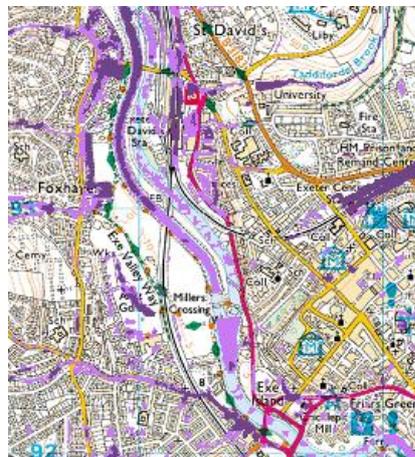


# Devon County Council

## Preliminary Flood Risk Assessment Report

Final Report  
May 2011



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### Contents Amendment Record

This report has been amended as follows:

<b>Issue</b>	<b>Revision</b>	<b>Date</b>	<b>Signed</b>
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## Executive Summary

This report has been prepared to assist Devon County Council (DCC) meet their duties to manage local flood risk and deliver the requirements of the Flood Risk Regulations 2009. DCC, defined as a Lead Local Flood Authority (LLFA) under the Regulations, is a large two tier authority covering eight district, city and borough councils, two national parks, one water company and one internal drainage board (IDB). The Preliminary Flood Risk Assessment (PFRA), comprising this document and the supporting spreadsheet represents the first stage of the requirements of the Regulations.

The PFRA process is aimed at providing a high level overview of flood risk from local flood sources, including surface water, groundwater, ordinary watercourses and canals. As a LLFA, DCC must submit its PFRA to the Environment Agency for review by 22nd June 2011. The methodology for producing this PFRA has been based on the Environment Agency's Final PFRA Guidance and Defra's Guidance on selecting national Indicative Flood Risk Areas, both published in December 2010.

In order to develop a clear overall understanding of the flood risk across Devon, flood risk data and records of historic flooding were collected from approximately 22 different local and national sources including the eight district and borough councils, the Environment Agency, water companies, emergency services and other risk management authorities.

The assessment of past flood risk in Devon has involved collecting information relating to over 5,000 past flood events. These have been analysed, extracting surface water, ordinary watercourse and groundwater flood events. Any records of events in areas now with flood prevention measures and those with any lack of detail have been discounted. A local threshold level was then set to determine the past events considered to have had local significant harmful consequences. This was set at more than 50 properties affected in 1 event, a considerably high threshold, due to the requirement to submit above threshold events in the Annex 1 Preliminary Assessment Spreadsheet at a scale considered significant to report to Europe.

However, it is still noted that many flood events in Devon below the threshold that do not qualify for Annex 1 have had impacts on people's lives and the economy. These are still considered to have been major incidents and locally significant and will therefore still be considered when assessing flood risk across Devon. In addition to this, comprehensive details on flood extents and consequences were largely unavailable from many records, also limiting the number of past events to report in Annex 1.

Future flood risk has been assessed by using nationally set thresholds. The Environment Agency has used a national methodology, which has been set out by Defra, to identify national indicative Flood Risk Areas across England. Of the ten national Indicative Flood Risk Areas that have been identified, none are located within DCC's administrative area.

However, it must be emphasised that there is a high risk of flooding from local sources across Devon, particularly from surface water. Based on national surface water modelling approximately 30,800 residential properties are estimated to be at risk from surface water flooding to a depth of greater than 0.3m during a rainfall event with a 1 in 200 (0.5%) annual chance of occurring.

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## Abbreviations

Acronym	Definition
AStSWF	Areas Susceptible to Surface Water Flooding
AStGWF	Areas Susceptible to Groundwater Flooding
DCC	Devon County Council
Defra	Department for Environment, Food and Rural Affairs
DRN	Digital River Network
CoP	Communities of Practice
CFMP	Catchment Flood Management Plan
CSM	Customer Service Management
EA	Environment Agency
EC	European Commission
FRIS	Flood Reconnaissance Information System
FMfSW	Flood Map for Surface Water
FWMA	Flood & Water Management Act 2010
GHG	Greenhouse Gas
GIS	Geographical Information Systems
IDB	Internal Drainage Board
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NFCDD	National Flood and Coastal Defence Database
NRD	National Receptors Database
PPS25	Planning and Policy Statement 25: Development and Flood Risk
PFRA	Preliminary Flood Risk Assessment
RFDC	Regional Flood Defence Committee
SAB	SuDS Approving Body
SFRA	Strategic Flood Risk Assessment
SPA	Special Protection Areas
SAC	Special Areas of Conservation
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage Systems

# 1 Introduction

This document reports the findings of research undertaken by Devon County Council (DCC) towards the preparation of a Preliminary Flood Risk Assessment (PFRA) for its administrative area (this excludes the unitary authorities of Torbay and Plymouth).

The chief drivers behind this research and preparation of the PFRA report are two sets of new legislation: the Flood Risk Regulations, which came into force on the 10th December 2009; and the Flood & Water Management Act (FWMA) which gained Royal Assent on the 8th April 2010. Under these pieces of legislation, all Unitary Authorities, and in two-tier systems, all County Councils, including DCC, are designated a Local Lead Flood Authority (LLFA) and have formally been allocated a number of key responsibilities with respect to local flood risk management. A full description of these responsibilities is provided in Chapter 2.

The purpose of the Flood Risk Regulations was to transpose the EC Floods Directive<sup>1</sup> into domestic law in England and Wales and to implement its provisions. In particular it places duties on the Environment Agency and LLFAs to prepare a number of documents including:

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

Table 1-1 shows the elements of work required from DCC under the Flood Risk Regulations 2009, along with the timescales of their respective delivery. The first two elements of work, highlighted below, are covered by the preparation of this PFRA report. The further elements of work are not required to be undertaken as DCC has no national Flood Risk Areas that meet the national criteria of 30,000 people at risk. However any data gathered will be used to support and inform the preparation of Devon's Local Strategy for Flood Risk Management, which will be the next stage of legislation to progress. Section 4.3 explains the difference between the national Flood Risk Area thresholds used and those used to determine locally significant past flood events in Devon.

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

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

<sup>1</sup> Directive 2007/60/EC on the assessment and management of flood risk

## 1.1 Scope of PFRA Report

The PFRA exercise is a high level screening process, to gather local and national information in order to describe both the probability and harmful consequences of past and potential future flooding.

As a LLFA, DCC is responsible for assessing potential flood risk from:

- Surface water (see definition in Table 1-2);
- Ordinary watercourses;
- Groundwater; and
- Canals

Flooding associated with the sea, main rivers and reservoirs is the responsibility of the Environment Agency and therefore does not need to be considered by LLFAs as part of the PFRA, unless it is considered to interact with and affect flooding from the local sources listed above.

**Table 1-2** Environment Agency Definition of Surface Water Flooding

*'A surface water flood event that results from rainfall generated overland flow before the runoff enters any watercourse or sewer. Usually associated with high intensity rainfall (typically >30mm/hr) resulting in overland flow and ponding in depressions in the topography, but can also occur with lower intensity rainfall or melting snow where the ground is saturated, frozen, developed or otherwise has low permeability. Urban underground sewerage/drainage systems and surface watercourses may be completely overwhelmed, preventing drainage. Surface water flooding does not include sewer surcharge in isolation.'*

## 1.2 Aims and Objectives

The aim of this report is to review all of the existing flood risk information available from the LLFA and partner organisations, consisting of data on local historic flood events, flood probabilities and harmful consequences of flood events on the economy, environment and cultural heritage. This data collection exercise will then enable national surface water flood risk models to be verified and to ultimately identify areas of flood risk within the LLFA area, whilst supporting the local strategy for flood risk management.

Objectives of the PFRA report:

- To consider the systems to be used in order to collect, store and share flood risk data, considering the quality assurance, security and licensing arrangements.
- To propose arrangements for the management and maintenance of flood risk data with partner organisations.
- To assess historic flood risk within the DCC region, highlighting significant events and the harmful consequences of similar events if they were to occur in the present day.
- To assess the harmful consequences of possible future flood events within the DCC region considering climate change effects.
- To review the default nationally significant Indicative Flood Risk Areas provided by the Environment Agency
- To propose any further or amended national areas of flood risk to the Environment Agency with supporting information.

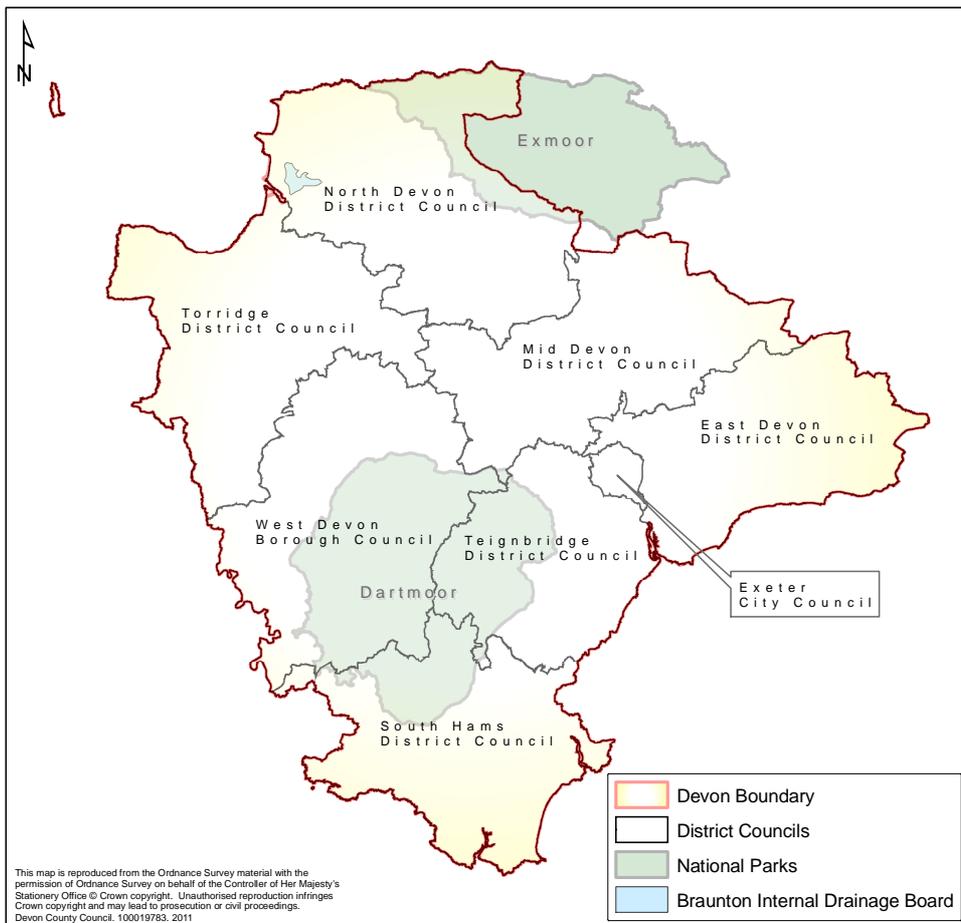
### 1.3 Study Area of Devon County Council

The third largest county in the country, Devon boasts an extraordinary environment. An environment of contrasts, with two coasts, two world heritage sites and two national parks. The local economy features both areas of above average productivity and those which are well below the national average.

This is a time of major development and regeneration across the county, and current projects include an expanding airport and a regionally significant employment park. The total road length of the county is some 8,000 miles. Indeed, Devon is the authority with the longest highway network in the country.

DCC's local flood risk responsibilities cover Devon, excluding the unitary local authorities of Plymouth City Council and Torbay Council. However, hydrological processes do not adhere to administrative boundaries and so processes occurring in these areas will also affect the DCC area of responsibility and in return DCC is responsible for outside of its area. The PFRA for DCC falls into the region of the South West river basin district and The Catchment Flood Management Plans (CFMPs) within Devon cover the catchments of: Exeter; East Devon; North Devon; South Devon; and the Tamar catchment. Figure 1-1 shows the extent of DCC's administrative boundaries.

Detailed information on the Landscape Character Zones, Topography, Climate and Settlement pattern for Devon can be found in the DCC Mineral and Development Framework Strategic Flood Risk Assessment (SFRA)<sup>2</sup>.



**Figure 1-1** Devon County Council administrative area.

<sup>2</sup> Devon County Minerals Development Documents: Strategic Flood Risk Assessment, September 2007

## 2 Lead Local Flood Authority Responsibilities

### 2.1 Introduction

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

**Table 2-1** New Responsibilities for Managing Flood Risk (Environment Agency guidance<sup>3</sup>)

*The regulations define new responsibilities for flood risk management based on the recommendations of the Pitt review. These are consistent with the Flood and Water Management Act. Below summarises the key terminology and responsibilities:*

**Environment Agency** – the competent authority for managing risk from main rivers, the sea and large raised reservoirs.

**Lead Local Flood Authority** – responsible for managing local flood risk in particular from ordinary watercourses, surface runoff and groundwater. In relation to England, the LLFA is the unitary authority for the area, or if there is no unitary authority, the county council.’

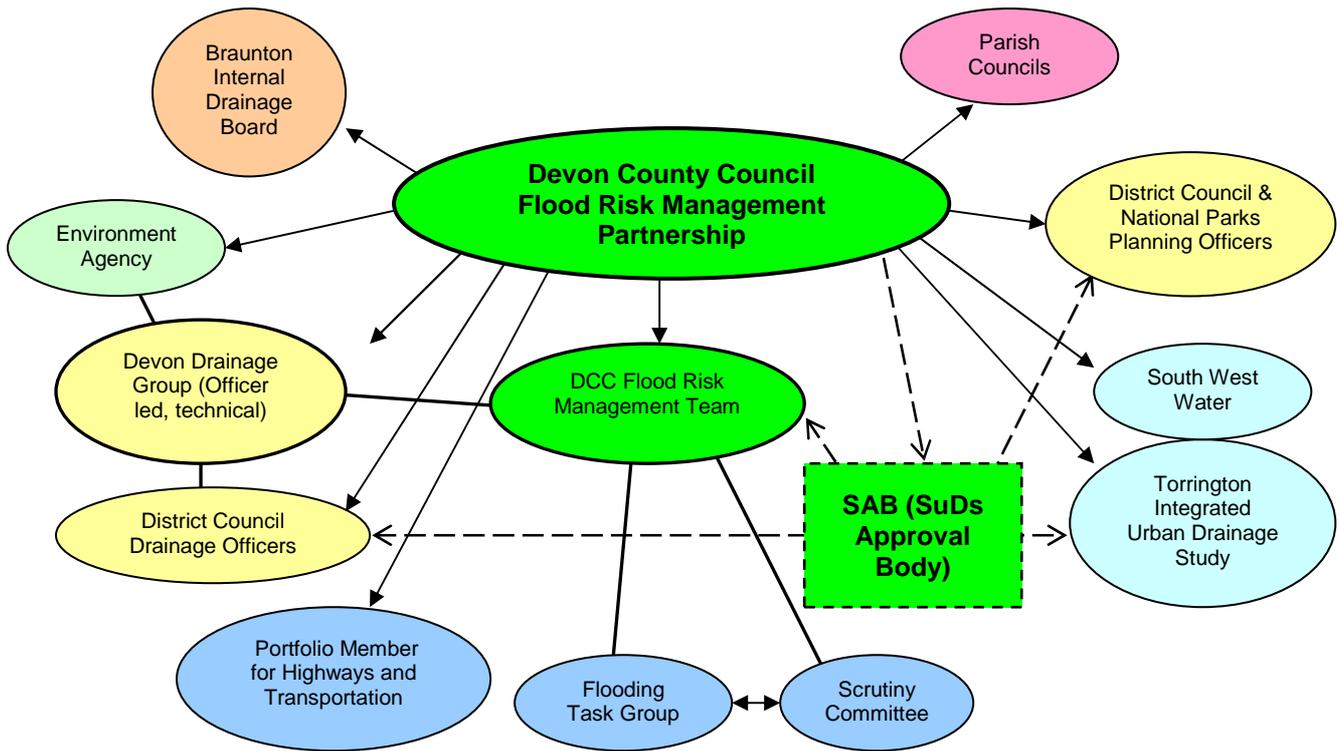
Much of the local knowledge and technical expertise necessary for DCC to fulfil their duties as LLFA lies with the District and Borough councils and other partner organisations. It is therefore crucial that DCC works alongside these groups and organisations as they undertake their responsibilities to ensure effective and consistent management of local flood risk throughout the county and to contribute to the provision of a coordinated and holistic approach to flood risk management across the study area.

### 2.2 Governance and Partnership Arrangements

Figure 2-1 shows the current arrangements for DCC and its local flood risk partners. This is currently an informal arrangement but shows the extent of partners involved in local flood risk management. This importance of working together is highlighted in The Flood Risk Regulations 2009, Regulation 35 and The Flood and Water Management Act 2010, Section 12, which both require relevant authorities to cooperate with one another.

A partnership arrangement through the Devon Drainage Group, also shown within Figure 2-1 has already seen collaborative working towards the data collection and management requirements of the PFRA.

<sup>3</sup> Environment Agency Preliminary Flood Risk Assessment Final Guidance, December 2010, pg 2.



**Figure 2-1** Current Devon Flood Risk Management Partnership arrangements (current arrangements with SAB yet to be established)

### 2.3 Communication with Partners and the Public

Communication with partners is explained in section 2.2 with the Devon Drainage Group and the other relevant “Risk Management Authorities”. It is proposed that local flood risk information is communicated to the public and other authorities through the DCC website using an ArcGIS server, where the public will be free to explore the data themselves. The aim of this exercise will be to provide as much relevant information online in order to maintain consistency of information communicated to the public and ease of access. It is also envisaged that the flood risk data will be available to local flood risk partners, including the planning authorities, where organisations can submit new data through DCC in order to ensure that the information is up to date and accurate.

A Communities of Practice (CoP)<sup>4</sup> group, entitled “Devon Flood Risk Management Partnership” has been set up to allow for collaborative and secure space to share experiences and solutions and develop ideas. This group will allow for network opportunities, discussion forums, a document storage facility and more for the Devon Flood Risk Management Partnership.

### 2.4 Public Engagement

It is recognised that members of the public may also have valuable information to contribute to the PFRA and to local flood risk management more generally across Devon. Therefore the Parish councils have been consulted via a survey process to highlight and validate surface water drainage issues across Devon. Currently the return rate for the parish surveys is 20%. However, some late returns are still being received.

<sup>4</sup> Communities of practice for local government is a website that supports collaboration across local government and the public sector. It is a freely accessible resource, supported by collaboration tools that encourage knowledge sharing and learning from each others’ experiences.

## 2.5 Further Responsibilities

Aside from forming partnerships and coordinating and leading on local flood management, there are a number of other key responsibilities that have arisen for LLFAs from the FWMA and the Flood Risk Regulations. These responsibilities include:

- **Investigating flood incidents** – LLFAs have a duty to investigate and record details of significant flood events within their area. This duty includes identifying which authorities have flood risk management functions and what they have done or intend to do with respect to the incident, notifying risk management authorities where necessary and publishing the results of any investigations carried out. Further information with respect to this duty is provided in Chapter 8.
- **Asset Register** – LLFAs also have a duty to maintain a register of structures or features which are considered to have an effect on flood risk, including details on ownership and condition as a minimum. The register must be available for inspection and the Secretary of State will be able to make regulations about the content of the register and records.
- **SuDS Approving Body** – LLFAs are designated as the SuDS Approving Body (SAB) for any new drainage system, and therefore must approve, adopt and maintain any new sustainable drainage systems (SuDS) within their area.
- **Local Strategy for Flood Risk Management** – LLFAs are required to develop, maintain, apply and monitor a local strategy for flood risk management in its area. The local strategy will build upon information such as national risk assessments and will use consistent risk based approaches across different local authority areas and catchments.
- **Works powers** – LLFAs have powers to undertake works to manage flood risk from surface runoff and groundwater, consistent with the local strategy for flood risk management for the area.
- **Designation powers** – LLFAs, as well as district councils and the Environment Agency have powers to designate structures and features that affect flooding or coastal erosion in order to safeguard assets that are relied upon for flood or coastal erosion risk management.

## 3 Methodology and Data Review

### 3.1 Introduction

The PFRA is a high-level screening exercise used to identify areas where the risk of flooding is considered to be significant and warrants further examination and management through the production of flood risk and flood hazard maps and flood risk management plans.

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

### 3.2 Methodology

Gathering information and data from the local partners has involved structured meetings with each individual stakeholder organisation and survey questionnaires to gain an overview of the data available to DCC, detailed in an internal report<sup>5</sup>. A PFRA workshop has been conducted consisting of the County, District, City, Borough Councils, Environment Agency and South West Water representatives. This has provided an opportunity to discuss the data and information to be shared between all of the local organisations involved.

There are various published flood risk management reports, including the region's Strategic Flood Risk Assessments, Regional Flood Risk Appraisal, Catchment Flood Management Plans, River Basin Management Plan, Shoreline Management Plans, Multi Agency Flood Plan and additional information from National Parks. These have been interrogated in a local flood risk management policy review<sup>6</sup> in order to retrieve information on current and past flood risk in the DCC region.

ArcGIS software has been used in order to map the local flood risk using national and local data sets from local flood risk stakeholders.

Partner organisations have been contacted and relevant flood risk data requested in order to assist with the PFRA exercise. Table 3-1 and Table 3-2 detail the available data and information gathered from local flood risk stakeholders, in addition to any issues with access and the collation of this data.

The following organisations were also approached to provide any available data: National Parks; Network Rail; Braunton Internal Drainage Board; Navigation & Harbour Authorities; and Devon and Somerset Fire and Rescue.

In addition, all Parish and Town councils were approached directly to provide data on past flooding. This data was found not to provide any events of a significant national interest but will be used to inform Devon's Local Strategy for Flood Risk Management as required by the FWMA (see Section 2.5).

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<sup>5</sup> Devon County Council internal report, Investigation into the Impact on Devon County Council of the Introduction of the Flood Risk Regulations 2009, September 2010

<sup>6</sup> Devon County Council internal report, Policy Review, November 2010

**Table 3-1** Partner organisations and their available data.<sup>7</sup>

Partner Organisation and Available Data	Any Availability, Limitations, Data Storage and Data Licensing Issues
<b>Devon County Council:</b> Details held on local flood events through the Customer Service Management system (CSM), consisting of reports of flooding of private properties, flooding of roads and blocked surface water drainage.	Data only able to cover past 5 years. Inconsistent levels of detail recorded.
<b>District Councils:</b> <i>Exeter; West Devon; North Devon; East Devon; Mid Devon; Teignbridge; Torridge; and South Hams.</i>  The flood risk data management methods used across the Districts are inconsistent. Following the local PFRA workshop, a consistent approach for recording future flood events is envisaged. Some historic flooding information has been supplied.	Responses not received from all.  Data formats of spreadsheets and paper records.  Levels of record detail varied across Districts.
<b>Parish and Town Councils:</b> Parish councils where consulted for information regarding local flooding issues by means of a parish survey sent directly to town and parish councils.	20% response from town/parishes in Devon.
<b>Internal Drainage Board (IDB):</b> Braunton Marsh IDB is the only drainage board in Devon. Responsibilities consist of managing water levels for the purpose of livestock farming where the area actually floods very rarely. <sup>8</sup>	IDB consulted and concluded that there is no relevant information held for the PFRA report.
<b>Water Companies:</b> South West Water has supplied DCC with GIS data layers on local surface water flooding incidents and local drainage catchments areas.	Data only to be shared at a postcode level.
<b>Network Rail:</b> The local Network Rail office has an informal flood plan which is updated yearly with information on areas of rail track prone to flooding. The majority of flood risk is from fluvial and tidal sources.	Local office has no spare capacity to retrieve any data for the PFRA at present.
<b>Navigation Authorities:</b> Grand Western Canal (DCC) and Exeter City Ship Canal (Exeter City Council)	There are no records of historic flood events held by the navigation authorities.
<b>Harbour Authorities:</b> Salcombe Harbour; Teignmouth Harbour; Ilfracombe Harbour (North Devon Council); Dart Harbour; and Bideford Harbour (Torridge District Council)	No significant local flood risk issues relevant for this PFRA report.
<b>Natural England:</b> Hold data sets valuable for assessing environmental impacts, such as the location of SSSIs, Special Protection Areas (SPAs) and Special Areas of Conservation (SACs).	Data layers available and downloaded from Natural England website.
<b>Devon and Somerset Fire and Rescue:</b> Data consists of GIS point data of recorded flood incidents.	Data available from the last 2 years.
<b>British Hydrological Society Chronology of British Hydrological Events:</b> An online database including details of historic flood events for catchment areas across the country.	Available to the public.  Details of relevant flood events searched and retrieved.

<sup>7</sup> Except Environment Agency data, please see Table 3.2.

<sup>8</sup> Braunton Marsh Management Study 2007, Manning (2007)

**Table 3-2** GIS data sets available from the Environment Agency via the DataShare website GeoStore<sup>9</sup> and through the local Area Office in Exminster, Devon.

EA Data Layer
<b>Historic Flooding Map:</b> Extent of past flood events from rivers, sea and groundwater.
<b>Flood Event Outlines on the National Flood and Coastal Defence Database (NFCDD):</b> Flood event outline, covering records from all sources of flooding.
<b>Flood Event Maps:</b> Historic records of flood events from paper records, now digitised.
<b>Flood Reconnaissance Information System (FRIS):</b> Information collected after flood events, detailing affected properties and the extent of flooding.
<b>Detailed River Network (DRN):</b> This can display the classifications of rivers to identify main rivers and ordinary watercourses.
<b>National Receptor Dataset (NRD):</b> Includes social, economic, environmental and cultural receptors that could be at risk of flooding, such as residential properties.
<p><b>Flood Map:</b> Extent of flooding from the sea and river catchments over 3km<sup>2</sup> *. Including:</p> <ul style="list-style-type: none"> <li>• Flood Defences</li> <li>• Flood Storage Areas</li> <li>• Areas Benefiting from Flood Defences</li> <li>• Flood Zone 3: Flood extent from rivers with 1% annual probability of occurring and from the sea with 0.5% annual probability.</li> <li>• Flood Zone 2: Flood extent from rivers and the sea with 0.1% annual probability of occurring or largest historic event if a greater extent.</li> </ul> <p>* National policy is to map catchments over 3km<sup>2</sup>, however mapping is available on some smaller watercourses.</p>
<p><b>Areas Susceptible to Surface Water Flooding (AStSWF):</b> Three nationally modelled outline layers.</p> <ul style="list-style-type: none"> <li>• Areas More Susceptible</li> <li>• Areas with Intermediate Susceptibility</li> <li>• Areas Less Susceptible</li> </ul>
<p><b>Flood Map for Surface Water (FMfSW):</b> 2<sup>nd</sup> generation version of the modelled surface water flood maps.</p> <ul style="list-style-type: none"> <li>• 200 year rainfall event &gt;0.1m deep</li> <li>• 200 year rainfall event &gt;0.3m deep</li> <li>• 30 year rainfall event &gt;0.1m deep</li> <li>• 30 year rainfall event &gt;0.3m deep</li> </ul>
<b>Areas Susceptible to groundwater flooding (AStGWF):</b> 1km grid squares showing the risk of groundwater flooding.
<b>Paper Records:</b> Photos, flood reports, newspaper reports and scheme reports available, some of this is digitally available.

<sup>9</sup> Environment Agency's online DataShare service GeoStore, <http://www.geostore.com/environment-agency>

### 3.3 Storing and Sharing Information

In order to ensure acceptable and consistent data storage and sharing standards, a DCC Data Management Plan<sup>10</sup> will be followed, in addition to recording the location, purpose and availability of each data set. Data listed in Table 3-1 and Table 3-2 are stored on secure password protected computers and viewed on ArcGIS where possible. Future data management is also considered so that a system is in place to ensure that the data sets held are updated and maintained to a consistent standard.

### 3.4 Quality Assurance, Security, Data Licensing and Restrictions

Data sets used have been scrutinised in order to highlight any errors, which have then been corrected. Data sharing agreements exist between DCC and partner organisations. These agreements have been followed when presenting information in this PFRA report. Any Environment Agency data used within this report has followed any data licensing and data restriction information supplied with each dataset. Data standards for documents which will be submitted to the Environment Agency have also been followed according to Annex 5 of the PFRA guidance<sup>11</sup>.

A brief assessment of the data collection process is included in this chapter to provide transparency with respect to the methodology. By flagging up the issues identified in the data collection phase it is hoped this could serve as a catalyst to improve the collection of flood risk data from now onwards. A number of issues arose during the data collection process, as described below:

The lack of a consistent flood data recording system across the County, District, City and Borough councils has led to major inconsistencies in the recording of flood event data. This has resulted in incomplete, or sometimes nonexistent, flood record datasets. Further information on addressing this issue in the future is included in Chapter 8. Some of the datasets collated are not exhaustive and it is felt that they are unlikely to represent the complete flood risk issues in a particular area.

It is crucial in flood risk assessment to retain the data collected over long periods of time in order to improve confidence in predicting longer return period events. Therefore DCC will ensure that data sets collected from now on will be retained for long periods, giving a larger range of data and increasing the certainty in assessments made in future.

### 3.5 Scrutiny and Review Process

DCC scrutiny and review procedures involve submitting the PFRA report to the Cabinet Member for Highways and Transportation for approval. Internal review is advised by the guidance to ratify the report prior to formal submission to the Environment Agency on 22 June 2011, as required by the Flood Risk Regulations 2009.

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<sup>10</sup> Devon County Council internal report, Preliminary Flood Risk Assessment (PFRA) Data Management Plan "Living Draft", December 2010

<sup>11</sup> Environment Agency Preliminary Flood Risk Assessment (PFRA), Annexes to the final guidance, 02/03/2011

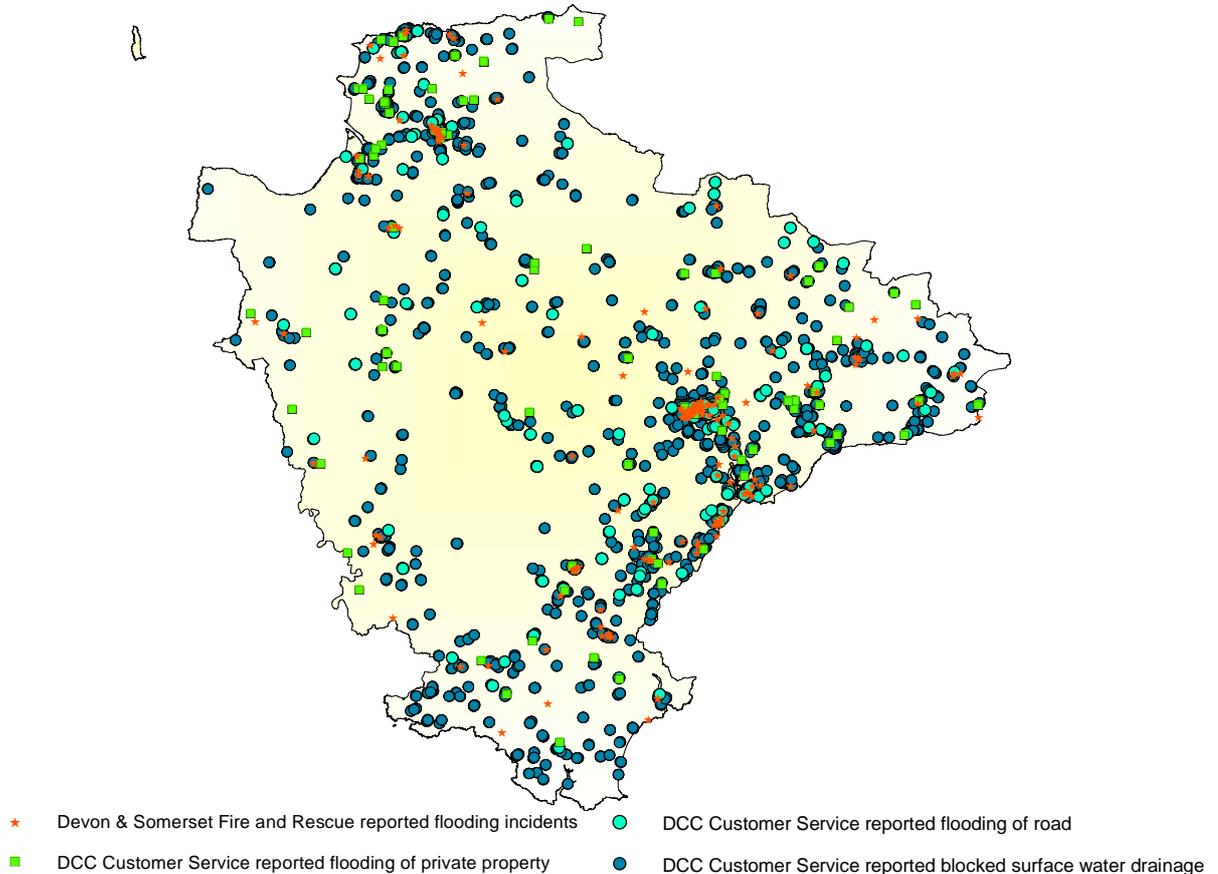
## 4 Past Flood Risk

### 4.1 Summary and Description of Past Flood Risk

There have been many flooding incidents recorded across Devon from surface water and ordinary watercourses, with river and tidal influences often contributing. Although there is a large proportion of agricultural land in Devon which can often contribute to flooding through field runoff, the development and urbanisation across the region over the years also contributes towards increased flood risk, where land management changes are increasing surface runoff rather than retaining water. Past flood records from local partners as described in Tables 3-1 and 3-2 have been collated and analysed. However, records that fit the following criteria have been discounted:

- Records where the main source is from a main river or tidal sources and there is no interaction with local sources.
- Records with uncertainties or without enough detail.
- Records from locations now with improved drainage or defences.

Figure 4-1 to Figure 4-3 show all of the GIS point data gathered of past flood events from the Environment Agency FRIS database, DCC records and Devon and Somerset Fire and Rescue, illustrating the different sources of flooding, prior to the data being analysed and the locally significant flood events extracted. This gives a general idea of the spatial extent of past flood events in Devon, with over 5,000 incidents recorded. Some of the past major flood events in Devon include floods from all sources, such as Lynmouth in 1952; Exeter in 1960; East Devon in 1968; Newton Abbot in 1979; North Devon in 2000; and East Devon in 2008. Significant events have been included in the Annex 1 Preliminary Assessment Spreadsheet.



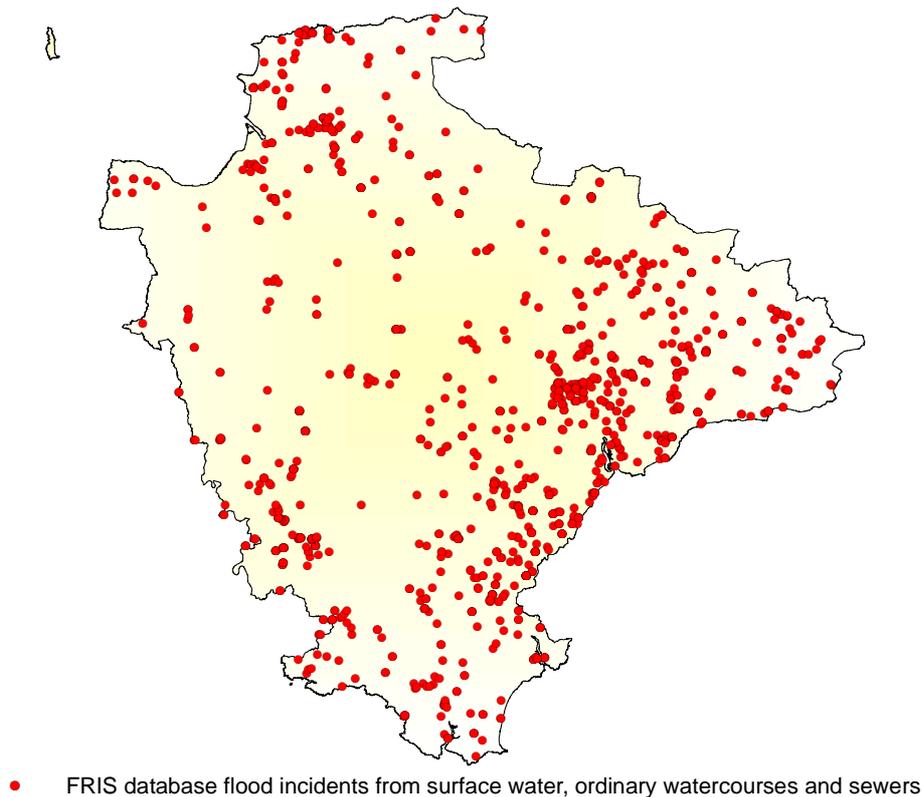
**Figure 4-1** Devon County Council Customer Service System data and Devon and Somerset Fire and Rescue data representing flooding incidents reported across Devon.

#### 4.1.1 Surface Water Flooding

Surface water flooding occurs when heavy rainfall exceeds the capacity of local drainage networks or the permeability of the ground surface or soils, resulting in water flowing across the ground. The majority of surface water flooding incident records have been acquired through the Environment Agency FRIS database. Supporting information was also obtained from the local water company, South West Water of areas known to have flooded due to hydraulic overload of sewers. This indicates areas particularly prone to surface water and has helped to verify the historic records. Fire and Rescue Service data has also contributed to this process in addition to feedback and historic records from local District Councils and information from the CFMPs.

The majority of the significant events reported in the Annex 1 spreadsheet are from surface water runoff. Many of the surface water flooding records although not considered to be nationally significant, are still considered to be significant at a local scale. The records collated show localised areas across Devon that have suffered from surface water flooding over the last 50 years, with towns and villages across Teignbridge, North and East Devon areas in particular. Although these are not reported in detail as part of this PFRA, they will support research for Devon's Local Strategy for Flood Risk Management.

Figure 4-2 illustrates the extent of surface water flooding incidents (including ditch water, sewers and ordinary watercourses) across Devon dating back to the 19<sup>th</sup> century, including a range of different sized events with up to 1,000 incident records. Although this data is not exhaustive, it does represent the spatial pattern of flooding problems for Devon.



**Figure 4-2** Environment Agency FRIS data showing flood incidents across Devon from local sources, surface water, ordinary watercourses and sewers.

#### **4.1.2 Groundwater Flooding**

Groundwater flooding occurs as a result of water rising up from an underlying aquifer or from water flowing from abnormal springs. This tends to occur after long periods of sustained high rainfall, and the areas at most risk are often low-lying where the water table is more likely to be at shallow depth. Groundwater flooding is known to occur in areas underlain by major aquifers, although increasingly it is also being associated with more localised floodplain sands and gravels.

Devon's geology is one of the most varied in the British Isles and this is reflected in the great variety of its landscapes. The geology of Devon consists of sandstones and shale underlying much of the County. Slates, sandstones and volcanics are found in South Devon and Exmoor National Park in North Devon, and granite makes up the majority of Dartmoor National Park in South Devon.

There is limited detailed information available on flood risk from groundwater from historical records. Although groundwater may have been a contributing factor to flood incidents, there are no significant incidents reported in Annex 1 from groundwater flooding as the main source, however, 1 event in Teignbridge is listed with groundwater contributing as an additional source to the flooding.

#### **4.1.3 Sewer Flooding**

Sewer flooding is often caused by excess surface water entering the drainage network. In the historic records analysed, sewer flooding is only occasionally recorded as the main or additional source of flooding. South West Water has provided GIS data points of sewer hydraulic overload spots from the past two decades which have been used to support and verify other historic information and surface water models. However, due to data sharing agreements, these data points are not published in this report. There are 2 significant historic flood events in Annex 1 with sewers listed as an additional source of the flooding, occurring in Ottery St Mary and North Devon.

#### **4.1.4 Canal and Ordinary Watercourse Flooding**

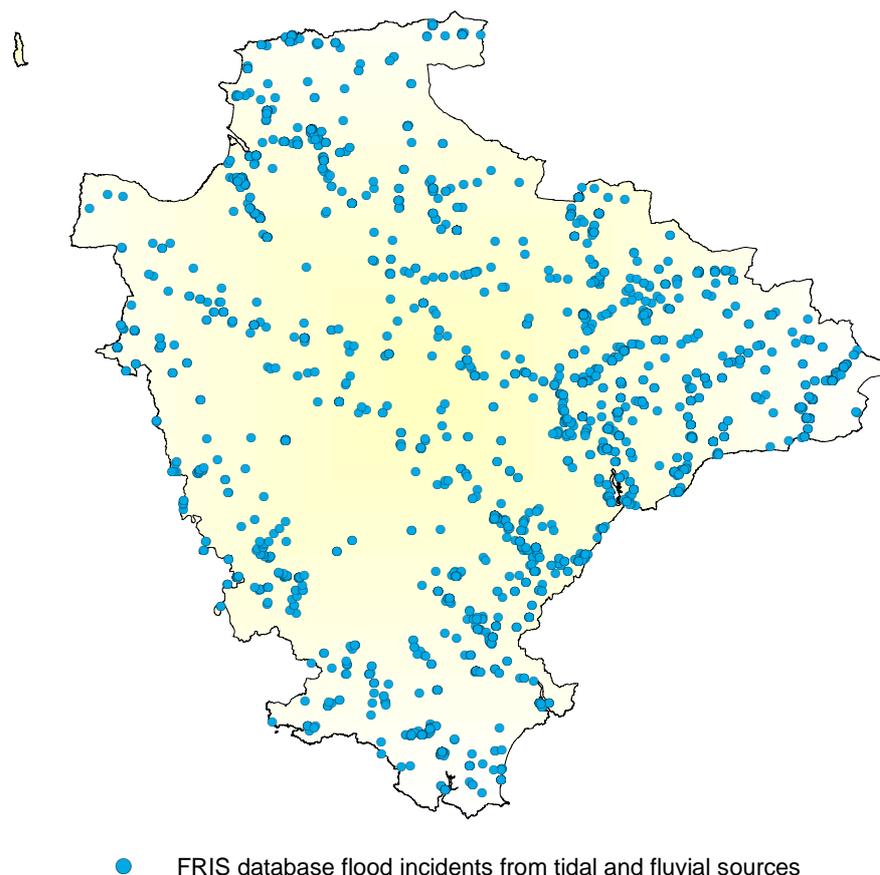
The Navigation Authorities within Devon consist of DCC, responsible for the Grand Western Canal and Exeter City Council responsible for the Exeter City Ship Canal. Canals can attenuate flows and store flood water, however there are no records of historic flood events held by the navigation authorities in Devon. This may require further investigation and form part of the Devon's Local Strategy for Flood Risk Management.

The historic records available on ordinary watercourse flood incidents are from the Environment Agency FRIS database, with additional supporting information from the District Council records supplied. It is not often clear from the records analysed whether the main source of flooding is from a main river or an ordinary watercourse, however, any records with lack of detail on the source of flooding have been omitted. Ordinary watercourses appear as the cause of flooding in localised areas in Devon and are often interacting with surface runoff and main river flooding. Ordinary watercourse is listed in Annex 1 as the main source of flooding for 1 significant historic event in Exeter and as an additional source of flooding for 5 events, occurring in East and North Devon and the Teignbridge area.

#### **4.1.5 Interaction with Main Rivers and the Sea**

There is a large amount of data available from the Environment Agency regarding flooding from the sea and main rivers. Several of the historic flood event records collated have some interaction with either main rivers or the sea. 2 events in Annex 1 list main river as the main source of flooding, with interactions from other local sources contributing.

There are several significant major historical floods that have occurred in Devon over the last 60 years but due to these floods being caused by main rivers and tidal influences, they have not been included in this report. This includes the catastrophic Lynmouth Flood of 1952, the Exeter floods in 1960 and Newton Abbot in 1979. Figure 4-3 illustrates the extent of river and tidal flooding incidents across Devon dating back to the 14<sup>th</sup> century, including a range of different sized events. However, this data may include some ordinary watercourse flooding.



**Figure 4-3** Environment Agency FRIS data showing flood incidents across Devon tidal and fluvial sources.

## 4.2 Significant Harmful Consequences

Annex 1 reports on past flood events from local sources, surface water and ordinary watercourses considered to have had significant harmful consequences to human health, the economy, the environment or cultural heritage. These events reported in Annex 1 are those that exceed the local significance threshold, set by DCC as part of this PFRA exercise. However, it is noted that any flood event that occurs will be significant on some scale to the local community and have a significant impact on people's lives and the economy.

National guidance issued by Defra sets thresholds for defining national Indicative Flood Risk Areas, where the current flood risk is of national significance (30,000 people at risk). However, no guidance has been issued for defining locally significant harmful consequences for the assessment of past flood events and so it is up to each LLFA to set its own definition. It has been suggested by the Environment Agency that the threshold should be an order of magnitude below the significance criteria for determining the national Indicative Flood Risk Areas. They also recommend that, as a minimum, it should involve flooding of a number of properties, on more than one occasion.

Table 4-1 shows a definition of a significant flood event that has been put to the South West Flood Risk Managers Group for discussion, with the objective of achieving a consistent definition for use in all the South West PFRA's.

**Table 4-1** Definition and reasoning set out by South West Flood Risk Managers Group for the definition of local significant past flood event.

<p><b>Definition:</b></p> <p>For the purpose of reporting past floods, a flood is deemed significant if it:</p> <ul style="list-style-type: none"> <li>• Caused internal flooding to five or more residential properties, or</li> <li>• Flooded two or more business premises, or</li> <li>• Flooded one or more items of critical infrastructure, or</li> <li>• Caused a transport link to be totally impassable for a significant period.</li> </ul> <p>The definition of “significant period” is dependant on the transport link affected as follows (Highway categories are as set out in Table 1 of the UKRLG Code of Practice for Highway Maintenance<sup>11</sup>):</p> <ul style="list-style-type: none"> <li>• Category 1 highways (motorways) and major rail links – 2 hours or more</li> <li>• Category 2 and 3a highways and other railway links – 4 hours or more</li> <li>• Category 3b and 4a highways – 10 hours or more</li> <li>• Category 4b highways – 24 hours or more</li> </ul>
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### 4.3 Adopted Method

In order to identify locally significant past flood events in Devon, the methodology and significance criteria outlined in Environment Agency guidance and Table 4-1 has been followed as closely as possible. Data collated for the PFRA exercise in the form of spreadsheet tables, parish council surveys and GIS data points and polygons have been analysed and any records with gaps, uncertainties or lack of detail have been discounted. Records from locations where improved flood defences are now in place have also been ignored, unless the residual risk is still considered to be significant. This however may need further investigation as part of Devon’s Local Strategy for Flood Risk Management. Table 4-2 explains the different criteria assessed in the historic records available to DCC.

**Table 4-2** Local significance criteria assessed and limitations with the historic flood records available.

<p><b>Number of properties flooded:</b> This information is not always given but searches have been made on the data sets using the threshold of 5 or more properties.</p> <p><b>Number of Business Premises flooded:</b> This information is rarely given in flood incident details. However, searches have still been made and any incidents with 2 or more commercial properties affected have been extracted.</p> <p><b>Critical Infrastructure Flooded:</b> Some information can be found in flood incident details of critical infrastructure flooded. However, none of this data is detailed and reliable enough and therefore this criterion has not been assessed. Future data collection of flood incidents will require this information to be recorded more accurately. DCC has made a request for further information on this matter, which it is currently unable to access but the situation is being kept under review.</p> <p><b>Transport link flooded and impassable:</b> Some information can be found in flood incident details of road closures and flooding of roads. However, none of this data is detailed and reliable enough and therefore this criterion has not been assessed. Future data collection of flood incidents will require this information to be recorded.</p> <p><b>Location to have flooded on more than one occasion:</b> For the events recorded it was considered that they were still too significant to be discounted, even if the location had only flooded once.</p>
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<sup>12</sup> UK Roads Liaison Group - Well-maintained Highways, Code of Practice for Highway Maintenance Management

Due to the information recorded in the available historic records, the only significance criterion that was consistently given for all records was the number of residential properties affected. Therefore this was used to rank the remaining flood event records in order of local significance. This process resulted in 31 past local flood event records in Devon with 5 or more properties affected. In addition to this, comprehensive details on flood extents and consequences were largely unavailable from many records, also limiting the number of past event records considered reliable and to therefore be included.

The requirements for populating the Annex 1 Preliminary Assessment Spreadsheet on past flood events are that the flood events should be significant enough for reporting to Europe and that the threshold level should be determined by each individual LLFA. Therefore the threshold set by DCC to determine the 'locally significant' events has been increased from the previously suggested 5, to 50 properties. However, many smaller events affecting less than 50 properties are still considered to have had significant impacts on Devon's economy and people's lives. These smaller events will not qualify for inclusion in the Annex 1 spreadsheet but will form part of Devon's Local Strategy for Flood Risk Management, where the flood risk in those areas will be investigated and assessed more thoroughly.

The choice of 50 or more properties affected in one event has been considered as a reasonable threshold for the purpose of the Annex 1 submission, giving 9 locally significant past flood events in Devon. It was considered to set the threshold at 100 to tie in with the emergency planning thresholds for flood plans. However this would have excluded some events that have had a major impact to communities in Devon. Table 4-3 shows the results of the range of threshold levels considered for the 31 events. Figure 4-4 shows the locations of the 9 locally significant events across Devon and Table 4-4 gives a brief summary of these 9 events to be included in the PFRA Annex 1 spreadsheet submission.

**Table 4-3** Number of locally significant historic flooding records from local sources in Devon for a range of threshold levels.

Significance level threshold (Number of properties affected)	Number of flood event records
5 or more	31
10 or more	20
20 or more	13
30 or more	11
50 or more	9
100 or more	4

**Table 4-4** Summary table of Devon's significant events in Annex 1, for reporting to Europe.

Event Number	Location	Date	Properties Flooded	Main Source	Secondary Source
1	East Devon	29 Oct 2008	334	Surface runoff	Ordinary watercourse +
2	Exeter	19 Jul 1972	174	Ordinary watercourse	Unknown
3	Bideford	26 Dec 1979	160	Surface runoff	Unknown
4	North Devon	13 May 1996	128	Main rivers	Surface runoff & ordinary watercourses +
5	Ottery St Mary	7 Aug 1997	57	Artificial infrastructure	Sewerage
6	Ottery St Mary	30 Sep 1997	57	Main rivers	Surface runoff
7	Teignmouth	1 Dec 1972	54	Surface runoff	Ordinary watercourse and Main rivers
8	Teignbridge	7 Dec 2000	54	Surface runoff	Ordinary watercourse & groundwater
9	Stokeinteignhead	19 Jun 1957	50	Surface runoff	Ordinary watercourse

#### 4.4 Local and National Thresholds

The threshold of 50 properties affected is for the assessment of past local flood events and should not be confused with the national thresholds set for the assessment of future flood risk. Table 4-5 explains the different thresholds, where the local flood risk cluster areas and the national Indicative Flood Risk Areas have been set by Defra for the whole of England. The locally significant past flood event threshold has been set locally by DCC as part of this PFRA exercise. The national Indicative Flood Risk Areas are discussed in detail in chapter 6 and The blue square and cluster areas referred to are shown in Figures 6-1 and 6-2.

**Table 4-5** Definitions of thresholds set and indicators used to determine local and national significant harmful consequences for past and future flood risk assessment.

	<b>Threshold level set by</b>	<b>Number of properties at risk</b>	<b>Number of people at risk</b> (based on number of residential properties x 2.34, the average estimated number of residents per property)	<b>Number of critical services at risk</b> (including schools, hospitals, nursing homes, power and water services)
<b>National Indicative Flood Risk Areas</b> National significance threshold set for the assessment of <u>future flood risk</u> . 'Cluster Areas' that exceed stated thresholds	Defra	–	>30,000	>150
'Cluster Areas' – 3km square that contains 5 or more 'blue squares' that are touching	Defra	5 or more blue squares touching		
'Blue Squares' – 1km grid area	Defra	–	>200	>1
<b>Locally Significant Flood Event</b> DCC significance threshold set for the assessment of <u>past flood events</u> for reporting in Annex 1	<b>DCC</b>	<b>50</b>	–	–
<b>Local Flood Risk Areas</b>	Areas that will form part of Devon's Local Strategy for Flood Risk Management (future work)			



### Devon County Council Preliminary Flood Risk Assessment

#### Locally Significant Past Flood Events from Annex 1 Spreadsheet

Significant events ranked  
by the number of properties  
affected



1. East Devon 29/10/08 -334 properties



2. Exeter 19/07/1972 -174 properties



3. Bideford 26/12/79 -150 properties



4. North Devon 13/05/96 -128 properties



5. Ottery St Mary 7/08/97 -57 properties



6. Ottery St Mary 30/09/97 -57 properties



7. Teignmouth 01/12/72 - 54 properties



8. Teignbridge 7/12/00 -54 properties



9. Stokeinteignhead 19/06/57 -50 properties



District Councils



National Parks

Date:  
11/03/2011

Author:  
Flood Risk Management  
(RR)

Scale:  
1:450,000 @ A3

File:  
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Maps\FRA significant flood events.mxd



Highway Management  
Devon County Council  
Environment, Economy & Culture  
Lucombe House, County Hall  
Exeter, EX2 4QW  
Tel: 01392 382104, Fax: 01392 381459

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Figure 4-4 Past significant events ranked by the number of properties affected



## 5 Future Flood Risk

### 5.1 Future Floods and Their Consequences

The identification of Flood Risk Areas through the PFRA should also take into account future floods, defined as any flood that could potentially occur in the future. The assessment of future flood risk will primarily rely on a technical review of the Environment Agency's Flood Map for Surface Water (FMfSW) which has been recently circulated to LLFAs. The FMfSW uses a numerical hydraulic model to predict the extent of flood risk from two rainfall events (1 in 30 and 1 in 200 annual chance).

The following factors were considered when assessing future flood risk across the Devon study area; topography, location of ordinary watercourses, location of flood plains that retain water, characteristics of watercourses (lengths, modifications), effectiveness of any works constructed for the purpose of flood risk management, location of populated areas, areas in which economic activity is concentrated, the current and predicted impact of climate change and the predicted impact of any long-term developments that might affect the occurrence or significance of flooding, such as proposals for future development.

#### 5.1.1 Surface Water Flooding

The Environment Agency has produced a national assessment of surface water flood risk in the form of two national mapping datasets. The first generation national mapping, Areas Susceptible to Surface Water Flooding (AStSWF), contains three susceptibility bandings for a rainfall event with a 1 in 200 chance of occurring. The national methodology has since been updated to produce the FMfSW, a revised model containing flood extents for two rainfall events (1 in 30 annual chance and 1 in 200 annual chance) and two flood depth bandings (greater than 0.1m and greater than 0.3m). A combination of these models is to be used for assessing the future flood risk in Devon and is explained in section 5.2, regarding 'locally agreed surface water information'.

Annex 2 details the surface water models available and gives figures of the number of properties affected across the whole of Devon under the different model scenarios. However, as a combination of these models is to be used for Devon, property counts will be more appropriate for local areas and communities at risk and will form part of Devon's Local Strategy for Flood Risk Management.

Table 5-1 shows where DCC sits in comparison to other LLFAs that share its border. This shows that Devon is ranked considerably high, at 8 nationally with 43,752 properties at risk of flooding. This ranking is based on properties at risk using the AStSWF model, which is also basis of future funding for LLFAs from Defra.

**Table 5-1** Properties at risk from surface water flooding in Devon County Council, ranked with neighbouring Local Authorities.

National Ranking	Local Authority	Properties at Risk of Surface Water Flooding
8	Devon County	43,752
11	Somerset County	31,004
30	Dorset County	25,526
34	Cornwall	21,907
126	City of Plymouth	4,566
129	Torbay	4,290

#### 5.1.2 Groundwater Flooding

There is little information available on future flood risk to groundwater. Figure 5-2 shows the Environment Agency's dataset, Areas Susceptible to Groundwater Flooding (AStGWF) for the Devon area. This highlights 1km grid areas with different levels of risk to groundwater flooding. Details of properties at risk in Devon according to AStGWF is given in Annex 2, the areas showing high susceptibility broadly tie in with historical flooding data, highway

maintenance and drainage problem areas. However, the areas at risk covers the majority of Devon and therefore a more detailed investigation will be necessary using the percentage bands shown in Figure 5-2, of areas with high susceptibility. This will form part of Devon's Local Strategy for Flood Risk Management to identify areas at risk to prioritise.

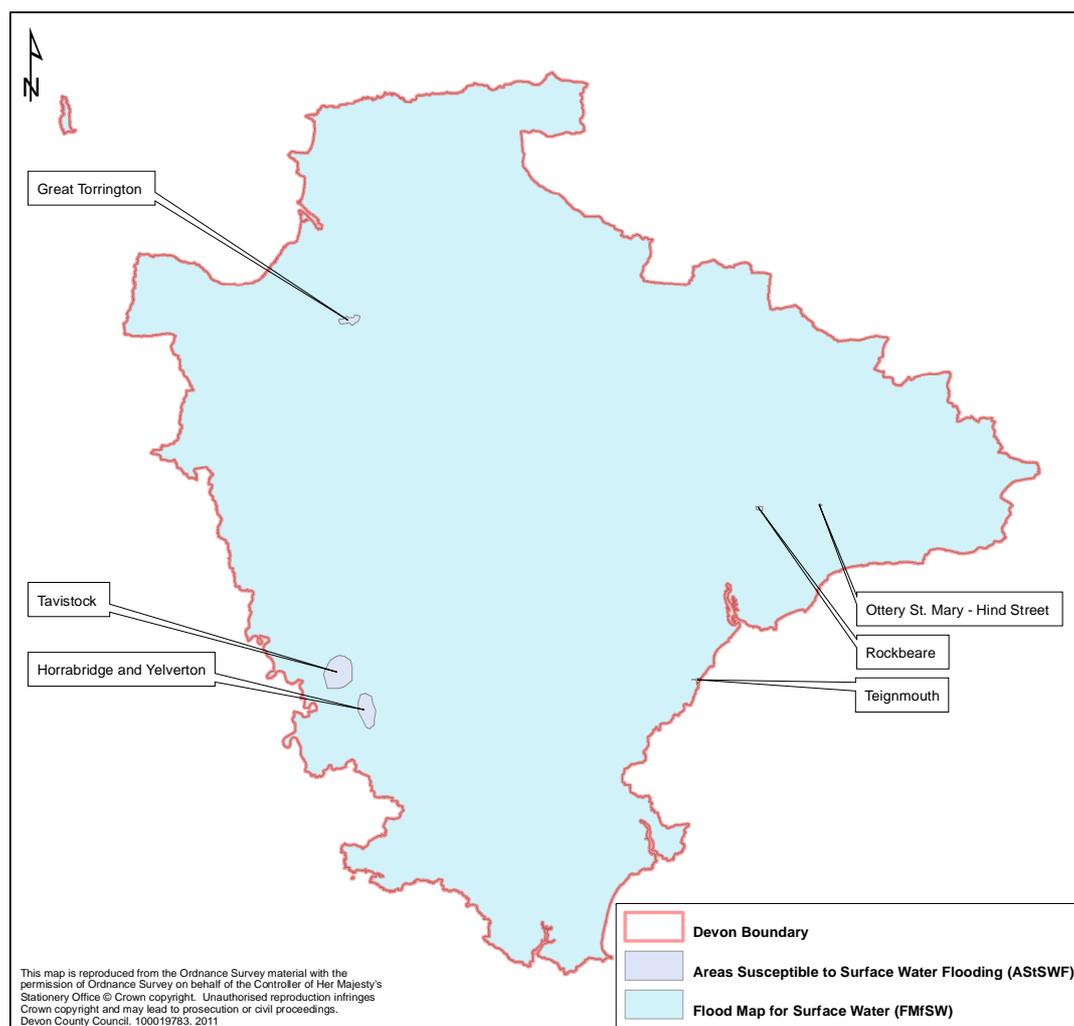
Strategic Flood Risk Assessments (SFRAs) have been completed across the eight District Councils and two National Parks within Devon. Some of these assessments report on the risk to groundwater flooding and historic incidents in parts of Devon. Past localised groundwater flooding incidents have been recorded in Budleigh Salterton and Barnstaple. The following areas are highlighted as areas that may be at particular risk of groundwater flooding: High Bickington in Torridge; Tiverton; Cullompton; Crediton; Kingsteignton; Newton Abbot; Rydon Stream Catchment; Starcross; Dawlish; and Dawlish Warren.

## **5.2 Locally Agreed Surface Water Information**

In order to determine the locally agreed surface water information, the surface water data that best represents local conditions is to be reviewed, discussed and agreed between LLFAs, the Environment Agency, water companies and IDBs. This process has involved scrutinising the surface water flood maps, AStSWF and FMfSW by comparing the modelled areas with historic information and any other available modelling or local knowledge. After analysing the data and liaising with partners, it has been decided that FMfSW generally represents the area of Devon with the most accuracy. However, 6 areas have been identified where AStSWF gives a more accurate representation of surface water flooding. Figure 5-1 illustrates the localised areas where the FMfSW map will be replaced by AStSWF. These areas range from a whole village to one street area where FMfSW was considered inaccurate. Figure 5-3 shows the different surface water models and how these fit together to give the most accurate picture as possible of the potential future surface water flooding in Devon.

The locally agreed surface water information maps will be shared through the Devon Flood Risk Management Partnership arrangement shown in Figure 2-1. This will be important when informing local planning authorities to ensure that SFRAs are updated with this more accurate local information.

As more modelling work is developed in the next few years, further areas of the locally agreed information may be replaced where it is felt that the new local surface water models can give a more accurate representation of the areas at risk. The locally agreed surface water information will be reviewed as part of the next cycle of PFRAs, however, Devon's Local Strategy for Flood Risk Management will detail any future modelling for the region and plans to ensure that the local surface water information is kept up to date and accurate on a regular basis.



**Figure 5-1** Areas of Devon where AStSWF and FMfSW modelling will be used.

## 5.3 The Impacts of Climate Change

### 5.3.1 The Evidence

There is clear scientific evidence that global climate change is occurring and therefore needs to be considered in regard to flood risk management.

Over the past century around the UK sea levels have risen. Relative sea level (sea level taking into account changes in land height) in the South West has risen by approximately 25cm since 1916. Annual mean precipitation over England and Wales has not changed significantly since 1766 when records began but 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. Between 1961 and 2006 more winter rain has fallen in intense wet spells. Some of the changes might reflect natural variation; however the broad trends are in line with projections from climate models.

### 5.3.2 Key Projections for South West River Basin District

Even if greenhouse gas (GHG) emissions stopped today, the climate would continue to change for 30-40 years due to past GHG emissions. Reducing our GHG emissions will reduce the amount of climate change and its effect on flood risk in the future.

The 2009 UK Climate Projections (UKCP09)<sup>13</sup> are the latest to be published at the time of writing this report. There is still a great deal of uncertainty within climate modelling, which needs to be acknowledged by decision makers. UKCP09 manages this uncertainty by providing a range of projected change for each climate variable.

Global CO<sub>2</sub> emissions are currently at a rate similar to those assumed within the high emission models (Le Quéré et.al 2010)<sup>14</sup> and existing flood guidance from Defra is based on the high emission scenarios. If global GHG emissions follow a high future scenario, the UKCP09 projected changes by the 2050s relative to the 1961-1990 baseline climate are:

- Winter precipitation is very likely to increase by between 3% and 41%.
- Precipitation on the wettest day in winter is very likely to be between 2% and 26% heavier.
- Change in precipitation on the wettest day in summer is less certain. The change is very likely to be between -21% and 12%.
- Relative sea level at Plymouth is very likely to increase by between 13cm and 42cm from 1990 levels.
- Preparing for peak river flows to increase by 20% by the 2050's is recommended in Planning Policy Statement 25 (PPS25) on development and flood risk.
- Increases in rain are projected to be greater near the coast than inland.

If global GHG emissions are not reduced from their current rates the changes in climate are projected to be greater than those described above.

### 5.3.3 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 the unexpected must be prepared for.

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. Recharge may increase in wetter winters, or decrease in drier summers.

Where appropriate, local studies need to be conducted to understand climate impacts in detail, including effects from other factors like land use. Sustainable development and drainage will help with adapting to climate change and manage the risk of damaging floods in future.

### 5.3.4 Adapting to Change

There is sufficient confidence in large scale climate models to say that there is a need to plan for change. There is more uncertainty at a local scale but model results can still assist in planning for adaptation. For example it is understood that rain storms may become more intense, even if it cannot be predicted 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% compared to the 1991 to 1950 baseline level, under the medium emissions scenario.

It is essential to respond to climate change by planning ahead. This can be prepared for by understanding the current and future vulnerability to flooding, developing plans for increased

<sup>13</sup> UK Climate Projections UKCP09 <http://ukclimateprojections.defra.gov.uk/>

<sup>14</sup> Recent Trends in CO<sub>2</sub> Emissions, Real Climate <http://www.realclimate.org/index.php/archives/2010/06/recent-trends-in-co2-emissions/>

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 will need to be made against deeper uncertainty. It will therefore be necessary to consider a range of measures and retain flexibility to adapt. This approach, embodied within flood risk appraisal guidance, will help to ensure that vulnerability to flooding is not increased.

#### **5.3.5 Long Term Developments**

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, PPS25 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 (LPA) may accept that flood risk can be increased contrary to Government policy, usually because of the wider benefits of a new or proposed major development. Any exceptions would not be expected to increase risk to levels which are "significant" (in terms of the Government's criteria).



**Devon County Council  
Preliminary Flood Risk Assessment**

**Areas Susceptible to  
Groundwater Flooding**

**Devon Boundary**

**District Council Boundaries**

**Areas Susceptible to Groundwater Flooding  
RISK**

**>= 75%**

**>= 50% <75%**

**>= 25% <50%**

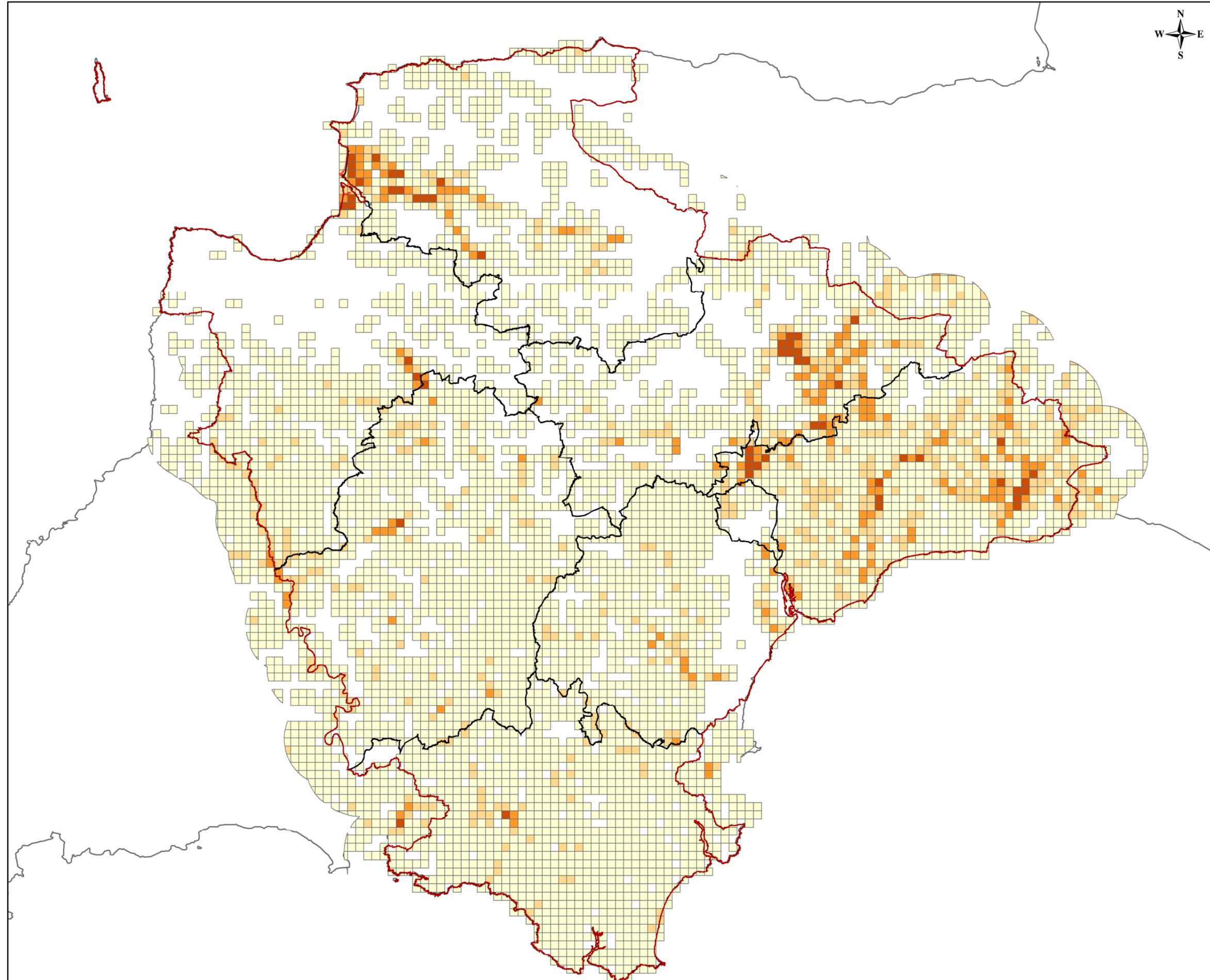
**< 25%**

<i>Date:</i> 16/03/2011	<i>Author:</i> Flood Risk Management (RR)
<i>Scale:</i> 1:450,000 @ A3	<i>File:</i> ....\GIS\PFRA Maps\ AStGWF DCC 2.mxd

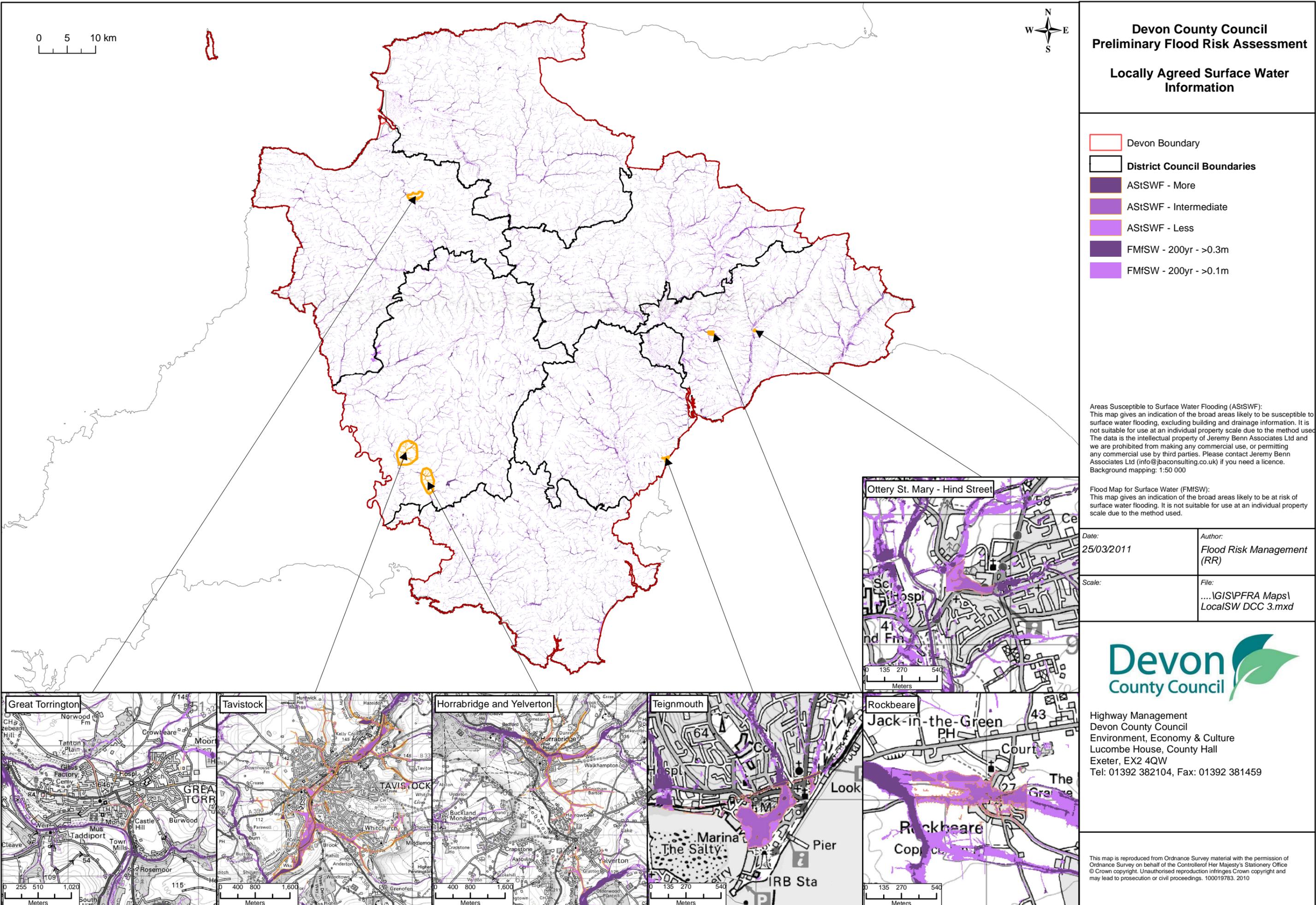


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**Figure 5-2** AStGWF map showing 1km grid squares of susceptibility to groundwater flooding



**Devon County Council  
Preliminary Flood Risk Assessment**

**Locally Agreed Surface Water  
Information**

- Devon Boundary
- District Council Boundaries
- AStSW - More
- AStSW - Intermediate
- AStSW - Less
- FMfSW - 200yr - >0.3m
- FMfSW - 200yr - >0.1m

**Areas Susceptible to Surface Water Flooding (AStSW):**  
This map gives an indication of the broad areas likely to be susceptible to surface water flooding, excluding building and drainage information. It is not suitable for use at an individual property scale due to the method used. The data is the intellectual property of Jeremy Benn Associates Ltd and we are prohibited from making any commercial use, or permitting any commercial use by third parties. Please contact Jeremy Benn Associates Ltd (info@jbaconsulting.co.uk) if you need a licence. Background mapping: 1:50 000

**Flood Map for Surface Water (FMfSW):**  
This map gives an indication of the broad areas likely to be at risk of surface water flooding. It is not suitable for use at an individual property scale due to the method used.

Date: 25/03/2011	Author: Flood Risk Management (RR)
Scale:	File: ....\GIS\PFRA Maps\ LocalSW DCC 3.mxd



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Figure 5-3 Locally Agreed Surface Water Information consisting of AStSW and FMfSW

## 6 Flood Risk Areas

### 6.1 Overview and Methodology

In order to ensure a consistent national approach, Defra have identified significance criteria and thresholds to be used for defining national Indicative Flood Risk Areas. Guidance on applying these thresholds has been released in Defra's guidance document<sup>15</sup>. This guidance outlines the methodology and agreed key risk indicators and threshold values which must be used to determine the national Indicative Flood Risk Areas. These areas will require flood hazard and risk maps to be prepared in line with the Flood Risk Regulations.

The methodology is based on using national flood risk information to identify 1km squares where local flood risk exceeds a defined threshold. Where there are 5 or more adjacent squares, a 'cluster area' is formed, showing areas where flood risk is most concentrated. If a cluster area contains over 30,000 people predicted to be at risk of flooding, it is identified as a national Indicative Flood Risk Area. Table 6-1 sets out and explains these thresholds.

**Table 6-1** National Indicative Flood Risk Area methodology and threshold levels.

	Threshold level set by	Number of properties at risk	Number of people at risk (based on number of residential properties x 2.34, the average estimated number of residents per property)	Number of critical services at risk (including schools, hospitals, nursing homes, power and water services)
<b>National Indicative Flood Risk Areas</b> National significance threshold set for the assessment of future flood risk. 'Cluster Areas' that exceed stated thresholds	Defra	–	>30,000	>150
'Cluster Areas' – 3km square that contains 5 or more 'blue squares' that are touching	Defra	5 or more blue squares touching		
'Blue Squares' – 1km grid area	Defra	–	>200	>1
<b>Local Flood Risk Areas</b>	Areas that will form part of Devon's Local Strategy for Flood Risk Management (future work)			

### 6.2 National Indicative Flood Risk Areas

The Defra methodology outlined above has been followed at a national scale, identifying 10 Flood Risk Areas across the country. None of these areas fall within the DCC boundary and so there are no areas to review in this PFRA report. Devon has no Indicative Areas as none of the cluster areas exceed the threshold level of 30,000 people at risk. The closest to this in Devon is the City of Exeter, with 7,619 people at risk (see Table 6-2). However, the methodology must still be followed by LLFAs using any additional local information to challenge any Flood Risk Areas identified or not identified.

<sup>15</sup> Selecting and reviewing Flood Risk Areas for local sources of flooding, guidance to Lead Local Flood Authorities, Flood Risk Regulations 2009, Defra 15 December 2010.

### 6.3 Local Flood Risk Areas and the Identification of New National Indicative Flood Risk Areas

The 1km 'blue squares' and cluster areas identified for Devon have been issued by Defra and are shown on the maps in Figures 6-1 and 6-2 respectively. The national thresholds used are explained on the maps and in Table 6-1, where these cluster areas do not exceed the nationally set threshold to become a national Indicative Flood Risk Area. The cluster areas have been analysed locally but it is still felt that there still is no additional information to support any of these being identified as new national Indicative Flood Risk Areas.

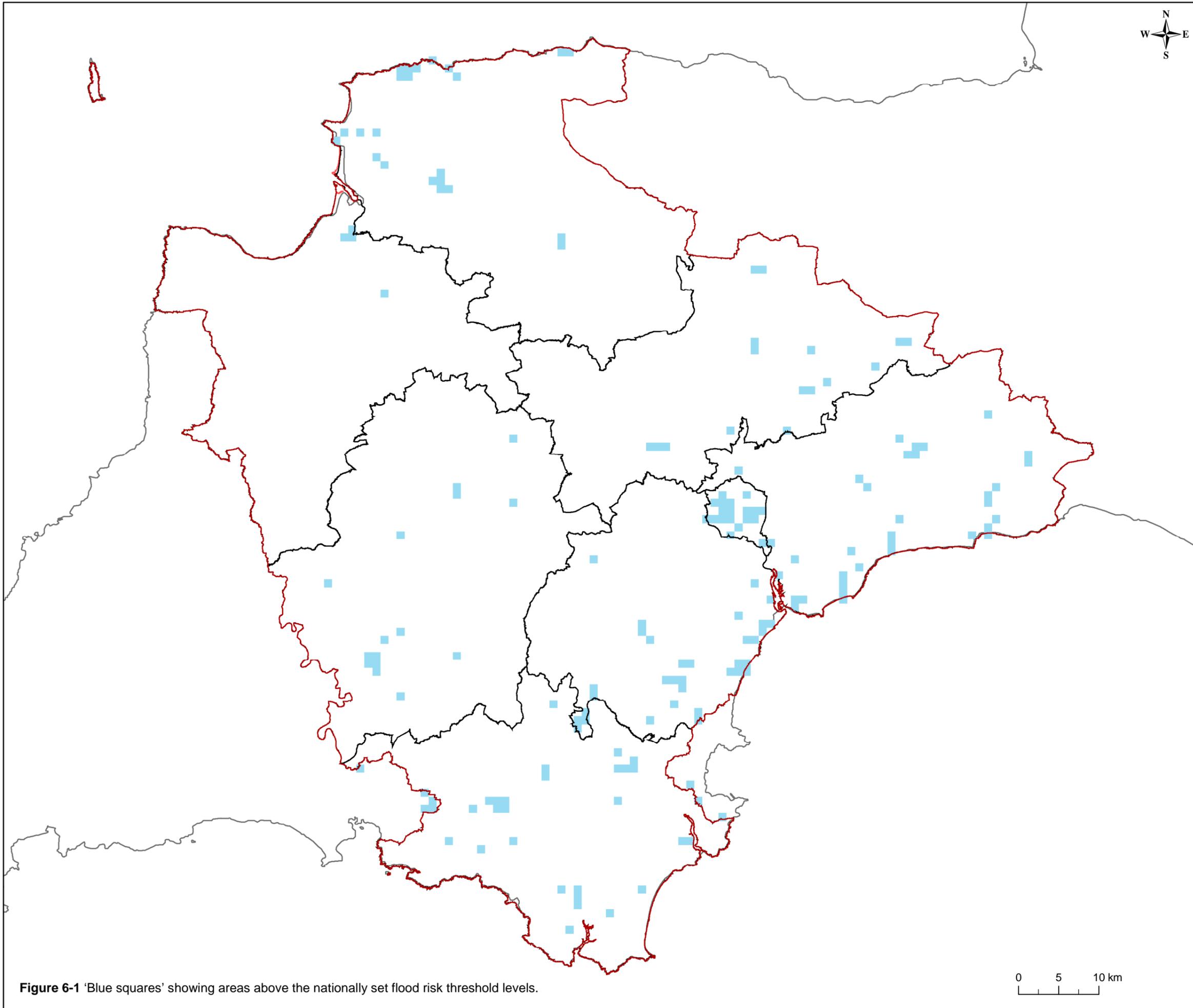
Table 6-2 lists these cluster areas, providing information on the number of people predicted to be at risk from surface water flooding. This will help to prioritise the areas within Devon that need further investigation and assessment and will form part of the Devon's Local Strategy for Flood Risk Management. This will also provide an opportunity to investigate any potential cross border issues of the cluster sites with neighbouring LLFAs. It is clear from Table 6-2 that surface water flood risk in Exeter will be a priority for Devon's local strategy. However, it is also noted that Exmouth has not been included in the national rankings and yet the town is estimated to have over 4,000 people at risk. This will also require further study in the local strategy.

**Table 6-2** Flood risk cluster areas in Devon and people at risk from surface water flooding.

National Ranking using FMfSW	Cluster Site	Estimated Number of People at Risk	
		FMfSW	AStSWF
44	Exeter	7,619	10,619
–	Exmouth	4,006**	3,365**
121	Tavistock*	2,813	1,699**
138	Barnstaple	2,403	3,545
150	Teignmouth*	2,228	2,265
155	Ilfracombe	2,139	1,437**
178	Ivybridge	1,734	1,708**

\*Areas using AStSWF model under the locally agreed surface water information.

\*\*Alternative local method used to calculate number at risk.



**Devon County Council  
Preliminary Flood Risk Assessment**

**1km Areas Above Nationally Set  
Flood Risk Thresholds**

- Devon Boundary**
- District Council Boundaries**
- Places Above Flood Risk Thresholds**

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

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

Indicators calculated using the Environment Agency's detailed method of counting (based on property outlines) for the new Flood Map for Surface Water (deep – for 1 in 200 annual probability rainfall).

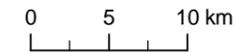
<i>Date:</i> 16/03/2011	<i>Author:</i> Flood Risk Management (RR)
<i>Scale:</i> 1:450,000 @ A3	<i>File:</i> GIS\FRA Maps\Blue Squares\Blue Squares Selection.mxd

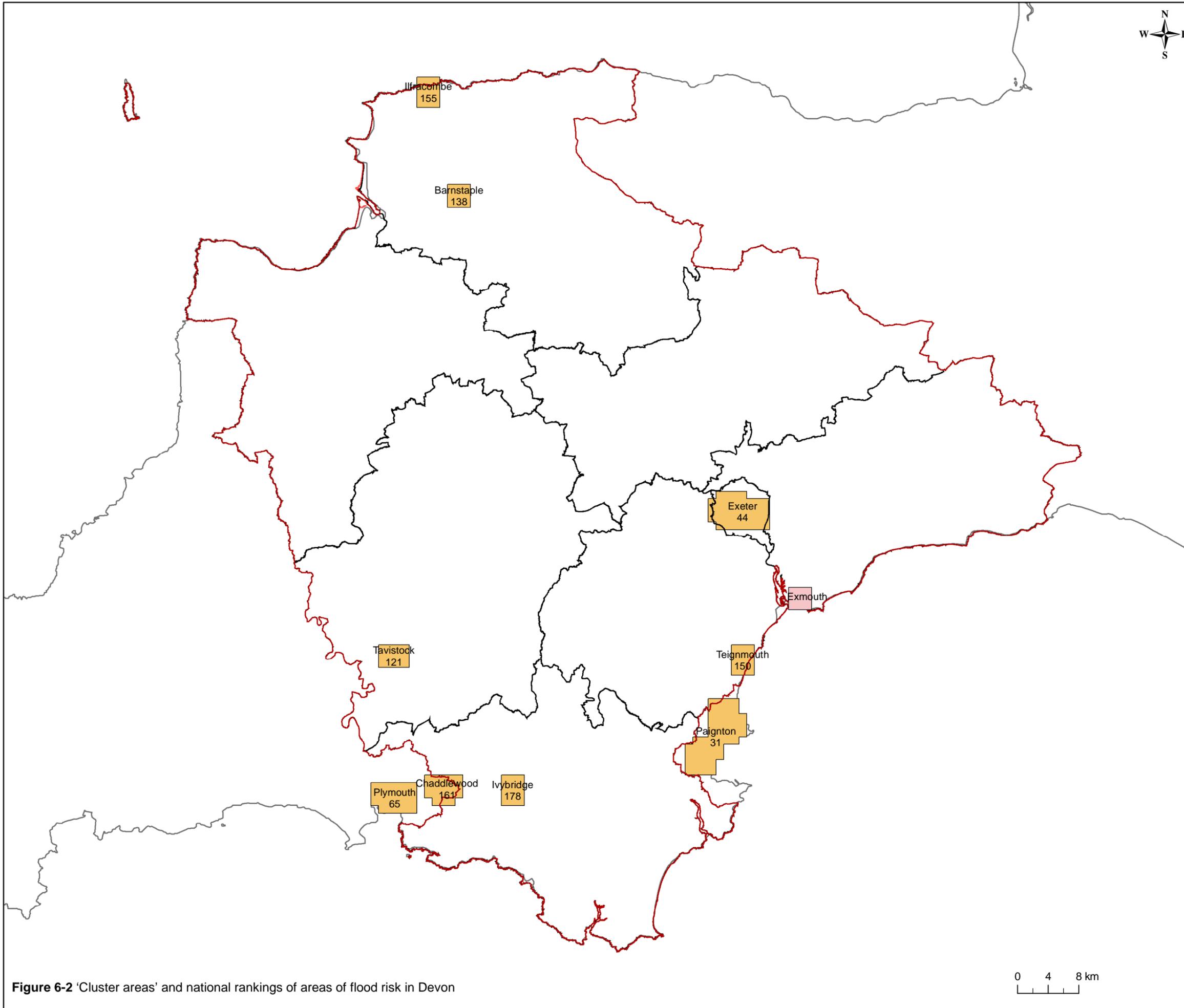


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**Figure 6-1** 'Blue squares' showing areas above the nationally set flood risk threshold levels.





**Devon County Council  
Preliminary Flood Risk Assessment**

**Clusters of Places above the  
Nationally Set Flood Risk Thresholds  
in England - FMfSW**

- Devon Boundary
  - District Council Boundaries
  - English Clusters FMfSW
  - Area not nationally ranked as a Cluster
- # Number refers to rank in terms of people at risk

These clusters are formed from all 3km squares that contain 5 or more places above the Flood Risk Thresholds (1km Blue Squares) that are touching.

The clusters are labelled with their rank in terms of people at risk. Cluster no.1 contains the highest number of people at risk, cluster no. 219 the lowest.

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

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

Indicators calculated using the Environment Agency's detailed method of counting (based on property outlines) for the new Flood Map for Surface Water (deep – for 1 in 200 annual probability rainfall)

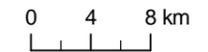
Date: 16/03/2011	Author: Flood Risk Management (RR)
Scale: 1:450,000 @ A3	File: G:\SVPFRA Maps\ Cluster Sites\FMfSWClus DCC Clipped.mxd



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**Figure 6-2** 'Cluster areas' and national rankings of areas of flood risk in Devon



## **7 Scrutiny & Review Procedures**

The scrutiny and review procedures that must be adopted when producing a PFRA are set out by the European Commission (EC). Meeting quality standards is important in order to ensure that the appropriate sources of information have been used to understand flood risk and the most significant flood risk areas are identified.

Another important aspect of the review procedure is to ensure that the guidance is applied consistently; a consistent approach will allow all partners to understand the risk and manage it appropriately. The scrutiny and review procedure will comprise two key steps, as discussed below.

### **7.1 Local Authority Review**

The first part of the review procedure is through an internal Local Authority review of the PFRA, in accordance with appropriate internal review procedures. Internal approval should be obtained to ensure the PFRA meets the required quality standards, before it is submitted to the Environment Agency.

Within Devon, the PFRA will be taken to local flood risk partners for comments. It will then be taken for approval by the Cabinet Member for Highways and Transportation.

The Environment, Economy and Culture Scrutiny Committee Flooding Task Group were given an overview of the PFRA and the Flood and Water Management work in general on 15 October 2010.

### **7.2 Environment Agency Review**

Under the Flood Risk Regulations, the Environment Agency has been given a role in reviewing, collating and publishing all of the PFRAs once submitted.

The Environment Agency will undertake a technical review (area review and national review) of the PFRA, which will focus on instances where Flood Risk Areas have been amended and ensure the format of these areas meets the provided standard. If satisfied, they will recommend submission to the relevant Regional Flood Defence Committee (RFDC) for endorsement. RFDCs will make effective use of their local expertise and ensure consistency at a regional scale. Once the RFDC has endorsed the PFRA, the relevant Environment Agency Regional Director will sign it off, before all PFRAs are collated, published and submitted to the European Commission.

The first review cycle of the PFRA will be led by DCC and must be submitted to the Environment Agency by the 22 June 2017. They will then submit it to the European Commission by the 22 December 2017 using the same review procedure described above.

## 8 Next Steps

### 8.1 Local Strategy for Flood Risk Management and Partnership Arrangements

Devon's Local Strategy for Flood Risk Management will be viewed as a major tool to make a difference to communities at risk of flooding. It will take a more detailed look and assessment of the local areas at risk highlighted as a result of this PFRA exercise and will focus on setting future direction on flood risk management in Devon.

The current partnership arrangements are illustrated in Figure 2-1. However, these are currently informal and will require a formal set up and a launch event to raise the profile of flooding issues in Devon, requiring further support and collaboration from partners. Meetings are likely to be quarterly, each concentrating on a particular theme associated with flood risk. The partnership will also provide a forum for a co-operative approach from the 'Risk Management Authorities' which is in the spirit of the legislation.

It is also a requirement of the Act that 'Risk Management Authorities' have a duty to co-operate using their existing powers. Where there are particular issues to be solved, the relevant land drainage, highways, planning, or water professionals can be gathered to work together, within current budget restrictions.

### 8.2 Reviewing and Updating Flood Data and Modelling

Data management and providing information is a key future role for managing flood risk in Devon. The data must be managed and maintained in such a way as to ensure the most up to date information is available in order to make the correct strategic decisions on future work.

It is planned to have external access available to DCC's GIS flood risk mapping to ensure information is freely available for the public, planning authorities and others. This will provide the same data to all in a transparent way in line with the European INSPIRE directive<sup>16</sup>.

The PFRA process forms part of a continuous 6 year cycle for LLFAs under the Flood Risk Regulations. However, as Devon has no national Indicative Flood Risk Areas, there are no Flood Hazard, Flood Risk Maps or Management Plans to produce. DCC will however, be required to review and prepare a revised PFRA report, to be completed before June 2017. This review process must then subsequently be carried out at intervals of no more than 6 years.

### 8.3 Post Flood Event Data Collection

With regards to the implementation of the duty of LLFAs to investigate following a flood event, it is proposed that DCC will use a similar database to the Environment Agency FRIS, to be managed centrally at DCC. District and highway colleagues would then be provided with a simplified spreadsheet to submit, should they receive information following a flood event.

Figure 8-1 shows the proposed method of collecting flood event information from April 2011 onwards. This spreadsheet system will be issued to District Councils and highway colleagues for completing when contacted by the public about local flood events. This record system also includes the requirements of LLFAs to record the following information from 22 Dec 2011: Flood event start date; days duration; probability; main source; main mechanism; main characteristics; and significant consequences of flooding.

---

<sup>16</sup> Directive 2007/2/EC Infrastructure for Spatial Information in the European Community (INSPIRE)

A		B			C		D		E		F		G		H		I		J		K		L		
1					<b>Flood Event Record</b>									Mandatory		Preferred		Optional							
2																									
3		District / Borough Council:			Records kept from:		Records kept to:								Total flood events:										
4																									
5																									
6																									
7		Flood Event		Event Start Date		Event Duration (hours or days)		Location (Address, Town)		Location (Post Code)		Eastings		Northings		Estimated Return Period / Frequency of flooding		Depth of Flooding (m)		Extent of Flooding (m <sup>2</sup> )		Main Source of Flooding		Confidence of Source	
8																									
9																									
10																									
11																									
12																									
13																									
14																									
15																									

Flood Event Record spreadsheet continued...

M		N		O		P		Q		R		S		T		U		V		W		X		Y		Z			
1																													
2																													
3																													
4																													
5																													
6																													
7		Main Mechanism of Flooding		Main Characteristics of Flooding		Residential properties flooded		Commercial properties flooded		Critical Infrastructure at Risk		Damage caused		Photos of Flood Event		Photo File Location		Details of any Actions Taken		Issue Resolved		Additional Comments		Rainfall Event		Rainfall Depth (mm)		Rainfall Duration (hours)	
8																													
9																													
10																													
11																													
12																													
13																													
14																													
15																													
16																													

Figure 8-1 Proposed future data collection method for flood events.

### 8.4 Maintaining an Asset Register

It is envisaged that the current highway asset management function at DCC will be expanded to include the new asset collection information, incorporating information from ‘Risk Management Authorities’ and set short, medium and long term priorities for compiling the asset register. It will be a requirement to expand this work to include ordinary watercourses. However specific areas may be able to be focused on in the first instance according to the cluster areas shown on flood mapping, i.e. Exeter, Tavistock, Barnstaple, Teignmouth, Ilfracombe and Ivybridge, shown in Figure 6-2. The current asset data held provides a good starting point but long term arrangements will need to be considered.

### 8.5 Development and Planning

Surface water runoff from hard surfaced areas increases peak flow and therefore the incorporation of SuDS in a development should ensure impact is minimised to green field run off rates. This needs consideration early in the planning process to ensure the SuDS principles can be applied on development sites without contributing to problems in the surrounding areas. Therefore planning applications should clearly include these drainage options.

With the emerging responsibility as a LLFA under the FWMA 2010, DCC will be required to work closely with the Planning Authorities (District Councils and National Parks) as a SuDS Approval Body (SAB). Some indication is provided in the guidance documents of the FWMA. It not envisaged that this will be fully implemented until April 2012 or later, although there is a need to set up the combined planning application process before that date.

Therefore, it is essential that DCC work closely with Local Planning Authorities to integrate this new planning requirement into current processes such as SFRAs, LDFs and Core Strategies and develop a consistent approach so future development does not adversely affect communities by flooding.

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## **Annex 1: Records of past floods and their significant consequences (Preliminary Assessment Report Spreadsheet)**

Please refer to Annex 1 of the Preliminary Assessment Report Spreadsheet attached to this report, detailing the past significant flood events identified for DCC, also discussed in Chapter 4.1.

## **Annex 2: Records of future floods and their significant consequences (Preliminary Assessment Report Spreadsheet)**

Please refer to Annex 2 of the Preliminary Assessment Report Spreadsheet attached to this report. This includes a complete record of future flood risk within Devon, including details of the potential consequences of flooding to key risk receptors within the county listed for a range of predictive tidal and fluvial, surface water, and groundwater models. The details of this are discussed in Chapter 5.

## **Annex 3: Records of Flood Risk Areas and their rationale (Preliminary Assessment Report Spreadsheet)**

Please refer to Annex 2 of the Preliminary Assessment Report Spreadsheet attached to this report. However there have been no Flood Risk Areas identified for DCC therefore none have been recorded in this section.

## **Annex 4: Preliminary Flood Risk Assessment Checklist**

Please refer to Annex 4, attached to this report, which contains the Preliminary Flood Risk Assessment Checklist that has been provided by the Environment Agency to act as a checklist for reviewing PFRA submissions.