Central Lancashire Level 1 Strategic Flood Risk Assessment

Final Report

January 2025

Prepared for:

Preston
South Ribble
Chorley
Central Lancashire

www.jbaconsulting.com

Document Status

Issue date	27 January 2025
Issued to	Carolyn Williams
BIM reference	LOU-JBA-XX-XX-RP-Z-0001
Revision	P02
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JBA Project Code	2023s1344

This report describes work commissioned by Preston City Council, on behalf of the Central Lancashire Local Plan Team. The Client's representative for the contract was Carolyn Williams of Preston City Council. Freya Nation and Laura Thompson of JBA Consulting carried out this work.

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Acknowledgements

JBA would like to thank the representatives of Preston City Council, Chorley Council, South Ribble Borough Council, the Environment Agency and United Utilities for information provided to inform this assessment.

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Abbreviations

AEP	Annual Exceedance Probability
CFMP	Catchment Flood Management Plan
CLA	Central Lancashire Authorities
CSO	Combined Sewer Overflow
Defra	Department for Environment, Food & Rural Affairs
DLUHC	Department for Levelling Up, Housing and Communities
EA	Environment Agency
FAS	Flood Alleviation Scheme
FCERM	Flood and Coastal Erosion Risk Management
FMfP	Flood Map for Planning
FRA	Flood Risk Assessment
FRM	Flood Risk Management
FRR	Flood Risk Regulations
FRCC-PPG	Flood Risk and Coastal Change planning Practice Guidance
FRMP	Flood Risk Management Plan
FSA	Flood Storage Area
FWMA	Flood and Water Management Act
GI	Green Infrastructure
HFM	Historic Flood Map
LA	Local Authority
LCC	Lancashire County Council
LDP	Local Development Plan
LFRMS	Local Flood Risk Management Strategy
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
mAOD	Metres Above Ordnance Datum
NFM	Natural Flood Management
NPPF	National Planning Policy Framework
PFR	Property Flood Resilience
PPG	Planning Practice Guidance
RBD	River Basin District
RFCC	Regional Flood and Coastal Committee
RFO	Recorded Flood Outline
RMA	Risk Management Authority

RoFSW	Risk of Flooding from Surface Water
SA	Sustainability Appraisal
SAB	SuDS Approval Body
SFRA	Strategic Flood Risk Assessment
SoP	Standard of Protection
SuDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan
UU	United Utilities
WFD	Water Framework Directive
WwNP	Working with Natural Processes

Executive Summary

This Level 1 Strategic Flood Risk Assessment (SFRA) is an update to the previous SFRA, completed in 2021, using the latest flood risk information available at the time of writing, together with the most current flood risk and planning policy available from the National Planning Policy Framework (NPPF) (2024)[1] and Flood Risk and Coastal Change Planning Practice Guidance (FRCC-PPG) (2022)[2]. The latest SFRA guidance has also been considered, including 'How to prepare a strategic flood risk assessment' guidance, March 2024[3], and the 'Strategic flood risk assessments a Good Practice Guide' guidance, December 2021[4]. The latest climate change guidance for strategic flood risk assessment and site-specific flood risk assessments has also been considered[5].

This Level 1 SFRA is focused on collecting readily available flood risk information from key stakeholders, the aim being to help identify the spatial distribution of all sources of flood risk present throughout the Central Lancashire Authorities' (CLA) authority areas of Chorley, Preston and South Ribble, to inform the application of the Sequential Test.

The Central Lancashire Local Plan requires this Level 1 SFRA to initiate the sequential risk-based approach to the allocation of land for development and to identify whether application of the Exception Test is likely to be necessary. This will help to inform and provide the evidence base for the update to the Local Plan. This SFRA considers risk across the whole authority area and takes a catchment-based approach to flood risk management and the cumulative impacts of new development.

The constituent Local Planning Authorities (LPAs) provided their latest potential development site allocation information. An assessment of flood risk has been undertaken on all sites to assist the CLA in their decision-making process for site allocation through the CLA Local Plan.

The supplied potential development sites are shown to be at varying risk from fluvial, tidal and surface water flooding. Development consideration assessments for all sites are summarised through four strategic recommendations within Appendix E and the development sites assessment spreadsheet in Appendix C. The strategic recommendations broadly entail the following:

- Strategic Recommendation A – recommend for withdrawal as the site is within Flood Zone 3b. Check whether developable area can be reduced or whether it

1 National Planning Policy Framework, Ministry of Housing, Communities and Local Government, UK Government, 2024

2 Flood Risk and Coastal Change Planning Practice Guidance; Ministry of Housing, Communities & Local Government, 2022

3 How to prepare a Strategic Flood Risk Assessment, Defra and Environment Agency, 2024

4 Strategic flood risk assessments A GOOD PRACTICE GUIDE. ADEPT, 2021

5 Flood risk assessments: climate change allowances - GOV.UK (www.gov.uk)

may be possible to incorporate the functional floodplain into site layout and design as open greenspace;
- Strategic Recommendation B – Level 2 SFRA required. Withdraw from allocation or carry out Level 2 SFRA to confirm risk. Exception test may be required;
- Strategic Recommendation C – Progress to developer-led FRA. Development permission subject to FRA; and
- Strategic Recommendation D – Development could be allocated on flood risk grounds based on the evidence of this Level 1 SFRA.

A total of 403 sites were screened against the latest available flood risk information:

- Strategic Recommendation A applies to 87 sites.
- Strategic Recommendation B applies to 246 sites, with 237 of these requiring a Level 2 SFRA as a result of medium or high surface water flood risk.
- Strategic Recommendation C applies to 6 sites.
- Strategic Recommendation D applied to 64 sites.

See Appendix C for a full breakdown of the risk at each site and Appendix E which discusses the identified risks.

SFRA Recommendations

The main planning policy and flood risk recommendations to come out of this SFRA are outlined briefly below and are based on the fundamentals of the National Planning Policy Framework and the Flood Risk and Coastal Change Planning Practice Guidance (see Sections A.3.1 and A.3.2 of Appendix A).

SFRA recommendation:

- No development within the functional floodplain, unless development is water compatible and has passed the exception test;
- The sequential approach must be followed in terms of site allocation and development management;
- Ensure site-specific Flood Risk Assessments are carried out to a suitable standard, where required, with full consultation required with the Local Planning Authority, the Lead Local Flood Authority, the Environment Agency, and United Utilities as a minimum, before planning permission can be granted
- Appropriate investigation and use of SuDS;
- Natural Flood Management techniques must be considered for mitigation;
- Phasing of development must be carried out to avoid possible cumulative impacts; and

Included within this Level 1 SFRA, along with this main report, are:

- Discussion of relevant Planning Framework and Flood Risk Management Policies – Appendix A The Planning Framework and Flood Risk Policy;
- Detailed interactive GeoPDF maps showing all available flood risk information together with the assessed sites – Appendix B Interactive GeoPDF maps;

- Development site assessment spreadsheet detailing the risk to each site with recommendations on development – Appendix C Development site assessment spreadsheet;
- A technical note on the delineation of the present day and future functional floodplain – Appendix D Functional floodplain delineation;
- Discussion of the strategic recommendations outlined in the site assessment spreadsheet – Appendix E Strategic Recommendations of the proposed sites;
- A technical note detailing the climate change modelling methodology – Appendix F Climate change modelling note; and
- Assessment of the cumulative impacts of development – Appendix G Catchment-level assessment of Cumulative Impacts of Development on Flood Risk.

1 Introduction

1.1 Commission

Preston City Council commissioned JBA Consulting for the undertaking of a Level 1 Strategic Flood Risk Assessment (SFRA) to update the existing Level 1 SFRA published in February 2021. The updated Level 1 SFRA will be used as part of the evidence base to support the emerging Central Lancashire Local Plan (CLLP) which will cover the Central Lancashire Authority (CLA) areas of Preston City Council, South Ribble Borough Council and Chorley Borough Council. Lancashire County Council (LCC) is the Lead Local Flood Authority (LLFA) for the CLA area.

Since the 2021 Level 1 SFRA was published there have been updates to the National Planning Policy Framework (NPPF)[1] and the Flood Risk and Coastal Change Planning Practice Guidance (FRCC-PPG)[2]. The Environment Agency (EA) have also published updated guidance and best practice. This SFRA update accounts for these updates.

1.2 Purpose of the Strategic Flood Risk Assessment

All local planning authorities (LPA) should carry out a Level 1 SFRA for their area to provide the evidence base on flood risk to inform local plans. A Level 2 SFRA will be required where the LPA plans to allocate land for development in areas of medium to high flood risk.

The Central Lancashire Level 1 SFRA has been carried out in accordance with Government's latest development planning guidance including the NPPF[1], first published March 2012 and last updated December 2024, and the accompanying flood risk and planning practice guidance, the FRCC-PPG[2] first published in 2014 and last updated August 2022. The EA's latest SFRA guidance has also been considered, including 'How to prepare a strategic flood risk assessment' guidance[3], May 2024, and the 'Strategic flood risk assessments A Good Practice Guide' guidance[4], November 2021.

This SFRA makes use of the most up-to-date flood risk datasets, available at the time of submission, to assess the extent of risk, at a strategic level, to the whole Central Lancashire area.

The SFRA appendices contain interactive GeoPDF maps (Appendix B) showing the potential development site allocations overlaid with the latest, readily available, gathered flood risk information.

1.3 Central Lancashire Level 1 Strategic Flood Risk Assessment

The key objectives of this SFRA, in line with the above-mentioned guidance and, more specifically, the CLA's project brief are to:

- Update the functional floodplain to account for the 1 in 30-year fluvial and coastal defended flood events as advised in EA guidance[5]. The guidance also suggests

assessing the potential impacts of climate change on the future extent of the functional floodplain.

- Update existing EA flood models for the latest relevant climate change allowances, including the following events:
  - 1 in 30-year defended event for functional floodplain
  - 1 in 30-year defended event plus central climate change allowance for future functional floodplain
  - 1 in 100-year undefended event plus central climate change allowance
  - 1 in 100-year undefended event plus higher central climate change allowance.
- Assess potential Local Plan site allocations through an updated sites screening assessment to account for sequential test changes, updated functional floodplain and climate change modelling.
- Update the Level 1 report and Appendix A to account for new guidance and best practice.
- Update interactive GeoPDF Maps to include up to date site allocations, updated flood risk information, updated functional floodplain and climate change modelling outputs.
- Update the Cumulative Impact Assessment.
- Carry out surface water climate change modelling.

Following the completion of the Level 1 SFRA, a Level 2 SFRA will be required to build on the findings of the Level 1 SFRA, focussing on identified high-risk sites or communities that are considered important to local plan development. The modelled flood risk information, updated as part of this Level 1 SFRA, should support further application of the Sequential Test and inform on whether sites can pass the Exception Test, where applicable, and allow for flood risk indicators to be produced for use in the Sustainability Appraisal of the CLLP.

1.4 Consultation

The EA's 2024 SFRA guidance recommends the LPA should consult with the following parties, external to the LPA:

- The EA;
- The LLFA;
- Emergency planners;
- Emergency services;
- Water and sewerage companies;
- Reservoir owners or undertakers, if relevant;
- Internal drainage boards, if relevant;
- Highways authorities
- Relevant district councils (i.e. within the CLA and neighbouring districts); and
- Regional flood and coastal committees.

1.5 SFRA future proofing

This SFRA has been developed using the most up-to-date data and information available at the time of preparation. The SFRA has been future proofed as far as possible though the reader should always confirm with the source organisation (the Central Lancashire Authorities) that the latest information is being used when decisions concerning development and flood risk are being considered. The FRCC-PPG, alongside the NPPF, is referred to throughout this SFRA, being the current primary development and flood risk guidance information available at the time of the finalisation of this SFRA.

The EA's SFRA guidance states a review of a SFRA should be carried out when there are changes to:

- The predicted impacts of climate change on flood risk,
- Detailed flood modelling - such as from the EA or LLFA,
- The spatial development strategy or relevant local development documents,
- Local flood management schemes,
- Flood risk management plans,
- Shoreline management plans,
- Local flood risk management strategies, and
- National planning policy or guidance.

The SFRA should also be reviewed after a significant flood event. It is in any authority's interest to keep the SFRA as up to date as possible.

Ideally, the SFRA should be kept as a 'live' entity and continually updated when new information becomes available. The EA requests for reports and maps to be published online and be easily updateable, when required.

This SFRA uses the EA's Flood Map for Planning (FMfP) version issued in November 2024 to assess fluvial and tidal risk. The Flood Map for Planning is updated by the EA as and when accepted new modelling data becomes available. The reader should therefore refer to the online version of the Flood Map for Planning to check whether the flood zones may have been updated since November 2024, via the following link: Flood Map for Planning

To assess the surface water risk to the potential development sites, this SFRA uses the EA's Risk of Flooding from Surface Water (RoFSW) dataset (November 2024). This dataset can be updated periodically when applicable local surface water modelling is carried out that adheres to the EA's required methodology. The reader should therefore refer to the online version of the RoFSW map to check whether the surface water flood outlines have been updated, via the following link: Check Long Term Flood Risk.

At the time of writing, the EA is planning to publish a new National Flood Risk Assessment (NaFRA2) in early 2025. NaFRA2 will provide a single picture of current and future flood risk from rivers, the sea and surface water, using both existing detailed local information and improved national data and surface water flood risk will be incorporated into the Flood Map for Planning.

The EA is therefore pausing updates to the flood zones of the Flood Map for Planning until March 2025. During this period, where new flood zone information becomes available in the CLA area, a comment will appear on the current Flood Map for Planning service stating - "*Our understanding of flood risk from rivers and the sea has changed since this information was published*". Any new information must be used instead of the flood zones published on the Flood Map for Planning service, when preparing or updating the SFRA, when requesting planning application flood risk assessments (FRA), and when applying the sequential and exception tests. The CLA may wish to update this SFRA once the new Flood for Planning is published.

2 Study Area

2.1 Central Lancashire

The Central Lancashire Authorities region is situated in the north-west of England within the county of Lancashire and has an area of approximately 460 square kilometres, covering three Local Authority areas:

- Preston City Council
- South Ribble Borough Council
- Chorley Borough Council

The three local authorities have a history of working together to deliver strategic objectives through the production of local plans, such as the Central Lancashire Adopted Core Strategy (July 2012)[6].

According to the Office for National Statistics 2021 Census data[7], the combined population of Central Lancashire is 376,602. The most populated authority area is Preston with a population of 147,835. South Ribble has a population of 111,035 and Chorley has a population of 117,732.

The main river management catchments in the CLA region are the Wyre catchment in the north, the Ribble catchment in the centre and the Douglas catchment in the south.

2.2 Geology and topography

Due to the size of the region, the geology and topography are considerably varied. According to the British Geological Survey records[8], in the Preston authority area, bedrock is Sandstone and Conglomerate, with this changing to Millstone Grit Group bedrock to the east of the region from Samlesbury in the north to Rivington in the south. In Chorley, much of the area is characterised by Pennine Lower Coal Measures Formation and South Wales Lower Coal Measures Formation bedrock. Leyland and the area to the west is characterised by Mudstone, Stone and Sandstone bedrock. Other deposits across the CLA area include Bowland High Group and Craven Group and undifferentiated Permian rock.

The topography of the region is varied, ranging from flat, low-lying land to the west, closer to the coast, to areas of higher elevation, notably the West Pennine Moors, towards the south-east (see Figure 2-1). Topography also rises in the north of the CLA region towards Beacon Fell which lies at 266 mAOD.

6 Central Lancashire Adopted Core Strategy Local Development Framework (July 2012)
7 Office for National Statistics 2021 Census data, area profiles
8 BGS Geology - British Geological Survey

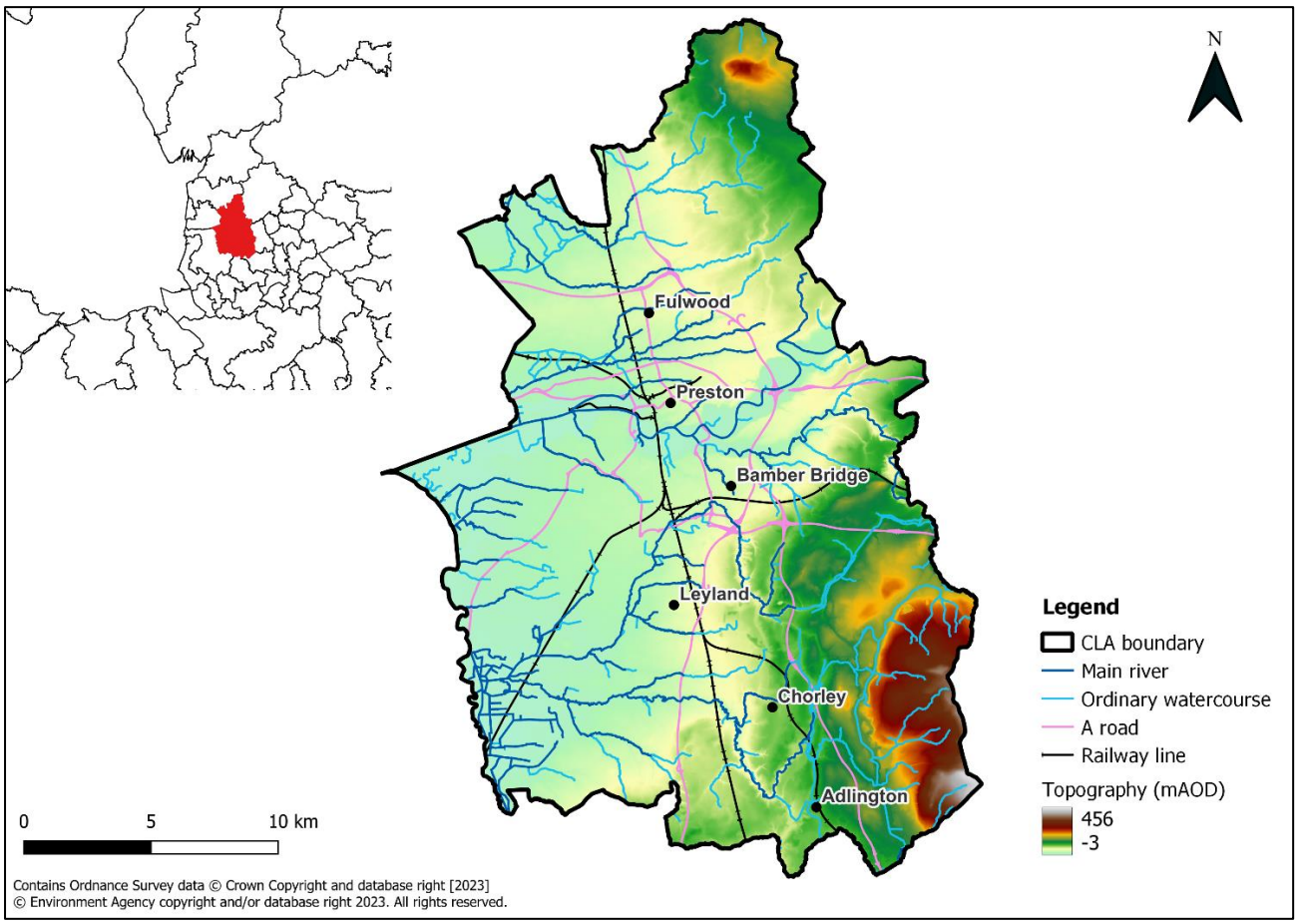


Figure 2-1: Topography, watercourses and transport infrastructure in Central Lancashire

2.3 Main rivers

Main rivers are usually larger rivers and streams. The EA has permissive powers to carry out maintenance, improvement or construction work on main rivers to manage flood risk. The EA also regulate works next to main river watercourses through the Environmental Permitting Regulations 2016. The range of activities subject to regulation are listed at on the GOV.UK website[9].

While the EA has permissive powers to undertake works, the maintenance of main rivers is primarily the responsibility of riparian owners. The CLA region contains the main rivers of the Ribble, Douglas, Yarrow, and Lostock (Figure 2-2).

2.3.1 River Ribble

The River Ribble rises in the Pennines in the Yorkshire Dales at the confluence of Gayle Beck and Cam Beck. It is the only river rising in Yorkshire which flows westward. It flows through the settlements of Settle, Clitheroe, Ribchester and the City of Preston, before discharging into the Irish Sea; a length of 75 miles (121 km). It is one of the longest rivers in

9 Flood risk activities: environmental permits - GOV.UK (www.gov.uk)

the North West, draining a catchment of 2,128 km^2. Its 10-mile (16 km) wide estuary forms part of the Ribble and Alt Estuaries Special Protection Area for wildlife.

2.3.2 River Douglas

The River Douglas is a tributary of the River Ribble and also has two main river tributaries, the River Tawd (not applicable to the CLA) and the River Yarrow. The Douglas rises on Rivington Moor, before travelling 23 miles to meet the Ribble near Hesketh Bank. The river flows through Lancashire and Greater Manchester. Rising at relatively low altitude, the Douglas drains extensive areas of flat land where intensive agriculture and horticulture dominate before flowing into the Ribble Estuary.

2.3.3 River Yarrow

A main river tributary of the River Douglas, the River Yarrow originates from the West Pennine Moors where it then feeds the Yarrow Reservoir, which in turn feeds the Anglezarke and Upper and Lower Rivington Reservoirs. The river then passes underneath the Leeds and Liverpool Canal, joining Black Brook at Yarrow Bridge before passing through Eccleston and Croston, where it feeds the River Douglas at Sollom. The entire course of the River Yarrow falls within Chorley district and passes through several villages.

2.3.4 River Lostock

The source of the Lostock is at the confluence of Slack Brook and Whave's Brook at the entrance to Miller Wood near Withnell Fold. The Lostock continues along the Leeds and Liverpool Canal to Lower Copthurst, where it turns westwards, draining Whittle-le-Woods before turning north by Clayton-le-Woods. The river continues bypassing the towns of Farington and Leyland before moving west towards Croston and joining the River Yarrow.

2.3.5 Other main rivers

There are many other tributaries of the Rivers Ribble, Douglas, Yarrow and Lostock that are also designated as main river watercourses by the EA. These watercourses are presented on the interactive GeoPDF maps in Appendix B.

2.4 Ordinary watercourses

Ordinary watercourses are any watercourse that is not designated main river. These watercourses can vary in size considerably and can include rivers, streams and all ditches, drains, cuts, culverts, dikes, sluices, sewers (other than public sewers within the meaning of the Water Industry Act 2014) and passages, through which water flows. Ordinary watercourses do not always contain flowing water all year long; there may be times where the watercourses run dry, particularly over prolonged dry spells. Such watercourses can be described as ephemeral watercourses.

Ordinary watercourses come under the regulation of the LLFA, which has permissive powers to carry out works, should this be deemed necessary, and have regulatory control

over certain development activities within the watercourse channel. However, the responsibility for the maintenance of ordinary watercourses lies with the riparian owner. A riparian owner is anyone who owns a property where there is a watercourse within or adjacent to the boundaries of their property; they are responsible for watercourses or culverted watercourses passing through their land. Figure 2-2 shows the ordinary watercourses in the CLA area.

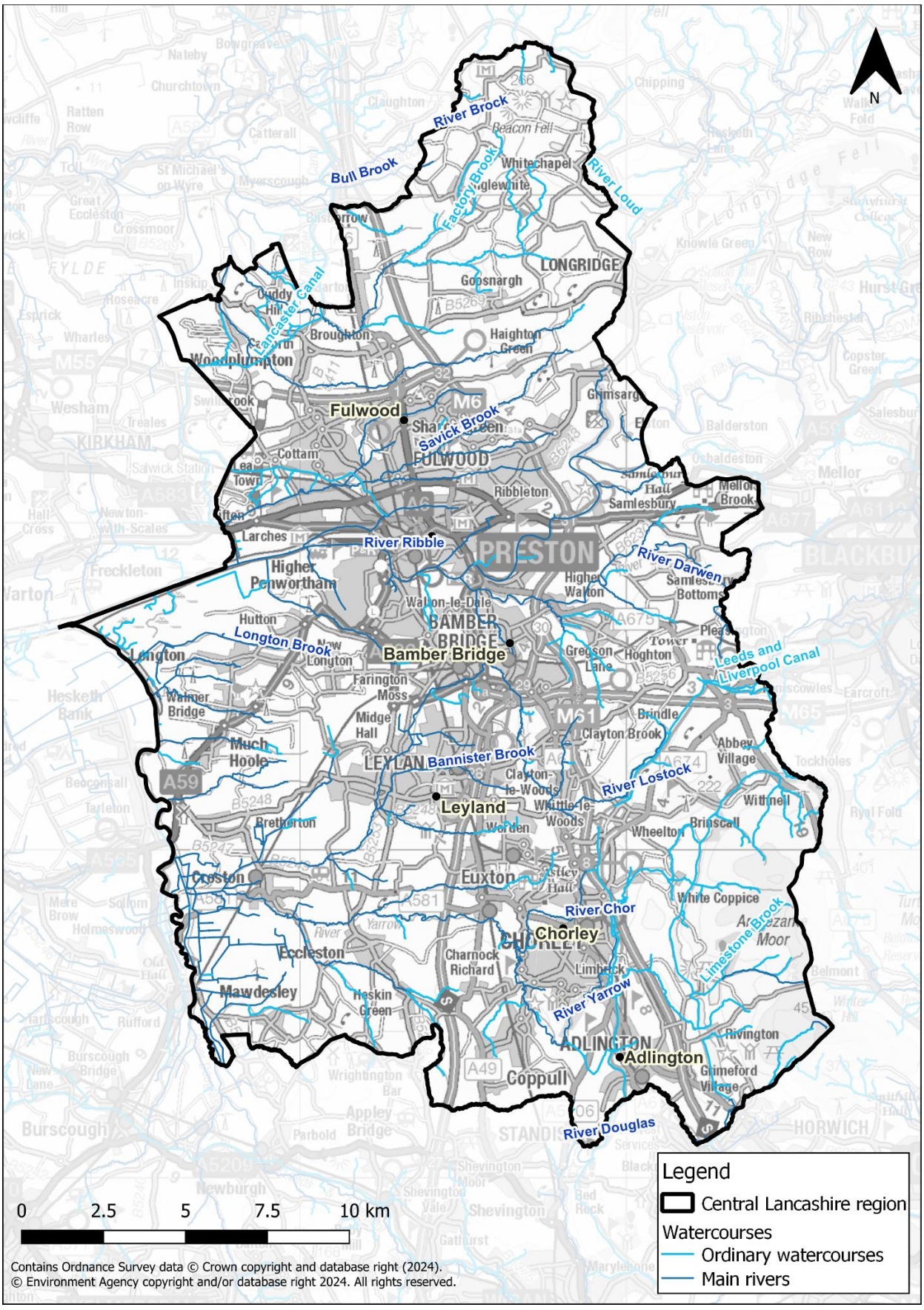


Figure 2-2: Ordinary watercourses and main rivers in Central Lancashire

3 Understanding flood risk

3.1 Sources of flooding

Flooding can happen at any time in a wide variety of locations. It constitutes a temporary covering of land not normally covered by water and presents a risk when human or environmental assets are present in the area that floods. Assets at risk from flooding can include housing, transport and public service infrastructure (including vulnerable services such as hospitals and schools), commercial and industrial enterprises, agricultural land and environmental and cultural heritage. Flooding in Central Lancashire can occur from many different and combined sources such as fluvial (from main rivers and ordinary watercourses), tidal (from the sea), surface water, groundwater, sewers or indirectly from infrastructure failure (residual risk).

Different types and forms of flooding present a range of different risks and the flood hazards of speed of inundation, depth and duration of flooding can vary greatly. With climate change, the frequency, pattern and severity of flooding are expected to change and become more damaging.

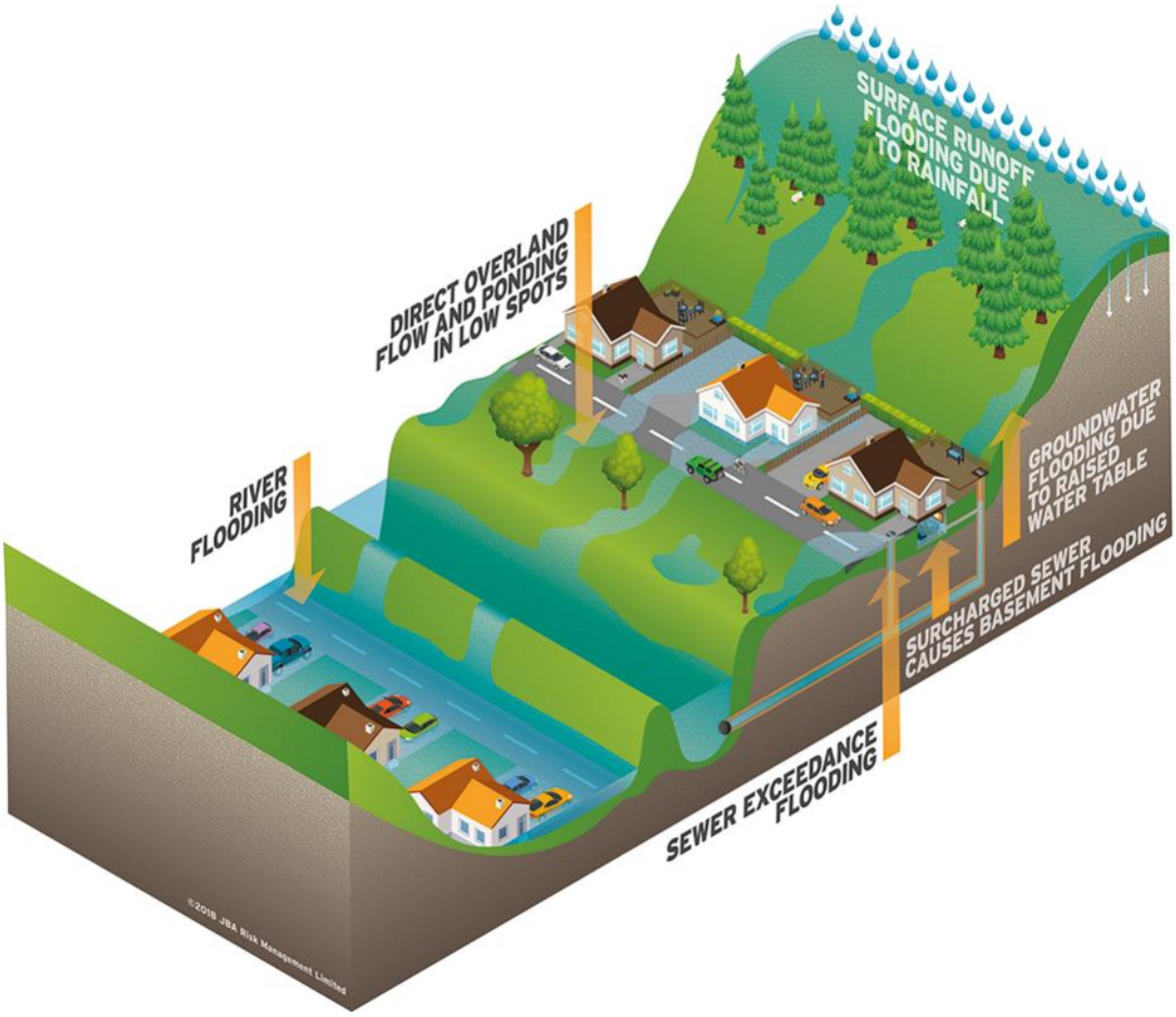


Figure 3-1: Flooding from all sources

3.1.1 Rivers

River flooding is the inundation of floodplains from watercourses; the inundation of areas outside the floodplain due to the influence of structures such as bridges, embankments and other features that artificially raise water levels; overtopping or breaching of defences; blockages of culverts or flood channels / corridors.

River flooding is associated with the exceedance of channel capacity during higher flows or as a result of structural failure (residual risk). The process of flooding from a watercourse depends on a number of characteristics associated with the catchment including geographical location and variation in rainfall; steepness of the channel and surrounding floodplain; and infiltration and rate of runoff associated with urban and rural catchments.

3.1.2 Tidal

Tidal flooding can occur in times of high astronomical tides and can also be exacerbated by storm surge and wave action. Coastal regions and areas along tidal estuaries are at risk from tidal flooding.

The EAs' Flood Map for Planning (Rivers and Sea) (Section 4.1.1) is used to assess flood risk from main rivers and the sea in this SFRA. The Flood Map for Planning is presented on the interactive GeoPDF maps in Appendix B.

3.1.3 Surface water

Surface water or pluvial flooding of land from surface water runoff is usually caused by intense rainfall that may only last a few hours. In these instances, the volume of water from rural land can exceed infiltration rates in a short amount of time, resulting in the flow of water over land. Within urban areas, this intensity can be too great for the urban drainage network resulting in excess water flowing along roads, through properties and ponding in lower areas or natural depressions. Areas at risk of pluvial flooding can, therefore, lie outside of the fluvial and tidal flood zones of the Flood Map for Planning.

Pluvial flooding within the urban areas of Central Lancashire will typically be associated with events equal to or greater than the 1 in 30 year (3.3% AEP (Annual Exceedance Probability)) design standard of new sewer systems. Some older sewer and highway drainage networks may have a lower capacity than is required to mitigate for the 3.3% AEP event. There is also residual risk associated with these networks due to possible network failures, blockages or collapses.

There are certain locations, generally within the urban areas, where the probability and consequences of pluvial flooding are more prominent due to the complex hydraulic interactions that exist in the urban environment. Urban watercourse connectivity, surface water or combined sewer capacity and the location and condition of highway gullies all have a major role to play in surface water flood risk.

Surface water flood risk should be afforded equal standing in importance and consideration as fluvial and tidal flood risk, given the increase in rainfall intensities due to climate change and the increase in impermeable land use due to development. It should be acknowledged

that once an area is flooded during a large rainfall event, it is often difficult to identify the route, cause and ultimately the source of flooding without undertaking further site-specific and detailed investigations.

The EA's Risk of Flooding from Surface Water (RoFSW) map (Section 4.2.1) is used to assess surface water flood risk in this SFRA. Also, Section 5.7 provides guidance on SuDS options for developers. The RoFSW is presented on the interactive GeoPDF maps in Appendix B.

3.1.4 Groundwater

Flooding from groundwater occurs when the water table rises after prolonged rainfall to emerge above ground level remote from a watercourse. It is most likely to occur in low-lying areas underlain by permeable rock (aquifers) and groundwater recovery areas, after pumping for mining or industry has ceased. Warmer, wetter winters due to climate change may have significant impacts on groundwater levels.

The occurrence of flooding from groundwater is usually localised and unlike flooding from rivers or the sea, does not generally pose a significant risk to life due to the slow rate at which the water level rises. However, groundwater flooding can cause significant damage to property, especially in urban areas and can pose further risks to the environment and ground stability.

There are several mechanisms that increase the risk of groundwater flooding including prolonged rainfall, high in-bank river levels, artificial structures, groundwater rebound and mine water rebound. Properties with basements or cellars or properties that are located within areas deemed to be susceptible to groundwater emergence are at particular risk. Development within areas that are susceptible to groundwater emergence will generally not be suited to infiltration SuDS; however, this is dependent on detailed site investigation, ground survey and risk assessment at the FRA stage.

JBA's 5m Groundwater Flood Map (Section 4.3) is used to assess potential risk from groundwater in this SFRA and is presented on the interactive GeoPDF maps in Appendix B.

3.1.5 Sewers

Flooding from the sewer network can occur when flow entering the system, such as an urban storm water drainage system, exceeds its available discharge capacity, the system becomes blocked or it cannot discharge due to a high water level in the receiving watercourse. Pinch points and failures within the drainage network may also restrict flows. Water can then back up through the drainage network and surcharge through manholes, potentially flooding highways and properties. It must be noted that sewer flooding in 'dry weather' resulting from blockage, collapse or pumping station mechanical failure (for example), is the sole concern of the drainage undertaker.

Combined sewers spread extensively across urban areas serving residential homes, businesses and highways, conveying wastewater and surface water to treatment works. Combined Sewer Overflows (CSOs) provide an EA consented overflow release from the

drainage system into local watercourses or surface water systems during times of high flows. The potential implementation of Schedule 3 of the Flood and Water Management Act (FWMA) should help to reduce the pressures on sewers, reducing surface water and sewer flood risk, and discharges from storm overflows. Some areas may also be served by separate waste and surface water sewers which convey wastewater to treatment works and surface water into local watercourses or combined sewers.

United Utilities (UU) is the water company responsible for the management of the public sewer drainage network across Central Lancashire.

3.1.6 Reservoirs

A reservoir can usually be described as an artificial or non-natural lake where water is stored for use. The risk of flooding associated with reservoirs is residual (Section 4.5) and is associated with failure of reservoir outfalls or dam breaching. This risk is reduced through regular inspection and maintenance by the reservoir owner / undertaker or operating authority. Reservoirs in the UK have an extremely good safety record with no incidents resulting in the loss of life since 1925.

The EA's Reservoir Flood Map (RFM) shows the locations at risk from reservoir flooding (Section 4.5.1).

3.1.7 Canals

The risk of flooding from a canal is residual and is dependent on a number of factors. As canals are manmade systems that are heavily controlled, it is unlikely they will respond in the same way as a natural watercourse during a storm event. Flooding is more likely to be associated with residual risks, similar to those associated with river defences, such as overtopping of canal banks, breaching of embanked reaches or asset (gate) failure as highlighted in Table 3-1. Canals can also have a significant interaction with other sources, such as watercourses that feed them and minor watercourses or drains that cross underneath. Section 4.6 discusses the potential risks from canals in Central Lancashire.

Table 3-1: Canal flooding

Potential Mechanism	Significant Factors
Leaking causing erosion and rupture of canal lining leading to breach	Embankments Sidelong ground Culverts Aqueduct approaches
Collapse of structures carrying the canal above natural ground level	Aqueducts Large diameter culverts Structural deterioration or accidental damage
Overtopping of canal banks	Low freeboard Waste weirs
Blockage or collapse of conduits	Culverts

3.2 Likelihood and consequence

Flood risk is a combination of the likelihood of flooding and the potential consequences arising. It is assessed using the source – pathway – receptor model as shown below. This is a standard environmental risk model common to many hazards and should be the starting point of any assessment of flood risk. However, it should be remembered that flooding could occur from many different sources and pathways, and not simply those shown in the illustration below.

The principal flood sources in Central Lancashire include fluvial, tidal and surface water; the most common pathways are rivers, drains, sewers, overland flows; and the receptors include people, their property and the environment. All three elements must be present for flood risk to arise. Mitigation, i.e. flood defence measures have little or no effect on sources of flooding, but they can block or impede pathways or reduce risk to receptors.

3.2.1 Likelihood

The likelihood of flooding is expressed as the percentage probability based on the average frequency measured or extrapolated from records over a large number of years. A 1% AEP event indicates the flood level that is expected to be reached on average once in a hundred years, i.e., it has a 1 in 100 (1%) chance of occurring in any one year, not that it will occur once every one hundred years. Table 3-2 provides an example of the flood probabilities used to describe the flood zones as defined in the FRCC-PPG and as used by the EA in its Flood Map for Planning (Rivers and Sea).

NOTE: Paragraph 078 of the FRCC-PPG states: - *"flood zones shown on the Flood Map for Planning do not take account of the possible impacts of climate change and consequent changes in the future probability of flooding"*.

The Flood Map for Planning can be accessed online via: Flood map for planning.

Table 3-2: NPPF flood zones[10]

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 0.1% annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map for Planning – all land outside Zones 2, 3a and 3b)
Zone 2 Medium Probability	Land having between a 1% and 0.1% annual probability of river flooding; or land having between a 0.5% and 0.1% annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1% or greater annual probability of river flooding; or Land having a 0.5% or greater annual probability of sea. (Land shown in dark blue on the Flood Map)
Zone 3b The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. LPAs should identify in their SFRAs areas of functional floodplain and its boundaries accordingly, in agreement with the EA. (Not separately distinguished from Zone 3a on the Flood Map for Planning)

3.2.2 Consequence

The consequences of flooding include fatalities, property damage, disruption to lives and businesses, with severe implications for people (e.g. financial loss, emotional distress, health problems). Consequences of flooding depend on the hazards caused by flooding (depth of water, speed of flow, rate of onset, duration, water quality) and the vulnerability of receptors (type of development, nature, e.g. age-structure of the population, presence and reliability of mitigation measures etc.).

Flood risk is then expressed in terms of the following relationship:

Flood risk = probability of flooding x consequences of flooding

3.2.3 Risk

Flood risk is not static; it cannot be described simply as a fixed water level that will occur if a river overtops its banks or from a high spring tide that coincides with a storm surge. It is therefore important to consider the continuum of risk carefully. Risk varies depending on the severity of the event, the source of the water, the pathways of flooding (such as the condition of flood defences) and the vulnerability of receptors as mentioned above. It is also clear that risk will increase with climate change.

10 Table 1: Flood Zones, Paragraph 001 of the Flood Risk and Coastal Change Planning Practice Guidance, August 2022

3.2.3.1 Existing risk

This is the risk 'as is' considering any flood defences that are in place. Typically these provide a minimum Standard of Protection (SoP). Hence, if a settlement lies behind a fluvial flood defence that provides a 1 in 100-year SoP then the actual risk of flooding from the river in a 1 in 100-year event is generally low. However, the residual risk may be high in that the impact of flood defence failure would likely be high.

Existing risk describes the primary, or prime, risk from a known and understood source managed to a known SoP. However, it is important to recognise that risk comes from many different sources and that the SoP provided will vary within a river catchment. Hence, the existing risk of flooding from the river may be low to a settlement behind the defence but moderate from surface water, which may pond behind the defence in low spots and is unable to discharge into the river during high water levels.

3.2.3.2 Residual risk

Defended areas remain at residual risk as there is a risk of defence failure during significant flood events. Areas behind flood defences are at particular risk from rapid onset of fast-flowing and deep-water flooding, with little or no warning if defences are overtopped or breached.

Whilst the actual risk of flooding to a settlement that lies behind a fluvial flood defence that provides a 1 in 100-year SoP may be low, there will always be a residual risk from flooding if these defences overtopped or failed that must be considered. Because of this, it is never appropriate to use the term "flood free".

Developers must be able to demonstrate that development will be safe for the lifespan of the development. To that end, Paragraph 042 of the FRCC-PPG states:

"Where residual risk from flood risk management infrastructure affects large areas, the Strategic Flood Risk Assessment will need to indicate the nature, severity and variation in risk within this area, and provide guidance for residual risk issues to be covered in site-specific flood risk assessments. Where necessary, local planning authorities should use information on identified residual risk to state in strategic policies their preferred mitigation strategy for ensuring development will be safe throughout its lifetime in relation to urban form, risk management and where flood mitigation measures are likely to have wider sustainable design implications".

Residual flood risk from breach or overtopping of defences must be managed for any new development. Detailed mitigation must be agreed through site-specific FRAs or through Level 2 SFRAs where it would be necessary to demonstrate site allocations would be safe for their lifetime.

3.3 Climate change

Following on from the UK Climate Projections 2009 (UKCP09), the UK Climate Projections 2018 (UKCP18) delivered a major upgrade to the range of UK climate projection tools designed to help decision-makers assess their risk exposure to our changing climate.

The UKCP18 project used cutting-edge climate science to provide updated observations and climate change projections up to the year 2100 across the UK. The project builds upon UKCP09 to provide the most up-to-date assessment of how the climate of the UK may change over the 21st century.

UKCP18 updates the projections over land and provides a set of detailed future climate projections for the UK at a 12km scale. Models of high impact events such as from localised heavy rainfall in the summer months were created. UKCP18 enables the UK to adapt to the challenges and opportunities presented by climate change.

In relation to flood risk and climate change in the planning system, the NPPF states:

"All plans should apply a sequential, risk-based approach to the location of development – taking into account all sources of flood risk and the current and future impacts of climate change – so as to avoid, where possible, flood risk to people and property..." (para 172).

The CLLP should do this by safeguarding land from development that is required, or likely to be required, for current or future flood management; and to seek opportunities for the relocation of development, including housing, to more sustainable locations from areas where climate change is expected to increase flood risk.

The likely impacts of climate change are well documented and will have a significant impact on flood risk across Central Lancashire. Increases in duration and intensity of extreme rainfall events as a result of climate change will increase flood risk from multiple sources. Section 4.8.1 details the EA's climate change allowances and how these have been applied in this SFRA.

4 Flood risk in Central Lancashire

4.1 Flood risk from rivers and the sea

Figure 4-1 shows the EA's Flood Map for Planning (Rivers and Sea), which identifies areas across Central Lancashire that are at risk of flooding from rivers and sea, not accounting for flood defence infrastructure. Several of these areas are located within Flood Zone 3 and therefore identified as being at high risk of fluvial and/or tidal flooding. An extensive area of Flood Zone 3 is located along the River Ribble, which passes through the City of Preston as it flows east to west across the Central Lancashire region. Other key areas include Walton-le-Dale and Higher Walton, south-east of the City of Preston, Penwortham, south-west of the City of Preston, Bamber Bridge, also south-east of the City of Preston and Croston in the east of the Central Lancashire region. The flooding within these areas is likely to be attributable to the River Darwen, River Ribble, Hennel Brook and Rivers Douglas and Yarrow respectively.

A number of watercourses in Central Lancashire have tidal reaches. These include the Douglas, Yarrow, Lostock, Wymott Brook, Longton Brook, Ribble, Mill Brook, Darwen and Savick Brook. This means that the flows and levels within these rivers are influenced by the tides.

Other areas identified as being at high risk include Leyland and Farington, in the south of Central Lancashire, which are at risk from the Bannister Brook, River Lostock and an unnamed tributary of the River Lostock. Whittle-le-Woods, east of Leyland, is at risk of flooding from the River Lostock and Carr Brook.

There are additional areas of medium flood risk (Flood Zone 2). Areas within this zone include the area in the west of the City of Preston, surrounding Preston Dock, which is at risk of flooding from the River Ribble, Boilton Marsh at risk of flooding from the River Ribble, and parts of Longton and Hutton which are at risk of flooding from the Longton Brook and Mill Brook.

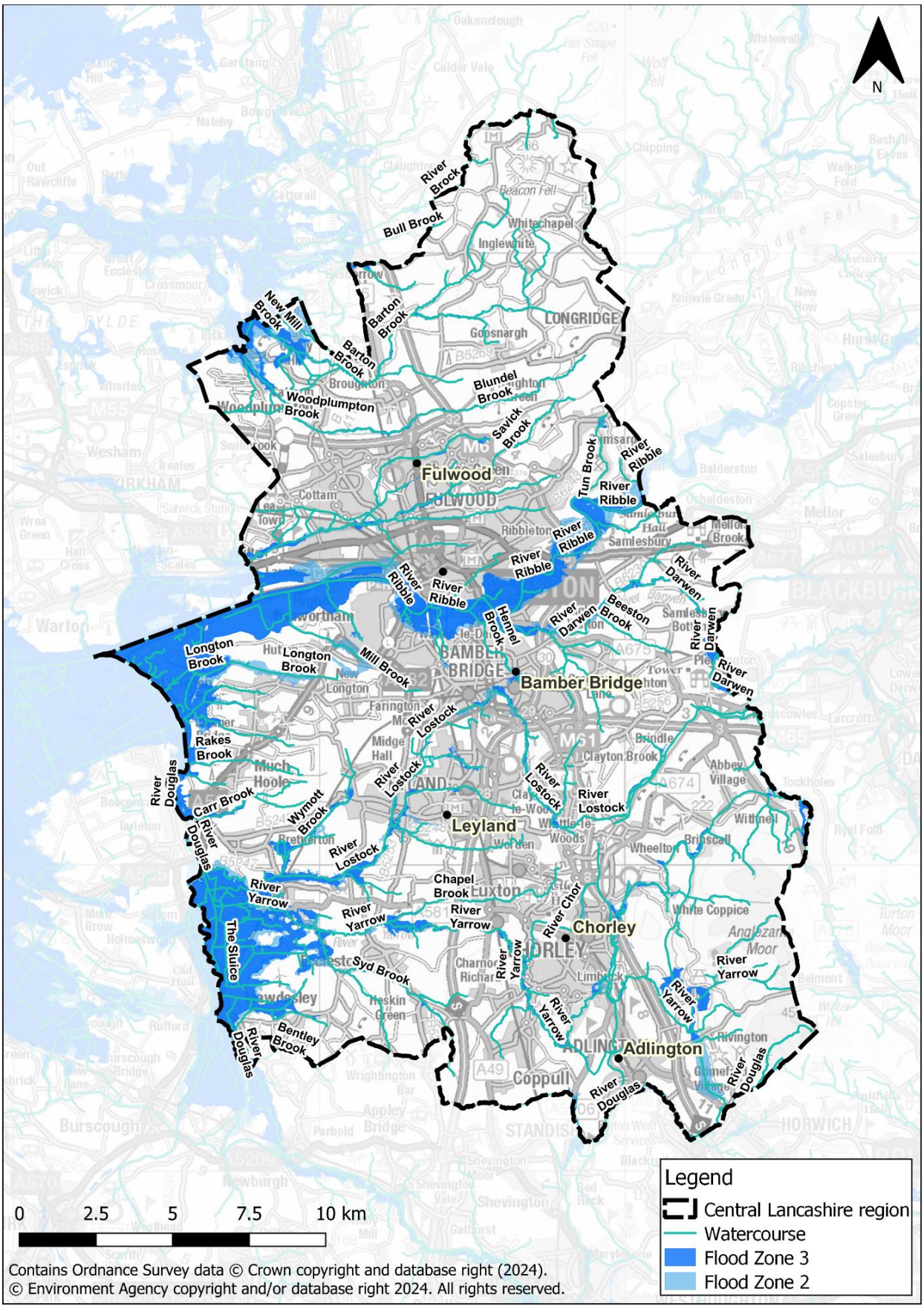


Figure 4-1: Flood Map for Planning showing the risk of flooding from rivers and sea within Central Lancashire

4.1.1 EA Flood Map for Planning (Rivers and Sea)

The interactive GeoPDF maps in Appendix B present the EA's Flood Map for Planning, which shows the fluvial coverage of Flood Zones 2 and 3 across the study area at a more detailed scale.

The Flood Map for Planning is the main dataset used by planners for predicting the location and extent of flooding from rivers and the sea. This is supported by detailed hydraulic river modelling reports that provide further detail on flooding mechanisms.

The Flood Map for Planning provides the flood extents for the 1 in 100 year (1% AEP) flood event for rivers (Flood Zone 3), the 1 in 200 year (0.5% AEP) flood event from the sea (also Flood Zone 3), and the 1 in 1000 year (0.1% AEP) flood event from rivers and the sea (Flood Zone 2). Flood zones were originally prepared by the EA using a methodology based on the national digital terrain model (NextMap), derived river flows from the Flood Estimation Handbook (FEH) and two-dimensional flood routing. Since their initial release, the EA has regularly updated its flood zones with detailed hydraulic model outputs as part of its national flood risk mapping programme.

The Flood Map for Planning is precautionary in that it does not take account of flood defence infrastructure (which can be breached, overtopped or may not be in existence for the lifetime of the development) and therefore, represents a worst-case scenario of present day flood risk. The flood zones do not consider sources of flooding other than from rivers or the sea and do not take account of climate change. As directed by the FRCC-PPG, this SFRA subdivides Flood Zone 3 into Flood Zone 3a and Flood Zone 3b, also known as the functional floodplain.

This SFRA uses the Flood Map for Planning issued in November 2024 to assess the risk from river flooding within identified priority areas. The Flood Map for Planning is updated by the EA, as and when new modelling data becomes available. The reader should therefore refer to the online version of the Flood Map for Planning[11] to check whether the flood zones may have been updated since November 2024.

Note: at the time of writing the EA is due to publish a new Flood Map for Planning in March 2025 which will account for the impacts of climate change and will also include for surface water flood risk. This will allow for simpler application of the sequential test.

The EA also provides a 'Risk of Flooding from Rivers and Sea Map'. This map shows the EA's assessment of the likelihood of flooding from rivers and the sea, at any location and is based on the presence and effect of all flood defences, predicted flood levels and ground levels. This dataset is high level and should not be used in the assessment of flood risk for planning applications but is a useful source of information to show the presence and effects of flood risk management infrastructure. This dataset is further discussed in Section 4.1.3.

11 Flood Map for Planning Service, GOV.UK

4.1.2 Functional floodplain (Flood Zone 3b)

The functional floodplain forms a very important planning tool in making space for flood waters when flooding occurs. Development should be directed away from these areas.

Table 1, Paragraph 078 of the FRCC-PPG defines Flood Zone 3b as:

"…*land where water from rivers or the sea has to flow or be stored in times of flood. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. Functional floodplain will normally comprise:*

- *land having a 3.3% or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively; or*
- *land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding)".*

Paragraph 078 also explains that:

"Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency."

The extent of the functional floodplain is assessed and agreed upon by the LPA and the EA, based in part on local knowledge of flooding. A technical note is provided in Appendix D that explains the methodology and datasets used in creating the functional floodplain.

4.1.3 EA Risk of Flooding from Rivers and Sea map

The Risk of Flooding from Rivers and Sea map (RoFRS) is a high level national dataset showing the likelihood of flooding from rivers and the sea based on the presence and effect of all flood defences, predicted flood levels and ground levels, and is shown on the interactive GeoPDF maps in Appendix B. The RoFRS map splits the likelihood of flooding into four risk categories:

- High – greater than or equal to 1 in 30 year event (3.3% AEP) chance in any given year;
- Medium – less than 1 in 30 year event (3.3% AEP) but greater than or equal to 1 in 100 year event (1% AEP) chance in any given year;
- Low – less than 1 in 100 year event (1% AEP) but greater than or equal to 1 in 1000 year flood event (0.1% AEP) chance in any given year; and
- Very Low – less than 1000 year event (0.1% AEP) chance in any given year.

The RoFRS map is included on the interactive GeoPDF maps to act as a supplementary piece of information.

This dataset is not suitable for use with any planning application, nor should it be used for the sequential testing of site allocations. The EA's Flood Map for Planning should be used for all planning purposes, as per the FRCC-PPG.

4.2 Surface water flood risk

The risk of flooding from surface water is shown in Figure 4-2 and illustrates that there are numerous areas of surface water flood risk across Central Lancashire. Surface water risk largely follows the topography, like that of fluvial watercourses. Several areas are identified as being at high risk including the City of Preston, Higher Walton, Bamber Bridge, Chorley, Hoghton Bottoms, Buckshaw Village and surrounding areas.

4.2.1 Risk of Flooding from Surface Water dataset

The Risk of Flooding from Surface Water (RoFSW) map is the third-generation national surface water flood map, produced by the EA, aimed at helping to identify areas where localised, flash flooding can cause problems even if the main rivers are not overflowing. The RoFSW, used in this SFRA to assess risk from surface water, has proved extremely useful in supplementing the EA Flood Map for Planning by identifying areas in Flood Zone 1, which may have critical drainage problems, and therefore should inform the sequential test.

EA guidance on the use of the RoFSW states:

"This dataset is not suitable for identifying whether an individual property will flood. It should not be used with basemapping more detailed than 1:10,000 as the data is open to misinterpretation if used as a more detailed scale. Because of the way the map has been produced and the fact that it is indicative, the map is not appropriate to act as the sole evidence for any specific planning or regulatory decision or assessment of risk in relation to flooding at any scale without further supporting studies or evidence."

More detailed surface water modelling would be required at the FRA stage to robustly inform on surface water flood risk to a site and surrounding areas.

The RoFSW includes surface water flood outlines, depths, velocities, and hazards for the following events:

- 1 in 30 year event (3.3% AEP) – high risk;
- 1 in 100 year event (1% AEP) – medium risk; and
- 1 in 1000 year event (0.1% AEP) – low risk.

The outlines of the RoFSW are presented on the interactive GeoPDF maps in Appendix B.

The EA produced a guidance document, updated in April 2019[12], explaining the methodology applied in producing the map.

Note: The national map of surface water flood risk has undergone a significant update as part of the EA's NaFRA2. However, the updated map is not available for this SFRA. The updated map is due to form part of the new Flood Map for Planning to be published March 2025.

12 What is the Risk of Flooding from Surface Water map? Environment Agency, 2019

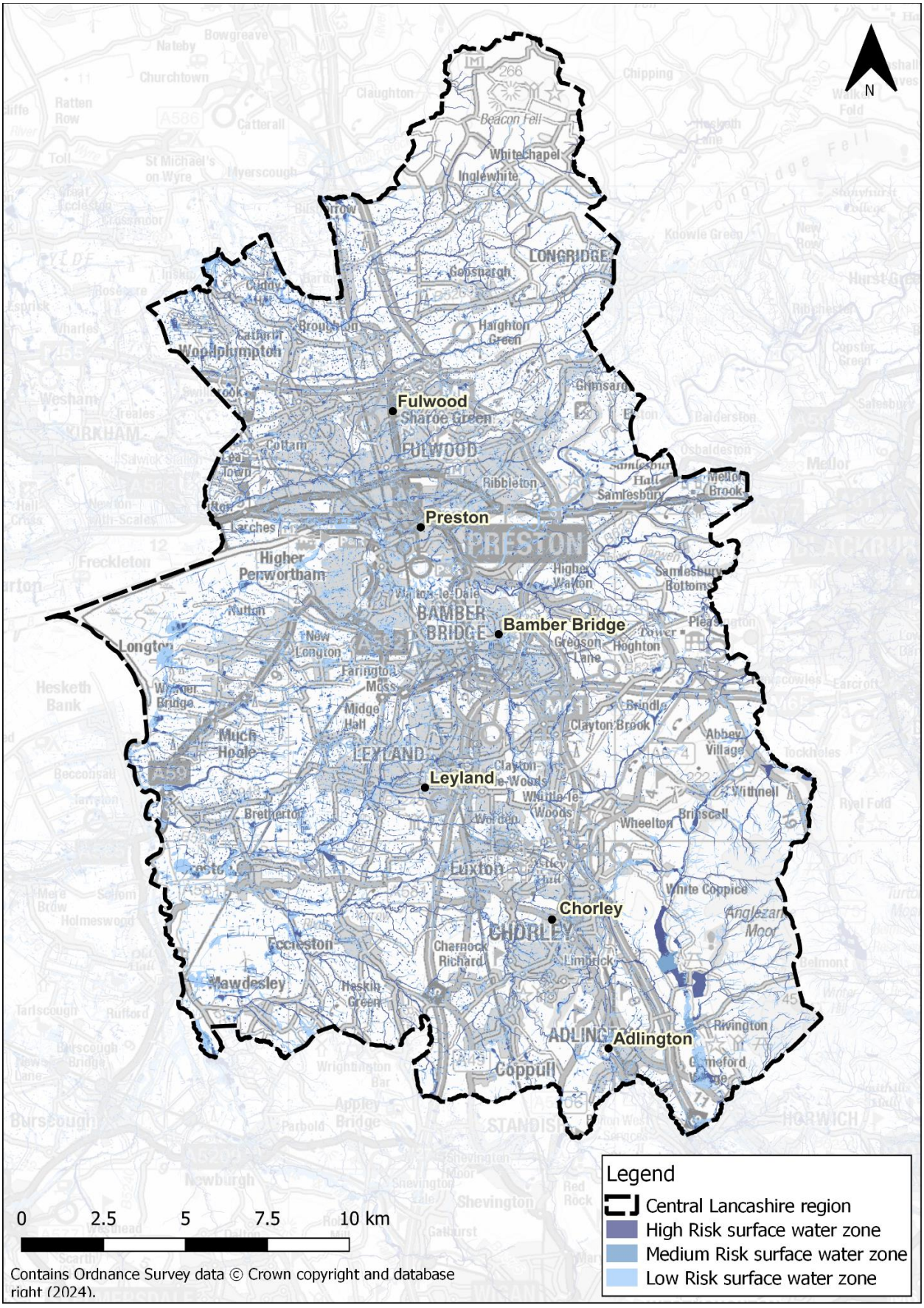


Figure 4-2: Risk of Flooding from Surface Water within Central Lancashire

4.2.1.1 Locally agreed surface water information

The FWMA[13] states that Lancashire County Council, as LLFA, should:

"*…review, discuss, agree and record, with the Environment Agency, Water Companies, Internal Drainage Boards and other interested parties, what surface water flood risk data best represents their local conditions. This will then be known as locally agreed surface water information*."

At the time of writing, locally agreed surface water information for the CLA either consists of:

- The RoFSW map; or
- Compatible local mapping if it exists i.e., from a SWMP; or
- A combination of both these datasets for defined locations in the LLFA area.

4.3 Groundwater risk

This SFRA assesses groundwater flood risk through JBA's 5m Groundwater Flood Risk Map, which provides a general broadscale assessment of the groundwater flood hazard. The good practice guide to producing SFRAs[14], developed by the EA and published in December 2021, recommends the use of this dataset in SFRAs. The map is categorised by grid code where each code is explained in Table 4-1.

13 Flood and Water Management Act, GOV.UK, 2010

14 Strategic flood risk assessments A GOOD PRACTICE GUIDE, Report produced using Environment Agency research on 'using flood risk information in spatial planning' (2019-2020), 2021

Table 4-1: Groundwater flood hazard classification of JBA groundwater map

Groundwater head difference (m)*	Grid Code	Class label
0 to 0.025	4	Groundwater levels are either at, or very near (within 0.025m of), the ground surface in the 100-year return period flood event. Within this zone there is a risk of groundwater flooding to both surface and subsurface assets. Groundwater may emerge at significant rates and has the capacity to flow overland and/or pond within any topographic low spots.
0.025 to 0.5	3	Groundwater levels are between 0.025m and 0.5m below the ground surface in the 100-year return period flood event. Within this zone there is a risk of groundwater flooding to surface and subsurface assets. There is the possibility of groundwater emerging at the surface locally.
0.5 to 5	2	Groundwater levels are between 0.5m and 5m below the ground surface in the 100-year return period flood event. There is a risk of flooding to subsurface assets, but surface manifestation of groundwater is unlikely.
>5	1	Groundwater levels are at least 5m below the ground surface in the 100-year return period flood event. Flooding from groundwater is not likely.
N/A	0	No risk. This zone is deemed as having a negligible risk from groundwater flooding due to the nature of the local geological deposits.
*Difference is defined as ground surface in mAOD minus modelled groundwater table in mAOD.		

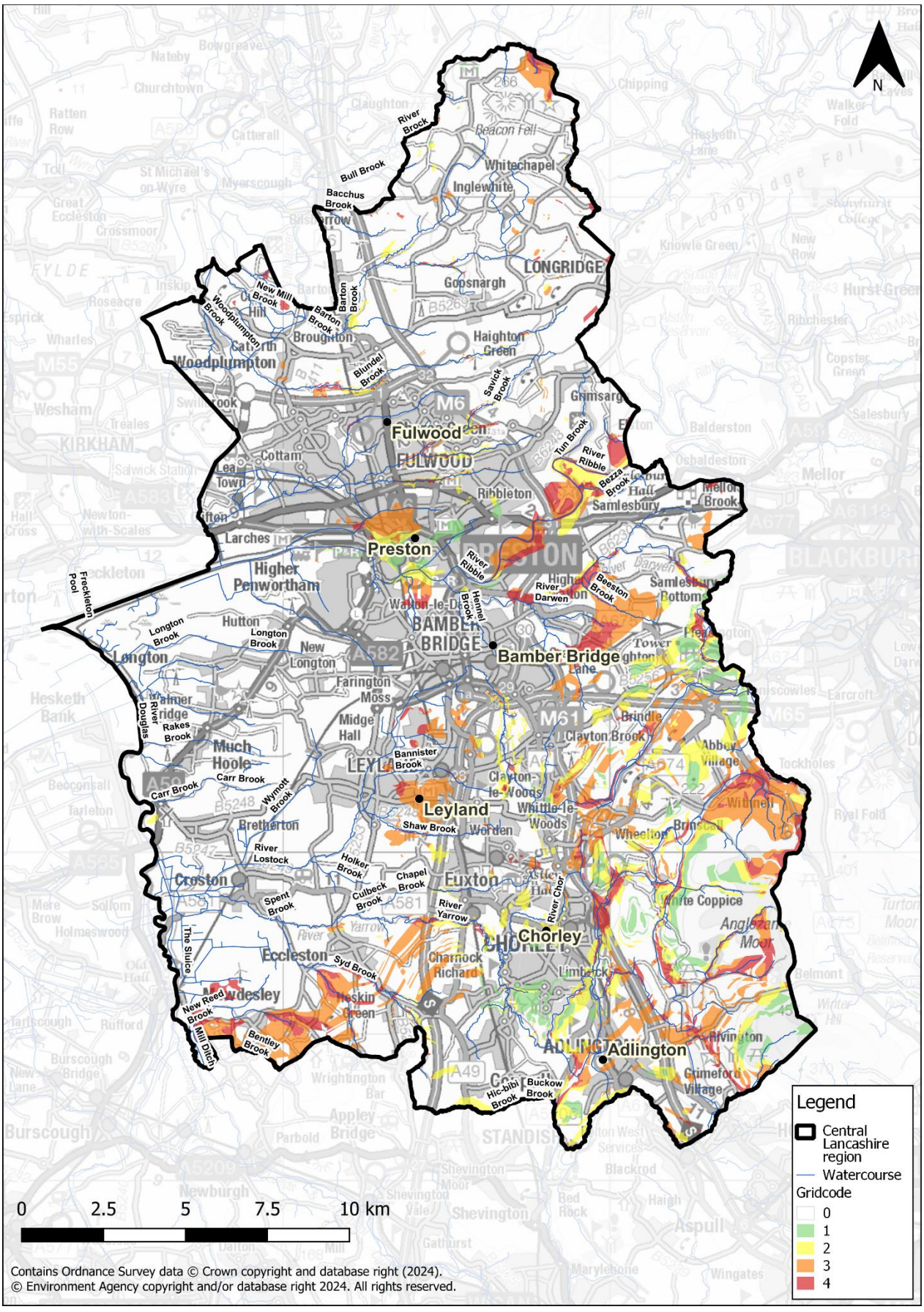


Figure 4-3: Groundwater risk within Central Lancashire

Figure 4-3 shows the risk of groundwater emergence across Central Lancashire. The main areas with grid code 4 include Leyland, Higher Walton, Gregson Lane and surrounding areas. There are scattered areas of grid code 4 to the east of the Central Lancashire boundary including in Rivington, Limbrick, Cowling, Heapey, Abbey Village, Hoghton Bottoms and Samlesbury. Areas categorised as grid code 3 are located throughout the Central Lancashire area with notable locations within this risk category being the City of Preston, Abbey Village, Wheelton, Farington, Leyland, Mawdesley, Adlington and the surrounding areas.

It is important to make sure that future development is not placed at unnecessary risk from any flood source. Therefore, risk of groundwater emergence should be considered on a site-by-site basis in development planning.

Groundwater risk should be considered particularly when determining the acceptability of SuDS schemes as a way of managing surface water drainage. Developers should consult with the LPA, the LLFA and the EA at an early stage of any site-specific groundwater assessment.

JBA's 5m groundwater map is shown on the interactive GeoPDF maps in Appendix B.

4.4 Flood risk from sewers

The Lancashire Local Flood Risk Management Strategy[15] (LFRMS) notes there being a significant flood risk from combined sewers within Chorley. It also mentions the potential for sewer flooding across the Preston authority area, given much of the drainage system is made up of combined sewers.

4.5 Flood risk from reservoirs

The EA is the enforcement authority for the Reservoirs Act 1975 in England and Wales, with the FWMA amending this Act. All large reservoirs must be regularly inspected and supervised by reservoir panel engineers. Local authorities are responsible for coordinating emergency plans for reservoir flooding and ensuring communities are well prepared. The LPA should work with other members of the Lancashire Resilience Forum to develop these plans. See Section 5.9.1.1 for more information on the Lancashire Resilience Forum.

Paragraph 046 of the FRCC-PPG states that, in relation to development planning and reservoir dam failure:

“The local planning authority will need to evaluate the potential damage to buildings or loss of life in the event of dam failure, compared to other risks, when considering development downstream of a reservoir. Local planning authorities are also advised to consult with the owners/operators of raised reservoirs, to establish constraints upon safe development."

15 Lancashire LFRMS | Lancashire County Council | 2021-2027

4.5.1 Reservoir Flood Map (RFM)

The EA has produced Reservoir Flood Maps (RFM) for all large reservoirs that they regulate under the Reservoirs Act 1975 (reservoirs that hold over 25,000 cubic metres of water). The FWMA updated the Reservoirs Act and targeted a reduction in the capacity at which reservoirs should be regulated from 25,000m^3 to 10,000m^3. This reduction is, at the time of writing, yet to be confirmed meaning the requirements of the Reservoirs Act 1975 should still be adhered to.

In November 2021, the EA published the RFM guidance 'Reservoir flood maps: when and how to use them[16]', which provides information on how the maps were produced and what they contain.

To view the RFM, the Defra Data Services Platform can be used to search for specific reservoirs[17].

The EA provided a GIS file of the RFM covering Central Lancashire. The RFM shows that there are 36 large-raised reservoirs that have the potential to impact Central Lancashire in the event of a breach during a dry-day scenario. Figure 4-4 highlights the Risk of Flooding from Reservoirs extents across Central Lancashire for a dry-day scenario. A dry-day, as opposed to a wet-day scenario, assumes the water level in a reservoir is lower than the spillway level and the upstream and downstream watercourses are at normal levels.

The RFM extent shows the worst credible area that is susceptible to dam breach flooding. The map should be used to prioritise areas for evacuation/early warning. It is worth considering that reservoirs within the UK have an extremely good safety record with no incidents resulting in the loss of life since 1925.

If development is proposed downstream of a reservoir, there will need to be an assessment of whether work is needed to improve the design or maintenance of the reservoir. Together with the reservoir undertakers, the LPA should look to avoid an intensification of development within the risk areas and/or make sure that reservoir undertakers can assess the cost implications of any reservoir safety improvements required due to changes in land use downstream of these assets.

The LPA will need to evaluate:

- The potential damage to buildings or loss of life in the event of dam failure compared to other risks;
- How an impounding reservoir will modify existing flood risk in the event of a flood in the catchment is location within and/or whether emergency draw-down of the reservoir will add to the extent of flooding; and
- Emergency planning requirements with appropriate officers to ensure safe sustainable development.

16 Reservoir flood maps: when and how to use them – Environment Agency, 2021.
17 Reservoir Flood Maps, Environment Agency

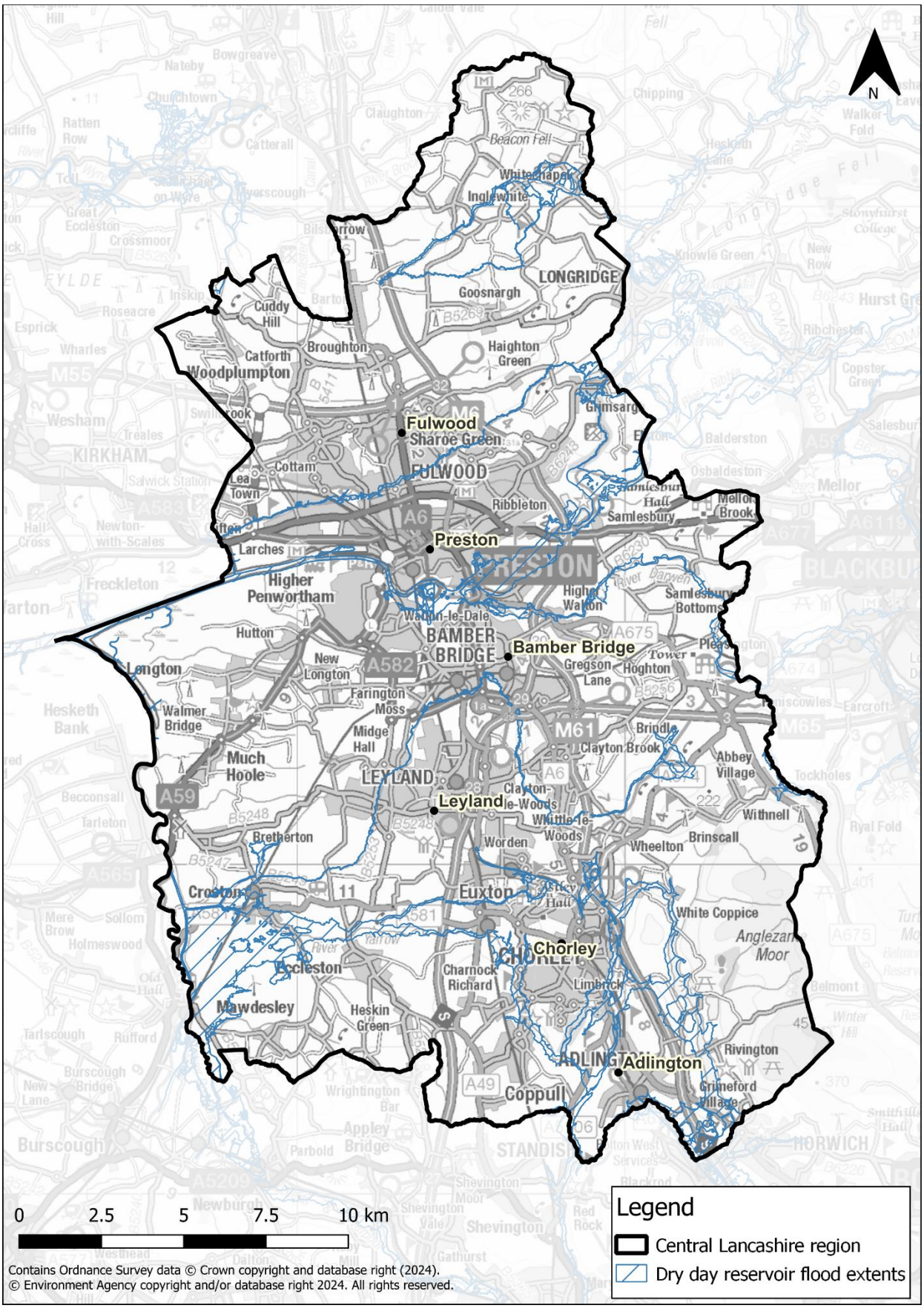


Figure 4-4: Risk of Flooding from Reservoirs within Central Lancashire during a dry-day scenario

4.6 Flood risk from canals

The risks associated with flooding from canals are dependent on the potential failure location with the consequence of flooding higher where floodwater could cause the greatest harm due to the presence of local highways and adjacent property.

There are three canals running through Central Lancashire. The Canal & River Trust are responsible for the care and enhancement of all three canals including:

- Lancaster Canal
- Leeds and Liverpool Canal
- Ribble Link

At present, canals do not have a level of service for flood recurrence (i.e., there is no requirement for canals to be used in flood mitigation), although the Canal & River Trust, as part of its function, will endeavour to maintain water levels to control the risk of flooding from canals to adjacent properties. It is important, however, that any development proposed adjacent to a canal be investigated on an individual basis regarding flooding issues and should be considered as part of any FRA.

4.6.1 Historic flooding from canals

As part of this SFRA, the Canal & River Trust have provided the details of known canal flooding incidents that have occurred within Central Lancashire because of canal breaching and overtopping. The location of these historic breach and overtopping events is shown in Figure 4-5. Table 4-2 provides the details of these incidents.

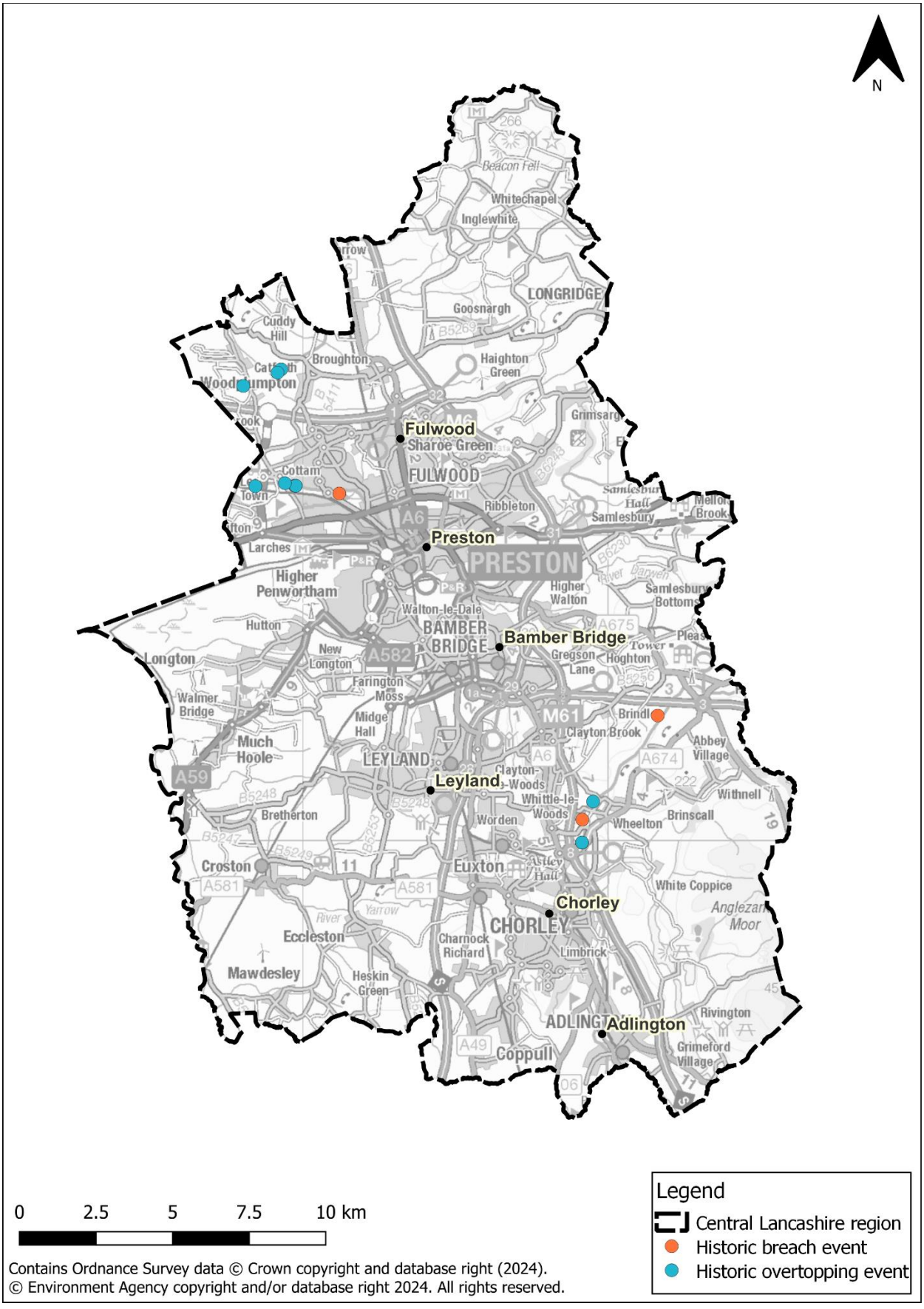


Figure 4-5: Canal & River Trust historic flooding incidents

Table 4-2: Incidents of historical canal breaches and overtopping events in Central Lancashire

Location	Description	Result	Date
Cottam	The canal embankment at this location has caused numerous problems over the years. It has since received a more durable wall of steel piles driven down into the embankment.	Breach	1935
Ollerton	During World War Two the War Office Training Wing held a battle course here for Home Guard units. A canister bomb explosion resulted in a breach of the canal bank.	Breach	1940
Johnsons Hillock	Lock gate failure whilst small cruiser in lock chamber. Resulted in many lock gates being reinforced.	Breach	1967
Moor Side	The leak north of bridge 34 towpath side broke out again causing overtopping in the adjacent field, clay trench in towpath required to prevent reoccurrence; voids in the wash wall caused this overtopping.	Overtopping	01/07/2009
Cottam, Preston	700m overtopping into field and causing minor flooding of pastureland. Canal bank protection has deteriorated to a point that overtopping occurs when the water level is high.	Overtopping	24/09/2010

Location	Description	Result	Date
Whittle-le-Woods	Adjacent Landowner reports that due to low spot in towpath, canal overtops regularly into his field, between the winding hole and the culvert crossing. Latest occurrence followed heavy rainfall event and heightened levels in canal.	Overtopping	12/02/2011
Cottam, Preston	Overtopping incident on the offside mid length between bridges 17 18. Cause of overtopping low freeboard/ eroded free board in pastureland and therefore release of water occurs when pound is high/ above normal operating level.	Overtopping	22/09/2011
Cottam, Preston	Overtopping of a narrow section of embankment north of the culvert north of bridge 17. Steady flow over a circa 300mm breach onto pastureland. At a depth of c50mm.	Overtopping	18/10/2011
Near A582	Narrow breach of the embankment on the offside north of the culvert, north of bridge 19. Length of breach circa 300mm flowing onto pastureland.	Overtopping	18/10/2011

Location	Description	Result	Date
Cottam, Preston	Overtopping of the offside embankment north of bridge 17. Max depth of OT confirmed as 25mm over central 0.5m section tapering to 0 at edges. Failure of bank protection and damage to the bank by cattle has allowed the canal to overtop. High continuous flow rate also noted on 10/01/13.	Overtopping	10/01/2013
Whittle-le-Woods	LL-075-P0950, 0950m overtopping across towpath	Overtopping	10/04/2014
Blackleach	An overtopping incident to the north of bridge 28. A small trickle is presently flowing over the embankment into the field. A section of bank has been trodden by cattle.	Overtopping	13/10/2014
Cottam, Preston	Very low freeboard on the offside, north of culvert 6, north of bridge 17, Preston Sports Arena. This is due to cattle paddling the embankment to a very low free board on the offside.	Overtopping	05/11/2014
Heapey	LL-077-P0500 Timber piling failure and cattle erosion (now protected) led to standing water at location on offside. May be linked to culvert leak see zx13110756.	Overtopping	14/08/2015
Moor Side	Offside into adjacent Dyke	Overtopping	22/11/2017

4.7 Cumulative impacts assessment

The NPPF states that strategic policies…

"…*should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards*" (para 171).

Previous policies have relied on the assumption that if each individual development does not increase the risk of flooding, the cumulative impact will also be minimal. However, if there is a lot of development occurring within one catchment, particularly where there is flood risk to existing properties or where there are few opportunities for mitigation, or proposed developments of less than 10 dwellings that are not referred to the LLFA for consultation under the Town and Country Planning (Development Management Procedure) Order (DMPO) 2015, the cumulative impact may be to change the flood response of the catchment.

In plan making and development planning, consideration should be given to the following:

- The importance of the phasing of development,
- Cross boundary impacts i.e., there should be dialogue between the Central Lancashire authorities and neighbouring authorities (West Lancashire, Fylde, Wyre, Ribble Valley, Blackburn with Darwen, Bolton and Wigan) upstream and downstream of Central Lancashire on flood risk management practices and plans for development,
- Leaving space for floodwater by safeguarding land through the Local Plan and utilising greenspace for flood storage and slowing the flow (see Sections 4.7.2 and 4.10.4),
- Ensuring floodplain connectivity,
- Use of appropriate SuDS and the containment of surface water onsite as opposed to directing elsewhere (see Section 5.7),
- The loss of floodplain storage volume, as well as the impact of increased flows on flood risk downstream. Whilst the loss of storage for individual developments may only have a minimal impact on flood risk, the cumulative effect of multiple developments may be more severe.

All development plans are required to comply with the NPPF and FRCC-PPG and demonstrate they will not increase flood risk elsewhere. Therefore, providing all new development complies with the latest guidance and legislation relating to flood risk and sustainable drainage, in theory there should not be any increase in flood risk downstream.

Strategic solutions may include upstream flood storage, integrated major infrastructure/Flood Risk Management schemes, new defences, and watercourse improvements as part of regeneration and enhancing green infrastructure, with opportunities for Working with Natural Processes and retrofitting of SuDS to existing development.

Through the CLLP, the CLA should consider the following strategic solutions:

- Seeking a betterment of existing flood risks both within the site and in surrounding areas, with developments meeting national and local standards for flood risk assessments and surface water drainage strategies;
- Use of sustainable flood storage and mitigation schemes to store water and manage surface water runoff in locations that provide overall flood risk reduction as well as environmental benefits, including the implementation of nature-based solutions where possible;
- In areas where flood risk is being managed effectively, there will be a need in the future to keep pace with increasing flood risk as a result of climate change;
- Assessment of long-term opportunities to move development away from the floodplain and to create blue/green river corridors throughout the Central Lancashire area;
- Identification of opportunities to use areas of floodplain to store water during high flows, to reduce long-term dependence on engineered flood defences located both within and outside the Central Lancashire area;
- Safeguarding the natural floodplain from inappropriate development;
- Where possible, changes in land management should look to reduce runoff rates from development whilst maintaining or enhancing the capacity of the natural floodplain to retain water. Land management and uses that reduce runoff rates in upland areas should be supported;
- Development should maintain conveyance of watercourses through hamlets and villages to help reduce the impact of more frequent flood events and to improve the natural environment and Water Framework Directive (WFD) targets;
- Use of this SFRA to help inform future development and minimise flood risk from all sources;
- Implementation of upstream catchment management i.e., slow the flow and flood storage schemes could be implemented in upper catchments to reduce risk downstream and across neighbouring authority boundaries; and
- Promotion and consideration of SuDS at the earliest stage of development planning.

According to the NPPF, LPAs should work with neighbouring authorities to consider strategic cross-boundary issues and infrastructure requirements. Local authorities also have a duty to cooperate whereby councils work together on strategic matters and produce effective and deliverable policies on strategic cross boundary matters.

The FWMA requires all risk management authorities (RMA) to cooperate with relevant authorities regarding exercising flood and coastal risk management. The Central Lancashire authorities are represented by the North-West Regional Flood and Coastal Committee (RFCC) where cross-boundary resources, projects and data are shared between neighbouring authorities.

4.7.1 Hydrological linkages and cross boundary issues

The majority of main rivers within Central Lancashire originate from within the Central Lancashire region and eventually flow into the River Ribble which empties into the Irish Sea near Lytham-St-Anne's, in neighbouring Fylde District.

Major land use changes within neighbouring catchments are unlikely to have a significant impact on the flow regimes and flood risk in the CLA area. However, there are a number of watercourses that flow through Central Lancashire into neighbouring local authorities located downstream including the River Douglas which flows into Wigan, the River Brock which forms the boundary of Preston and Wyre and the Bentley Brook which straddles the border between Chorley and West Lancashire. Development control and responsible land management across Central Lancashire is crucial to ensuring sustainable development within the downstream authorities.

Figure 4-6 illustrates fluvial hydraulic linkages for the catchments in and around Central Lancashire. The River Ribble enters Central Lancashire from the Ribble Valley Borough and the River Darwen enters Central Lancashire from Blackburn with Darwen Borough. Upstream land use changes within the districts of Ribble Valley and Blackburn with Darwen could influence flood risk along the corresponding rivers. In addition, the River Brock flows along the boundary of Central Lancashire and Wyre Borough and continues to flow through the Wyre Borough. Similarly, the River Ribble flows through Central Lancashire and into the Ribble Estuary between Fylde and West Lancashire Boroughs. The River Douglas rises at the edge of Central Lancashire, within the Borough of Chorley and flows south, through Wigan Metropolitan Borough before returning back into Central Lancashire along the boundary with West Lancashire Borough. Close partnerships between Central Lancashire and the neighbouring authorities i.e. West Lancashire, Fylde, Wyre, Ribble Valley, Blackburn with Darwen, Bolton and Wigan should be maintained.

Were the above strategic solutions not considered in upstream development planning, the following issues may occur:

- Reduction in upstream floodplain storage capacity; and
- Increase in impermeable areas leading to a reduction in rainfall infiltration and subsequent increased runoff to the detriment of downstream communities.

The need for consistent regional development policies controlling runoff or development in floodplains within contributing districts is therefore crucial as this would have wider benefits for neighbouring local authorities as well as those which make up Central Lancashire. This should be carried out by the successful implementation of the sequential test.

The authorities of influence upstream and downstream of Central Lancashire are:

Upstream

- Ribble Valley
- Blackburn with Darwen
- Bolton

Downstream

- West Lancashire
- Fylde
- Wyre
- Wigan

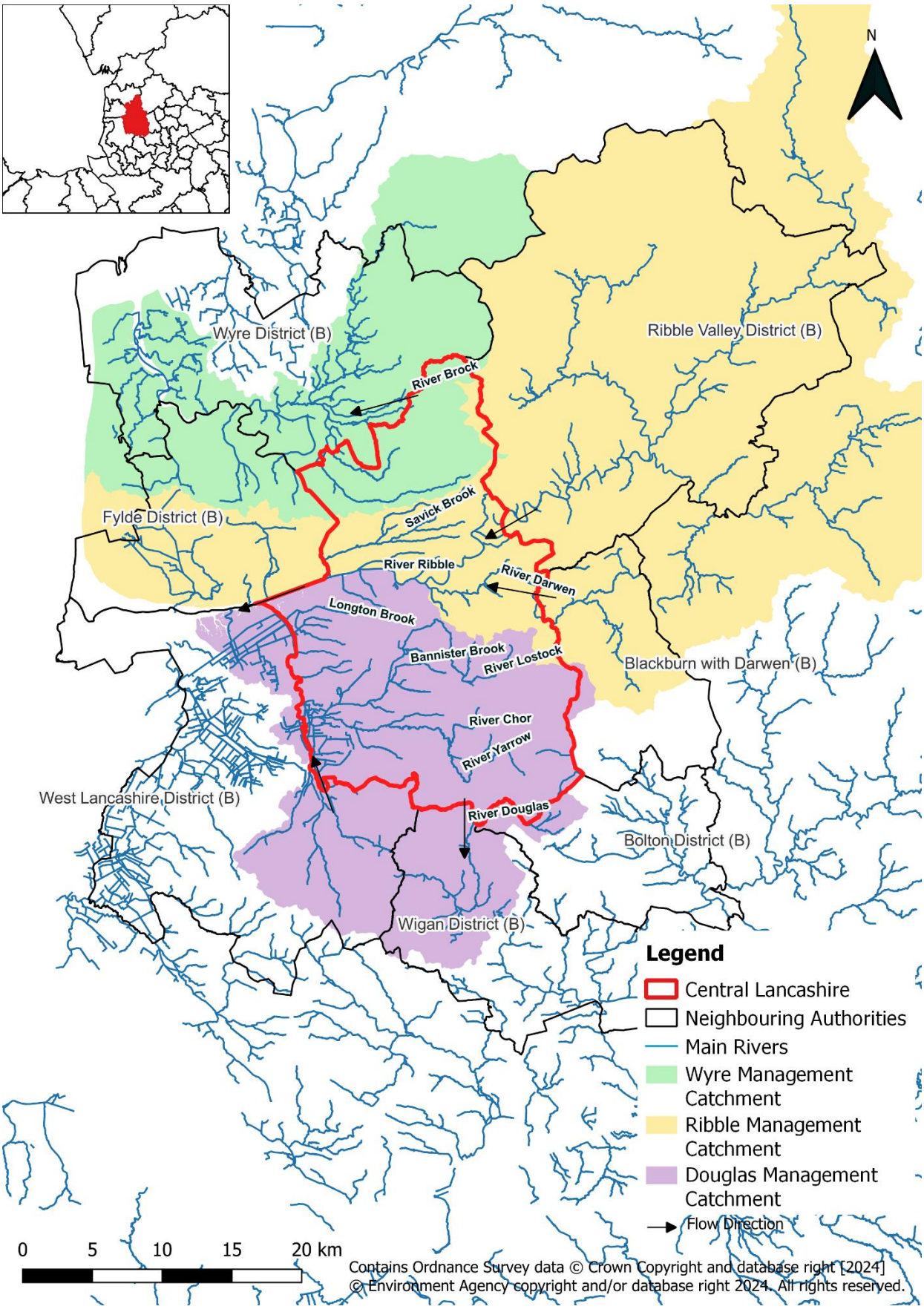


Figure 4-6: Hydrological linkages for catchments in and around Central Lancashire

4.7.2 Safeguarding land for flood storage

Where possible, the CLA may look to allocate land designed for flood storage functions through the CLLP. Such land can be explored by using this SFRA to assess the flood risk within areas of open space and to ascertain what benefit could be gained by leaving at risk areas undeveloped.

Paragraph 172 of the NPPF states *"to avoid where possible, flood risk to people and property, the LPAs should manage any residual risk by*:

safeguarding land from development that is required, or likely to be required, for current or future flood management".

Applicable locations may include any current greenfield sites:

- Considered to be large enough to store floodwater to achieve effective mitigation (modelling would be required to establish required storage volumes);
- With large areas of their footprint at high or medium surface water flood risk (based on the RoFSW) outside of fluvial and tidal flood risk zones;
- Within the functional floodplain (Flood Zone 3b);
- With large areas of their footprint at risk from Flood Zone 3a; and
- That are large enough and within a suitable distance to receive floodwater from a nearby development site using appropriate SuDS techniques which may involve pumping, piping or swales/drains.

Brownfield sites could also be considered, though this would entail clearance of existing buildings, conversion to greenspace and contaminated land assessments.

4.7.3 Catchment-level assessment of cumulative impacts of development on flood risk

Cumulative impacts are defined as the effects of past, current and future activities on the environment. These cumulative impacts may be negative, i.e. development leading to an increase in the existing level of flood risk within the catchment, or positive i.e. surface water management within a development helping to alleviate existing flooding issues within a catchment. A catchment-level assessment has been completed as part of this SFRA to understand the impact of future development on flood risk in Central Lancashire. Appendix G details the methodology and results of the assessment.

4.8 Climate change

NPPF para 8 states that mitigating and adapting to climate change is an important objective that is key to delivering sustainable development that should be delivered through local plans.

In relation to flood risk and climate change in the planning system, the NPPF states:

"*New development should be planned for in ways that:*

a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to

ensure that risks can be managed through suitable adaptation measures, including through incorporating green infrastructure and sustainable drainage systems". (Para 164).

The Level 1 SFRA should be the starting point for any LPA to assess the effects of climate change on flood risk across the local plan area. Section 4.8.2 details the climate change modelling carried out as part of this SFRA.

Along with the NPPF, FRCC-PPG and EA guidance, the CLA should refer to the Royal Town Planning Institute and Town & Country Planning Association's new edition of their joint guidance: 'The Climate Crisis – a guide for local authorities on planning for climate change'[18] when preparing the local plan.

4.8.1 EA climate change allowances

The EA previously revised the climate change allowances for sea level rise in December 2019, peak river flows in July 2021, and peak rainfall intensities in May 2022, for use in FRAs and SFRAs and will, at the time of writing, use these revised allowances when providing advice. These updates are based on the release of UKCP18.

Climate change guidance is continually evolving therefore developers should refer to the climate change allowances online[19] to ensure those outlined below are the most up-to-date available.

The CLA may require developers to use specific climate change allowance categories. Refer to local guidance for further information.

4.8.1.1 Sea level allowances

Allowances for sea level rise are based on river basin district and were last updated in 2019. The allowances for the North West RBD are shown in Table 4-3. The number in brackets is the cumulative sea level rise for each year within each range. The EA expects SFRAs and FRAs to assess both allowance categories and also the H++ allowance in some cases. The H++ scenario for sea level rise for England is set at a total sea level rise of 1.9 metres, up to the year 2100.

Table 4-3: Sea level allowances for the North-West RBD

Allowance category	2000-2035 (mm)	2036-2065 (mm)	2066-2095 (mm)	2096-2125 (mm)	Cumulative rise 2000-2125 (m)
Upper end	5.7 (200)	9.9 (297)	14.2 (426)	16.3 (489)	1.41
Higher central	4.5 (158)	7.3 (219)	10 (300)	11.2 (336)	1.01

18 The Climate Crisis – a guide for local authorities on planning for climate change | The Royal Town Planning Institute and Town & Country Planning Association | January 2023

19 Flood risk assessments: climate change allowances | Environment Agency | May 2022

4.8.1.2 Peak river flow allowances

Peak river flow allowances include for the anticipated changes to peak flow by EA management catchment. Broadly, both the central and higher central allowances for the 2080s epoch are required to be assessed for SFRAs. Table 4-4 lists the allowances for each management catchment and Figure 4-7 shows the Wyre, Ribble and Douglas management catchments which cover Central Lancashire. Management catchments are sub-catchments of river basin districts.

Table 4-4: Recommended peak river flow allowances for the Wyre, Ribble and Douglas management catchments

Management catchment	Allowance category	Total potential change anticipated for peak river flows (based on a 1981 to 2000 baseline)		
		2020s (2015-2039)	2050s (2040-2069)	2080s (2070-2125)
Wyre	Upper end	29%	44%	67%
	Higher central	22%	29%	44%
	Central	18%	23%	35%
Ribble	Upper end	27%	44%	71%
	Higher central	19%	29%	46%
	Central	16%	23%	36%
Douglas	Upper end	24%	45%	79%
	Higher central	15%	26%	47%
	Central	12%	19%	35%

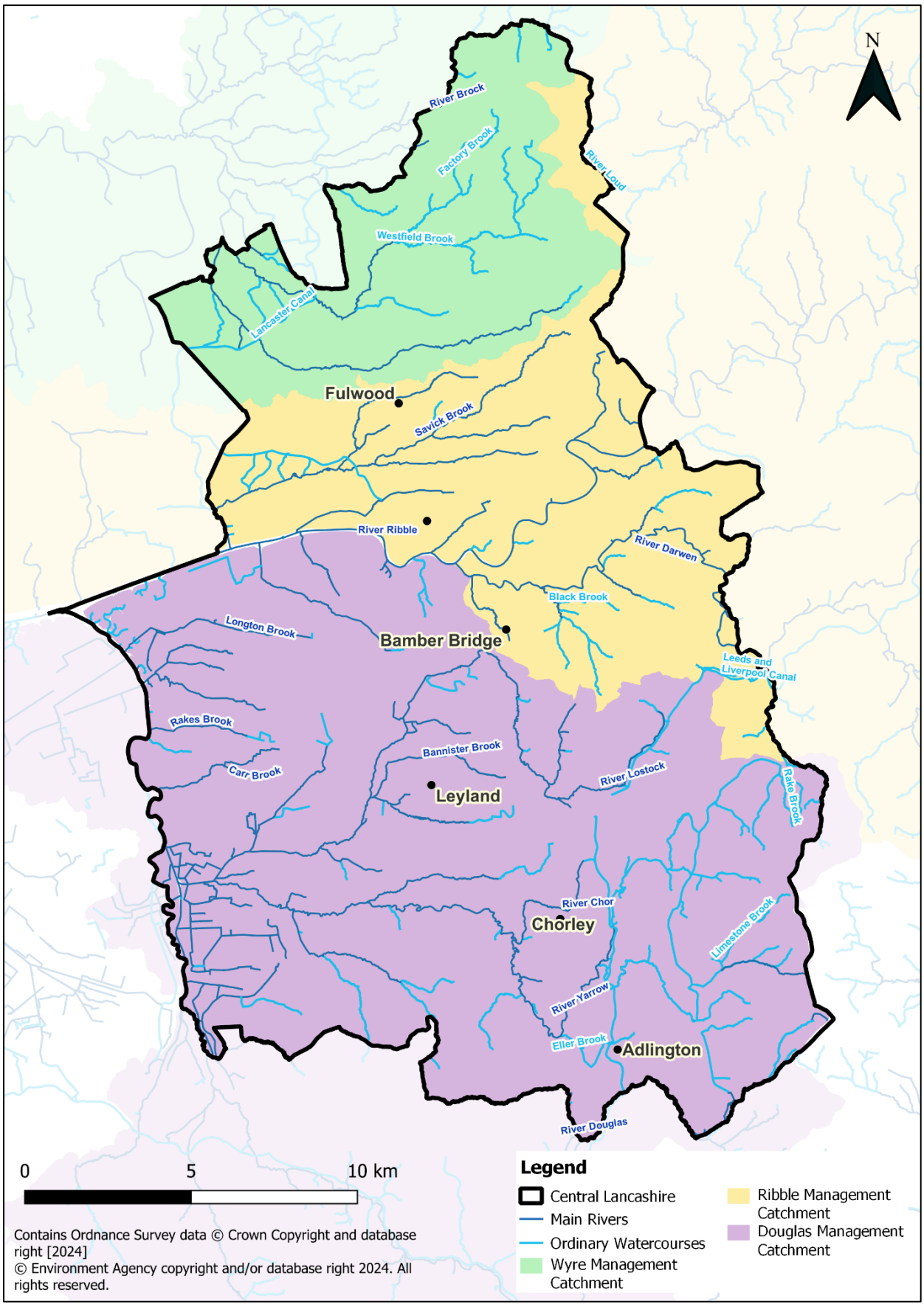


Figure 4-7: EA management catchments

4.8.1.3 Peak rainfall intensity allowances

To gauge the impacts of climate change on surface water and for small scale drainage design, the EA has produced allowances for peak rainfall intensities based on EA management catchments, provided in Table 4-5, which should be used for small (less than 5km^2) and urbanised drainage catchments. However, the peak flow allowances (Table 4-4) should be used for any large rural drainage catchments.

The EA advises that SFRAs and FRAs should assess the upper end allowances to gauge the range of impacts.

Table 4-5: Peak rainfall intensity allowances in small and urban catchments for England

Management catchment	Allowance category	Total potential change anticipated for peak rainfall intensities (based on a 1961 to 1990 baseline)			
		3.3% annual exceedance rainfall event		1% annual exceedance rainfall event	
		2050s (up to 2060)	2070s (2061-2125)	2050s (up to 2060)	2070s (2061-2125)
Wyre	Upper end	35%	45%	40%	50%
	Central	25%	30%	25%	35%
Ribble	Upper end	35%	40%	40%	50%
	Central	25%	30%	25%	35%
Douglas	Upper end	35%	40%	40%	45%
	Central	25%	30%	25%	35%

4.8.2 Climate change modelling in Central Lancashire

To represent the increased flood risk from climate change on flooding from rivers and from the coast, peak river inflows and tidal boundaries were uplifted respectively according to the EA allowances listed in the tables above. The hydraulic models of the watercourses and coastal areas outlined in Table 4-6 were updated in accordance with the EA peak river flow allowances and sea level allowances (where applicable), to produce flood extents to support application of the sequential test through the SFRA. These climate change flood extents are presented on the interactive GeoPDF maps in Appendix B.

Table 4-6: Modelled climate change allowances with Central Lancashire

Watercourse	Management catchment	Central allowance modelled	Higher central allowance modelled
Bannister Brook	Douglas	35%	47%
Black Brook	Douglas	35%	47%
Bryning Brook	Douglas	35%	47%
Buckow Brook	Douglas	35%	47%
Grimsargh	Ribble	36%	46%

Watercourse	Management catchment	Central allowance modelled	Higher central allowance modelled
Hall Pool	Douglas	35%	47%
Hennel Brook	Ribble	36%	46%
Bannister Hall watercourse	Ribble	36%	46%
Horwich	Douglas	35%	47%
Longton Brook	Douglas	35%	47%
River Lostock	Douglas	35%	47%
WC1 watercourse (tributary of River Lostock)	Douglas	35%	47%
WC2 watercourse (tributary of Bannister Brook)	Douglas	35%	47%
WC6 watercourse (tributary of River Ribble)	Douglas	35%	47%
Mill Brook	Douglas	35%	47%
Penwortham Lane watercourse	Douglas	35%	47%
Ribble Estuary*	Alt and Crossens	44%	58%
River Ribble and River Douglas	Ribble and Douglas	35%	47%
River Brock	Wyre	35%	44%
River Chor	Douglas	35%	47%
River Yarrow	Douglas	35%	47%
Wymott Brook	Douglas	35%	47%
River Wyre	Wyre	35%	44%
Croston			
*Ribble Estuary modelling was undertaken by JBA for the Liverpool City Region Combined Authority (LCRCA) SFRA in 2023. It has been agreed between LCRCA and the Central Lancashire Authorities to share this modelling for use within the Central Lancashire SFRA.			

The impact of climate change on surface water has been modelled based on the EA allowances for peak rainfall for the whole Central Lancashire region. The interactive GeoPDF maps in Appendix B show the RoFSW plus climate change mapping.

4.9 Historic risk

Records of past flood events can help to build a picture of areas and locations that may be prone to flooding and to help back up or confirm flood modelling outputs. Historic flood events can also help risk management authorities to target where flood risk management or resilience works may be required based on tangible evidence.

4.9.1 LLFA historic flood records

LLFA's are required, under the FWMA, to maintain and update a historic flood incidents database as and when any locally significant flood incidents occur. The LLFA has a statutory responsibility to investigate and report upon any 'locally significant' flood events. Details of these events are usually recorded in Section 19 reports which can be found on LCC's website[20]. Most recently, at the time of writing, these include:

- January 2022 (Bamber Bridge)
- July 2021 (Penwortham)
- June 2018 (Fulwood)
- November 2017 (Preston, Chorley and South Ribble)
- September 2016 (Chorley and South Ribble)
- August 2016 (Preston, Chorley and South Ribble)
- June 2016 (Preston, Chorley and South Ribble)
- December 2015 (Preston, Chorley and South Ribble)
- Summer 2012 (Croston, Leyland and Higher Walton)

The main sources of flooding indicated in these Section 19 reports are surface water and fluvial flooding, often due to the capacity of drainage networks being unable to cope with large amounts of rainfall. The North West River Basin District FRMP[21] states that compared to other RBDs in the country, the principal rivers in the North West are generally shorter and respond more quickly to prevailing weather conditions.

4.9.2 EA Historic Flood Map and Recorded Flood Outlines

The Historic Flood Map (HFM) is a spatial dataset showing the maximum extent of all recorded historic flood outlines from river, sea and groundwater and shows areas of land that have previously been flooded across England. Records began in 1946 when predecessor bodies to the EA started collecting information about flooding incidents. The HFM accounts for the presence of defences, structures, and other infrastructure where such existed at the time of flooding. It includes flood extents that may have been affected by overtopping, breaches or blockages. It is also possible that historic flood extents may have changed and that some areas would not flood at present i.e., if a flood defence has been built.

20 Lancashire County Council Section 19 Flood Investigation Reports
21 North West River Basin District Flood Risk Management Plan 2021 - 2027

The HFM does not contain any information regarding the specific flood source, return period or date of flooding, nor does the absence of the HFM in an area mean that the area has never flooded, only that records of historic flooding do not exist. The Recorded Flood Outlines (RFO) dataset however does include details of flood events. The difference between the two datasets is that the HFM only contains flood outlines that are 'considered and accepted' by the EA following adequate verification of the RFO dataset using certain criteria.

4.9.3 Historic fluvial flooding

Significant fluvial flooding has been documented by LCC as the LLFA through Section 19 reports.

In December 2015 there were multiple winter storms, most notably Storm Desmond and Storm Eva. Heavy rainfall meant that natural and constructed drainage networks were overwhelmed and there was fluvial flooding from main rivers including the Ribble, Lostock, Darwen, Yarrow and Douglas. Properties were flooded internally and externally in Preston, South Ribble and Chorley Districts.

In the summer of 2012 intense rainfall led to significant flooding in Central Lancashire. In Croston, 72 properties were impacted by a combination of surface water flooding and fluvial flooding from the River Yarrow.

The HFM and RFO datasets show areas of historic flooding mainly along the River Ribble at Walton-le-Dale, Higher Walton, City of Preston and to the east of Preston; along the River Lostock at Whittle-le-Woods, Lostock Hall and Leyland; the River Yarrow at Croston and Ecclestone; the River Douglas at Croston and Adlington and the River Wyre at Catforth.

The HFM and RFO datasets are shown on the interactive GeoPDF maps in Appendix B.

4.9.4 Historic sewer flooding

According to the North West River Basin District FRMP (2022)[22] historic sewer flooding has occurred in June 2020 in Broughton, Leyland, Woodplumpton, Preston and Chorley.

A Section 19 report published by LCC about Summer 2012 flooding noted that after intense rainfall, 15 properties were affected by surface water flooding and dilute sewage surcharging from a combined sewer.

4.9.5 Historic surface water flooding

Surface water has been recorded to have previously contributed to flood events across the district.

22 North West River Basin District Flood Risk Management Plan 2021 to 2027

Summer 2012

Two flood events occurred in the summer of 2012: one in June (surface water) and one in September (fluvial). In June, rain intensities were recorded at 10-15 mm per hour in several rain gauge regions. 1,676 properties flooded across the North West due to overloaded sewers. 86 customer contacts reported wastewater issues in South Ribble Borough and 58 in Chorley Borough.

December 2015

There were multiple winter storms in 2015. Saturation of the ground exacerbated surface water flooding and properties in Chorley Borough, City of Preston and South Ribble Borough were affected by surface water flooding internally and externally.

September 2016

Heavy rain resulted in surface water flooding along highways and affecting the exterior of two properties in Chorley Borough and one property in South Ribble Borough.

August 2016

Heavy rain led to external surface water flooding at four properties in Chorley Borough, two properties in the City of Preston and two properties in South Ribble Borough.

June 2016

Heavy rain led to external flooding to two properties in Chorley Borough, 1 property in the City of Preston and 11 properties in South Ribble Borough.

November 2017

Intense rain resulted in extensive surface water and fluvial flooding across Lancashire. There was surface water flooding to highways and to nine properties in Chorley Borough, three properties in the City of Preston and three properties in South Ribble Borough.

June 2018

A blocked gulley resulted in external surface water flooding to a property in Fulwood, City of Preston after heavy rainfall.

June 2020

Heavy rainfall led to surface water, as well as combined surface water and sewer flooding in Leyland, Broughton, Woodplumpton, Preston and Chorley.

4.9.6 Historic groundwater flooding

It is difficult to attribute a groundwater flooding event as occurring solely due to groundwater as its source. It may be the case that groundwater flood events have occurred but have not been recorded. The LFRMS for Lancashire states that "*groundwater flood risks in Lancashire tend to be prevalent in lower lying areas underlain by permeable rocks and soils as is typical throughout the West Lancashire Plain and Fylde Peninsula*". Other areas noted to be susceptible to groundwater flooding include low-lying areas in the west of the region, as evidence by the presence of ponds and the networks of ground drains.

4.10 Flood risk management

The aim of this section of the SFRA is to identify existing flood risk management (FRM) assets and proposed FRM schemes. The location, condition and design standard of existing assets will have a significant impact on actual flood risk mechanisms. Whilst future schemes in high flood risk areas carry the possibility of reducing the probability of flood events and reducing the overall level of risk. Both existing assets and future schemes will have a further impact on the type, form and location of new development or regeneration.

4.10.1 EA inspected assets (Spatial Flood Defences)

The EA maintains a spatial dataset called the Spatial Flood Defences dataset. This national dataset contains such information as:

- Asset type (flood wall, embankment, high ground, demountable defence, bridge abutment);
- Flood source;
- Design Standard of Protection (SoP);
- Asset length;
- Asset age;
- Asset location; and
- Asset condition.

This dataset does not include flood defence assets on non-main rivers. See Figure 4-8 for condition assessment grades using the EA's Condition Assessment Manual[23] (CAM).

The design standard of protection (SoP) for a flood defence is a measure of how much protection a flood defence gives. If the SoP is 100, the defence is designed to protect against a flood with the probability of occurring once in 100 years (1% AEP event).

23 Environment Agency. (2012). Visual Inspection Condition Grades. In: EA Condition Assessment Manual. Bristol: Environment Agency. P9.

Grade	Rating	Description
1	Very Good	Cosmetic defects that will have no impact on performance
2	Good	Minor defects that will not reduce the overall performance of the asset
3	Fair	Defects that could reduce the performance of the asset
4	Poor	Defects that would significantly reduce the performance of the asset. Further investigation needed.
5	Very Poor	Severe defects resulting in complete performance failure.

Figure 4-8: EA flood defence condition assessment grades

Table 4-7: Major flood defences within Central Lancashire

Defence Location	Asset Type	Flood Source	Watercourse	Design Standard	Condition Grade
City of Preston	Wall (10)	Fluvial/ tidal	River Ribble	100 years (8), 25 years (1), 10 years (1)	Unknown (3), 2 (1), 3 (4), 4 (2)
	Embankment (20)	Fluvial/ tidal	River Ribble	150 years (1), 100 years (11), 75 years (1), 50 years (3), 25 years (2), unknown (2)	Unknown (17), 3 (3)
Chorley Borough	Wall (19)	Fluvial/ tidal	River Yarrow (14), River Lostock (2), River Douglas (2), River Chor (1)	50 years (7), 25 years (8), 20 years (1), 10 years (3)	Unknown (9), 3 (9), 4 (1)
	Embankment (78)	Fluvial/ tidal	River Douglas (30), River Yarrow (19), New Reed Brook (11), Wymott Brook (6), River Lostock (6), Mill Ditch (6)	150 years (2), 100 years (25), 70 years (4), 50 years (16), 40 years (1), 25 years (6), 20 years (1), 5 years (23)	Unknown (23), 2 (1), 3 (54)
South Ribble Borough	Wall (26)	Fluvial/ tidal	River Ribble (13), River Darwen (8), Bannister Brook (3), River Lostock (2)	100 years (15), 70 years (6), 50 years (3), 25 years (2)	Unknown (14), 2 (5), 3 (6), 4 (1)

Defence Location	Asset Type	Flood Source	Watercourse	Design Standard	Condition Grade
	Embankment (50)	Fluvial/ tidal	River Ribble (12), River Darwen (11), Longton Brook (7), Walmer Brook (6), River Douglas (5), River Lostock (3), Bannister Brook (1), unnamed watercourse (5)	100 years (32), 75 years (2), 70 years (9), 50 years (3), 25 years (3), 5 years (1)	Unknown (37), 3 (12), 4 (1)
*The number in brackets refers to the number of features with that attribute.					

The Spatial Flood Defences dataset, which displays the defences by asset type, is shown on the interactive maps in Appendix B.

As well as the ownership and maintenance of a network of formal defence structures, the EA carries out several other flood risk management activities that help to reduce the probability of flooding, whilst also addressing the consequences of flooding. These include:

- Maintaining and improving the existing flood defences, structures and watercourses;
- Enforcement and maintenance where riparian owners unknowingly carry out work that may be detrimental to flood risk;
- Identifying and promoting new flood alleviation schemes (FAS), where appropriate;
- Working with local authorities to influence the location, layout and design of new and redeveloped property and ensuring that only appropriate development is permitted relative to the scale of flood risk;
- Operation of Floodline Warnings Direct and flood warning services for areas within designated Flood Warning Areas (FWA) or Flood Alert Areas (FAA). EA FWAs and FAAs are shown on the Interactive GeoPDF maps in Appendix B;
- Promoting awareness of flooding so that organisations, communities, and individuals are aware of the risk and are therefore sufficiently prepared in the event of flooding; and
- Promoting resilience measures for existing properties that are currently at flood risk or may be in the future as a result of climate change (Property Flood Resilience - see Section 5.8.5).

4.10.2 LCC assets and future flood risk management schemes

LCC (as the LLFA), under the provisions of the FWMA, has a duty to maintain a register of structures or features that have a significant effect on flood risk, including details of ownership and condition as a minimum. The asset register should include those features relevant to flood risk management function including feature type, description of principal

materials, location, measurements (height, length, width, diameter) and condition grade. The FWMA places no duty on the LLFA to maintain any third-party features, only those for which the authority has responsibility as land/asset owner. The LLFA may carry out a strategic assessment of structures and features within the asset register to inform partners' capital programmes and prioritise maintenance programmes

LCC is not promoting any flood alleviation or flood risk management schemes in the CLA area at the time of writing. Completed flood risk management schemes within the region include:

Croston Flood Risk Management Scheme[24]

The Croston Flood Risk Management Scheme was officially opened on 6 July 2017 and manages flood risk for 438 properties in Croston. The project was developed by the EA in partnership with Chorley Borough Council, Lancashire County Council and United Utilities**,** and in collaboration with the Lower Yarrow Flood Action Group. The scheme comprises an upstream flood storage area on the River Yarrow and a 600m earth embankment which is capable of retaining up to 1.3 million m^3 of water.

Yarrow Meadows Floodplain Project[25]

Led by the EA and Chorley Borough Council, the Yarrow Meadows Floodplain Project aims to develop Yarrow County Park through natural flood management, habitat creation and new footpaths and bridges.

Preston and South Ribble Flood Risk Management Scheme[26]

At the time of writing, The EA was delivering a £54.7m Flood Risk Management Scheme to improve flood protection to homes, businesses and schools along parts of the River Ribble. The scheme will improve the local environment as well as community amenities. The first phase of the project entails construction in Broadgate & Riverside (Preston) and in Lower Penwortham. The second phase includes works in Walton le Dale, Frenchwood and Fishwick, and Higher Walton.

4.10.3 Water company assets

The sewerage infrastructure within the Central Lancashire area may have a risk of localised flooding associated with the existing drainage capacity and sewer system. UU is responsible for the management of the adopted sewerage system. This includes surface water and foul sewerage. There may however be some private surface water sewers in the area as only those connected to the public sewer network that were transferred to the water companies under the Private Sewer Transfer in 2011 are likely to have been constructed since this transfer date. Surface water sewers discharging to watercourses were not part of

24 Official opening of Croston Flood Risk Management Scheme - GOV.UK (www.gov.uk)
25 Yarrow Meadows Masterplan (thefloodhub.co.uk)
26 Preston and South Ribble Flood Risk Management Scheme | The Flood Hub

this transfer and would therefore not be under the ownership of UU, unless adopted under a Section 104 adoption agreement.

Water company assets include Wastewater Treatment Works, Combined Sewer Overflows, pumping stations, detention tanks, sewer networks and manholes.

4.10.4 Natural Flood Management / Working with Natural Processes

Natural flood management (NFM) or Working with Natural Processes (WwNP) is a type of nature-based flood risk management solution used to protect, restore and re-naturalise the function of catchments and rivers to reduce flood and coastal erosion risk. WwNP has the potential to provide environmentally sensitive approaches to minimising flood risk, to reduce flood risk in areas where hard flood defences are not feasible and to increase the lifespan of existing flood defences.

A wide range of techniques can be used that aim to reduce flooding by working with natural features and processes in order to store or slow down floodwaters before they can damage flood risk receptors (e.g. people, property, infrastructure, etc.). WwNP involves taking action to manage flood and coastal erosion risk by protecting, restoring and emulating the natural regulating functions of catchments, rivers, floodplains and coasts.

The EA is actively encouraging the implementation of WwNP measures within catchments and coastal areas in order to assist in the delivery of environmental protection and national policies. The implementation of WwNP will continue to become a fundamental component of the flood risk management tool kit due to climate change.

4.10.4.1 Evidence base for WwNP to reduce flood risk

The EA has produced a WwNP evidence base[27], which includes three interlinked projects:

- Evidence directory;
- Mapping the potential for WwNP; and
- Research gaps.

The evidence base can be used by those planning projects that include WwNP measures to help understand:

- Their potential FCRM benefits and multiple benefits;
- Any gaps in knowledge;
- Where it has been done before and any lessons learnt; and
- Where in a catchment they might be most effective.

A guidance document sits alongside the evidence directory and the WwNP maps that explains how to use them to help make the case for implementing WwNP when developing business cases.

27 Working with natural processes to reduce flood risk, GOV.UK, February 2021

4.10.4.2 Mapping the potential for WwNP

National maps for England make use of different mapping datasets and highlight the potential areas for tree-planting (for three different types of planting), runoff attenuation storage, gully blocking and floodplain reconnection. The maps can be used to signpost potential areas for WwNP and do not consider issues such as landownership and drainage infrastructure, but they may well help start the conversation and give indicative estimates of, for example, additional distributed storage in upstream catchments.

These maps are intended to be used alongside the evidence directory to help practitioners think about the types of measure that may work in a catchment and the best places in which to locate them. There are limitations with the maps, however it is a useful tool to help start dialogue with key partners. The maps are provided as spatial data for use in GIS and interactive GeoPDF format, supported by a user guide and a detailed technical guide.

The WwNP types are listed in Figure 4-9.

WWNP Type	Open data licence details
Floodplain reconnection	• Risk of Flooding from Rivers and Seas (April 2017). • Data derived from the Detailed River Network, which is not displayed, rescinding the licence requirements for displaying the dataset (to be superseded by OS Water Network but not available for project in time). • Constraints data.
Run-off attenuation features	• Data derived from Risk of Flooding from Surface Water (Depth 1% AEP and Depth 3.3% AEP) (October 2013). The original data is not displayed due to licensing restrictions. • Constraints data. • Gully blocking potential (a subset of run-off attenuation features on steeper ground). • Data derived from OS Terrain 50 (2016) to classify each run-off attenuation feature based on median slope.
Tree planting (3 categories)	• Floodplain: Flood Zone 2 from Flood Map for Planning (April 2016) and new constraints layer. • Riparian: 50m buffer OS water features with constraints layer • Wider catchment woodland: o Based on slowly permeable soils. o BGS Geology 50,000 Superficial and Bedrock layers (both V8, 2017). Used with new science to derive new 100m gridded open data. This new layer can be used to signpost areas of SLOWLY PERMEABLE SOILS and can be checked in more detail on the BGS portal. o To the north of the line of Anglian glaciation, the presence of till-diamicton has been shown to be a strong predictor of slowly permeable soils. o To the south of this line, particular bedrock geologies have shown a similarly strong spatial relationship to the presence of slowly permeable soils.

Figure 4-9: WwNP measures and data

The WwNP datasets are included on the interactive GeoPDF maps in Appendix B and should be used to highlight any sites or areas where the potential for WwNP should be investigated further as a means of flood mitigation:

- Floodplain Reconnection:
  - Floodplain Reconnection Potential – areas of low or very low probability based on the Risk of Flooding from Rivers and Sea dataset (see Section 4.1.3) that are near a watercourse and that do not contain properties, are possible locations for floodplain reconnection. It may be that higher risk areas can be merged, depending on the local circumstances.
- Runoff Attenuation Features (Run-off attenuation features are based on the premise that areas of high flow accumulation in the RoFSW) maps are areas where the runoff hydrograph may be influenced by temporary storage if designed correctly):
  - Runoff Attenuation Features 1% AEP
  - Runoff Attenuation Features 3.3% AEP
- Tree Planting
  - Floodplain Woodland Potential and Riparian Woodland Potential – woodland provides enhanced floodplain roughness that can dissipate the energy and momentum of a flood wave if planted to obstruct significant flow pathways. Riparian and floodplain tree planting are likely to be most effective if close to the watercourse in the floodplain, which is taken to be the 0.1% AEP flood extent (Flood Zone 2) and within a buffer of 50 metres of smaller watercourses where there is no flood mapping available. There is a constraints dataset that includes existing woodland; and
  - Wider Catchment Woodland Potential – slowly permeable soils have a higher probability of generating 'infiltration-excess overland flow' and 'saturation overland flow'. These are best characterised by gleyed soils, so tree planting can open up the soil and lead to higher infiltration and reduction of overland flow production.

Limitations

The effectiveness of WwNP measures is site-specific and depends on many factors, including the location and scale at which they are used. It may not always be possible to guarantee that these measures alone will deliver a specified standard of defence. Consequently, flood risk management measures should be chosen from several options ranging from traditional forms of engineering through to more natural systems. The research gaps that need to be addressed to move WwNP into the mainstream are identified in the evidence directory.

The key locations within Central Lancashire that are considered to have significant potential for WwNP schemes include:

- Croston
- Catforth

- Eccleston
- Woodplumpton
- Leyland

An interactive map of nature-based flood risk management projects and potential projects can be found at JBA Trust Mapping[28].

4.10.5 EA flood risk management activities and Flood and Coastal Erosion Risk Management (FCERM) Research and Development

The FCERM Research and Development Programme is run by the EA and Defra and aims to serve the needs of all flood and coastal operating authorities in England. The strategic objectives for research include:

- better understand future flood and coastal erosion risk
- prepare for the scale and frequency of future incidents
- optimise the management of FCERM infrastructure
- improve responsibility and funding for flood and coastal risk
- understand the potential of new technology and innovation
- increase resilience to flood and coastal erosion risk
- completed and ongoing research can be researched online.[29]

4.10.6 Summary of flood risk

The risk across Central Lancashire is varied:

- The main fluvial risk comes from the River Ribble that flows along the Preston and South Ribble boundary towards the east of the Central Lancashire area, the River Darwen that affects Walton-le-Dale and Higher Walton, the River Lostock that affects communities such as Leyland and Cuerden Green, and the River Yarrow in Chorley Borough Council's area affecting Croston, Ulnes Walton and just west of Chorley town centre.
- The main tidal risk comes from the Ribble Estuary and the River Ribble which flows along the Preston and South Ribble boundary affecting Penwortham and just south of Preston City Centre, and the River Douglas which flows northward to the estuary along the western boundary of Central Lancashire.
- Surface water risk is spread across the entirety of Central Lancashire with the area in the south-east of Chorley Borough to the east of the M61 being of particular risk where there is a collection of reservoirs such as the Anglezarke, Yarrow and Upper Rivington.
- The areas with the highest levels of groundwater vulnerability are located mainly within Chorley Borough Council's region to the east: Withnell and along the M61 by Lower Copthurst, High Copthurst, Knowley, and Little Knowley. Also, along the

28 Working with Natural Processes Mapping, JBA Trust

29 FCERM research and development projects, GOV.UK, March 2021

Preston and South Ribble boundary following the River Ribble, and along the South Ribble and Chorley boundary by Higher Walton, Gregson Lane and Hoghton; and

- The main reservoir risk according to the Reservoir Flood Map, affects Preston City Centre, the area just south of Croston, and some risk in Chorley Town Centre and Adlington.

5 Development and flood risk

5.1 Introduction

The information and guidance provided in this chapter summarises the online guidance provided in the NPPF and FRCC-PPG and other government guidance on development and flood risk. Specifically, the basis from which to apply the sequential approach in the development allocation and development management process.

5.2 Sequential approach

The FRCC-PPG provides the basis for the sequential approach. It is this approach, integrated into all stages of the development planning process, which provides the opportunities to reduce flood risk to people, property, infrastructure, and the environment to acceptable levels. Land at the lowest risk of flooding from all sources should be considered for development, following the requirements of the sequential test.

The approach is based around the FRM hierarchy, in which actions to avoid, substitute, control and mitigate flood risk is central. For example, it is important to assess the level of risk to an appropriate scale during the decision-making process, (starting with this Level 1 SFRA). Once this evidence has been provided, positive planning decisions can be made and effective FRM opportunities identified.

Figure 5-1 illustrates the FRM hierarchy with an example of how this may translate into the CLA's development allocation and developer's development management decisions and actions.

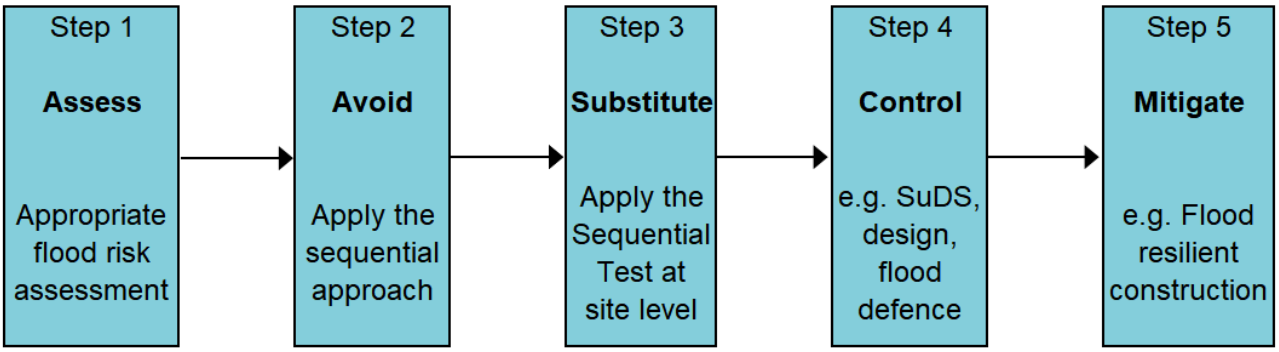


Figure 5-1: Flood risk management hierarchy

There are two different aims in carrying out the sequential test depending on what stage of the planning system is being carried out, i.e., the CLA allocating land in the CLLP or when determining specific planning applications for development. The CLA will apply the sequential test to potential allocations for inclusion in the local plan using the whole local planning authority area to increase the possibilities of accommodating development that is not exposed to flood risk, both now and in the future. For other developments, such as windfall developments, developers must supply evidence to the CLA, with a suitable planning application, that the development has passed the test.

This Level 1 SFRA provides the basis for applying the sequential test. The CLA should perform the test as part of the process by which the suitability of sites is tested for plan-making purposes through the development of site assessment reports. Alternatively, it can be demonstrated through a free-standing document, or as part of a Housing and Economic Land Availability Assessment.

Whether any further work is needed to decide if the land is suitable for allocation will depend on both the vulnerability of the development and the flood zone it is proposed for. Table 2 of the FRCC-PPG[30] defines the flood risk vulnerability and flood zone 'incompatibility' of different development types to fluvial and / or tidal flooding, as shown in Figure 5-2.

Flood Zones	**Flood Risk Vulnerability Classification**				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✔	✔	✔	✔	✔
Zone 2	✔	Exception Test required	✔	✔	✔
Zone 3a †	Exception Test required †	X	Exception Test required	✔	✔
Zone 3b *	Exception Test required *	X	X	X	✔ *

Key:

✔ Exception test is not required

X Development should not be permitted

Figure 5-2: Table 2 of the FRCC-PPG flood risk vulnerability and flood zone 'incompatibility'

30 Flood risk and coastal change - GOV.UK, 2022

Notes to Figure 5-2:

- *This table does not show the application of the Sequential Test which should be applied first to guide development to the lowest flood risk areas; nor does it reflect the need to avoid flood risk from sources other than rivers and the sea;*
- *The Sequential and Exception Tests do not need to be applied to those developments set out in National Planning Policy Framework footnote 56. The Sequential and Exception Tests should be applied to 'major' and 'non major' development;*
- *Some developments may contain different elements of vulnerability and the highest vulnerability category should be used, unless the development is considered in its component parts.*

"†" In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.

"" In Flood Zone 3b (functional floodplain) essential infrastructure that has passed the Exception Test, and water-compatible uses, should be designed and constructed to:*

- *Remain operational and safe for users in times of flood;*
- *Result in no net loss of floodplain storage;*
- *Not impede water flows and not increase flood risk elsewhere*.

5.3 The sequential test for local plan preparation

The FRCC-PPG, para 024, states the aim of the sequential test is:

"*…to steer new development to areas with the lowest risk of flooding, taking all sources of flood risk and climate change into account."*

The CLA should seek to avoid inappropriate development in areas at risk of all sources of flooding, where applicable, by directing development away from areas at highest risk and ensuring that all development does not increase risk and where possible can help reduce risk from flooding to existing communities and development.

At a strategic level, this should be carried out through the Local Plan using this Level 1 SFRA by:

1. Applying the sequential test and if the sequential test is passed, applying and passing the exception test, if required, through a Level 2 SFRA;
2. Safeguarding land from development that is required for current and future flood management (i.e. using the EA's potential for WwNP datasets as a starting point);
3. Using opportunities offered by new development to reduce the causes and impacts of flooding through effective mitigation i.e., SuDS;
4. Identifying where flood risk is expected to increase with climate change so that existing development may be made sustainable in the long term through Property Flood Resilience measures; and
5. Seeking opportunities to facilitate the relocation of at risk development including housing to more sustainable locations, where feasible.

Figure 5-3 presents Diagram 2 of the FRCC-PPG (para 026), which illustrates the sequential test process for plan preparation. The Test can be applied using the information provided in this Level 1 SFRA.

This is a stepwise process, but a challenging one, as a number of the criteria used are qualitative and based on experienced judgement. The process must be documented, and evidence used to support decisions recorded.

This can be done using the development site screening assessment spreadsheet in Appendix C. This spreadsheet shows that the CLA, through the SFRA, has applied the sequential test for sites at fluvial, tidal, and / or surface water risk and thus considered development options for each site.

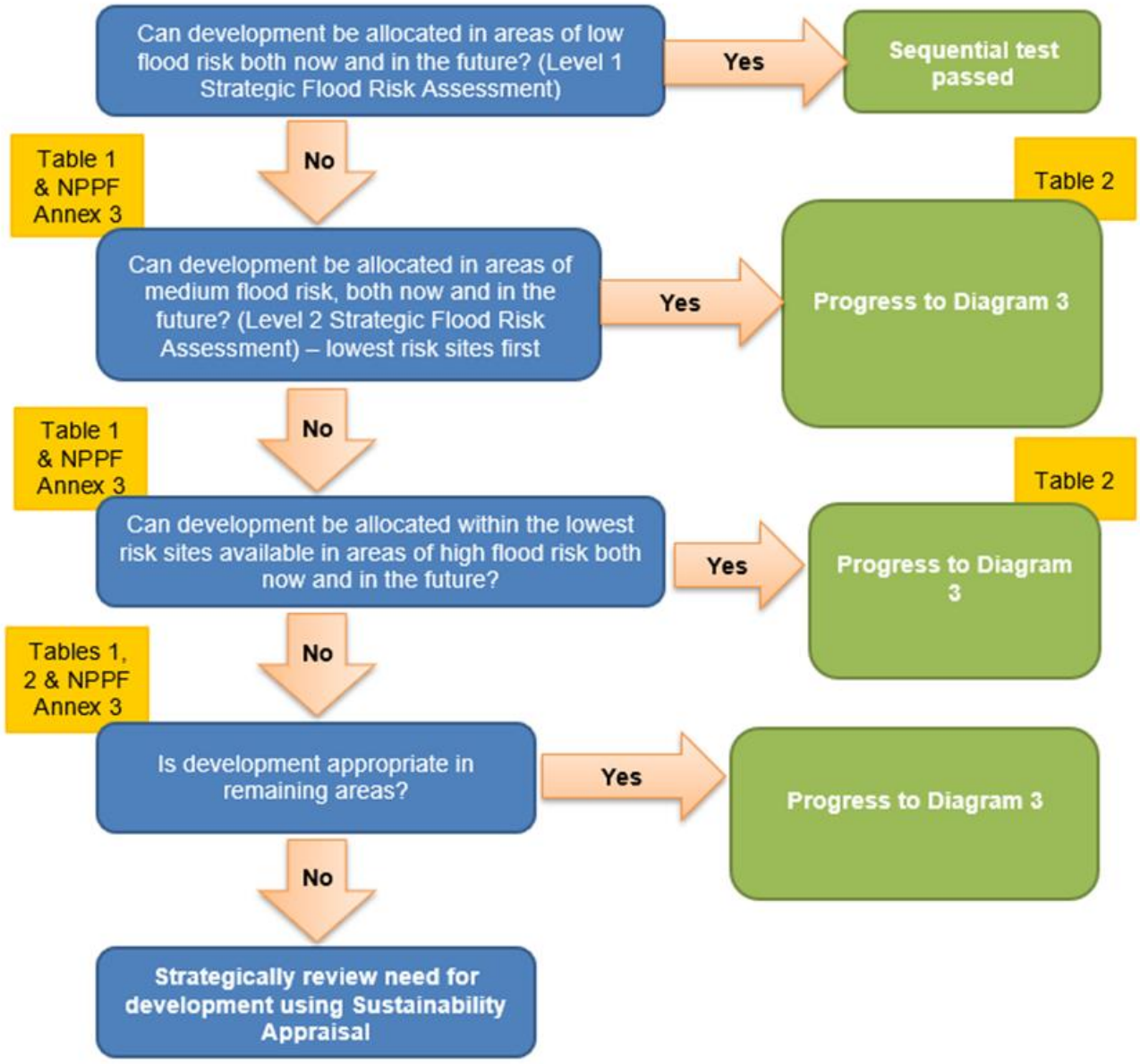


Figure 5-3: Diagram 2: Application of the sequential test for plan preparation[31]

Notes on Diagram 2:

- 'Tables 1 and 2' refer to the flood zone and flood risk tables of the FRCC-PPG Paragraphs 078-079
- 'Areas of low flood risk' include:
  - Areas within Flood Zone 1 (rivers and sea),
  - Areas within the low risk surface water flood event extent of the Risk of Flooding from Surface Water map,
  - Areas not at additional risk from climate change.
- 'Areas of medium flood risk' include:
  - Areas within Flood Zone 2 (rivers and sea),

31 Flood risk and coastal change: paragraph 25, GOV.UK, 2022

- Areas within the medium risk surface water flood event extent of the Risk of Flooding from Surface Water map,
- Areas at risk from Flood Zone 2 plus climate change,

- ‘Areas of high flood risk’ include:
  - Areas within Flood Zone 3a and Flood Zone 3b (rivers and sea),
  - Areas within the high risk surface water flood event extent of the Risk of Flooding from Surface Water map
  - Areas at risk from Flood Zone 3a plus climate change and future functional floodplain.

Sources of flooding other than fluvial, tidal and surface water also need to be considered. However, the datasets available for other risk sources are not of the appropriate level of detail required to be used to inform the sequential test, including for risk from groundwater (Section 4.3), sewers (Section 4.4) and reservoirs (Section 4.5). At the strategic plan making level, these datasets can only be used to flag that there is risk from these sources that should be investigated in more detail at the site-specific FRA stage.

The approach shown in Figure 5-3 provides an open demonstration of the sequential test being applied in line with the NPPF and the FRCC-PPG. The CLA should agree a locally specific approach to application of the sequential test, based on the available evidence and circumstances. The EA would not be required to approve the locally specific approach taken by the CLA, though they can consult the EA regarding potential sites and any local information or consultations with the LLFA and any wider stakeholders should also be taken into account.

This Level 1 SFRA provides the main evidence required to carry out this process, including for windfall sites that do not form part of the local plan allocation process. The process also enables those sites that have passed the sequential test and may require the exception test or additional more detailed investigation through a Level 2 SFRA, to be identified.

"The need for the exception test will depend on the potential vulnerability of the site and of the development proposed, in line with the Flood Risk Vulnerability Classification set out in Annex 3" (NPPF para 177).

5.4 The exception test for local plan preparation

The NPPF, para 178, states:

“*To pass the exception test it should be demonstrated that:*

a) the development would provide wider sustainability benefits to the community that outweigh the flood risk; and

b) the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.”

A site must satisfy both elements of the test to enable allocation in the local plan. A Level 2 SFRA would normally inform on whether the second part of the exception test can be passed, notwithstanding the requirement for a site-specific FRA at the planning application

stage. However, as stated in para 180 of the NPPF, the test may need to be reapplied if relevant aspects of the planning proposal had not been considered when the test was first applied to allocate the site in the local plan, or if more recent information about existing or potential flood risk is available and should be accounted for.

Figure 5-4 presents Diagram 3 of the FRCC-PPG (para 033), which illustrates the application of the exception test for allocating sites in the local plan. This process should be informed by a Level 2 SFRA.

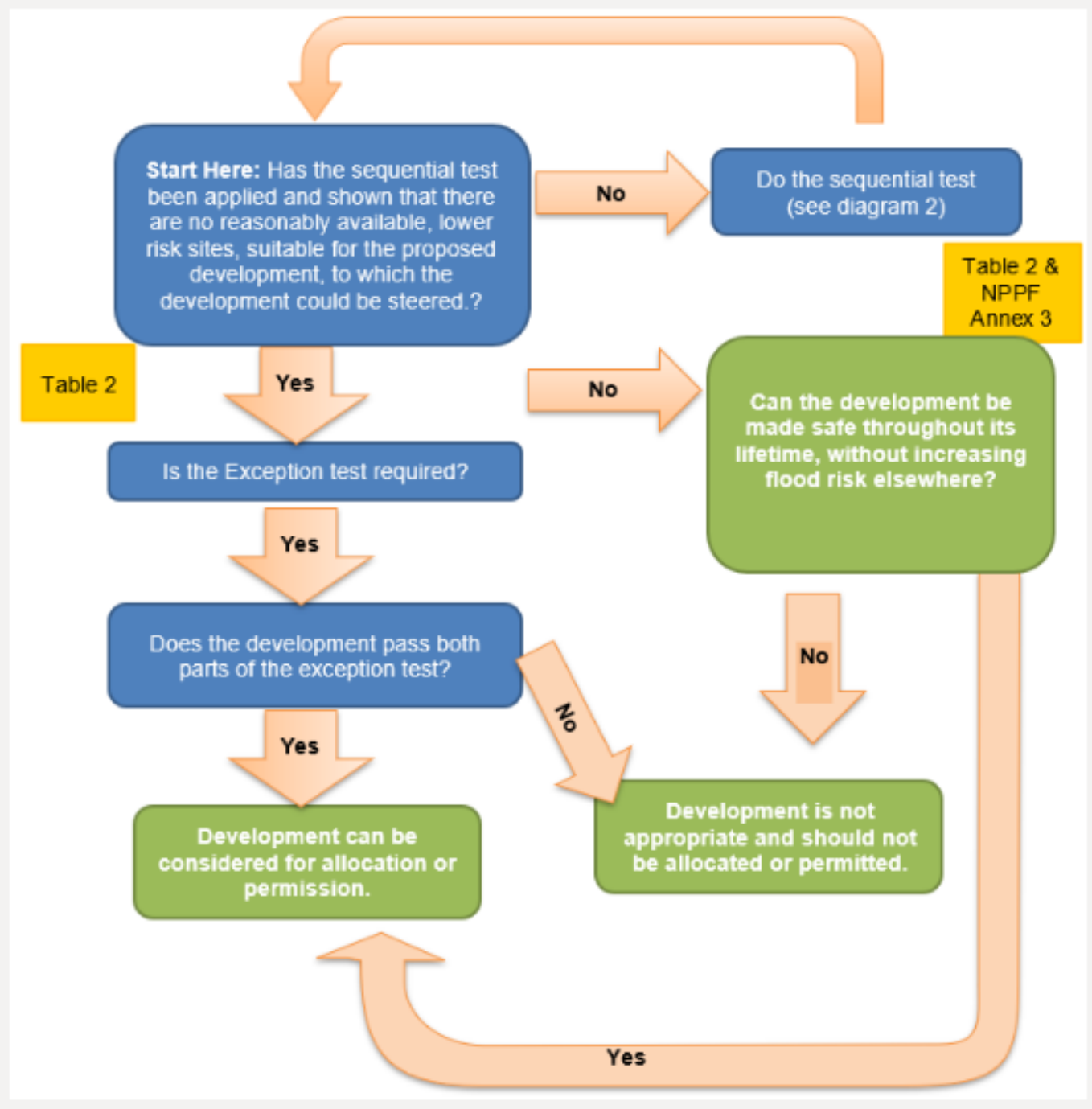


Figure 5-4: Diagram 3: Application of the exception test to plan preparation

Where it is found to be unlikely that the exception test can be passed due to few wider sustainability benefits (part a), the risk of flooding being too great (part b), or the viability of the site being compromised by the level of flood risk management work required, then the CLA should consider avoiding the site altogether.

Once this process has been completed, the CLA should then be able to allocate appropriate development sites through the local plan as well as prepare flood risk policy, including the requirement to prepare site-specific FRAs for all allocated sites that remain at risk of flooding or that are greater than one hectare in area.

5.5 Development management sequential and exception testing

5.5.1 Sequential testing for developers

The CLA, with advice from the EA on the relative flood risk between the proposed site and any alternative sites identified, are responsible for considering the extent to which sequential testing considerations have been satisfied for a site.

Developers are required to apply the sequential test to all available potential development sites, unless a site is:

- A strategic allocation and the test has already been carried out by the CLA through the local plan process, or
- Subject to a change of use (except to a higher vulnerability classification), or
- A minor development (householder development, small non-residential extensions with a footprint of less than 250m^2), or
- Located in Flood Zone 1, unless there are other flooding issues in the area of the development (i.e., groundwater, sewer flooding, residual risk), and not at risk from climate change, including for access and escape route, and land raising.

This Level 1 SFRA contains information on all sources of flooding, to the extent that information was made available. This should be considered when a developer undertakes the sequential test, including the consideration of reasonably available sites at lower flood risk. The impacts of climate change on all sources of flood risk, where feasible, should be robustly accounted for, i.e., through appropriate modelling.

Local circumstances must be used to define the area of application of the sequential test (within which it is appropriate to identify reasonably available alternative sites). The criteria used to determine the appropriate search area relate to the catchment area for the type of development being proposed. For some sites this may be clear e.g., school catchments, in other cases it may be identified by other local plan policies. For some sites e.g., regional distribution sites, it may be suitable to widen the search area beyond the relevant LPA administrative boundaries. The relevant LPA should be consulted before deciding on the appropriate search area.

The sources of information on reasonably available sites may include:

- Site allocations in the local plan

- Sites with planning permission but not yet built
- Housing and Economic Land Availability Assessments (HELAAs)/ five-year land supply/ authority monitoring reports
- Locally listed sites for sale.

It may be that several smaller sites or part of a larger site at lower flood risk form a suitable alternative to a development site at high flood risk. Ownership or landowner agreement is not acceptable as a reason not to consider alternatives.

5.5.2 Exception testing for developers

If, following application of the sequential test it has been agreed with the LPA that it is not possible for the development to be in areas with a lower probability of flooding, the exception test must then be applied if required (as set out in Diagram 3 of the FRCC-PPG). Developers are required to apply the exception test to all applicable sites (including strategic allocations).

The applicant will need to provide information that the application can pass both parts of the exception test by:

- Demonstrating that the development would provide wider sustainability benefits to the community that outweigh the flood risk (part a).
- Referring to wider sustainability objectives in the Sustainability Appraisal. These generally consider matters such as biodiversity, green infrastructure, historic environment, climate change adaptation, flood risk, green energy, pollution, health, transport etc.
- Detailing the suitability issues the development will address and how doing it will outweigh the flood risk concerns for the site e.g., by facilitating wider regeneration of an area, contributing to the local economy, providing community facilities, infrastructure that benefits the wider area, etc.
- Demonstrating that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall (part b).
- Demonstrating that the site will be safe, and the people will not be exposed to hazardous flooding from any source. The FRA should consider actual and residual risk and how this will be managed over the lifetime of the development, including:
    - The design of any flood defence infrastructure, including operation and maintenance
    - Availability of dry access and escape routes during the extreme flood event, accounting for climate change impacts
    - Design of the development to manage and reduce flood risk wherever possible i.e., through SuDS, including for designated ownership and maintenance procedures
    - Resident awareness through appropriate emergency plans and signposting / signage

- Emergency planning and flood warning and evacuation procedures, including whether the development would increase the pressure on emergency services to rescue people during a flood event; and
- Any funding arrangements required for implementing mitigation measures, maintenance procedures.

5.6 Site-specific Flood Risk Assessment

The principal aims of an FRA are to determine the level of flood risk to a site and to confirm that suitable flood management measures can be developed to control flooding, and safeguard life and property, without increasing risk to the surrounding area.

Once the site has been sequentially tested and has been identified as being likely to pass the exception test through a Level 2 SFRA, a site-specific FRA should be undertaken. The LPA, LLFA and EA should be consulted, as a minimum, to determine the content and scope of the FRA.

The production of a site-specific FRA can be seen as an iterative process by subdividing the FRA into three stages:

- Stage 1 is a screening study used to identify whether there are any flood risk issues that need to be considered further i.e., reviewing the SFRA outcomes;
- Stage 2 is a scoping study that should be undertaken if the Stage 1 FRA indicates that there are flood risk issues that need further consideration; and
- Stage 3 is a detailed study where further quantitative analysis is required to fully assess flooding issues and confirm that effective mitigation measures can be implemented to control flood risk and that the second part of the exception test can be passed.

It is appropriate to review the level of risk present and assess whether development is appropriate and achievable at each stage of the assessment.

The SFRA is an assessment of flood risk at a strategic level. This information can be used to provide evidence for Stages 1 and 2 of the FRA. Where a more detailed FRA is required (Stage 3), then a developer should undertake a detailed assessment of the flood risk at the site, which would likely include appropriate flood modelling. A suitable drainage strategy would also normally be required for new developments to ensure surface water is controlled to a rate set by the LLFA.

Significant consultation with the LPA and key consultees and stakeholders that are relevant to the site will be required for complex development proposals. Complex developments may need to include flood mitigation measures and compensatory storage.

Together with appropriate consultation, accepted FRA guidance should be followed by developers including:

- Find out when you need to do an FRA as part of a planning application, how to complete one and how it's processed:

- Flood risk assessments if you're applying for planning permission[32]
- Flood risk assessment in flood zones 2 and 3[33]
- Flood risk assessment in flood zone 1 and critical drainage areas[34]

- EA standing advice:
  - Preparing a flood risk assessment: standing advice[35]

In summary, the FRA should address the following:

1. Development description and location
   - What is the type of development and where will it be located?
   - What is the vulnerability classification (Table 2 of FRCC-PPG (Figure 5-2)) of the current and future building use?
   - Has the development site been assessed in the SFRA? If so, has the sequential test been carried out? Has the exception test (if applicable) been applied and passed previously?
2. Access and escape routes
   - Can safe access and escape routes be achieved during the extreme flood event whilst accounting for climate change?
   - Safe access and escape routes should be explicitly identified as part of an agreed emergency plan tailored specifically to the site.
3. Definition of flood hazard
   - What are the sources of flooding at the site?
   - For each source how would flooding occur? Referencing any historical records
   - What existing surface water drainage infrastructure is present on the site? Consultation required with LPA, LLFA, EA and water companies.
4. Probability
   - Confirm the flood zone designation for the site (refer to the Flood Map for Planning: Flood Map for planning)
   - Determine the actual and residual risks at the site
   - What are the discharge rates and volumes generated by the existing site and proposed development? How should these be attenuated and to what rates?
5. Climate change
   - How is flood risk at the site likely to be affected by climate change? Check appropriate allowances (see Section 4.8).[36]
6. Flood Risk Management measures

32 Flood risk assessments if you're applying for planning permission, GOV.UK, 2017
33 Flood risk assessment in flood zones 2 and 3, GOV.UK, 2017
34 Flood risk assessment in flood zone 1 and critical drainage areas, GOV.UK, 2017
35 Preparing a flood risk assessment: standing advice, GOV.UK, February 2022
36 Flood risk assessments: climate change allowances, GOV.UK, May 2022

- How will the site be protected from flooding, including from the potential impacts of climate change, over the lifetime of the development?

7. Residual risks
   - What are the consequences to the site of flood defence failure? Breach / overtopping scenarios should be modelled.
   - What are the consequences to the site of asset blockage? Culvert, bridge blockage scenarios should be modelled.
   - Is there residual risk from reservoirs? If so, how can this be mitigated and does the emergency plan for the site address such risk? Reference the EA's Reservoir Flood Map[17].
   - Is there residual from canals? If so, how can this be mitigated and does the emergency plan for the site address such risk? Consultation required with the EA, LLFA and Canal & River Trust, or private owner. Breach / overtopping scenarios should be modelled if applicable.
   - What flood-related risks will remain after mitigation measures have been implemented?
   - How, and by whom, will these risks be managed over the lifetime of the development?
8. Offsite impacts
   - How will the proposed development design make sure there are no impacts to other development downstream or nearby now and in the future?
   - What measures will be implemented to control surface water runoff? SuDS? What arrangements are in place for SuDS ownership, maintenance?
9. Groundwater
   - This mechanism of flooding should be considered particularly when determining the acceptability of SuDS schemes as a way of managing surface water drainage. Developers should consult with the LPA, LLFA and EA at an early stage of the assessment to establish any requirements for ground investigation.
10. Sewer systems
    - Where the SFRA has identified a risk of surface water flooding, any water that escapes from the sewer system would tend to follow similar flow paths and pond in similar locations.
    - Where required, liaison with the relevant water company should be undertaken at an early stage in the assessment process to confirm localised sewer flooding problems that could affect the site.
    - Future development should be designed so that it does not exacerbate existing sewer capacity problems. Developers should check with the LPA whether a Water Cycle Study has been developed.

5.7 Surface water management and Sustainable Drainage Systems

Development has the potential to cause an increase in impermeable area, an associated increase in surface water runoff rates and volumes, and consequently a potential increase in downstream flood risk due to overloading of sewers, watercourses, culverts, and other drainage infrastructure. Managing surface water discharges from new development is therefore crucial in managing and reducing flood risk to new and existing development downstream and nearby. Carefully planned development can also play a role in reducing the number of properties that are directly at risk from surface water flooding.

The planning system has a key role to play in setting standards for sustainable drainage from new developments and ensuring that developments are designed to take account of the risk from surface water flooding. Sustainable drainage plays an important part in reducing flows in the sewer network and in meeting environmental targets, alongside investment in maintenance by the water companies on their assets. Water companies plan their investment on a five-year rolling cycle, in consultation with key partners, including the EA and local authorities.

The Department for Levelling Up, Housing and Communities (DLUHC) (formally the Department for Communities and Local Government (DCLG)) announced, in December 2014, that the local planning authority, in consultation with the LLFA, should be responsible for delivering SuDS[37] through the planning system. Changes to planning legislation gave provisions for major applications of ten or more residential units or equivalent commercial development to require sustainable drainage within the development proposals in accordance with the 'non-statutory technical standards for sustainable drainage systems[38], published in March 2015. A Practice Guidance[39] document has also been developed by the Local Authority SuDS Officer Organisation (LASOO) to assist in the application of the non-statutory technical standards.

Developers should be aware of Schedule 3 of the Flood and Management Act (see Appendix A). The Act, which incorporates recommendations from the 2008 review includes the implementation of new SuDS standards and the removal of the automatic rights for developers to connect to public sewers. Schedule 3, when enacted, will provide a framework for the approval and adoption of drainage systems, a SuDS Approval Body (SAB), and national statutory standards on the design, construction, operation, and maintenance of SuDS.

The Design and Construction Guidance (DCG) for sewers became the regulated sewerage guidance on 1 April 2020. This allows water and sewerage companies to adopt SuDS components that meet the criteria of the DCG. Details on the sewerage sector guidance can be found online.[40]

37 Sustainable drainage systems, UK Parliament, 2014
38 Sustainable drainage systems: non-statutory technical standards, Defra, 2015
39 Non-Statutory Technical Standards for sustainable drainage, LASOO, 2016
40 Sewerage Sector Guidance, Water UK

5.7.1 LCC Sustainable Drainage

To manage flood risk, all development, regardless of development type, flood zone and development size, must give priority use to SuDS. Particularly for major developments, there is a requirement to assess and include SuDS for managing surface water at the development unless it is demonstrated during the assessment that it is inappropriate for the site, i.e., due to high groundwater levels not allowing for infiltration SuDS.

At the time of writing, LCC does not adopt any specific SuDS schemes. However, LCC states that all SuDS constructions should be undertaken in line with the CIRIA SuDS Manual[45] and the DEFRA Technical Standards for SuDS to meet the adoption criteria for United Utilities. The Lancashire SuDS Pro-forma should be submitted alongside any planning application, which summarises the details within the site-specific flood risk assessment (Section 5.6) and sustainable drainage strategy.

5.7.2 SuDS and the NPPF

The NPPF, para 182, states:

"*Sustainable drainage systems provided as part of proposals for major development should:*

a. Take account of advice from the lead local flood authority;

b. Have appropriate proposed minimum operational standards; and

c. Have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development".

All developments, both major and minor, are to include SuDS, providing multiple benefits that contribute to many other NPPF policies, including climate change, biodiversity net gain, amenity, and water quality improvements. Where site conditions may be more challenging, the SuDS components used will need to accommodate the site's opportunities and constraints. At a strategic level, this should mean identifying opportunities for a variety of SuDS components according to geology, soil type, topography, groundwater/mine water conditions, their potential impact on site allocation, and setting out local SuDS guidance and opportunities for in perpetuity adoption and maintenance.

Maintenance options must clearly identify who will be responsible for maintaining SuDS and funding for maintenance should be fair for householders and premises occupiers and set out a minimum standard to which the SuDS must be maintained.

Sustainable drainage should form part of an integrated design methodology secured by detailed planning conditions to make sure that the SuDS to be constructed is maintained to a minimum level of effectiveness.

5.7.3 SuDS hierarchy

The runoff destination should always be the first consideration when considering design criteria for SuDS including the following possible destinations in order of preference:

1. To ground;

2. To surface waterbody;
3. To surface water sewer; or
4. To combined sewer.

Effects on water quality should be investigated when considering runoff destination in terms of the potential hazards arising from development and the sensitivity of the runoff destination.

The EA may also look at the potential impact of an outfall structure through the planning consultation and Environmental Permitting Regulation[41] process. It should be noted that detailing modelling will not be available for all outfalls therefore developers should carry out their own investigations whilst referring to the non-statutory technical standards for sustainable drainage systems (March 2015)[42].

The non-statutory technical standards for sustainable drainage systems sets out appropriate design criteria based on the following:

1. Flood risk outside the development;
2. Peak flow control;
3. Volume control;
4. Flood risk within the development;
5. Structural integrity;
6. Designing for maintenance considerations; and
7. Construction.

Many different SuDS techniques can be implemented. As a result, there is no one standard correct drainage solution for a site. In most cases, using the Management Train principle (see Figure 5-5), will be required, where source control is the primary aim. Source control includes interception of the first 5mm of rainfall and water quality treatment should be as near to source as possible.

In February 2021, Defra published its research project to review and provide recommendations to update the current non-statutory technical standards for sustainable drainage systems[43]. Based on the research findings, recommendations have been made to replace the current standards with a new suite of standards to cover the following:

1. Runoff destinations
2. Everyday rainfall
3. Extreme rainfall
4. Water quality
5. Amenity
6. Biodiversity

41 Environmental permits: detailed information | Environment Agency
42 Sustainable drainage systems: non-statutory technical standards, GOV.UK, 2015
43 Defra (2021) Recommendations to Update Non-Statutory Technical Standards for Sustainable Drainage Systems (SuDS) - WT15122

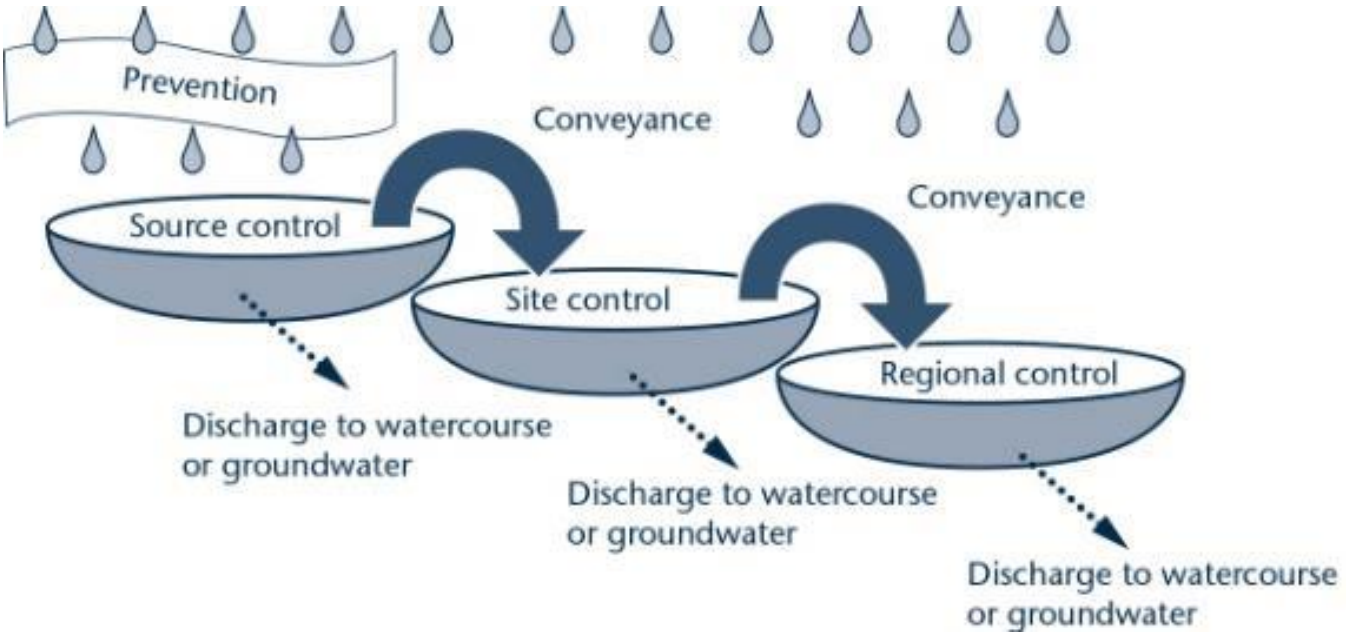


Figure 5-5 SuDS management train principle[44]

The effectiveness of a flow management scheme within a single site is heavily limited by land use and site characteristics including (but not limited to) topography, geology, and soil (permeability) and available area. Potential ground contamination associated with urban and former industrial sites should be investigated with concern being placed on the depth of the local water table and potential contamination risks that will affect water quality. The design, construction and ongoing maintenance regime of any SuDS scheme must be carefully defined as part of a site-specific FRA. A clear and comprehensive understanding of the catchment hydrological processes (i.e., nature and capacity of the existing drainage system) is essential for successful SuDS implementation.

In addition to the national standards, the LLFA and / or LPA may set local requirements for planning permission that include more rigorous obligations than the non-statutory technical standards. More stringent requirements should be considered where current greenfield sites lie upstream of high-risk areas. This could include improvements on greenfield runoff rates. The LLFA and LPA should always be contacted with regards to any local requirements at the earliest opportunity in development planning.

The CIRIA SuDS Manual[45] 2015 should also be consulted by developers. The SuDS manual (C753) is highly regarded and incorporates the latest research, industry practice, technical advice, and adaptable processes to assist in the planning, design, construction, management, and maintenance of good SuDS. The SuDS Manual complements the non-statutory technical standards and goes further to support the cost-effective delivery of multiple benefits.

44 CIRIA (2008) Sustainable Drainage Systems: promoting good practice – a CIRIA initiative
45 CIRIA (2008), CIRIA SuDS Manual

5.7.4 Overland flow paths

Underground drainage systems have a finite capacity and regard should always be given to larger events when the capacity of the network will be exceeded. Hence there is a need to design new developments with exceedance in mind. This should be considered alongside any surface water flows likely to enter a development site from the surrounding area.

Masterplanning should make sure that existing overland flow paths are retained within the development. As a minimum, the developer should investigate, as part of a site-specific FRA, the likely extents, depths, and associated hazards of surface water flooding on a development site. This is considered to be an appropriate approach to reduce the risk of flooding to new developments. Green/blue infrastructure should be used wherever possible to accommodate such flow paths. EA standing advice states that floor levels should always be set a minimum of 300 mm above ground level (or 300 mm freeboard above the design flood level) to reduce the consequences of any localised flooding unless local guidance states otherwise.

5.8 Mitigation measures

Whilst the sequential approach to development and flood risk should always be followed, there are certain instances where development must occur in areas of flood risk. This section details the generic mitigation measures that are available for new development and for existing developments at flood risk.

5.8.1 Site layout and design

Flood risk should be considered at the first stage in planning the layout and design of a site to provide an opportunity to reduce flood risk within the development.

The NPPF states that a sequential, risk-based approach should be applied to try to locate more vulnerable land use away from areas of flood risk for example to higher ground, while more less vulnerable development (e.g., vehicular parking, recreational space) can be in higher risk areas that may be on lower ground. Whether parking in floodplains is appropriate will be based on the likely flood depths and hazard, evacuation procedures and availability of flood warning.

Waterside areas, or areas along known flow routes, can be designed and maintained as blue / green infrastructure, being used for recreation, amenity, and environmental purposes, allowing the preservation of flow routes and flood storage, and at the same time providing valuable social and environmental benefits contributing to other sustainability objectives. Landscaping should ensure safe access to higher ground from these areas and avoid the creation of isolated islands as water levels rise during a flood event.

5.8.2 Sustainable Drainage Systems

SuDS provide a means of dealing with the quantity and quality of surface water and can also provide amenity and biodiversity benefits. Given the flexible nature of SuDS they can be used in most situations within new developments as well as being retrofitted into existing

developments. SuDS can also be designed to fit into most spaces. For example, permeable paving could be used in parking spaces or rainwater gardens as part of traffic calming measures.

The developer is responsible for ensuring the design, construction and future/ongoing maintenance of any SuDS scheme is carefully and clearly defined, and a clear and comprehensive understanding of the existing catchment hydrological processes and current drainage arrangements is essential.

5.8.3 Modification of ground levels

Any proposal for modification of ground levels will need to be assessed as part of a detailed FRA.

Modifying ground levels to raise land above the required flood level is an effective way of reducing flood risk to a particular site in circumstances where the land does not act as conveyance for floodwaters. However, care must be taken as raising land above the floodplain could reduce conveyance or flood storage in the floodplain and could adversely impact flood risk downstream or on neighbouring land. Raising ground levels can also deflect flood flows, so analyses through modelling should be performed to demonstrate that there are no adverse effects on third party land or property.

Compensatory flood storage should be provided and would normally be on a level-for-level, volume-for-volume basis on land that does not currently flood but is adjacent to the floodplain (for it to fill and drain). It should be in the vicinity of the site and within the red line of the planning application boundary (unless the site is strategically allocated). Guidance on how to address floodplain compensation is provided in Appendix A3 of the CIRIA Publication C624[46].

Where proposed development results in a change in building footprint, the developer should make sure that it does not impact upon the ability of the floodplain to store or convey water and seek opportunities to provide floodplain betterment.

Raising levels can also create areas where surface water might pond during significant rainfall events. Any proposals to raise ground levels should be tested through appropriate modelling to make sure that it would not cause increased ponding or build-up of surface runoff on third party land.

5.8.4 Raised floor levels

If raised floor levels are proposed, these should be agreed with the LPA and the EA. The minimum Finished Floor Level (FFL) may change dependent upon the vulnerability and flood risk to the development.

In high flood risk areas, FFLs should be set to a minimum of whichever is higher of 600mm above the average ground level of the site, the adjacent road level to the building or the

46 CIRIA January 2004, CIRIA Report 624: Development and Flood Risk - Guidance for the Construction Industry

100-year plus climate change peak flood level, where the latest climate change allowances have been used (see Section 4.8.1 for the climate change allowances). An additional allowance may be required due to residual risks relating to blockages to the channel, culvert or bridge structures and should be considered as part of an FRA. Any proposals for lower FFLs would need to be based on site-specific evidence presented in a FRA.

Allocating the ground floor of a building for less vulnerable, non-residential use is an effective way of raising living space above flood levels. Single storey buildings such as ground floor flats or bungalows are especially vulnerable to the rapid rise of floodwater (such as that experienced during a breach). This risk can be reduced by use of multiple storey construction and raised areas that provide an escape route from the development to safe areas.

Similarly, the use of basements should be avoided. Habitable uses of basements within Flood Zone 3 and areas at high or medium risk of surface water flooding should not be permitted, whilst basement dwellings in Flood Zone 2 will be required to pass the exception test. Access should be situated 300mm above the design flood level and waterproof construction techniques used.

5.8.5 Property flood resilience

Para 181 of the NPPF explains that development must only be allowed in areas at flood risk where, following the sequential and exception tests and supported by an FRA, the development is appropriately flood resistant and resilient.

Flood resilience and resistance measures are mainly designed to mitigate flood risk and reduce damage and adverse consequences to existing property. Such measures may aim to help residents and businesses recover more quickly following a flood event.

The 'Code of practice for property flood resilience', published by CIRIA in 2021[47], defines active PFR measures as *"…measures which are not permanently installed into the property and will require deployment before a flood event (e.g. a door guard)*'. Passive PFR measures are defined as '…*measures which are installed into the property and do not require further deployment or activation before a flood event (e.g. a flood door or automatic airbrick cover)*".

Research[48] carried out by the then DCLG (now DLUHC) and the EA recommended that the use of PFR measures should generally be limited to a nominal protection height of 600 mm above ground level, the lowest point of ground abutting the external property walls. This is because the structural integrity of the property may be compromised above this level. The EA recommends that advice from a structural engineer should be sought for any measures to resist a depth of 600 mm or more.

47 CIRIA (2021) Code of practice for property flood resilience (C790F)
48 DCLG & EA (2007) Improving the Flood Performance of New Buildings - Flood Resilient Construction

It should be noted that it is not possible to completely prevent flooding to all communities and businesses. Also, PFR measures would not be expected to cause an increase in flood risk to other properties or other parts of the local community. They will help mitigate against flood risk but, as with any flood alleviation scheme, flood risk cannot be removed completely. Emergency plans should, therefore, be in place that describe the installation of measures and residual risks.

As the flood risk posed to a property cannot be removed completely, it is recommended that PFR products are deployed in conjunction with pumps of a sufficient capacity. Pumps help manage residual flood risks not addressed by PFR measures alone such as rising groundwater.

5.8.5.1 Definitions

Flood resilience measures aim to reduce the damage caused by floodwater entering a property. Flood resilience measures are based on an understanding that internal flooding may occur again and when considering this eventuality, homes and businesses are encouraged to plan for flooding with an aim of rapid recovery and the return of the property to a habitable state.

For example, tiled floors are easier to clean than carpets, raised electricity sockets and high-level wall fixings for TVs/computers may mean that that power supply remains unaffected. Raising kitchen or storage units may also prevent damage that may not require replacement after a flood. There is a lot of information available about what items get damaged by floodwater and features that are considered to provide effective resilience measures that can be installed at a property.

Flood resistance measures aim to reduce the amount of floodwater entering the property. Obvious inflow routes, such as through doors and airbricks may be managed, for example, by installing bespoke flood doors, door flood barriers and automatic closing airbricks. However, the property's condition and construction are also key to understanding how floodwater may enter and move between buildings. For example, floodwater can also flow between properties through connecting cavity walls, cellars, beneath suspended floors and through internal walls. Flood resistance measure alone may not keep floodwater out. Building condition is a critical component of any flood mitigation study.

5.8.5.2 Property mitigation surveys

To define the scale and type of resistance or resilience measures required, a survey will need to be undertaken to pick up property threshold levels, air brick levels, doorways, historic flood levels and several ground spot levels required to better understand the flood mechanisms for floodwater arriving at the property (e.g., along roads and pavements). The depth of flooding recorded at a property will help guide the selection of the most appropriate PFR measures. Surveys will need to include:

- Detailed property information i.e., structure, presence of air bricks, cellars, outlet pipes, floor levels, door and window levels, manhole and grid locations;

- An assessment of flood risk, including property (cross) threshold levels;
- Routes of water ingress (fluvial, ground and surface water flooding);
- An assessment of the impact of floodwaters;
- A schedule of recommended measures to help to reduce risk;
- Details of recommendations (including indicative costs);
- Advice on future maintenance of measures; and
- Advice on flood preparedness and emergency planning.

All sources of flooding will need to be considered, including a comprehensive survey of openings (doors, windows, and air bricks), as well as potential seepage routes through walls and floors, ingress through service cables, pipes, drains and identification of possible weaknesses in any deteriorating brickwork or mortar.

5.9 Emergency planning

The provisions for emergency planning for local authorities as Category 1 responders are set out by the Civil Contingencies Act, 2004[49] and the National Flood Emergency Framework for England, December 2014[50]. This framework is a resource for all involved in emergency planning and response to flooding from rivers, surface water, groundwater, and reservoirs. The framework sets out Government's strategic approach to:

- Ensuring all delivery bodies understand their respective roles and responsibilities when planning for and responding to flood related emergencies;
- Giving all those involved in an emergency flooding situation a common point of reference, which includes key information, guidance and key policies;
- Establishing clear thresholds for emergency response arrangements;
- Placing proper emphasis on the multi-agency approach to managing flooding events;
- Providing clarity on the means of improving resilience and minimising the impact of flood events;
- Providing a basis for individual responders to develop and review their own plans; and
- Being a long-term asset that will provide the basis for continuous improvement in flood emergency management.

Along with the EA flood warning systems, there are a range of flood plans at a local level, outlining the major risks from flooding and the strategic and tactical response framework for key responders. The EA and the Association of Directors of Environment, Economy, Planning and Transport (ADEPT) have produced guidance on flood risk emergency plans for new development (September 2019)[51]. It would however be for the LPA to review and

49 Civil Contingencies Act, GOV.UK, 2004
50 The national flood emergency framework for England, GOV.UK, 2014
51 Flood Risk Emergency Plans for New Development, ADEPT/EA, September 2019

approve flood risk emergency plans with their emergency planners or through the Local Resilience Forum (see Section 5.9.1.1).

This SFRA contains useful data to allow emergency planning processes to be tailored to the needs of the area and be specific to the flood risks faced. The interactive GeoPDF maps in Appendix B and accompanying GIS layers should be made available to emergency planners to help prepare for any flood event and throughout the planning process.

5.9.1 Civil Contingencies Act

Under the Civil Contingencies Act (CCA, 2004)[52], LCC as the LLFA and the Central Lancashire Authorities are classified as Category 1 responders and thus have duties to assess the risk of emergencies occurring, and use this to:

- Inform contingency planning;
- Put in place emergency plans;
- Put in place business continuity management arrangements;
- Put in place arrangements to make information available to the public about civil protection matters;
- Maintain arrangements to warn, inform and advise the public in the event of an emergency;
- Share information with other local responders to enhance coordination; and
- Cooperate with other local responders to enhance coordination and efficiency and to provide advice and assistance to businesses and voluntary organisations about business continuity management.

During an emergency, such as a flood event, the local authorities must co-operate with other Category 1 responders (such as the emergency services and the EA) to provide the core response.

5.9.1.1 Lancashire Resilience Forum (LRF)[53]

The aim of the LRF is to legally deliver the duties stated in the Civil Contingencies Act 2004 within a multi-agency environment. The LRF is a group of multi-agency organisations that work together to prepare and respond to emergencies in Lancashire. The LRF involves local authorities, emergency services, health agencies, EA and local businesses.

The LRF's common objectives are to:

- Prevent the situation from getting worse;
- Save lives;
- Relieve suffering;
- Protect property;
- Recover to normality as soon as possible;

52 The Civil Contingencies Act, GOV.UK, 2013
53 Lancashire Resilience Forum

- Facilitate criminal investigation and judicial process as necessary.

The LRF's main roles include:

- Assessing the impacts of the risk and providing this information to the public in a Community Risk Register;
- Creating emergency plans
- Responding together in a coordinated way
- Training and testing for preparedness
- Learning the lessons from incidents and exercises.

5.9.1.2 Community Risk Register

The LRF produces the Community Risk Register (CRR)[54] which lists the possible risks the probability of an emergency event occurring and the potential impact. The CRR provides information on the biggest emergencies that may happen in Lancashire, together with an assessment of how likely they are to happen and the potential impacts to people, houses, the environment and local businesses. Each identified risk is then analysed and given a rating according to how likely the risk is to lead to an emergency and their potential impact on safety and security, health, economy, environment and society.

5.9.1.3 Community Emergency Plan

Communities may need to rely on their own resources to minimise the impact of an emergency, including a flood, before the emergency services arrive. Many communities already help each other in times of need, but experience shows that those who are prepared cope better during an emergency. Communities with local knowledge, enthusiasm and information are a great asset and a Community Emergency Plan can help. Details on how to produce a community emergency plan, including a toolkit and template, are available from the Government's website[55]. LCC have produced guidance and emergency plans on how to prepare and respond to emergencies, these are available online via: Emergency plans - Lancashire County Council.

5.9.1.4 Local Flood Plans

This SFRA provides several flood risk data sources that should be used when producing or updating flood plans. The CLA will be unable to write their own specific flood plans for new developments at flood risk. Developers should write their own. Generally, owners with individual properties at risk should write their own individual flood plans, however larger developments or regeneration areas, such as retail parks, hotels and leisure complexes, should consider writing one collective plan for the assets within an area.

This SFRA can help to:

54 Lancashire Community Risk Register
55 Resilience in society: infrastructure, communities and business, GOV.UK, December 2014

- Update these flood plans if appropriate;
- Inform emergency planners in understanding the possibility, likelihood and spatial distribution of all sources of flooding;
- Identify safe evacuation routes and access routes for emergency services;
- Identify key strategic locations to be protected in flooding emergencies, and the locations of refuge areas that are capable of remaining operational during flood events;
- Provide information on risks in relation to key infrastructure, and any risk management activities, plans or business continuity arrangements;
- Raise awareness and engage local communities;
- Support emergency responders in planning for and delivering a proportionate, scalable and flexible response to the level of risk; and
- Provide flood risk evidence for further studies.

The guidance written by the EA and ADEPT[56] is aimed at LPAs to help assist in setting up their own guidelines on what should be included in flood risk emergency plans.

As the LLFA, LCC have produced a Local Flood Risk Management Strategy (LFRMS) which explains how local flood risk is managed in Lancashire. The current strategy covers the period between 2021 and 2027 and is available online[15].

5.10 Flood warning and evacuation plans

Developments that include areas that are designed to flood (e.g., amenity greenspace areas) or have a residual risk associated with them (e.g., located behind a flood defence), will need to contain appropriate flood warning and instructions so users and residents are safe in the event of a flood. This will include both physical warning signs and written flood warning and evacuation plans. Those using any new development should be made aware of any evacuation plans.

In relation to a new development, it is up to the LPA to determine whether the flood warning and evacuation plans, or equivalent procedures, are sufficient or not. If the LPA is not satisfied, considering all relevant considerations, that a development can be considered safe without the provision of safe access and escape routes, then planning permission should be refused.

Whilst there is no statutory requirement on the EA or the emergency services to approve evacuation plans, LPAs are accountable under their Civil Contingencies duties, via planning condition or agreement, to make sure that plans are suitable. This should be done in consultation with development management officers and emergency planners. Given the cross-cutting nature of flooding, it is recommended that further discussions are held internally to the LPA between emergency planners and policy planners/development

56 Flood Risk Emergency Plans for New Development, ADEPT/Environment Agency, September 2019

management officers, the LLFA, drainage engineers and to external stakeholders such as the emergency services, the EA, UU and Canal & River Trust.

It may be useful for both the LLFA and spatial planners to consider whether, as a condition of planning approval, flood evacuation plans should be provided by the developer that aim to safely evacuate people out of flood risk areas, using as few emergency service resources as possible. It may also be useful to consider how key parts of agreed flood evacuation plans could be incorporated within local development documents, including in terms of protecting evacuation routes and assembly areas from inappropriate development.

Once the development receives planning permission, it will be the requirement of the plan owner (developer) to make sure the plan is put in place, and to liaise with the LPA and LLFA regarding maintenance and updating of the plan.

At the time of writing, there are 23 EA Flood Warning Areas within Central Lancashire, which are located primarily along main rivers including the Ribble Estuary at the City of Preston, Hutton, Longton and Lower Penwortham; River Ribble at Walton-le-Dale and Samlesbury; River Lostock at Leyland; Black Brook at Chorley; River Darwen at Higher Walton; River Yarrow at Croston; Savick Brook at Fulwood and Cadley; and Syd Brook at Eccleston. Central Lancashire's emergency plans are created by the Lancashire Resilience Forum.

5.10.1 What should a flood warning and evacuation plan include?

Flood warning and evacuation plans should include the information stated in Table 5-1. Advice and guidance on plans are accessible from the EA website and plan templates are available for businesses and local communities.

Table 5-1: Flood warning and evacuation plans

Consideration	Purpose
Availability of existing flood warning system	The EA offers a flood warning service that covers designated Flood Warning Areas in England. In these areas, they can provide a full flood warning service.
Rate of onset of flooding	The rate of onset is how quickly the water arrives and the speed at which it rises, which, in turn, will govern the opportunity for people to effectively prepare for and respond to a flood. This is an important factor within Emergency Planning in assessing the response time available to the emergency services.
How flood warning is given and the occupant's awareness of the likely frequency and duration of flood events	Everyone eligible to receive flood warning should be signed up to the EA flood warning service. Where applicable, the display of flood warning signs should be considered. Particularly sites that will be visited by members of the public daily, such as sports complexes, car parks, retail stores. It is envisaged that the

Consideration	Purpose
	responsibility should fall upon the developers and should be a condition of the planning permission. Information should be provided to new occupants of houses concerning the level of risk and subsequent procedures if a flood occurs.
The availability of site staff, occupants, or users to respond to a flood warning and the time taken to respond to a flood warning	The plan should identify roles and responsibilities of all responders. The use of community flood wardens should also be considered.
Designing and locating safe access routes, preparing evacuation routes and the identification of safe locations for evacuees	Dry routes will be critical for people to evacuate as well as emergency services entering the site. The source, extent, depth, and flood hazard rating, including allowance for climate change, should be considered when identifying these routes.
Vulnerability of occupants	Vulnerability classifications associated with development as outlined in the FRCC-PPG. This is closely linked to its occupiers i.e., elderly, less able, children are more vulnerable.
How easily damaged items will be relocated, and the expected time taken to re-establish normal use following an event	The impact of flooding can be long lasting well after the event has taken place affecting both the property which has been flooded and the lives that have been disrupted. The resilience of the community to get back to normal will be important including time taken to repair/replace damages.
Mental health	Exposure to a flood event i.e., having your home flooded can have severe effects on the mental health of those affected. There should be guidance on how to get help with mental issues.

5.10.2 EA Flood Warning Areas (FWA) and flood awareness

The EA monitors river levels within the main rivers affecting the CLA area and based upon weather predictions provided by The Met Office, assesses the anticipated maximum water level that is likely to be reached within the proceeding hours (and/or days). Where these predicted water levels are expected to result in inundation of a populated area, the EA will issue a series of flood warnings within defined FWAs, encouraging residents to take action to avoid damage to property in the first instance.

More information on flood warnings is provided by the EA[57]. Live information on flood warning and flood alerts is available[58].

Emergency planners may also use the outputs from this SFRA to raise awareness within local communities. This should include raising awareness of flood risk, roles, responsibilities and measures that people can take to make their homes more resilient to flooding from all sources whilst also encouraging all those at fluvial and /or tidal flood risk to sign up to the EA's Flood Warning Service.[59]

It is also recommended that Category 1 responders are provided with appropriate flood response training to help prepare them for the possibility of a major flood with an increased number of people living within flood risk areas, to make sure that adequate pre-planning response and recovery arrangements are in place.

57 Flood alerts and warnings: what they are and what they do, Environment Agency, November 2010

58 Flood warning and alert service, Met Office and Environment Agency

59 Flood warning service sign up, GOV.UK

6 Summary and recommendations

6.1 Summary

This Level 1 SFRA provides a single repository planning tool relating to flood risk and development in Central Lancashire. Key flood risk stakeholders namely the EA, LLFA and UU were consulted to collate all available and relevant flood risk information on all sources into one comprehensive high-level assessment. Together with this report, this SFRA also provides a suite of interactive GeoPDF maps (Appendix B) illustrating the level of risk to the district. Appendices C and E present a flood risk screening assessment of all potential local plan site allocations to enable the CLA to perform the sequential test.

Whilst the aim of the sequential approach is the avoidance of development in areas of high and / or medium flood risk areas, where the constituent authorities are looking for continued growth and/or regeneration, this may not always be possible. This SFRA therefore provides the necessary links between spatial development, wider flood risk management policies, local strategies, and plans and on the ground works by combining all available flood risk information together into one single repository. However, as this is a strategic study, detailed local information on flood risk is not fully accounted for.

The data and information used throughout the SFRA process is the most up-to-date data available at the time of writing. Once new, updated, or further information becomes available, the CLA should look to update this SFRA. The Level 1 SFRA should be maintained as a 'live' entity that is updated as and when required (when new modelling or flood risk information becomes available or national changes in policy). The LPA can decide to update the SFRA and the EA and LLFA as statutory consultees on local plans can also advise on when an update is required to inform the local plan evidence base.

Gaps in the data received to inform this SFRA are noted within Section 6.2. Recommendations for further work are provided in Section 6.3.

6.2 Data gaps

Gaps in data and information have become apparent throughout the preparation of this SFRA. It may be the case that this information does not exist or has not been made available for the SFRA for unknown reasons. Such gaps in information includes:

- Lancashire County Council's up to date historic flood records in GIS format
- United Utilities up to date historic flood records in GIS format
- EA fluvial and tidal hydraulic modelling for the following locations:
  - Savick Brook - modelling files and results unavailable
  - Upper Lostock/Lower Lostock - superseded by Lostock 2020 model
  - Chapel Brook - model not appropriate
  - Churchtown - model not available
  - Upper Middle Wyre Asset Review - model not available

- Moorbrook Culvert SFRM - third party model therefore EA cannot provide model or results.

6.3 Recommendations for further work

The SFRA process has developed into more than just a planning tool. Sitting alongside the Sustainability Appraisal and Local Flood Risk Management Strategy, it can be used to provide a much broader and inclusive vehicle for integrated, strategic and local flood risk management and delivery.

There are several studies listed in Table 6-1 that may be of benefit to the LPA, in developing their flood risk evidence base to support the delivery of the Local Plan, or to the LLFA to help fill critical gaps in flood risk information that have become apparent through the preparation of this Level 1 SFRA.

Table 6-1: Plans and assessments beneficial to developing the flood risk evidence base

Type	Study	Reason	Timeframe
Understanding of local flood risk	Level 1 SFRA update	When there are changes to: the predicted impacts of climate change on flood risk; detailed flood modelling - such as from the EA or LLFA; the local plan, spatial development strategy or relevant local development documents; local flood management schemes; flood risk management plans; local flood risk management strategies; and national planning policy or guidance. Or after a significant flood event.	As required

Type	Study	Reason	Timeframe
	Level 1 SFRA update; Level 2 SFRA; site-specific FRA	Potential development sites should be assessed against all flood risk information for inclusion in the Level 1 SFRA. Reviewing of EA flood zones in those areas not covered by existing detailed hydraulic models i.e., the Flood Map for Planning does not cover every watercourse such as those <3km^2 in catchment area or ordinary watercourses. If a watercourse or drain is present on OS mapping but is not covered by the Flood Map for Planning, this does not mean there is no potential flood risk. A model may therefore be required to ascertain the flood risk, if any, to any nearby sites.	Short term
	Level 2 SFRA	Further, more detailed assessment of flood risk to high and medium risk sites as notified by this Level 1 SFRA.	Short term
	Preliminary site-screening FRAs/ outline drainage strategy	Further, more detailed assessment of larger strategic sites, if the LPA feels this is prudent.	Short term
	SWMP/ detailed surface water modelling	At the time of writing there are no Surface Water Management Plans which cover Preston, Chorley or South Ribble. The LLFA may wish to produce SWMPs covering these areas based on the most up to date surface water flood risk information and climate change allowances.	Short term

Type	Study	Reason	Timeframe
	Climate change assessment for Level 1 update / part of Level 2 SFRA	Modelling of climate change, using EA's allowances where these are updated, for the watercourses mentioned in Section 6.2.	Ongoing
Flood storage and attenuation	Working with Natural Processes	Further assess WwNP options in upper catchments to gauge possible areas for Natural Flood Management. Promote creation of floodplain and riparian woodland, floodplain reconnection and runoff attenuation features where the research indicates that it would be beneficial within the district.	Short term
Water resources	Water Cycle Study	To ensure sufficient provision of infrastructure for water supply and wastewater for new development.	Short term
Data collection	Flood Incident data	LCC should continue to record flood events including such information as date, location, weather, flood source (if apparent without an investigation), impacts (properties flooded or number of people affected) and response by any Risk Management Authority. This should be made available in GIS format.	Ongoing
	FRM Asset Register	The LLFA should continue to update and maintain its asset register as per FWMA requirements.	Ongoing
Risk assessment	Asset inspection	The LLFA may arrange with the EA to carry out inspections of critical assets (see Section 4.10.2) and those defences with condition grades of 4 (see Section 4.10.1).	Short term

Type	Study	Reason	Timeframe
Capacity	SuDS review / guidance	The LLFA should clearly identify its requirements of developers for inclusion of SuDS in new developments in line with the forthcoming enactment of Schedule 3 of the FWMA. Internal capacity, within CLA and / or the LLFA, should be in place to deal with SuDS applications, set local specification and set policy for adoption and future maintenance of SuDS.	Short term
Partnership	United Utilities	The LPA and LLFA should continue to collaborate with UU on sewer and surface water projects to ensure their assets can remain operational and resilient at all times across the catchment and that capacity for new development is appropriate.	Ongoing
	EA	CLA should continue to work with the EA on fluvial flood risk management projects. Potential opportunities for joint schemes to tackle flooding from all sources should be identified.	Ongoing
	Community	Continued involvement with the community through existing flood risk partnerships.	Ongoing

A Appendix A - The Planning Framework and Flood Risk Policy

This section contains information relating to the planning framework and provides a background to the flood risk policy documents that are relevant to the Central Lancashire authorities.

B Appendix B - Interactive GeoPDF maps and GIS data

The SFRA Maps consist of all flood risk information used within the SFRA, by way of interactive GeoPDF maps. Open the Overview Map in Adobe Acrobat. The Overview Map includes an overview of the authority area boundaries; clicking on a boundary will open up an Index Map covering that authority area. The Index Map includes a set of grid squares; clicking on one of these squares will open up one of the Detailed Maps of the area.

Within the detailed maps, use the zoom tools and the hand tool to zoom in/out and pan around the open detailed map. In the legend on the right-hand side of the detailed maps, layers can be switched on and off when required by way of a dropdown arrow.

A zipped folder containing the relevant GIS datasets has also been provided as part of Appendix B allowing the CLA to replicate the GeoPDF mapping using their own software, or upload the data to an online mapping portal if desired.

C Appendix C - Development site assessment spreadsheet

Excel spreadsheet containing an assessment of flood risk to the potential development sites based on Flood Zones 2, 3a and 3b, as delineated through this SFRA and accounting for climate change, and the Risk of Flooding from Surface Water (RoFSW), also accounting for climate change. Each site is assigned a strategic recommendation based on risk and developability.

D Appendix D - Functional floodplain delineation

Technical note explaining the methodology behind the delineation of the functional floodplain (Flood Zone 3b) for this SFRA.

E Appendix E - Strategic Recommendations of the proposed sites

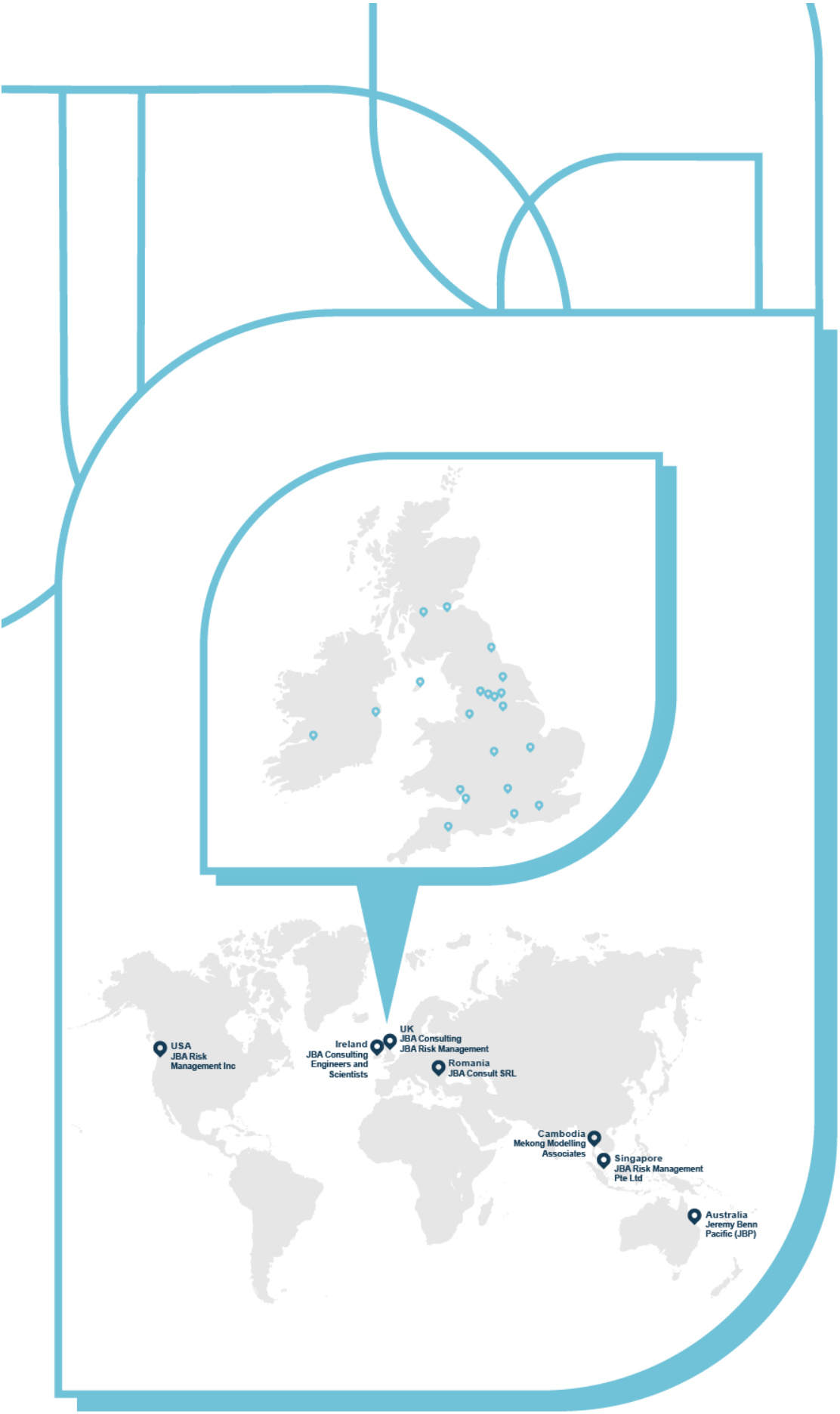
Summarises the outcomes of the Sites Assessment process recorded in Appendix C.

F Appendix F - Climate Change Modelling Note

Inventory and technical modelling note of EA fluvial and tidal hydraulic models that have been updated with the latest climate change allowances in the SFRA.

G Appendix G - Catchment-level assessment of Cumulative Impacts of Development on Flood Risk

Outlines the methodology and results of the detailed cumulative impact assessment.



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