

Leicestershire County Council  
**Preliminary Flood Risk Assessment**

June 2011





## Revision Schedule

**Final**  
June 2011

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## Executive Summary

This document forms a Preliminary Flood Risk Assessment (PFRA) report for Leicestershire County Council 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 and ordinary watercourses and any interaction these have with main rivers and the sea.

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<sup>1</sup>. As a Lead Local Flood Authority (LLFA), Leicestershire County Council must submit their PFRA to the Environment Agency for review by 22nd June 2011.

Three past flood events have been classified as having caused nationally significant harmful consequences: in Loughborough in 1998, and in Market Harborough in 2002 and 2006. Limited information is available on these events, but from local knowledge they have been identified as clearly having been nationally significant. A number of other locally significant events have also been identified.

Of the ten indicative Flood Risk Areas that have been identified by the Environment Agency nationally, one covers Leicestershire County Council's administrative area. However, further areas at risk on the fringes of the Indicative Flood Risk Area have been identified (including the M1/M69 Interchange and the County police Headquarters) by Leicestershire County Council and Leicester City Council. The Indicative Flood Risk Area for Leicestershire County also covers some parts of neighbouring districts that are hydrologically linked, notably Leicester City. Therefore, Leicestershire County Council and Leicester City Council have collaboratively agreed and proposed an extension to the existing Indicative Flood Risk Area. Collaborative working and knowledge sharing with neighbouring authorities is extremely important for future flood risk management in Leicester.

<sup>1</sup> <http://publications.environment-agency.gov.uk/pdf/GEHO1210BTGH-e-e.pdf>



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## Acronyms and Abbreviations

Abbreviation	Description
ASfSWF	Areas Susceptible to Surface Water Flooding
CFMP	Catchment Flood Management Plan
CLG	Communities and Local Government
Defra	Department for Environment, Food and Rural Affairs
DG5	Sewer flooding register
FMfSW	Flood Map for Surface Water
FWMA	The Flood and Water Management Act 2010
HA	Highways Agency
IDB	Internal Drainage Board
IPCC	Intergovernmental Panel on Climate Change
LA	Local Authority
Leicestershire CC	Leicestershire County Council
LDDs	Local Development Documents
LDF	Local Development Framework
LLFA	Lead Local Flood Authority
NE	Natural England
PPS	Planning Policy Statement
The Regulations	The Flood Risk Regulations 2009
RFDC	Regional Flood Defence Committee
SAC	Special Area for Conservation
SFRA	Strategic Flood Risk Assessment
SPA	Special Protection Area
SPD	Supplementary Planning Document
STW	Severn Trent Water
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage Systems
SUEs	Sustainable Urban Extensions
SWMP	Surface Water Management Plan
UKCIP	United Kingdom Climate Impacts Programme
WAG	Welsh Assembly Government



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## 1. Introduction

1.1.1 This document forms a Preliminary Flood Risk Assessment (PFRA) report by Leicestershire County Council (Leicestershire CC) as required in accordance with the Flood Risk Regulations 2009.

### 1.2 What is a Preliminary Flood Risk Assessment?

1.2.1 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 report with supplemental Annexes and identifying Flood Risk Areas.

1.2.2 This PFRA report 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.

1.2.3 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 (EA's) national information (for example Flood Map for Surface Water) and existing local products such as the Strategic Flood Risk Assessment (SFRA) and the ongoing Surface Water Management Plan (SWMP).

### 1.3 Background

1.3.1 The key drivers behind the PFRA are two pieces of new legislation; the Flood Risk Regulations 2009 (The Regulations) which came into force on the 10th December 2009, and the Flood & Water Management Act (FWMA), which gained Royal Assent on the 8th April 2010, many actions from which also contribute to this PFRA.

1.3.2 The Regulations 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.

1.3.3 The FWMA 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.

1.3.4 Under these pieces of legislation, all Unitary Authorities are designated 'Lead Local Flood Authorities' (LLFAs) and have formally been allocated a number of key responsibilities with respect to local flood risk management. Consequently, Leicestershire CC is designated as a LLFA. A full description of these responsibilities is provided in Section 2.

1.3.5 The Regulations place duties on the EA and LLFAs to prepare a number of documents including:

- Preliminary Flood Risk Assessments.
- Flood hazard and flood risk maps.

- Flood Risk Management Plans.

- 1.3.6 The purpose of the PFRA report under the Regulations is to provide the evidence for identifying nationally significant Flood Risk Areas. The report will also provide a useful reference point for all local flood risk management and inform local flood risk management strategies.
- 1.3.7 The scope of the PFRA is to consider past flooding and potential future flooding from sources of flooding other than main rivers, the sea and reservoirs; these fall under the responsibility of the EA. Therefore, the PFRA addresses surface runoff, flooding from groundwater and ordinary watercourses and any interaction these have with local drainage systems.
- 1.3.8 The PFRA also considers floods which have significant harmful consequences for human health, economic activity and the environment, where this information is available.

## 1.4 PFRA Timetable

- 1.4.1 Table 1-1 shows the elements of work undertaken by Leicestershire CC under the Regulations, along with the timescales of their respective delivery. The first two elements of work are covered by the preparation of this PFRA report.

Table 1-1: Elements of Work Required under the Flood Risk Regulations 2009

22 <sup>nd</sup> June 2011	<b>Prepare Preliminary Assessment Report.</b>	<i>The PFRA should focus on local flood risk from surface water, groundwater, ordinary watercourses and canals.</i>
22 <sup>nd</sup> June 2011	On the basis of the PFRA, identify <b>Flood Risk Areas.</b>	<i>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.</i>
22 <sup>nd</sup> June 2013	Prepare <b>Flood Hazard Maps</b> and <b>Flood Risk Maps</b> for each Flood Risk Area.	<i>Used to identify the level of hazard and risk of flooding within each Flood Risk Area to inform Flood Risk Management Plans.</i>
22 <sup>nd</sup> June 2015	Prepare <b>Flood Risk Management Plans</b> for each Flood Risk Area.	<i>Plans setting out risk management objectives and strategies for each Flood Risk Area.</i>

## 1.5 Aims and Objectives

- 1.5.1 The key objectives can be summarised as follows:
- Establish an evidence base of historic flood risk information, which will be built up on in the future and used to support and inform the preparation of Leicestershire CC's Local Flood Risk Management Strategy.
  - Assess historic flood events within the study area from local sources of flooding (including flooding from surface water, groundwater and ordinary watercourses), and the consequences and impacts of these events.
  - Assess the potential harmful consequences of future flood events within the study area.

- Review the provisional national assessment of indicative Flood Risk Areas provided by the EA and provide explanation and justification for any amendments required to the Flood Risk Areas.
- Provide a summary of the systems used for data sharing and storing, and provision for quality assurance, security and data licensing arrangements.
- Identify relevant partner organisations involved in future assessment of flood risk; and summarise means of future and ongoing stakeholder engagement.
- Describe arrangements for partnership and collaboration for ongoing collection, assessment and storage of flood risk data and information.
- Summarise the methodology adopted for the PFRA with respect to data sources, availability and review procedures.

## 1.6 Study Area

- 1.6.1 The study area for this PFRA is defined by the administrative boundary of Leicestershire CC, which covers approximately 2,073 km<sup>2</sup>. The geographical extent of the study area is illustrated in Figure 1-1. Leicestershire CC has a population of 644,800 (ONS 2009).
- 1.6.2 The Leicestershire CC administrative area includes the seven lower tier councils of Blaby District Council, Charnwood Borough Council, Harborough District Council, Hinckley and Bosworth Borough Council, Melton Borough Council, North West Leicestershire District Council, and Oadby and Wigston Borough Council.
- 1.6.3 The study area falls across the Anglian, Humber and Severn River Basin Districts and is served by two EA regions: Anglian and Midlands. The Anglian Region is split into East, Central and North areas and the Midlands Region is split into West, Central and East areas. Each of the EA regional areas have separate Regional Flood and Coastal Committees and Leicestershire CC has one Councillor represented on each. The study area is also served by two water companies: Anglian Water and Severn Trent Water.
- 1.6.4 There are numerous watercourses within the Leicestershire County administrative boundary, some of which are designated as Statutory Main River and others as Ordinary Watercourses. Leicestershire CC have responsibilities for ordinary watercourses, many of which are culverted and artificially straightened, particularly in the urbanised areas. The largest river in the region is the River Soar, which rises near Hinckley and flows from south to north through central Leicestershire, before eventually joining the River Trent at Trent Lock.
- 1.6.5 The Grand Union Canal passes north to south through the middle of the study area and is interlinked with the navigable reaches of the River Soar.

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## 2. Lead Local Flood Authority Responsibilities

### 2.1 Introduction

- 2.1.1 The preparation of a PFRA is just one of several responsibilities of LLFAs under the new legislation. This section provides a brief overview of other responsibilities Leicestershire CC are obliged to fulfil under their role as a LLFA.

### 2.2 Leadership and Partnership

- 2.2.1 In his Review of the summer 2007 flooding, Sir Michael Pitt stated that “*the role of local authorities should be enhanced so that they take on responsibility for leading the coordination of flood risk management in their areas*”. As the designated LLFA, Leicestershire CC is therefore responsible for leading local flood risk management across Leicestershire.
- 2.2.2 Much of the local knowledge and technical expertise necessary for Leicestershire CC to fulfil its duties as LLFA lies with the County Council and other partner organisations. It is therefore crucial that Leicestershire CC work alongside these groups and organisations as they undertake their responsibilities to ensure effective and consistent management of local flood risk throughout the county and to contribute to the provision of a coordinated and holistic approach to flood risk management across the study area.

#### Existing Flood Risk Collaboration

- 2.2.3 Leicestershire CC actively participates in an existing collaborative flood risk partnership in the region. Under the Local Resilience Forum, a Flood Risk Management Board with representatives from Leicestershire CC, Leicestershire City Council, Rutland County Council and other key stakeholders such as the Environment Agency, meet quarterly to review and coordinate LLFA actions and cross-boundary issues.
- 2.2.4 Linked to the Flood Risk Management Board, the Local Resilience Forum (LRF) also has several working groups which include the Flood Working Group (for flood response), the Surface Water Management Group (SWaMp) and a Planning Group (Figure 2-1).

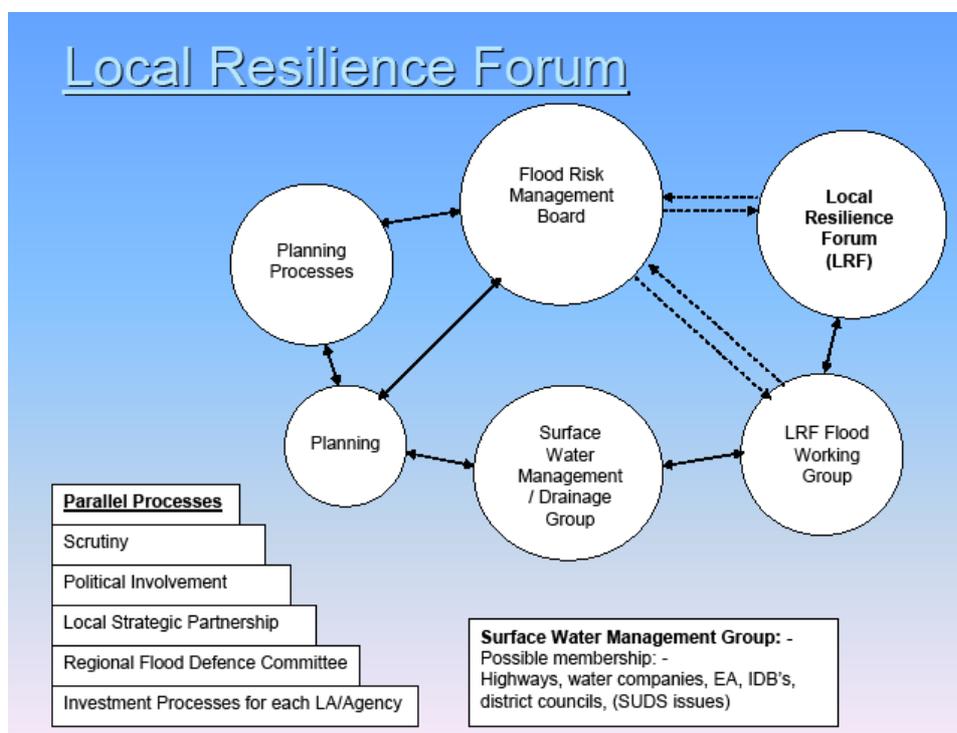


Figure 2-1: Existing flood risk collaboration under the LRF

- 2.2.5 Flood Risk Management within Leicestershire CC is coordinated through the Flood Risk Management Board, shared with other agencies. Leicestershire County Council provides support to the three areas of flood risk management each of which has a supporting flood risk management working group as follows:
- 2.2.6 **Emergency Response/Warning and Informing of Flood Risk:** Emergency response to flood events is provided by the County Council's Environment and Transport Department which operates 24 hour highway response teams with supporting operational management cooperating with the emergency services as required. Also as required the County Council's emergency planners and local resilience forum will provide tactical and strategic support to larger events, and also lead on providing flood warning and informing of flood risk including the management of volunteer local flood wardens across the county.
- 2.2.7 **Management of surface water drainage assets:** Primarily maintenance and improvement of the public highway drainage systems is undertaken by the County Council's Environment and Transport Department including where required the use of the 24 hour highway response teams.
- 2.2.8 **Planning:** The County Council provides support to the Local Planning Authorities (the District Councils) and is preparing for the expected legislation relating to Sustainable Urban Drainage adoption bodies.
- 2.2.9 The LLFA Board will maintain close links and communications with the external partners and key stakeholders, who will also be invited to comment on and review the operations of the Board.

2.2.10 Key to the success of any flood risk partnership is the sharing and management of knowledge and Leicestershire CC recognise this as underpinning successful flood risk management across the city. Another key component is communication at different levels from Council members to the general public.

2.2.11 Leicestershire CC are committed to working collaboratively and in partnership with key stakeholders, neighbouring authorities and across departments to ensure that flood risk management in the area is properly coordinated and is carried out in a sustainable and efficient manner. To ensure that this is recognised within the Lead Local Flood Board, Leicestershire CC have identified external partners under the same functions as the internal structure to allow for a consistent approach to flood risk management.

## 2.3 Stakeholder Engagement

2.3.1 As part of the preparation of the PFRA for Leicestershire CC, stakeholders have been and will continue to be engaged representing the following organisations and authorities:

- Blaby District Council
- Charnwood Borough Council
- Harborough District Council
- Hinckley and Bosworth Borough Council
- Leicester City Council
- Melton Borough Council
- North West Leicestershire District Council
- Oadby and Wigston Borough Council
- Environment Agency
- Severn Trent Water Ltd
- Anglian Water Services Ltd
- British Waterways
- Network Rail
- Leicestershire Fire and Rescue Services
- Highways Agency
- Natural England
- Critical Services – NHS/Utilities

## 2.4 Public Engagement

2.4.1 It is recognised that members of the public may also have valuable information to contribute to the PFRA and to local flood risk management more generally across Leicestershire. Stakeholder 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. Therefore, the Lead local Flood Authority Board will agree, in consultation with other flood risk management authorities, the approach and detail of any public engagement first.

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

## 2.5 Further Responsibilities

2.5.1 Aside from forging partnerships and coordinating and leading on local flood management, there are a number of other key responsibilities that have arisen for LLFAs from the Flood & Water Management Act and the Flood Risk Regulations. It is important to note at this stage that not all responsibilities have been enacted yet and some are still awaiting orders to commence. However, it is anticipated that these responsibilities will 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.
- **Local Strategy for Flood Risk Management** – LLFAs are required to develop, maintain, apply and monitor a local strategy for flood risk management in its area. The local strategy will build upon information such as national risk assessments and will use consistent risk based approaches across different local authority areas and catchments.
- **Works powers** – LLFAs have powers to undertake works to manage 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 or coastal erosion in order to safeguard assets that are relied upon for flood or coastal erosion risk management.

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## 3. Methodology and Data Review

### 3.1 Data Sources and Availability

- 3.1.1 The approach for producing this PFRA was based upon the EA's PFRA Final Guidance, which was released in December 2010. The PFRA is based on readily available or derivable data and with this in mind; the following methodology has been used to undertake the PFRA.

### 3.2 Methodology

#### Data Collection from Partner Organisations

- 3.2.1 The following authorities and organisations were identified and contacted to share data for the preparation of the PFRA; various teams within the County Council, all the District Councils within Leicestershire, Leicester City Council, Rutland Council, Anglian Water, Severn Trent Water, British Waterways, Leicestershire Fire and Rescue Service, and the EA.

#### Assessing Historic Flood Risk

- 3.2.2 Existing datasets, reports and anecdotal information from the stakeholders listed above were collated and reviewed to identify details of major past flood events and associated consequences including economic damage, environmental and cultural consequences and impact on the local population.
- 3.2.3 It was anticipated that information would be provided in a geo-referenced format. However, this was only the case for data provided by Charnwood Borough Council. Other datasets were geo-referenced where possible. Geo-referencing enables the display of information using GIS software and overlay layers to identify the spatial distribution of historic flood events and relate these datasets to receptor information, in order to assess the overall flood risk.

#### Assessing Future Flood Risk

- 3.2.4 The identification of Flood Risk Areas through the PFRA should also take into account future floods. The assessment of future flood risk within the Indicative Flood Risk Area will primarily be delivered through collaboration with Leicester City Council in the production of their Surface Water Management Plan. Within Loughborough the assessment of future flood risk will primarily be delivered through the County Council Surface Water Management Plan. Across the whole PFRA area the assessment of future flood risk will initially involve work to validate and prioritise locally significant future flood risk.
- 3.2.5 The following factors were considered when assessing future flood risk across the Leicestershire County study area; topography, location of ordinary watercourses, location of floodplains that retain water, characteristics of watercourses (lengths, modifications), effectiveness of any works constructed for the purpose of flood risk management, location of populated areas, areas in which economic activity is concentrated, the current and predicted impact of climate change and the predicted impact of any long-term developments that might affect the occurrence or significance of flooding, such as proposals for future development.

## Identifying Flood Risk Areas

- 3.2.6 Information regarding historic and future flood risk will be used to formally identify Flood Risk Areas. To achieve this, flood risk indicators will be used to determine the impacts of flooding on human health, economic activity, cultural heritage and the environment. The use of flood risk indicators helps to develop understanding of the impacts and consequences of flooding. Key flood risk indicators are summarised in Table 3-1.

Table 3-1: Key Flood Risk Indicators

Impacts of flooding on:	Flood Risk Indicators
<b>Human Health</b>	<ul style="list-style-type: none"> <li>• Number of residential properties.</li> <li>• Critical services (Hospitals, Police/Fire/Ambulance Stations, Schools, Nursing Homes, etc).</li> </ul>
<b>Economic Activity</b>	<ul style="list-style-type: none"> <li>• Number of non-residential properties.</li> <li>• Length of road or rail.</li> <li>• Area of agricultural land.</li> </ul>
<b>Environment</b>	<ul style="list-style-type: none"> <li>• Consequences of pollution.</li> <li>• Impacts on designated environmental sites (Special Areas of Conservation, Special Protection Areas, Ramsar sites, Sites of Special Scientific Interest).</li> <li>• Impacts on designated cultural heritage assets.</li> </ul>

- 3.2.7 The above indicators have been selected and analysed by Defra and the EA in order to identify areas where flood risk and potential consequences exceed a pre-determined threshold. The areas that have been identified using this methodology and exceed 30,000 people at risk have been mapped and identified as Indicative Flood Risk Areas. Leicestershire has been identified as one of ten national Indicative Flood Risk Areas. For further details, please refer to Defra's Guidance for selecting and reviewing Flood Risk Areas for local sources of flooding (December 2010).

## 3.3 Data Sources and Availability

- 3.3.1 Table 3-2 catalogues the relevant information and datasets held by partner organisations and provides a description of each of the datasets. Much of this data was collected as part of the ongoing SWMPs within Leicestershire (Loughborough SWMP, for example).
- 3.3.2 The data collected for this PFRA is held by Leicestershire CC Highways, in accordance with the security, licensing and use restrictions described below. Significant flood events in the future will be recorded in accordance with the data requirements described in Annex 1.

Table 3-2: Relevant Information and Datasets

	Dataset	Description
Environment Agency	Areas Susceptible to Surface Water Flooding	The first generation national mapping, which outlines areas of risk from surface water flooding across the country with three susceptibility bandings (less, intermediate and more susceptible).
	Flood Map for Surface Water	The updated (second generation) national surface water flood mapping which was released at the end of 2010. This dataset includes two flood probabilities (1 in 30 and a 1 in 200 chance of occurring) and two depth bandings (greater than 0.1m and greater than 0.3m).
	Flood Map (Rivers and the Sea)	Shows the extent of flooding from rivers with a catchment of more than 3km <sup>2</sup> and flooding from the sea.
	Areas Susceptible to Groundwater Flooding	Coarse scale national mapping showing areas which are susceptible to groundwater flooding.
	National Receptors Dataset	A national dataset of social, economic, environmental and cultural receptors including residential properties, schools, hospitals, transport infrastructure and electricity substations.
	Indicative Flood Risk Areas	Nationally identified flood risk areas, based on the definition of 'significant' flood risk described by Defra and WAG.
	Historic Flood Map	Attributed spatial flood extent data for flooding from all sources.
	River Trent (CFMP)	CFMPs consider all types of inland flooding from rivers, groundwater, surface water and tidal flooding and are used to plan and agree the most effective way to manage flood risk in the future.
	Strategic Flood Risk Mapping reports, models and outputs	Under the Environment Agency's Strategic Flood Risk Mapping programme, detailed river models and flood risk maps have been produced for the main rivers in Leicestershire.
Leicestershire County Council	Historical flooding records	Historical records of flooding from surface water, groundwater and ordinary watercourses.
District and Borough Council	Strategic Flood Risk Assessments (SFRA)	SFRAs contain useful information on historic flooding, including local sources of flooding from surface water, groundwater, ordinary watercourses and canals. Level 1 SFRAs are available for all seven District and Borough Councils.
	Historical flooding records	Historical records of flooding from surface water, groundwater and ordinary watercourses. Location of Flood retention basins
Severn Trent Water	DG5 Register for Severn Trent areas	DG5 Register logs and records of sewer flooding incidents in each area.
Anglian Water Services	DG5 Register for Anglian Water areas in Leicestershire (Harborough). <i>Records were not made available.</i>	DG5 Register logs and records of sewer flooding incidents in each area. <i>Records were not made available.</i>

<b>British Waterways</b>	British Waterways canal network	Detailed GIS information on the British Waterways canal network, including the location of canal centrelines, sluices, locks, culverts, etc.
	Records of canal breaches and overtopping events	Records of historical canal breaches and canal overtopping events across Leicestershire.
<b>Leicestershire Fire and Rescue Service</b>	Historic flooding records	Records of historic flooding events from the Fire Service's Incident Recording System including location, date / time, property type, and incident type and description
<b>Other</b>	Relevant datasets	From the British Geological Society, Housing Communities Agency, Natural England, Network Rail and developers

### 3.4 Data Limitations

3.4.1 A brief assessment of the data collection and review process is included in this section to provide transparency with respect to the methodology. Leicestershire CC and their key stakeholders are aware of many of the limitations that existing datasets present. As part of their duties under the Flood and Water management Act, Leicestershire CC will be formally recording flood incidents and maintaining an asset register that will improve the quantity, quality and consistency of future flood risk datasets. A number of issues arose during the data collection process, as described below:

#### Inconsistent Recording Systems

3.4.2 Flood events are currently recorded by the County Highways Team. However, incidents are also recorded by other departments within the council such as the Emergency Management Team or the Environment Team. At present, there is no formal and consistent process for recording flooding incidents. So, one team may keep a full record of a flood incident including the numbers of properties affected, dates, times, flow routes etc. whilst another may only record the fact that an incident has occurred. However, this will change as the Lead Local Flood Authority Board consults with Council teams and implements new procedures.

3.4.3 At present, the recording of flood incidents amongst external stakeholders and flood risk management authorities is also undertaken differently in each authority. Consequently, this has led to a variation in the level of detail and quantity of data available. Further information on addressing this issue in the future is included in Section 7.

### Incomplete Datasets

- 3.4.4 The Leicestershire CC Highways team holds records (spreadsheet and GIS) of locations (geo-referenced) affected by flooding as far back as 1986. They also hold approximately 100 anecdotal and paper records and details of other historical flood events together with locations known to regularly flood during heavy rainfall. However, as highlighted above, the datasets are not exhaustive and may not accurately represent the complete flood risk issues in a particular area. This is to be expected with historical datasets but nonetheless could impact on the identification of flood risk areas.
- 3.4.5 Data sharing by sewerage undertakers (Severn Trent Water and Anglian Water in the Leicestershire CC area) is restricted because of the potentially sensitive nature of some information on flooding from sewers. This is described in more detail in Section 4.6.2.
- 3.4.6 In order to fulfil statutory commitments set by OFWAT, all sewerage undertakers maintain a register of properties which have suffered flooding from public sewers (the DG5 Register). The register includes incidents of both internal property flooding together with flooding to curtilages, highway and other open areas (external flooding). Only flooding due to hydraulic deficiencies are recorded on the DG5 register. Sewer flooding due to blockages is not recorded on the DG5 register. Properties flooded in severe weather (rare events) are recorded but OFWAT do not require these to go onto the DG5 register. It is also important to note that the DG5 register is not a full record of properties that have experienced sewer flooding in the past, since on completion of a flood alleviation scheme, properties are removed from the register.

### Records of Consequences of Flooding

- 3.4.7 Very few 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.

## 3.5 Quality Assurance

- 3.5.1 All data received has been subject to quality assurance measures to monitor and record the quality and relevance of the data and information. A data quality score was given, which is a qualitative assessment based on the Data Quality System provided in the SWMP Technical Guidance document (March 2010). This system is explained in Table 3-3.

*Table 3-3: Data Quality System from SWMP Technical Guidance (March 2010)*

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

3.5.2 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.

### 3.6 Security, Licensing and Use Restrictions

3.6.1 A number of datasets used in the preparation of this PFRA are subject to licensing agreements and use restrictions. The following national datasets provided by the EA 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.
- Areas Susceptible to Groundwater Flooding.
- Flood Map for Surface Water.
- National Receptor Database.

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

- Strategic Flood Risk Assessments.
- Catchment Flood Management Plan (River Trent).
- Surface Water Management Plans (ongoing).

3.6.3 The use of some of the datasets made available for this PFRA has been restricted. These include records of property flooding held by the Council and by Severn Trent Water. Anglian Water Services has not made any flood records available. Necessary precautions must be taken to ensure that all information given to third parties is treated as confidential and is in accordance with data and licensing agreements. In some instances, before data can be passed to third parties, permission must be sought from the relevant data provider. 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.

3.6.4 Some datasets may only be licensed for use by the Council for a limited period of time and this should be taken into account when updates or revisions are made to the PFRA or subsequent studies.

3.6.5 The security of data is also a key consideration when it comes to collecting, collating and storing sensitive data. All data collected is stored on local servers which are password protected. Leicestershire CC must adhere to these data security measures to ensure that sensitive data is held in a secure manner.

## 4. Past Flood Risk

### 4.1 Overview of Historic Flooding in Leicestershire

- 4.1.1 Flood records across Leicestershire were collected from the data sources discussed in Table 3-2. Some records included information on flood date, type of location affected (for example domestic property, garden or highway), the flood source and the estimated return period, but many contained no such information. Information on the impacts of flooding (cf. Table 3.1) has typically not been recorded historically, and although some anecdotal information has been collected, no precise records of impacts are available.
- 4.1.2 In response to historic flood events, a large number of flood alleviation schemes have been implemented, and these have successfully reduced the incidence of flooding across the County.
- 4.1.3 A summary of information specific to each source of flooding considered as part of the PFRA is included below.

### 4.2 Surface Water Flooding

- 4.2.1 Surface water flooding occurs when heavy rainfall exceeds the capacity of local drainage networks and water flows across the ground. Pluvial/surface water flooding has historically and continues to be a significant problem in Leicestershire. The flashy nature and short duration of such events has made them difficult to predict and protect against.

Table 4-1: Available Information on Surface Water Flooding

Location	Dates	Available Details
Charnwood Forest	Summer 2007	Notable flooding due to overland flow occurred in a number of locations around Charnwood Forest, particularly in parts of Swithland, Woodhouse Eaves, Rothley, Nanpantan and Newtown Linford.
Loughborough	1998	Surface water flooding
Harborough	Unknown	Kibworth Beauchamp, North Kilworth, Dunton Bassett and areas of Peatling Magna are affected by fluvial flooding from an un-named watercourse which has a lack of capacity in the channel and culverts during periods of heavy rainfall. Thurnby (Barley Lane, Station Road, Fiona Drive, Uppingham Rad, Grange Lane, Lakeside Court and Stoughton Road) are flooded following periods of heavy rainfall. Overland flow and surface water runoff is also known to affect the following areas; Scraftoft, Fleckney, Lubenham and Great Glen.

- 4.2.2 Leicestershire was not badly affected by the extreme rainfall which caused flooding of large parts of the UK during the summer of 2007. However, some records of surface water flooding are available, as summarised in Table 4-1. One of these events occurred in Loughborough in 1998 and, although insufficient data has been obtained so far to sufficiently document the event, Leicestershire CC believe that the severity of flooding makes this a nationally significant event. As such, the details available are recorded in Annex 1.

4.2.3 Due to the limited amount of information available on flood dates, causes and consequences, none of the other events noted below can be definitively assessed as having been significant floods.

## 4.3 Ordinary Watercourse flooding

4.3.1 Flooding from ordinary watercourses can occur as a result of the channel capacity being exceeded, a blockage occurring, or as a result of small culverted sections surcharging. Available details of ordinary watercourse flooding are summarised in Table 4-2.

Table 4-2: Available Information of Ordinary Watercourse flooding

Location	Dates	Available Details
Charnwood	January 1999	Flooding occurred in Queniborough Parish Dyke, a tributary of the River Wreake in Charnwood Borough, due to a restrictive (unconsented) culvert, siltation, channel obstruction and inadequate grillage.
The Nook, Anstey	2000s	The Nook, Anstey has historically flooded regularly, but flooding occurrences were significantly reduced following diversion of the upper 85% of the catchment in the 1960s and implementation of a Combined Sewer Overflow reduction scheme by Severn Trent Water in the 1990s. However, structural failure of parts of the Leicester Road culvert in Anstey in the 2000s resulted in some 40 properties flooding due to the culvert surcharging.
Syston	1947, 1992, 1993	In Syston, severe flooding occurred along the Barkby Brook in 1947, 1992 and 1993. Channel capacity remains exceeded up to 20% of the time in a given year, and approximately 140 properties are estimated to be at risk.
Hemington Village	1977	In February 1977, 9 houses, a post office, 2 public houses and a road were flooded. The cause of flooding was the inadequate capacity of brook, culverts and access bridges. Hemington Brook is affected by backing up from the River Trent. Hemington Brook is known not to have flooded in the last 12 years.
Lockington	Unknown	Flooding of roads and properties has been reported in Lockington caused by the inadequate capacity of Lockington Brook and the culvert in the centre of the village.
Hallgate and Ladygate	Unknown	Other reported flooding includes houses and the road in Hallgate and Ladygate in Diseworth from Diseworth Brook and Hall Brook which carry runoff from Nottingham East Midlands Airport and flooding of an access road from B5401 in Long Whatton from Long Whatton Brook. However, these are thought to be the result of local issues regarding channel maintenance.
Swithland	'Numerous occasions' included Summer 2007	Flooding from Swithland Brook and overland flow from the surrounding agricultural land, mainly resulting in surcharging of the culvert beneath Main Street at the west of the village. Numerous properties affected.

- 4.3.2 Parts of Swithland are known to have flooded on numerous occasions, affecting numerous properties, although precise dates and whether impacts on properties were internal or external are uncertain. A detailed study of flooding mechanisms and impacts has been undertaken, including high level recommendations of mitigation options.
- 4.3.3 Several other ordinary watercourses have caused flooding in the past. Some of these flood events have been severe, however the watercourses involved have now been enmained by the Environment Agency (for example, Grace Dieu Brook through Whitwick). Consequently, these events will be recorded and addressed by the Environment Agency as flooding from Main Rivers.
- 4.3.4 In general, records of flooding from ordinary watercourses are limited in detail in terms of impacts and consequences and therefore, at this time, none of the events noted above can be definitively assessed as having been significant floods. As such, these events are not recorded in Annex1.

## 4.4 Flooding from Canals

- 4.4.1 Information was obtained from British Waterways which details the canal network throughout Leicestershire, including the location of canals, weirs, sluices and locks.

*Table 4-3: Available Information of Canal Flooding*

Location	Dates	Available Details
Bottesford	2001	Grantham Canal presents the potential to transfer floodwater between catchments; for example in 2001 floodwaters moved via the canal from the River Devon into the Winter Beck, increasing flooding around Bottesford.
Melton Mowbray	Unknown	Floodwater backs up when the capacities of culverts under the Grantham Canal have been insufficient to convey heavy rainfall.

- 4.4.2 Although flooding has not been recorded historically, it is also worth noting that there are concerns that flooding could occur from the Asby Canal, where it passes through North West Leicestershire and the Grand Union Canal flows through Harborough and Charnwood boroughs. In Charnwood, Loughborough town centre has been identified as a potentially vulnerable to flooding from the canal if culverts are blocked or of insufficient capacity to convey runoff from significant rainfall events, causing floodwaters to back up. The canal is also thought to provide a potential flow path for higher flood levels in the River Soar upstream of Loughborough into central Loughborough.
- 4.4.3 British Waterways have not reported any historic breaches or overtopping events in the county.
- 4.4.4 Due to the limited amount of information available on flood causes and consequences, none of the events noted above can be definitively assessed as having been significant floods.

## 4.5 Groundwater Flooding

- 4.5.1 Groundwater flooding occurs as a result of water rising up from the underlying aquifer or from water flowing from abnormal springs. This tends to occur after long periods of sustained high rainfall, and the areas at most risk are often low-lying where the water table is more likely to be at shallow depth. Groundwater flooding is known to occur in areas underlain by major aquifers, although increasingly it is also being associated with more localised floodplain sands and gravels.
- 4.5.2 The majority of Leicestershire is underlain by non-permeable or low-permeability geology, so where groundwater exists it flows through strata very slowly and in limited quantities. It is not thought that groundwater rebound following the cessation of industrial abstractions has been a problem in the region. The Melton Strategic Flood Risk Assessment includes one record of groundwater flooding (Table 4-4), but no other records of historic groundwater flooding have been uncovered in Leicestershire.
- 4.5.3 Due to the limited amount of information available on flood dates, causes and consequences, none of the events noted below can be definitively assessed as having been significant floods.

*Table 4-4: Available Information on Groundwater Flooding*

Location	Dates	Available Details
Frisby, Melton Mowbray	Unknown	Egression of groundwater through fissures in the hillside at Frisby on the Wreake has been known to generate overland flow.

## 4.6 Sewer Flooding

- 4.6.1 Sewer flooding is often caused by excess surface water entering the drainage network and can also occur due to insufficient capacity in the surface and foul water network, but also due to 'one off' events such as trees falling and fly tipping, blocking drains and screens.
- 4.6.2 STW are keen to participate in flood risk management in Leicestershire and have agreed to share with Leicestershire CC certain datasets that can assist in identifying flood sources in the county, one of which was the DG5 register of sewer flooding. Terms and conditions apply to the sharing of the DG5 register due to potentially sensitive information which may mean that some information cannot be shared publicly. In order to protect sensitive customer information, STW have only provided flooding locations accurate to 4/5 post code digits.
- 4.6.3 Parts of Harborough are covered by Anglian Water, but due to data sensitivity, no information from Anglian Water has been made available.
- 4.6.4 It is worth noting that new sewers are designed to have sufficient capacity to accommodate a 1 in 30 year rainfall event. Thus sewers are not designed to accommodate extreme rainfall events, so it is likely that flooding will occur from sewers and drains during such events.

Table 4-5: Available Information on Sewer Flooding

Location	Dates	Available Details
Market Harborough Town Centre	30 <sup>th</sup> July 2002:	Internal flooding of properties on the High Street , The Square, Coventry Road, St Marys Road, Northampton Road, Church Street and Adam & Eve St, due to insufficient capacity of local public sewers prior to discharge to the River Welland.
Market Harborough Town Centre	6 <sup>th</sup> July 2006:	Internal flooding following heavy rainfall, due to insufficient capacity of local public sewers prior to discharge to the River Welland. Affected High Street, Kings Fead Place, Northampton Road, The Square, St Marys Road, Coventry Road, Fairfield Road and Douglas Drive.
Market Harborough Town Centre	1999, 2001, 2002, 2006.	In addition to the two events noted above, flooding of Market Harborough town centre, especially in the locality of the High Street, The Square, Church Street and Coventry Road, has been recorded for numerous occasions. Where flood source data is available, flooding is reported to be caused by insufficient capacity of the local public sewers.
Ashfield Drive in Anstey	1996, 2005, 2006, 2007, 2009, 2010.	Flooding from surface water sewers only, affecting domestic dwellings, gardens and highways.
Charleston Crescent in Barwell	2004, 2006.	Flooding from foul and surface water sewers, affecting domestic dwellings and gardens.
Church Street, Marigold Drive, and Sketchley Road in Billesdon	1997, 1999, 2002, 2003, 2004, 2006, 2009, 2010.	Flooding from foul and surface water sewers, affecting domestic dwellings, internal holdings, commercial properties and gardens.
Rosebank Road and Island Close in Countesthorpe	1996, 2001, 2006, 2007, 2009, 2010.	Flooding from foul and surface water sewers, affecting domestic dwellings, gardens and highways.
Beacon Road, Loughborough	2004, 2009.	Flooding from foul and surface water sewers, affecting domestic dwellings.

4.6.5 Sewer flooding has been recorded at numerous locations across the study area. This includes both surface water (172 events) and foul water (640 events) and both (49 events). The available records do not include detailed information on the causes or impacts of sewer flooding, or the precise locations. Those areas where flooding is recorded to have affected five or more locations (accurate to 4-5 postcode digits) are summarised in Table 4-5.

- 4.6.6 Due to the limited amount of information available on precise flood locations, causes and consequences, few of the events noted below can be definitively assessed as having been significant floods. Market Harborough town centre has suffered frequently from flooding in the past, but information on the nature of flooding is limited. Whenever information on flood mechanisms is available, flooding is attributed to heavy rainfall and insufficient sewer capacity. Information on flood consequences is also limited, but because the flood events of 30<sup>th</sup> July 2002 and 6<sup>th</sup> July 2006 across Market Harborough town centre were obviously severe (cf. Table 4-5) Leicestershire CC believe these two events should be considered nationally significant. Whilst a number of other lesser events are significant at local scale, only the two larger events have been recorded in Annex 1.

## 4.7 Consequences of Historic Flooding

- 4.7.1 As a result of the issues discussed in Chapter 3.4, insufficient data is available to draw definitive conclusions on the impacts and consequences of historic flood events on people, the economy and the environment, as this information has not been recorded in the past.
- 4.7.2 Information on historic events has been collated into a floods database by Leicestershire CC Highways, and existing records will be augmented if further information becomes available. A number of these events are clearly locally important, but due to the lack of information available, few historic flood events can be definitively assessed as having had 'significant harmful consequences' at national level.
- 4.7.3 The Loughborough 1998 flood event and the two largest flood events on record in the town centre of Market Harborough (which occurred on 30<sup>th</sup> July 2002 and 6<sup>th</sup> July 2006) were major events. Therefore, although limited data has so far been obtained to provide details on the impacts and consequences of the events, Leicestershire CC has classified them as significant and has recorded them as such in Annex 1 of the Preliminary Assessment Spreadsheet.
- 4.7.4 A complete record of locations where flooding has occurred will be kept by Leicestershire CC 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 Leicestershire's Local Flood Risk Management Strategy.

## 5. Future Flood Risk

### 5.1 Overview of Future Flood Risk

#### Surface Water Flooding

- 5.1.1 A SWMP is currently under development for the Leicester Principal Urban Area (PUA) and Sustainable Urban Extensions (SUEs). Leicestershire CC are also developing a SWMP for Loughborough, which incorporates an Integrated Urban Drainage model. The draft results of the SWMP pluvial modelling have been used to inform this PFRA. Results from the pluvial modelling will be available to inform the second cycle of the PFRA process and the production of flood hazard and flood risk maps for this area.
- 5.1.2 The EA has produced a national assessment of surface water flood risk in the form of two national mapping datasets. The first generation national mapping, Areas Susceptible to Surface Water Flooding (AStSWF), contains three susceptibility bandings for a rainfall event with a 1 in 200 chance of occurring (Less, Intermediate and More susceptible). The national methodology has since been updated to produce the Flood Map for Surface Water (FMfSW), a revised model containing two flood events (1 in 30 annual chance and 1 in 200 annual chance) and two depth bandings (greater than 0.1m and greater than 0.3m). The FMfSW for the Leicestershire CC administrative area is presented in Figure 5-1, highlighting areas at risk of surface water flooding in the future.
- 5.1.3 The risk of sewer flooding is inherently considered by using the EA's FMfSW which take account of the drainage system by applying a national 'sewer infiltration rate' of 12mm / hour.
- 5.1.4 Using EA data<sup>2</sup>, the number of properties at risk of surface water flooding within the Leicestershire County Indicative Flood Risk Area has been estimated (please note that the property count includes hydrological linked neighbouring authorities that are covered by the Indicative Flood Risk Area).
- 5.1.5 For a rainfall event with a 1 in 200 annual chance of occurring, 70,300 properties are at risk from flooding to a depth of 0.1m, 53,400 of which are residential properties (76%). 21,500 properties are at risk from flooding to a depth of 0.3m of which 15,700 are residential properties (73%). Further details on the potential harmful consequences of future flooding are included in Annex 2 of the Preliminary Assessment Spreadsheet.

#### Groundwater Flooding

- 5.1.6 Although it is thought that groundwater flooding has occurred in the past, there is no local information available which provides evidence on future groundwater flood risk across Leicestershire and groundwater rebound is not believed to be an issue in the county. The Environment Agency's national dataset, Areas Susceptible to Groundwater Flooding, has been used to form the basis of the assessment of future flood risk from groundwater. This dataset is illustrated in Figure 5-2 and areas at high risk from groundwater flooding are identified.

<sup>2</sup> Environment Agency Spreadsheet: "LLFA\_Property\_Counts\_Rounded\_for\_PFRA", March 2011

### Flooding from Ordinary Watercourses

- 5.1.7 The fluvial flood map has been used to assess the risk of flooding from ordinary watercourses. The Detailed River Network was used to identify ordinary watercourses and this was cross referenced with the Flood Map for Rivers and the Sea to assess future flood risk from this source.
- 5.1.8 Outputs from this modelling will be reviewed by the Lead Local Flood Board and key stakeholders (including the EA) and may be used to identify new flood risk areas in Leicestershire.

### Flooding from Canals

- 5.1.9 There is no available information on future flood risk from canals. However, British Waterways are currently working on a study to better understand the future flood risk from canals, which will be available to inform the second cycle of the PFRA process.

## 5.2 Locally Agreed Surface Water Information

- 5.2.1 A definition of 'locally agreed surface water information' has been considered in conjunction with the EA in order to agree what surface water information best represents local conditions across Leicestershire. Currently the FMfSW, which gives an overview of the future flood risk from surface water across Leicestershire, forms the agreed available surface water flooding information in Leicestershire. This dataset is presented in Figure 5-1.
- 5.2.2 However, the SWMPs that are currently being completed for Leicester and Loughborough will have city-wide pluvial modelling at a greater level of detail than the FMfSW dataset. Until the SWMPs are complete and the modelled outputs have been agreed by the Lead Local Flood Board, they cannot be used in this cycle of the PFRA. However it is anticipated that the results will form the Locally Agreed Surface Water Information for Leicestershire for the next cycle of the PFRA.

## 5.3 Potential Consequences of Future Flooding

- 5.3.1 The EA has used the FMfSW mapping and the NRD to identify a number of areas across the country which exceed a given threshold, described in Table 5-1 below.

*Table 5-1: Flood risk threshold used to identify future consequences of flooding*

'Significant harmful consequences' defined as greater than...	Description
200 people <i>or</i>	Flooded to a depth of 0.3m during a rainfall event with a 1 in 200 chance of occurring (or 0.5%)
20 businesses <i>or</i>	
1 critical service	

- 5.3.2 This assessment was carried out based on 1km<sup>2</sup> national grid squares, and the grid squares that exceed this criterion were identified. The grid squares within Leicestershire where flood risk is considered to exceed this threshold are illustrated on Figure 5-3. These areas represent where flood risk is considered to be the most severe across the Country.
- 5.3.3 Flood risk areas with the Leicestershire County boundary area are mainly concentrated in and directly adjacent to Leicester City, with smaller clusters at Burbage, Loughborough, Melton Mowbray and Shepsted. Otherwise flood risk areas are few and far between in Leicestershire, and grid squares tend to be isolated. Leicestershire CC are already working in close cooperation with Leicester City LLFA to manage future flood risk, and on this basis no additional information has been included in Annex 2 of this PFRA.

## 5.4 Climate Change and Long Term Developments

### The Evidence of Climate Change

- 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 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 Anglian 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 14% (very likely to be between 3 and 31%).
  - Precipitation on the wettest day in winter up by around 14% (very unlikely to be more than 29%).
  - Relative sea level at Felixstowe very likely to be up between 10 and 41cm 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 16%.

#### *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. 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.
- 5.4.8 Drainage systems in the district have been modified to manage water levels and could help in adapting locally to some impacts of future climate on flooding, but may also need to be managed differently. Rising sea or river levels may also increase local flood risk inland or away from major rivers because of interactions with drains, sewers and smaller watercourses. Even small rises in sea level could add to very high tides so as to affect places a long way inland.
- 5.4.9 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.

#### Key Projections for Humber River Basin District

- 5.4.10 If emissions follow a medium future scenario, UKCP09 projected changes by the 2050s relative to the recent past are
- Winter precipitation increases of around 12% (very likely to be between 2 and 26%).
  - Precipitation on the wettest day in winter up by around 12% (very unlikely to be more than 24%).
  - Relative sea level at Grimsby very likely to be up between 10 and 41cm 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 14%.

#### *Implications for Flood Risk*

- 5.4.11 Climate changes can affect local flood risk in several ways. Impacts will depend on local conditions and vulnerability.
- 5.4.12 Wetter winters and more of this rain falling in wet spells may increase river flooding. 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.
- 5.4.13 Drainage systems in the district have been modified to manage water levels and could help in adapting locally to some impacts of future climate on flooding, but may also need to be managed differently. Rising sea or river levels may also increase local flood risk inland or away from major rivers because of interactions with drains, sewers and smaller watercourses. Even small rises in sea level could add to very high tides so as to affect places a long way inland.

- 5.4.14 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.

#### Key Projections for Severn River Basin District

- 5.4.15 If emissions follow a medium future scenario, UKCP09 projected changes by the 2050s relative to the recent past are:
- Winter precipitation increases of around 12% (very likely to be between 2 and 26%).
  - Precipitation on the wettest day in winter up by around 9% (very unlikely to be more than 22%).
  - Relative sea level at Bristol 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 9 and 18%.
  - Increases in rain are projected to be greater at the coast and in the south of the district.

#### *Implications for Flood Risk*

- 5.4.16 Climate changes can affect local flood risk in several ways. Impacts will depend on local conditions and vulnerability.
- 5.4.17 Wetter winters and more of this rain falling in wet spells may increase river flooding along the Severn and its tributaries. 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.
- 5.4.18 Drainage systems in the district have been modified to manage water levels and could help in adapting locally to some impacts of future climate on flooding, but may also need to be managed differently. Rising sea or river levels may also increase local flood risk inland or away from major rivers because of interactions with drains, sewers and smaller watercourses.
- 5.4.19 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

- 5.4.20 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.
- 5.4.21 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.

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### Long term Developments

- 5.4.22 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.
- 5.4.23 In England, Planning Policy Statement 25 (PPS25): 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."
- 5.4.24 In Wales, Technical Advice Note 15 (TAN15): Development and Flood Risk sets out a precautionary framework to guide planning decisions. The overarching aim of the precautionary framework is "to direct new development away from those areas which are at high risk of flooding".
- 5.4.25 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).

## 5.5 Proposed Major Developments

- 5.5.1 Leicestershire CC continues to support the Local Planning Authorities within the County (the District Councils) and adjacent to the County, primarily Leicester City, to ensure that flood risk management is given proper consideration through the planning processes managed by those authorities

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## 6. Review of Indicative Flood Risk Areas

### 6.1 Overview

- 6.1.1 In order to ensure a consistent national approach, Defra and WAG have identified significance criteria and thresholds to be used for defining flood risk areas. Guidance on applying these thresholds has been released in Defra's document "Selecting and reviewing Flood Risk Areas for local sources of flooding". In this guidance document, Defra have set out agreed key risk indicators and threshold values which must be used to determine Flood Risk Areas.
- 6.1.2 The methodology is based on using national flood risk information to identify 1km squares where local flood risk exceeds a defined threshold. These areas within Leicestershire are illustrated in Figure 5-3. Where a cluster of these grid squares leads to an area where flood risk is most concentrated, and over 30,000 properties are predicted to be at risk of flooding, this area has been identified as an Indicative Flood Risk Area.
- 6.1.3 This guidance has now been released and the Environment Agency has applied it to identify 10 Indicative Flood Risk Areas across the country. The area of Leicestershire and Leicester City, has been identified as one of these Indicative Flood Risk Areas.

### 6.2 Review of Indicative Flood Risk Area

- 6.2.1 Figure 5-4 shows the geographical extent of the indicative Flood Risk Area for Leicestershire and Leicester City. Based on the 1km<sup>2</sup> grid and the currently available locally agreed surface water dataset, the Environment Agency FMfSW, the Indicative Flood Risk Area generally appears to give a fair representation of flood risk in Leicestershire. However, several areas with critical infrastructure and residential and commercial properties have been identified as being at risk of flooding on the fringes of the Indicative Flood Risk Area. It is therefore proposed to extend the Indicative Flood Risk Area.

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## 7. Identification of Flood Risk Areas

- 7.1.1 The designated Indicative Flood Risk Area for Leicestershire area also covers hydrologically linked areas of adjoining administrative areas which are separate Lead Local Flood Authorities, most significantly Leicester City. Due to the hydrological linkage, the Indicative Flood Risk Area cannot be easily split and therefore it is important that a cross boundary and collaborative approach is taken to managing local flood risk as local issues can often stem from a wider catchment issue.
- 7.1.2 Leicestershire CC, and Leicester City Council have worked together and have agreed that the current Indicative Flood Risk Area should be extended. This is because significant areas of residential and commercial properties, and areas of significant infrastructure including the M1/M69 interchange and the County Police Headquarters, are identified as being at risk of flooding on the south western fringe of the Indicative Flood Risk Area. The proposed extension to the Indicative Flood Risk Area is shown in Figure 5-4 in Annex 5.
- 7.1.3 As discussed in Section 5, there is a SWMP currently underway for Leicester. Once the outputs have been reviewed by the Lead Local Authority Flood Board and key stakeholders, additional new flood risk areas may be identified based on critical drainage areas identified in the SWMP. The outputs from this study will be used to support and inform the next stages of the requirements of the Flood Risk Regulations.

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## 8. Next Steps

### 8.1 Future Data Management Arrangements

- 8.1.1 This PFRA for Leicestershire will be reviewed by the County Council's cabinet prior to submission to the Environment Agency.
- 8.1.2 Under the Flood Risk Regulations, the Environment Agency has been given a role in reviewing, collating and publishing all of the PFRAs once submitted. The Environment Agency will undertake a technical review (area review and national review) of the PFRA, which will focus on instances where Flood Risk Areas have been amended and ensure the format of these areas meets the provide standard. If satisfied, they will recommend submission to the relevant Regional Flood and Coastal Committee (RFCC) for endorsement. RFCCs will make effective use of their local expertise and ensure consistency at a regional scale. Once the RFCC has endorsed the PFRA, the relevant Environment Agency Regional Director will sign it off, before all PFRAs are collated, published and submitted to the European Commission.
- 8.1.3 The first review cycle of the PFRA will be led by Leicestershire County Council in 6 years time and must be submitted to the Environment Agency by the 22nd of June 2017. They will then submit it to the European Commission by the 22nd of December 2017 using the same review procedure described above.
- 8.1.4 As LLFA the County Council intends to use this PFRA as the basis for management of areas within the Indicative Flood Risk Area in conjunction with the City Council, relevant District Councils and other partners overseen by the Flood Risk Management Board.
- 8.1.5 In order to continue to fulfil their role as LLFA, Leicestershire County Council is required to investigate future flood events and ensure continued collection, assessment and storage of flood risk data and information.
- 8.1.6 However, it is crucial that all records of flood events are documented consistently and in accordance with the INSPIRE Directive (2007/2/EC). It is recommended that a centralised database will be kept up to date by Leicestershire County Council, who has the overall responsibility to manage flood data through the whole administrative area of Leicestershire County. This can be used as an evidence base to inform future assessments and reviews and for input into the mapping and planning stages.
- 8.1.7 It will be important to ensure that the 'centralised database' is managed in such a way so that where data has been provided under a confidentiality agreement, it continues to be used in accordance with the agreement.
- 8.1.8 In accordance with Section 19 of the Floods and Water Management Act, Severn Trent Water Ltd and Anglian Water Ltd will need to be informed of any reported flood incidents that involve sewer flooding which are captured on the Flood Event Data Recording System.

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- 8.1.9 The proposed method for flood event data collection and management will be developed by the Lead Local Flood Authority Board. As part of this PFRA and the SWMP for Leicestershire, a GIS database of historical flood events has been prepared that is based on a simple spreadsheet system. This allows the database to be updated and completed by Council teams and key stakeholders without the need for specialist software.
- 8.1.10 An extract of the spreadsheet is presented below in Figure 7-1 and 7-2. The fields are colour coded to represent the details which are absolutely compulsory, and those which would be useful to have but not essential.



## 8.2 Prepare Flood Risk and Flood Hazard Maps

8.2.1 Part 3 of The Regulations state that LLFAs within indicative flood risk areas must prepare flood risk and flood hazard mapping for each Flood Risk Area by 22nd December 2013. As highlighted earlier, Leicestershire CC are collaborating with the City Council in the production of a SWMP for the Indicative Flood Risk Area that includes detailed surface water and ordinary watercourse modelling. The outputs of this modelling include flood risk and flood hazard mapping for Leicestershire.

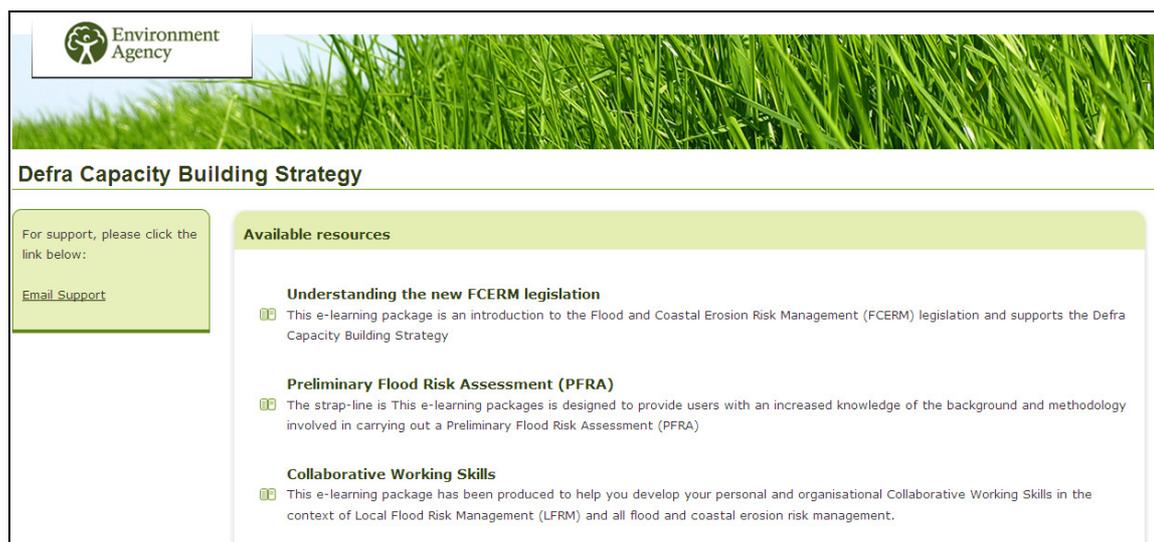
## 8.3 Prepare Flood Risk Management Plans

8.3.1 Part 4 of Regulations state that LLFAs must prepare flood risk management plans for each Flood Risk Area by 22nd December 2015. The SWMP for the Indicative Flood Risk Area forms the first step towards forming a Flood Risk Management Plans for Leicestershire. The Leicestershire Lead Local Flood Board will build on the SWMP to formulate a Flood Risk Management Plan together with its partners.

## 8.4 Prepare the 2nd cycle of the PFRA

8.4.1 Section 17 of the Flood Risk Regulations state that LLFAs must prepare a revised Preliminary Assessment Report by 22nd June 2017, and carry out subsequent reviews every 6 years.

8.4.2 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.



Environment Agency

Defra Capacity Building Strategy

For support, please click the link below:

[Email Support](#)

**Available resources**

**Understanding the new FCERM legislation**  
This e-learning package is an introduction to the Flood and Coastal Erosion Risk Management (FCERM) legislation and supports the Defra Capacity Building Strategy

**Preliminary Flood Risk Assessment (PFRA)**  
The strap-line is This e-learning packages is designed to provide users with an increased knowledge of the background and methodology involved in carrying out a Preliminary Flood Risk Assessment (PFRA)

**Collaborative Working Skills**  
This e-learning package has been produced to help you develop your personal and organisational Collaborative Working Skills in the context of Local Flood Risk Management (LFRM) and all flood and coastal erosion risk management.

Figure 8-3 Environment Agency e-Learning module

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## 9. References

- Defra (2006). Flood and Coastal Defence Appraisal Guidance, FCDPAG3 Economic Appraisal, Supplementary Note Operating Authorities – Climate Change Impacts.  
<http://www.defra.gov.uk/environment/flooding/documents/policy/guidance/fcdpag/fcd3update0303.pdf>
- Defra (2010). Selecting and reviewing Flood Risk Areas for local sources of flooding: Guidance to Lead Local Flood Authorities.  
<http://www.defra.gov.uk/environment/flooding/documents/research/flood-risk-method.pdf>
- Environment Agency (2009). Building Trust With Communities  
<http://www.ncl.ac.uk/ihs/research/environment/rehmarc/pdfs/workingwithothers.pdf>
- Environment Agency (2010). Preliminary Flood Risk Assessment - Final Guidance (Report – GEHO1210BTGH-E-E)  
<http://publications.environment-agency.gov.uk/pdf/GEHO1210BTGH-e-e.pdf>
- Environment Agency (2010). Preliminary Flood Risk Assessment – Annexes to the Final Guidance (Report –GEHO1210BTHF-E-E)  
<http://publications.environment-agency.gov.uk/pdf/GEHO1210BTHF-e-e.pdf>
- European Commission (2007). Directive 2007/60/EC on the assessment and management of flood risks.  
[http://ec.europa.eu/environment/water/flood\\_risk/index.htm](http://ec.europa.eu/environment/water/flood_risk/index.htm)
- Flood Risk Regulations (2009).  
<http://www.legislation.gov.uk/ukxi/2009/3042/contents/made>
- European Union (2007). INSPIRE Directive (2007/2/EC).  
<http://inspire.jrc.ec.europa.eu/>
- IPCC, Fourth Assessment Report (AR4)  
<http://www.ipcc.ch/>
- Office of National Statistics (2007). Mid Year Estimates of Population (2007) Wolverhampton  
[http://www.wolverhampton.gov.uk/council/statistics/population/mid\\_year\\_estimate.htm](http://www.wolverhampton.gov.uk/council/statistics/population/mid_year_estimate.htm)
- Scott Wilson (2009). Black Country Water Cycle Study and Surface Water Management Plan Final Report  
<http://blackcountrycorestrategy.dudley.gov.uk/evidencesa>
- Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Avery, M. Tignor and H.L. Miller (Eds.). Summary for Policymakers. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. 9.  
<http://www.ipcc.ch/ipccreports/ar4-wg1.htm>
- S J Brown, M Beswick, E Buonomo, R Clark, D Fereday, D Hollis, R G Jones, E J Kennett, M Perry, J Prior and A Scaife. (2008). Met Office Submission to the Pitt Review - Executive Summary, The extreme rainfall of Summer 2007 and future extreme rainfall in a changing climate. 08/01/2008

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## Annex 1: Records of Past Floods and their Significant Consequences

**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	Main mechanism of flooding	Main characteristic of flooding
Mandatory / optional: Format:	Mandatory Unique number between 1-9999	Mandatory Max 5,000 characters	Mandatory Max 250 characters	Mandatory 12 characters: 2 letters, 10 numbers	Optional Max 250 characters	Optional for first cycle 'yyyy' or 'yyyy-mm' or 'yyyy-mm-dd'	Optional for first cycle Number with two decimal places	Optional for first cycle Max 25 characters	Optional for first cycle Pick from drop-down	Optional Max 250 characters, same source terms	Optional Pick from drop-down	Optional for first cycle Pick from drop-down	Optional for first cycle Pick from drop-down
Notes:	A sequential number starting at 1 and incrementing by 1 for each record.												
Notes:	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.												
Notes:	Name of the locality associated with the flood, using recognised postal address names such as streets, towns, or counties. If the flood affected the whole LLFA, then record the name of the LLFA.												
Notes:	Reference of the National Grid (centre point, falls within polygon) of the flood extent, or of the area affected if there is no extent information.												
Notes:	A description of the general location that was flooded.												
Notes:	The date when the flood commenced - when land not normally covered by water became covered by water.												
Notes:	The number of days (duration) of the flood - when land not normally covered by water was covered by water. Values should be within the range 0.01 - 999.99 (permitting a range can be recorded to the nearest quarter of an hour, where appropriate).												
Notes:	The chance of the flood occurring 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.												
Notes:	Refer to the PFRA guidance for definitions of source(s) of flooding. Report the source(s) here, using the same source terms.												
Notes:	(other than the Main source of flooding), report the source(s) here, using the same source terms.												
Notes:	Pick a broad level of confidence in the Main source of flooding. Correct, Medium (some evidence of source but not compelling - about 50% confident that source is correct) or Low (source assumed - about 20% confident that source is correct) or 'Unknown'.												
Notes:	Pick a mechanism of flooding from: 'Natural exceedance' (of capacity), 'Defence 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'.												
Notes:	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	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 occurring in any given year.	Essex	SX1234512345	Several towns and villages across west Essex	1998-04-15		0.25 20-50	Surface runoff		High	Natural exceedance	Natural flood
Records begin here:	1	Surface water flooding during periods of heavy rainfall in 1998	Loughborough	SK5350019500	Unknown. Thought to be across the whole town.	Unknown	Unknown	Unknown	No data	Unknown	Unknown	No data	No data
	2	30 July 2002: Internal flooding of properties on the High Street, The Square, Coventry Road, Market Harborough, St Marys Road, Northampton Road, Church Street and Adam & Eve St, due to insufficient capacity of local public sewers prior to discharge to the River Welland.	Market Harborough	SP7350087500	Market Harborough Town Centre	30/07/2002	Unknown	Unknown	Artificial infrastructure	Unknown	Medium	Natural exceedance	Natural flood
	3	06 July 2006: Internal flooding following heavy rainfall. Insufficient capacity of local public sewers prior to discharge to the River Welland. Affected 2006 High Street, Kings Fead Place, Northampton Road, The Square, St Marys Road, Coventry Road, Fairfield Road and Douglas Drive.	Market Harborough	SP7350087500	Market Harborough Town Centre	06/07/2006	Unknown	Unknown	Artificial infrastructure	Unknown	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	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	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
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	Optional Number between 1-10,000,000	Optional Pick from drop-down	Optional Max 250 characters	Mandatory Pick from drop-down	Optional Max 250 characters	Mandatory Pick from drop-down	Optional Max 250 characters	Optional Max 1,000 characters	Optional Max 250 characters	Optional Number with two decimal places	Optional Pick from drop-down	Optional Pick from drop-down	Optional 'yyyy' or 'yyyy-mm' or 'yyyy-mm-dd'	Optional Max 50 characters	Optional Max 250 characters	Optional Pick from drop-down	Optional Max 50 characters	Auto-populated Max 42 characters
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.	Any additional comments about the past flood record.	Epping Forest District Council	The total area of the land flooded, in km <sup>2</sup>	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'.	Site survey	1998-04-20	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.	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.	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 auto-populate 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.
Yes	23	Observed number		No				No		No					Medium	Site survey	1998-04-20		Ordnance Survey AddressPoint, CEH 1:50k River Centreline, NextMap DTM.	Unmarked	Private	UKE10000012P0001
	Unknown	Unknown	Unknown	No	Unknown	Unknown	Unknown	No	Unknown	No	Unknown	Flooding due to surface water stated in Charnwood Strategic Flood Risk Assessment. Identified through local knowledge as clearly having been significant, even though further details are unavailable.	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	UKE10000018P0001
Yes	Unknown	Unknown	Unknown	Yes	Unknown	Unknown	Unknown	No	Unknown	No	Unknown	Identified through local knowledge as clearly having been significant, even though further details are unavailable.	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	UKE10000018P0002
Yes	Unknown	Unknown	Unknown	Yes	Unknown	Unknown	Unknown	No	Unknown	No	Unknown	Identified through local knowledge as clearly having been significant, even though further details are unavailable.	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	UKE10000018P0003
Yes																						

## **Annex 2: Records of Future Floods and their Consequences**



## **Annex 3: Records of Flood Risk Areas and their Rationale**

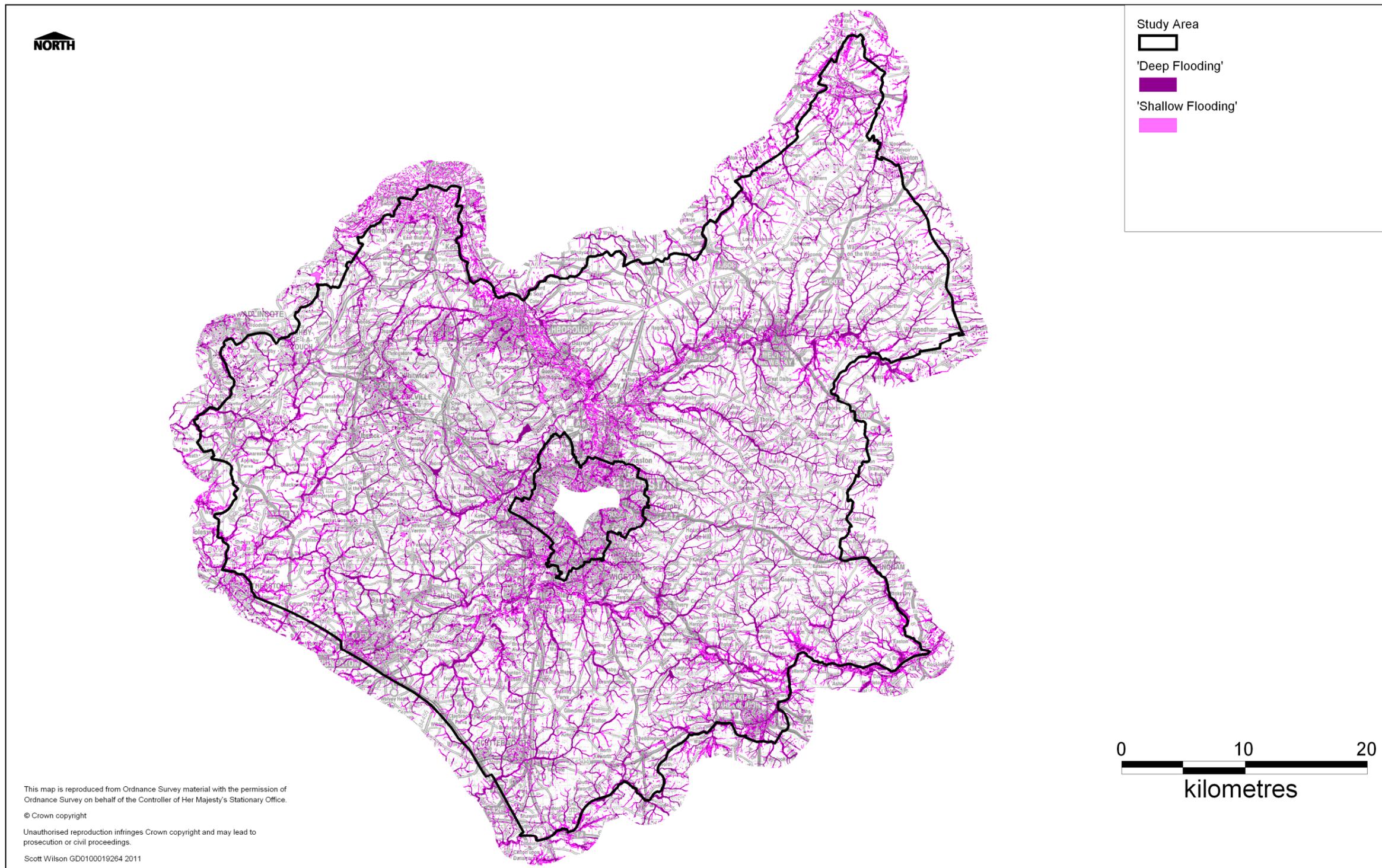


## **Annex 4: Review Checklist**

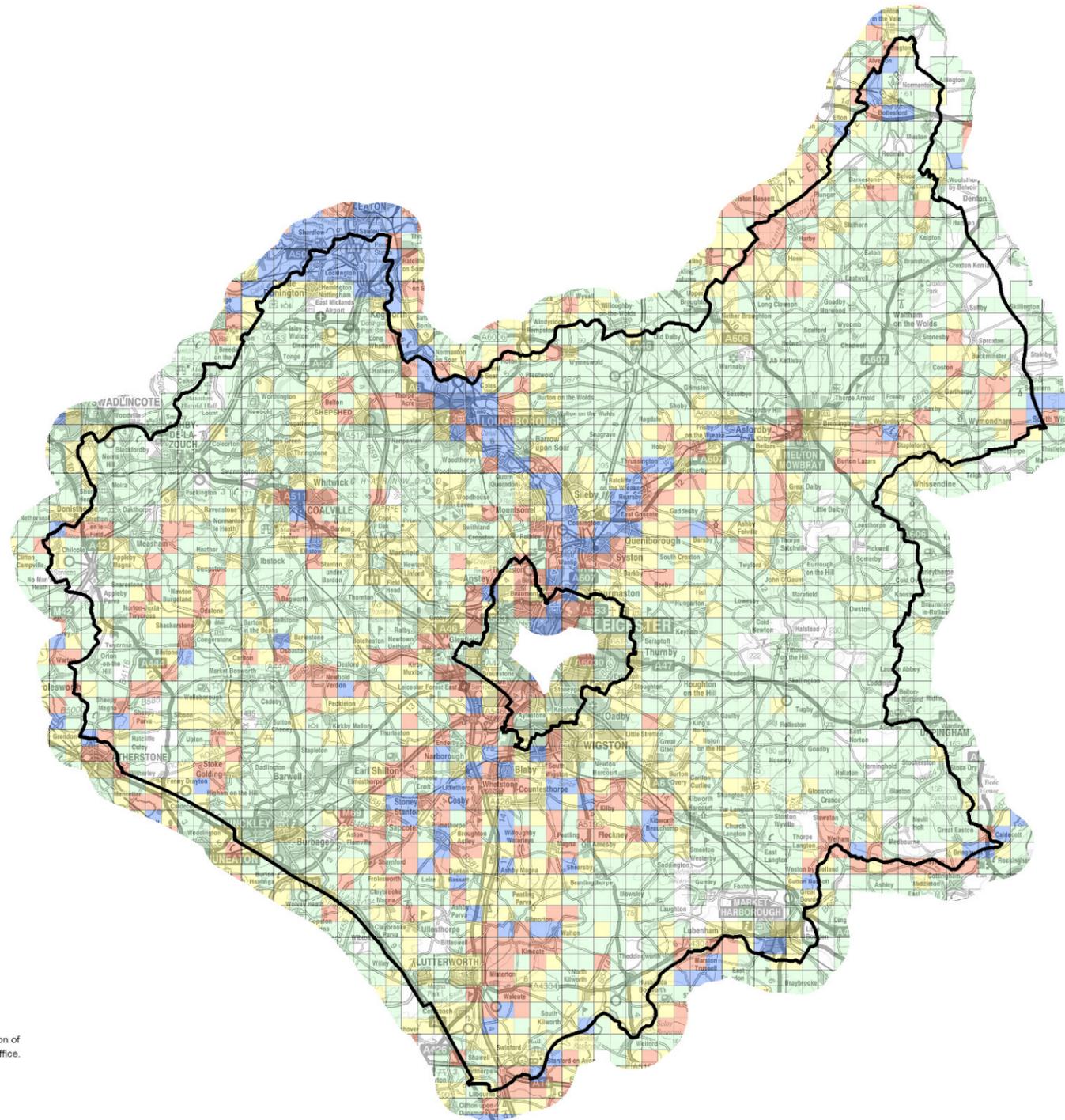
Preliminary Flood Risk Assessment Checklist				
LLFA Name:				
Checklist questions	Notes for completion	LLFA	Environment Agency area review	Environment Agency national review
<b>Step 1 Set up governance and develop partnerships</b>				
1.1	Have appropriate governance and partnership arrangements been 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.	Cabinet - June 2011	
<b>Step 2 Determine appropriate data systems</b>				
2.1	Has a data management system been established and implemented?	See Annex 5 for information about data standards	Yes	
<b>Step 3 Collate information on past and future floods and their consequences</b>				
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, please refer to Section 3 of report	
<b>Step 4 Determining locally agreed surface water information</b>				
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.	21,806 - simplified method including proposed increase in boundary.	
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.	Yes	
<b>Step 5 Complete Preliminary Assessment Report Document</b>				
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 - based on locally agreed Surface Water Information - the FMISW	
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	
<b>Step 6 Record information on past and future floods with significant consequences in spreadsheet</b>				
6.1	Are records of past flooding with significant harmful consequences recorded on the Preliminary Assessment Report spreadsheet (Annex 1 of Preliminary 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 - possibly but not enough information available to determine if events were "significant"	
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	
<b>Step 7 Illustrate information on past and future floods</b>				
7.1	Have summary maps been produced for past and future floods?	Refer to section 3.4 and 3.5 of guidance	Yes	
<b>Step 8 Review Indicative Flood Risk Areas</b>				
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	
<b>Step 9 Identify Flood Risk Areas</b>				
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.	N/A	
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	Indicative Flood Risk Area has been increased based on critical infrastructure (police headquarters, M1/M69 interchange) shown to be at risk of flooding in the Areas above Threshold mapping and also on FMISW.	
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	
<b>Step 10 Record information including rationale - ONLY COMPLETE IF ANSWER TO 9.1 IS YES</b>				
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	Yes	

## Annex 5: Figures

- Figure 5-1: Flood Map for Surface Water 1 in 200 Year chance
- Figure 5-2: Areas Susceptible to Groundwater Flooding
- Figure 5-3: Places Above Threshold
- Figure 5-4: Indicative Flood Risk Areas



Job Title Job D138716 - Leicestershire County Council PFRA	<b>Figure 5-1: Flood Map for Surface Water 0.5% AEP (1 in 200 Chance)</b>			
	Scale at A3: NTS			
<a href="http://www.scottwilson.com">www.scottwilson.com</a>	Drawn VR	Check NW	Approved MT	Revision 1
				Date May 2011



**Study Area**



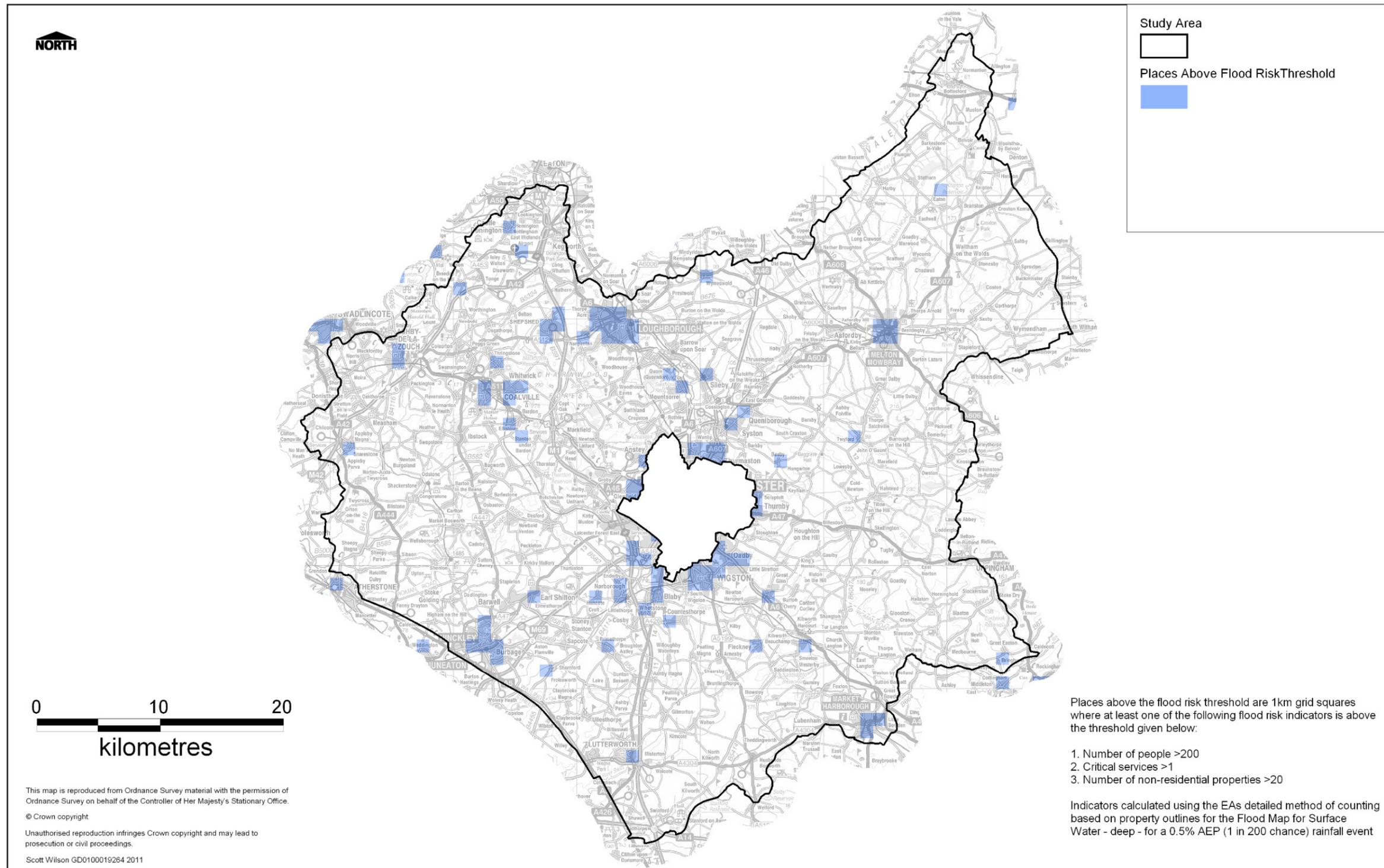
**Susceptibility to Groundwater Flooding**

- < 25%
- >= 25% < 50%
- >= 50% < 75%
- >= 75%

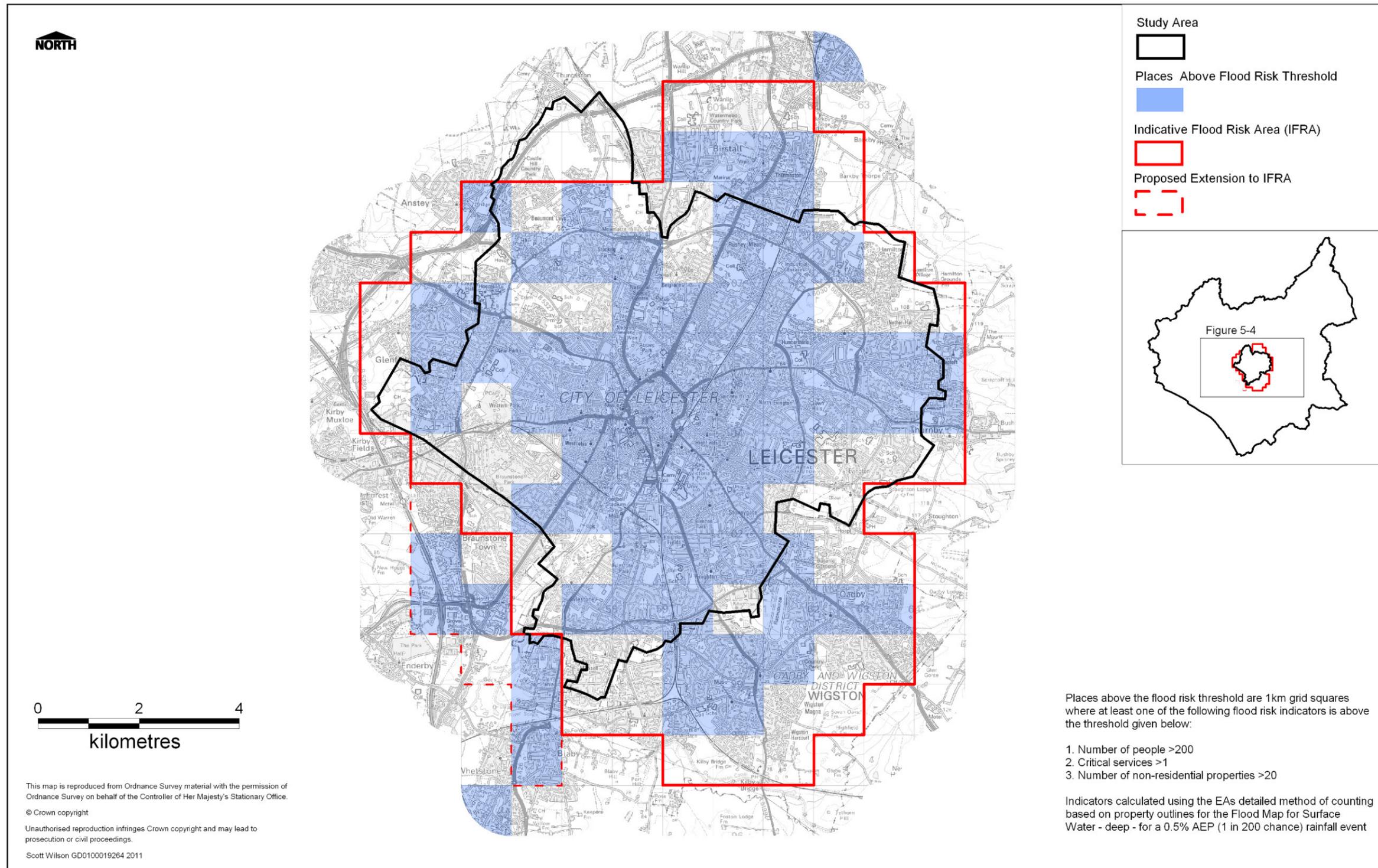
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Job Title Job D138716 - Leicestershire County Council PFRA	<b>Figure 5-2: Areas Susceptible to Groundwater Flooding</b>										
	Scale at A3: NTS										
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">www.scottwilson.com</td> <td style="width: 10%;">Drawn</td> <td style="width: 10%;">VR</td> <td style="width: 10%;">Check</td> <td style="width: 10%;">NW</td> <td style="width: 10%;">Approved</td> <td style="width: 10%;">MT</td> <td style="width: 10%;">Revision</td> <td style="width: 10%;">1</td> <td style="width: 10%;">Date</td> <td style="width: 10%;">May 2011</td> </tr> </table>		www.scottwilson.com	Drawn	VR	Check	NW	Approved	MT	Revision	1
www.scottwilson.com	Drawn	VR	Check	NW	Approved	MT	Revision	1	Date	May 2011	



Job Title	Figure 5-3 Places Above Threshold		
Job D138716 - Leicestershire County Council PFRA	Scale at A3: NTS		
	www.scottwilson.com	Drawn: VR Check: NW Approved: MT Revision: 1 Date: May 2011	



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

1. Number of people >200
2. Critical services >1
3. Number of non-residential properties >20

Indicators calculated using the EAs detailed method of counting based on property outlines for the Flood Map for Surface Water - deep - for a 0.5% AEP (1 in 200 chance) rainfall event

<p>Job Title</p> <p>Job D138716 - Leicestershire County Council PFRA</p>	<p><b>Figure 5-4: Indicative Flood Risk Area (including proposed amendment)</b></p>				
		<p>Scale at A3: NTS</p>			
<p>www.scottwilson.com</p>	<p>Drawn VR</p>	<p>Check NW</p>			<p>Approved MT</p>