

## Document Control Sheet

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## Executive Summary

This Preliminary Flood Risk Assessment has been prepared by Cheshire West and Chester Borough Council as Lead Local Flood Authority (LLFA) in order to meet the duties to manage local flood risk and deliver the requirements of the Flood Risk Regulations (2009) and the Flood and Water Management Act (2010).

The production of the Preliminary Flood Risk Assessment (PFRA) is imposed by Sections 10-12 of the Flood Risk Regulations (2009) and it is the first step in the management of local flood risk. The PFRA process is aimed at providing a high level overview of flood risk from local flood sources through a review of historic flooding incidents and the predicted future extents of flooding, based on the outputs of computer models from both Cheshire West and Chester Borough Council and the Environment Agency.

Section 17 of the Flood Risk Regulations (2009) states subsequent reviews must be carried out at intervals of no more than 6 years. This document is the first review of the original PFRA published in June 2011.

In January 2017 the Department for Environment, Food and Rural Affairs (DEFRA) and the Environment Agency (EA) replaced its guidance on significant risk for the identification of flood risk areas for Lead Local Flood Authorities (LLFAs) about the criteria for assessing and reviewing whether a risk of flooding is significant. The Regulations require LLFAs to determine whether any part or parts of their area face significant risk of flooding and to identify any such areas as Flood Risk Areas (FRAs). This was produced under regulation 14(3) of the Flood Risk Regulations 2009 (the Regulations), and replaced the previous guidance published in 2010. LLFAs are only required to do this in relation to local flood risks which include flooding from:

- Surface Water.
- Groundwater.
- Ordinary Watercourses.

LLFAs do not need to consider risks of flooding from the sea, main rivers or reservoirs, except where these may affect flooding from another source. Flood hazard and risk maps and flood risk management plans must subsequently be prepared for the FRAs identified.

The purpose in reviewing the results lies with the determination of whether the level of flood risk is severe enough to be reported at both a European and National scale. DEFRA has identified that a FRA containing a cluster of over 30,000 people would be considered for significant European importance. Of the indicative FRAs that have been identified nationally, none are located within the Cheshire West and Chester Borough Council administrative area.

Depending on the approach taken to EU exit, there may be potential to make changes to the FRR in the coming years. EU exit does not, however, alter the requirement for LLFAs to review preliminary assessment reports and FRAs by 22<sup>nd</sup> June 2017 as the UK will still be a full member of the EU at that point. Any proposals to refine the approach to mapping flood hazard and risk or preparing FRMPs will be consulted on later in the cycle.

It is the responsibility of the LLFA to decide what it considers as a historical flood with “significant harmful consequences” at a local level. Initially there was no specific guidance determining the national flooding importance level. Cheshire West and Chester Borough Council have liaised with several neighbouring LLFAs in shaping and finalising this significance level. This has led to the formation of the Cheshire Mid-Mersey Partnership with the aim to identify and resolve flooding issues at both the Tactical and Strategic levels whilst adhering to best industrial practices.

Cheshire West and Chester Borough Council has decided that a flood of “significant harmful consequences” would have one or more of the following characteristics:

**Table 0.1: Flood Event of Significant Harmful Consequences**

Impact of flooding on:	Category	Consequence
Human Health	Number of individuals	≥ 200
Economic Activity	Number of critical services	≥ 2
	Number of residential properties	≥ 83
	Number of non-residential properties	≥ 20
	Principal Highway Network	Transport links impassable for more than 5 hours.

A review of information on past flood incidents have been received from various stakeholders, both locally and nationally, which include water and sewerage companies, utility companies, the Canal & River Trust, the Emergency Services, and other Risk Management Authorities. There were several limitations associated with the stakeholder data. The main issues related to inconsistent and incomplete records, resulting in limited knowledge of flooding sources and the consequences of events. There have not been any flooding events identified from local sources that have been deemed to have “significant consequences” during the period June 2011 to June 2017.

An analysis of data available on future flood risk has found that there could be flooding with adverse consequences as a result of surface water flooding. Modelling outputs provided by the Environment Agency indicate that up to 2,018<sup>1</sup> properties, of which 1767 are residential and 251 business, could be at risk from surface water flooding in a 1% (1 in 100 year) annual probability rainfall event. Therefore the scale of risk is not sufficient to be considered a FRA, reportable at a European Level. There is more detailed mapping that has been conducted as part of the Cheshire West and Chester Borough Council Surface Water Management Plan however it does not cover the whole of the administrative area.

During the investigation process into historic and future flood risk there have not been any flooding instances which need to be reported at either a National or European level. However, there are a number of flooding problems that have potential to become greater issues considered locally important to Cheshire West and Chester Borough Council. Furthermore, the surface water modelling undertaken by the Environment Agency indicates that there may be a significant number of properties at risk in the future.

<sup>1</sup> Figures used are taken from EA modelling outputs and require further checks. Preliminary checks on this data have shown some disparities, in particular relating to non-residential properties where CWAC figures give approx. 20% more properties in this bracket.

The information on flood risk gathered for this PFRA will be used for future steps to guide flood risk management in Cheshire West and Chester Borough Council. The methodology for producing this PFRA has been based on the Environment Agency's Final PFRA Guidance and DEFRA's Guidance on selecting Flood Risk Areas, both published in January 2017.

To progress Cheshire West and Chester Borough Council approach to flood risk management, including on-going work post-PFRA submission, it will be designed to meet its objectives under the Flood Risk Regulations (2009) and the Flood and Water Management Act (2010) to:

- Continue to develop links with adjacent LLFAs and other bodies responsible for flood risk management;
- Utilise data collected to maintain a manageable GIS database, controlled centrally, for use on future development control queries, investigation, planning etc.;
- Provide assessments to identify the flood risk management prioritisations over the entire administrative area;
- Update the current Local Flood Risk Management Strategy;
- Continually update the Asset Register;
- Record, document and (where appropriate) investigate future floods.
- Require developers to give priority attention to the use Sustainable Urban Drainage Systems (SuDS), unless demonstrated to be inappropriate.

## **Disclaimer**

### **This document is issued in Draft**

#### **Limitations**

The EA definition of Critical Services excludes Broadcasting (TV / Radio), CCTV Control rooms, Food processing, Gas / Oil Storage / Distribution, Oil Refining, Chemical Works, Incinerators, Landfill sites, Railway Stations and other Transport Related Infrastructure. All of which are significant from an Emergency Planning scenario.

## Self Assessment Form (Summary)

The Environment Agency have produced and written a Self-Assessment Form (January 2017) and associated guidance for the LLFA with options for its delivery for the 2nd Edition Review. Cheshire West and Chester has rewritten the PFRA. To adhere to the requirements the following table is produced as a checklist.

PFRA report section		Activity for PFRA/FRA review		Response
1	Governance and partnership	1.1	Since publication of the PFRA in 2011, have there been any changes to, or creation of new, risk management authorities (RMAs) with responsibilities in the LLFA area?	See para 3.2 of this PFRA
		1.2	Are all roles and responsibilities for collecting and recording flood risk data and information clearly defined, including the respective roles and responsibilities of upper and lower tier authorities and other RMAs where relevant?	
2	Data systems and management	2.1	Do you have an up to date record of relevant sources of flood risk data and information for the LLFA area, including those held by other organisations?	QGIS and Confirm are the main logging and information recording systems.
		2.2	Have sources of 'locally agreed surface water information' been established and maintained for the LLFA area and agreed with relevant partners?	
		2.3	Are systems in place to collect, record and share data and information for the purpose of assessing flood risk in the LLFA area?	
		2.4	Are systems in place to assure the quality and security of data and information recorded for the purpose of assessing flood risk in the LLFA area?	
		2.5	Do you understand the condition and performance of the public, third party and private assets in your register in terms of flood risk?	
3	Past floods since Dec 2011 only) required for reporting to the European Commission	3.1	Have any flood events occurred since publication of the original PFRA report in December 2011 that have added to or changed your understanding of significant flood risk in the LLFA area? See the guidance document on which floods to report.	Annex 1 was updated to record storm events Jun 2016.
		3.2	Has your current understanding of significant flood risk in the LLFA area changed as a result of the consequences of floods that have occurred since 2011? How?	
4	Future flood information Information on future floods is required for reporting to the European Commission	4.1	Have you created or received new information on potential future floods that has added to or changed your understanding of significant flood risk in the LLFA area since publication of your original PFRA report in 2011?	EA's recently revised climate change guidance, the Heat Map and other modelling data is being used.
		4.2	Have you created or received new information to improve the understanding of the future impact of climate change on flood risk in the LLFA area?	
		4.3	Have you created or received new information on long term developments to improve your understanding of flood risk in the LLFA area?	

PFRA report section			Activity for PFRA/FRA review	Response
		4.4	Has your understanding of flood risk in the LLFA area changed since 2011 as a result of new information on the potential consequences of future floods, the impact of climate change or long term developments? How?	
5	Identification of Flood Risk Areas for 2nd planning cycle	5.1	Are the indicative FRAs an appropriate representation of significant surface water flood risk in your LLFA area?	Information is within ghe PFRA 2017.
		5.2	Do the consequences of flooding from other local sources, i.e. groundwater or ordinary watercourses, or from combined multiple sources, indicate any other areas of significant risk?	
	5.3	Has your PFRA review identified any other information which indicates other areas of significant risk?		
	5.4	On the basis of the national evidence provided and your review, do you agree with the indicative FRAs for your area?		
	5.5	On the basis of local evidence and your review, are you amending or identifying any additional FRAs for your area?		
6	Updating the original preliminary assessment	6.1	Have you completed an addendum to update your preliminary assessment report? Updates are required for reporting to the European Commission	Information is within ghe PFRA 2017.

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## Abbreviations

AOD: Above Ordinance Datum;

AStSWF: Areas Susceptible to Surface Water Flooding;

AStGwF: Areas Susceptible to Groundwater Flooding;

BGS: British Geological Survey;

BUA: Built-up Areas;

BUASD: Built-up Areas Sub-divisions;

CEX: Chief Executive

CFMP: Catchment Flood Management Plan;

CMMP: Cheshire & Mid Mersey Partnership

COW: Critical Ordinary Watercourse (reclassified as Main River);

CSO: Combined Sewer Overflow

CWAC: Cheshire West and Chester Borough Council;

DCWW: Dwr Cymru Welsh Water;

DEFRA: Department for Environment, Food and Rural Affairs;

EA: Environment Agency;

EC: European Community;

EU: European Union;

FWMA: Flood and Water Management Act 2010;

FRA: Flood Risk Area / Flood Risk Assessment;

FRMP: Flood Risk Management Plan

FRR: Flood Risk Regulations

GIS: Geographical Information Systems;

ICM: Integrated Catchment Modelling

IPCC: Intergovernmental Panel on Climate Change;

LGF: Local Government Forum;

LLFA: Lead Local Flood Authority;

NRD: National Receptor Dataset;

OEFRPG: Operational Emergency Flood Response Plan Groups;

OFWAT: Water Services Regulation Authority;

OS: Ordinance Survey;

PFRA: Preliminary Flood Risk Assessment;

RFCC: Regional Flood & Coastal Committee;

RFDC: Regional Flood Defence Committee;

RoFSW: Risk of Flooding from Surface Water

SFRA: Strategic Flood Risk Assessment;

SuDS: Sustainable Urban Drainage System;

SWMP: Surface Water Management Plan;

UKCP09: United Kingdom Climate Projections 2009;

uFMfSW: Updated Flood Map for Surface Water;

WAG: Welsh Assembly Government.

# 1. Introduction

## 1.1 Background

Following extensive flooding across the United Kingdom in 2007, Sir Michael Pitt on behalf of the UK Government undertook a comprehensive review of the lessons to be learned from the floods and made a series of recommendations. The Pitt Review (2008) was the catalyst for Local Authorities and partner agencies to become more responsible for flood risk with many of the recommendations incorporated into the Flood and Water Management Act 2010 (FWMA 2010).

The FWMA 2010 identified a number of responsibilities, powers and duties to be executed in phases to help manage flood risk in a more holistic way. The FWMA 2010 defines a lead role for local authorities and designated Cheshire West and Chester Borough Council a Lead Local Flood Authority (LLFA) responsible for the management of local sources of flooding such as surface water. An overview of these duties is provided in Section 3. The Environment Agency retained its role in managing flood risk from main rivers and coastal sources.

Alongside the Act, the EC Floods Directive (Directive 2007/60/EC) on the assessment and management of flood risk was transposed into domestic law in England and Wales under the European Communities Act 1972 via the Flood Risk Regulations 2009 (FRR 2009). The purpose of the EC Floods Directive is to establish a framework for assessing and managing flood risk across the European Community.

Cheshire West and Chester Borough Council as a “Lead Local Flood Authority” (LLFA) has a duty to prepare a Preliminary Flood Risk Assessment (PFRA) in accordance with Part 2 of the FRR 2009 which sets out the requirements.

Cheshire West and Chester Borough Council published its original PFRA in June 2011 and subsequent reviews must be carried out at intervals of no more than 6 years. This document is the first revision of the original PFRA.

The PFRA (and any subsequent maps and plans) form part of the local flood risk management strategy that Cheshire West and Chester Borough Council is required to prepare under the FWMA 2010.

## 1.2 Preliminary Flood Risk Assessments (PFRA)

The PFRA is a high level screening exercise to identify areas in which the risk of local flooding is significant and warrants further examination through the production of maps and management plans.

The Flood Risk Regulations (2009) provide a framework for managing flood risk over a 6 year cycle, comprising:

1. Production of a Preliminary Flood Risk Assessment report;
2. Identification of Flood Risk Areas;
3. Production of appropriate Flood Hazard and Flood Risk Maps and,
4. Preparing Flood Risk Management Plans.

This report marks the first of a four stage process. The outcome of the review is to provide evidence for the identification of FRAs (Stage 2). The PFRA makes use of existing and available data, and focuses on local flood risk sources.

The identification of FRAs will establish whether or not the final two stages of preparing hazard and risk maps and flood risk management plans are required for the administrative area.

The local sources of flooding for the purposes of the PFRA are:

- **Groundwater** - Water that flows out from the ground due to high water tables locally or regionally;
- **Ordinary Watercourses** - Out of channel flows from small watercourses such as streams, brooks and drainage ditches that are not regarded to be Main River by the Environment Agency;
- **Surface runoff** - Water that flows over land following a heavy rainfall event, before it enters a natural watercourse or an artificial drainage network.

Note for the purpose of the PFRA the LLFA does not have to report flood risk from Main Rivers, coastal/the sea, reservoirs and canals, except where these may affect flooding from another source. With the exception of canals flood risk is the responsibility of the Environment Agency. For canals, the primary responsibility for land drainage and flood prevention rests with private parties. The Canal and River Trust do not have any specific statutory responsibilities (under FWMA 2010) in relation to flooding and, therefore, its responsibilities are those of an owner and operator of its canals and other waterways.

The table below indicates the work required to meet the requirements of the FFRA. This PFRA aims to meet the first two requirements.

**Table 1.1: Elements of Work required under the Flood Risk Regulations, 2009.**

Timescale for first edition	Assessment or Plan	Description	Timescale for first review / revision
22 <sup>nd</sup> June 2011	Prepare <b>Preliminary Flood Risk Assessment Report</b>	Stage 1. The PFRA focuses on local flood risk arising from <b>surface water, groundwater, Ordinary Watercourses, and canals.</b>	22 <sup>nd</sup> June 2017
22 <sup>nd</sup> June 2011	On the basis of the PFRA, identify <b>Indicative FRAs</b>	Stage 2 Indicative Flood Risk Areas are a defined term, and are areas of nationally significant risk affecting 30,000 people or more. The PFRA is required to record " <b>locally significant risk areas</b> " which are flood areas, above a locally determined threshold of affected people, and having significant harmful consequences.	22 <sup>nd</sup> June 2017
22 <sup>nd</sup> June 2013	Prepare <b>Flood Hazard Maps and Flood Risk Maps</b> for each FRA	Stage 3 The hazard and risk maps will show the <b>likely extent, depth, direction, speed of flow and probability</b> of possible floods and their <b>consequences.</b>	22 <sup>nd</sup> June 2019
22 <sup>nd</sup> June 2015	Prepare <b>Flood Risk Management Plans</b> for each FRA	Stage 4 The Flood Risk Management Plans will set out what the <b>risk management objectives</b> are, the measures proposed to achieve those objectives and how the measures are to be implemented.	22 <sup>nd</sup> June 2021

The PFRA provides a useful source of reference for future local flood risk management strategies, informing the production of Flood Hazard and Flood Risk Maps (Stage 3), and contributing to the preparation of Future Flood Risk Management Plans (Stage 4).

### 1.3 UK Exit from the European Union

Depending on the approach taken to EU exit, there may be potential to make changes to the FRR in the coming years. EU exit does not, however, alter the requirement for LLFAs to review preliminary assessment reports and FRAs by 22nd June 2017 as the UK will still be a full member of the EU at that point. Any proposals to refine the approach to mapping flood hazard and risk or preparing FRMPs will be consulted on later in the cycle.





## **2. Aims and Objectives of the PFRA**

### **2.1 Aims**

The primary aim of this PFRA is to provide an assessment of potential local flood risk by applying a high level screening exercise across the administrative area of Cheshire West and Chester Borough Council; referred to as the study area. The analysis uses existing and available information. It is intended to reassess governance and partnership working, as well as information sharing within the adjacent LLFA areas since the first publication of the report in June 2011, so that efficient flood risk management strategies are developed. This version of the PFRA will also provide assurance the Council's roles, responsibilities, and continual development under the FRR 2009 and FWMA 2010. The PRFA review is an opportunity to ensure those assessments are up to date and fit for purpose.

The risk of local flooding is defined as significant by European Standards if the flooding is affecting a cluster of more than 30,000 people. These local flooding risks are grouped in areas and are deemed Indicative FRAs. If these areas are found to exist within the Local Authority Boundary then they may warrant further examination at a later stage through the production of Flood Risk and Hazard maps and Flood Management plans.

### **2.2 Objectives**

The objectives of this PFRA are to:

- Identify relevant partner organisations involved in future assessment of flood risk and summarise the means of future and on-going stakeholder engagement.
- Describe arrangements for partnership and collaboration for on-going collection, assessment and storage of flood risk data and information.
- Provide a summary of the systems used for data sharing and storing including provisions for quality assurance, security and data licensing arrangements.
- Summarise the methodology adopted for the PFRA with respect to data sources, availability and review procedures.
- Assess historic flood events within the study area from local sources of flooding (including flooding from surface water, groundwater and Ordinary Watercourses) and where possible, the consequences and impacts of these events.
- Establish an evidence base of historic flood risk information which will be built upon in the future and will to support and inform the preparation of Cheshire West and Chester Borough Council Local Flood Risk Strategy.
- Assess the potential harmful consequences of future flood events within the study area.

- Review the provisional national assessment of indicative FRAs provided by the Environment Agency and provide an explanation and justification for any amendments required to the FRAs.

## 2.3 Cheshire West and Chester Borough Council PFRA Study Area

Cheshire West and Chester Borough Council has a population of 333,900 and an area of 91,664ha. Much of the borough is rural with over 42% of land classed as Green Belt.<sup>2</sup> The borough is bounded by the Welsh border to the west; the Mersey Estuary, Halton Borough Council and Warrington Borough Council to the north; Cheshire East Borough Council to the east; and Shropshire County Council to the south.

The main urban areas (Figure 2.1) are the historic City of Chester with a population of 81,000, the industrial town of Ellesmere Port (60,300) and Northwich and Winsford (101,400). There are smaller settlements at Neston, Frodsham, Helsby and Malpas along with a number of rural villages across the area.

The principal rivers within the Borough are the River Weaver, River Gowy, River Dee, River Dane and River Croco. The River Mersey also flows along part of the northern border of the borough boundary.

The Shropshire Union Canal, Trent and Mersey Canal, and the Weaver Navigation are within the study area and are managed by the Canal and River Trust. The Manchester Ship Canal to the north of the Borough is managed by the Manchester Ship Canal Company, a subsidiary of Peel Ports Group.

There are two water companies providing sewerage services within the borough:

- Dwr Cymru Welsh Water – Neston to Malpas areas, including Chester and Tattenhall.
- United Utilities – The eastern part of the Borough.

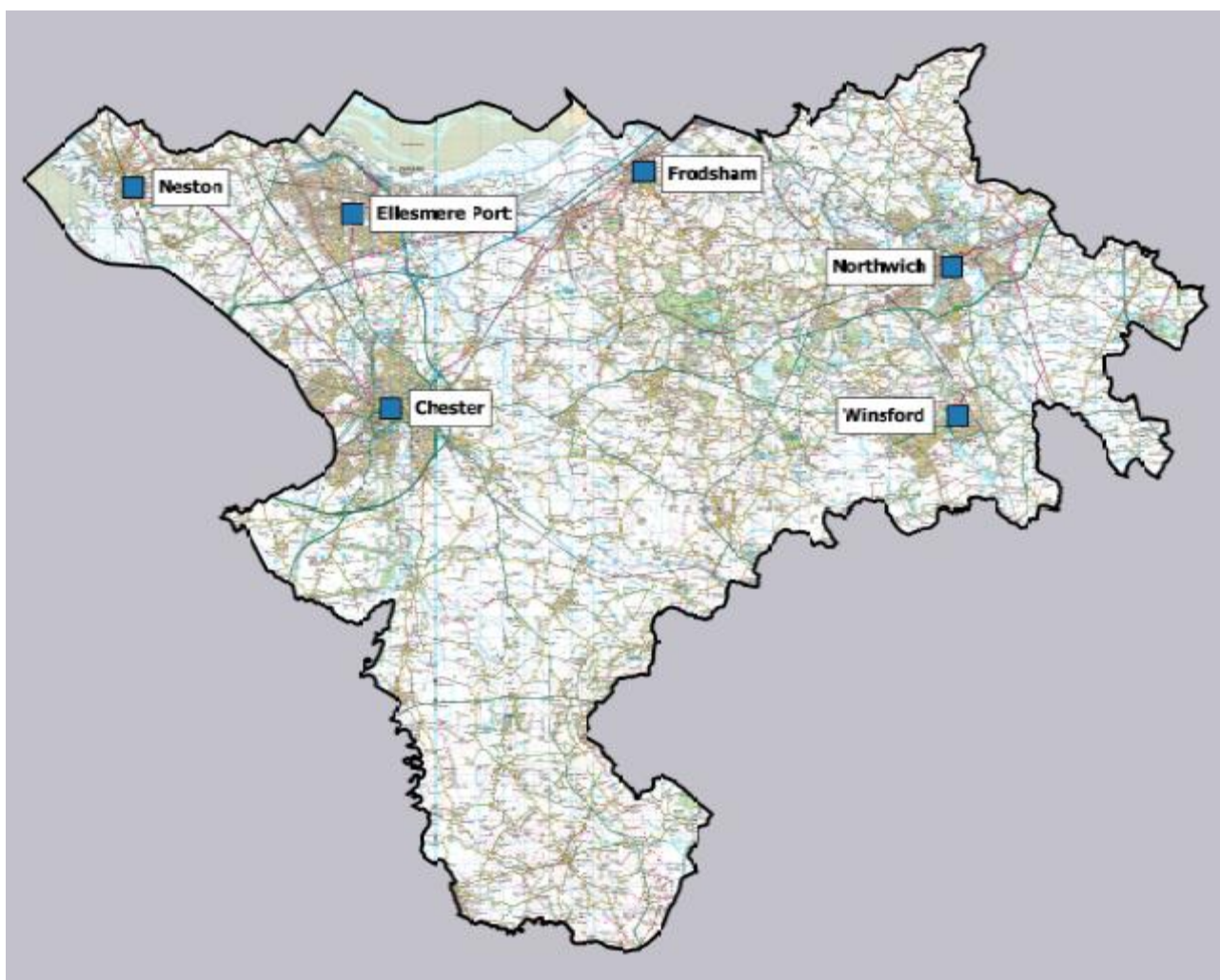
The two water companies providing clean water within the borough are:

- Dee Valley Water – Chester area. (Note: At the time of writing this report a takeover by Severn Trent Water has been agreed).
- United Utilities – The remainder of the borough.

In addition Severn Trent Water have water extraction points located in the Tattenhall and Malpas areas. United Utilities have raw water extraction along the River Dee.

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<sup>2</sup> CWAC Local Plan – Strat 9 Green Belt and countryside.



**Figure 2.1 Cheshire West and Chester Borough Council Administrative Boundary and PRFA Study Area.**

### 3. Lead Local Flood Authority (LLFA) Responsibilities

#### 3.1 Introduction

The preparation of a PFRA is one of several responsibilities of LLFAs under FRR 2009 and FWMA 2010. This section provides an overview of other responsibilities Cheshire West and Chester Borough Council are obliged to fulfil under their role as a LLFA.

**Table 3.1: Flood Risk Responsibilities**

Level of Flood Risk	Organisation	Responsibilities
National Flood Risk	Environment Agency	Responsible for Main Rivers, the Sea and Reservoirs
Local Flood Risk	Lead Local Flood Authority	<p>Responsible for Canals (where not in private ownership), Groundwater, Ordinary Watercourses, and Surface runoff</p> <p>The LLFA is the unitary authority for the area, or if there is no unitary authority, the county council.</p> <p>Note for Canals - The Canal and River Trust do not have any specific statutory responsibilities (under FWMA 2010) in relation to flooding and, therefore, its responsibilities are those of an owner and operator of its canals and other waterways.</p>
Local Flood Risk	Water Company (i.e. United Utilities)	Responsible for sewers except where it is wholly or partly caused by rainwater entering the system. Floods or raw sewage caused by blocking of a sewer for example are not covered by the regulations, neither is flooding from burst water mains.

#### 3.2 Coordination of Flood Risk Management

In his Review of the Summer 2007 flooding, Sir Michael Pitt stated that “the role of local authorities should be enhanced so that they take on responsibility for leading the coordination of flood risk management in their areas”. As the designated LLFA, Cheshire West and Chester Borough Council is therefore responsible for leading local flood risk management across the area.

Local knowledge and technical expertise necessary for Cheshire West and Chester Borough Council to fulfil their duties as a LLFA lies with the Council and other partner organisations. It is therefore crucial that the Council work alongside these partners as they undertake their responsibilities to ensure effective and consistent management of local flood risk. Since the first publication of the PFRA in June 2011 a number of partnerships and working groups have been established across different organisations.

### **3.2.1 Stakeholder Engagement**

As part of the PFRA, the Cheshire West and Chester Borough Council Flood Group Forum has sought to engage stakeholders representing the following organisations and authorities:

- United Utilities;
- Dwr Cymru Welsh Water;
- Environment Agency;
- Canal & River Trust;
- Mersey Forest;
- Local Fire and Rescue Service.
- Local Police.
- Peel Ports Group (Including Manchester Ship Canal Company)

Data has also been collated internally within Cheshire West and Chester Borough Council.

It is crucial that the Council continues to forge successful partnerships with the Environment Agency, Dwr Cymru Welsh Water, United Utilities and other important key stakeholders to ensure effective coordination and management of flood risk across the area.

### **3.2.2 Other Lead Local Flood Authority (LLFA) Engagement**

Due to the position of the study area being situated within the River Mersey Catchment, Cheshire West and Chester Borough Council are in consultation with neighbouring Local Authorities.

Cheshire West and Chester Borough Council is part of a sub-regional LLFA working group formed in 2010; the Cheshire and Mid-Mersey Flood Working Group. The group (hereby known as the Partnership) operates at both Tactical and Strategic levels.

The Risk Management Authorities (RMAs) of the Partnership are:

- Warrington Borough Council – Partnership Lead;
- Cheshire East Council;
- Cheshire West and Chester Borough Council;
- Halton Borough Council;
- St Helens Borough Council;
- Staffordshire County Council;
- Environment Agency;
- United Utilities.

The Partnership has a critical role to play in managing the risk of flooding from all sources and in working with communities to help them become more resilient. It provides a forum to enable RMAs, other partners and communities, to identify how they can work together to deliver an improved and more effective and efficient flood risk management service.

### **The Operational Group**

Engineers from Cheshire West and Chester Borough Council, United Utilities, Dwr Cymru Welsh Water and Environment Agency meet on a quarterly basis or as required if flood events occur, to discuss issues and scheme delivery. The Operational Level is where day-to-day Flood Risk Management activities take place.

### **The Tactical Group**

Technical and operational leads/managers meet on a monthly basis to coordinate delivery, share skills and implement decisions made at the Strategic level. The Tactical Group, chaired by Warrington Borough Council, reports directly to the Strategic Group who are responsible for setting the overall strategic direction of the partnership.

### **The Strategic Group**

Set the strategic direction for joint working and the management of flood risk across the Partnership. Elected Members and senior representatives from the RMAs meet each quarter. The meetings are timed to coincide with financial the planning cycle of the Regional Flood & Coastal Committee (RFCC).

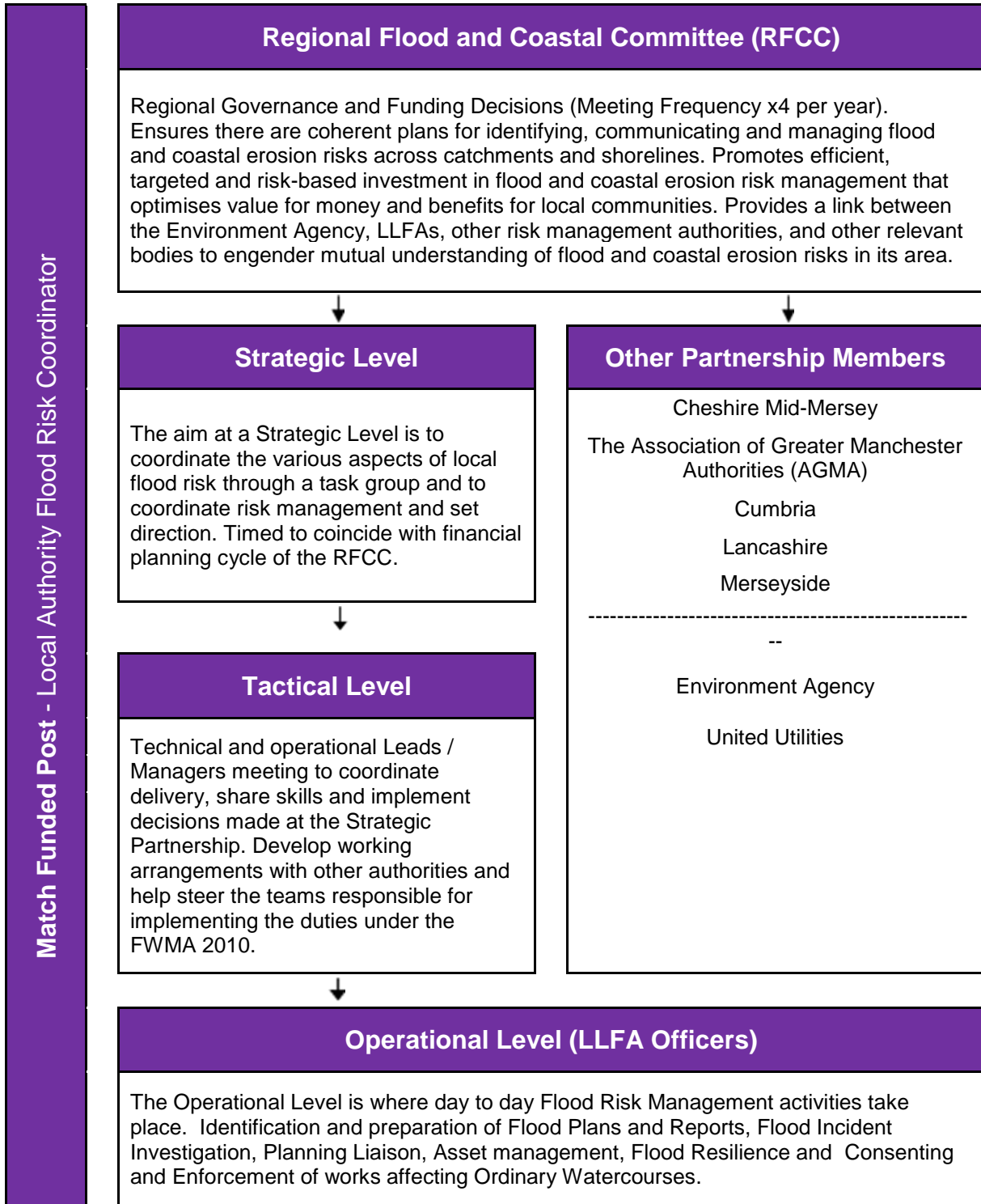
### **Regional Flood & Coastal Committee (RFCC)**

The RFCC for the North West region provides a local democratic role in the identification and management of flood and coastal erosion risk in order to ensure the purposeful and efficient spending of public money and other resources.

The RFCC works with LLFAs, the Environment Agency and other RMAs to develop a mutual understanding of risk across its locality, and use this understanding to help develop plans to manage risk reflecting DEFRA's aims for flood and coastal erosion risk management. RFCC meetings are held each quarter, although there may be additional meetings at a sub-group level where local authorities are working together.

The RFCC provides a platform for frequent knowledge transfer with all Partnerships situated in the North West region. These are;

- Cheshire Mid-Mersey
- The Association of Greater Manchester Authorities (AGMA);
- Cumbria;
- Lancashire;
- Merseyside.



**Figure 3.1: Cheshire Mid-Mersey Flood and Coastal Erosion Risk Management Partnership Structure**

**3.2.3 Public Engagement**

The Council recognises that members of the public have valuable information to contribute to local flood risk management. The Environment Agency’s ‘Building Trust with Communities’ (2005) document provided the basis for Cheshire West and Chester Borough Council of how to communicate risk including the causes, probability and

consequences to the general public and professional forums such as local resilience. The enforcement of FRR 2009 and FWMA 2010 into UK law accelerated the need for Councils to increase public engagement. This has brought significant benefits to local flood risk management including building trust, gaining access to additional local knowledge and increasing the chances of stakeholder acceptance of options and decisions proposed in future flood risk management plans.

### 3.3 Further Responsibilities

In addition to increasing partnership relations, coordinating, and leading on local flood management there are a number of other key responsibilities that have arisen for LLFAs since the introduction of the FRR 2009 and FWMA 2010. These responsibilities include:

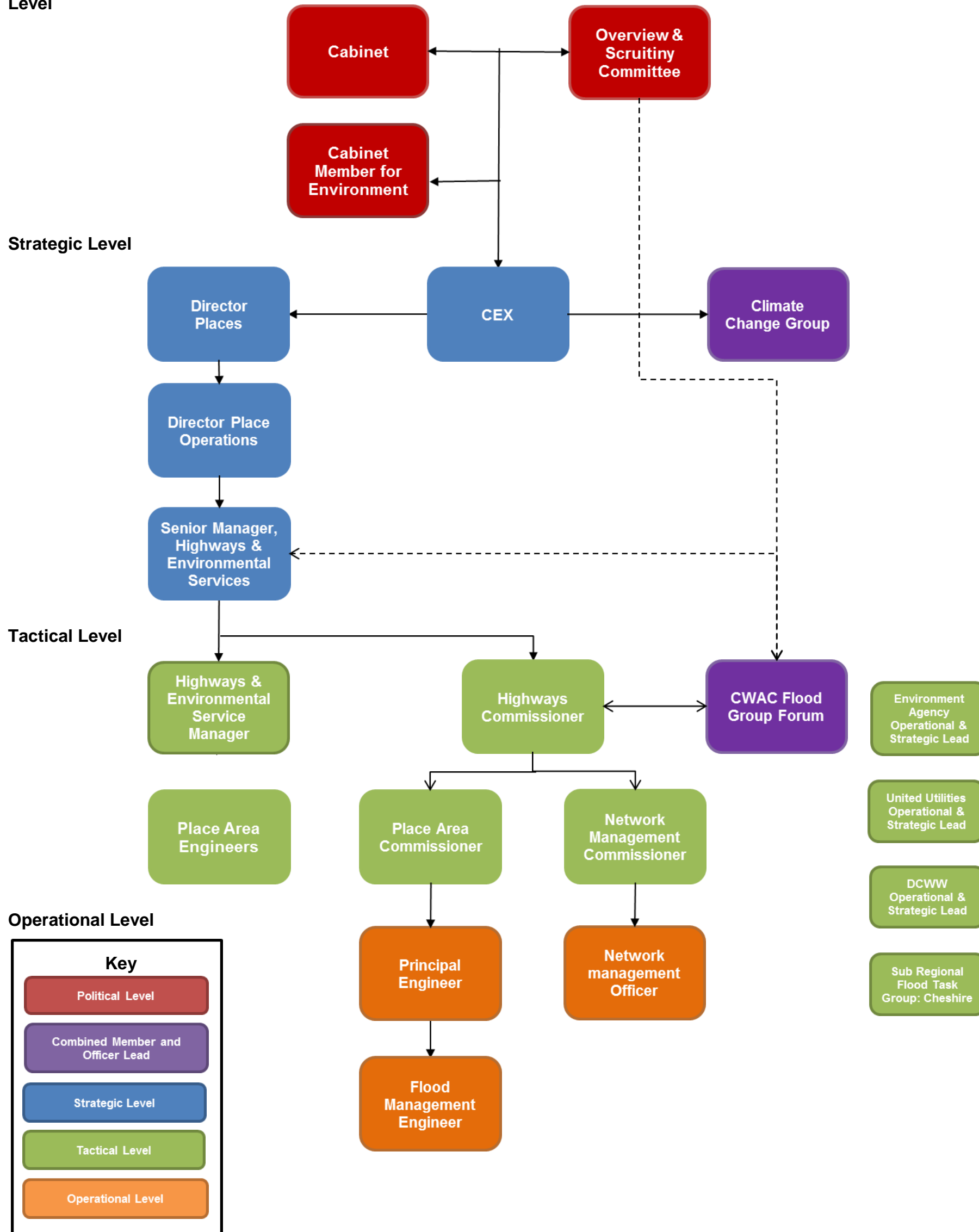
- **Investigating flood incidents** – Section 19 of FWMA 2010 state LLFAs have a duty to investigate and record details of significant flood events within their area. This duty includes identifying which authorities have flood risk management functions and what they have done or intend to do with respect to the incident, notifying risk management authorities where necessary and publishing the results of any investigations carried out.
- **Asset Register** – Section 21 of FWMA 2010 state LLFAs have a duty to maintain a register of structures or features which, in the opinion of the authority, are likely to have a significant effect on a flood risk in its area, and a record of information about each of those structures or features, including information about ownership and state of repair. 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.
- **Statutory Planning Consultee** – In December 2014, the Government announced changes to the planning system that required developers to prioritise the use of SuDS where technically feasible and economically viable. LLFAs became statutory consultees for major development proposals from April 2015. These changes are set out in Paragraph 103 of the National Planning Policy Framework (NPPF) and are supported by DEFRA's Non-Statutory Technical Standards for SuDS.
- **Local Strategy for Flood Risk Management** – Under Section 9 of FWMA 2010 LLFAs are required to develop, maintain, apply and monitor a local strategy for flood risk management in their area. The local strategy will build upon information such as national risk assessments and will use consistent risk based approaches across different local authority areas and catchments.
- **Works powers** – LLFAs have powers to undertake works to manage flood risk from surface runoff and groundwater, consistent with the local flood risk management strategy for the area.
- **Designation powers** – Under Schedule 1, Section 30 of the FWMA 2010, LLFAs 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.



- **Duty to Cooperate and Share information** – LLFAs, as well as other Flood Authorities (Environment Agency, Water Companies, other LLFAs) have a duty to cooperate with each other and the power to request information, in connection with flooding, of any person or body.
- **Consenting changes to Ordinary Watercourses (Amendment to Land Drainage Act 1991: S23, S24 and S25)** – 'Regulation' is the management of activities undertaken on watercourses. It involves granting consent for acceptable work to be carried out and taking enforcement action if work is unacceptable. If riparian owners wish to build a culvert/structure or make any alteration likely to affect the flow of an ordinary watercourse, land drainage consent is required from the Council as an LLFA.

Cheshire West and Chester Borough Council have fully complied with the above responsibilities since the first publication of the PFRA and will continue to strengthen these for the period 2017 – 2023.

**Political Level**



**Figure 3.2: Cheshire West and Chester Borough Council Flood Risk Management Governance Structure**

## 4. Methodology and Data Review

### 4.1 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. This is achieved through the production of flood risk and flood hazard maps and flood risk management plans.

In January 2017 DEFRA replaced its guidance on significant risk for the identification of FRAs for LLFAs about the criteria for assessing and reviewing whether a risk of flooding is significant. This replaced the previous guidance published in 2010 (updated March 2011).

The PFRA involves:

- Collecting information on past (historic) and future (potential) floods.
- Assembling the information into a preliminary assessment report.
- Identifying FRAs.

### 4.2 Methodology

The following phased process has been undertaken in order to produce this report:

**Table 4.1: Report Phases**

Phase	Description
1	<ul style="list-style-type: none"> <li>• Key partnership liaison - internal and external data collection</li> <li>• Stakeholder partnership meetings</li> </ul>
2	<ul style="list-style-type: none"> <li>• Review and analysis of historic flood risk data</li> <li>• Review and analysis of future flood risk data</li> <li>• GIS mapping of data</li> <li>• Draft report writing</li> </ul>
3	<ul style="list-style-type: none"> <li>• Review of indicative FRAs</li> <li>• GIS mapping</li> <li>• Draft report writing</li> </ul>
4	<ul style="list-style-type: none"> <li>• Internal draft report review from EA and internal Council staff</li> <li>• Council approval</li> <li>• Draft PFRA submitted to EA by 22<sup>nd</sup> June 2017</li> </ul>

### 4.2 Phase 1 – Data Collection

#### 4.2.1 Partner Organisations

The following authorities and organisations that were identified and contacted to share data for the preparation of the PFRA include:

- United Utilities;

- Dwr Cymru Welsh Water
- Environment Agency;
- Canal & River Trust (CWAC submitted a request for data but no data was available since 2011);
- Emergency Services.

#### 4.2.2 Critical Services

Within this PFRA critical services have been mentioned throughout. Critical services are defined by the EA as:

- Schools / Collages / Nurseries;
- Police Stations / Prisons;
- Nursing / Care / Retirement Homes;
- Fire Stations / Ambulance Stations / Hospitals / Clinics / GP Surgeries;
- Electricity Installations / Water Treatment & Distribution / Sewage Treatment Works.

The EA definition of Critical Services excludes Broadcasting (TV / Radio), CCTV Control rooms, Food processing, Gas / Oil Storage / Distribution, Oil Refining, Chemical Works, Incinerators, Landfill sites, Railway Stations and other Transport Related Infrastructure. All of which are significant from an Emergency Planning scenario.

#### 4.2.3 Data Collection

Table 4.2 catalogues the relevant information and datasets received from partner organisations and provides a description of each of the datasets that were obtained by Cheshire West and Chester Borough Council.

The data is geo-referenced where possible. This has made it possible to display this information using GIS software and overlay layers to identify the spatial distribution of historic flood events and relate these datasets to receptor information, in order to assess the overall flood risk.

**Table 4.2: Datasets received from partner organisations**

Organisation	Datasets Received From Partner Organisations
Environment Agency	Areas Susceptible to Surface Water Flooding Flood Map for Surface Water Indicative Flood Risk Areas Historic Flood Map Flood Event Outlines Main River and Ordinary Watercourse National Receptor Data
United Utilities	Internal & External Flooding of Properties
Welsh Water	Internal & External Flooding of Properties
Cheshire Fire & Rescue	Internal Flooding of Properties
Canal & River Trust	CWAC submitted a request for data but no data was available since 2011

The majority of the data has been specifically provided for this PFRA study and is not publicly available due to data protection requirements, therefore there are restrictions on data use. Cheshire West and Chester Borough Council must adhere to these data security measures. All data collected is stored on secured local servers, which are password protected.

Table 4.3 illustrates the restrictions on the use of this data.

**Table 4.3: Summary of data restrictions and licensing details**

Organisation	Restrictions on Use of Data
Dwr Cymru Welsh Water	The use of provided data is restricted to Cheshire West and Chester Borough Council and their partners for the preparation of its preliminary flood risk assessment
United Utilities	The use of provided data is restricted to Cheshire West and Chester Borough Council and their partners for the preparation of its preliminary flood risk assessment
Cheshire Fire and Rescue	The use of provided data is restricted to Cheshire West and Chester Borough Council and their partners for the preparation of its preliminary flood risk assessment
Environment Agency	The use of some data is restricted to Cheshire West and Chester Borough Council and their partners for the preparation of its preliminary flood risk assessment. The use of other data is unrestricted.

**Table 4.4: Recording the Quality of Data**

Data Quality Score	Description	Explanations	Example
1	Best possible	No better available; not possible to improve in the near future	<ul style="list-style-type: none"> <li>High resolution LIDAR</li> <li>River/sewer flow data</li> <li>Rain gauge data</li> </ul>
2	Data with known deficiencies	Best replaced as soon as new data are available	<ul style="list-style-type: none"> <li>Typical sewer or river model that is a few years old</li> </ul>
3	Gross assumptions	Not invented but based on experience and judgement	<ul style="list-style-type: none"> <li>Location, extent and depth of much surface water flooding</li> <li>Operation of un-modelled highway drainage</li> <li>'future risk' inputs e.g. rainfall, population</li> </ul>
4	<b>Heroic assumptions</b>	<b>An educated guess</b>	<ul style="list-style-type: none"> <li><b>Ground roughness for 2D models</b></li> </ul>

**Table 4.5: Relevant Information and Datasets Description**

Owner	Dataset	Description	Confidence Rating
Environment Agency	Risk of Flooding from Surface Water (RoFSW)	Published 2013 national surface flood map supersedes: <ul style="list-style-type: none"> <li>• Areas Susceptible to Surface Water Flooding maps (2008)</li> <li>• Updated Flood Map for Surface Water (2010)</li> </ul> Dataset provides banding for High, Medium and Low risk to depth and velocity. Dataset is updated annually.	2
	Flood Map (Rivers & Sea)	Shows the extent of flooding from rivers with a catchment of more than 3km <sup>2</sup> and from the sea.	2
	Areas Susceptible to Groundwater Flooding (AStGF)	1 kilometre square grid that identifies at a broad scale areas susceptible to flooding from groundwater on the basis of geological and hydrogeological conditions.	3
	National Receptor Database (NRD)	A national dataset of social, economic, environment and cultural receptors including residential properties, school, hospitals, transport infrastructure and electricity substations.	2
	Indicative Flood Risk Areas	Nationally identified flood risk areas, based on the definition of 'significant' flood risk described by DEFRA & WAG.	2
	Historic Flood Map (HFM)	GIS layer showing the maximum extent of all individual Recorded Flood Outlines from river, the sea and groundwater springs and shows areas of land that have previously been subject to flooding	3
	Mersey Estuary Catchment Flood Management Plan (CFMP)	CFMP's consider all types of inland current and future flooding, from rivers, groundwater, surface water and tidal flooding and are used to plan and agree the most effective way to manage flood risk in the future.	2
	LiDAR Data	Topographic Information held for Cheshire West and Chester Borough Council is generally high resolution data.	1
	Rain Gauge Information	Gauge information available at selected sites across Cheshire West and Chester Borough Council – made available on request	2
Telemetry	EA operates telemetry system across the Borough, watercourse level and flow information collected. – available on request	1	
Cheshire West and Chester Borough Council	Anecdotal information	Anecdotal information: flood risk, flood history and local flood hotspots.	4
	CMM Partnership Ordinary Watercourse Critical Asset Identification & Condition Survey	Outputs from partnership work consist of: <ul style="list-style-type: none"> <li>• Identification of critical assets</li> <li>• CCTV survey of identified culverts</li> <li>• Flood modelling</li> <li>• Ordinary Watercourse Condition data</li> </ul>	2
	Strategic Flood Risk Assessment Level 1	The Stage 1 SFRA focuses on collecting information regarding all sources of flooding. This helps to identify the spatial distribution of flood risk sources.	3

	Strategic Flood Risk Assessment Level 2	The Stage 2 SFRA focuses on the details nature of flood hazard taking into account the presence of flood risk management measures such as flood defences and the location of key development and regeneration areas.	2
	Historic Flooding Records	Historic records of flooding from surface water, groundwater and ordinary watercourses.	2
	Asset Register / Record	Register of flood risk management assets.	4
United Utilities	Modelling Information	Models of drainage systems operated and maintained by United Utilities.	2
	Asset Register	Asset register available to Cheshire West and Chester Borough Council on request.	2
	Telemetry	Information regarding sewer performance	2
	Modelling Information	Models of drainage systems operated and maintained by United Utilities.	2
Dwr Cymru Welsh Water	Modelling Information	Models of drainage systems operated and maintained by United Utilities.	2
	Asset Register	Asset register available to Cheshire West and Chester Borough Council on request.	2
	Telemetry	Information regarding sewer performance	2
	Modelling Information	Models of drainage systems operated and maintained by United Utilities.	2
Fire & Rescue	Incident Response Register	Issue logs of all events recorded by Cheshire Fire and Rescue Service. This includes internal floods such as burst pipes and sewerage problems	2
Other Sources	Media Records	Information obtained from online media – news websites / social media etc.	2

#### 4.2.4 Data Limitations

The first edition of the PFRA identified a number of issues during the data collection process. Whilst a some processes have since been improved, a number of limitations remain.

#### Inconsistent Recording Systems

Previously the lack of a consistent flood data being captured within one central recording system within Cheshire West and Chester Borough Council had led to inconsistencies in the recording of flood event data. Cheshire West and Chester Borough Council has partly addressed this issue as part of undertaking Sections 19 and 21 of the FWMA 2010. Flood

data is recorded centrally in Confirm, the Council's enquiry system. After 12 months data pertaining to the location of the flood incident reported and the person reporting the incident is removed in accordance with Data Protection legislation. Only sections of the study area recently been flooded have been scrutinised for consistency, the limitation of inconsistent recording still applies for those sections of the study area that have only experienced flooding historically.

### **Incomplete Datasets**

Some of the datasets collated are not exhaustive and are questionable to accurately represent the complete local flood risk issues in a particular area. Cheshire West and Chester Borough Council, along with the other stakeholders, have reduced the number of incomplete datasets since 2011. Records for recent flooding locations are now comprehensive, however knowledge gaps still remain in sections of the study area that have only experienced flooding historically and therefore hinder the identification of accurate FRAs.

### **Varied Quality of Data**

Depending upon stakeholder objectives of collecting information there have been leniencies in the varied quality in historic flood records. This has made it difficult to accurately assess the consequences of historic local flooding.

### **Records of Consequences of Flooding**

It is not always possible to clearly identify and compartmentalise flooding, particularly from engineered systems that are typically interconnected, which results in flooding from a combination of sources. Data records provided by the other partner organisations were not always comprehensive for specific past flood events. Since 2011 there has been increased co-operation with stakeholders to standardise the recording procedure to become more aligned and comprehensive, increasing confidence to identifying flooding source and consequence.

### **Quality Assurance**

Data collected was subject to quality assurance measures to monitor and record the quality and accuracy of acquired information and datasets. A data quality score was given, which is a qualitative assessment based on the Data Quality System provided in the Surface Water Management Plans (SWMP) Technical Guidance document (March 2010).

## **4.3 Phase 2 – Data Review and Analysis**

### **4.3.1 Assessing Historic Flood Risk**

Existing datasets, reports and anecdotal information from the stakeholders have been collated and reviewed to identify details of major past flood events which had locally significant harmful consequences. The analysis included an assessment of economic damage, environmental and cultural consequences and impact on the local population.

For further information on historical flooding please refer to Section 5 of this PFRA.



### 4.3.2 Assessing Future Flood Risk

The identification of FRAs through the PFRA should also take into account future floods, defined as any flood that could potentially occur in the future. This definition includes predicted floods extrapolated from current conditions in addition to those with an allowance for climate change. The assessment of future flood risks will primarily rely on a technical review of the Environment Agency's Risk of Flooding from Surface Water (RoFSW) maps first published in 2013 and updated annually.

The previous PFRA relied upon a technical review of surface water flood depth maps (1 in 200 annual chance of flood with 180 minute duration) produced for the Surface Water Management Plan (SWMP) as the best available information. For areas not covered by the SWMP modelling the Environment Agency's Areas Susceptible to Surface Water Flooding Map was used. Both datasets have been superseded by the RoFSW which, when compared to observe actual flooding, better represents the flood extents.

In January 2017 the PFRA guidance, first published in 2011, was revised due to increased understanding of the FWMA 2010 requirements, data collection and recording methods, completion of flood alleviation schemes, and technological advances to produce more accurate model predictions. Table 4.6 summarises the main differences between the guidance documents.

**Table 4.6: Differences between assessment criteria**

Description	2011 PFRA	2017 PFRA
Rainfall Return Period for analysis	1 in 30 year (3.3%) 1 in 200 year (0.5%)	1 in 30 (3.3%) 1 in 100 (1%) 1 in 1000 (0.1%)
Number of "blue squares" formed within a 3x3 km square grid to create a cluster. Refer to Section 4.1 for further information	5	5

RoFSW maps were generated using 'direct rainfall' modelling (the application of rainfall to all cells in a 2D model, and runoff is routed within the hydraulic model). RoFSW maps do not take into account any non-surface water influences such as rivers, sea, sewers or groundwater.

**Table 4.7: Risk Categories for RoFSW maps**

Banding	Return Period
High	>1 in 30 years (3.3%).
Medium	Between 1 in 100 (1%) and 1 in 30 years (3.3%).
Low	Between 1 in 1000 (0.1%) and 1 in 100 years (1%).
Very Low	<1 in 1000 years (0.1%).

Risk categories, to depth and velocity of flood waters, have been assigned based on the information provided by the Environment Agency. **Even though it is based as an annual chance of the event occurring, there is no limit on the event taking place at multiple times throughout the year.**

**Table 4.8: Information contained in the RoFSW banding.**

Predicted Depth (mm) Banding	Predicted Velocity (m/s) Banding
> 900	>0.25
300 to 900	<0.25
< 300	<0.25

Further information regarding the Risk of Flooding from Surface Water Maps (formerly known as the updated Flood Map for Surface Water - uFMfSW) is available at the following webpage:

<https://www.gov.uk/government/publications/flood-maps-for-surface-water-how-they-were-produced>

The following factors were considered when assessing the future flood risk across the study area:

- Topography.
- Location, and type, of drainage systems.
- Characteristics of watercourses (lengths, modifications).
- Location of Ordinary Watercourses and Flood Plains that retain water.
- Residential / economical areas.
- Effectiveness of any works constructed for the purpose of flood risk management.
- Current and predicted impact of climate change.
- Proposals for future development.

For further information on future flooding please refer to Section 6 of this PFRA.

#### **4.4 Phase 3 – Reviewing Indicative Flood Risk Areas**

Information on historic and future flood risk has been used to formally review FRAs. Flood risk indicators have been used to determine the impacts, and consequences, of flooding on human health, economic activity, environment and cultural heritage.

The flood risk indicators have been selected and analysed by DEFRA and the Environment Agency in order to identify areas where flood risk and potential consequences exceed a pre-determined threshold. The areas that have been identified using this methodology, and exceed 30,000 people at risk, have been mapped and identified as Indicative FRAs (Appendix A, Figure 2).

**Table 4.9: Key Flood Risk Indicators and Impacts**

Impact of flooding on:	Flood Risk Indicators
Human Health	Number of residential properties. Critical services (Hospital, Police / Fire / Ambulance Stations, Schools, Nursing, Homes, etc.). The number of critical services can be identified using the National Receptor Dataset (NRD). However the LLFAs note that NRDs do not show the impact of flooding of individual sites.
Economic Activity	Number of non-residential properties. Principal road that is flooded for longer than 5 hours. Area of agricultural land. With the details of the lengths placed into NRDs. it is also important to consider significant consequences by looking at the importance of the route (national, regional, local), alternatives and diversions. This is important in a case of any settlement, routes, rail networks being cut off by flooding.
Environment	Designated sites (SSSIs, SACs, SPAs, etc.) and BAP habitat. It also identifies the flooding consequences around pollution (PPC, COMAH) and Contaminated land.
Cultural Heritage	Cultural heritage sites (World Heritage Sites), Scheduled Ancient Monuments, Listed Buildings, Conservation Areas, Registered Parks and Gardens.

#### 4.4.1 The Criteria

Table 4.10 sets out for people, services, properties and communities, the level of flood risk which LLFAs should consider to be significant for the purposes of the Regulations. These indicators and criteria relate to the risk of surface water flooding from a rainfall event with a 1% (or 1 in 100) chance of occurring in any one year.

The Environment Agency has provided a set of indicative FRAs for LLFAs to consider. LLFAs are only required to do this in relation to local flood risks, including risks of flooding from surface water, groundwater and ordinary watercourses. They do not need to consider risks of flooding from the sea, main rivers or reservoirs, except where these may affect flooding from another source.

**Table 4.10: Indicators and criteria for assessing whether the risk of local flooding is significant for the purposes of identifying FRAs**

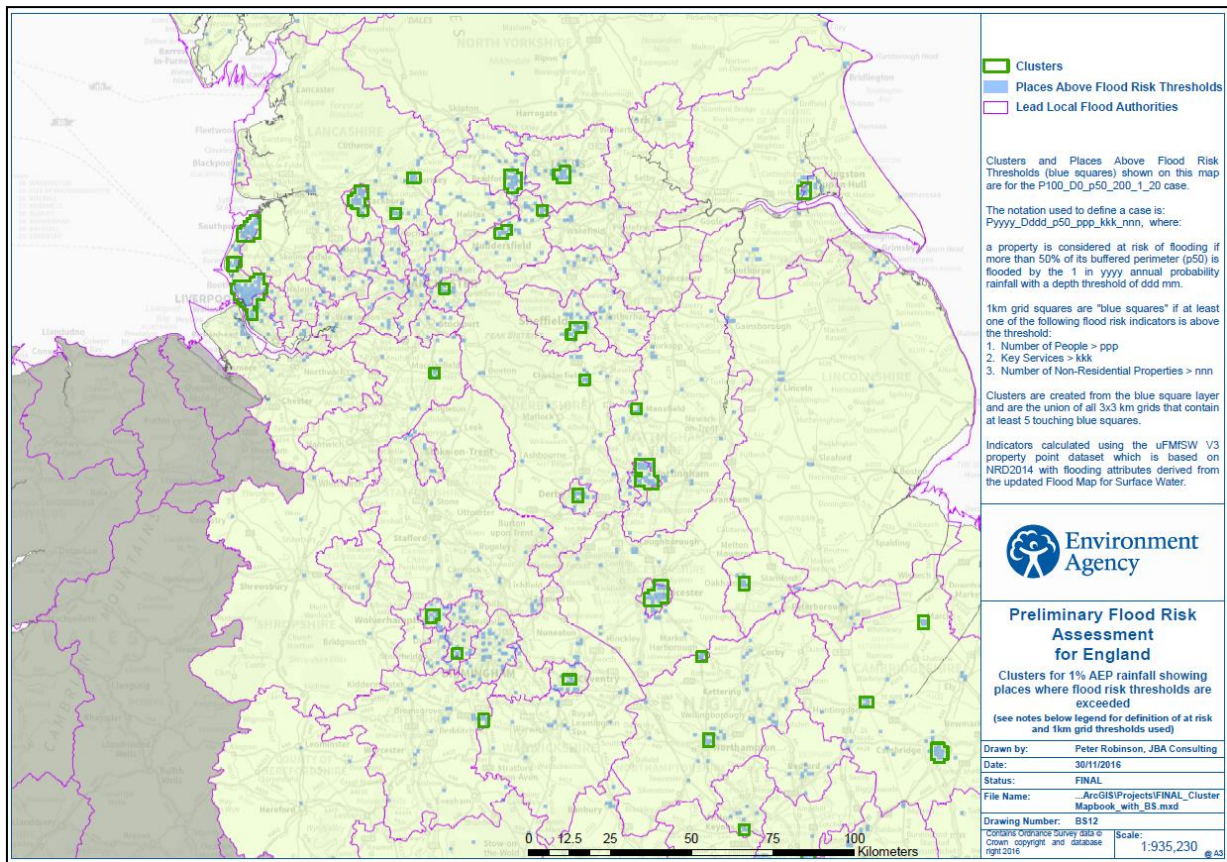
Method for determining indicative Flood Risk Areas	Definition	Indicator	Criteria
Cluster method	<p>A cluster is formed where, within a 3x3 km square grid, at least five of the nine 1km squares meet the criteria for one or more of the indicators.</p> <p>Where multiple overlapping grids meet the requirement, these are unified to form a larger cluster.</p> <p>All of the clusters (both small and large) have been identified as indicative flood risk areas.</p>	Number of people at risk of surface water flooding*	<p>200 people or more per 1km grid square</p> <p>Number of people taken as 2.34 times the number of residential properties at risk.</p>
		Number of key services at risk of surface water risk* e.g. utilities, emergency services, hospitals, schools	More than one per 1km grid square
		Number of reportable properties (residential and non-residential) properties at risk*	20 or more per 1km grid square
Communities at risk method	Community areas, as defined by the Office for National Statistics built-up areas (BUAs) and built-up areas sub-divisions (BUASD), where there is a large number of properties at risk.	Number of reportable properties (residential and non-residential) properties at risk*	3,000 or more reportable properties (residential and non-residential) within a BUA/BUASD.

\*Risk of surface water flooding from a rainfall event with a 1% (or 1 in 100) chance of occurring in any one year

#### 4.4.2 Review

Cheshire West and Chester Borough Council do not have any Clusters or Communities at Risk within the borough.

**Figure 4.1: Clusters for 1% AEP rainfall showing places where flood risk thresholds are exceeded**





## 5. Historic Flood Risk – Assessment of Past Flooding

### 5.1 Introduction

This section summarises the readily available and relevant information on historic floods. The PFRA guidance requires floods identified with “significant harmful consequences” to be reported in the spreadsheet in Annex 1 of this report.

“Significant harmful consequences” are considered to be impacts of flooding that may have negative consequences for human health, the social and economic welfare of individuals and communities, infrastructure, and the environment (including cultural heritage).

The definition of a past flood with “significant harmful consequences” is determined by the LLFA. The level of significance is chosen so that only relatively harmful flood events are included in the PFRA. Such flood events are those that would be deemed significant when considered from a national perspective.

For the purposes of this PFRA, the definition of “significant” has been defined by Cheshire West and Chester Borough Council as followed:

**Table 5.1: Historically Significant Harmful Consequences**

Impact of flooding on:	Category	Consequence
Human Health	Number of individuals	$\geq 200$
Economic Activity	Number of critical services	$\geq 2$
	Number of residential properties	$\geq 83$
	Number of non-residential properties	$\geq 20$
	Principal Highway Network	Transport links impassable for more than 5 hours.
Environment	-	-
Cultural Heritage	-	-

Using the definition above, Cheshire West and Chester Borough Council has no records of local floods with historically significant harmful consequences.

Irrespective of “significance”, Cheshire West and Chester Borough Council considers that all flood events that affect property or people justify consideration. Therefore, where known, information on all flood events has been gathered. A summary of the information specific to each source of flooding relevant to the PFRA is included in this chapter. Other floods that do not meet the criteria, or for which the consequences are not known, are not included in Annex 1, as per the PFRA guidance, but their locations are plotted on the relevant figures.

It is noted that flooding can be the result of complex interactions between the different sources (e.g. Main River and surface water) and the degree of influence from other sources are not always fully understood.

The Cheshire West and Chester Borough Council Local Flood Management Strategy, first published in February 2016, addressed these issues from the first publication of the PFRA. The strategy is to be reviewed by June 2021.

## 5.2 Overview

### 5.2.1 Surface Water Flooding (Overland Flow)

Surface water flooding, also known as pluvial flooding, results from overland flow before the runoff enters a watercourse or drainage system. It is usually the result of high intensity rainfall exceeding the hydraulic capacity of the receiving system. However it can also occur with lower intensity rainfall when the land has a low permeability and/or is already saturated, frozen or developed.

Surface water flooding within the United Kingdom is becoming a regular issue due to the high rate of developments creating large impermeable surfaces. There are certain locations within the study area where this flooding mechanism is more prominent due to the increased urban nature of the catchment, combined with the complex hydraulic interactions between the tidal systems, urban watercourses, surface water drainage systems, and combined sewer systems at overflow locations.

Some records do not identify the number, and duration, of properties flooded. This has led to low confidence as often only street names have been reported, regularly from local media, and do not specifically identify the nature of the flooding, possible causes, or exact locations.

Annex A provides a spatial overview of collected historic surface water flooding data. There are a total of 267 recorded historical surface water flooding events of varying significance and type by Cheshire West and Chester Borough Council.

**Table 5.2: Historic Flood Records Summary**

Organisation	Internal Flooding	External Flooding	Total
United Utilities	25	85	110
Dwr Cymru Welsh Water	18	11	29
CWAC	88	351	439
Cheshire Fire & Rescue (2013-16)	22	18	40
Totals	153	465	618

Cheshire West and Chester Borough Council have no recorded incidents of historically significant harmful consequences for surface water flooding.



### 5.2.2 Ordinary Watercourse Flooding (Fluvial)

Flooding from any type of watercourse, also known as fluvial flooding, occurs when intensive or prolonged rainfall causes a watercourse to exceed hydraulic capacity. The additional inflow causes the water to rise above its banks or retaining structures and subsequently flows onto the land.

All watercourses within the study area have been identified using the Environment Agency's Detailed River Network (DRN) and are classified as either Main River or Ordinary Watercourse. These are indicated in Figure 4 of Appendix A.

Main Rivers are usually larger rivers and streams. Other rivers are called Ordinary Watercourses. The Environment Agency carries out maintenance, improvement or construction work on Main Rivers to manage flood risk under the Water Resources Act 1991. Environment Agency powers to carry out flood defence work apply to main rivers only. Lead local flood authorities, district councils and internal drainage boards carry out flood risk management work on ordinary watercourses. The Environment Agency decides which watercourses are Main Rivers. It consults with other risk management authorities and the public before making these decisions. The Main River map is then updated to reflect these changes. Inclusion of Main Rivers is beyond the scope of this PFRA.

Ordinary Watercourses are any watercourses that are not designated a Main River by the Environment Agency and therefore come under the powers of Cheshire West and Chester Borough Council. These include every river, stream, ditch, drain, cut, dyke, sluice, sewer (other than a public sewer) and passage through which water flows and which does not form part of a Main River.

Ordinary Watercourses with known flood risks associated to them (limited channel capacity, channel constrictions or a poor maintenance regime) were previously designated Critical Ordinary Watercourses (COWs). These were not classified as Main River but which the Council had agreed with the Environment Agency to be critical because they have the potential to put at risk from flooding large numbers of people or property. In 2006/7, the Environment Agency reclassified all COWs as Main Rivers and took over responsibility for their maintenance and management, in a process known as enmainment.

There have been no reported incidents of internal flooding to property arising solely from fluvial flooding.

### 5.2.3 Sewer Flooding

Sewer flooding is often caused by drainage systems exceeding hydraulic capacity during periods of intensive, or prolonged, rainfall. These drainage systems, owned and maintained by the sewage undertaker (Dwr Cymru Welsh Water, and United Utilities), receive either:

- Foul only flows;
- Surface water flows;
- Both foul and surface water flows (combined system).

Combined sewerage systems are mostly associated with sections of the study area developed during the Victorian era. To maintain hydraulic efficiency the combined system contains a number of relief structures to divert excess flows to adjacent watercourses to

reduce the risk of sewer flooding from manholes. These structures are known as Combined Sewer Overflows (CSOs). The operation of these increases the risk of fluvial flooding, as well as pollution of the watercourse. Developments from the late 1970s / early 1980s have been constructed using individually separate foul and surface water systems, but many of them connect onto combined sewerage systems.

There are some housing developments from the early 20<sup>th</sup> century that utilise the principles of the separate system where both foul and surface water flows are routed in the one manhole. These dual manholes operate in a similar manner to CSOs and are normally situated at the head of the sewerage network, whereas CSOs are situated in the main body of the system. Dual manholes can cause major pollution problems from storm sewage discharges or dry weather discharges via surface water sewers as a result of foul sewer blockages.

Dwr Cymru Welsh Water and United Utilities have provided an incident register for locations that have experienced internal (i.e. flooding within a property) and external flooding from a number of sources. The register has been filtered to identify hydraulic issues, such as overloading of the sewerage system or restriction at outfall locations caused by high level in the receiving watercourse. "Other" causes of flooding, for example blockages, asset failure or other operational issues, have been discounted from this PFRA.

Figure 05 in Appendix A presents the historic sewer flooding information provided by Dwr Cymru Welsh Water and United Utilities. There have been a total of 110 flooding incidents (96 external and 43 internal) across the study area. Areas where the historic data suggests that sewer flooding is a particular issue are Chester City Centre, Ellesmere Port Little Sutton, and Tarvin.

Cheshire West and Chester Borough Council has not identified any historically significant harmful consequences due to flooding from the sewerage system. Areas affected by sewer flooding which have not been classified as having significant harmful consequences will be reviewed as part of Cheshire West and Chester Borough Council's longer-term strategy.

#### **5.2.4 Groundwater Flooding**

Groundwater flooding occurs when the water table rises above normally expected and anticipated levels and emerges at the ground surface. Groundwater flooding occurs in response to a combination of already high groundwater levels (regularly during mid or late winter) and intense or unusually prolonged periods of rainfall. Other mechanisms which produce groundwater flooding including:

- Artificial structures;
- Groundwater rebound (which occurs when abstraction, typically for drinking water, industrial or mine dewatering purposes, stops and water levels return to pre-abstraction levels);
- Mine water rebound;
- High in-bank river levels.

The occurrence of groundwater flooding is usually localised and, unlike flooding from watercourses, does not generally pose a significant risk to life due to the slow rate at which

the water level rises but can last several months and can cause significant social and economic disruption to the affected areas.

There are known locations with high groundwater within the Borough however, there are no specific records or reported incidents of internal groundwater flooding. Therefore it is considered currently that there are no groundwater flood incidents that would result in 'significant harmful consequences' as defined by the PFRA threshold.

### **5.2.5 Canals**

The Canal & River Trust, formerly British Waterways, is the organisation delegated for the maintenance of 2,000 miles of waterways in England and Wales.

In the study area there are three canals maintained by the Canal & River Trust. These are:

- Shropshire Union Canal
- Trent and Mersey Canal
- Weaver Navigation

There is one canal that is privately maintained by the Manchester Ship Canal Company. This is:

- Manchester Ship Canal

These engineered systems are heavily controlled and are unlikely to respond in the same manner during periods of rainfall as natural watercourses. The probability of flooding is more associated with residual risks, such as overtopping of canal banks, breaching of embanked reaches or asset (gate) failure. Each canal also has significant interaction with other sources of flood risk, such as the main rivers and the minor watercourses that feed them, or drains that cross beneath them.

Cheshire West and Chester Borough Council submitted a request for flooding since 2011 to the Canal and River Trust, but no data was available. Areas affected by canal flooding which have not been classified as having significant harmful consequences will be reviewed as part of Cheshire West and Chester Borough Council longer-term strategy.

### **5.2.6 Interaction with Main Rivers**

Many of the sources previously mentioned connect to the Main Rivers which eventually drain to the Irish Sea. For the study area the Main Rivers are:

- River Croco
- River Dane
- River Dee
- River Mersey
- River Weaver

Ordinary Watercourses flow into Main Rivers, and vice versa, Main Rivers flow into or under canals, and urban drainage systems outfall into Main Rivers. Flooding mechanisms associated with these interactions are often the result of flow backing up because another source has prevented normal discharge.

Information about historical flooding will often be due to an unknown source, or because of interactions between sources. This interaction will be difficult to identify without detailed flood risk studies.

The Environment Agency has legal responsibility for main rivers and as such flooding directly from them has not been discussed within this PFRA.

### **5.3 Summary**

Cheshire West and Chester Borough Council have reviewed and identified that there are no nationally significant flooding incidences within the study area. There is one historical local significant flooding incidence within the study area and that is the subject of a Section 19 Flood Investigation. There are also instances of flooding that are not significant, of which the Council are aware.

## 6. Future Flood Risk

### 6.1 Introduction

Whilst analysis of past flooding provides valuable information on the nature and extents of flooding that have occurred in Cheshire West and Chester Borough Council in the past, it does not necessarily inform us about how and where flooding may occur in the future.

Predictions of future flood risk are produced using combinations of hydrological and hydraulic modelling and analysis of past hydrological records to make future predictions. The following sections of this PFRA discuss the potential sources of flooding within the study area. The following sources of flooding have been considered in subsequent sections of this report:

- Ordinary watercourses (fluvial);
- Surface water;
- Groundwater;
- Canals.

### 6.2 Overview

#### 6.2.1 Surface Water Flooding

As identified in Table 4.5 there are a number of national and local level surface water flooding datasets available for the study area.

Since 2008 The Environment Agency has produced a series of surface water flood maps to aid local authorities in determining areas at risk of flooding. The latest incarnation of the maps is the Risk of Flooding from Surface Water (RoFSW) maps. This has been previously discussed in Section 4.3.2 of this report.

Environment Agency guidance on using surface water flood risk information recommends that Cheshire West and Chester Borough Council, as an LLFA, should: review, discuss, agree and record, with the Environment Agency, United Utilities, and other interested parties, what surface water flood data best represents their local conditions, known as “locally agreed surface water information”. Whilst this is not a requirement under the Regulations, it does inform the PFRA process as this information should play an important role in identifying FRAs.

Cheshire West and Chester Borough Council has agreed with all interested parties that the Risk of Flooding from Surface Water (RoFSW) mapping is the most appropriate dataset that represents the risk of flooding from surface water within the study area at a high level.

Annex 2 and Table 6.1 identify areas within Cheshire West and Chester Borough Council potentially at risk of surface water flooding.

It should be noted that the RoFSW dataset, the successor to uFMfSW, does contain the following limitations:

- In urban areas, rainfall is reduced to 70% to represent infiltration, then a rainfall reduction of 12mm/hr is applied to represent the effects of the drainage system.

- Large subsurface drainage elements, such as flood relief culverts and flood storage, are not included. These assumptions can affect the modelled extent and pattern of flooding. Modelled flood extents are particularly sensitive to the drainage rate used.
- At the national scale there is limited recorded surface water flood data that exists for LLFAs to perform validation, so in many places no validation has been carried out yet.
- As with many other flood models the input information, model performance and modelling that were used to create the RoFSW vary for different areas; these affect the reliability of the mapped flood extents and, in turn, the suitability for different applications.
- RoFSW does not take individual property threshold heights into account.
- The flood extents show predicted patterns of flooding based on modelled rainfall. In reality, no two storms are the same, and so two floods of similar rarity may result in different patterns of flooding and consequently these maps cannot definitively show that an area of land or property is, or is not, at risk of flooding.
- It does not show future scenarios, for example climate change.

This dataset has been used to assess the potential surface water flood risk to properties across the study area, summarised in Table 6.1.

**Table 6.1: Numbers of Properties Potentially at Risk from Surface Water Flooding in the Future**

Susceptibility to surface water flooding banding	Category	CWAC Review	Environmental Agency Review	Difference (absolute value)
High (1 in 30 yr)	All Properties	616	-	-
	Residential Properties	481	-	-
	Non-Residential Properties	121	-	-
	Critical Services	14	-	-
	People	1,126	-	-
Medium (1 in 100 yr)	All Properties	2,121	2,018	-103
	Residential Properties	1,777	1,767	-10
	Non-Residential Properties	311	251	-60
	Critical Services	33	43	10
	People	4,158	4,135	-23
Low (1 in 1000 yr)	All Properties	11,234	10,499	-735
	Residential Properties	9,473	9,403	-70
	Non-Residential Properties	1,626	1,096	-530
	Critical Services	135	159	24
	People	22,167	22,003	-164

NOTE- Unlike using buildings as the common point, 1m buffer drawing round NRD points and updated with information

Whilst it is recognised that due to future effects of climate change the overall susceptibility to surface water flooding will increase. Properties will still be banded as being at 'Low' risk through to 'High' risk of surface water flooding.

Property counts are derived from counts undertaken using GIS software and the National Receptor Database. The level of future flood risk and the estimated associated consequences are provided in the spreadsheet in Annex 2.

Further information to background and limitations to risk of surface water mapping by the Environment Agency can be obtained via the following link.

[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/297432/LIT\\_8988\\_0bf634.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/297432/LIT_8988_0bf634.pdf)

### **6.2.2 Sewer Flooding**

Hydraulic (1D) sewer models have been created which cover the majority of the sewerage network by Dwr Cymru Welsh Water and United Utilities. These have been verified against a flow survey to provide an accurate representation of network performance during both dry weather and storm conditions. A suite of design storm events of differing return periods, durations, and inclusive of the effects of climate change, are then applied to the models to assess hydraulic performance. The outputs include a range of predicted surcharge levels and flood volumes at individual node locations. Clusters of flooding nodes are then grouped based upon the common hydraulic deficiencies and / or geographic location and are checked against historical records to confirm existing flooding locations, as well as a tool to predict future flooding locations.

Whilst this data allows a high-level analysis of sewer flood risk, there are a number of limitations with the data:

- Not all sewer networks are modelled.
- Model confidence is low in sections of the network that were not covered by flow monitor during the survey period.
- The models are calibrated for a particular period and conditions the flow survey was installed and may not fully take into consideration the effects of seasonality.
- 1D models do not represent the flow path unlike 2D and Integrated Catchment Modelling (ICM) models. Predicted flood volume in 1D models departures and returns to the system at the same node location, in truth this may not be the case.
- Not all models accurately represent interaction watercourses at outfall locations. A number of 1D models are to be upgraded to include representation of watercourses, Integrated Catchment Modelling (ICM) which includes the 2D element, during the coming years. This will enable increased understanding of hydraulic interactions of all systems, in particular the operational performance of CSOs and flood routing paths of surfaces waters.

Figure 5 in Appendix A presents the historic sewer flooding information provided by United Utilities and Dwr Cymru Welsh Water. There have been a total of 139 flooding incidents (96 external and 43 internal) across the study area.

Based on information readily available on their website in their “Strategic Direction Statement” United Utilities are proposing to address a significant number of sewer flooding problems by 2020. Based on figures from 2015, this will include a 40% reduction to the number of properties experiencing internal foul flooding. This is to be achieved through investment in the completion of a number of studies and capital works projects.

Dwr Cymru Welsh Water are currently completing a consultation exercise and intend to publish a final version of “Welsh Water 2050” in 2018. This document will replace “Our Sustainable Future”, which is still available on their website.

### **6.2.3 Groundwater Flooding**

The British Geological Survey (BGS) Groundwater Flooding Susceptibility Map has been used to show the potential future groundwater flood risk. This data does not necessarily imply flooding of properties, only that groundwater would emerge at the surface first within the indicated areas.

The Groundwater Flood Susceptibility Map does not incorporate anomalous discharge from springs or flooding associated with urban groundwater rebound, mine water discharge, urban drainage, or any other flooding associated with changes in the engineered environment.

Figure 7 in Appendix A indicates that areas of the study area to the south west of Chester, in Ellesmere Port, in Northwich and the various villages across the borough are highly susceptible to groundwater emergence.

### **6.2.4 Ordinary Watercourses**

There is at present no specific Borough wide modelling for ordinary watercourses however the Environment Agency have produced Flood Zone Maps which shows the results of coarse modelling of catchments over 3km<sup>2</sup> (Figure 8 in Appendix A). The Environment Agency Flood Map does not provide information on flood depth, speed or volume of flow.

Figure 8 shows that few ordinary watercourses within the study area have been included within the Flood Zone Map. Most of the ordinary watercourses are not currently within high consequence locations, such as urban areas, however increased levels of development in the areas around existing urban settlements are likely to increase risk of flooding from ordinary watercourses. As things stand, although future climate change is likely to increase fluvial flood risk, the majority of risk will come from Main Rivers.

In order to better understand the risk of flooding from ordinary watercourse, Cheshire West and Chester Borough Council in 2012 commissioned JBA Consulting to assist the Council with development of an asset database and also to determine the flood risk associated with the assets collated.

JBA Consulting simulated flooding caused by 100% blockage scenario in pipes, culverts or bridges using JScreen software. JScreen defined the extent of flood, and analysed its consequences highlighting the different property types that are vulnerable to flood if a culvert or any other flood risk asset were to fail.



In 2014/15, Cheshire West and Chester Borough Council as part of the Cheshire Mid-Mersey Partnership (CMMP) undertook a project to improve the knowledge of flood risk from the ordinary watercourse network across the partnership area by undertaking asset inspections, topographical surveys and modelling works on ordinary watercourses which had been identified using the best available information at the time as potentially high risk. This project was considered to build upon the previous work completed by JBA due to the increase in collection of information.

CH2M Hill was appointed in November 2014 under the Water and Environment Management (WEM) Framework to undertake appropriate assessment of more than 30 km of non-main watercourse across the CMMP areas. Three separate surveys were outlined to capture the required data for the proposed study outputs;

- T98 Conditional Asset Assessment.
- CCTV survey.
- Topographical survey.

Catchment wide modelling and mapping was undertaken by CH2M following the completion of the survey investigations enabling visualisation of possible implications of events with return periods of 1 in 5 year, 1 in 30 year and 1 in 100 year. The modelled flood risk mapping represents the current situation of assets on the ground using the surveyed data to populate model data. (Flood Outline mapping shown in Figure 9, Appendix A) Model results have been used to produce depth grids, flood outlines and property counts based on properties from the Nation Receptor Database (NRD) to identify properties at risk.

The small size of the watercourses considered within this study means there were no observed flow data sets available, therefore best practice outlined by the Environment Agency was followed:

- Catchments delineated using GIS and FEH CDROM.
- Catchment descriptors from FEH CDROM used within ReFH analysis to calculate inflows for required return periods.

Summary of property counts (locations extracted from NRD) within flood outline for modelled reach as part of CH2M Hill study are shown in Table 6.2 below:

**Table 6.2: Numbers of Properties Potentially at Risk from Surface Water Flooding in Area of Modelling**

Location	Description	Property Count 1 in 5yr	Property Count 1 in 30yr	Property Count 1 in 100yr
Cheshire West 1	Helsby	1	2	3
Cheshire West 2	Kingsley	13	19	22
Cheshire West 3	Childer Thornton	0	0	0

Although it appears that flooding may occur, at the above sites. Property counts do not achieve the threshold to be determined as having “significant harmful consequences“. Kingsley (Cheshire West 2) is predicted to be the most vulnerable area in the administrative area.

Cheshire West 3 represents watercourses at Childer Thornton – between Hooton Lane, Church Wood and Ellesmere Port Golf Club. No culverts were modelled at this location as culvert capacities are not exceeded by calculated flows. Flood outlines do not show any properties at risk as the modelled area is relatively rural and a distance from any developments. Modelling technique has resulted in backwater effect of water between Church Wood and Hooton Lane due to the flat nature of the land at this site. Therefore no modelled flows have bypassed the lake at Church Wood to enter the reach at Ellesmere Port Golf Club.

### **Note – The River Mersey**

The Environment Agency do not classify the reach of the River Mersey through Cheshire West and Chester Borough Council as main river, as it is a heavily modified river system as extensive re-sectioning and embankment works were carried out in the 1960s. Although not classified as a main river, the Environment Agency does manage the river, with the River Mersey and its five main tributaries forming the focus of the Environment Agency's Flood Risk Management Strategy for Cheshire West and Chester Borough Council.

### **6.2.5 Canals**

The Canal & River Trust have previously undertaken a study for mapping flood risk areas. Cheshire West and Chester Borough Council submitted a request for data, but no new data is available since 2011.

## **6.2 Summary**

Based on DEFRA thresholds of more than 30,000 people at flood risk, flood risk from local flooding sources in Cheshire West and Chester Borough Council is below the level of significant risk

As indicated in Table 6.1 there are up to 2,018 properties (4,135 people) potentially at risk during a flood event with a 1% (1 in 100) annual probability.

## 7. Climate Change and Long Term Development

Generally, preliminary assessment reports in 2011 described only the broad implications of climate change at river basin district level, based on UK Climate Projections, 2009 (UKCP09). Since then, some LLFAs have carried out local studies that included climate change assessments on flood risk.

The next set of climate projections is due in 2018 (UKCP18). Until then UKCP09 is still a valid tool to aid decision-makers to assess the full range of risks from the changing climate and advise to adapt.

### 7.1 Initial Review

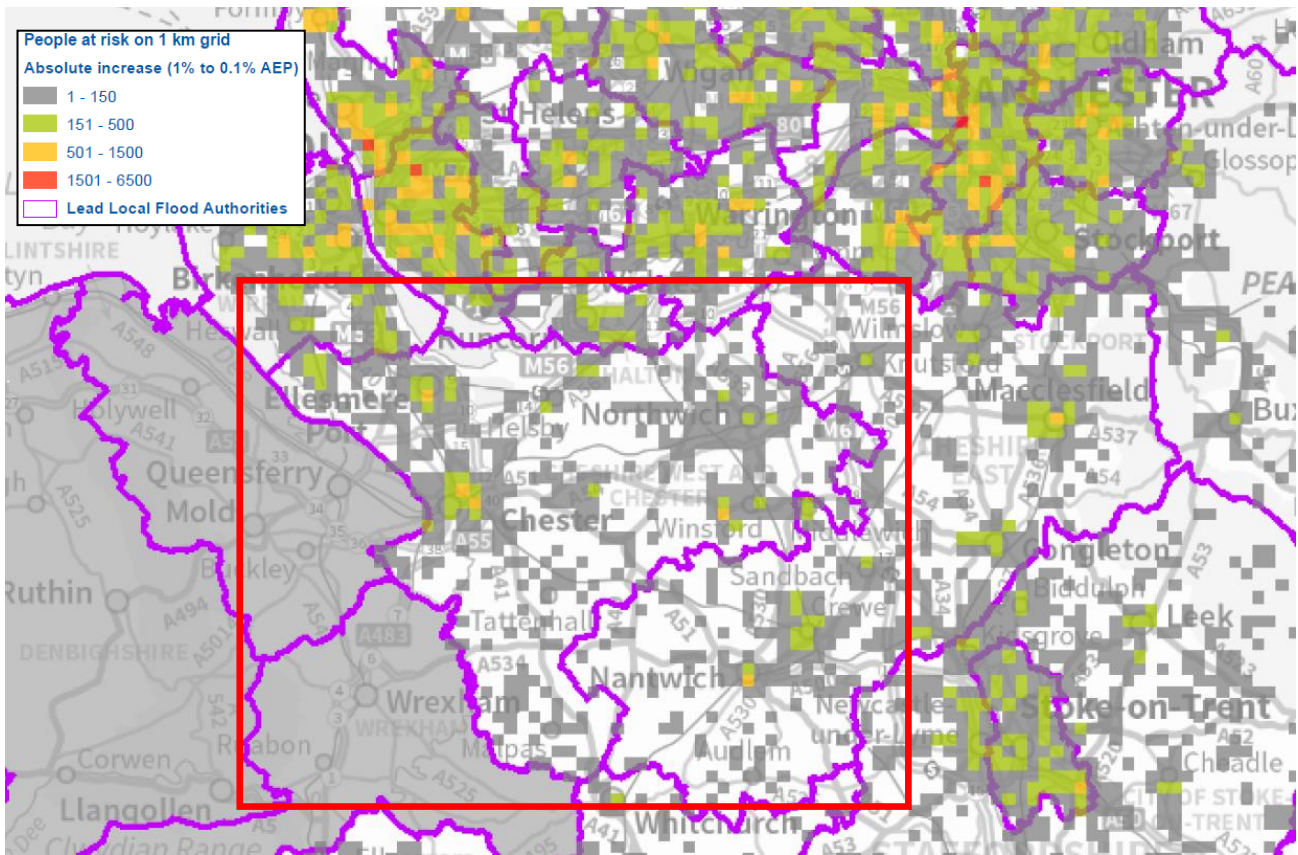
Whilst a significant amount of work has been completed since the introduction of the PFRA in 2011 it is still recognised that the implications of climate change for local flood risk are still not well understood.

The Environment Agency have carried out a simple analysis at the national level to compare the number of people at risk from surface water flooding from a rainfall event with a 1% chance (1 in 100 year return period) of occurring in any year to the number at risk from an event with a 0.1% chance (1 in 1000 year return period) of occurring in any year. The numbers of people at risk are counted per 1 kilometre grid square across England. The resulting 'heat map' shows how the absolute number of people at risk increases between these two rainfall events for each 1km grid square.

This method is not based on climate projections, and it does not account for future population growth. It does provide a simple way, however, of identifying areas that could be susceptible to increased rainfall intensity as a proxy for climate change. It is a reasonable proxy for an upper end climate change scenario for the end of the century, both in the pattern of change across the country and the percentage increase in intensity compared to the current climate.

Figure 7.1 shows an extract from the 'heat map'. Red and orange squares indicate the highest increase in numbers of people at risk, and green and grey indicate lower increases.

**Figure 7.1: Extract from the 'heat map' illustrating absolute increase in numbers of people at risk from surface water flooding for a 0.1% rainfall event compared to a 1% event**



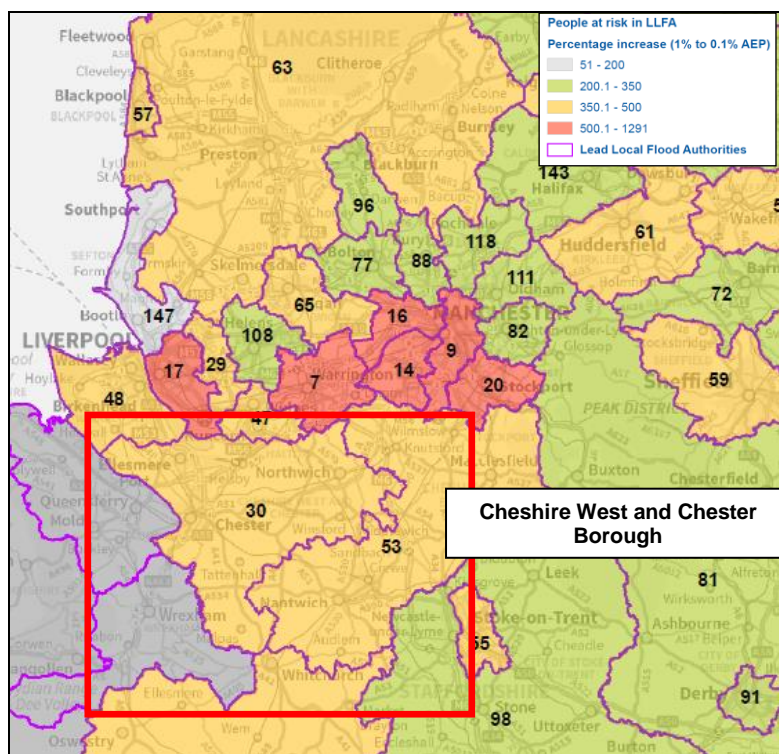
This 'heat map' provides an initial understanding of how climate change may affect local flood risk in the future, and helpful when considering the indicative FRAs as part of this PFRA review.

At the national scale the administrative area of Cheshire West and Chester Borough Council is positioned 30<sup>th</sup> out of 152 LLFAs when reviewing the percentage increase in people at risk of flooding in LLFAs for the 0.1% rainfall event compared with the 1% event. Whilst this may sound severe Cheshire West and Chester Borough is positioned 90<sup>th</sup> in absolute increase in people at risk of flooding.

**Table 7.1: Absolute and percentage Increase in the number of people at risk of flooding by LLFA for 0.1% (1000 year) rainfall event compared with 1% (100 year) event**

Rank	LLFA Name	Residential properties (1 in 100 year)	Residential properties (1 in 1000 year)	Non residential properties (1 in 100 year)	Non residential properties (1 in 1000 year)	Key Services (1 in 100 year)	Key Services (1 in 1000 year)	Number of People (1 in 100 year)	Number of People (1 in 1000 year)	Absolute increase between 1 in 100 and 1 in 1000 year	Percentage increase in people at risk
1	City of Portsmouth (B)	392	5,452	98	617	8	52	917	12,758	11,841	1291
2	Newham London Boro	1,463	14,514	109	1,154	20	154	3,423	33,963	30,540	892
3	North East Lincolnshire (B)	1,021	9,874	71	688	16	74	2,389	23,105	20,716	867
7	Warrington (B)	890	7,298	117	855	25	142	2,083	17,077	14,994	720
30	Cheshire West and Chester Borough	1,767	9,403	251	1,096	43	159	4,135	22,003	17,868	432
47	Halton Borough	809	3,886	127	830	18	59	1,893	9,093	7,200	380
53	Cheshire East Borough	2,204	10,481	430	1,343	31	148	5,157	24,526	19,369	376

**Figure 7.2: Extract from percentage increase in the number of people at risk of flooding by LLFA for 0.1% (1000 year) rainfall event compared with 1% (100 year) event**



Note: Number in LLFA indicates the rank of the LLFA in order of largest to smallest percentage increase in number of people at risk, and corresponds to Table 7.2

## 7.2 The Impacts of Climate Change – The Evidence

Over the past century around the UK sea level rises have occurred and more of our winter rain falling in intense wet spells. Seasonal rainfall is highly variable. It seems to have decreased in summer and increased in winter, although winter amounts changed little in the last 50 years. Some of the changes might reflect natural variation; however the broad trends are in line with projections from climate models.

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 2080's.

There is enough confidence in large scale climate models to say that Cheshire West and Chester Borough Council and the UK must plan for change. There is more uncertainty at a local scale but model results can still help to plan to adapt. For example it is now understood that rain storms may become more intense, even though there are still uncertainties 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%

## 7.3 Key Projections for North West River Basin District

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

- Winter precipitation increases of around 14% (very likely to be between 4 and 28%)
- Precipitation on the wettest day in winter up by around 11% (very unlikely to be more than 25%)
- Relative sea level at Morecambe very likely to be up between 6 and 36cm from 1990 levels (not including extra potential rises from polar ice sheet loss)
- Peak river flows in a typical catchment likely to increase between 11 and 18%

Increases in rain are projected to be greater near the coast than inland.

## 7.4 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 especially in steep, rapidly responding 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 Cheshire West and Chester Borough Council needs to be prepared for the unexpected.

Drainage systems in the district may 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.

Where appropriate, Cheshire West and Chester Borough Council will be involved in local studies to understand climate impacts in detail, including effects from other factors like land use. Sustainable development and drainage will help with adaptation to climate change and manage the risk of damaging floods in future.

## **7.5 Adapting to Change**

Past emission means some climate change is inevitable. It is essential Cheshire West and Chester Borough Council and the UK respond by planning ahead. The Council can prepare by understanding 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, the Council has had to make local decisions with less certainty. A range of measures therefore will need to be considered to retain the flexibility to adapt. This approach, embodied within flood risk appraisal guidance, will help to ensure that the Council does not increase the vulnerability to flooding.

## **7.6 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, Section 10 of National Planning Policy Framework (section of relevance formally 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.

In Wales, Technical Advice Note 15 (TAN15) on development and flood risk sets out a precautionary framework to guide planning decisions. The overarching aim of the precautionary framework is "to direct new development away from those areas which are at high risk of flooding."

Adherence to Government policy ensures that new development does not increase local flood risk. However, in exceptional circumstances the Local Planning Authority may accept that flood risk can be increased contrary to Government policy, usually because of the wider benefits of a new or proposed major development. Any exceptions would not be expected to increase risk to levels which are "significant" (in terms of the Government's criteria).

Cheshire West and Chester Borough Council will ensure new developments will manage surface water at source and ensure developments do not contribute to flooding problems

elsewhere. Where possible, new developments may relieve existing problems by improved management of surface water flows.

## **7.7 Local Drainage Capacity**

Since the introduction of the FWMA 2010 Cheshire West and Chester Borough Council has done some work to increase its knowledge to the local drainage systems. This is to be documented as part of the asset register, although there still remains a knowledge gap in sections of the study area. To develop flood alleviation strategies within the study area, additional investigation to identify these local drainage systems are required. This is an on-going exercise and will be addressed in future reports.



## 8. Review of Indicative Flood Risk Areas

### 8.1 Overview

As described in Section 4 in order to ensure a consistent national approach, DEFRA have identified significant criteria and thresholds to be used for defining FRAs.

Guidance on applying these thresholds has been released in the Environment Agency's "*Review of preliminary flood risk assessments (Flood Risk Regulations 2009): Guidance for lead local authorities in England*" (25<sup>th</sup> January 2017) which superseded DEFRA's "*Selecting and reviewing Flood Risk Areas for local sources of flooding*" (first published September 2013, withdrawn February 2017). This guidance document sets out agreed key risk indicators and threshold values which must be used to determine FRAs.

The methodology is based on using national flood risk information to identify 1km grid squares where local flood risk exceeds a defined threshold. Where a cluster of these grid squares leads to an area where flood risk is most concentrated and over 30,000 people are predicted to be at risk of flooding, this area has been identified as an Indicative FRA.

Figure 2 in Appendix A shows the High Risk Areas identified by DEFRA.

There are no clusters shown in the study area, and therefore there are no Indicative FRAs within the Cheshire West and Chester Borough Council boundary as defined by the PFRA criteria.

Cheshire West and Chester Borough Council has accepted the current proposed indicative significant FRAs. However, it is recognised that the Council has several locally significant flood risk issues as can be seen on other flood data collated.



## **9. Next Steps**

### **9.1 Future Data Management Arrangements**

#### **9.1.1 Investigation**

In order to continue to fulfil the role of Local Lead Flood Authority Cheshire West and Chester Borough Council is required to investigate future flood events and ensure continued collection, assessment and storage of flood risk data and information. The central flood data collection spreadsheet will be updated with each flood event.

#### **9.1.2 Policy for Investigation and Recording**

All flood events will be subject to investigations and recording. The local threshold for formal investigation leading to publication is a flood event with significant consequences. A flood event with significant consequences is one that has had, or could have had if action had not been taken, one or more of the following impacts:

- Resulted in major disruption to the flow of traffic.
- Posed, or could have posed, a risk to human health.
- Adversely affected the functioning of critical infrastructure.
- Caused harmful impacts to environmentally and socially important assets.
- Caused internal flooding to a property used for residential or commercial purposes.

It is crucial that all records of flood events are documented consistently and in accordance with the INSPIRE Directive (2007/2/EC), European Directive transposed into UK Law in December 2009. The centralised database will be kept up to date by Cheshire West and Chester Borough Council, who has the overall responsibility to manage flood data throughout the administrative area. This can be used as an evidence base to inform future assessments and reviews and for input into the mapping and planning stages.

#### **9.1.3 Asset Register**

Section 21 of FWMA 2010 state LLFAs have a duty to maintain a register of structures or features which, in the opinion of the authority, are likely to have a significant effect on a flood risk in its area, and a record of information about each of those structures or features, including information about ownership and state of repair. Cheshire West and Chester Borough Council will continue to develop this database.

### **9.2 Review Procedures**

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 FRAs are identified.

The review procedure will comprise two key steps, namely, Local Authority Review and Environment Agency Review. The Review Checklist in Annex 4 of this document is used by all LLFA's and the Environment Agency to review and ensure a consistent review process is applied.

The review of the PFRA for Cheshire West and Chester Borough Council will be undertaken by the Lead Local Flood Officer and the Executive Member for Environmental Protection.

### **9.2.1 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, quality assurance and resilience. The Council will then take it for approval in accordance to Corporate Procedures before being delivered to the Environment Agency to ensure national consistency.

The PFRA must be reviewed and updated every 6 years. The first edition of the PFRA was submitted to the Environment Agency on 22<sup>nd</sup> June 2011. This report (the second edition) is the first review and is to be submitted to the Environment Agency on 22<sup>nd</sup> June 2017 under Sections 10 and 17 of FRR 2009.

### **9.2.2 Environment Agency Review**

Under Section 10 of FRR 2009 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 FRAs have been amended and ensure the format of these areas meets the provide standard. Once satisfied, the Environment Agency EA will then recommend submission of the PFRA to the relevant Regional Flood Defence Committee (RFDC) for endorsement if satisfied. 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.

All PFRAs obtained by the Environment Agency will then be collated, published and submitted to the European Commission by 22<sup>nd</sup> December 2017 under Section 16 of FRR 2009.

Future review cycles, of no more than 6 years, will use the same procedure described above.

## **9.3 Spatial Developments**

The PFRA, along with the SFRA and SWMP, will inform the Local Development Framework (LDF). Strategic development will be approached through planning and development, appropriate design, situation and location of future development can all contribute to reducing the risk of flooding, including;

- Application of property and location specific flood protection measures;
- Application of sustainable urban drainage techniques for new developments;
- Identify river corridors and the natural flood plain to provide potential riverside storage and urban river corridors in built up areas.

Cheshire West and Chester Borough Council is a statutory consultee for major developments which have surface water implications. The Council is to provide comments in relation to surface water drainage aspects of planning applications within 21 days.

## **Annexes**

Annexe 1	Past Floods
Annexe 2	Future Floods
Annexe 3	Flood Risk Areas
Annexe 4	PFRA Checklist

## Appendix A: Figures

Figure 1:	PFRA Study Area
Figure 2:	DEFRA / EA Identified 1km <sup>2</sup> High Surface Water Flood Risk Thresholds
Figure 3:	CWAC Spatial Distribution of Historic Flood Records
Figure 4:	Classification of Watercourses Within the Administrative Boundary of CWAC
Figure 5:	United Utilities / Dwr Cymru Welsh Water Spatial Distribution of Historic Flood Records
Figure 6a:	EA Risk of Flooding from Surface Water Dataset (CWAC West)
Figure 6b	EA Risk of Flooding from Surface Water Dataset (CWAC East)
Figure 6c	EA Risk of Flooding from Surface Water Dataset (CWAC South)
Figure 7:	BGS Groundwater Flood Risk Map
Figure 8:	Environment Agency Flood Map for Planning
Figure 9:	Ordinary Watercourse Model Outputs from CMM Partnership Project
Figure 10:	Review of Critical Services at Risk of Surface Water Flooding
Figure 11:	Cheshire Fire and Rescue Historic Flood Locations

## Appendix B: Methods used to develop indicative FRAs for the second cycle

***Extract from Review of preliminary flood risk assessments (Flood Risk Regulations 2009): guidance for lead local flood authorities in England (25th January 2017 – produced by the Environment Agency)***

We used two methods to identify areas of potentially significant risk as the basis for the indicative FRAs. In each case we used national information from the current (2016) Risk of Flooding from Surface Water (RoFSW) map - previously known as the updated Flood Map for Surface Water (uFMfSW) - and a rainfall event with a 1% chance of occurring in any year.

### **Method 1 - Cluster analysis for concentrations of people/property at risk**

In this method, 1km grid squares of places where surface water flood risk is an issue ("blue squares") were identified wherever at least 200 people or 20 non-residential properties or more than 1 key service might be flooded.

In some areas these blue squares are densely packed together representing a concentration of high consequences from surface water flooding and providing a way of identifying areas where flood risk could be significant. Where many grid squares are close together (clustered) and the risk is most concentrated, these clusters form indicative FRAs.

All clusters contain at least 5 adjacent blue squares. The flood risk indicators used in the identification of indicative FRAs are summarised in the table below. These are similar to those used to develop indicative FRAs in 2011, but using a rainfall event with a 1% chance of occurring in any year rather than 0.5% chance as in 2011. This is because current surface water risk products do not include the assessment of a 0.5% chance rainfall event.

**Table B-1: Definition of flood risk indicators used in cluster analysis**

Indicator	Definition	Threshold
People	Number of people at risk taken as 2.34 times the number of residential properties at risk of flooding	200 people or more per 1km grid square
Key Services	Number of key services at risk, for example utilities, emergency services, hospitals, schools	2 or more per 1km grid square
Non-residential Properties	Number of non-residential properties at risk from flooding	20 or more per 1km grid square

### **Method 2 - Communities at risk (C@R)**

Method 1 identifies locations where the density of flood risk is highest across the country. There are other locations where the total flood risk is high but not as concentrated as those areas identified in method 1. So, to complement method 1, we have used information from our C@R work.

For C@R we have analysed the surface water flood risk for communities according to [Office for National Statistics built-up areas \(BUAs\) and built-up areas sub-divisions \(BUASDs\)](#).

Built-up areas (BUAs) are characteristic of settlements including villages, towns or cities. In 2011 across England and Wales 95 per cent of the usually resident population lived in



BUAs. They include areas of built-up land with a minimum of 20 hectares (200,000m<sup>2</sup>). Any areas with less than 200 metres between them are linked to become a single BUA, with BUASDs identified.

Where available, we have used BUASDs to provide greater granularity of communities in large urban areas. Where this approach identifies 3,000 or more reportable properties at risk of surface water flooding, the BUA/BUASD forms an indicative FRA. As with method 1, this is for a rainfall event with a 1% chance of occurring in any year.

The National Receptor Database (NRD2014) property point dataset with the uFMfSW Property Point v3 attributes was used to classify a property as 'at risk' of flooding from surface water. 'At risk' properties were counted by BUASD boundary (to exclude non-reportable property points e.g. telephone boxes, advertising hoardings).

### **Combining method 1 and method 2 and identifying indicative FRAs**

In some locations, clusters of blue squares from method 1 and BUA/BUASDs from method 2 overlap. Where this is the case, the indicative FRA is the total extent of the two areas combined.

## Appendix C: Limitations to the Methods used to develop indicative FRAs for the second cycle

### Method 1 - Cluster analysis for concentrations of people/property at risk Grid-based approach

Cheshire West and Chester Borough Council had two main concerns regarding the approach taken by the Environment Agency.

1. The requirement for two critical services to be within the threshold may be misrepresentative of the importance of those critical services. For example:

- Two nursing homes would outrank a hospital or;
- Two electricity sub-stations would outrank a school.

Whilst these issues can be followed up on an individual basis, the standard procedure would not pick up a grid square containing a single, but vital, critical service.

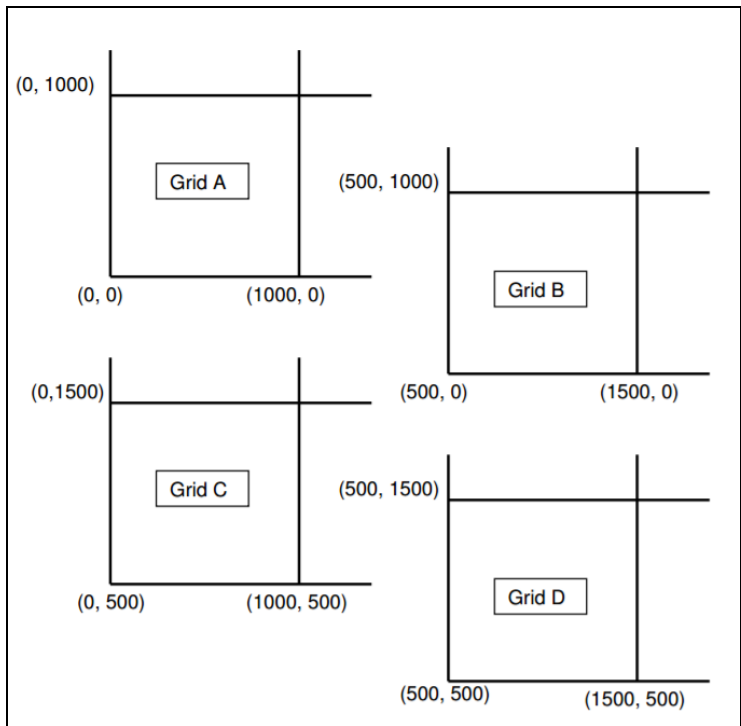
Cheshire West and Chester Borough Council undertook an internal review of the dataset to identify all critical services within the Borough and are illustrated in Figure 10 Appendix A.

Cheshire West and Chester Borough Council agrees with all the critical service locations identified by the Environment Agency at risk of flooding, including those which are above the threshold. There were no locations identified that resulted in outranking as in the aforementioned example.

2. The grid-based approach contains an arbitrary reference. The geographical location of each grid square depends upon the grid origin, which is set by the Ordnance Survey grid system. If for example the grid square was repositioned by 500m, as illustrated in Figure C-2, then the number of critical services within a 1km<sup>2</sup> may alter and thus may / may not adhere to the desired threshold.

Cheshire West and Chester Borough Council did not undertake any further analysis to a shift in the grid system as the Ordnance Survey grid system is considered to be a national standard.

**Figure C-1: Variation to shift in grid system**



### Allocation of Critical Services

The National Receptor Dataset (NRD) contains a property categorisation code that links to methods in the Multi-Coloured Manual (MCM) for estimating flood damages based on flood depth. NRD links individual property types in the property points dataset (known as OS Base Function property types) to MCM codes, to facilitate flood damage estimation. Each MCM code is therefore a broad category (such as 'hospital') containing a number of detailed property types. In defining the detail of flood risk indicators the Environment Agency based indicators on MCM codes where suitable, and used more detailed OS Base Function property types where the property classification was not suitable. For the purpose of the PFRA, critical services are defined by the Environment Agency in Table C-1.

**Table C-1: Critical Services**

Critical Service	MCM Code	Description
Schools	Not used	Initially MCM code 610 was considered (described as School, College, University, Nursery). However this includes some OS Base Function property types that are not critical services, such as 'vehicle driver training' and 'training'. Instead the Environment Agency chosen a set of OS Base Function types: Education Primary School First School Private School Further education college School High School School for the Deaf Higher Education Secondary School Infant School Special School Junior School Technical School Middle School University Nursery Pre-school Education Etc....
Hospitals	660	-
Nursing/Care/Retirement Homes	625	Predominately comprises nursing homes and rest homes, but also covers a number of other institutions, including prisons.
Police Stations	651	-
Fire and Ambulance Stations	650	-
Prisons	625	Predominately comprises nursing homes and rest homes, but also covers a number of other institutions, including prisons.
Sewerage Treatment Works	840	-
Electricity Installations	960	-

Cheshire West and Chester Borough Council undertook a sensitivity analysis as part of the PFRA review. Whilst the methodology utilised by the Environment Agency is considered acceptable, caution was required to the sub-classification of these and their relevance. Reviewing the 2013 Multi-Coloured Manual (Chapter 5: Flood damage to non-residential properties) a number of NRD codes were incorrect, duplicated, or categorised as generic within the Cheshire West and Chester Borough Council area. An example of this is illustrated in Table C-2.

Further information to the classification of NRD to MCM codes can be obtained from the following location:

<http://www.mcm-online.co.uk/wp-content/uploads/2015/05/Ch5-Matching-NRD-to-MCM-Codes.pdf>

**Table C-2: Example of Critical Services Discrepancy within Cheshire West and Chester**

Environment Agency Review		Cheshire West and Chester Borough Council Review	
Critical Service	MCM Code	Critical Service	MCM Code
Hospitals	660	Hospice	6
		Hospital	6
		Hospital / Hospice	6
		Medical	6
		Professional Medical Service	6

The internal review process identified no additional critical services at risk of flooding with respect to the Environment Agency review. However, it did provide an overview to critical services which are beyond the threshold but may be vulnerable to future flooding

### Number of people at risk of surface water flooding

In order to verify information provided by Environment Agency, Cheshire West and Chester Borough Council undertook an internal review to assess confidence in the data.

The population per household for the PFRA assessment has been set by the Environment Agency as 2.34. The 2.34 multiplier is based on the Office for National Statistics General Household Survey, 2006. According to the Office for National Statistics Census information, the average household size in the UK was 2.30 people per household, compared to 2.40 in 2001. The average population with the 46 wards of Borough Council is 2.30 (2011 census). Whilst the population factor used for the PFRA is considered acceptable for Cheshire West and Chester Borough Council at the national level, caution is required due to the population distribution at the local level which may result in a 1km<sup>2</sup> exceeding the  $\geq 200$  people threshold.

**Table C-3: Populations per household within Cheshire West and Chester Borough Council**

Cheshire West and Chester Borough Council	Population per Household (2011 census)*
Blacon	2.3
Boughton	1.9
Chester City	1.7
Chester Villages	2.4
Davenham & Moulton	2.4
Dodleston & Huntington	2.4
Ellesmere Port Town	2.2
Elton	2.3
Farndon	2.3
Frodsham	2.2
Garden Quarter	2.4
Gowy	2.4
Grange	2.3
Great Boughton	2.3
Handbridge Park	2.1
Hartford & Greenbank	2.4
Helsby	2.3
Hoole	2.2
Kingsley	2.4
Lache	2.3
Ledsham and Manor	2.5
Little Neston and Burton	2.3
Malpas	2.3
Marbury	2.4
Neston	2.2

Cheshire West and Chester Borough Council	Population per Household (2011 census)*
Netherpool	2.2
Newton	2.2
Parkgate	2.2
Rossmore	2.0
Saughall & Mollington	2.4
Shakerley	2.4
St Pauls	2.3
Strawberry	2.5
Sutton	2.4
Tarporley	2.3
Tarvin & Kelsall	2.4
Tattenhall	2.3
Upton	2.4
Weaver & Cuddington	2.3
Whitby	2.4
Willaston & Thornton	2.2
Winnington & Castle	2.2
Winsford Over & Verdin	2.4
Winsford Swanlow & Dene Ward	2.4
Winsford Wharton	2.5
Witton & Rudheath	2.4
<b>Average</b>	<b>2.3</b>

\*Values have been rounded to one decimal place

In relation to Point 2 of the grid-based approach, any amendment to the positioning the grid square may result in exceedance of the >200 people threshold.

### Council Boundary - 1km<sup>2</sup> grid vs Actual Boundary

The outputs of calculating critical services, residential and non-residential properties within the Cheshire West and Chester Borough Council area is contained within the 1km<sup>2</sup> grid square provided by the Environment Agency. The administrative boundary divides squares, thus a discrepancy is created between the Council's dataset and that provided by the Environment Agency.

Cheshire West and Chester Borough Council was in regular consultation with neighbouring authorities to confirm the correct definition of the administrative boundary, identify any areas of cross broader developments, and confirm which grid squares may skew the results of data analysis (i.e. double counting). Only minimal discrepancies were identified thus enabling to increase confidence in the dataset provided by the Environment Agency.