LLFAs should complete the pale blue sections with the relevant information, and send to their Environment Agency Local Area Contact along with the Preliminary Assessment Report and Annexes. Yellow and green boxes on this coversheet are for Environment Agency completion

Preliminary Flood Risk Assessment Review	
LLFA Name	Warwickshire County Council
If collaboration, list other LLFAs	
LLFA Lead contact name	Peter Bones
Email address	petebones@warwickshire.gov.uk
Contact telephone number	01926 412 826
Date sent to Environment Agency	TO COMPLETE

Documents submitted		
	LLFA	**EA date received**
Preliminary Assessment Report	Yes	
Annex 1 - Past floods reporting template	Yes	
Annex 2 - Future floods reporting template	Yes	
Annex 3 - Flood Risk Area reporting template	N/A	
Annex 4 - Review checklist	Yes	

Flood Risk Areas	
Was there an indicative Flood Risk Area?	No
Is a Flood Risk Area proposed?	No

Approvals	
LLFA approval	
Name	**TO COMPLETE**
Title	**TO COMPLETE**
Date	**TO COMPLETE**

For completion by Environment Agency		
Region		
Area		
Lead contact name		
	Review date	**Recommendation**
Environment Agency area		
National review panel		
RFCC/FRMW		
Regional Director Sign-off		
Ministerial referral (if applicable)		

Warwickshire Preliminary Flood Risk Assessment
(PFRA)

Warwickshire County Council

May 2011
Final Report
9W5869

Warwickshire County Council

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Drafted by	R Ranger	
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Date/initials check	17/5/11	
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Date/initials approval	17/5/11	

EXECUTIVE SUMMARY

This Preliminary Flood Risk Assessment (PFRA) report for Warwickshire has been prepared to comply with the Flood Risk Regulations 2009 and the Flood and Water Management Act 2010 and in accordance with the Environment Agency's Final PFRA Guidance published in December 2010.

It summarises the findings from the first two stages of the flood risk management cycle for the County of Warwickshire and presents the results of a high level screening exercise, identifying areas of significant flood risk. Warwickshire County Council have recognised their role as the central point in the management of local flood risk and have strengthened and extended their partnership network to enable the collection, collation and assessment of available historic and future flood risk information for the County.

Using this information the scale and consequences of past flooding has been summarised, identifying six flood risk events with locally adverse consequences over the past twenty years (all of which meet a defined local 'significance criteria'). The potential impacts of future flood events have been summarised and the Environment Agency's Flood Map for Surface Water (FMfSW) defined as the appropriate 'Locally Agreed Surface Water Information'. No Indicative Flood Risk Areas (IFRA) have been identified within the County, although its proximity to the West Midlands IFRA has been recognised, as have flood risk 'clusters' affecting Nuneaton, Rugby and Leamington Spa.

The report concludes with structured actions for the County Council to implement to support and progress local flood risk management in the future.

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GLOSSARY

Annual Exceedence Probability (AEP)	The probability associated with a return period (T). An event of return period 50 years has an AEP of 1/50, 0.02 or 2%.
Antecedent Conditions	The pre-existing condition before a rain event (e.g. waterlogged soil)
Artificial Infrastructure	Manmade water-conveyance infrastructure such as sewers, canals and highways drains.
Assets	Structures, or a system of structures, used to manage flood risk.
Catchments	An area that serves a river with rainwater. Every part of land where the rainfall drains to a single watercourse is in the same catchment.
Climate Change	Long-term variations in global temperature and weather patterns both natural and as a result of human activity, primarily greenhouse gas emissions.
Cultural Heritage	Buildings, structures and landscape features that have an historic value. These are known as heritage assets.
Culvert	Covered channel or pipe that forms a watercourse below ground level, or through a raised embankment.
Defences	A structure that is used to reduce the probability of floodwater or coastal erosion affecting a particular areas (for example a raised embankment or sea wall)
Defra	UK Government department responsible for policy and regulations on the environment, food and rural affairs.
Enmained	Watercourse designated as a Main River
Environment Agency	Executive Non-departmental Public Body responsible to the Secretary of State for Environment, Food and Rural Affairs and an Assembly Sponsored Public Body responsible to the National Assembly for Wales.
Flood	The temporary covering by water of land not normally covered with water.
Flood probability	The estimated likelihood of a flood of a given magnitude occurring or being exceeded in any specified time period.
Flood risk	An expression of the combination of the flood probability and the magnitude of the potential consequences of the flood event.
Flood Risk Area	An areas determined as having a significant risk of flooding in accordance with guidance published by Defra and WAG.

Flood Risk Threshold	1km national grid squares created through an overlay of the FMfSW and the NRD that exceed a threshold determined by the Environment Agency.
Flood Zones	Flood Zones are defined in Table D.1 of Planning Policy Statement (PPS) 25: Development and Flood Risk. They indicate land at risk by referring to the probability of flooding from river and sea, ignoring the presence of defences.
Groundwater	Water which is below the surface of the ground and in direct contact with the ground or subsoil.
Indicative Flood Risk Area	Areas determined by the Environment Agency as indicatively having a significant flood risk, based on guidance published by Defra and WAG and the use of certain national datasets. These indicative areas are intended to provide a starting point for the determination of Flood Risk Areas by LLFAs.
Lead Local Flood Authority	Unitary Authorities or County Councils which issue Local Flood Risk Management Strategies for surface water run-off, groundwater and non-main rivers and have powers to carry out works for the management of surface water run-off and groundwater.
Local Authority	Administrative authorities (Districts and Boroughs) that operate in a two tier local government system under the County Councils.
Local Flood Risk	Flood risk from sources other than main river, the sea and reservoirs, principally meaning surface runoff, groundwater and ordinary watercourses.
Main River	A watercourse shown as such on a Main River Map, and for which the Environment Agency has responsibilities and powers.
National Receptor Database	A collection of risk receptors produced by the Environment Agency.
Ordinary Watercourses	All watercourses that are no designated Main River and which are the responsibility of Local Authorities or where they exist, Internal Drainage Boards.
Pathway	The connection between a particular source and a receptor that may be harmed.
Preliminary assessment report	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.

Preliminary assessment spreadsheet	Reporting spreadsheet which LLFAs need to complete. The spreadsheet will form the basis of the Environment Agency's reporting to the European Commission.
Receptor	Something that may be harmed by flooding.
Regulations	The Flood Risk Regulations 2009
Resilience	The ability of the community, services, area or infrastructure to withstand the consequences of an incident.
Risk	Measures the significance of a potential event in terms of likelihood and impact.
Risk assessment	A structure and auditable process of identifying potentially significant events, assessing their likelihood and impacts, and then combining these to provide an overall assessment of risk, as a basis for further decisions and actions.
River basin district	There are 11 river basin districts in England and Wales, each comprising a number of contiguous river basins and catchments. The Environment Agency is responsible for collating LLFA reports at a river basin district level.
Runoff	Water flow over the ground surface to the drainage system.
Source	The origin of a hazard (e.g. heavy rainfall, strong winds, surge etc).
Surface runoff	Rainwater (including snow and other precipitation) which is on the surface of the ground (whether or not it is moving) and has not entered a watercourse, drainage system or public sewer.
Sustainable Drainage Systems (SuDS)	A sequence of management practices and control structures, often referred to as SuDS, designed to drain surface water in a more sustainable manner. Typically, these techniques are used to attenuate rates of runoff from potential development sites.

ABBREVIATIONS

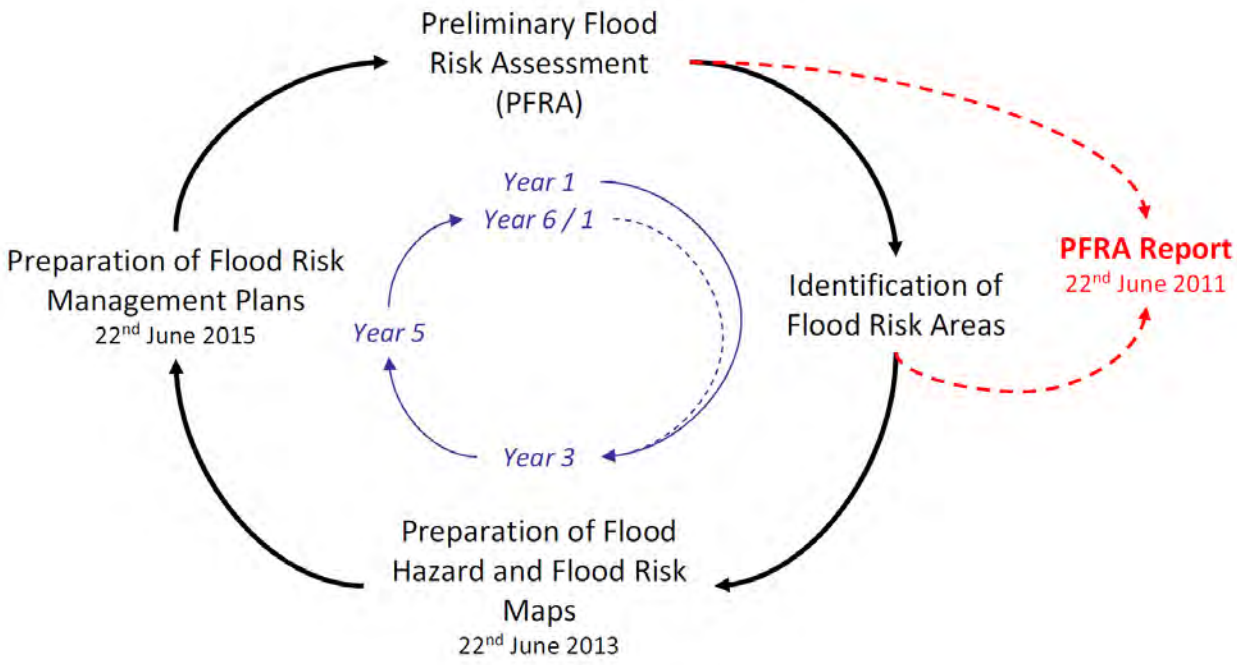
AEP	Annual Exceedence Probability
AONB	Area of Outstanding National Beauty
AStSWF	Areas Susceptible to Surface Water Flooding
AStGWF	Areas Susceptible to Ground Water Flooding
BGS	British Geological Survey
CFMP	Catchment Flood Management
COMAH	Control of Major Accident Hazard (sites)
Defra	Department for Environment, Flood and Rural Affairs
DTM	Digital Terrain Model
FMfSW	Flood Map for Surface Water
HS2	High Speed Two
GIS	Geographical Information Systems
IPCC	International Pollution Prevention and Control (sites)
LLFA	Lead Local Flood Authority
NRD	National Receptor Database
PFRA	Preliminary Flood Risk Assessment
PPS25	Planning Policy Statement 25
SAB	SuDS Approval Board
SAC	Special Area of Conservation
SPA	Special Protection Areas
SSSI	Sites of Special Scientific Interest
SuDS	Sustainable Drainage Systems
UKCP09	United Kingdom Climate Projections 2009
WAG	Welsh Assembly Government

1 INTRODUCTION

1.1 Aims and Objectives

The Flood Risk Regulations 2009 came into force on 10th December 2009. The Regulations implement the European Floods Directive in England and Wales (the aim of which is to provide a consistent approach to managing flood risk across Europe). These regulations require four stages of activity within a six year flood risk management cycle, as illustrated in **Figure 1.1**.

Figure 1.1 - Stages of the Flood Risk Regulations and Flood Risk Management Cycle



Inline with the Floods and Water Management Act (FWMA), which gained Royal Assent on the 8th April 2010, the Flood Risk Regulations place responsibility upon all Lead Local Flood Authorities (LLFAs) to manage local flood risk and deliver the requirements shown in **Figure 1.1**. ***Please note, within England the LLFAs are identified as the Unitary Authority or County Council, in this case Warwickshire County Council***. As such the LLFAs are responsible for undertaking a Preliminary Flood Risk Assessment (PFRA) and identifying Flood Risk Areas for local sources of flood risk. This PFRA report summarises the findings from the first two stages of the flood risk management cycle for Warwickshire County.

The aim of the PFRA is therefore to provide an assessment of local flood risk (both historical and future) and the consequence of flooding across the study area to enable the identification of Flood Risk Areas. The objectives of the process are to:

- prompt LLFAs to act upon their legislative requirements;
- instigate partnership relationships;
- source flood risk information relevant to their area;

- formulate an action plan to enable completion of the flood risk management cycle (and its subsequent reviews); and
- develop an efficient method of recording future flood events and their impacts.

1.2 Scope

This Preliminary Flood Risk Assessment (PFRA) report has been written to the specification provided within the Environment Agency's final guidance document, dated December 2010[1], and presents the results of a high level screening exercise to identify areas of significant flood risk within Warwickshire County.

The screening exercise has consisted of a desk-based analysis of all existing and readily available flood risk data and information within Warwickshire to provide an assessment of the following four key areas:

1. Past flood risk and identification of floods with significant harmful consequences;
2. Future flood risk and the potential consequences of future floods;
3. Identification of Flood Risk Areas; and
4. Identification of measures to support the review of the PFRA every six years.

However, only the sources of flooding that are classified as being the responsibility of the LLFA (Warwickshire County Council) are included within the PFRA, as summarised in **Table 1.1**. A full description of these sources of flooding, as presented in the PFRA guidance, is included in **Annex 6**.

Table 1.1 - Sources of Flooding

Source of Flooding	Responsible Organisation	
	Lead Local Flood Authority ***(included within PFRA)***	**Environment Agency** ***(not included in PFRA)***
Ordinary Watercourses	✓	
Surface Runoff (from rain or snowmelt)	✓	
Groundwater	✓	
Artificial Water Bearing Infrastructure[1]	✓	
Main Rivers	***Interactions with sources above only***	✓
The Sea	***Not applicable to Warwickshire***	✓
Reservoirs	***Interactions with sources above only***	✓

NOTES

[1] includes canals, highways drains, water supply systems and sewers (where flooding is wholly or partially caused by rainwater or other precipitation entering or affecting the system)

[1] Preliminary Flood Risk Assessment (PFRA) Final Guidance, Environment Agency, 07/12/2010

As outlined in the PFRA guidance, the key steps followed to produce this report are summarised in **Figure 1.2** below:

Figure 1.2 - Key PFRA Steps

1.3 Study Area

The study area for this PFRA is the County of Warwickshire, located in the West Midlands region of England. Warwickshire County is a two tier county and, as shown in **Figure 1.3** below includes the following five Local Authorities:

- Stratford on Avon District Council;
- Warwick District Council;
- Rugby Borough Council;
- Nuneaton and Bedworth District Council; and
- North Warwickshire District Council.

The City of Coventry is administered separately to the rest of the County and, is therefore excluded from Warwickshire County Council's flood risk responsibilities.

Warwickshire is a land locked County in the heart of England with an administrative area of approximately 1,975km^2. It is bounded to the south by Oxfordshire and Gloucestershire, the west by Worcestershire and the Birmingham conurbation (West Midlands Metropolitan County), the north by Staffordshire and Derbyshire and to the east by Leicestershire and Northamptonshire.

Warwickshire has a total population of approximately 535,100 (mid-2009 population estimate)[2]. There are six main towns within the County - Stratford upon Avon, Warwick, Leamington Spa, Rugby, Nuneaton and Bedworth - centralising the population in the centre and north of the County. Largely due to its location in proximity to Birmingham and Coventry, the County is dissected by a number of major roads, including the M40, M42 and M6 and the M6 toll, in addition to a number of canals. However, the southern area of the County is largely rural and includes a small portion of the Cotswold Area of Outstanding National Beauty (AONB). Employment in the County is provided by a mixture of light industry (replacing the declining heavy industries in the north and middle of the County), mineral extraction and tourism (focussed in Warwick and Stratford on Avon Districts).

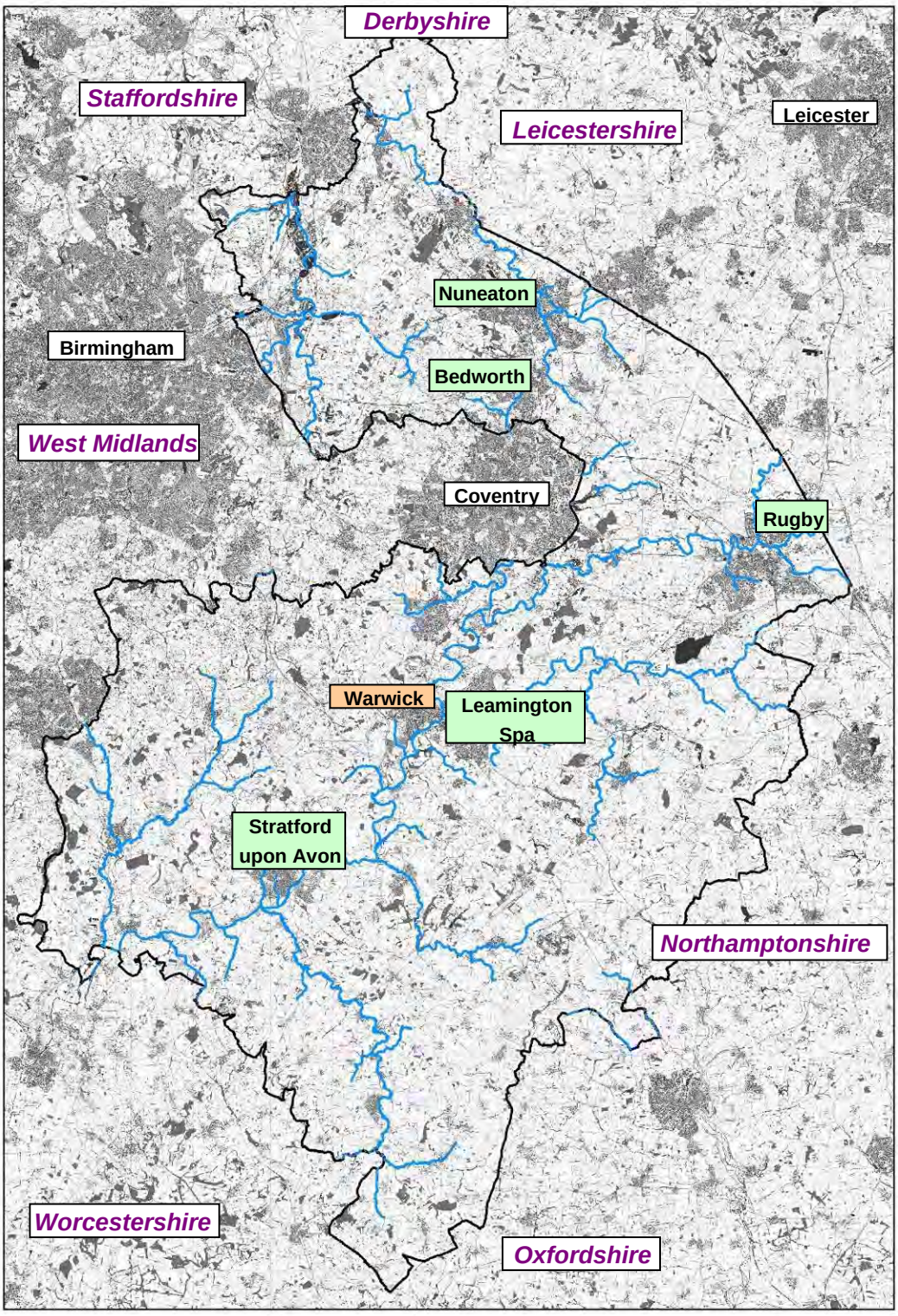
Most of the Warwickshire countryside is gentle rolling, interspersed with low lying river valleys, including the Rivers Avon, Stour, Anker and Tame. Most of the County is located within the catchment of the River Avon, ultimately draining into the River Severn. However, the Rivers Tame and Anker, however, which drain northern Warwickshire (including the towns of Nuneaton and Bedworth), are located within the River Trent catchment. The watershed between these two catchments is roughly the line of the M6 motorway and, as such, the County is mostly split between the Environment Agency's River Basin Districts of the Humber (20.7% of the County area) and Severn (76.6% of the County area). A small area (2.7% of the County) drains into the Thames catchment[3].

[2] Warwickshire Observatory, Warwickshire County Council
http://www.warwickshire.gov.uk/observatory/observatorywcc.nsf/05a17cfbd3bcf85d802572920033cf0f/bfb8b0a1d34f274c802572c00048108f?OpenDocument

[3] Percentages provided by the Environment Agency

Wastewater disposal and water supply services are mostly provided by Severn Trent Water Limited, although water supply to the very northern end of North Warwickshire District is provided by South Staffordshire Water.

Figure 1.3 - PFRA Study Area



2 LEAD LOCAL FLOOD AUTHORITY RESPONSIBILITIES

2.1 Introduction

From the new legislation, outlined in Section 1, LLFAs now have several responsibilities to fulfil in addition to the completion of the PFRA, including:

- coordinating and leading on **local flood management**;
- the **investigation of flood incidents**;
- the maintenance of an **asset register**;
- the fulfilment of their duty as a **SuDS Approving Body** (SAB);
- the development, maintenance, application and monitoring of a **Local Strategy for Flood Risk Management**;
- utilisation of **works powers** to manage flood risk; and
- utilisation of **designations powers** in order to safeguard assets.

To enable them to fulfil these responsibilities the LLFAs need to determine appropriate governance and partnership arrangements and communication links, as discussed below.

2.2 Governance and Partnership Arrangements

Following the floods of summer 2007 floods, a Strategic Flood Forum was set up, consisting of Warwickshire County Council, the five Local Authorities, the Environment Agency, Severn Trent Water, the National Farmers Union, the Highways Agency and planning groups. The group meets quarterly and it aims to:

- Ensure effective collaboration between Agencies and Departments (including fire and rescue);
- Review progress of Agencies and Departments in respect to the fifteen Urgent Recommendations of the Pitt Report;
- Look at maintenance and drainage infrastructure improvement in the medium-long term;
- Ensure local drainage forums meet regularly with appropriate representation and to progress key projects;
- Prepare and update a list of key contact details between Agencies;
- Review and propose improvements to communication systems during and after emergencies;
- Help, review and influence organisational policies to ensure consistency; and
- Help explore appropriate funding sources.

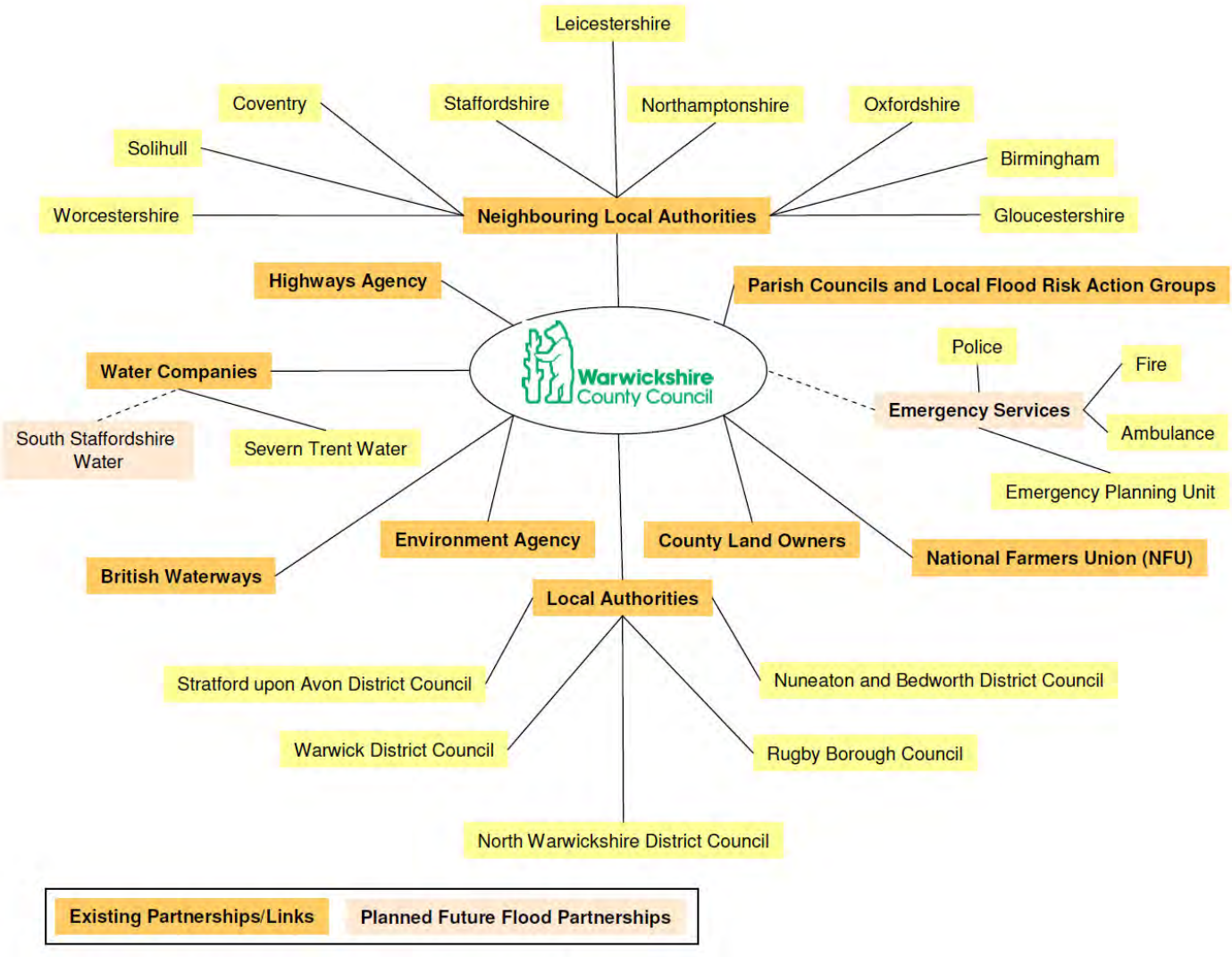
With their assignment as LLFA for Warwickshire, the County Council have recognised their role as the central point in the management of local flood risk. They have utilised the partnership network developed as part of the Strategic Flood Forum to consult with key partners during the preparation of this PFRA report. This consultation has enabled the collation of flood risk information and formed a basis for the implementation of future actions. Particular emphasis has been placed on forming new partnerships with the Parish Councils and the Local Flood Forums (most notably Alcester, Stratford, Snitterfield and Leamington) through the distribution of a 'flood survey'. This has enabled the assimilation of local knowledge regarding flood events to be incorporated

into the PFRA process. A network diagram illustrating the existing and planned partnership arrangements is included in **Figure 2.1** below. As it is recognised that affected members of the public hold the key information regarding the impacts of flood events, particular emphasis will be placed on the collation of first hand data following future floods into a standardised database.

2.3 Communication

Warwickshire County Council recognises the importance of regular communication with both its partners and members of the public and aim to improve the regularity of when such contacts are made. However, potential issues surrounding property blight and personal identity are recognised by the Council and, as such, dissemination of information to the general public will currently be limited to a simplified, non property-specific, format. To enable this, a consensus will be sought between the partnership organisations shown in **Figure 2.1** regarding data sharing and display arrangements.

Figure 2.1 - Warwickshire County Council Existing Partnership Arrangements



3 METHODOLOGY AND DATA REVIEW

3.1 Introduction

As outlined in Sections 1 and 2 above, this PFRA report is a high level screening exercise that has been written to the specification included within the Environment Agency's PFRA final guidance document. As such it has been based solely on existing data that was available within the timeframe of this study. Certain limitations in this data have been identified and are discussed below.

3.2 Methodology

Completion of this PFRA report has followed the methodology outlined in **Figure 1.2**, with the key steps discussed below.

3.2.1 Governance and Partnerships

This is discussed in Section 2 above.

3.2.2 Data Systems - Current and Future

To centralise the collation of data from numerous sources, Warwickshire County Council developed a spreadsheet to capture the following key attributes regarding historic floods:

- Source of data;
- Location of flood;
- Time and date of flood;
- Duration of flood;
- Recurrence and probability of flood;
- General information;
- Depth, cause and source of floodwater;
- Details of flow pathway (if known);
- Location of photo records or event plan;
- Consequence to human health;
- Economic consequences;
- Consequences to the environment and cultural heritage;
- Risk score; and
- Post event investigation details.

To assist in prioritising the management of maintenance and repairs the Council has determined a risk calculation for each flood location, based upon the consequences and frequency of the flooding. The spreadsheet has also been extended to enable the recording of post event investigation records and maintenance job details. This will become a standardised tool to capture future flood event information, possibly in the form of a database. This is discussed further in **Section 7**.

The data collected has been analysed using a combination of Excel data interrogation and GIS mapping.

3.2.3 Collation of Information on Past Floods

Existing datasets, reports and anecdotal information have been collected from numerous partners, shown in **Figure 2.1**, to obtain as much information on each of the spreadsheet attributes listed above as possible. This data has been collected in a variety of formats, including GIS shapefiles, hard copy documents and maps. A summary of the historic data obtained is provided in **Table 3.1** below. Due to concerns over property blight and personal data security not all these datasets are publicly available. Where they have been used within this report they are included at a scale which does not identify individual properties or personal details.

This information has been used in **Section 4** of this report to identify the key flood events that have affected Warwickshire, determine which have resulted in significant harmful consequences, identify appropriate local thresholds for significant floods, map the extent and conveyance routes, where available, and complete **Annex 1**.

Table 3.1 - Sources of Information on Past Floods

Source	Dataset	Description	Publicly Available?
Environment Agency	Historic Flood Map	GIS flood extent for historic floods, mainly Main River flooding.	
	Catchment Flood Management Plans (CFMPs)	Reports to plan and agree management of future flood risk. Includes historic reports of flooding from all sources.	✓
	'Flooded Communities in Warwickshire'	Summary table of impact of summer 2007 floods in Warwickshire provided by the Environment Agency	
Warwickshire County Council	Historic Flooding Records	Historic flooding records from all sources.	
	Anecdotal Information	Anecdotal information from Council officers for all sources of flooding (mainly related to more recent flood events)	
	Planning Applications	Evidence of flooding submitted as part of a planning application rejection. Includes a page extract from a book summarising historic flood events in Warwick (source unknown).	
	Strategic Flood Risk Assessment	Contain information on historical flooding from all sources (County-wide)	✓
Local Authorities (District and Borough Councils)	Strategic Flood Risk Assessments	Contain information on historical flooding from all sources (Stratford on Avon District only)	✓
	Historic Flooding Records	Records and locations of flooding from all sources	

Source	Dataset	Description	Publicly Available?
	Flood Survey Questionnaires	Stratford-upon-Avon District only for Easter 1998 floods.	
	Flood Event Photographs	Photographs taken by Council officials or members of the public during flood events.	
	Anecdotal Information	Anecdotal information from Council officers for all sources of flooding (mainly related to more recent flood events).	
	Grant Applications	Locations of grant applications following Summer 2007 floods (Stratford upon Avon District only).	
Parish Councils	Flood Survey Questionnaires	Questionnaires sent by Warwickshire County Council during the preparation of the PFRA to summarise the risk of flooding.	
	Flood Incident Reports	Parish specific flood incident reports (certain parishes only).	
	Anecdotal Information	Anecdotal information from Council officers and members of the public for all sources of flooding (includes newspaper cuttings).	
British Waterways	Historic Breach Locations	GIS locations for historic canal breach locations, including date.	
	Historic Overtopping Locations	GIS locations for historic canal overtopping locations, including date.	
Severn Trent Water	DG5 Register	Register log of sewer flooding incidents in each area. Includes repeat occurrences and sewer type.	
Highways Agency	Flooding Records	Records of highways flooding. ***No records available at time of request.***	
Internet	News Reports	Additional records of large flood events, often containing date, location and consequences.	✓

3.2.4 Collation of Future Flood Risk Information

There is a limited amount of model data available within Warwickshire for the assessment of future flooding, with all datasets provided by the Environment Agency at a national scale. The datasets collected for use in this PFRA report are summarised in **Table 3.2** below. This information has been used to summarise and map the future flood risk and possible consequences for Warwickshire in **Section 5** and **Annex 2**.

Table 3.2 - Sources of Future Flood Risk Information

Source	Dataset	Description	Publicly Available?
Environment Agency	Areas Susceptible to Surface Water Flooding (AStSWF)	First generation national mapping, outlining areas of risk from surface water flooding across the country with three susceptibility bandings (less, intermediate and more)	
	Flood Map for Surface Water (FMfSW)	Second generation national surface water flood mapping containing two flood events (1 in 30 and 1 in 200) and two depth bandings (greater than 0.1m and greater than 0.3m)	
	Areas Susceptible to Groundwater Flooding (AStGWF)	National mapping showing areas susceptible to groundwater flooding on 1km² grid based on four bands (<25%, 25-50%, 50-75% and >75%)	
	Flood Map	Extent of flooding from rivers with a catchment of more than 3km² and the sea for two probability events (1% and 0.1%)	✓
	National Receptors Database	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.	
	Places Above Flood Risk Thresholds	National dataset identifying 1km² where one of the flood risk indicators (number of people, critical services, non-residential properties) is above defined thresholds.	
	Reservoir Inundation Maps	National Dataset of areas at risk of flooding if a reservoir were to fail.	✓

3.2.5 Determination of Locally Agreed Surface Water Information

The information collected on future flooding has been used to identify and map the 'locally agreed surface water information', discussed in **Section 5**.

3.2.6 Completion of PFRA report

All the data discussed above has been used to complete this report to the specification set out in the Environment Agency's PFRA final guidance, including the completion of the standard Annexes.

3.2.7 Identify/Review Flood Risk Areas

The indicative areas provided by the Environment Agency have been reviewed using the local information contained within the PFRA report (see **Section 6**).

3.3 Data Limitations

Numerous datasets have been collected from a variety of sources. As such there is very little consistency in the data format, availability, coverage and quality, summarised below. These limitations have been recognised by Warwickshire County Council, who, through the implementation of a centralised flood risk recording spreadsheet/database, intend to improve the collection of flood risk data in the future (see **Section 7**).

3.3.1 Variability in Data Format

Data has been received from partners in a variety of formats ranging from georeferenced GIS shapefiles and data points to anecdotal hand written notes and maps constructed from memory. Many of the parish records also detail flooding within the parish as a whole, rather than individual roads or properties. This has had an impact on the accuracy of locating and correlating individual flood records in both space and time and, as a consequence, the ability to identify duplicates in flood data from different sources. Where detailed location information is not provided the position of a flood report has been interpreted by the user from general details, introducing the potential for error in the record.

3.3.2 Data Availability

Although the partnership approach has had a positive impact on the willingness to provide flood data, variability in recording mechanisms has meant data has not been readily available from all sources. The short timescales available for the collection of anecdotal information from such sources may have limited the accuracy of the flood records or number of events recorded. Other organisations, such as water companies, only hold flood records for a certain number of years, limiting the length of the flood record and placing greater emphasis on more recent flood events.

3.3.3 Incomplete Records

Due to the variations in recording flood incident information within different organisations, not all events, or the attributes of each event, have been comprehensively documented. As such the details of some events, or in other cases entire flood events, are missing from the flood record. This is particularly common with reference to the source or consequences of flood events, which are often absent in the historic record.

3.3.4 Varying Quality

Due to all the limitations mentioned above there is a variance in the quality of data received from different sources and therefore confidence in the accuracy of the data. It is hoped this will be improved in the future through the implementation and consistent use of the Warwickshire spreadsheet, or resulting database.

3.3.5 Future Flooding Model Data

Due to the immense complexity of the real world, all model simulations have inherent assumptions and limitations within them and should not be considered prescriptive

forecasts of future scenarios. The assumptions within all the models used in this PFRA can be determined from the original source (i.e. the Environment Agency guidance notes).

3.4 Quality Assurance, Security, Licensing and Restrictions

All data collected and entered into Warwickshire County Council's historical flood records spreadsheet has been assigned a data quality score. This is a qualitative assessment based on the Data Quality System provided in the SWMP Technical Guidance document (March 2010) and the Flood and Coastal Risk Management 'Multi Coloured Manual'[4], outlined below. This provides a basis for analysing and monitoring the quality of the data collected and used in this PFRA.

Table 3.3 - Data Quality System

Data Quality Score	Description	Explanations	Example (from PFRA Data)
1	Best available	No better available; not possible to improve in near future	Detailed georeferenced and surveyed records or real-time distress calls
2	Data with known deficiencies	Best replaced as soon as new data is available	Newspaper cuttings or post-event reports
3	Gross assumptions	Not invented but based on experience and judgement	Anecdotal records from affected residents.
4	Heroic assumptions	An educated guess	Anecdotal records from 'hearsay'

Data security is a key consideration, especially for third party datasets. The requirement to use data within the PFRA on a non-property specific basis has been adhered to and all discussion of the extent and consequences of flood events have been left geographically vague. All sensitive data is held in a secure manner, with the raw information only being accessed by Warwickshire County Council. The restrictions on the use of data are included in **Table 3.4** below. Information available to the public is indicated in **Tables 3.1** and **3.2** above.

Table 3.4 - Restrictions on the Use of Third Party Data

Organisation	Restriction on Use of Data
Severn Trent Water	A confidentiality agreement has been signed which restricts the use of this data to Warwickshire County Council and their consultants for the preparation of this PFRA.
British Waterways	A confidentiality agreement has been signed which restricts the use of this data to Warwickshire County Council and their consultants for the preparation of this PFRA.
Environment Agency	The use of some data is restricted to Warwickshire County Council and their consultants for the preparation of this PFRA. The use of other data is unrestricted.
Local Authorities	Historic flood information cannot be used at a property specific scale.

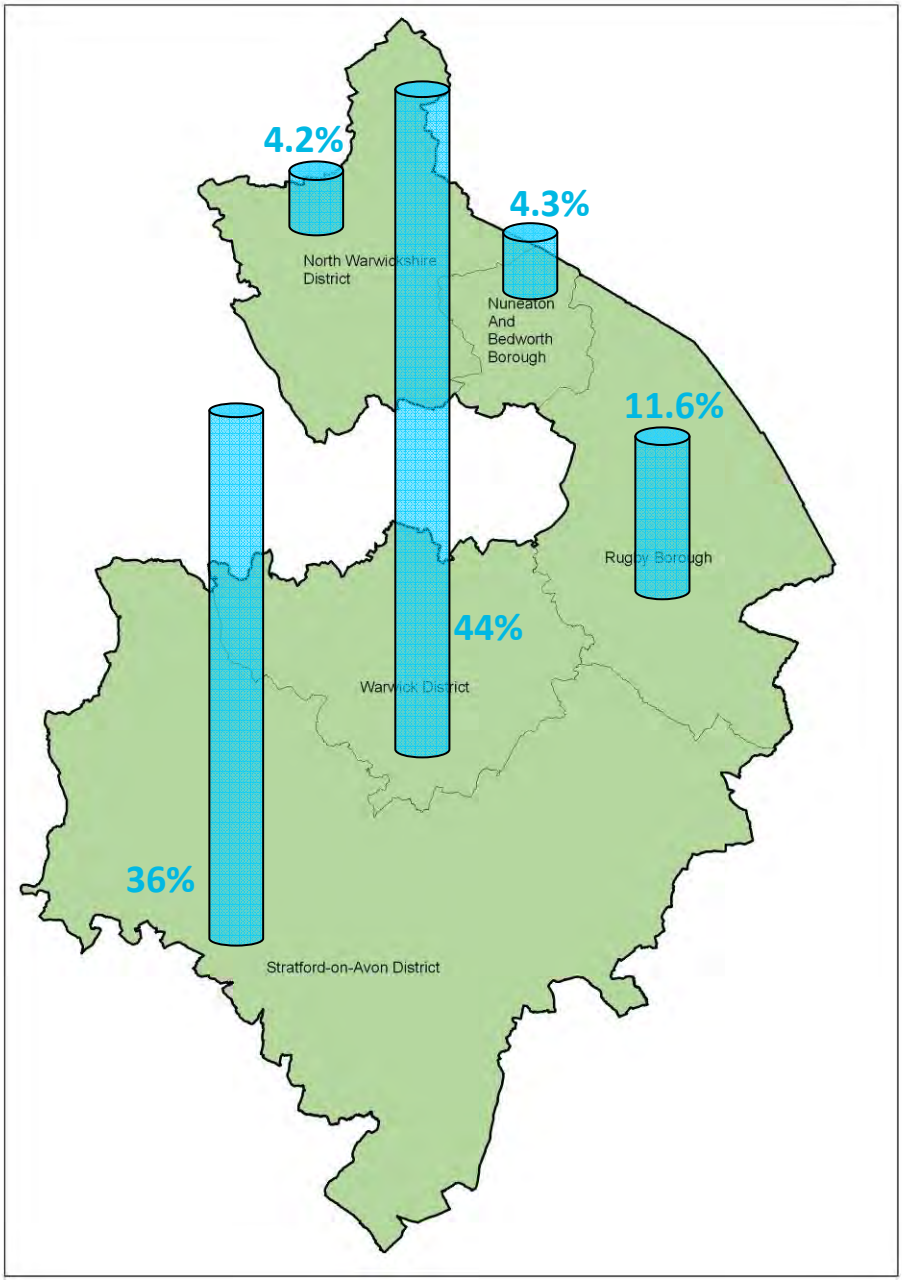
[4] The Benefits of Flood and Coastal Risk Management: A Manual of Assessment Techniques, Flood Hazard Research Centre, 2005

4 PAST FLOOD RISK

4.1 Overview of Past Flooding in Warwickshire

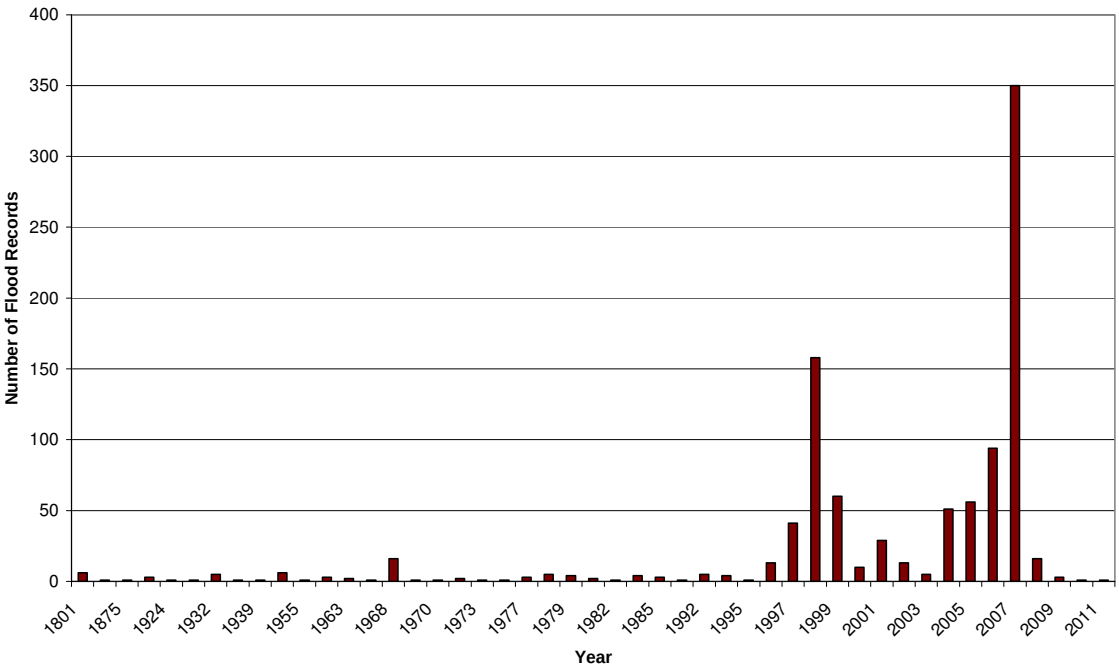
Flood records across Warwickshire were collected from the data sources identified in **Table 3.1** and entered into the spreadsheet discussed in **Section 3.2.2**. A total of 1,019 records of historic flooding have been collected across Warwickshire County Council's administrative area, split by Local Authority area as illustrated in **Figure 4.1**. Due to the variation in data recording systems between different organisations this distribution should not be interpreted as a direct representation of the distribution of flood risk across the County (e.g. one record may represent an individual property or an entire parish).

Figure 4.1 - Percentage of Flood Records Collected within Each Local Authority Area



The flood records collected span from 1801 to 2011, with a significant increase in record numbers from the middle of the 1990s (see **Figure 4.2** below).

Figure 4.2 - Number of Flood Records per Year



The locations of each of the historic flooding records are shown in **Figure 4.3**[5]. The symbology on this figure has been set to show the source of the flood risk information by the shape of the symbol and the frequency of the flooding by the colour, as outlined below:

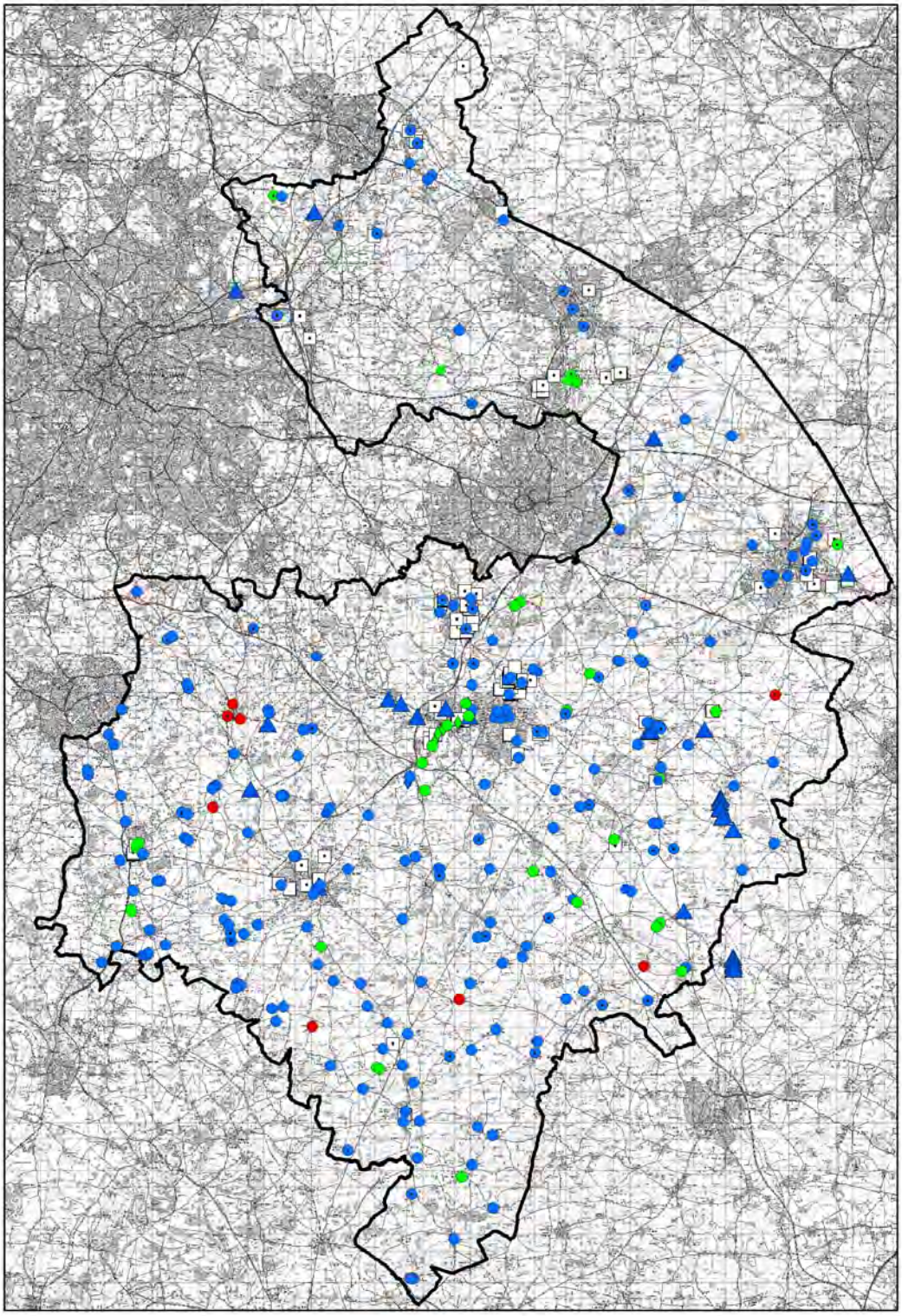
Table 4.1 - Symbology of Past Flooding

Source of Flood Record		
Organisation	**Property Flooding**	**Symbol**
Local Authority	Yes	○
	No/Not Recorded	⊙
Water Company	Yes	□
	No/Not Recorded	▣
British Waterways	Yes	△
	No/Not Recorded	◬
Residents	Yes	◇
	No/Not Recorded	◈
Environment Agency	Yes	⬡
	No/Not Recorded	⬢

Frequency of Flooding	
Regularity of Repeat Events	**Colour**
Unknown	○
More than 1 every year	●
Every 1 - 5 years	●
Exceptional (> every 5 years)	●

[5] Figure provided by Warwickshire County Council -

Figure 4.3 - Location, Source and Frequency of Past Flooding Records in Warwickshire



4.2 Source of Flooding

Multiple sources of flooding were identified within the record of past flooding, as shown in the excerpt from the recording spreadsheet below. Due to the number of gaps and uncertainties in the flood records the source of the flooding has not been mapped on **Figure 4.3**. In addition many flood records identify multiple flood sources (illustrated in **Figure 4.4**), leading to confusion within the symbology when mapped together.

Figure 4.4 - Excerpt of Past Flood Record Showing Flood Origin Categorisation

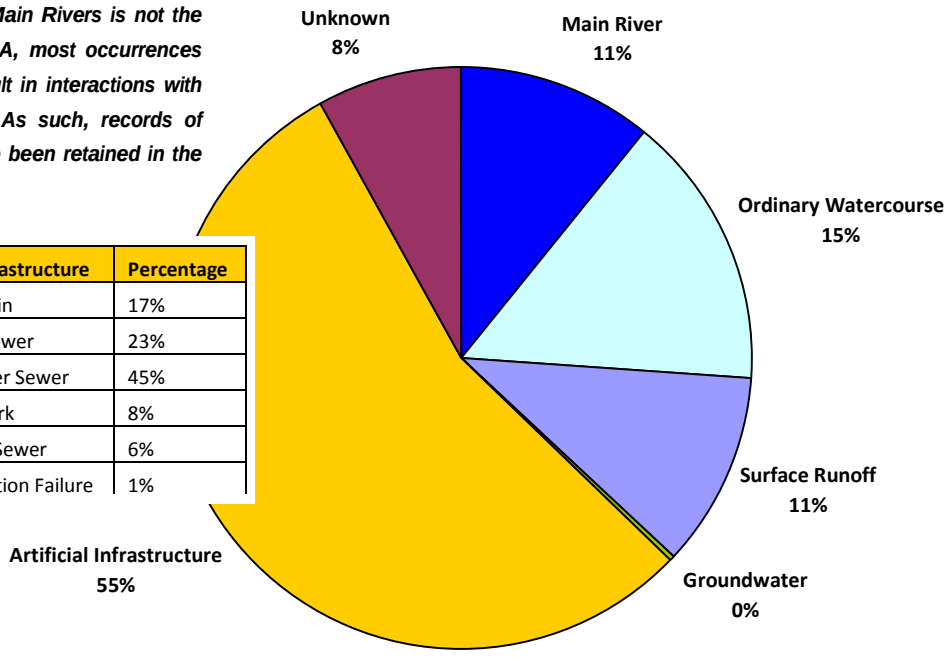
Cause of Flooding	Sources of Flooding											Main Source of Flooding		
	Main River Event [Main River]	Ordinary Watercourse [Ordinary Watercourse]	Trash Screen/ Culvert Blockage [Ordinary Watercourse]	Overland Flow [Surface Water]	Groundwater [Groundwater]	Canal [Artificial Drainage]	Sewer [Artificial Drainage]	Pumping Station Failure [Artificial Drainage]	Capacity of Highways Drainage [Artificial Drainage]	Unknown [Unknown]	Other - Specify	Main Source of Flooding	Confidence in Main Source of Flooding	Characteristics of Flood
Natural Exceedance	Y			Y			Y	Y				Surface Runoff	High-Medium	Natural Flood
Natural Exceedance	Y											Main River	High	Natural Flood
Natural Exceedance	Y			Y			Y					Surface Runoff	Medium	Natural Flood
Natural Exceedance	Y			Y								Surface Runoff	High	Natural Flood
Natural Exceedance	Y		Y						Y			Main River	Medium	Natural Flood
Natural Exceedance	Y		Y						Y			Main River	Medium	Natural Flood
Natural Exceedance	Y			Y								Main River	High-Medium	Natural Flood
Natural Exceedance		Y	Y	Y								Ordinary Watercourse	Medium	Natural Flood
Natural Exceedance	Y											Main River	High-Medium	Natural Flood

When categorised into the sources of flooding specified within the PFRA guidance, the following distribution is shown. As many records display multiple sources of flooding representing interactions between different flood mechanisms this distribution must be viewed with a degree of caution.

Figure 4.5 - Distribution of Source of Flooding Within Past Flood Records

Although flooding from Main Rivers is not the responsibility of the LLFA, most occurrences within Warwickshire result in interactions with the drainage network. As such, records of Main River flooding have been retained in the record of past flooding.

Artificial Infrastructure	Percentage
Highway Drain	17%
Combined Sewer	23%
Surface Water Sewer	45%
Canal Network	8%
Unspecified Sewer	6%
Pumping Station Failure	1%



4.2.1 Surface Water Flooding

Surface water flooding occurs as a result of excess rainfall that has not entered a watercourse, drainage system or sewer. It tends to occur as a result of a heavy rainfall event occurring after a period of persistent rain, resulting in very wet antecedent conditions and therefore rapid runoff. Records of this type of event cover most of Warwickshire and have been collected from a variety of sources. Due to the interaction between different sources of flooding during a rainfall event, such flooding is often not identified separately to watercourse or artificial infrastructure exceedence.

4.2.2 Artificial Infrastructure

This type of flooding includes the exceedence of the sewer network, highway drains and canals as a result of an excess of surface water. Water companies record sewer flooding on a DG5 register, which targets funding to resolve flooding issues, and British Waterways maintains a register of occurrences of canal overtopping and breaching. No information was available directly from the Highways Agency for use in this study, but highway flooding information has been collected from the Local Authorities, the Strategic Flood Risk Assessments and local residents.

Figure 4.5 implies that flooding from artificial infrastructure accounts for over 50% of all flooding in Warwickshire. However, a number of organisations (including Severn Trent Water Ltd and British Waterways) record this type of flooding in a systematic manner (whereby each record identifies a separate event, covering a very specific geographical location). The number of records therefore appears inflated compared with other types of flooding, which are often recorded on a settlement wide scale. However, due to the location of such infrastructure in urban areas, on road networks and connecting inside properties, the consequences are often very severe.

4.2.3 Groundwater Flooding

Groundwater flooding occurs as a result of water rising up from under the ground surface, usually in locations underlain by permeable rocks (aquifers). There are limited records of groundwater flooding occurrences in Warwickshire. Where groundwater flooding has occurred, it is usually recorded in combination with multiple other sources of flooding after periods of sustained rainfall. Only one groundwater flood event has been recorded in isolation, related to a major redevelopment beside existing properties.

4.2.4 Ordinary Watercourses

These are the minor watercourses (including rivers, streams, ditches, cuts, dykes and non-public sewers) within Warwickshire that have not been enmained by the Environment Agency. As such, their maintenance is the responsibility of the Local Authority. Despite the high number of Main Rivers in Warwickshire, there are also a large number of ordinary watercourses across Warwickshire, many of which are culverted in urban areas. Excess flow, blockages in the channel, or elevated Main River water levels, often result in the flooding of settlements, including urban areas.

4.2.5 Interactions with Main River Flooding

As ordinary watercourses and many surface water sewers and highways drains outfall into Main Rivers, there is a strong interaction between flooding from these sources and flooding from the rivers. Most past flooding within Warwickshire has occurred following a period of sustained rainfall, resulting in multiple sources of flooding at one time. As such it is often difficult to distinguish between the separate sources listed above.

4.3 Consequences of Past Flooding

Information regarding the consequences of past flood events in Warwickshire is often limited or missing from the flood record and, where it is included, it is often estimated from anecdotal sources. As such, a degree of caution must be employed when interpreting the data. A summary of the consequences of flooding within the past record is provided in **Table 4.2** below.

Table 4.2 - Summary of Flood Consequences

Consequence of Flood	Number of Records Recording Consequence	Percentage of Total Records
Residential Properties (Internally)	632	62%
Roads Flooded	186	18%
Residential Properties (Externally)	161	16%
Agricultural Land Flooded	87	9%
Commercial Properties (Internally)	41	4%
Other Economic Consequences	19	2%
Commercial Properties (Externally)	22	2%
Railways Flooded	6	1%
Critical Infrastructure	8	1%
Pollutant Sites	1	0%

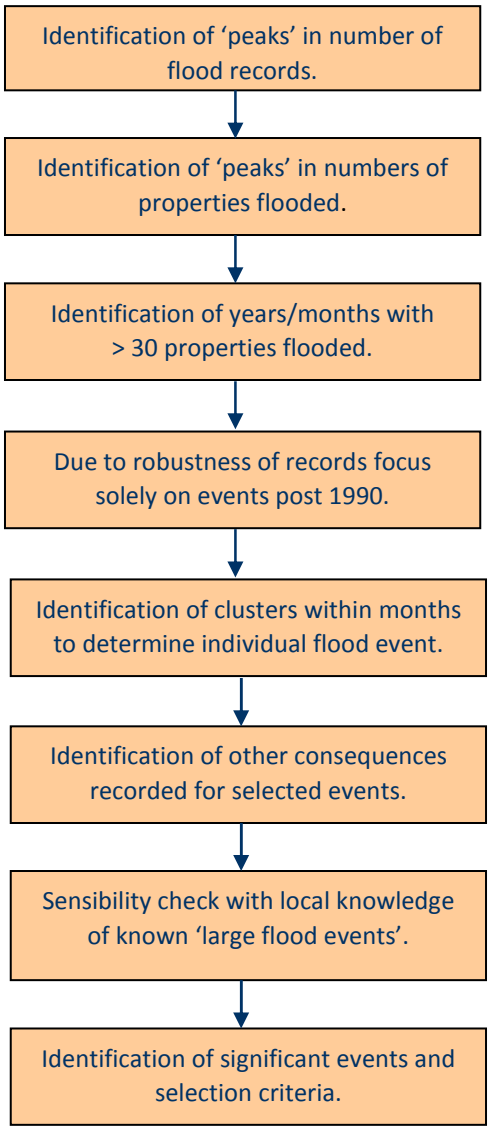
Please note that individual flood records cover a variety of geographical scales, from one property to whole parishes. These figures are therefore not representative of the exact number of properties or locations affected

Due to the length of the flood record and number of individual flood events it is not feasible to list the consequences recorded from each historic flood here, although significant records only appear from the mid 1990s onwards. They are, however, discussed for the significant flood events below.

4.4 Flood Events with Significant Harmful Consequences

To determine the floods with Significant Harmful Consequences in Warwickshire, the criteria used by the Environment Agency for determining the Indicative Flood Risk Areas were considered and scaled down for the local area. As the number of properties flooded was considered to be the most robust and comprehensive record of harmful consequences of flooding, this was used as the baseline for selecting the significant flood events within the last decade.

Figure 4.6 - Methodology for Selecting Significant Flood Criteria



Using this methodology the following selection criteria for floods with significant harmful consequences were determined for Warwickshire:

1. **Greater than 30 properties flooded AND**
2. **More than one commercial property (including farms) flooded OR**
3. **One or more items of critical infrastructure flooded OR**
4. **More than 1 transport route (road or railway) closed for six hours or more.**

Using these criteria the following six past flood events in Warwickshire are noted as having significant harmful consequences:

- January 1992
- Easter 1998
- August 1999
- June 2005
- Summer 2007
- December 2008

The consequences of these events are summarised in **Table 4.3** below and recorded in more detail in **Annex 1**.

Table 4.3 - Summary of Past Floods with Significant Harmful Consequences in Warwickshire

Flood Event	Recorded Duration	Source of Flooding	Number of Properties Flooded	*Estimate Number of People*[2]	Commercial Properties Flooded	Critical Infrastructure Flooded	Key Transport Routes Flooded
13th January 1992 ***WARWICK AND STRATFORD ON AVON DISTRICTS***	< 1 day	Ordinary Watercourses Sewers Highways Drains Main Rivers	>35 internally (Snitterfield only)	***82 approx***	Yes ***Number and type unspecified***	***Not specified***	Bell Lane (main access route in village)
Easter 1998 (9th April) ***SOUTHERN HALF OF COUNTY***	2 days	Ordinary Watercourses Overland Flow Sewers ***(surface water and combined)*** Highways Drains Groundwater Main River	>480 internally >520 total	***1120 approx*** ***1215 approx***	>20 internally >35 Total ***Stables*** ***Workshops*** ***Car Parks*** ***Pubs*** ***Tourist Attractions*** ***Garages*** ***Service Station*** ***Industrial Estate*** ***Farms*** ***Supermarket*** ***Marina*** ***Pottertons Factory*** ***Bed & Breakfast***	Yes ***Surgery*** ***Village Hall*** ***Toilet Blocks*** ***School*** ***Caravan Parks***	A423 A429 A3400 B439 B6568 B4088 B4086 B4089 B4632 Numerous villages marooned
9th August 1999 ***WARWICK DISTRICT ONLY***	<24 hours	Sewers ***(surface water and combined)***	31 internally 35 total	***73 approx*** ***82 approx***	1 ***Details Unknown***	***Not specified***	Side Roads ***Radford Semele and Kenilworth***

Flood Event	Recorded Duration	Source of Flooding	Number of Properties Flooded	*Estimate Number of People*[2]	Commercial Properties Flooded	Critical Infrastructure Flooded	Key Transport Routes Flooded
June 2005 (24th - 28th) ***WARWICK DISTRICT ONLY***	4 days	Sewers ***(surface water and combined)*** Main River	32 internally 46 total	***75 approx*** ***110 approx***	***Not specified***	***Not specified***	A4189
Summer 2007 (June and July) [1] ***COUNTY -WIDE***	1 - 6 days	Ordinary Watercourses Overland Flow Sewers Highways Drains Main River	>1600 >1750 total	***3745 approx*** ***4095 approx***	>75 internally >80 Total ***Packaging Plant*** ***Farms (livestock and crops lost)*** ***Mill*** ***Golf Courses*** ***Agricultural Centre*** ***Shops*** ***Pubs*** ***Offices*** ***Function Centre*** ***Stables*** ***Workshops*** ***Service Station*** ***Warehouses***	Yes ***Schools*** ***Caravan Parks***	A4091 A3400 B4089 B439 A435 B4087 B5000 Many bridges impassable Numerous villages marooned
December 2008 ***CENTRAL WARWICKSHIRE***	1 day	Ordinary Watercourses Main River Overland Flow Highways Drains	54 internally 55 total	***125 approx*** ***130 approx***	***Not specified***	***Not specified***	A444

NOTES

[1]Classified as one event due to interactions between the two events and antecedent conditions.

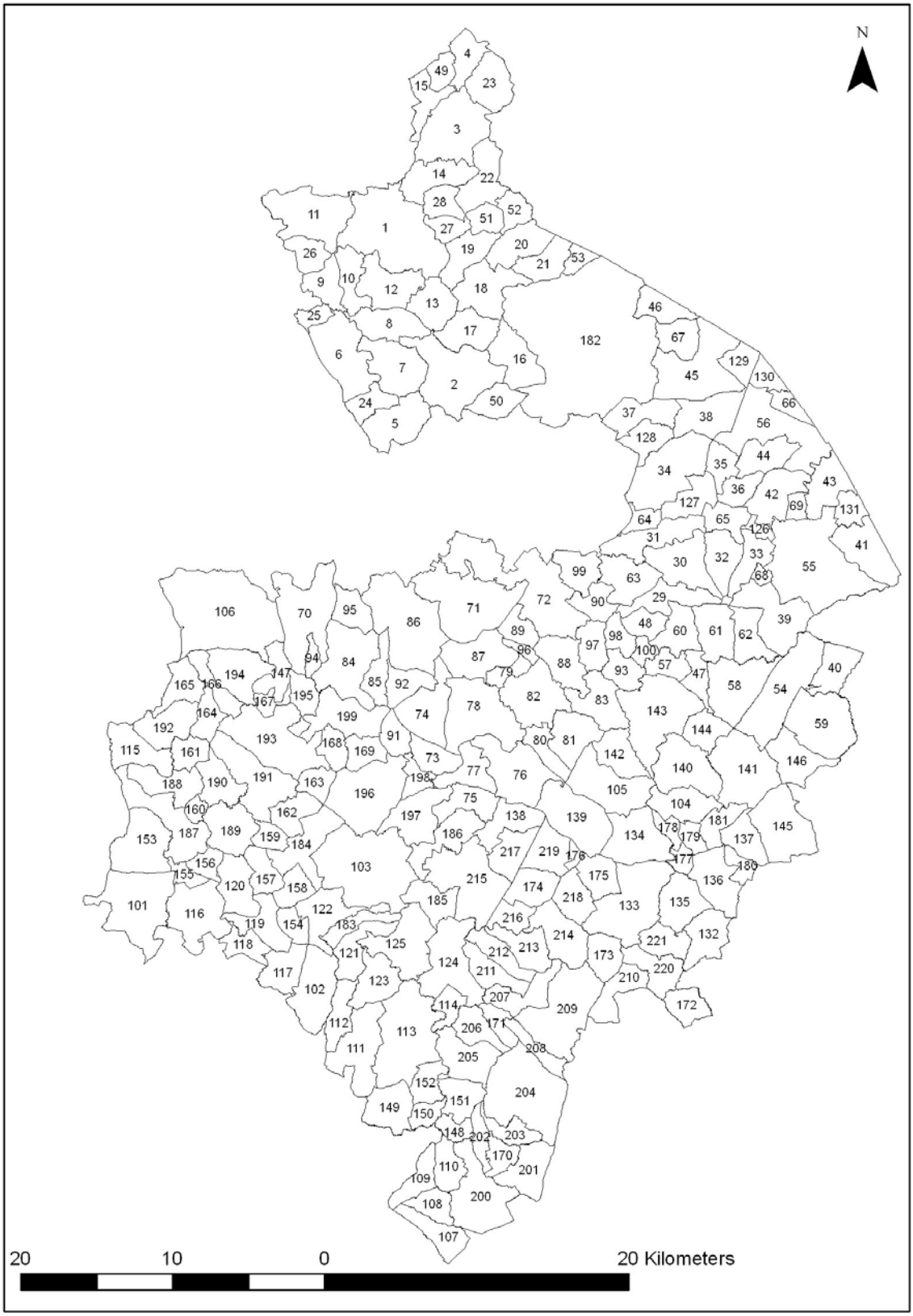
[2] Using scaling factor of 2.34 specified in PFRA guidance.

The rough extent of these flood events are illustrated in **Figures 4.7 - 4.13**. Insufficient detail is included within the historic records to enable identification of conveyance routes.

4.5 Drainage Capacity

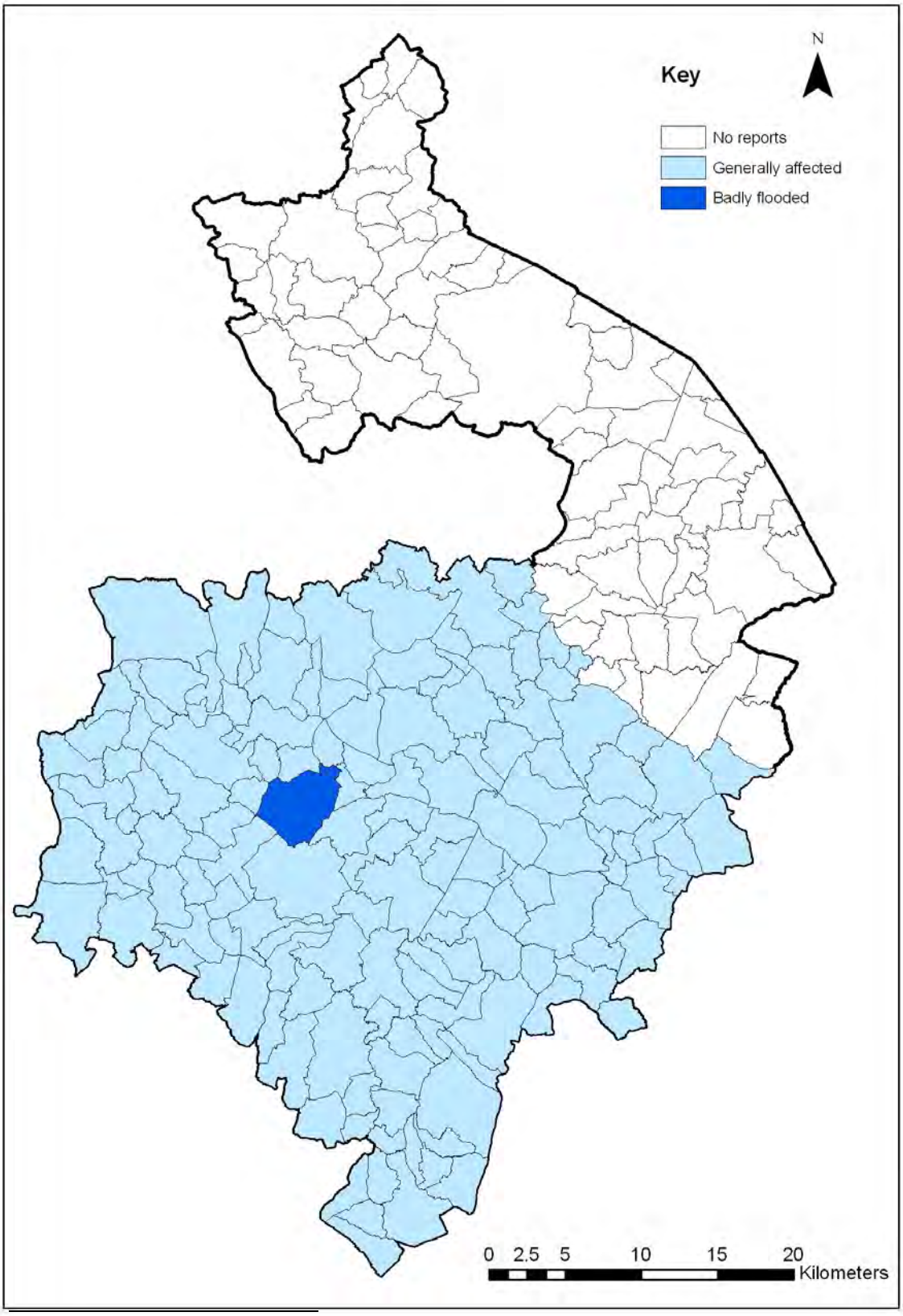
No information is readily available regarding drainage capacity within Warwickshire. However, the Annual Exceedence Probability (AEP) for the County-wide significant events listed above ranges from 3% (1 in 35 chance of occurring in any one year) to 0.5% (1 in 200 chance of occurring in any one year). As such an estimation can b e made that the drainage capacity in the County is exceeded in rainfall events greater than the 3% AEP (higher than a 1 in 35 chance of occurring in any one year), which is also the design capacity of most underground drainage systems.

Figure 4.7 - Parish Overview



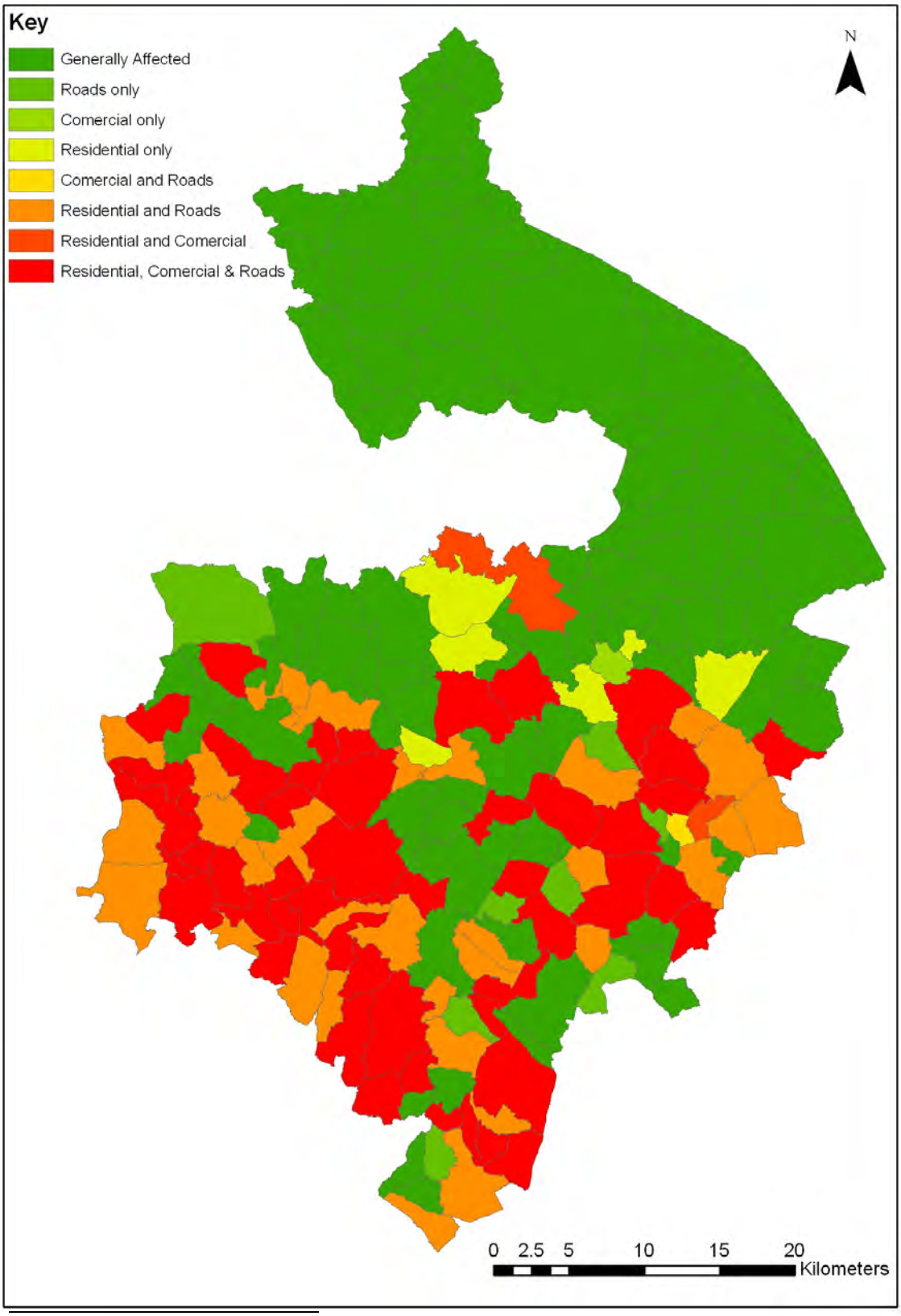
1	Kingsbury	56	Monks Kirby	111	Ilmington	166	Oldberrow
2	Fillongley	57	Marton	112	Admington	167	Henley-in-Arden
3	Polesworth	58	Leamington Hastings	113	Tredington	168	Langley
4	Newton Regis	59	Wolfhampcote	114	Halford	169	Wolverton
5	Great Packington	60	Frankton	115	Sambourne	170	Stourton
6	Coleshill	61	Bourton and Draycote	116	Bidford-on-Avon	171	Whatcote
7	Maxstoke	62	Thurlaston	117	Long Marston (Marston Sicca)	172	Shotteswell
8	Shustoke	63	Ryton-on-Dunsmore	118	Dorsington	173	Radway
9	Curdworth	64	Binley Woods	119	Welford-on-Avon	174	Compton Verney
10	Lea Marston	65	King's Newnham	120	Temple Grafton	175	Gaydon
11	Middleton	66	Willey	121	Preston on Stour	176	Lighthorne Heath
12	Nether Whitacre	67	Burton Hastings	122	Clifford Chambers and Milcote	177	Watergall
13	Over Whitacre	68	Cawston	123	Whitchurch	178	Chapel Ascote
14	Dordon	69	Cosford	124	Ettington	179	Hodnell and Wills Pastures
15	Shuttington	70	Lapworth	125	Alderminster	180	Stoneton
16	Astley	71	Kenilworth	126	Little Lawford	181	Radbourn
17	Arley	72	Stoneleigh	127	Brinklow	182	Nuneaton & Bedworth Un-parished Area
18	Ansley	73	Sherbourne	128	Ansty	183	Atherstone on Stour
19	Bentley	74	Budbrooke	129	Copston Magna	184	Old Stratford and Drayton
20	Mancetter	75	Wasperton	130	Wibtoft	185	Loxley
21	Hartshill	76	Bishop's Tachbrook	131	Newton and Biggin	186	Charlecote
22	Grendon	77	Barford	132	Farnborough	187	Alcester
23	Austrey	78	Warwick	133	Burton Dassett	188	Coughton
24	Little Packington	79	Old Milverton	134	Bishop's Itchington	189	Haselor
25	Water Orton	80	Whitnash	135	Fenny Compton	190	Great Alne
26	Wishaw	81	Radford Semele	136	Wormleighton	191	Aston Cantlow
27	Baxterley	82	Royal Leamington Spa	137	Priors Hardwick	192	Studley
28	Baddesley Ensor	83	Offchurch	138	Newbold Pacey	193	Wootton Wawen
29	Stretton-on-Dunsmore	84	Rowington	139	Chesterton and Kingston	194	Ullenhall
30	Wolston	85	Shrewley	140	Southam	195	Preston Bagot
31	Brandon and Bretford	86	Beausale, Haseley, Honiley and Wroxall	141	Napton on the Hill	196	Snitterfield
32	Church Lawford	87	Leek Wootton and Guy's Cliffe	142	Ufton	197	Hampton Lucy
33	Long Lawford	88	Cubbington	143	Long Itchington	198	Fulbrook
34	Combe Fields	89	Ashow	144	Stockton	199	Claverdon
35	Stretton under Fosse	90	Bubbenhall	145	Priors Marston	200	Long Compton
36	Easenhall	91	Norton Lindsey	146	Upper and Lower Shuckburgh	201	Whichford
37	Shilton	92	Hatton	147	Beaudesert	202	Cherington
38	Withybrook	93	Hunningham	148	Burmington	203	Sutton-under-Brailes
39	Dunchurch	94	Bushwood	149	Stretton-on-Fosse	204	Brailes
40	Willoughby	95	Baddesley Clinton	150	Tidmington	205	Honington
41	Clifton upon Dunsmore	96	Blackdown	151	Barcheston	206	Idlicote
42	Harborough Magna	97	Weston under Wetherley	152	Shipston on Stour	207	Oxhill
43	Churchover	98	Wappenbury	153	Arrow with Weethley	208	Compton Wynyates
44	Pailton	99	Baginton	154	Weston-on-Avon	209	Tysoe
45	Wolvey	100	Eathorpe	155	Wixford	210	Ratley and Upton
46	Stretton Baskerville	101	Salford Priors	156	Exhall	211	Pillerton Priors
47	Birdingbury	102	Quinton	157	Binton	212	Pillerton Hersey
48	Princethorpe	103	Stratford-upon-Avon	158	Luddington	213	Butlers Marston
49	Seckington	104	Ladbroke	159	Billesley	214	Kineton
50	Corley	105	Harbury	160	Kinwarton	215	Wellesbourne
51	Merevale	106	Tanworth-in-Arden	161	Spernall	216	Combrook
52	Atherstone	107	Little Compton	162	Wilmcote	217	Moreton Morrell
53	Caldecote	108	Barton-on-the-Heath	163	Bearley	218	Chadshunt
54	Grandborough	109	Great Wolford	164	Morton Bagot	219	Lighthorne
55	Rugby Un-parished Area	110	Little Wolford	165	Mappleborough Green	220	Warmington
						221	Avon Dassett

Figure 4.8 - Areas Affected by January 1992 Significant Flood Event[6]



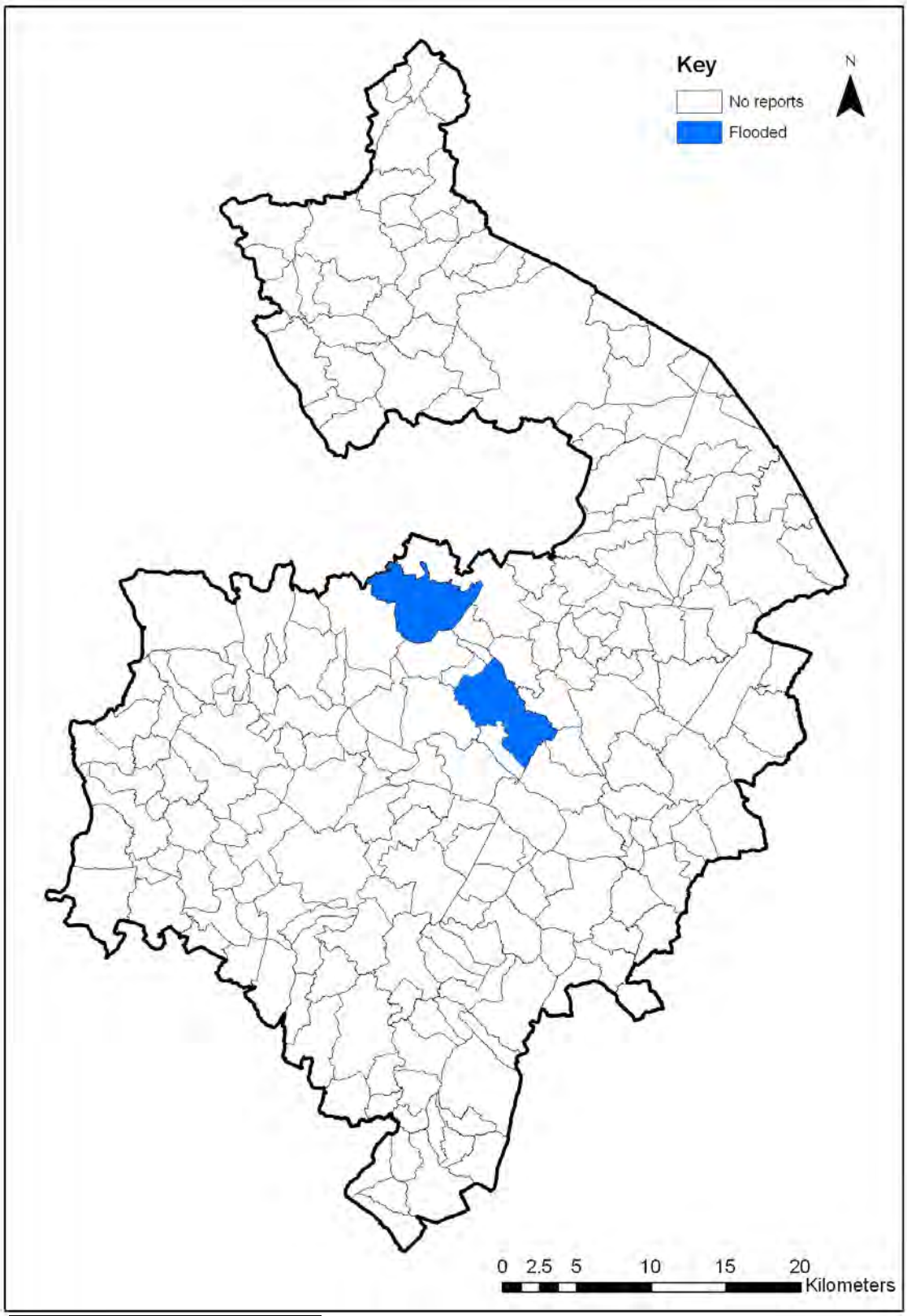
[6] Figure provided by Warwickshire County Council

Figure 4.9 - Areas Affected by Easter 1998 Significant Flood Event[7]



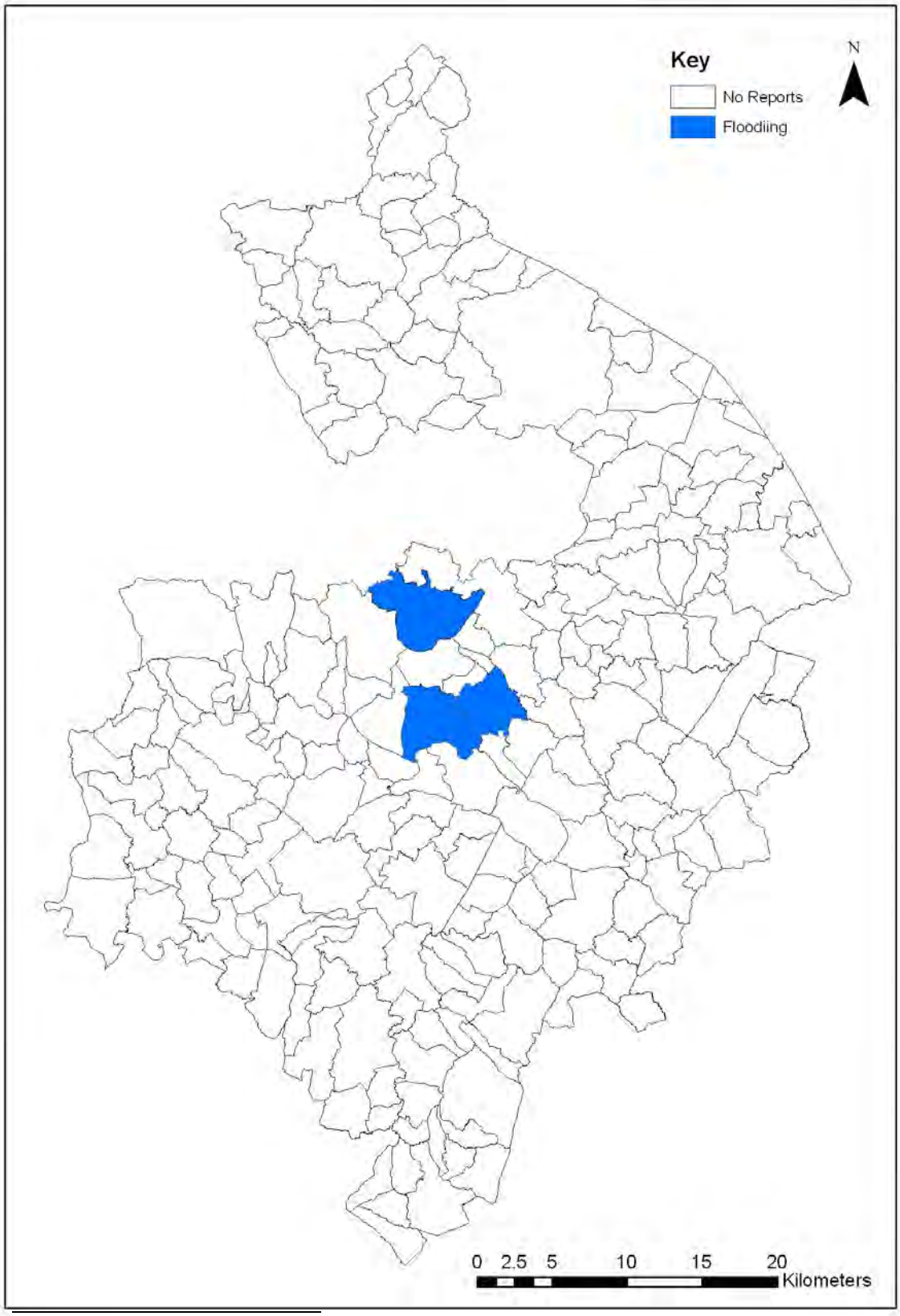
[7] Figure provided by Warwickshire County Council

Figure 4.10 - Areas Affected by August 1999 Significant Flood Event[8]



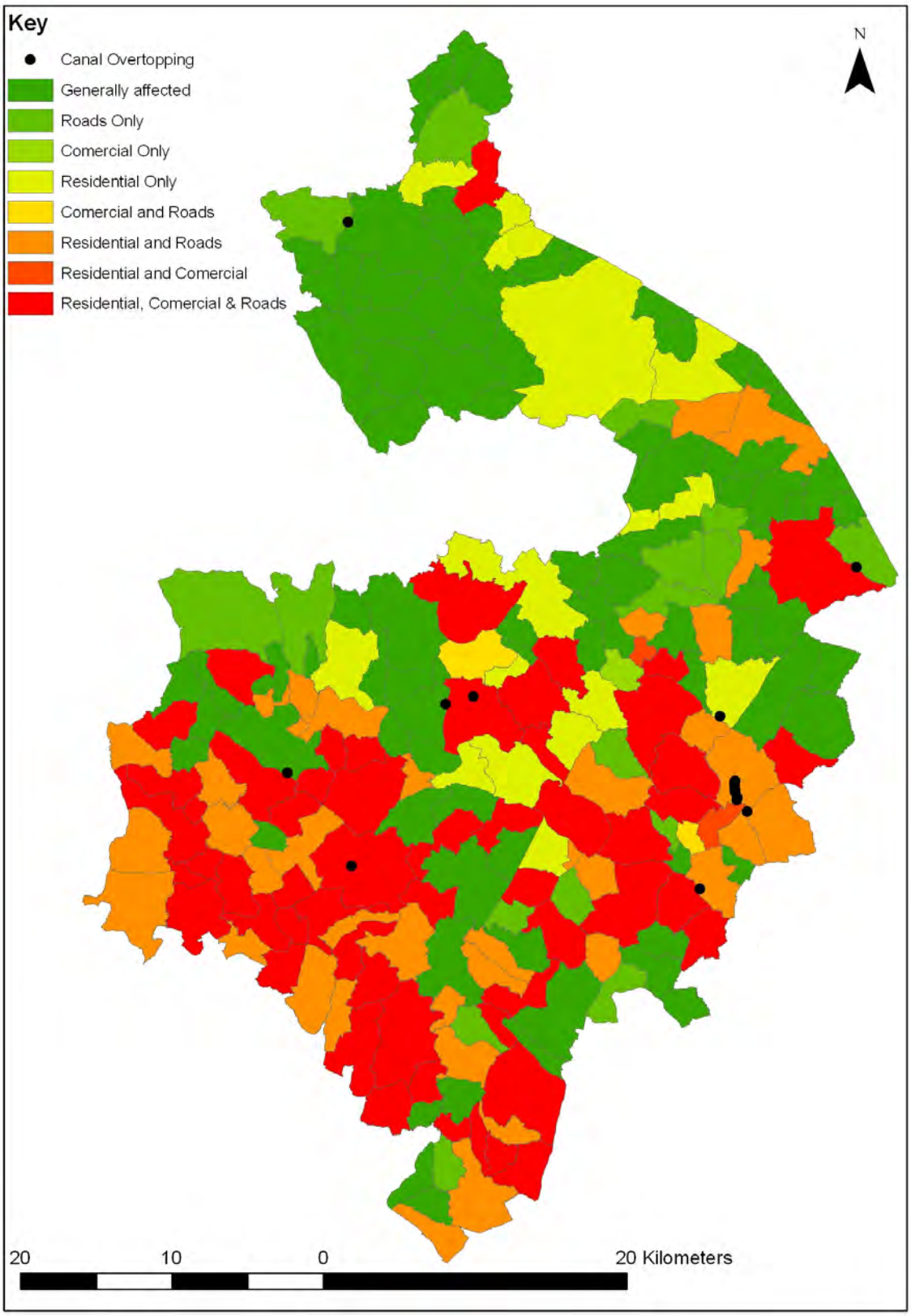
[8] Figure provided by Warwickshire County Council

Figure 4.11 - Areas Affected by June 2005 Significant Flood Event[9]



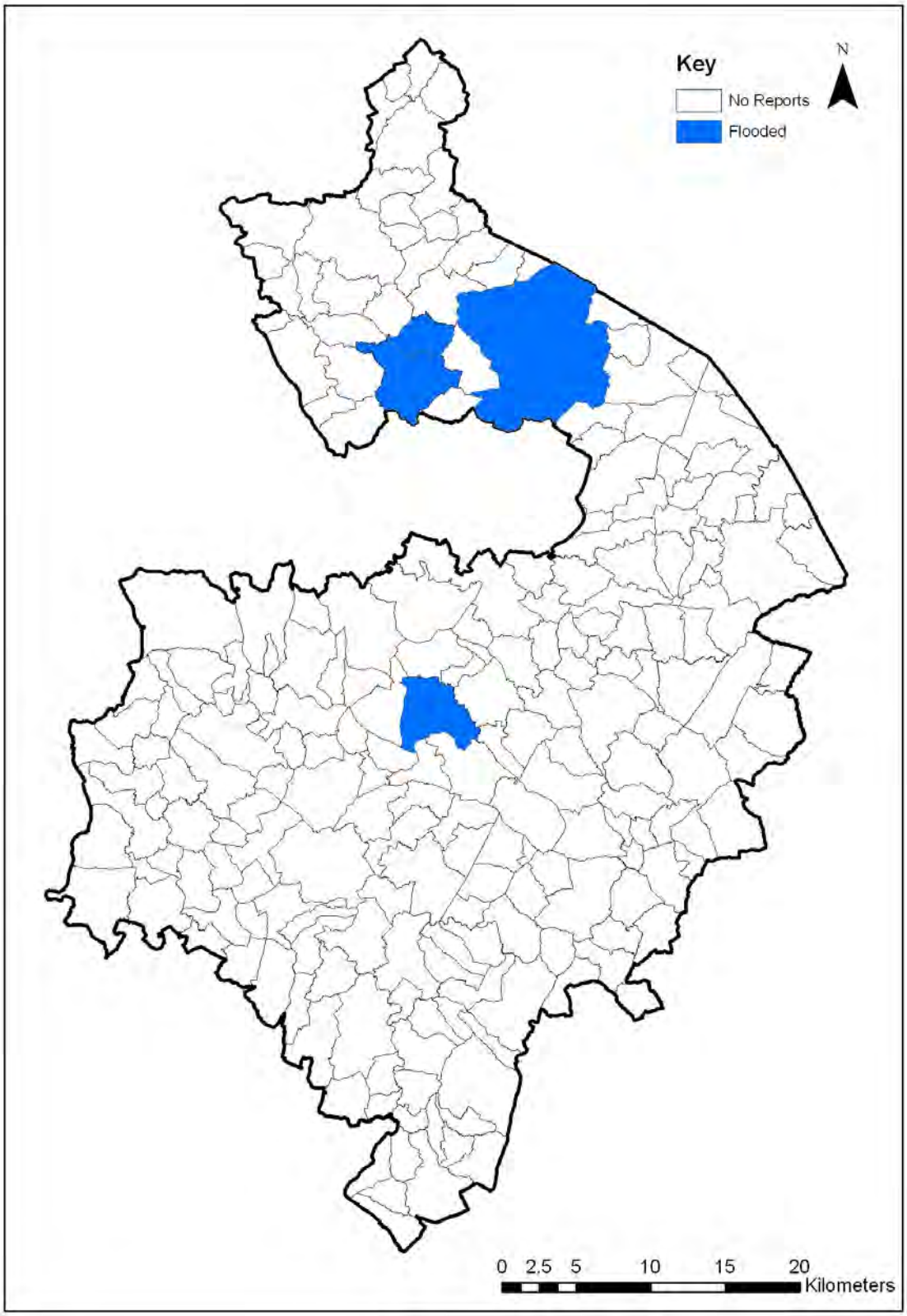
[9] Figure provided by Warwickshire County Council

Figure 4.12 - Areas Affected by Summer 2007 Significant Flood Event[10]



[10] Figure provided by Warwickshire County Council

Figure 4.13 - Areas Affected by December 2008 Significant Flood Event[11]



[11] Figure provided by Warwickshire County Council

5 FUTURE FLOOD RISK

5.1 Overview of Future Flood Risk

As identified in **Table 3.2**, a number of national datasets and model outputs are available to simulate surface water flooding, groundwater flooding and flooding from ordinary watercourses. These sources of information are discussed in more detail below.

5.1.1 Areas Susceptible to Surface Water Flooding (AStSWF)

This is a first generation national surface water mapping dataset, produced by the Environment Agency. It contains three susceptibility bandings ('less' to 'more' susceptible to surface water flooding) for a rainfall event with a 1 in 200 (0.5% AEP) chance of occurring in any year. The rainfall event is simulated over coarse resolution (5m) Digital Terrain Model (DTM) grid, allowing water to flow to and gather in the lowest points. The resulting map shows areas that are susceptible to surface water flooding without any allowance for the underground sewerage or drainage networks, or buildings.

5.1.2 Flood Map for Surface Water (FMfSW)

The second generation national surface water mapping dataset produced by the Environment Agency, the FMfSW models include more detail than the AStSWF, namely:

- more storm events;
- the influence of buildings; and
- the influence of the sewer system

The FMfSW mapping has been produced for the 1 in 30 (3.33% AEP) and 1 in 200 (0.5% AEP) chance of occurring in any year and for two depths for each - greater than 0.1m (shallow) and greater than 0.3m (deep). Reductions in rainfall have been applied in rural and urban areas to represent the impact of infiltration and sewers.

5.1.3 Flood Maps

The Environment Agency have produced a national dataset showing the modelled flood outlines for all watercourses with a catchment greater than 3km² for flood events with a 1 in 100 (1% AEP) and 1 in 1000 (0.1% AEP) chance of occurring in any year. The detail of the modelling varies between watercourses with the Main Rivers generally having more precise outlines than the ordinary watercourses. For this study the Main River flood zones have been removed from the mapping to provide a representation of future flooding from ordinary watercourses.

5.1.4 Areas Susceptible to Groundwater Flooding (AStGWF)

Another dataset produced by the Environment Agency, the AStGWF is a strategic scale map showing flood areas on a 1km² grid. The data uses the top two susceptibility bands of the British Geological Society (BGS) 1:50,000 Groundwater Flood Susceptibility Map (which includes consolidated aquifers and superficial deposits) but not groundwater

rebound. The mapping shows the proportion (for four classifications) of each 1km grid square over which groundwater might emerge.

5.2 Consequences of Future Flooding

The possible harmful consequences of future flooding have been estimated for each of the above datasets with regards to human health, economics and the environment by overlaying the future flooding outlines with the location of receptors in GIS. Receptors (such as property numbers, land areas etc) in each of these categories have been identified using the National Receptor Dataset (NRD).

Please note that due to time restrictions it was not feasible to undertake the footprint method of property selection on a County scale for each of the datasets and all receptors[12]. As such the number of residential and commercial properties at risk have been provided by the Environment Agency (calculated using NRD v1.0). Calculations for the other receptors have been undertaken through the overlay of the NRD v1.1 with the future flooding outlines. As the NRD provides receptor locations in the form of points located towards the centre of buildings properties which partially fall within the flood outlines, but for which the central point may be outside the flood outline, will be excluded from the count. As such, the count provided for receptors located as points within the NRD v1.1, may be an underestimation of reality.

A summary of the consequences assessed are outlined below.

5.2.1 Consequences to Human Health

- Number of dwellings at risk (***provided by the Environment Agency using NRD v1.0***);
- Number of people at risk (***number of properties multiplied by 2.34***)[13]; and
- Number of critical services at risk, including schools, hospitals, nursing/care/retirement homes, emergency services, prisons, sewage treatment works and electricity installations (***calculated by overlaying the NRD v1.1 with the flood outlines)***

5.2.2 Economic Consequences

- Number of non residential properties at risk (***provided by the Environment Agency using NRD v1.0***);
- Area of agricultural land, Grades 1, 2 and 3 only, at risk (***calculated by overlaying the NRD v1.1 with the flood outlines)***;
- Length of road at risk (***calculated by overlaying the NRD v1.1 with the flood outlines)***; and
- Length of rail at risk ***(calculated by overlaying the NRD v1.1 with the flood outlines)***.

[12] A method by which the outline of a building is overlaid with the predicted flood extent rather than the centre point - explained in the Environment Agency's 'Flood Map for Surface Water Property Count Method', November 2010

[13] Scaling factor stated in the PFRA final guidance

5.2.3 Environmental Consequences

All of these have been calculated by overlaying the NRD v1.1 with the flood outlines:

- Number of Pollution Prevention and Control (PPC) and Control of Major Accident Hazard (COMAH) sites at risk;
- Area of internationally and nationally designated sites ***(including Special Areas of Conservation (SACs), Special Protection Areas (SPA), Ramsar sites and Sites of Special Scientific Interest (SSSIs))***; and
- Number/area of internationally and nationally designated heritage sites (***including World Heritage Sites, Scheduled Monuments, Listed Buildings and Registered Parks and Gardens)***.

5.2.4 Summary of the Consequences of Future Flooding

A detailed record of the consequences of future flooding for each of the datasets listed above is included in **Annex 2** of this report. A summary is provided in **Table 5.1** below:

Table 5.1 - Summary Consequences of Future Flooding

Data Set		Source of Flooding	Number of Residential Properties at Risk[3]	Number of People at Risk[4]	Number of Non Residential Properties at Risk[3]
AStSWF	Less[1]	Surface Water (County wide)	34,900	81,666	12,900
	Intermediate[1]		13,200	30,888	5,600
	More[2]		1,145	2,679	1,394
FMfSW	1 in 30 (>0.1m depth)[2]	Surface Water (County wide)	6,732	15,753	5,517
	1 in 30 (>0.3m depth)[2]		1,422	3,327	1,908
	1 in 200 (>0.1m depth)[1]		44,700	104,598	15,000
	1 in 200 (>0.3m depth)[1]		11,900	27,846	4,900
Flood Maps	1 in 100 (FZ3)[2]	Ordinary Watercourses	704	1,647	213
	1 in 1000 (FZ2)[2]		1,071	2,506	344
AStGWF	>75%[2]	Groundwater	23,484	54,953	7,727

NOTES

[1] Data provided by Environment Agency - Calculated using NRD v1.0 and footprint method

[2] Data calculated using NRD v1.1 and simple GIS point overlays

[3] Please note that Environment Agency provided figures are rounded to the nearest 100.

[4] Calculated using 2.34 residents per property, as specified in PFRA Final Guidance document

The Environment Agency has used the FMfSW mapping (1 in 200 deep) and the NRD (v1.0) to identify a number of 1km² national grid squares across the Country that exceed the following threshold:

1. 200 people at risk of flooding ***or***
2. 20 businesses at risk of flooding ***or***
3. 1 critical service at risk of flooding

The grid squares in Warwickshire that exceed this threshold are illustrated in **Figure 5.1**, These are the areas where flood risk, based upon the FMfSW, is considered to be the most severe across the County.

Although details of the number and area of environmentally designated and culturally significant sites is provided in **Annex 2**, the Environment Agency has provided a list of the key sites at risk of flooding from surface water, stating the following for Warwickshire:

SAC sites[14]

- Ensor's Pool - 64.8% of the area of the SAC is at risk of surface water flooding.

SSSI sites

- A total of 14.1% of the area classified as SSSI within Warwickshire County is at risk of surface water flooding.

5.3 Locally Agreed Surface Water Information

A definition of 'locally agreed surface water information' has been considered to agree the surface water information that best represents local conditions across Warwickshire. As there is no specific local information available, the FMfSW is considered to the best available dataset for use. It is considered to be more accurate than the AStSWF maps within Warwickshire, due to the increased detail included within the model. Comparison with the available past flooding point data does not identify any anomalies within the outline of the FMfSW as compared to the AStSWF.

Similarly, as there are no local models, the Environment Agency's Flood Maps and AStGWF are considered the best outlines for ordinary watercourse and groundwater, respectively.

Summary maps showing the outlines for the FMfSW (**Figures 5.2a** and **5.2b**), the AStGWF (**Figure 5.3**) and the Flood Maps for ordinary watercourses (**Figure 5.4**) are shown below.

5.4 Climate Change

5.4.1 The Evidence

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

Over the past century around the UK sea level rise has been seen and more of the 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.

[14] Please note that RAMSAR, SAC, SPA and SSSI sites are combined as 'Environmentally Designated Sites' in Annex 2.

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.

There is enough confidence in large scale climate models to say that the UK must plan for change. There is more uncertainty at a local scale but model results can still help with plans to adapt. For example it is understood that rain storms may become more intense, even if there is uncertainlty 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%.

As stated in Section 1.3 of this report, Warwickshire is split between three River Basin Districts - the Humber, Severn and Thames. The climate change predictions and impacts for flood risk for each of these Districts is given below.

5.4.2 Key Projections for Humber River Basin District

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

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

Wetter winters and more of this rain falling in wet spells may increase river flooding. 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.

Drainage systems in the River Basin 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.

5.4.3 Key Projections for Severn River Basin District

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

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

Wetter winters and more of this rain falling in wet spells may increase river flooding 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.

Drainage systems in the River Basin 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.

5.4.4 Key Projections for Thames River Basin District

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

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

Implications for Flood Risk

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

Wetter winters and more of this rain falling in wet spells may increase river flooding in both rural and heavily urbanised catchments. More intense rainfall causes more

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

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

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

5.4.5 Local Information Regarding Climate Change

At the present time there is no local information to simulate the future impacts of climate change. Where appropriate, local studies are needed to understand climate impacts in detail for all River Basin Districts outlined above including effects from other factors like land use. Sustainable development and drainage will help us adapt to climate change and manage the risk of damaging floods in future.

5.4.6 Adapting to Change

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

Although the broad climate change picture is clear, local decisions have to be made against deeper uncertainty. A range of measures should therefore be considered and flexibility retained to adapt. This approach, embodied within flood risk appraisal guidance, will help to ensure that vulnerability to flooding is not increased.

5.4.7 General

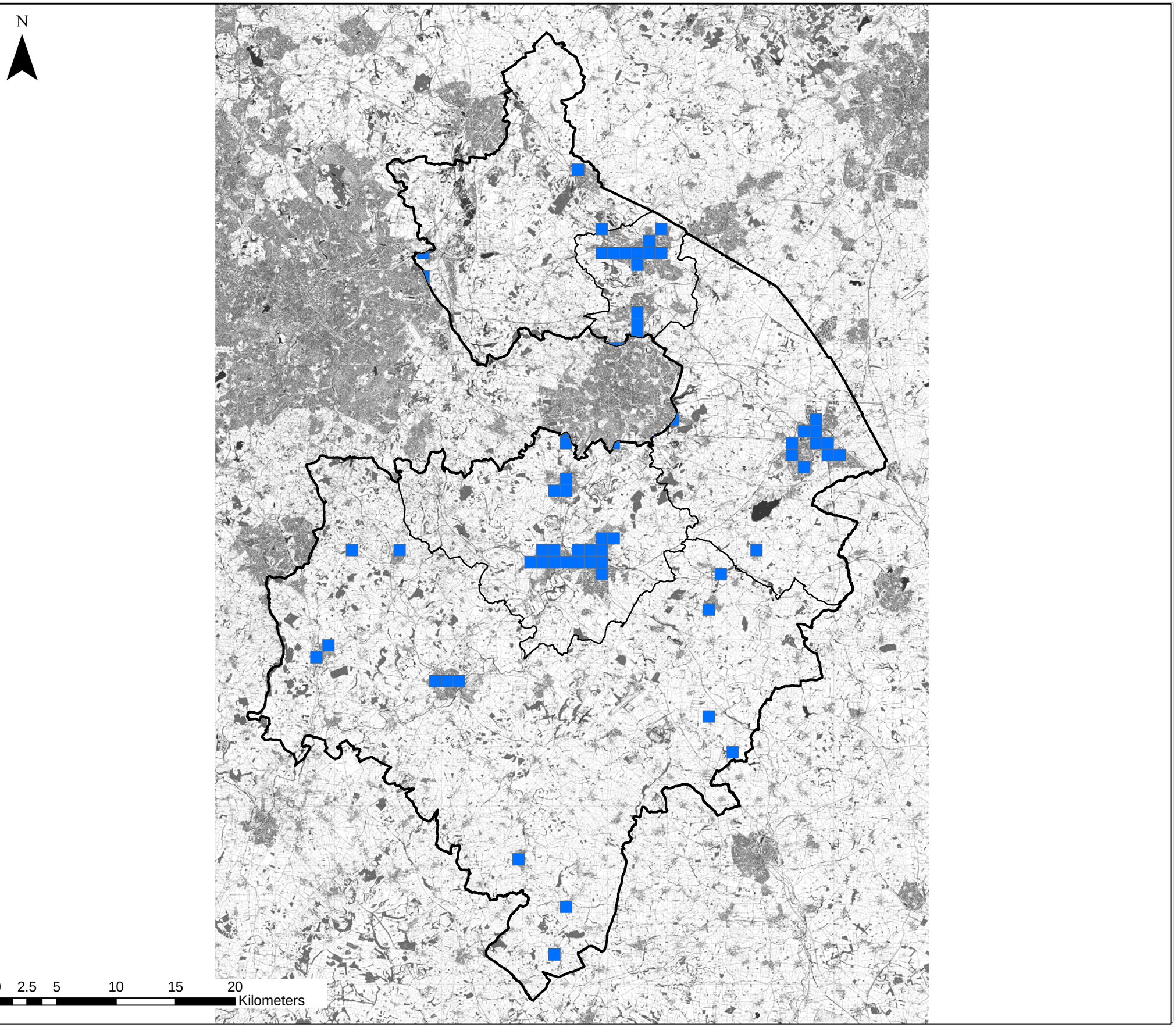
It is possible that long term developments might affect the occurrence and significance of flooding. However current planning policy aims to prevent new development from increasing flood risk.

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

Adherence to Government policy ensures that new development does not increase local flood risk. However, in exceptional circumstances the Local Planning Authority may accept that flood risk can be increased contrary to general 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).

5.4.8 Warwickshire Developments

As a result of the proposed abolition of the Regional Spatial Strategies (RSS) long term large scale development locations within Warwickshire are currently uncertain. As such it is not appropriate to identify particular locations within this revision of the PFRA report. However, one large scale development which has particular significance with regards to flood risk within Warwickshire is the proposed development of the High Speed Two (HS2) railway line. Although the exact route is as yet unknown the impacts of the development (both during and after construction) on flood risk within the local area is a key consideration that must be addressed. This applies to all forms of flood risk, from potential restrictions or blockages of watercourses, the diversion or blockage of surface water flow routes from the construction of embankments and the increase in surface runoff from the railway line. Adequate drainage that does not increase flood risk elsewhere will be a necessity.



Key

Places Above Flood Risk Threshold

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

Title:
Floods Over Threshold

Project:
Warwickshire County Council PFRA 2011

Date:
14/03/2011

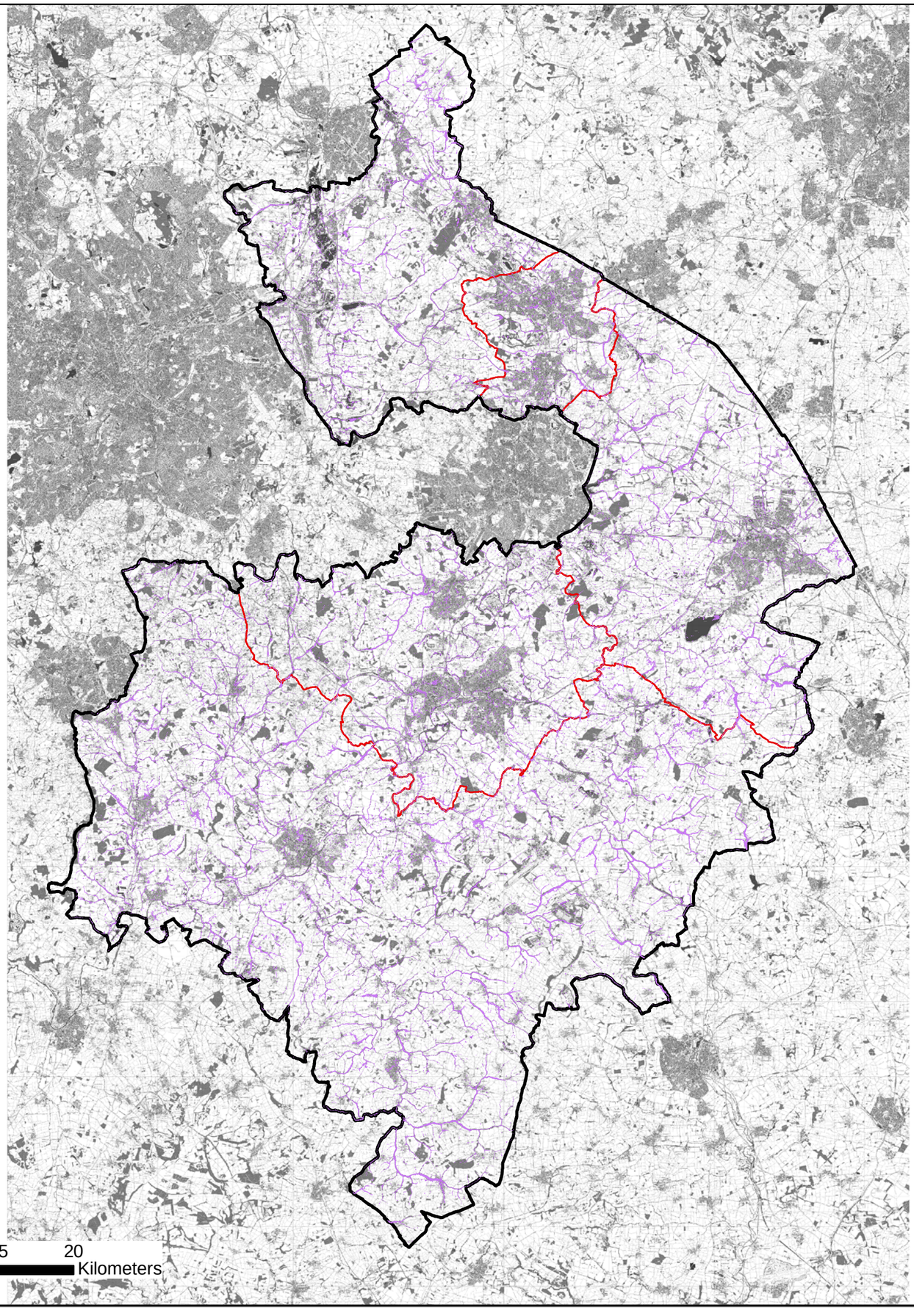
Scale:
1:300,000

Figure:
5.1

Warwickshire County Council

ROYAL HASKONING

N



Key

- FMfSW 1 in 30 >0.1m
- FMfSW 1 in 30 >0.3m

Title:
Locally Agreed Surface Water Information.
Flood Maps for Surface Water 1 in 30 Year (FMfSW 1in30)

Project:
Warwickshire County Council PFRA 2011

Date:
14/03/2011

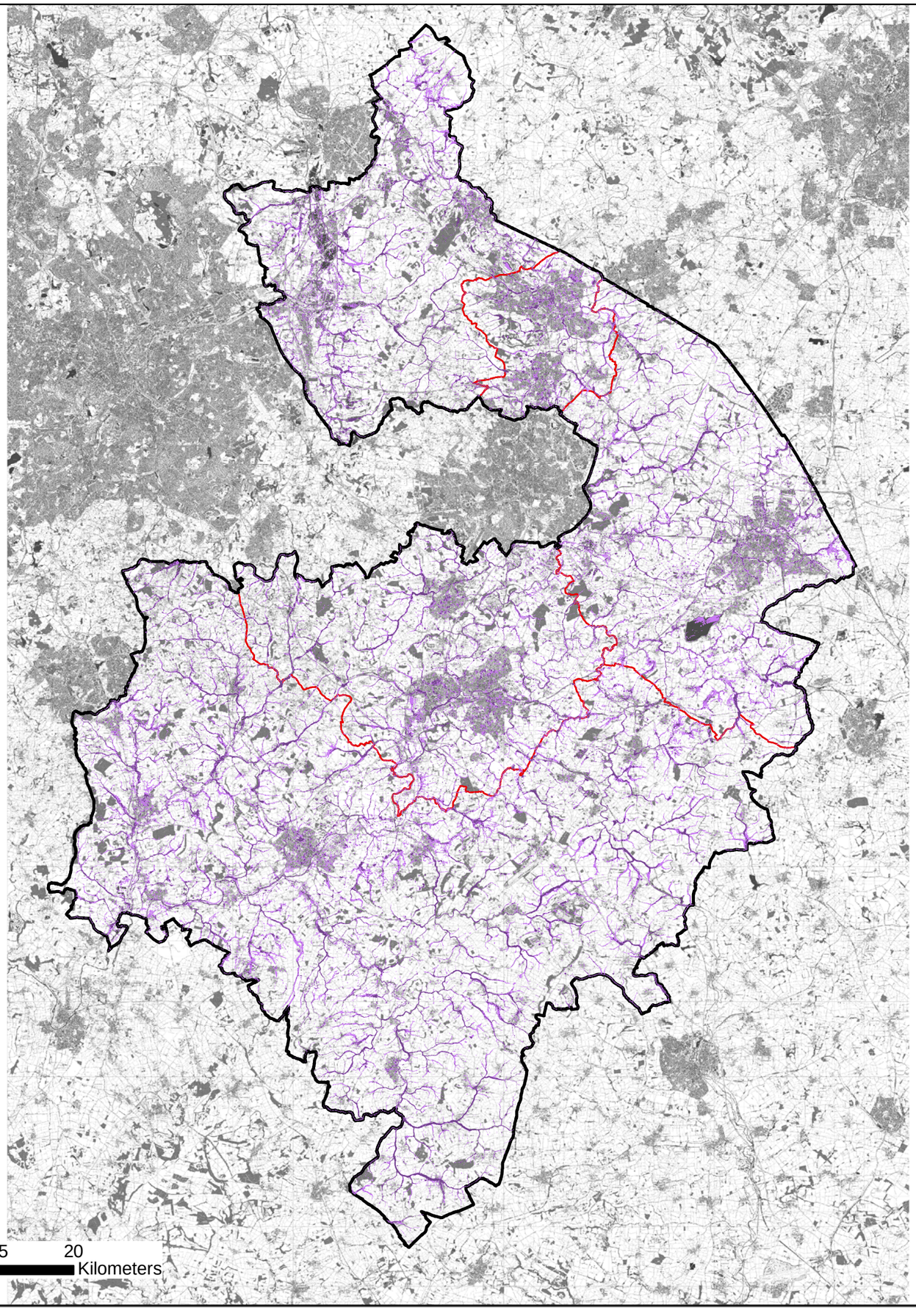
Scale:
1:300,000

Figure:
5.2a

Warwickshire County Council

ROYAL HASKONING

N



0 2.5 5 10 15 20
Kilometers

Key

- FMfSW 1 in 200 >0.3m
- FMfSW 1 in 200 >0.1m

Title:
Locally Agreed Surface Water Information.
Flood Maps for Surface Water 1 in 200 Year (FMfSW 1in200)

Project:
Warwickshire County Council PFRA 2011

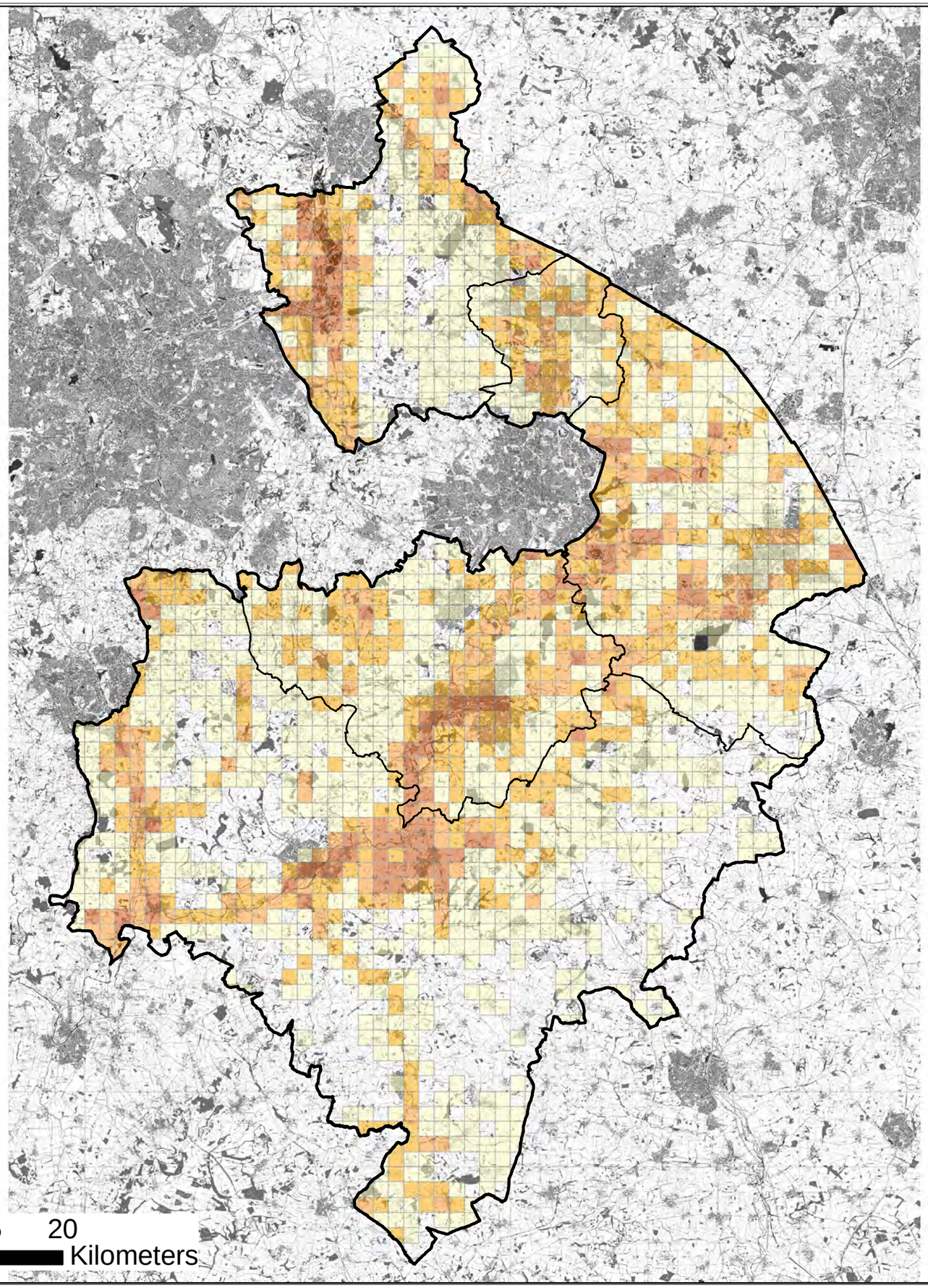
Date:
14/03/2011

Scale:
1:300,000

Figure:
5.2b

Warwickshire County Council

ROYAL HASKONING



Key

GroundWater Probability

- Less than 25%
- 25% to 50%
- 50% to 75%
- Greater than 75%

Source / Copyright

Title:

Areas Susceptible to Groundwater Flooding (AStGWF)

Project:

Warwickshire County Council PFRA 2011

Date: 14/03/2011

Scale: 1:425,000

Figure: 5.3

Warwickshire County Council

ROYAL HASKONING

N

0 2.5 5 10 15 20
Kilometers

Key

- Flood Zone 3
- Flood Zone 2

Title:
Flooding From Ordinary Watercourses

Project:
Warwickshire County Council PFRA 2011

Date:
14/03/2011

Scale:
1:300,000

Figure:
5.4

Warwickshire County Council

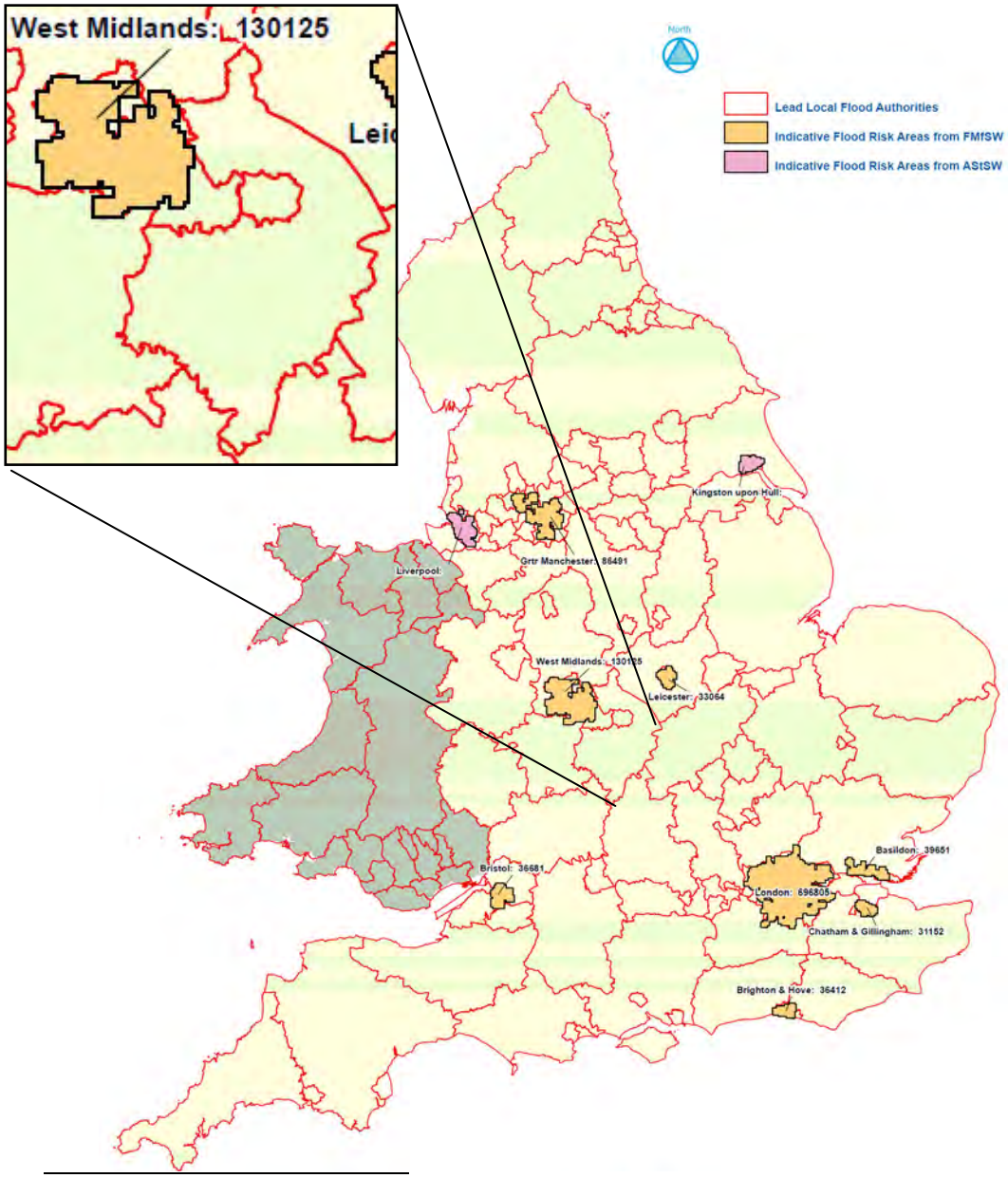
ROYAL HASKONING

6 INDICATIVE FLOOD RISK AREAS

6.1 Identification of Indicative Flood Risk Areas

To ensure a consistent national approach, Defra and WAG have identified significance criteria and threshold to be used for defining flood risk areas[15]. The Environment Agency has applied these criteria and thresholds to produce ten Indicative Flood Risk Areas across England, shown in **Figure 6.1**. Although very close to the West Midlands Indicative Flood Risk Area, as shown in the insert, Warwickshire is not located within any Indicative Flood Risk Areas.

Figure 6.1 - Indicative Flood Risk Areas Near Warwickshire[16]



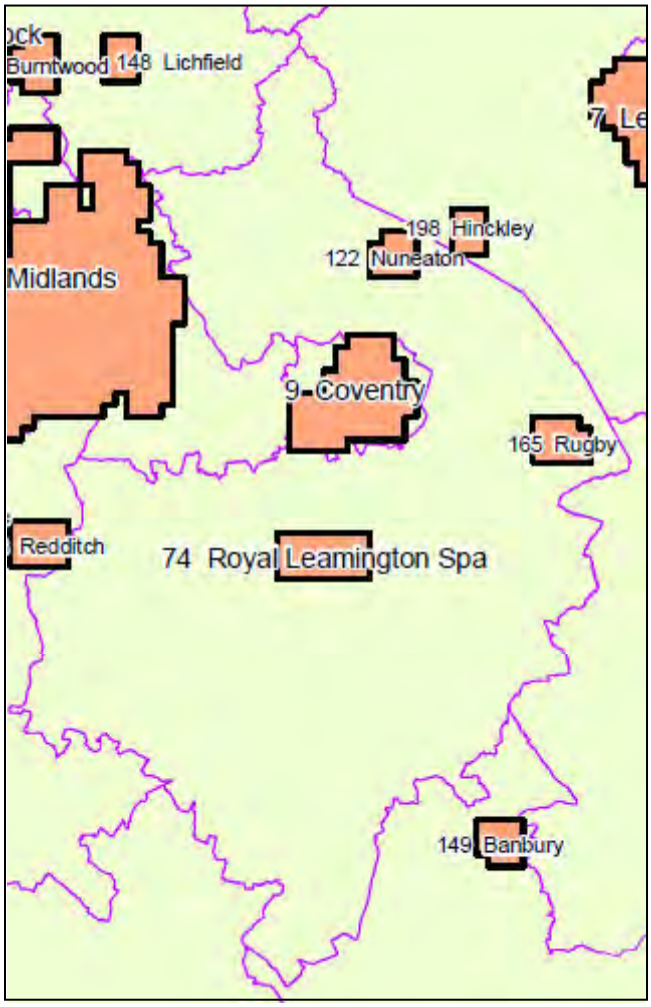
[15] See Defra's guidance document "Selecting and Reviewing Flood Risk Areas for Local Sources of Flooding"

[16] Figure produced by the Environment Agency

6.2 Review of Indicative Flood Risk Areas

As outlined in Section 5.2, a number of 1km squares in Warwickshire have been identified as having a risk of flooding above the Flood Risk Threshold, based upon the FMfSW. Some of these locations have been identified as forming a 3km² cluster, identifying the settlements of Nuneaton, Rugby and Leamington Spa (see **Figure 6.2** below).

Figure 6.2 - Clusters of Places above the Flood Risk Thresholds in Warwickshire[17]



The numbers on the map refer to the rank of the settlement in terms of the number of people at risk on a scale of 1 (highest number of people at risk) to 219 (the lowest number of people at risk). **Table 6.1** summarises the information provided by the Environment Agency with regards to these clusters:

[17] Figure extracted from Environment Agency map

Table 6.1 - Details of Surface Water Flood Risk within Clusters Shown in Figure 6.2

Flood Risk Indicator	Name of Cluster		
	Leamington Spa	Nuneaton	Rugby
Rank (out of 219)	74	122	165
National Grid Reference	SP3000066000	SP3610091900	SP5039575921
Area	3200ha	1500ha	1900ha
Number of Residential Properties at Risk	3467[1]	***Not provided***	***Not provided***
Number of People at Risk	8113[1]	***Not provided***	***Not provided***
Number of Critical Services at Risk	22[1]	***Not provided***	***Not provided***
Number of Non Residential Properties at Risk	557[1]	***Not provided***	***Not provided***
Length of Road or Rail at Risk from Surface Runoff	11.8km	7.6km	4.4km
Area of Agricultural Land at Risk from Surface Runoff	50.3ha	15.5ha	19.3ha
Number of PPC sites potentially at risk from surface runoff.	0	1	1
Number of Listed Buildings (all grades) at risk from Surface Runoff	10	0	0
Number of Listed Buildings (Grades I and II*) at risk from Surface Runoff	1	0	0
Number of Scheduled Ancient Monuments at risk from Surface Runoff	3	3	0
Mean Potential for Groundwater Flooding over Cluster	47%	32.5%	27.8%
Area of Cluster with > 75% Ground-water Flooding Potential	700ha	0ha	0ha
Area of Cluster with > 50% Ground-water Flooding Potential	1300ha	400ha	300ha
Area of Cluster with > 25% Ground-water Flooding Potential	2300ha	800ha	800ha

NOTES: [1]Data based on AStGWF

Although all these locations have been identified in the assessments of both past and future flood risk within this PFRA, the required criteria for a cluster to have a population at risk of flooding of greater than 30,000 is not met for any of these locations. As such, no additional Indicative Flood Risk Areas have been identified within Warwickshire.

7 NEXT STEPS

To support the six year review of the PFRA, the following actions have been identified by Warwickshire County Council:

1. The spreadsheet developed as part of this PFRA will be utilised for the collation of flood records following future events, possibly in the form of a database;
2. Past flood event data missing from this PFRA (for example the Highways Authority records) will be sought and assimilated into the spreadsheet;
3. New relationships will be formed with additional partners identified in **Figure 2.1**;
4. Increased data sharing will be encouraged between all the partners shown on **Figure 2.1**;
5. The Warwickshire Flood Forum will continue to meet quarterly;
6. The relationships developed with the Parish Councils and Local Flood Forums will be maintained through quarterly meetings;
7. Data and information will be explained at a community level to promote resident engagement with the County Council;
8. Continued provision of advice to areas affected by flooding, to assist in the planning for future flood emergencies. A number of high risk areas, including villages with a potential to become marooned during a flood event have been identified as part of this PFRA process and will continue to be modified and updated. Dialogue will be held with the Emergency Services to distribute this information and knowledge;
9. All information collected as part of this PFRA will be utilised by the LLFA within their upcoming SuDS Approval Board (SAB) role;
10. The Planning Authority will be approached with the suggestion that Warwickshire County Council become a statutory consultee;
11. Flood audits will be required for all in-house highways and transport schemes;
12. All information collated within this PFRA will be used to inform the Local Flood Risk Strategy.

8 REFERENCES

Communities and Local Government ***'Planning Policy Statement 25: Development and Flood Risk'***, March 2010

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Warwickshire Observatory, Warwickshire County Council
http://www.warwickshire.gov.uk/observatory/observatorywcc.nsf/05a17cfbd3bcf85d802572920033cf0f/bfb8b0a1d34f274c802572c00048108f?OpenDocument

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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	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 / optional:	Mandatory	Mandatory	Mandatory	Mandatory	Optional	Optional for first cycle	Optional for first cycle	Optional for first cycle	Optional for first cycle	Optional	Optional	Optional for first cycle	Optional for first cycle	Mandatory	Optional	Optional	Optional	Mandatory	Optional	Optional	Optional	Mandatory	Optional	Mandatory	Optional	Optional	Optional	Optional	Optional	Optional	Optional	Optional	Optional	Optional	Auto-populated
Format:	Unique number between 1-9999	Max 5,000 characters	Max 250 characters	12 characters: 2 letters, 10 numbers	Max 250 characters	'yyyy' or 'yyyy-mm' or 'yyyy-mm-dd'	Number with two decimal places	Max 25 characters	Pick from drop-down	Max 250 characters, same source terms.	Pick from drop-down	Pick from drop-down	Pick from drop-down	Pick from drop-down	Number between 1-10,000,000	Pick from drop-down	Max 250 characters	Pick from drop-down	Number between 1-10,000,000	Pick from drop-down	Max 250 characters	Pick from drop-down	Max 250 characters	Pick from drop-down	Max 250 characters	Max 1,000 characters	Max 250 characters	Number with two decimal places	Pick from drop-down	Pick from drop-down	'yyyy' or 'yyyy-mm' or 'yyyy-mm-dd'	Max 50 characters	Max 250 characters	Pick from drop-down	Max 50 characters	Max 42 characters
Notes:	A sequential number starting at 1 and incrementing by 1 for each record.	Description of the flood and its adverse or potentially adverse consequences. Where available, information from other fields (Start date, Days duration, Probability, Main source, Main mechanism, Main characteristics, Significant consequences) should be repeated here.	Name of the locality associated with the flood, using recognised postal address names such as streets, towns, counties. If the flood affected the whole LLFA, then record the name of the LLFA.	National Grid Reference of the centroid (centre point, falls within polygon) of the flood extent, or of the area affected if there is no extent information.	A description of the general location that was flooded.	The date when the flood commenced - when land not normally covered by water became covered by water.	The number of days (duration) of the flood that land not normally covered by water was covered by water. Values should be within the range 0.01 - 999.99 (permitting records to the nearest quarter of an hour, where appropriate).	The chance of the flood occuring in any given year - record X from "a 1 in X chance of occurring in any given year". Where this is difficult to estimate, a range can be recorded.	Pick the source from which the majority of flooding occurred. Refer to the PFRA guidance for definitions of sources.	If flooding occurred from, or interacted with, any other sources (other than the Main source of flooding) from 'High' (compelling evidence of source - about 80% confident that source is correct), 'Medium' (some evidence of source but not compelling - about 50% confident that source is correct) or 'Low' (source assumed - about 20% confident that source is correct) or 'Unknown'.	Pick a broad level of confidence in the Main source of flooding from 'High' (compelling evidence of source - about 80% confident that source is correct), 'Medium' (some evidence of source but not compelling - about 50% confident that source is correct) or 'Low' (source assumed - about 20% confident that source is correct) or 'Unknown'.	Pick a mechanism from; 'Natural exceedance' (of capacity), 'Defence exceedance' (floodwater overtopping defences), 'Failure' (of natural or artificial defences or infrastructure, or of pumping), 'Blockage' or restriction' (natural or artificial blockage or restriction of a conveyance channel or system), or 'No data'.	Pick a characteristic from; 'Flash flood' (rises and falls quite rapidly with little or no advance warning), 'Natural flood' (due to significant precipitation, at a slower rate than a flash flood), 'Snow melt flood' (due to rapid snow melt), 'Debris flow' (conveying a high degree of debris), or 'No data'. Most UK floods are 'Natural floods'.	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), 'Estimates 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), 'Estimates 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	Medium	Site survey	1998-04-20		Ordnance Survey AddressPoint; CEH 1:50k River Centreline; NextMap DTM.	Unmarked	Private	UKE100000012P0001
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	Yes	23	Observed number		No			No		No													
Records begin here:																																			
	1 Heavy rain in the first half of January 1952 resulted in localised flooding along the Rivers Leam and Avon. A localised storm on the 12th/13th of the month fell onto saturated ground and resulted in the flooding of the village of Snitterfield, from capacity exceedence of the Bell Brook. Reports state that the impact was amplified as a result of channel restrictions and blockages. The flooding lasted less than a day, but affected more than 35 properties in the village, in addition to non residential buildings and agricultural land and cut one of the main access roads. The probability of this flood occuring in any one year is unknown.	Southern Warwickshire	SP2147160110		Warwick and Stratford on Avon Districts generally. Specific records in Snitterfield village.	13/01/1952	<1.00	Unknown	Ordinary watercourses	Main River, Artificial Infrastructure	Medium	Natural exceedance	Natural flood	Yes	35	Observed number	Unknown	Yes	>1	Observed number	Key access routes closed	No	Unknown	No	Unknown	Information collected from numerous sources, mostly based on anecdotal reports.	Warwickshire County Council, Stratford on Avon District Council, Severn Trent Water Ltd	Unknown	Medium	Professional staff notes			Ordnance Survey	Restricted	Private	UKE100000028P0001
	2 The Easter floods in 1998 affected a large part of the English Midlands and were caused by a band of heavy rain stalling over that part of the Country on the 9th and 10th April. The resulting flooding affected most of Warwickshire and originated from a combination of ordinary watercourses, surface runoff, exceedence of the artificial infrastructure and main rivers. The impacts within the County were widespread, with reports of more than 520 residential properties being inundated, in addition to more than 35 commercial buildings and numerous critical infrastructure and key roads. Within Warwickshire the Met Office has predicted that the rainfall recorded has a 1 in 35 year chance (3.5%) of falling in any one year.	Warwickshire	SP3301167022		Numerous towns and villages across Warwickshire	09/04/1998	2	35	Ordinary watercourses	Artificial Infrastructure, Main River, Surface Runoff	High-Medium	Natural exceedance	Natural flood	Yes	>520	Observed number	Medical Centres, Village Halls, Toilet Blocks, Schools, Caravan Parks, villages marooned	Yes	>35	Observed number	Numerous A roads closed Numerous B roads closed Loss of livestock Damage to bridges	Yes	Flooding of sewage treatment works	No	Unknown	Information collected from numerous sources, mostly based on anecdotal reports.	Warwickshire County Council, Stratford on Avon District Council, Warwick District Council, Severn Trent Water Ltd, Parish Councils	Unknown	High-Medium	Professional staff notes			Ordnance Survey	Restricted	Private	UKE100000028P0002
	3 An intense localised rainstorm fell over the towns of Kenilworth and Leamington Spa on the 8th/9th August 1999. Severn Trent Water have estimated the rainfall has between a 1 in 45 (2%) and 1 in 70 (1.4%) chance of occurring in any one year. This resulted in exceedence of the capacity of the artificial infrastructure of the area, internal flooding of more than 35 properties and 1 commercial property and the closure of one of the main access roads.	Warwick District	SP3020267844		Kenilworth, Leamington Spa and Radford Semele	09/08/1999	0.5	45-70	Artificial infrastructure		High	Natural exceedance	Natural flood	Yes	35	Observed number	Unknown	Yes	>1	Observed number	Key access routes closed	No	Unknown	No	Unknown	Information collected from numerous sources, mostly based on anecdotal reports.	Severn Trent Water Ltd	Unknown	High-Medium	Professional staff notes			Ordnance Survey	Restricted	Private	UKE100000028P0003
	4 An intense localised rainstorm fell over the towns of Kenilworth, Leamington Spa and Warwick on the 23rd/24th June 2005. Severn Trent Water have estimated the rainfall has a 1 in 5 (20%) chance of occurring in any one year. This resulted in exceedence of the capacity of the artificial infrastructure of the area, internal flooding of more than 45 properties, other commercial property and the closure of an A road.	Warwick District	SP3020267844		Leamington Spa, Kenilworth and Warwick	24/06/2005	4	5	Artificial infrastructure	Main River	High	Natural exceedance	Natural flood	Yes	45	Observed number	Unknown	Yes	Unknown	Observed number	Closure of A road	No	Unknown	No	Unknown	Information collected from numerous sources, mostly based on anecdotal reports.	Severn Trent Water Ltd, Warwickshire County Council	Unknown	High-Medium	Professional staff notes			Ordnance Survey	Restricted	Private	UKE100000028P0004
	5 During the summer of 2007 a succession of depressions tracked over Warwickshire over the two month period, bringing heavy rainfall and triggering multiple flood events throughout June and July. Warwickshire was impacted by both the major flood events (in the middle of June and the middle of July), although with more intense impacts recorded in July, resulting in surface water, Main River, ordinary watercourse, canal and sewer surcharge flooding, in addition to number of surface water flood events in between. Over the two month period more than 1750 residential properties and 80 commercial properties were flooded across Warwickshire. The floods also resulted in severe livestock losses, closure of roads and bridges and the surcharging of septic tanks. The Environment Agency has predicted that this event has a 1 in 200 year chance of occurring in any given year.	Warwickshire	SP3301167022		Numerous towns and villages across Warwickshire	14/06/2007	6	200	Surface runoff	Artificial Infrastructure, Main River, Ordinary Watercourse	High-Medium	Natural exceedance	Natural flood	Yes	>1750	Observed number	Schools, Caravan Parks, villages marooned	Yes	>80	Observed number	Numerous A roads closed Numerous B roads closed Railway flooded Many bridges impassable Loss of livestock	Yes	Flooding of septic tanks	No	Unknown	Information collected from numerous sources, mostly based on anecdotal reports.	Warwickshire County Council, Stratford on Avon District Council, Warwick District Council, Rugby Borough Council, Severn Trent Water Ltd, Parish Councils, British Waterways	Unknown	High	Professional staff notes			Ordnance Survey	Restricted	Private	
	6 It is assumed that this flood event was triggered by heavy localised rainfall falling over the central and northern areas of Warwickshire during the first half of December 2006. On 13th December over 55 residential properties were flooded within the County from a combination of ordinary watercourses, main rivers and surface runoff. The worst affected settlements were the towns/villages of Bedworth, Warwick, Fillongley and Arley. The probability of this event recurring in any one year is unknown.	Warwick District, Nuneaton and Bedworth	SP3070174829		Towns/Villages of Bedworth, Warwick, Fillongley and Arley	13/12/2006	1	Unknown	Ordinary watercourses	Main River, Surface Runoff	Medium	Natural exceedance	Natural flood	Yes	55	Observed number	Unknown	Yes	Unknown	Observed number	Closure of A road	No	Unknown	No	Unknown	Information collected from numerous sources, mostly based on anecdotal reports.	Warwickshire County Council, Parish Councils	Unknown	Medium	Professional staff notes			Ordnance Survey	Unmarked	Private	UKE100000028P0006

Annex 2
Records of Future Floods and Their Consequences

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

	Flood ID	Description of assessment method
Field:	**Flood ID**	**Description of assessment method**
Mandatory / optional:	**Mandatory**	**Mandatory**
Format:	Unique number between 1-9999	Max 1,000 characters
Notes:	A sequential number starting at 1 and incrementing by 1 for each record.	Description of the future flood information and how it has been produced. Cover Regulation 12(6) requirements of (a) topography, (b) the location of watercourses, (c) the location of flood plains that retain flood water, (d) the characteristics of watercourses, and (e) the effectiveness of any works constructed for the purpose of flood risk management. Information from other relevant fields (Probability, Main source, Name) should be repeated here.
Records begin here:	1	• Topography is derived from LIDAR (in larger urban areas, on 1, 2 and 3m grids; original accuracy ± 0.15m) and Geoperspective data (original accuracy ± 1.5m), processed to remove buildings and vegetation, then degraded to a composite 5m DTM. Manual edits applied where flow paths clearly omitted e.g. below bridges. • Flow routes dictated by topography; no allowance made for manmade drainage. The DTM may miss flow paths below bridges. • Areas that may flood are defined by dynamically routing a 6.5 hour duration storm with 1 in 200 chance of occurring in any year, over the DTM using JBA's JFLOW–GPU model. • Manning's n of 0.1 is used throughout, to allow broad scale effects of buildings and other obstructions to be approximated. • No allowance made for drainage, pumping or other works constructed for the purpose of flood risk management. • The 'less susceptible' layer shows where modelled flooding is 0.1-0.3m deep; you must not interpret this as depth of flooding, rather as indicative of susceptibility to flooding because of modelling uncertainties.
	2	• Topography is derived from LIDAR (in larger urban areas, on 1, 2 and 3m grids; original accuracy ± 0.15m) and Geoperspective data (original accuracy ± 1.5m), processed to remove buildings and vegetation, then degraded to a composite 5m DTM. Manual edits applied where flow paths clearly omitted e.g. below bridges. • Flow routes dictated by topography; no allowance made for manmade drainage. The DTM may miss flow paths below bridges. • Areas that may flood are defined by dynamically routing a 6.5 hour duration storm with 1 in 200 chance of occurring in any year, over the DTM using JBA's JFLOW–GPU model. • Manning's n of 0.1 is used throughout, to allow broad scale effects of buildings and other obstructions to be approximated. • No allowance made for drainage, pumping or other works constructed for the purpose of flood risk management. • The 'intermediate susceptibility' layer shows where modelled flooding is 0.3-1.0m deep; you must not interpret this as depth of flooding, rather as indicative of susceptibility to flooding because of modelling uncertainties.
	3	• Topography is derived from LIDAR (in larger urban areas, on 1, 2 and 3m grids; original accuracy ± 0.15m) and Geoperspective data (original accuracy ± 1.5m), processed to remove buildings and vegetation, then degraded to a composite 5m DTM. Manual edits applied where flow paths clearly omitted e.g. below bridges. • Flow routes dictated by topography; no allowance made for manmade drainage. The DTM may miss flow paths below bridges. • Areas that may flood are defined by dynamically routing a 6.5 hour duration storm with 1 in 200 chance of occurring in any year, over the DTM using JBA's JFLOW–GPU model. • Manning's n of 0.1 is used throughout, to allow broad scale effects of buildings and other obstructions to be approximated. • No allowance made for drainage, pumping or other works constructed for the purpose of flood risk management. • The 'more susceptible' layer shows where modelled flooding is >1.0m deep; you must not interpret this as depth of flooding, rather as indicative of susceptibility to flooding because of modelling uncertainties.
	4	• Topography is derived from 64.5% LIDAR (on 0.25m-2m grids; original accuracy ± 0.15m) and 35.5% NEXTMap SAR (on 5m grid; original accuracy ± 1.0m), processed to remove buildings & vegetation, then combined on a 2m grid; buildings added with an arbitrary height of 5m based on OS MasterMap 2009 building footprints, then resampled to a 5m grid DTM. Manual edits applied where flow paths clearly omitted e.g. below bridges. • Flow routes dictated by topography; a uniform allowance of 12mm/hr has been made for manmade drainage in urban areas. Infiltration allowance reduces runoff to 39% in rural areas and 70% in urban areas. • Areas that may flood are defined by dynamically routing a 1.1 hour duration storm with 1 in 30 chance of occurring in any year over the DTM using JBA's JFLOW–GPU model. • Manning's n of 0.1 in rural areas; 0.03 in urban areas, to reflect explicit modelling of buildings in urban areas. • No allowance made for local variations in drainage, pumping or other works constructed for the purpose of flood risk management. • The '>0.1m' layer shows where modelled flooding is greater than 0.1m deep.
	5	• Topography is derived from 64.5% LIDAR (on 0.25m-2m grids; original accuracy ± 0.15m) and 35.5% NEXTMap SAR (on 5m grid; original accuracy ± 1.0m), processed to remove buildings & vegetation, then combined on a 2m grid; buildings added with an arbitrary height of 5m based on OS MasterMap 2009 building footprints, then resampled to a 5m grid DTM. Manual edits applied where flow paths clearly omitted e.g. below bridges. • Flow routes dictated by topography; a uniform allowance of 12mm/hr has been made for manmade drainage in urban areas. Infiltration allowance reduces runoff to 39% in rural areas and 70% in urban areas. • Areas that may flood are defined by dynamically routing a 1.1 hour duration storm with 1 in 30 chance of occurring in any year over the DTM using JBA's JFLOW–GPU model. • Manning's n of 0.1 in rural areas; 0.03 in urban areas, to reflect explicit modelling of buildings in urban areas. • No allowance made for local variations in drainage, pumping or other works constructed for the purpose of flood risk management. • The '>0.3m' layer shows where modelled flooding is greater than 0.3m deep.
	6	• Topography is derived from 64.5% LIDAR (on 0.25m-2m grids; original accuracy ± 0.15m) and 35.5% NEXTMap SAR (on 5m grid; original accuracy ± 1.0m), processed to remove buildings & vegetation, then combined on a 2m grid; buildings added with an arbitrary height of 5m based on OS MasterMap 2009 building footprints, then resampled to a 5m grid DTM. Manual edits applied where flow paths clearly omitted e.g. below bridges. • Flow routes dictated by topography; a uniform allowance of 12mm/hr has been made for manmade drainage in urban areas. Infiltration allowance reduces runoff to 39% in rural areas and 70% in urban areas. • Areas that may flood are defined by dynamically routing a 1.1 hour duration storm with 1 in 200 chance of occurring in any year over the DTM using JBA's JFLOW–GPU model. • Manning's n of 0.1 in rural areas; 0.03 in urban areas, to reflect explicit modelling of buildings in urban areas. • No allowance made for local variations in drainage, pumping or other works constructed for the purpose of flood risk management. • The '>0.1m' layer shows where modelled flooding is greater than 0.1m deep.
	7	• Topography is derived from 64.5% LIDAR (on 0.25m-2m grids; original accuracy ± 0.15m) and 35.5% NEXTMap SAR (on 5m grid; original accuracy ± 1.0m), processed to remove buildings & vegetation, then combined on a 2m grid; buildings added with an arbitrary height of 5m based on OS MasterMap 2009 building footprints, then resampled to a 5m grid DTM. Manual edits applied where flow paths clearly omitted e.g. below bridges. • Flow routes dictated by topography; a uniform allowance of 12mm/hr has been made for manmade drainage in urban areas. Infiltration allowance reduces runoff to 39% in rural areas and 70% in urban areas. • Areas that may flood are defined by dynamically routing a 1.1 hour duration storm with 1 in 200 chance of occurring in any year over the DTM using JBA's JFLOW–GPU model. • Manning's n of 0.1 in rural areas; 0.03 in urban areas, to reflect explicit modelling of buildings in urban areas. • No allowance made for local variations in drainage, pumping or other works constructed for the purpose of flood risk management. • The '>0.3m' layer shows where modelled flooding is greater than 0.3m deep.
	8	• Areas Susceptible to Groundwater Flooding (AStGWF) is a strategic scale map showing groundwater flood areas on a 1km square grid • This data has used the top two susceptibility bands of the British Geological Society (BGS) 1:50,000 Groundwater Flood Susceptibility Map, which was developed on a 50m grid from: • NEXTMap 5m grid DTM. • National Groundwater Level data on a 50m grid • BGS 1:50 000 geological mapping, with classifications of permeability • It covers consolidated aquifers (chalk, limestone, sandstone etc.) and superficial deposits. • Flood plains are not explicitly identified; the mapping identifies where groundwater is likely to emerge, and not where the water is subsequently likely to flow or pond. • No allowance is made for engineering works, or for groundwater rebound or abstraction to prevent groundwater rebound. • Shows the proportion of each 1km grid square which is susceptible to groundwater emergence, using four area categories.
	9	• Modelling developed from combination of national (2004) and local (generally 1998-2010) modelling. • Topography derived from LIDAR (on 0.25m-2m grids; original accuracy ± 0.15m), NEXTMap SAR (on 5m grid; original accuracy ± 1.0m), processed to remove buildings & vegetation. For local modelling, topography may include ground survey. • Location of watercourses and tidal flow routes dictated by topographic survey. • Areas that may flood are defined for catchments >3km² by routing appropriate flows for that catchment through the model to ascertain water level and thus depth and extent. • Manning's n of 0.1 used for national fluvial modelling; variable (calibrated) values for national tidal modelling; appropriate values selected for local modelling. Channel capacity assumed as QMED for national fluvial modelling; local survey methods used for local modelling. • For the purpose of flood risk management, models assume that there are no raised defences.
	10	• Modelling developed from combination of national (2004) and local (generally 2004-2010) modelling. • Topography derived from LIDAR (on 0.25m-2m grids; original accuracy ± 0.15m), NEXTMap SAR (on 5m grid; original accuracy ± 1.0m), processed to remove buildings & vegetation. For local modelling, topography may include ground survey. • Location of watercourses and tidal flow routes dictated by topographic survey. • Areas that may flood are defined for catchments >3km² by routing appropriate flows for that catchment through the model to ascertain water level and thus depth and extent. • Manning's n of 0.1 used for national fluvial modelling; variable (calibrated) values for national tidal modelling; appropriate values selected for local modelling. Channel capacity assumed as QMED for national fluvial modelling; local survey methods used for local modelling. • For the purpose of flood risk management, models assume that there are no raised defences.

Flood ID	Name of Location	National Grid Reference	Location Description	Name	Flood modelled	Probability	Main source of flooding	Additional source(s) of flooding	Confidence in main source of flooding	Main mechanism of flooding	Main characteristic of flooding
Mandatory	**Mandatory**	**Mandatory**	Optional	Optional	Optional	**Mandatory**	**Mandatory**	Optional	Optional	**Mandatory**	**Mandatory**
Unique number between 1-9999	Max 250 characters	12 characters: 2 letters, 10 numbers	Max 250 characters	Max 250 characters	Max 250 characters	Max 25 characters	Pick from drop-down	Max 250 characters, same source terms	Pick from drop-down	Pick from drop-down	Pick from drop-down
A sequential number starting at 1 and incrementing by 1 for each record.	Name of the locality associated with the flood, using recognised postal address names such as streets, towns, counties. If the flood affects the whole LLFA, then record the name of the LLFA.	National Grid Reference of the centroid (centre point, falls within polygon) of the flood extent, or of the area affected if there is no extent information. If the flood affects the whole LLFA, then record the centroid of the LLFA.	A description of the general location that could be flooded.	Name of the model or map product or project which produced the future flood information	Background, or additional information on the probability of the flood modelled - such as whether Probability refers to probability of rainfall or water on the ground.	The chance of the flood occuring in any given year - record X from "a 1 in X chance of occurring in any given year".	Pick the source which generates the majority of flooding. Refer to the PFRA guidance for definitions of sources.	If the flood is generated by, or interacts with, any other sources (other than the Main source of flooding), report the source(s) here, using the same source terms.	Pick a broad level of confidence in the Main source of flooding from; 'High' (compelling evidence of source - about 80% confident that source is correct), 'Medium' (some evidence of source but not compelling - about 50% confident that source is correct) 'Low' (source assumed - about 20% confident that source is correct) or 'Unknown'.	Pick a mechanism from; 'Natural exceedance' (of capacity), 'Defence exceedance' (floodwater overtopping defences), 'Failure' (of natural or artificial defences or infrastructure, or of pumping), 'Blockage or restriction' (natural or artificial blockage or restriction of a conveyance channel or system), or 'No data'.	Pick a characteristic from; 'Flash flood' (rises and falls quite rapidly with little or no advance warning), 'Natural flood' (due to significant precipitation, at a slower rate than a flash flood), 'Snow melt flood' (due to rapid snow melt), 'Debris flow' (conveying a high degree of debris), or 'No data'. Most UK floods are 'Natural floods'.
1	Warwickshire	SP3301167022	Low lying ground and flow paths.	Areas Susceptible to Surface Water Flooding (AStSWF) - Less	Probability refers to the probability of the rainfall event. This identifies areas which are 'less susceptible' to surface water flooding. For more information refer to "What are Areas Susceptible to Surface Water Flooding" Environment Agency December 2010.	200	Surface runoff		High	Natural exceedance	Natural flood
2	Warwickshire	SP3301167022	Low lying ground and flow paths.	Areas Susceptible to Surface Water Flooding (AStSWF) - Intermediate	Probability refers to the probability of the rainfall event. This identifies areas with 'intermediate susceptibility' to surface water flooding.	200	Surface runoff		High	Natural exceedance	Natural flood
3	Warwickshire	SP3301167022	Low lying ground and flow paths.	Areas Susceptible to Surface Water Flooding (AStSWF) - More	Probability refers to the probability of the rainfall event. This identifies areas which are 'more susceptible' to surface water flooding.	200	Surface runoff		High	Natural exceedance	Natural flood
4	Warwickshire	SP3301167022	Low lying ground and flow paths.	Flood Map for Surface Water (FMfSW) - 1 in 30	Probability refers to the probability of the rainfall event, in this case producing flooding of greater than 0.1m depth.	30	Surface runoff		High	Natural exceedance	Natural flood
5	Warwickshire	SP3301167022	Low lying ground and flow paths.	Flood Map for Surface Water (FMfSW) - 1 in 30 deep	Probability refers to the probability of the rainfall event, in this case producing flooding of greater than 0.3m depth.	30	Surface runoff		High	Natural exceedance	Natural flood
6	Warwickshire	SP3301167022	Low lying ground and flow paths.	Flood Map for Surface Water (FMfSW) - 1 in 200	Probability refers to the probability of the rainfall event, in this case producing flooding of greater than 0.1m depth.	200	Surface runoff		High	Natural exceedance	Natural flood
7	Warwickshire	SP3301167022	Low lying ground and flow paths.	Flood Map for Surface Water (FMfSW) - 1 in 200 deep	Probability refers to the probability of the rainfall event, in this case producing flooding of greater than 0.3m depth.	200	Surface runoff		High	Natural exceedance	Natural flood
8	Warwickshire	SP3301167022		Areas Susceptible to Groundwater Flooding (AStGWF)	Does not describe a probability, but shows places where groundwater emergence more likely to occur.	Unknown	Groundwater		High	Natural exceedance	Natural flood
9	Warwickshire	SP3301167022	Floodplains of Ordinary Watercourses	Flood Map (for rivers and sea) - flood zone 3	Fluvial 1 in 100, tidal 1 in 200	100	Ordinary Watercourses		Medium	Natural exceedance	Natural flood
10	LLFA to complete	SP3301167022	Floodplains of Ordinary Watercourses	Flood Map (for rivers and sea) - flood zone 2	Extreme flood outline is 1 in 1000, and includes some historic where judged that this gives an indication of areas at risk of future flooding.	1000	Ordinary Watercourses		Medium	Natural exceedance	Natural flood

Flood ID	Significant consequences to human health	Human health consequences - residential properties	Property count method	Other human health consequences	Significant economic consequences	Number of non-residential properties flooded	Property count method	Other economic consequences	Significant consequences to the environment	Environment consequences	Significant consequences to cultural heritage	Cultural heritage consequences
Mandatory	**Mandatory**	Optional	Optional	Optional	**Mandatory**	Optional	Optional	Optional	**Mandatory**	Optional	**Mandatory**	Optional
Unique number between 1-9999	Pick from drop-down	Number between 1-10,000,000	Pick from drop-down	Max 250 characters	Pick from drop-down	Number between 1-10,000,000	Pick from drop-down	Max 250 characters	Pick from drop-down	Max 250 characters	Pick from drop-down	Max 250 characters
A sequential number starting at 1 and incrementing by 1 for each record.	Would there be any significant consequences to human health if the future flood were to occur?	Record the number of residential properties where the building structure would be affected either internally or externally if the flood were to occur.	Where residential or non-residential properties have been counted, it is important to record the method of counting, to aid comparisons between counts. Choose from; 'Detailed GIS' (using property outlines, as per Environment Agency guidance), 'Simple GIS' (using property points), 'Estimate from map', or 'Observed number'.	If there would be other Significant consequences to human health, describe them including information such as the number of critical services flooded.	Would there be any significant economic consequences if the future flood were to occur?	Record the number of non-residential properties where the building structure would be affected either internally or externally if the flood were to occur.	Where residential or non-residential properties have been counted, it is important to record the method of counting, to aid comparisons between counts. Choose from; 'Detailed GIS' (using property outlines, as per Environment Agency guidance), 'Simple GIS' (using property points), 'Estimate from map', or 'Observed number'.	If there would be other Significant economic consequences, describe them including information such as the area of agricultural land flooded, length of roads and rail flooded.	Would there be any significant consequences to the environment if the future flood were to occur?	If there would be Significant consequences to the environment, describe them including information such as national and international designated sites flooded, and pollution sources flooded.	Would there be any significant consequences to cultural heritage if the future flood were to occur?	If there would be Significant consequences to cultural heritage, describe them including information such as the number and type of heritage assets flooded.
1	Yes	34,900	Detailed GIS	43 Schools 24 Hospitals and Medical Centres 43 Nursing/Care/Retirement 2 Police Stations 8 Ambulance and Fire Stations 214 Sewage Treatment Works (MCM code 840) 297 Electricity Installations (MCM code 960)	Yes	12,900	Detailed GIS	22,600ha of agricultural land (Grades 1, 2 and 3) 270km Road (Grades A, B and Motorway) 60km Railway	Yes	8 PPC sites	Yes	787 Listed Buildings 583ha Registered Parks and Gardens
2	Yes	13,200	Detailed GIS	17 Schools 13 Hospitals and Medical Centres 233 Nursing/Care/Retirement 1 Police Stations 8 Ambulance and Fire Stations 122 Sewage Treatment Works (MCM code 840) 138 Electricity Installations (MCM code 960)	Yes	5,600	Detailed GIS	12,000 ha of agricultural land (Grades 1, 2 and 3) 120km Road (Grades A, B and Motorway) 30km Railway	Yes	2 PPC sites	Yes	365 Listed Buildings 400ha Registered Parks and Gardens
3	Yes	1,145	Simple GIS	4 Schools 2 Hospitals and Medical Centres 1 Nursing/Care/Retirement 38 Sewage Treatment Works (MCM code 840) 31 Electricity Installations (MCM code 960)	Yes	1,394	Simple GIS	3,000 ha of agricultural land (Grades 1, 2 and 3) 15km Road (Grades A, B and Motorway) 7km Railway	Yes	2 PPC sites	Yes	93 Listed Buildings 31ha Registered Parks and Gardens
4	Yes	6,732	Simple GIS	5 Schools 4 Hospitals and Medical Centres 14 Nursing/Care/Retirement 2 Ambulance and Fire Stations 83 Sewage Treatment Works (MCM code 840) 90 Electricity Installations (MCM code 960)	Yes	5,517	Simple GIS	7,300 ha of agricultural land (Grades 1, 2 and 3) 290km Road (Grades A, B and Motorway) 20km Railway	Yes	2 PPC sites 75ha SSSI/SAC	Yes	305 Listed Buildings 200ha Registered Parks and Gardens
5	Yes	1,422	Simple GIS	1 School 2 Nursing/Care/Retirement 1 Ambulance and Fire Stations 30 Sewage Treatment Works (MCM code 840) 22 Electricity Installations (MCM code 960)	Yes	1,908	Simple GIS	2,000 ha of agricultural land (Grades 1, 2 and 3) 17km Road (Grades A, B and Motorway) 4km Railway	Yes	1 PPC site	Yes	121 Listed Buildings 88ha Registered Parks and Gardens
6	Yes	44,700	Detailed GIS	11 Schools 8 Hospitals and Medical Centres 29 Nursing/Care/Retirement 2 Police Stations 3 Ambulance and Fire Stations 140 Sewage Treatment Works (MCM code 840) 223 Electricity Installations (MCM code 960)	Yes	15,000	Detailed GIS	13,400 ha of agricultural land (Grades 1, 2 and 3) 170km Road (Grades A, B and Motorway) 36km Railway	Yes	3 PPC sites	Yes	554 Listed Buildings 320ha Registered Parks and Gardens
7	Yes	11,900	Detailed GIS	3 Schools 2 Hospitals and Medical Centres 7 Nursing/Care/Retirement 2 Ambulance and Fire Stations 66 Sewage Treatment Works (MCM code 840) 69 Electricity Installations (MCM code 960)	Yes	4,900	Detailed GIS	4,460 ha of agricultural land (Grades 1, 2 and 3) 40km Road (Grades A, B and Motorway) 12km Railway	Yes	1 PPC site	Yes	221 Listed Buildings 160ha Registered Parks and Gardens
8	Yes	23,484	Simple GIS	41 Schools 36 Hospitals and Medical Centres 36 Nursing/Care/Retirement 5 Police Stations 1 Ambulance/Fire Station 61 Sewage Treatment Works (MCM code 840) 249 Electricity Installations (MCM code 960)	Yes	7,727	Simple GIS	7,000 ha of agricultural land (Grades 1, 2 and 3) 115 km Road (Grades A, B and Motorway) 23 km Railway	Yes	4 PPC sites	Yes	1,010 Listed Buildings 241ha Registered Parks and Gardens
9	Yes	704	Simple GIS	1 School 1 Nursing/Care/Retirement 9 Sewage Treatment Works (MCM code 840) 8 Electricity Installations (MCM code 960)	Yes	213	Simple GIS	650 ha of agricultural land (Grades 1, 2 and 3) 25 km Road (Grades A, B and Motorway) 3 km Railway	Yes	8 ha SSSI/SAC	Yes	10 Listed Buildings 23 ha Registered Parks and Gardens
10	Yes	1071	Simple GIS	4 School 1 Nursing/Care/Retirement 9 Sewage Treatment Works (MCM code 840) 12 Electricity Installations (MCM code 960)	Yes	344	Simple GIS	800 ha of agricultural land (Grades 1, 2 and 3) 14 km Road (Grades A, B and Motorway) 3 km Railway	Yes	8.5ha SSSI/SAC	Yes	18 Listed Buildings 25 ha Registered Parks and Gardens

Flood ID	Comments	Data owner	Area flooded	Confidence in modelled outline	Model date	Model Type	Hydrology Type	Lineage	Sensitive data	Protective marking descriptor	European Flood Event Code
Mandatory	Optional	Optional	Optional	Optional	Optional	Optional	Optional	Optional	Optional	Optional	Auto-populated
Unique number between 1-9999	Max 1,000 characters	Max 250 characters	Number with two decimal places	Pick from drop-down	'yyyy' or 'yyyy-mm' or 'yyyy-mm-dd'	Max 250 characters	Max 250 characters	Max 250 characters	Pick from drop-down	Max 50 characters	Max 42 characters
A sequential number starting at 1 and incrementing by 1 for each record.	Any additional comments about the future flood record.		The total area of the land flooded, in km^2	Pick a broad level of confidence in the modelled flood outline from; 'High' (good match to past flood extents - about 80% confident that outline is correct), 'Medium' (reasonable match - about 50% confident that outline is correct), 'Low' (poor match, sparse data - about 20% confident that outline is correct) or 'Unknown'.		Type of software used to create future flood information.	Type of hydrology method used to create future flood information.	Lineage is how and what the data is made from. Has this data been created by using data owned or derived from data owned by 3rd party (external) organisations? If yes please give details.	Has the information been classified under the Government's Protective Marking Scheme? Include protective marking time limit where known. Note: If "Approved for Access" then report "Unmarked".	For use where organisations apply the Government's Protective Marking Scheme.	This field will autopopulate using the LLFA name provided on the "Instructions" tab, and the Flood ID. It is an EU-wide unique identifier and will be used to report the flood information. Format: UK<ONS Code><P or F><LLFA Flood ID>. "ONS Code" is a unique reference for each LLFA. "P or F" indicates if the event is past or future. "LLFA Flood ID" is a sequential number beginning with 0001.
1	Residential and Non Residential property counts from NRD v1.0 (detailed GIS footprint method, provided by EA) All other counts from NRD v1.1 (simple GIS overlay)	JBA Consulting (distributed by Environment Agency under licence)	50,136ha	Low	2009-07	JFLOW-GPU	Depth-duration-frequency curves derived from FEH CD-ROM, from centre of each 5km model, with areal reduction factor applied to convert point rainfall estimate to more representative figure. Curve then used to derive 6.5 hr, 1:200 chance rainfall depth; this is converted to hyetograph, using summer rainfall profile.		Protect	Commercial	UKE10000028F0001
2	Residential and Non Residential property counts from NRD v1.0 (detailed GIS footprint method, provided by EA) All other counts from NRD v1.1 (simple GIS overlay)	JBA Consulting (distributed by Environment Agency under licence)	27,583ha	Low	2009-07	JFLOW-GPU	Depth-duration-frequency curves derived from FEH CD-ROM, from centre of each 5km model, with areal reduction factor applied to convert point rainfall estimate to more representative figure. Curve then used to derive 6.5 hr, 1:200 chance rainfall depth; this is converted to hyetograph, using summer rainfall profile.		Protect	Commercial	UKE10000028F0002
3	All counts from NRD v1.1 (simple GIS overlay)	JBA Consulting (distributed by Environment Agency under licence)	6,839ha	Low	2009-07	JFLOW-GPU	Depth-duration-frequency curves derived from FEH CD-ROM, from centre of each 5km model, with areal reduction factor applied to convert point rainfall estimate to more representative figure. Curve then used to derive 6.5 hr, 1:200 chance rainfall depth; this is converted to hyetograph, using summer rainfall profile.		Protect	Commercial	UKE10000028F0003
4	All counts from NRD v1.1 (simple GIS overlay)	Environment Agency	8,822ha	Medium-Low	2010-11	JFLOW-GPU	Depth-duration-frequency curves derived from FEH CD-ROM, from centre of each 5km model, with areal reduction factor applied to convert point rainfall estimate to more representative figure. Curve then used to derive 1.1 hr, 1:30 chance rainfall depth; this is converted to hyetograph, using summer rainfall profile. See "Description of assessment method" for allowances for infiltration and drainage.	Rainfall Hyetograph, EA 2m Composite DTM, OSMM Topography	Unmarked		UKE10000028F0004
5	All counts from NRD v1.1 (simple GIS overlay)	Environment Agency	2,473ha	Medium-Low	2010-11	JFLOW-GPU	Depth-duration-frequency curves derived from FEH CD-ROM, from centre of each 5km model, with areal reduction factor applied to convert point rainfall estimate to more representative figure. Curve then used to derive 1.1 hr, 1:30 chance rainfall depth; this is converted to hyetograph, using summer rainfall profile. See "Description of assessment method" for allowances for infiltration and drainage.	Rainfall Hyetograph, EA 2m Composite DTM, OSMM Topography	Unmarked		UKE10000028F0005
6	Residential and Non Residential property counts from NRD v1.0 (detailed GIS footprint method, provided by EA) All other counts from NRD v1.1 (simple GIS overlay)	Environment Agency	16,580ha	Medium-Low	2010-11	JFLOW-GPU	Depth-duration-frequency curves derived from FEH CD-ROM, from centre of each 5km model, with areal reduction factor applied to convert point rainfall estimate to more representative figure. Curve then used to derive 1.1 hr, 1:200 chance rainfall depth; this is converted to hyetograph, using summer rainfall profile. See "Description of assessment method" for allowances for infiltration and drainage.	Rainfall Hyetograph, EA 2m Composite DTM, OSMM Topography	Unmarked		UKE10000028F0006
7	Residential and Non Residential property counts from NRD v1.0 (detailed GIS footprint method, provided by EA) All other counts from NRD v1.1 (simple GIS overlay)	Environment Agency	5,585ha	Medium-Low	2010-11	JFLOW-GPU	Depth-duration-frequency curves derived from FEH CD-ROM, from centre of each 5km model, with areal reduction factor applied to convert point rainfall estimate to more representative figure. Curve then used to derive 1.1 hr, 1:200 chance rainfall depth; this is converted to hyetograph, using summer rainfall profile. See "Description of assessment method" for allowances for infiltration and drainage.	Rainfall Hyetograph, EA 2m Composite DTM, OSMM Topography	Unmarked		UKE10000028F0007
8	Data developed specifically for PFRA, and is unlikely to be suitable for any other purposes. Property counts undertaken for >75% chance groundwater exceedence only	Environment Agency	10,506ha	Low	2010-11	ArcGIS	Uses data which is developed from published BGS groundwater level contours, groundwater levels in BGS WellMaster database and some river levels. No probability is associated with this data.	British Geological Society (BGS) DiGMapGB-50 [Susceptibility to Groundwater Flooding].	Unmarked		UKE10000028F0008
9	Data updated quarterly. To understand the likelihood of future flooding, taking account of defences, refer to Areas Benefitting from Defences and National Flood Risk Assessment (NaFRA) data. Marked 'Protect' for complete national dataset only.	Environment Agency	777 ha	Medium	2010-11	Varies but mainly JFLOW, ISIS, HEC-RAS, TUFLOW for fluvial, and HYDROF for tidal.	National methodology described in "National Generalised Modelling for Flood Zones - Fluvial & Tidal Modelling Methods - Methodology, Strengths and Limitations". A national dataset (for England and Wales) of fluvial flood peak estimates was derived from the Flood Estimation Handbook (FEH) to generate a 1 in 100 chance fluvial flood. Local fluvial modelling uses FEH methods. Peak tidal water levels from either Dixon & Tawn (DT3) or local data sets to derive 1 in 200 chance tide levels including surge from POL CSX model.	NextMap SAR DTMe, UKHO Admiralty Charts, 1:50K CEH River Centre Line, CEH FEH Q(T) Grids, POL CSX Peak Extreme Water Levels, POL CS3 Astronomical Tides, UKHO Admiralty Tide Time-Series Calibration Locations, OS 1:10 Boundary Line MHW	Protect	Commercial	UKE10000028F0009
10	Data updated quarterly. To understand the likelihood of future flooding, taking account of defences, refer to National Flood Risk Assessment (NaFRA) data. Marked 'Protect' for complete national dataset only.	Environment Agency	969 ha	Medium	2010-11	Varies but mainly JFLOW, ISIS, HEC-RAS, TUFLOW for fluvial, and HYDROF for tidal.	National methodology described in "National Generalised Modelling for Flood Zones - Fluvial & Tidal Modelling Methods - Methodology, Strengths and Limitations". A national dataset (for England and Wales) of fluvial flood peak estimates was derived from the Flood Estimation Handbook (FEH) to generate a 1 in 1000 chance fluvial flood. Local fluvial modelling uses FEH methods. Peak tidal water levels from either Dixon & Tawn (DT3) or local data sets to derive 1 in 1000 chance tide levels including surge from POL CSX model.	NextMap SAR DTMe, UKHO Admiralty Charts, 1:50K CEH River Centre Line, CEH FEH Q(T) Grids, POL CSX Peak Extreme Water Levels, POL CS3 Astronomical Tides, UKHO Admiralty Tide Time-Series Calibration Locations, OS 1:10 Boundary Line MHW, Historic Flood Map	Protect	Commercial	UKE10000028F0010

Annex 3
Records of Flood Risk Areas and Their Rationale

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

Field:	**Flood Risk Area ID**	**Name of Flood Risk Area**	**National Grid Reference**	**Main source of flooding**	Additional source(s) of flooding	Confidence in main source of flooding	**Main mechanism of flooding**	**Main characteristic of flooding**	**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	**Origin of Flood Risk Area**	**Amended Flood Risk Area rationale**	**New Flood Risk Area rationale**	**Rationale detail**	European Flood Risk Area Code
Records begin here:																									

Annex 4
Review Checklist

Preliminary Flood Risk Assessment Checklist

LLFA Name: **Warwickshire County Council**

	Checklist questions	Notes for completion	LLFA	Environment Agency area review	Environment Agency national review
Step 1	**Set up governance and develop partnerships**				
1.1	Have appropriate governance and partnership arrangements been set up?	Refer to section 2.3 of guidance. Governance and partnership arrangements should be to the satisfaction of the LLFA.	Yes		
1.2	Who in the LLFA reviewed the PFRA and when was it done?	Please state the review and approval process and when approval was gained e.g. Officer, Scrutiny Committee, Cabinet. Refer to Section 5 of the guidance.	PETE BONES TO COMPLETE		
Step 2	**Determine appropriate data systems**				
2.1	Has a data management system been established and implemented?	See Annex 5 for information about data standards	Yes		
Step 3	**Collate information on past and future floods and their consequences**				
3.1	Has information been requested from all relevant partners?	See Flood Risk Regulations Part 6 Co-operation.	Yes		
3.2	Are there any gaps in available information? (This could include gaps which could have been filled but weren't, or gaps which couldn't be filled because the information wasn't available)	LLFAs - Are there gaps in certain locations, or for certain events that you are aware of, or for certain sources of flooding (such as groundwater). Respond with Yes/No and provide comments on any missing information. EA Review - Has all available information has been gathered and included?	Yes - Highways Authority information was unavailable within the time scales and additional data is expected from the Local Authorities and Parish Councils at a later date. All this information will be assimilated into the data systems when received.		
Step 4	**Determining locally agreed surface water information**				
4.1	Which dataset (or combination of datasets) has been determined as "locally agreed surface water information"?	LLFAs - Select from drop down. Refer to "Locally agreed surface water information" text box in section 3.5.1 (p.17) of guidance. EA review - Has this been agreed?	Flood Map for Surface Water		
4.2	Has the locally agreed surface water information been clearly stated and presented (on a map) in the Preliminary Assessment Report?	LLFAs - Select Yes/No from drop down list. Refer to "locally agreed surface water information" text box in section 3.5.1 (p.17) of guidance.	Yes		
4.3	If available, what is the total property count for locally agreed surface water information in the LLFA?	If known, please enter the total number of properties at risk in the LLFA.	44700		
4.4	If applicable, has the method for counting properties been described in the Preliminary Assessment Report?	Refer to text box on page 17 of guidance	Yes		
4.5	Has available information on local drainage capacity (where used to inform the determination of locally agreed surface water information) been included in the report?	Refer to text box on page 17 of guidance. Information provided on drainage may inform options for any future improvements to the Flood Map for Surface Water.	N/A		
Step 5	**Complete Preliminary Assessment Report Document**				
5.1	Does the Preliminary Assessment Report cover all the content described in Annex 1 of the Environment Agency's PFRA guidance?	LLFAs - If the Preliminary Assessment Report contains all the content described in Annex 2 of the PFRA guidance, respond with a 'Yes'. If there are some elements missing, please provide a brief explanation. EA Review - Include comments on any missing content.	Yes		
5.2	Has a summary table of flood events been produced?	Refer to section 3.4 and 3.5 of guidance	Yes		
5.3	Has a description of past flood events been included?	Refer to section 3.4 and 3.5 of guidance	Yes		
5.4	Has additional information been included on climate change and long term developments?	Refer to 3.6 of guidance. Standard text has been provided for Preliminary Assessment Reports which meets the minimum requirements of the Flood Risk Regulations. Please respond with Yes or No, and if additional information has been included, please state the information source(s)	Yes - reference to the HS2 development		
Step 6	**Record information on past and future floods with significant consequences in spreadsheet**				
6.1	Are records of past flooding with significant harmful consequences recorded on the Preliminary Assessment Report spreadsheet (Annex 1 of Prelminary Assessment Report) ?	LLFAs - past flooding should be recorded on the spreadsheet and included as Annex 1 of the Preliminary Assessment Report. EA review - Are all the mandatory fields complete?	Yes		
6.2	Are there any past floods with significant harmful consequences that have not been recorded? If so, please explain why not.	LLFAs - Respond with Yes or No. If No, provide additional information e.g. anecdotal information on flood, but not enough evidence to include EA review - Do you agree with LLFA response and comments?	No		
6.3	Have any additional records of future flooding (other than the national dataset information which is already completed) been recorded on the future flooding Preliminary Assessment Report spreadsheet (Annex 2 of Preliminary Assessment Report)	LLFAs - future flooding information should be recorded on the spreadsheet and included as Annex 2 of the Preliminary Assessment Report. EA review - Are all mandatory fields complete?	No		
Step 7	**Illustrate information on past and future floods**				
7.1	Have summary maps been produced for past and future floods?	Refer to section 3.4 and 3.5 of guidance	Yes		
Step 8	**Review indicative Flood Risk Areas**				
8.1	Is your LLFA within an indicative Flood Risk Area?	Indicative Flood Risk Areas were provided to LLFAs by the Environment Agency in December 2010.	No		
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.	N/A		
Step 9	**Identify Flood Risk Areas**				
9.1	Is a Flood Risk Area proposed?	LLFA - select a response from the drop down list and then complete the relevant questions 9.1.1 - 9.1.5. (NB. Indicative Flood Risk Areas can be amended due to Geography, past flooding and/or future flooding.)	No - no Flood Risk Area is proposed (go to question 9.3)		
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			
9.1.2	If changes have been made to the indicative Flood Risk Area because of geography, please identify what changes have been made.	Use the drop down list to identify the reasons for the change. Options are the same as the table on page 26 of the PFRA guidance. EA review - please confirm evidence supports change			
9.1.3	If changes have been made to the indicative Flood Risk Area because of past / historic flooding, please indicate the changes and the reasons why.	LLFA - identify the scale of the changes made e.g. major/minor increase or decrease in size of Flood Risk Area and the source of information used e.g. records of historic flooding. EA review - confirm scale of the changes made and provide indication of confidence in the evidence provided e.g. anecdotal evidence versus detailed report on flooding event.			
9.1.4	If changes have been made to the indicative Flood Risk Areas because of future flooding, please indicate the changes and the reasons why.	LLFA - identify the scale of the changes made e.g. major/minor increase or decrease in size of Flood Risk Area and the source of information used e.g. detailed modelling as part of SWMP. EA review - confirm scale of the changes made and indication of confidence in the evidence			
9.1.5	If a new Flood Risk Area is being proposed, does it meet the Defra / WAG thresholds?	Criteria and thresholds are set out in the Defra/WAG guidance on selecting and reviewing Flood Risk Areas for local sources of flooding EA review - identify the evidence provided to support this and indicate degree of confidence in the evidence.			
9.2	Does the proposed Flood Risk Area include flooding from interactions with main river, reservoirs or the sea?	LLFAs should respond with Yes or No. EA Review - Summarise the location and nature of interactions i.e. river or sea.			
9.3	Has an indicative Flood Risk Area been deleted?	LLFA - Respond with Yes/No and if an indicative Flood Risk Area has been deleted please provide a short description why. EA - confirm the evidence presented to support this is aligned to 'locally agreed surface water information'	No		
Step 10	**Record information including rationale - ONLY COMPLETE IF ANSWER TO 9.1 IS YES**				
10.1	If proposing Flood Risk Areas, have the mandatory fields in the spreadsheet been completed?	LLFAs - the spreadsheet indicates mandatory columns to be completed. EA Review - Are all mandatory fields complete?			
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			

Annex 5
GIS Layer of Flood Risk Areas

[Not Applicable to Warwickshire]

Annex 6
Sources of Flooding

Sources of Flooding (taken from Box 2, Page 3 of the PFRA Final Guidance)

Main river – watercourses legally defined and marked as such on the main river map. Generally they are larger streams or rivers, but can be smaller watercourses. The Environment Agency has legal responsibility for them.

The sea – coastal flooding can occur as a result of a combination of high tides and stormy conditions. If low atmospheric pressure coincides with a high tide, a tidal surge may cause serious flooding. We are responsible for managing risk from sea flooding.

Reservoirs – we are responsible for regulating large raised reservoirs under the Reservoirs Act 1975. We currently regulate reservoirs over 25,000 m^3 in capacity. This will reduce to10,000m^3 by the commencement of provisions of the Flood and Water Management Act. Reservoirs below this size are unlikely to present significant flood risks in the context of the Regulations. On this basis there is no need for LLFAs to include information on reservoirs in their PFRAs.

Local flood risk – flood risk from sources other than main rivers, the sea and reservoirs, principally meaning surface runoff, groundwater and ordinary watercourses.

Surface runoff – rainwater (including snow and other precipitation) which is on the surface of the ground (whether or not it is moving), and has not entered a watercourse, drainage system or public sewer. Flooding from surface runoff is sometimes called pluvial flooding. Note that the term 'surface water' is used generically to refer to water on the surface.

Groundwater – water which is below the surface of the ground and in direct contact with the ground or subsoil. It is most likely to occur in areas underlain by permeable rocks, called aquifers. These can be extensive, regional aquifers, such as chalk or sandstone, or may be more local sand or river gravels in valley bottoms underlain by less permeable rocks.

Ordinary watercourse – any river, stream, ditch, cut, sluice, dyke or non-public sewer which is not a main river.

Artificial water bearing infrastructure – includes reservoirs (see above), sewers, water supply systems and canals. Flooding from canals that are non main river should be included in a PFRA. LLFAs do not need to assess flooding from sewers, unless wholly or partly caused by rainwater or other precipitation entering or otherwise affecting the system. Floods of raw sewage caused solely, for example, by a sewer blockage do not fall under the Regulations. The Regulations also do not apply to floods from water supply systems, e.g. burst water mains.

Other – other rare sources of flooding are mentioned in the Floods Directive and include snowmelt and tsunamis. Snowmelt would count as precipitation and so could lead to surface runoff. Tsunamis are a form of flooding from the sea. It is anticipated that that the main focus of LLFAs in their PFRAs will be ordinary watercourses, surface runoff and groundwater.