risk that exceeds the threshold of 30,000 people at risk of flooding. Given that the number of people is determined by the number of residential properties x 2.34, this threshold effectively means that the flood risk area must include at least 12,800 residential properties within the FMfSW 1 in 200 yr deep areas.

7.0.9 Using the information on number of people at risk from surface water flooding in the Surrey Clusters (see table 5.1), none of these areas are close to the 30,000 threshold and therefore, no new flood risk areas are proposed.

8 Next Steps

8.0.1 The next step for the County is the imminent formation of the Surrey Flood Risk Partnership Board, see figure 2-1, which will take responsibility for developing the County’s flood risk management strategy.

8.0.2 The PFRA process, which requires review every 6 years, will ensure that data continues to be gathered so that the Board can monitor the changes in flood risk across the county and adapt the strategy as necessary.

8.0.3 The County have, for the past 3 years, gathered information from the Districts and Boroughs. In addition localised flood events have been monitored using the County’s highway CONFIRM software. This is currently being replaced by a new system called MG Connect. The software is still being developed, but once the core system becomes operational a specific flood recording system will be developed covering groundwater, ordinary watercourses and canals.

8.0.4 Geographic Information Systems (GIS) have proved invaluable during the initial Preliminary Flood Risk Assessment process and the County intends to increase its capabilities in this area so that more detailed analysis can be carried out. In addition, GIS will enable the county to exchange flood information with other authorities and publish data to the public.

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Annex 1 - Records of past floods and their significant consequences (preliminary assessment report spreadsheet)

As discussed in Chapter 4.4, due to the lack of data that was available regarding the consequences of past flooding, no flood events have been considered to have ‘significant harmful consequences’ on a national scale. Due to this, the relevant spreadsheet will not be included in this report.

Annex 2 - Records of future floods and their consequences (preliminary assessment report spreadsheet)

Annex 2 Future floods

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	Optional	Mandatory	Mandatory
Pick from drop-down	Max 250 characters, same source terms	Pick from drop-down	Pick from drop-down	Pick from drop-down
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	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	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
Surface runoff		High	Natural exceedance	Natural flood
Surface runoff		High	Natural exceedance	Natural flood
Surface runoff		High	Natural exceedance	Natural flood
Surface runoff		High	Natural exceedance	Natural flood
Surface runoff		High	Natural exceedance	Natural flood
Surface runoff		High	Natural exceedance	Natural flood
Surface runoff		High	Natural exceedance	Natural flood
Surface runoff		High	Natural exceedance	Natural flood
Groundwater		High	Natural exceedance	Natural flood
Main rivers	Sea, ordinary watercourses	Medium	Natural exceedance	Natural flood
Main rivers	Sea, ordinary watercourses	Medium	Natural exceedance	Natural flood

Significant consequences to human health	Human health consequences - residential properties	Property count method	Other human health consequences	**Significant economic consequences**
Mandatory	Optional	Optional	Optional	**Mandatory**
Pick from drop-down	Number between 1-10,000,000	Pick from drop-down	Max 250 characters	Pick from drop-down
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),	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?
Yes	12000	Detailed GIS		No
No	82307	Simple GIS		No
No	33305	Simple GIS		No
No	5985	Simple GIS		No
No	19811	Simple GIS		No
No	5002	Simple GIS		No
No	53332	Simple GIS		No
No	15132	Simple GIS		No
No				No

Number of non-residential properties flooded	Property count method	Other economic consequences	**Significant consequences to the environment**	Environment consequences
Optional	Optional	Optional	**Mandatory**	Optional
Number between 1-10,000,000	Pick from drop-down	Max 250 characters	Pick from drop-down	Max 250 characters
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),	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.
			No	
18,934	Simple GIS		No	
8,923	Simple GIS		No	
2223	Simple GIS		No	
5608	Simple GIS		No	
1646	Simple GIS		No	
12,528	Simple GIS		No	
4,310	Simple GIS		No	
			No	

Significant consequences to cultural heritage	Cultural heritage consequences		Comments	Data owner	Area flooded
Mandatory	Optional		Optional	Optional	Optional
Pick from drop-down	Max 250 characters		Max 1,000 characters	Max 250 characters	Number with two decimal places
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.		Any additional comments about the future flood record.		The total area of the land flooded, in km^2
No				Epping Forest District Council	
No				JBA Consulting (distributed by Environment Agency under licence)	
No				JBA Consulting (distributed by Environment Agency under licence)	
No				JBA Consulting (distributed by Environment Agency under licence)	
No				Environment Agency	
No				Environment Agency	
No				Environment Agency	
No				Environment Agency	
No			Data developed specifically for PFRA, and is unlikely to be suitable for any other	Environment Agency	
			Data updated quarterly. To understand the likelihood of future	Environment Agency	
			Data updated quarterly. To understand the likelihood of future	Environment Agency	

Confidence in modelled outline	Model date	Model Type	Hydrology Type	Lineage
Optional	Optional	Optional	Optional	Optional
Pick from drop-down	'yyyy' or 'yyyy-mm' or 'yyyy-mm-dd'	Max 250 characters	Max 250 characters	Max 250 characters
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		Type of software used to create future flood information.	Type of hydrology method used to create future flood information.	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.
Medium-Low	2008-08	2D-TuFlow	FEH (Revised Rainfall Runoff)	Ordnance Survey AddressPoint; CEH 1:50k River Centreline; NextMap DTM.
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	
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	
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	
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	Rainfall Hyetograph, EA 2m Composite DTM, OSMM Topography
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	Rainfall Hyetograph, EA 2m Composite DTM, OSMM Topography
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	Rainfall Hyetograph, EA 2m Composite DTM, OSMM Topography
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	Rainfall Hyetograph, EA 2m Composite DTM, OSMM Topography
Low	2010-11	ArcGIS	Uses data which is developed from published BGS groundwater level contours, groundwater levels in BGS WellMaster database and some river levels. No	British Geological Society (BGS) DiGMapGB-50 [Susceptibility to
Medium	2010-11	Varies but mainly JFLOW, ISIS, HEC-RAS, TUFLOW for fluvial, and HYDROF	National methodology described in "National Generalised Modelling for Flood Zones - Fluvial & Tidal Modelling Methods - Methodology, Strengths and Limitations". A	NextMap SAR DTMe, UKHO Admiralty Charts, 1:50K CEH River Centre Line,
Medium	2010-11	Varies but mainly JFLOW, ISIS, HEC-RAS, TUFLOW for fluvial, and HYDROF	National methodology described in "National Generalised Modelling for Flood Zones - Fluvial & Tidal Modelling Methods - Methodology, Strengths and Limitations". A	NextMap SAR DTMe, UKHO Admiralty Charts, 1:50K CEH River Centre Line,

Sensitive data	Protective marking descriptor	European Flood Event Code
Optional	Optional	Auto-populated
Pick from drop-down	Max 50 characters	Max 42 characters
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".	For use where organisations apply the Government's Protective Marking Scheme.	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.
Unmarked	Private	UKE10000012F0001
Protect	Commercial	UKE09000002F0001
Protect	Commercial	UKE09000002F0002
Protect	Commercial	UKE09000002F0003
Unmarked		UKE09000002F0004
Unmarked		UKE09000002F0005
Unmarked		UKE09000002F0006
Unmarked		UKE09000002F0007
Unmarked		UKE09000002F0008
Protect	Commercial	UKE09000002F0009
Protect	Commercial	UKE09000002F0010

Annex 3 - Records of Flood Risk Areas and their rationale (preliminary assessment report 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
Mandatory / optional:	**Mandatory**	**Mandatory**	**Mandatory**	**Mandatory**	Optional
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
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.
Example:	1	London	SX1234512345	Surface runoff	NA
Records begin here:	1	London OR London (Surrey Sections) OR Surrey Area 1 Surrey Area 2 Surrey Area 3 Surrey Area 4	SX1234512345	Surface runoff	NA

Confidence in main source of flooding	**Main mechanism of flooding**	**Main characteristic of flooding**	**Significant consequences to human health**	Human health consequences - residential properties	Property count method
Optional Pick from drop-down	**Mandatory** Pick from drop-down	**Mandatory** Pick from drop-down	**Mandatory** Pick from drop-down	Optional Number between 1-10,000,000	Optional Pick from drop-down
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'.	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'.
High	Natural exceedance	Natural flood	Yes	50000	Detailed GIS
High	Natural exceedance	Natural flood	Yes	50000	Detailed GIS

Other human health consequences	**Significant economic consequences**	Number of non-residential properties flooded	Property count method	Other economic consequences	**Significant consequences to the environment**
Optional Max 250 characters	**Mandatory** Pick from drop-down	Optional Number between 1-10,000,000	Optional Pick from drop-down	Optional Max 250 characters	**Mandatory** Pick from drop-down
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?
	No				No
	No				No

Environment consequences	**Significant consequences to cultural heritage**	Cultural heritage consequences	**Origin of Flood Risk Area**	**Amended Flood Risk Area rationale**	**New Flood Risk Area rationale**
Optional Max 250 characters	**Mandatory** Pick from drop-down	Optional Max 250 characters	**Mandatory** Pick from drop-down	**Mandatory** Pick from drop-down	**Mandatory** Pick from drop-down
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).	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).	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.	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.
	No		Indicative	NA	NA
	No		Indicative	NA	NA

Rationale detail	European Flood Risk Area Code
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 Flood Risk Area	UKE10000012A0001
indicative Flood Risk Area	UKE10000012A0001

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.	Surrey County Council - Environment & Transport Scrutiny Committee - 30th June 2011		
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	Yes		
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 - Limitations on past flooding information includes: lack of information for certain areas of Surrey, sources of flooding are often not known or have not been recorded and existing data is not uniform, and makes accurate comparisons difficult.		
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?	Flood Map for Surface Water		
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.	155300		
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	Yes		
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.	N/A		
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		
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?	N/A		
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?	No		
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?	No		
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		
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 - we have made changes to the indicative Flood Risk Area (respond to relevant questions 9.1.2 - 9.1.4)		
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	N/A		
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	Minor change in boundary		
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.	Yes - we have made changes to the indicative Flood Risk Area in two areas. The first is the addition of three 1km squares in Fetcham. Evidence shows property floods within the added areas. The second is the addition of two 1km		
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	N/A		
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.	N/A		
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.	N/A		
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?	No		
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 area(s) if one/any exist

Annex 2:

Environmental Agency Preliminary Flood Risk Assessment Guidance: Preliminary Assessment Report

02/03/2011

Preliminary Flood Risk Assessment (PFRA)

Annexes to the final guidance

Report – GEHO1210BTHF-E-E

Annex 1 – Preliminary assessment report

Text in black = template **headings** and *description of content*
Text in red = standard text for all preliminary assessment reports

Executive Summary

- *Short summary, 100-200 words*

Contents

- *List sections, as well as figures, tables and appendices*

Introduction

- *Scope of the report; local flood risk (i.e. not including flooding only from main rivers, the sea or large raised reservoirs)*
- *Aims and objectives; identifying Flood Risk Areas and supporting local flood risk management strategy*
- *Introduction to the study area*

Lead Local Flood Authority responsibilities

- *Governance and partnership arrangements, possible diagram to illustrate*
- *Communication with partners and the public*

Methodology and data review

- *Describe what information was gathered from within the LLFA, from the Environment Agency, from authorities listed in regulation 36(3), from other partners, and information which is available to the public*
- *Describe the availability and limitations of the information gathered i.e. was the data readily available? Are records missing? Were there any issues with gathering data from others?*
- *Describe the systems used to share and store information now and in the future*
- *Describe quality assurance, security, data licensing and restrictions*

Past flood risk

- *This section summarises relevant information on past floods with significant harmful consequences (if possible/desired, summarises relevant information on all past floods)*
- *Statement of what are considered 'significant harmful consequences' and why*
- *Summary table and description, outlining when floods have occurred and their consequences*
- *Summary map of past floods (or separate maps by source if there is lots of information) which should include information about the extent and conveyance route of past floods where available*

- *Reference to the detailed records of past floods with significant harmful consequences in the spreadsheet (annex 1)*

Future flood risk

- *This section summarises all relevant information on future floods*
- *Summary table and description, outlining the relevant information on future floods and their consequences*
- *Describe 'locally agreed surface water information' and state local drainage capacity*
- *Summary map illustrating what constitutes 'locally agreed surface water information'*
- *Reference to the detailed records of future floods and their possible consequences in the spreadsheet (annex 2)*
- *Climate change and long term developments; use the standard text provided in the text box (below)*
- *Summarise relevant local information (if any is available) concerning climate change impacts on local flood risk*
- *List any new or proposed major developments which may increase local flood risk*
- *The Environment Agency commissioned work to consider the varying impacts of climate change on sources of local flood risk for each River Basin District across England and Wales. This work has informed the standard text now provided in the text box below*

Review of indicative Flood Risk Areas

- *Referring to 'locally agreed surface water information', review any indicative Flood Risk Areas provided by the Environment Agency*
- *If there are no relevant indicative Flood Risk Areas this section is not required*

Identification of Flood Risk Areas

- *Describe amendments to indicative Flood Risk Areas due to geography, information about past flooding, or information about future flooding*
- *Justify any new Flood Risk Areas using information about past flooding, or information about future flooding*
- *Or state why no Flood Risk Areas have been identified*
- *Refer to the detailed records of Flood Risk Area(s) in the spreadsheet (annex 3)*
- *If possible/desired, provide a map of Flood Risk Area(s)*

Next steps

- *Outline any proposed measures to support the review of the PFRA every 6 years, including the collection of the information which was optional for this first cycle in Annex 1*

References

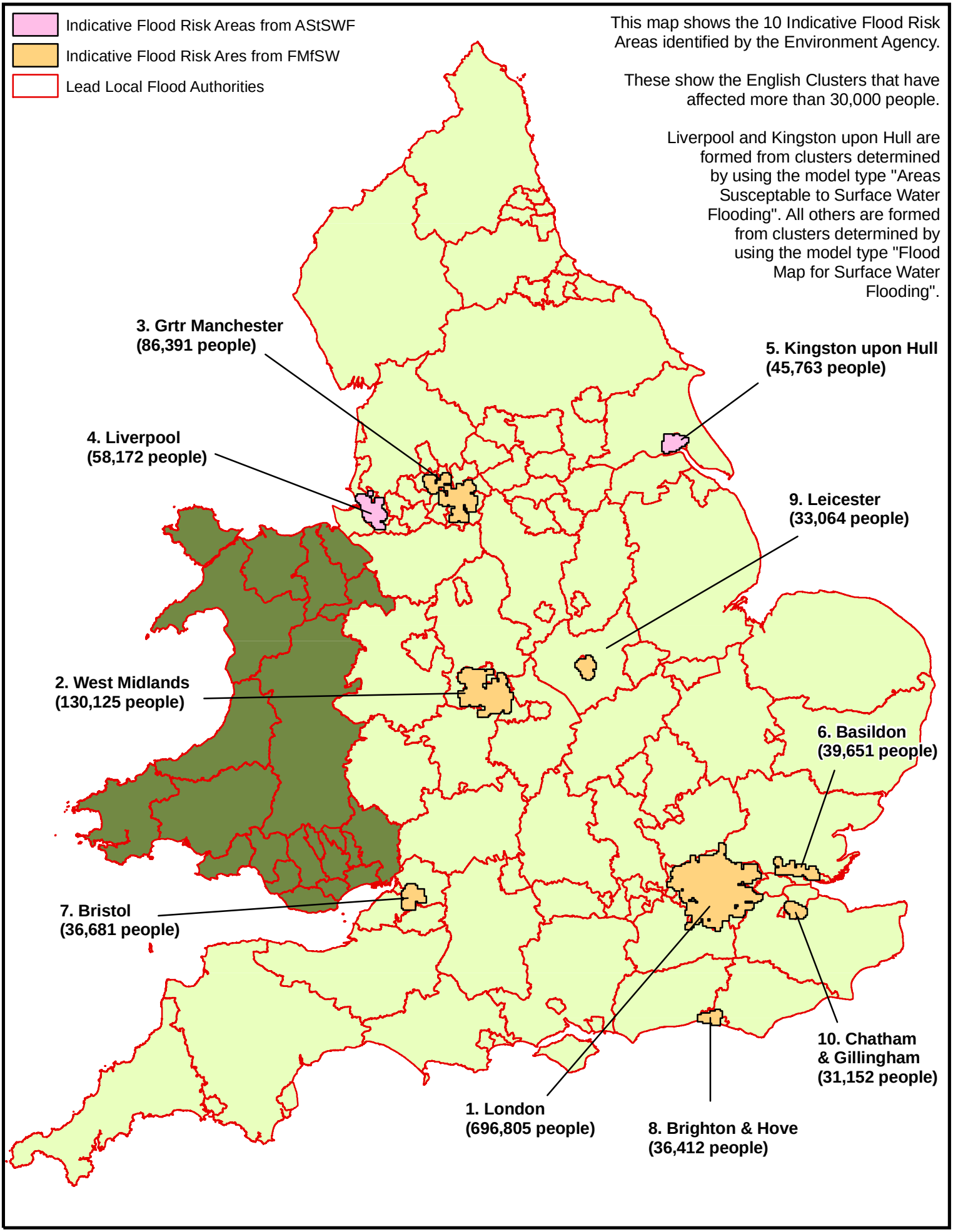
- *Provide full references (including URLs where possible) to publications and documents*

Annex 3:

Indicative Flood Risk Areas (IFRAs)

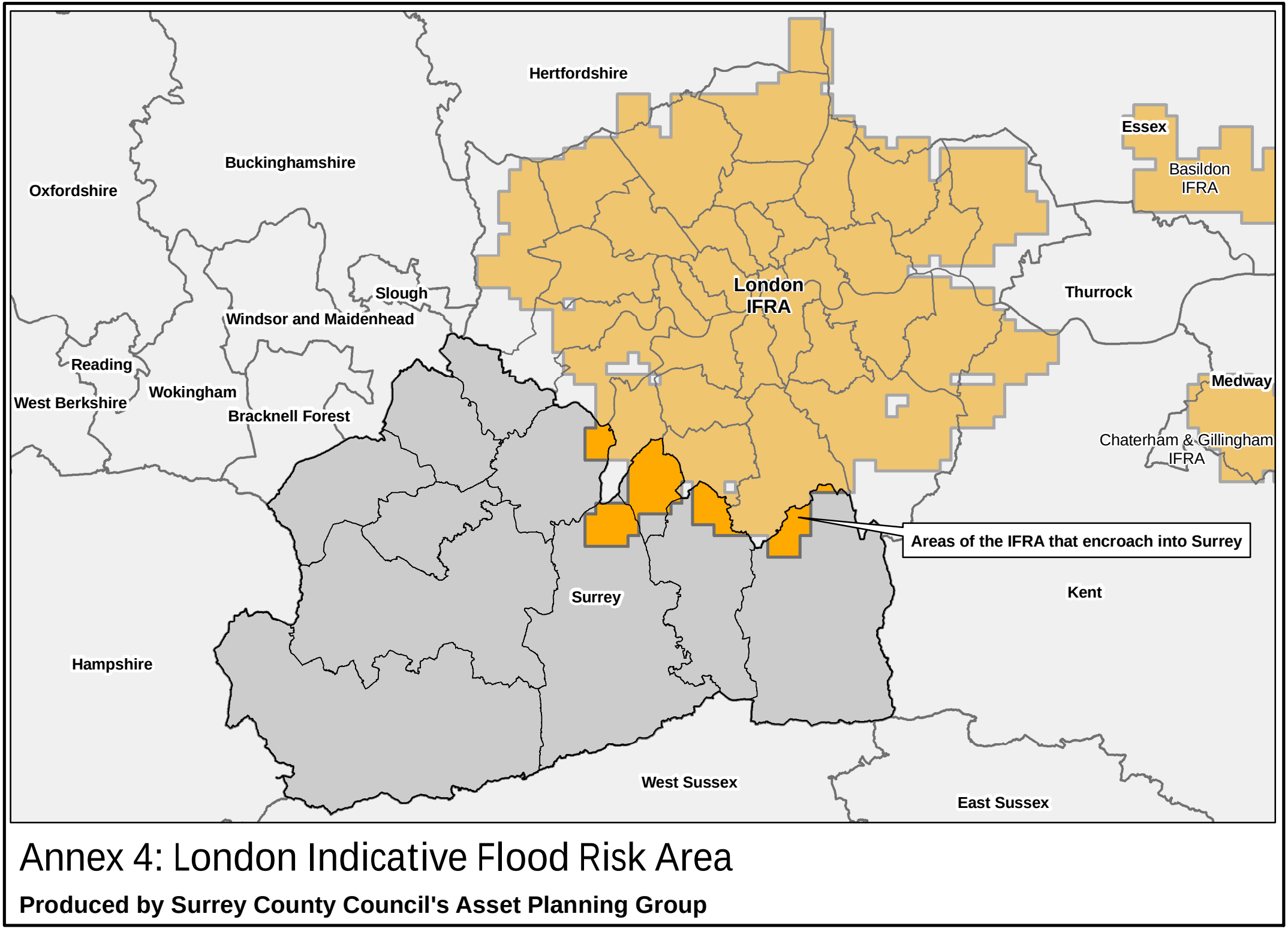
Annex 3: Indicative Flood Risk Areas (IFRAs)

Produced by Surrey County Council's Asset Planning Group



Annex 4:

London Indicative Flood Risk Area



Annex 4: London Indicative Flood Risk Area

Produced by Surrey County Council's Asset Planning Group