

River Douglas Catchment Flood Management Plan

Summary Report December 2009



managing
flood risk

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Introduction



I am pleased to introduce our summary of the River Douglas Catchment Flood Management Plan (CFMP). This CFMP gives an overview of the flood risk in the River Douglas catchment and sets out our preferred plan for sustainable flood risk management over the next 50 to 100 years.

The River Douglas CFMP is one of 77 CFMPs for England and Wales. Through the CFMPs, we have assessed inland flood risk across all of England and Wales for the first time. The CFMP considers all types of inland flooding, from rivers, groundwater, surface water and tidal flooding, but not flooding directly from the sea (coastal flooding), which is covered by Shoreline Management Plans (SMPs). Our coverage of surface and groundwater is however limited due to a lack of available information.

The role of CFMPs is to establish flood risk management policies which will deliver sustainable flood risk management for the long term. This is essential if we are to make the right investment decisions for the future and to help prepare ourselves effectively for the impact of climate change. We will use CFMPs to help us target our limited resources where the risks are greatest.

This CFMP identifies flood risk management policies to assist all key decision makers in the catchment. It was produced through a wide consultation and appraisal process, however it is only the first step towards an integrated approach to Flood Risk Management. As we all work together to achieve our objectives, we must monitor and listen to each others progress, discuss what has been achieved and consider where we may need to review parts of the CFMP.

Flooding in the Douglas CFMP area can be due to rivers overtopping their banks or from surface water, particularly in built up areas. There is also a risk of flooding from the sea, due to high tides and storm

surge or from backing up of river water due to high tides. Serious flooding has been recorded in Wigan, Croston, Appley Bridge, Leyland and Whittle Le Woods. There are currently more than 2,200 properties at risk of flooding in a 1% Annual Probability Event (APE) (this includes some tidal flooding). An additional 329 properties across the CFMP area would be at risk of flooding from rivers or the sea in a future 1% event.

We cannot reduce flood risk on our own, we will therefore work closely with all our partners to improve the co-ordination of flood risk activities and agree the most effective way to management flood risk in the future. To develop this plan and ensure social, economic and environmental issues were taken into account we worked with, and consulted many organisations. These include United Utilities, South Ribble Borough Council, Lancashire County Council, Chorley Borough Council Natural England, English Heritage, NFU and Defra.

This is a summary of the main CFMP document, if you need to see the full document an electronic version can be obtained by emailing enquiries@environment-agency.gov.uk or alternatively paper copies can be viewed at any of our offices in North West Region.

A handwritten signature in black ink, appearing to read 'Tony Dean'.

Tony Dean
Regional Director

Contents

The purpose of a CFMP in managing flood risk	3
Catchment overview	4
Current and future flood risk	6
Future direction for flood risk management	10
Sub-areas	
1 Wigan	12
2 Appley Bridge and Croston	14
3 Tidal River Douglas	16
4 Fluvial Yarrow	18
5 Leyland and Lostock to Whittle Le Woods	19
6 Horwich	20
7 Tidal Villages	22
8 Rivington	23
9 River Douglas	24
10 Rural Lostock and Yarrow Communities	26
Map of CFMP policies	28



The purpose of a CFMP in managing flood risk

CFMPs help us to understand the scale and extent of flooding now and in the future, and set policies for managing flood risk within the catchment. CFMPs should be used to inform planning and decision making by key stakeholders such as:

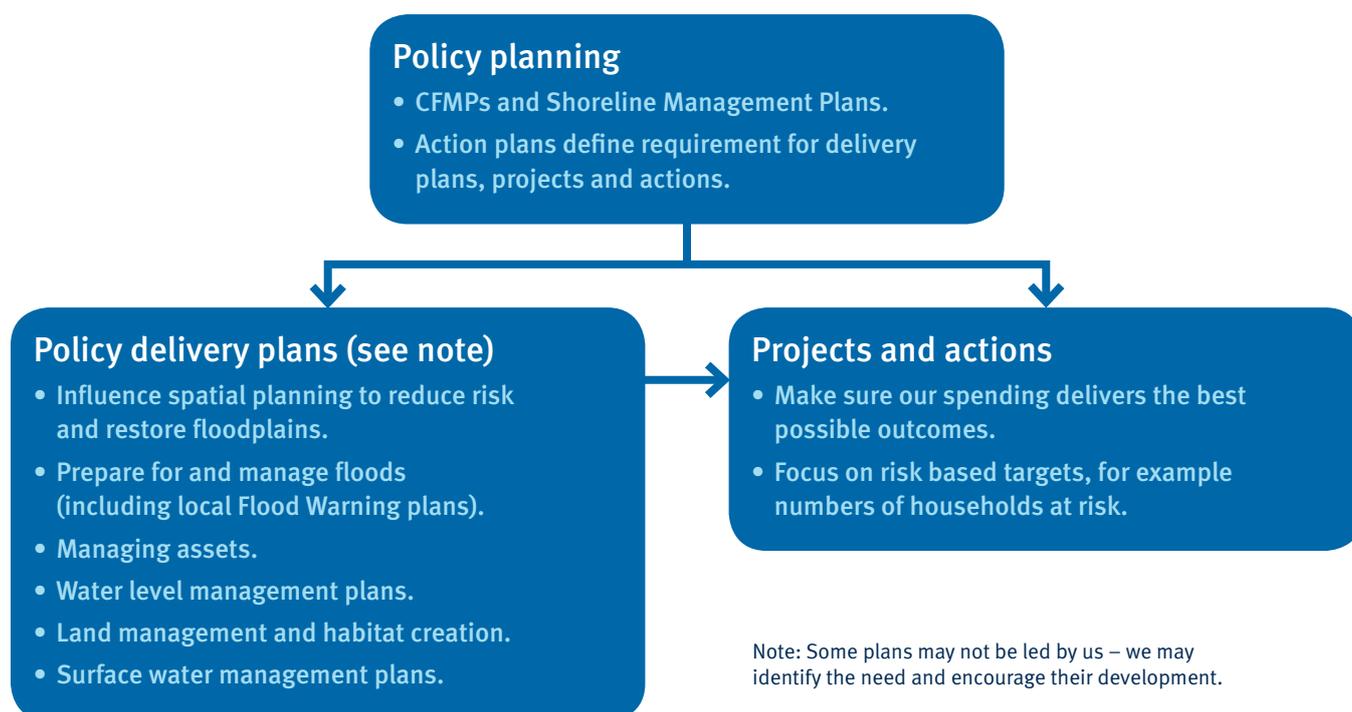
- The Environment Agency, who will use the plan to guide decisions on investment in further plans, projects or actions.
- Regional planning bodies and local authorities who can use the plan to inform spatial planning activities and emergency planning.

- Internal Drainage Board, water companies and other utilities to help plan their activities in the wider context of the catchment.
- Transportation planners.
- Landowners, farmers and land managers who manage and operate land for agriculture, conservation and amenity purposes.
- The public and businesses to enhance their understanding of flood risk and how it will be managed.

CFMPs aim to promote more sustainable approaches to managing flood risk. The policies identified in the CFMP will be delivered through a combination of different approaches. Together with our partners, we will implement these approaches through a range of delivery plans, projects and actions.

The relationship between the CFMP, delivery plans, strategies, projects and actions is shown in figure 1.

Figure 1 The relationship between CFMPs, delivery plans, projects and actions



Catchment overview

The Douglas CFMP area is located in Lancashire in North West England. The area is made up of both urban and rural areas. The east of the CFMP area is dominated by the larger urban settlements of Wigan, Chorley, Leyland and Skelmersdale and these contain around half of the flood risk areas. There has been a decline in many of the traditional manufacturing and related industries and some key areas have been targeted for regeneration. The western part of the CFMP area is mainly agricultural land with small villages and towns. Here the land quality is good and able to support high value agricultural and horticultural activity which maintains the local economy. There are currently more than 2200 properties in the Douglas CFMP area at risk of flooding in an event with a 1% chance of occurring in any year. (1% annual probability event (APE)).

The River Douglas has two major tributaries, the Rivers Yarrow and Lostock. The headwaters of the Douglas and Yarrow rise on Rivington Moor. The upper catchment is characterised by the Rivington Reservoir complex. This significantly alters the natural drainage patterns of the Douglas and Yarrow. These reservoirs are used for public water supply and play a strategic role in water supply across North West England.

In the eastern part of the CFMP area, the rivers are steeper, responding quickly to rainfall. In the west, the catchment is flatter and rivers respond more slowly to rainfall.

Land drainage within the CFMP study area has been significantly changed over time to allow intensively managed agricultural land and urban areas to be created. Development has taken place in the floodplain, leading to the risk of flooding in developed areas such as Wigan, Croston and Appley Bridge. In many reaches the rivers have been heavily modified. Raised defences have been introduced and used widely, they reduce flood risk by moving water rapidly along the channel and culverts. They prevent overtopping of the banks up to their designed standard of protection. Heavily modified watercourses, such as culverts can increase flood risk by restricting flow and forcing water to back up behind them and possibly flow out of the banks or channel. The floodplain of the lower Douglas and Yarrow consists of high grade agricultural land where drainage is modified by pumping within a complex network of artificial channels. The lower reaches of the Douglas are influenced by the tide which controls discharge from a number of river tributaries of the lower Douglas with pumped or flap outfalls. The Douglas flows into the

Ribble estuary approximately 8km downstream of Preston.

The Leeds and Liverpool Canal runs through the catchment. The River Douglas connects the canal and the Ribble Estuary. The area is crossed by several national transport links including the M6 and the west coast mainline railway. In some places, such as in the Fluvial Yarrow policy area, these are at risk of flooding.

There are locally and nationally important environmental sites in the CFMP area at risk of flooding. In the tidal Lower Douglas, close to the Ribble Estuary there is the Ribble and Alt specially protected area, the Ribble and Alt Ramsar, the Ribble Estuary SSSI and the Ribble Estuary NNR which have been designated for their populations of wildfowl.

Map 1 Main Features of River Douglas



Current and future flood risk

Overview of the current flood risk

Flood risk has two components: the chance (probability) of a particular flood and the impact (or consequence) that the flood would have if it happened. The probability of a flood relates to the likelihood of a flood of that size occurring within a one year period, it is expressed as a percentage. For example, a 1% flood has a 1% chance or probability of occurring in any one year, and a 0.5% flood has a 0.5% chance or probability of occurring in any one year. The flood risks from the main rivers quoted in this report take account of flood defences already in place.

The Douglas catchment has a history of flooding but the most notable events were in August 1987 and October 2000 when Croston village flooded affecting around 200 properties. The flow in 2000 was recorded and estimated to be the equivalent of a 0.5% APE or 1 in 200 year event. The Yarrow broke out of its banks upstream and the defences stopped the water returning to the river. There have been flood events in Chorley, Wigan and Leyland but recent flood alleviation works have mitigated the level of property damage after more damaging floods in the past.

The main sources of flooding in the Douglas catchment are as follows:

- River flooding is mainly from three rivers; the Douglas affects Wigan, the Yarrow affects Croston and Chorley and the Lostock affects Leyland and Whittle Le

Woods. Rivington Reservoirs play an important role in regulating flow. When they are not full they trap water flow from the upper catchment and when full they slow the water flow. This reduces flood peaks on the Yarrow and Douglas. In urban areas, culverts and other flow restrictions can make the flooding worse as flow backs up behind these obstacles and flow out of bank or channel. Parts of the catchment are tidally influenced; fluvial flood risk can be made worse by tide locking. River water cannot flow out to sea due to a high tide.

- Direct tidal flooding may occur in Hesketh Bank, where defences can be overtopped by a very high tide and storm surge. The main areas at risk from high tides are the floodplain on the east bank of the Douglas next to Tarleton (around 1.2m deep) and the floodplains adjacent to Beconsall, (up to 4m deep). High water levels within the Douglas Estuary may prevent pumped or flapped outfalls working correctly, leading to flooding behind the tidal defences; affecting mainly agricultural land. Tidal flooding and coastal processes will be assessed in the next Shoreline Management Plan (SMP) expected in 2010.
- Surface water flooding is caused by water collecting or flowing

over the surface before soaking into the ground or entering a watercourse. This type of flooding can occur throughout the catchment but usually only causes a low level of risk. Some of the problems in this catchment are due to urban drainage capacity. Chorley town centre experiences flooding as a result of water flowing down the streets and lack of capacity in the existing sewer system.

- Sewer flooding is usually caused by an inadequate sewer capacity or blockages within the network. There is a history of local flooding related to urban drainage in Chorley, Burscough and other sites in the catchment. There is minor flooding in Croston thought to be caused in part by high water levels in the river backing up the drains. United Utilities have an ongoing programme of work to maintain and improve public sewers.
- Groundwater- In the Douglas catchment there has been groundwater pumping for many years, but this has mostly ceased now. Some local flooding of property in Appley Bridge has been reported since pumping stopped. There is flood risk from the Rufford aquifer as the groundwater level would naturally be above the surface but the aquifer is covered by a thin layer of clay, which prevents

the groundwater flowing to the surface.

- Canal Flooding, there is risk from the Leeds/Liverpool canal as in some places it is above the level of the surrounding properties. British Waterways manage this structure.

What is at risk?

Using detailed hydraulic models and flood maps on the smaller water courses where no models exist we estimate there are more than 2,200 properties at risk of flooding in a 1% APE (this includes some tidal flooding). There are four environmentally designated sites and one scheduled ancient monument within the 1% annual probability flood extent, some of which could be adversely affected by a flood. There is a risk to the Leeds Liverpool canal, particularly in the Douglas valley between Wigan and Parbold, to motorway embankments and culverts and to rail infrastructure across the catchment. Urban areas are most affected by flooding but rural properties and grade one agricultural land will flood in a 1% APE. In the built up areas a few areas are at risk of flooding from water deeper than 3m in a relatively small flood event, and throughout the CFMP area there are people at risk of flooding with water deeper than 1m. This can be a risk to life.

Where is the risk?

The main flood risk to people and communities is in Croston, parts of Wigan and Appley Bridge. In Wigan flooding can affect socially vulnerable groups. In Croston a significant part of the community is at risk together with a school, sewage treatment works and businesses.

The map overleaf illustrates where the properties are at risk of flooding in a 1% annual probability event.

We recognise the potential risk from surface water and sewer flooding. Further studies, following on from the CFMP, will be undertaken to quantify this potential risk.

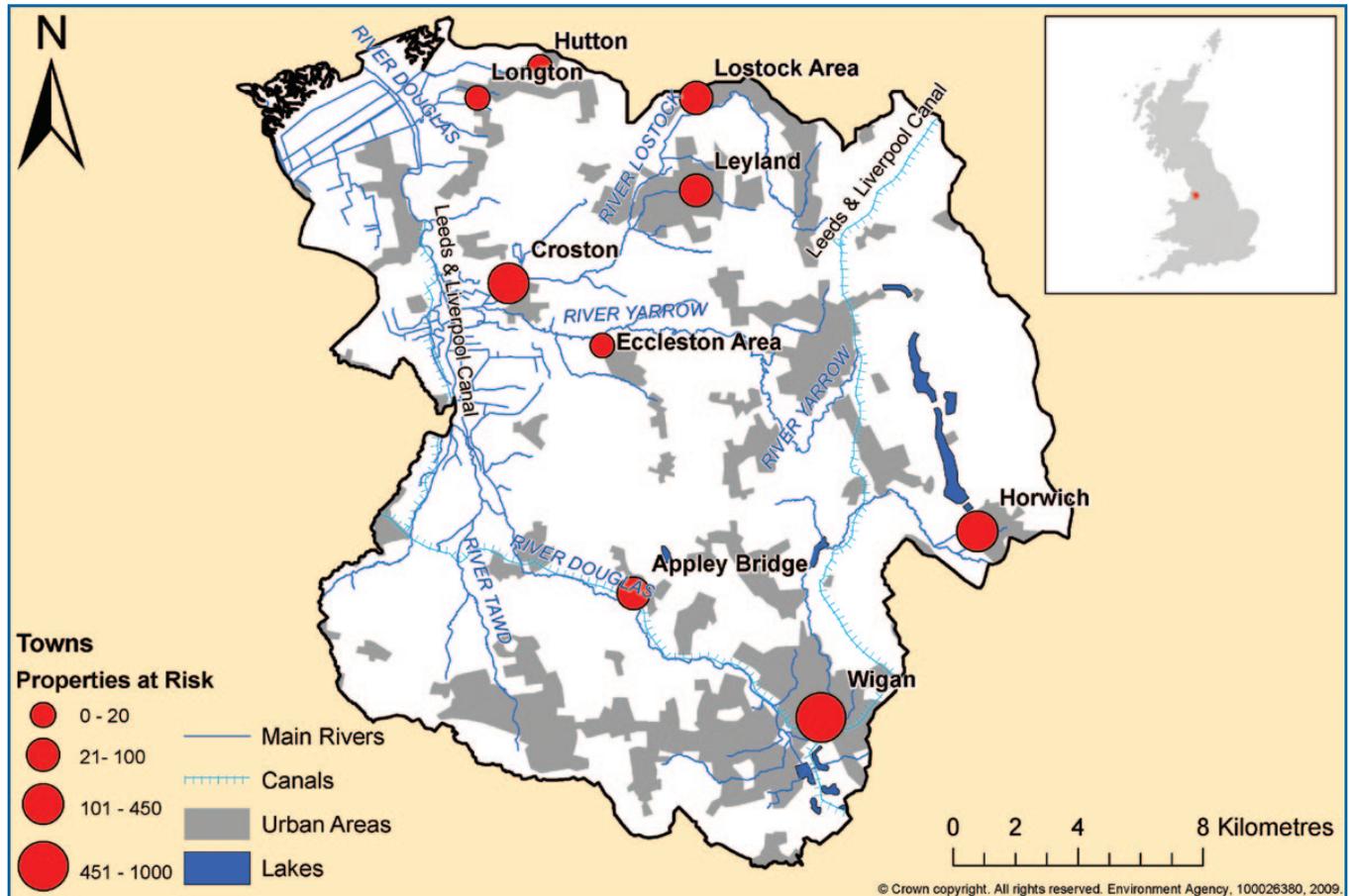
Table 1. Locations of Towns and Villages with 25 or more properties at risk in a 1% annual probability river flood

Number of properties at risk	Locations
500 to 1,000	In the Wigan Metropolitan Borough Council area at Wigan. In the Bolton Metropolitan Borough Council area at Horwich
101 to 500	In the South Ribble Borough Council area at Leyland. In the Chorley Borough Council area at Croston.
51 to 100	In the Chorley Borough Council area at Lostock to Whittle Le Woods In the Wigan Metropolitan Borough Council, West Lancashire District Council and Chorley Borough Council areas at scattered rural properties
25 to 50	In the West Lancashire District Council area at Appley Bridge

Table 2. Critical infrastructure at risk:

1 electricity substation, 1 wastewater treatment works
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Map 2 Flood Risk in the River Douglas CFMP Area



How we currently manage the risk in the catchment

The Douglas catchment has benefited from engineering schemes put in place over the last 50 years or more. These include:

- The Bannister Brook Flood Alleviation Scheme completed in 1993 has reduced the flood risk for the town of Leyland.
- Construction of defences at Wigan and Flood Alleviation works in Whittle Le Woods and Lostock.

In addition to these engineering schemes, other flood risk management activities are carried out in the catchment. These include activities that help to reduce the

probability of flooding, and those that address the consequences of flooding.

Activities that reduce the probability of flooding include:

- Maintaining and improving existing flood defences, structures and watercourses. The catchment has over 50 km of raised defences, more than 55% of these are maintained by the Environment Agency.
- Enforcement and maintenance where riparian owners and others carry out work detrimental to flood risk or neglect their duties.

- Identifying and promoting new Flood Alleviation Schemes where appropriate, such as in Horwich, Wigan and the tidal villages. There are also studies planned or ongoing in Croston, Appley Bridge, on the Tidal River Douglas and the Yarrow.
- Working with local authorities to influence the location, layout and design of new and redeveloped property and ensuring that only appropriate development is allowed on the floodplain through the application of Planning Policy Statement 25 (PPS25).

The impact of climate change and future flood risk

Activities that reduce the consequences of flooding include:

- Flood risk mapping, understanding where flooding is likely to occur.
- Operation of floodline and flood warning services to 5 areas and 2400 properties in the Douglas Catchment.
- Providing flood incident management response.
- Promoting awareness of flooding so that organisations, communities and individuals are aware of the risk and are prepared in case they need to take action in time of flood.
- Promoting resilience and resistance measures for those properties already in the floodplain.

In the future, flooding will be influenced by climate change, changes in land use (for example urban development) and rural land management. In the Douglas catchment, sensitivity testing revealed that climate change has the greatest impact on flood risk, with land management change, and urbanisation having a smaller effect. Whilst we do not know exactly what will happen in the future the key trends are:

- More frequent and intense storms causing more widespread flooding from drainage systems and some rivers.
- Wetter winters increasing the likelihood of large-scale flooding.

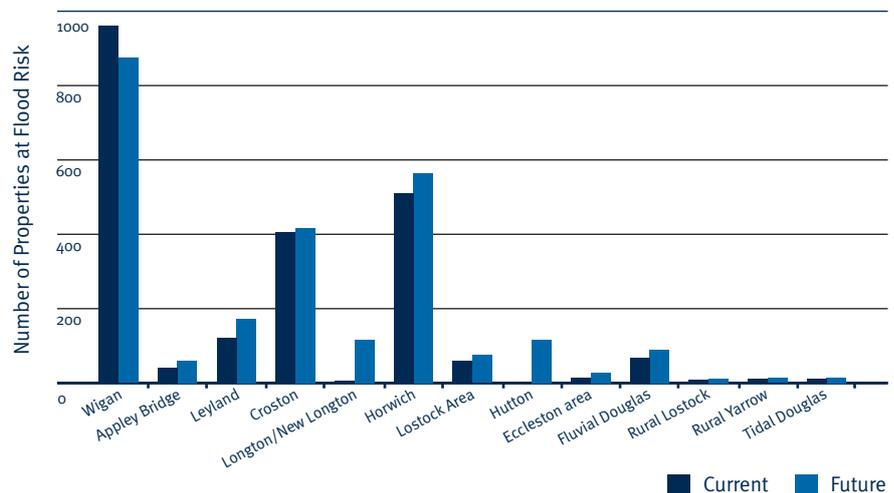
The future scenarios used in the Douglas CFMP were:

- A 20% increase in peak flow in all watercourses. The predicted increase in flow can affect the frequency, timing, scale of flooding and the flood levels.
- A total sea level rise of 841 mm by the year 2100.

In the Douglas CFMP area, the shape of the river valleys limits the extent of flooding and in many places the future increase in the flooded area is likely to be small with a increase in flood depth of around 0.15m, some areas will see a much greater increase, for example, Appley Bridge is predicted to see a 0.6m increase in flood depth. In the future, Wigan, Croston, Leyland to Whittle Le Woods, the villages of Longton, New Longton and Hutton and some rural areas, the flooded area will be larger and affect many extra properties. An additional 329 properties across the CFMP area would be at risk of flooding from rivers or the sea in a future 1% event. No additional environmental or heritage sites are in the future 1% annual probability flood extent but the flood depth and extent of flooding is expected to increase slightly.

Figure two shows the difference between current and future flood risk for a 1% event at key areas in the catchment.

Figure 2 Current and future (2100) flood risk to property from a 1% annual probability river flood, taking into account current flood defences.



Future direction for flood risk management

Approaches in each sub-area

We have divided the Douglas CFMP area into ten distinct sub-areas that have similar physical characteristics, sources of flooding and levels of risk. These sub-areas will allow us and the key stakeholders to promote flood risk management approaches, policies and actions that are most appropriate in that area to deliver the various Government and regional strategies, in particular “Making Space for Water”. In the face of increasing risk, it often is

not sustainable to keep building and raising defences. This is why we have to look catchment wide at how we direct effort and resources to ensure sustainable solutions. We have assessed what will be the most sustainable approach to managing flood risk in each sub-area. This is presented in the following sections and they outline:

- The key issues in that area.
- The vision and preferred policy.
- The proposed actions to implement the policy.

This document does set out our policies for managing flood risk, recognising the constraints that do exist. Our future direction for managing flood risk is expressed by applying one of our six standard policy options to that sub area. To select the most appropriate policy, the plan has considered how social, economic and environmental objectives are affected by flood risk management activities under each policy option. The six policy options are explained on page 11.

Map 3 Sub-areas

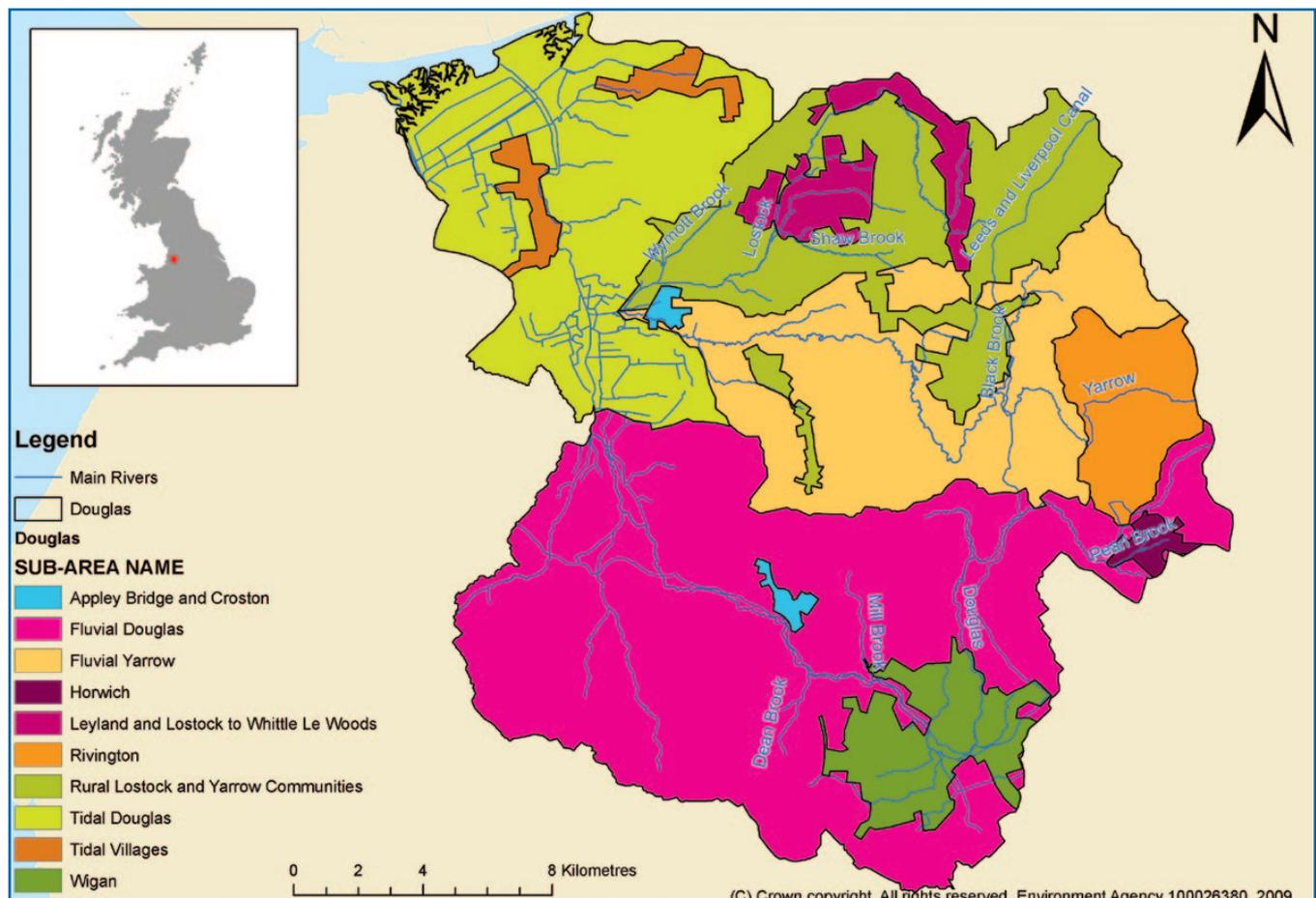


Table 3 Policy options

→ Policy 1

Areas of little or no flood risk where we will continue to monitor and advise

This policy will tend to be applied in those areas where there are very few properties at risk of flooding. It reflects a commitment to work with the natural flood processes as far as possible.

→ Policy 2

Areas of low to moderate flood risk where we can generally reduce existing flood risk management actions

This policy will tend to be applied where the overall level of risk to people and property is low to moderate. It may no longer be value for money to focus on continuing current levels of maintenance of existing defences if we can use resources to reduce risk where there are more people at higher risk. We would therefore review the flood risk management actions being taken so that they are proportionate to the level of risk.

→ Policy 3

Areas of low to moderate flood risk where we are generally managing existing flood risk effectively

This policy will tend to be applied where the risks are currently appropriately managed and where the risk of flooding is not expected to increase significantly in the future. However, we keep our approach under review, looking for improvements and responding to new challenges or information as they emerge. We may review our approach to managing flood defences and other flood risk management actions, to ensure that we are managing efficiently and taking the best approach to managing flood risk in the longer term.

→ Policy 4

Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change

This policy will tend to be applied where the risks are currently deemed to be appropriately-managed, but where the risk of flooding is expected to significantly rise in the future. In this case we would need to do more in the future to contain what would otherwise be increasing risk. Taking further action to reduce risk will require further appraisal to assess whether there are socially and environmentally sustainable, technically viable and economically justified options.

→ Policy 5

Areas of moderate to high flood risk where we can generally take further action to reduce flood risk

This policy will tend to be applied to those areas where the case for further action to reduce flood risk is most compelling, for example where there are many people at high risk, or where changes in the environment have already increased risk. Taking further action to reduce risk will require additional appraisal to assess whether there are socially and environmentally sustainable, technically viable and economically justified options.

→ Policy 6

Areas of low to moderate flood risk where we will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits

This policy will tend to be applied where there may be opportunities in some locations to reduce flood risk locally or more widely in a catchment by storing water or managing run-off. The policy has been applied to an area (where the potential to apply the policy exists), but would only be implemented in specific locations within the area, after more detailed appraisal and consultation.

Wigan

Our key partners are:

Wigan Metropolitan Borough Council

United Utilities

British Waterways

Highways Agency

The issues in this sub-area

Wigan is the largest town in the CFMP area. There is a history of flooding in the town centre from the River Douglas and from smaller watercourses elsewhere in the town. Wigan has seen a decline in its traditional industry and parts of the town, including parts of the town centre within the floodplain of the River Douglas, have been identified as regeneration areas. The rivers in Wigan are restricted by urban development including culverts and other structures. There is a risk of flooding from surface run-off, drains and sewers. Areas at risk of flooding include places with very high social vulnerability. There are 961 properties at risk of flooding from rivers in a 1% event and the average flood depth in properties is 0.6m. Infrastructure at risk includes health centres, the law court, electricity and gas sites. Two percent of the community is at risk of flooding, although this is concentrated in particular areas including Poolstock and Scholes where the proportion is much

greater. Wigan generates more than 50% of the cost of flood damage in the CFMP area. There are some raised defences in Wigan which reduce risk in smaller flood events. A scheme is proposed at Water Heyes which will reduce flood risk from the River Douglas but this would still leave 874 properties at risk of flooding in a 1% event in the future. There is a flood warning service, but uptake of this is only 37%.

The vision and preferred policy

Policy option 5: Areas of moderate to high flood risk where we can generally take further action to reduce flood risk.

Wigan is an important residential and industrial town and parts of the town are often exposed to flooding. The proposed Water Heyes scheme will reduce some of the risk from the River Douglas but will still leave hundreds of properties at risk of flooding in the future including areas at risk from tributaries of the Douglas, culverts, drains and sewers. Our vision is to reduce the current level of risk in the future by targeting key areas. Reduction of risk from smaller watercourses will involve a range of measures which may include additional defences, flood warning and sewer and drainage improvements. This will result in a safe environment in which people can live and work.

The key messages

- Finalise Flood Risk Management scheme for Wigan.
- Continue to maintain defences and major assets.
- Undertake risk assessments on culverts and other flow restrictions.
- Minimise inappropriate development in areas at risk of flooding.
- Continue with flood warning programme of information and education.

Proposed actions to implement the preferred policy

The essential actions to achieve our policy aim are listed below:

- Complete Water Heyes scheme for Wigan.
- Undertake a risk assessment on culverts and other flow restrictions in the Wigan sub-area. Prioritise these structures for redesign, replacement or removal according to the flood risk. Relevant sites include, Ince Brook, Hawkey Brook and Smithy Brook.
- Develop a communication plan for reservoir maintenance and management of emergency release from Rivington reservoirs.
- Investigate the standard of protection provided by the existing main river network and seek to reduce flood risk in a sustainable way. This is likely to be achieved through maintenance works and targetted improvements to structures and river channels, but will consider other approaches where appropriate.



↑ River Douglas through Wigan town centre

Appley Bridge and Croston

Our key partners are:

Wigan Metropolitan Borough Council

Chorley Borough Council

South Ribble Borough Council

West Lancashire District Council

United Utilities

British Waterways

Highways Agency

The issues in this sub-area

This sub-area contains two villages with similar flood risk characteristics.

The village of Croston is located on the River Yarrow just upstream of its confluence with the River Lostock. Appley Bridge is located on the River Douglas and Calico Brook.

In these two villages, 450 properties are at risk in a 1% APE, 406 of them in Croston, which is one third of the properties in the village, this could rise to 417 properties in the future due to climate change. Croston floods directly from the River Yarrow and also from culverted watercourses, drains, sewers and surface runoff. Appley Bridge floods at Millbank Estate from Calico Brook, although there is some risk elsewhere in the town from the River Douglas. There are 42 properties at risk in a 1% APE, increasing to 60 in the future.

There are some flood defences on the River Yarrow in Croston which reduce risk in smaller flood events and the village may benefit from rural defences in the surrounding area. Flood risk will increase in the future although not by a large amount. The frequency of smaller flood events may increase, as the defences are likely to be overtopped more frequently.

Flooding in Appley Bridge from the tributaries is deep (0.9m), fast onset and fast flowing and poses a risk to life. Some flooding is associated with undersized culverts. There is a temporary scheme in place. Calico Brook is diverted into the East Quarry at times of high flow. This substantially reduces risk but there have been some reports of groundwater flooding which may be linked to the increased water level in the quarry. There is a flood warning service in Croston and for the River Douglas.

The vision and preferred policy

Policy option 5: Areas of moderate to high flood risk where we can generally take further action to reduce flood risk.

Action is required to better protect these two villages from flooding now and in the future.

The risk of flooding from drains, sewers and surface run-off is likely to increase due to the effects of

climate change. Defences in Croston are likely to be overtopped more frequently in the future and the risk in Appley Bridge is likely to increase as the current temporary scheme reaches the end of its life.

Our vision is to reduce the current level of risk. In Croston, the reduction in flood risk is linked to the policy to increase flooding in the tidal Douglas and River Yarrow sub-areas. If additional flooding elsewhere is unable to deliver all the reduction in flood risk required, then other local measures may be needed. In Appley Bridge, we plan to reduce risk from current levels using either the current scheme or an alternative more sustainable solutions.

The key messages

- Avoid inappropriate development in areas at risk of flooding.
- Investigate alternative sustainable flood risk measures for Appley Bridge and Croston.
- Continue to maintain existing defences.
- Undertake risk assessments on culverts and other flow restrictions.
- Continue with flood warning programme of information and education.

Proposed actions to implement the preferred policy

The essential actions to achieve our policy aim are listed below:

- Carry out study for potential schemes to reduce flood risk in Croston. The study will include technical and economic investigation of a number of more local schemes which are likely to be in the Yarrow sub-area.
- Investigate alternative sustainable flood risk reduction measures for Appley Bridge, including the potential for formalising the current temporary scheme or alternative solutions.
- Undertake a risk assessment on culverts and other flow restrictions in the sub-area. Prioritise these structures for redesign, replacement or removal according to the flood risk.
- Undertake a study to improve understanding of interaction between river flow and tide in the sub-area and their impact on flood risk. The study should make use of modelling, surveys and historical information, and determine the current and future risk in Croston from combined fluvial and tidal events.
- Investigate the standard of protection provided by the existing main river network and seek to reduce flood risk in a sustainable way. This is likely to be achieved through maintenance works and targeted improvements to structures and river channels, but will consider other approaches where appropriate.



↑ Croston Bridge



↑ Calico Brook Appley Bridge

Tidal River Douglas

Our key partners are:

South Ribble Borough Council

West Lancashire District Council

National Farmers' Union

Natural England

RSPB

FWAG

Lancashire Wildlife Trust

Defra

Alt Ramsar site and the Ribble Estuary SSSI are in the flood zones but not thought to be adversely affected by fluvial or tidal flooding. There are significant raised defences (19.8km) in the sub-area, mainly along the River Douglas, which are designed to protect agricultural land (some of it grade 1) and properties in Tarleton. There is pumped drainage in some of the agricultural areas. We are currently investigating the impact of joint river and tidal flood events to better understand flood risk in this area.

This sub-area is mainly rural, with some scattered properties and small communities. There are significant amounts of grade 1 agricultural land which benefit from raised defences and pumping. Our vision for the area is to ensure that as much of the natural floodplain as possible is restored in order to provide storage, reducing flooding elsewhere (for example, in Croston and communities within this sub-area) and providing environmental benefits. Ways of achieving this may include managed realignment of defences and changes to the pumping operations.

The issues in this sub-area

This sub-area includes the River Douglas and its tributaries downstream of the tidal limit. It is a flat rural area, with a few small villages. Flooding occurs from rivers and the sea. There are 13 properties at risk of flooding in a 1% APE in the part of the sub-area that we have modelled (over 75% of properties at risk are covered by the model) and there may be other properties at risk in other parts. We estimate this could increase to 14 properties due to the effects of climate change by 2100. Infrastructure at risk includes two water treatment works. Some properties are flooded with water 1-2m deep even during small flood events. The sub-area contributes 60% of the agricultural damage in the CFMP area. Five km² of the Ribble and Alt SPA, the Ribble and

The vision and preferred policy

Policy option 6: Areas of low to moderate flood risk where we will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits.

The key messages

- Investigate restoring floodplain.
- Improve understanding of interaction between river flow and tide.
- Identify responsibilities for pumping of agricultural land.



↑ Longton Marsh

Proposed actions to implement the preferred policy

The essential actions to achieve our policy aim are listed below:

- Undertake a study to improve understanding of interaction between river flow and tide in the downstream parts of the sub-area and their impact on flood risk. Through the use of modelling, survey and historical information, the study should determine the current and future risk from combined fluvial and tidal events. This affects communities at risk in Croston, Hesketh Bank, Beconsall, Tarleton, New Longton and Longton. There are also large areas of grade 1 agricultural land at risk from tidal and fluvial flooding.
- Carry out study to identify the responsibilities for maintaining pumping within the sub-area for agricultural drainage. The study should identify the legal responsibilities and obligations and investigate more sustainable alternatives in the long term. It must also take into account the large area of grade 1 agricultural land. The study will initiate discussions between stakeholders affected by any potential change in the pumping regime.
- Undertake study to consider restoring floodplain. This should identify areas and opportunities to restore floodplains and create habitats within the sub-area. There will be appropriate information within the Shoreline Management Plan (SMP) for the Ribble Estuary.



↑ River Douglas in its lower reaches

Fluvial Yarrow

Our key partners are:

West Lancashire District Council

Lancashire County Council

Chorley Borough Council

The issues in this sub-area

This sub-area includes the River Yarrow and its tributaries upstream of the confluence with the River Douglas. It is mainly rural, with scattered properties and small communities. There are 16 properties at risk in a 1% event plus infrastructure, including the West Coast mainline railway. The main flood risk is from rivers. Current flood risk is low and future changes in flood risk are likely to be small. There are some defences in the lower reaches of the sub-area. These protect agricultural land, some of it high grade. The defences may also have some influence on the flow regime in Croston. There is a flood risk (very small) associated with Rivington Reservoirs which release water to the River Douglas, rapid releases from the reservoir (eg, to allow urgent maintenance work) may cause local flooding close to the reservoir, particularly if they occur during a wet period. The Environment Agency works with United Utilities to ensure any such release of water does not unduly increase flood risk.

The vision and preferred policy

Policy option 6: Areas of low to moderate flood risk where we will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits.

The River Yarrow sub-area is mostly agricultural, with a significant amount of grade 1 agricultural land in the lower part of the sub-area. The existing flood risk management measures are designed to protect this agricultural land. Our vision for the area is to ensure that as much of the natural floodplain as possible is restored in order to provide storage, reducing flooding elsewhere (for example, in Croston) and providing environmental benefits. The existing defences in the sub-area are likely to remain, although alternative actions may be proposed for some defences as part of schemes to increase flooding of suitable areas.

The key messages

- Investigate restoring the floodplain where possible.
- Develop a communication plan for Rivington reservoir.
- Improve understanding of interaction between rivers and the tide.

Proposed actions to implement the preferred policy

The essential actions to achieve our policy aim are listed below:

- Carry out a study to investigate suitable locations for habitat inundation. The study should focus on reducing flooding in the Croston sub-area whilst also identifying areas for the floodplain to be reconnected, habitat improvement and enhancement or habitat creation. The issue of good quality agricultural land being flooded more often must also be addressed.
- Undertake a study to improve understanding of interaction between river flow and tide in the downstream parts of the sub-area and their impact on flood risk. Through the use of modelling, survey and historical information, this should determine the current and future risk from combined fluvial and tidal events. The effects of the River Yarrow and its tributaries on Croston should be identified.
- Develop a communication plan for reservoir maintenance and management of emergency release from Rivington reservoirs.

Leyland and Lostock to Whittle Le Woods

Our key partners are:

South Ribble Borough Council

Chorley Borough Council

Lancashire County Council

British Waterways

Highways Agency

United Utilities

The issues in this sub-area

This sub-area contains the towns of Leyland, Lostock, Clayton Brook, Clayton Green and Whittle Le Woods. These are in the River Lostock catchment. Flooding is from the River Lostock and tributaries including Bannister Brook and Wade Brook in Leyland and Carr Brook in Whittle Le Woods. There are 180 properties at risk of flooding from rivers. There is also localised flooding from culvert restrictions and from surface water, drains and sewers. There is a culverted defence scheme on Bannister Brook and maintained channel sections in Whittle Le Woods.

The vision and preferred policy

Policy option 4: Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change.

This sub-area covers Leyland and smaller towns between Lostock and Whittle Le Woods. With the effects of climate change, the flood risk in these towns will increase (66 additional properties at risk of flooding from rivers and a 0.6m increase in the average flood depth in properties). Our vision for this sub-area is to take targeted action as necessary to sustain the current level of flood risk. This may include the introduction of a flood warning service, improvements to drainage network and sewer systems, increased channel and structure maintenance, opening up of channels in places where flooding is due to flow restrictions, and additional or improved defences.

The key messages

- Continue to maintain our existing defences.
- Investigate and address the causes of urban drainage flooding.

- Undertake risk assessments on culverts and other flow restrictions.

Proposed actions to implement the preferred policy

The essential actions to achieve our policy aim are listed below:

- Undertake a risk assessment on culverts and other flow restrictions in the sub-area. Prioritise these structures for redesign, replacement or removal according to the flood risk. Relevant sites include Bannister Brook, Bryning Brook, Wade Brook Mill Brook and the River Lostock.
- Investigate the standard of protection provided by the existing main river network and seek to reduce flood risk in a sustainable way. This is likely to be achieved through maintenance works and targeted improvements to structures and river channels, but will consider other approaches where appropriate.

Horwich

Our key partners are:

Bolton Metropolitan Borough Council

Highways Agency

United Utilities

The issues in this sub-area

Horwich is a small town on the edge of Rivington Moor in the upper part of the Douglas catchment. There is a risk of flooding in the town from the River Douglas and its tributaries, Pearl Brook and Nellies Clough. A third of the properties at risk of flooding from rivers are non-residential. Horwich generates 21% of the annual average damage from river flooding in the CFMP area. There is some flood risk (very small) associated with Rivington Reservoirs which release water to the River Douglas just upstream of Horwich. Rapid releases from the reservoir (eg, to allow maintenance work) may increase flood risk particularly if they occur during a wet period. The Environment Agency works with United Utilities to ensure any such releases do not unduly increase flood risk. There is also a risk of flooding from surface runoff, drains and sewers. A culvert blockage study has been completed as part of the Horwich SFRM and this has identified flow restrictions for repair or replacement.

There are some raised defences on the River Douglas immediately downstream of Horwich and work is in progress to implement a flood warning service.

The vision and preferred policy

Policy option 4: Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change.

Our flood zones have identified 510 properties at risk of flooding in Horwich (9% of property in the sub-area). As the climate changes, an extra 55 properties may be at risk of flooding. Our vision for this sub-area is that we will continue with our existing flood risk management actions and we will monitor change in flood risk and take action as it is needed. This will involve targeted actions and may include extending the flood warning area to include properties at risk from Pearl Brook and Nellies Clough (may be difficult to achieve required lead times), improvements to drainage and sewer networks, additional or improved defences.

The key messages

- Continue to maintain our existing defences.
- Undertake risk assessments on culverts and other flow restrictions.
- Continue with flood warning and the programme of information and education.
- Carry out study to improve understanding of sources of flood risk in the sub-area.

Proposed actions to implement the preferred policy

The essential actions to achieve our policy aim are listed below:

- Using information provided from the Horwich Strategic Flood Risk Management plan, produce a prioritised list of structures for redesign or replacement according to the flood risk.
- Develop a communication plan for reservoir maintenance and management of emergency release from Rivington reservoirs.
- Investigate the standard of protection provided by the existing main river network and seek to reduce flood risk in a sustainable way. This is likely to be achieved through maintenance works and targeted improvements to structures and river channels, but will consider other approaches where appropriate.
- Work in partnership with Bolton MBC and United Utilities over sewer and local surface water flooding. Identify and promote joint solutions where surface water and sewer flooding is known to exist.
- Completed river model outline for Horwich (River Douglas, Pearl Brook and Jepson's Clough). This will reduce some of the uncertainty of the current risk information from our flood zones.
- Encourage the use of appropriately designed Sustainable Drainage Systems (SUDS) to control run-off at source.



↑ River Douglas in Horwich

Tidal Villages

Our key partners are:

Lancashire County Council

South Ribble Borough Council

The issues in this sub-area

This sub-area includes the villages of Longton, New Longton, Hutton, Beconsall, Hesketh Bank and Tarleton which are all in the flat tidal part of the CFMP area. They are at risk of flooding from the River Douglas (Beconsall, Hesketh Bank and Tarleton), Longton Brook (Hutton) and Hall Pool (Longton). There are currently 23 properties at risk of flooding in a 1% event, but this may increase to more than 200 additional properties at risk in the future. There is a risk of flooding from the sea. There is also a risk of flooding from surface run-off, drains and sewers. Defences in the Tidal Douglas sub-area reduce risk in these villages. These include defences on the River Douglas next to Tarleton, sea defences at Hesketh Marsh and Hesketh Bank and defences on tributaries of Hall Brook and Longton Brook. We are investigating the consequences of a joint river/tidal flood event, to better understand the risk of flooding in this area. The flat topography means that the number of properties at risk could increase substantially in more extreme flood events.

The vision and preferred policy

Policy option 4: Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change.

The communities in this sub-area are at risk of flooding from both rivers and the sea. Existing management activities including the Hesketh Bank tidal flood warning area and maintenance of drainage and sewer networks will continue. As risk increases in the future due to climate change, we will take targeted actions. These could include offering a direct flood warning service for Hesketh Bank and Tarleton tidal flood warning area and a fluvial/ tidal flood warning service in Longton, New Longton and Hutton, and improvements to drainage network and additional or improved defences. This sub-area may see a reduction in flood risk in the future associated with actions taken in the tidal Douglas sub-area.

The key messages

- Continue to maintain existing defences in surrounding area.
- Investigate the impact of tidal and fluvial events in this sub-area.
- Undertake risk assessment on culverts and other flow restrictions.

Proposed actions to implement the preferred policy

The essential actions to achieve our policy aim are listed below:

- Using information provided from the Hall Pool strategic flood risk assessment to produce a prioritised list of structures for redesign or replacement according to the flood risk. Prioritise structures in Hesketh Bank, Beconsall and Tarleton for redesign, replacement or removal following an assessment of their flood risk.
- Work in partnership with the local authority and United Utilities over sewer and local surface water flooding. Identify and promote joint solutions where surface water and sewer flooding is known to exist.
- Continue with an inspection and maintenance regime but ensure work is in line with best value, risk based asset management plans.
- Investigate the standard of protection provided by the existing main river network and seek to reduce flood risk in a sustainable way. This is likely to be achieved through maintenance works and targeted improvements to structures and river channels, but will consider other approaches where appropriate.

Rivington

Our key partners are:

Chorley Borough Council

Bolton Metropolitan Borough Council

The issues in this sub-area

The Rivington sub-area is located in the east of the CFMP area and contains Rivington reservoirs and their catchments. The sub-area is rural and includes moorland areas around Rivington, with scattered properties and small communities. Apart from the reservoir and its main catchwater, the sub-area is fairly natural. The main flood

risk is from small watercourses, three properties at risk. We do not currently carry out any flood risk management activities in this sub-area. Flood risk is very low and is not expected to change significantly in the future.

The vision and preferred policy

Policy option 1: Areas of little or no flood risk where we will continue to monitor and advise.

This is a rural area, we do not currently carry out any flood risk management activities and our vision for this area is that this will continue. This is unlikely to lead to an increase in flood risk

in the future. We will monitor the reservoir as part of our actions for downstream sub-areas. Our vision will be achieved under our preferred approach of policy 1.

The key messages

- Monitor operation of Rivington Reservoir.
- Monitor and advise on the moorland grip project at Anglezarke.

Proposed actions to implement the preferred policy

The essential actions to achieve our policy aim are listed below:

- Monitor the communication plan developed by United Utilities for reservoir maintenance and management of emergency release from Rivington reservoir.
- Identify any monitoring information available and its quality following the moorland grip blocking project on Anglezarke moor. This project's objective is to reduce run-off in parts of the upper catchment by blocking drainage channels cut in the peat. It is hoped this will reduce flood risk further downstream in the catchment.



↑ Rivington Reservoir

(Fluvial) River Douglas

Our key partners are:

South Ribble Borough Council

West Lancashire District Council

Chorley Borough Council

Wigan Metropolitan Borough Council

Lancashire County Council

Highways Agency

United Utilities

British Waterways

The issues in this sub-area

The River Douglas sub-area covers the River Douglas between the outlet of Rivington Reservoir and the tidal limit at Rufford. In the rural areas, the main flood risk is from rivers. In the built-up areas, the risk is mainly associated with culverts and other flow restrictions. There is also a flood risk in the built up areas from surface run-off, drains and sewers. There are 68 rural properties at risk of flooding from rivers and there may be an additional 21 properties at risk in the future. Critical infrastructure at risk of flooding includes electricity supply sites and a water treatment works. The sub-area contributes 23% of the total agricultural damage in the CFMP area. Risk is forecast to increase in the future, with additional flooding of rural

property and high grade agricultural land mostly in the Abbey/ Eller Brooks and River Tawd catchments. In the built up areas there will also be a increase in flood risk in the future associated with urban runoff and channel restrictions which may not be able to cope with the intense rainfall events which are expected to become more frequent. Flood defences in the lower part of the sub-area protect agricultural land and rural property. There is some flood risk associated with rapid releases from Rivington Reservoirs, to allow maintenance work, which may increase flood risk, particularly if they occur during a wet period. The Environment Agency is working with United Utilities to ensure any such releases do not unduly increase flood risk.

The vision and preferred policy

Policy option 4: Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change.

This sub-area covers both towns and rural areas in the Douglas Valley. With the effects of climate change, the flood risk will increase particularly in the urban areas (21 additional properties at risk of flooding from rivers). Our vision for this sub-area is that we will take targeted action as

needed. The increase in risk may be scattered around the sub-area and may require a range of actions. Maintenance of defences, channels, structures and the urban drainage network will continue. We may consider improved land management (including targeted flooding of additional areas, if appropriate), flood resilience in properties or localised defences and flood warning. In built-up areas, measures could include improvements to the urban drainage network, increased channel and structure maintenance and opening up channels where restrictions are leading to flooding. There may be a reduction of risk in the downstream part of this sub-area as a consequence of our actions in the River Yarrow and tidal Douglas sub-areas.

The key messages

- Continue to maintain defences and major assets.
- Undertake risk assessments on culverts and other flow restrictions.
- Investigate alternative actions to manage flood risk at the current level in the future.
- Avoid inappropriate development in areas at risk from flooding.
- Continue with flood warning programme of information and education.

Proposed actions to implement the preferred policy

The essential actions to achieve our policy aim are listed below:

- Develop a communication plan for reservoir maintenance and management of emergency release from Rivington reservoirs.
- Undertake a risk assessment on culverts and other flow restrictions in the sub-area. Prioritise these structures for redesign, replacement or removal according to the flood risk. Relevant sites include the River Tawd and Abbey Brook.
- Investigate the standard of protection provided by the existing main river network and seek to reduce flood risk in a sustainable way. This is likely to be achieved through maintenance works and targeted improvements to structures and river channels, but will consider other approaches where appropriate.
- Encourage partner organisations to collaborate to produce Surface Water Management Plan to better manage flooding in key urban locations such as Skelmersdale, Burscough, Parbold and Standish.



↑ River Douglas at Wanesblades Bridge

Rural Lostock and Yarrow Communities

Our key partners are:

Chorley Borough Council

Wigan Metropolitan Borough Council

South Ribble Borough Council

The issues in this sub-area

This sub-area includes the town of Chorley and the smaller communities of Euxton, Eccleston, Heskin Green and Wrightington Bar on the River Yarrow catchment and the rural area of the River Lostock and its tributaries upstream of its confluence with the Yarrow.

In total there are 22 properties at risk in a 1% APE. Current flood risk is low and future changes (by 2100) in flood risk are likely to be small (3-4 properties).

Chorley has a history of flooding from surface water. The town is located on the side of a hill and water flows down to the River Chor in the valley. The river is culverted and surface flow ponds behind restrictions, including the railway embankment. Flood risk will increase in the future, particularly associated with urban drainage.

In the rural areas of the Lostock, eight properties are at risk from river flooding. Some defences are in

place, mostly to protect agricultural land.

The vision and preferred policy

Policy option 3: Areas of low to moderate flood risk where we are generally managing existing flood risk effectively.

The routine and reactive maintenance work which we and our partners (including the local authority, United Utilities and Network Rail) carry out plays a key role in managing flood risk in this sub-area. The current level of maintenance work however in the rural areas of the Lostock is low. Our vision is to continue with this work to manage risk at the current level. We may consider alternative more sustainable measures if appropriate. If further work identifies that the defences do not have a significant impact on flood risk in Croston, we may

then consider alternative more sustainable measures in the rural areas. We will achieve this vision under our preferred approach of policy three.

The key messages

- Continue to maintain our existing assets.
- Investigate and address the causes of urban drainage flooding.
- Undertake risk assessments on culverts and other flow restrictions.
- Improve understanding of interaction between river flow and the tide in the downstream parts of the sub-area.
- Investigate alternative actions to maintain risk at the current level in the future.
- Avoid inappropriate development in areas at risk of flooding.



↑ River Lostock at Littlewood Bridge Gauging Station

Proposed actions to implement the preferred policy

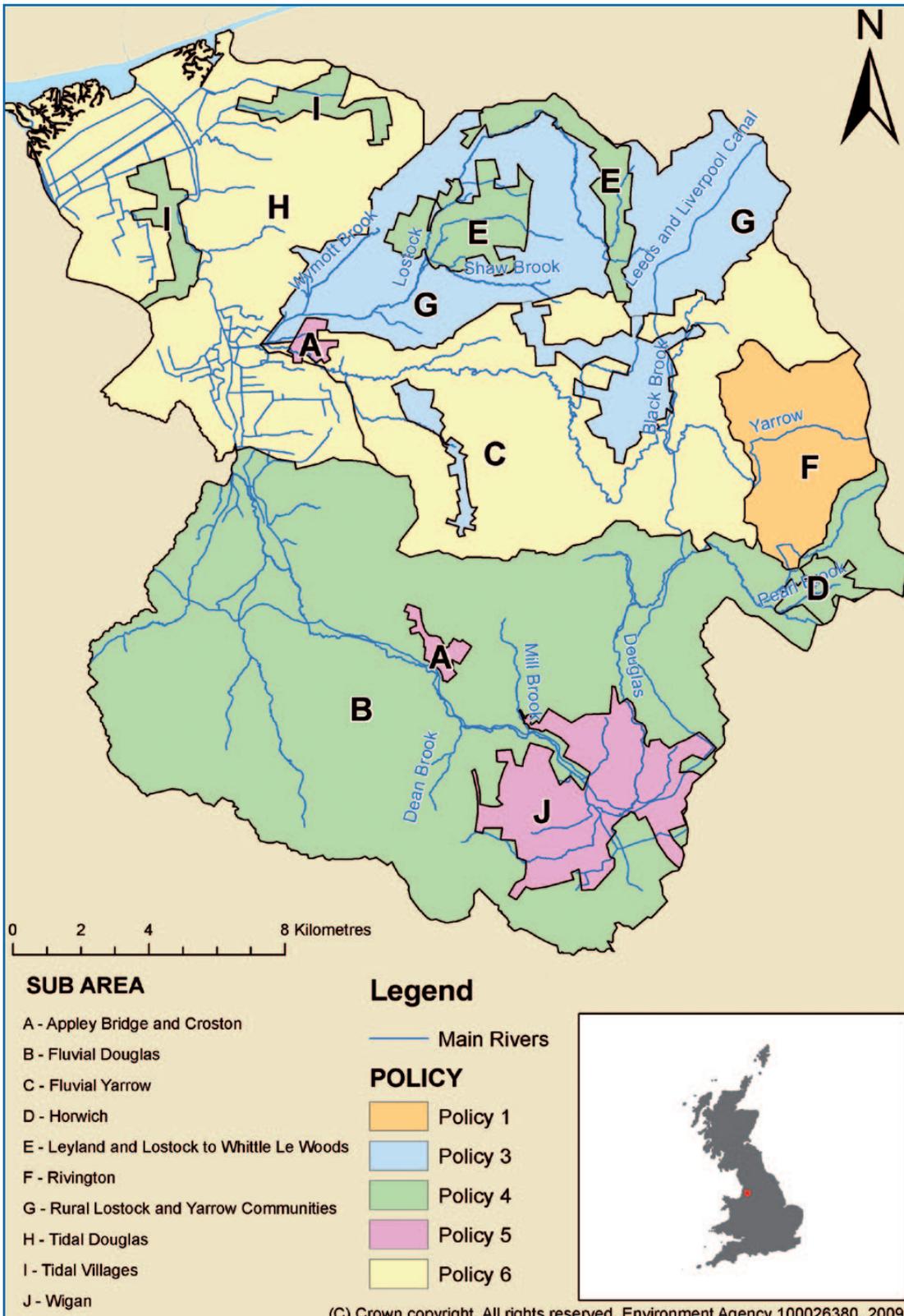
The essential actions to achieve our policy aim are listed below:

- Undertake a risk assessment on culverts and other flow restrictions in the sub-area. Prioritise these structures for redesign, replacement or removal according to the flood risk. This includes the River Chor in Chorley.
- Investigate the standard of protection provided by the existing main river network and seek to reduce flood risk in a sustainable way. This is likely to be achieved through maintenance works and targeted improvements to structures and river channels, but will consider other approaches where appropriate.
- Work in partnership with the local authority and United Utilities to address sewer and local surface water flooding and promote joint solutions where surface water and sewer flooding is known to exist.
- Develop a communication plan for reservoir maintenance and management of emergency release from Rivington reservoirs.
- Undertake a study to improve understanding of interaction between river flow and tide in the downstream parts of the sub-area and their impact on flood risk. Determine current and future risk to property and high grade agricultural land from combined events.
- Investigate opportunities to remove or realign embankments, create flood storage areas or other alternative means of flood risk management. Changes in land use may provide flood risk benefits and create habitat.



↑ Syd Brook at Eccleston

Map of CFMP policies



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