



Environment
Agency

Irwell Catchment Flood Management Plan

Summary Report December 2009



A photograph of a river at sunset, with the sky filled with warm orange and yellow hues. In the background, a city skyline is visible across the water. The foreground shows the calm surface of the river reflecting the light. Overlaid on this image is the title text "managing flood risk" in large, white, sans-serif font.

managing flood risk

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Introduction



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

The Irwell 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.

In the Irwell catchment, the main source of risk is flooding from rivers (fluvial flooding). Localised floods due to overloaded urban drainage/sewer systems, surface water and blocked culverts also occur.

Salford is the main area at risk and in 1946, some 5000 properties flooded. It is estimated that 7,500 properties in the catchment have a 1% probability of fluvial flooding each year. We estimate that by 2100 approximately 10,000 properties in the Irwell CFMP area could be at risk of fluvial flooding. This is an 8% increase compared to the current number.

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 manage 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 amongst others: AGMA, Peel Ports, Defra, United Utilities, Natural England and English Heritage.

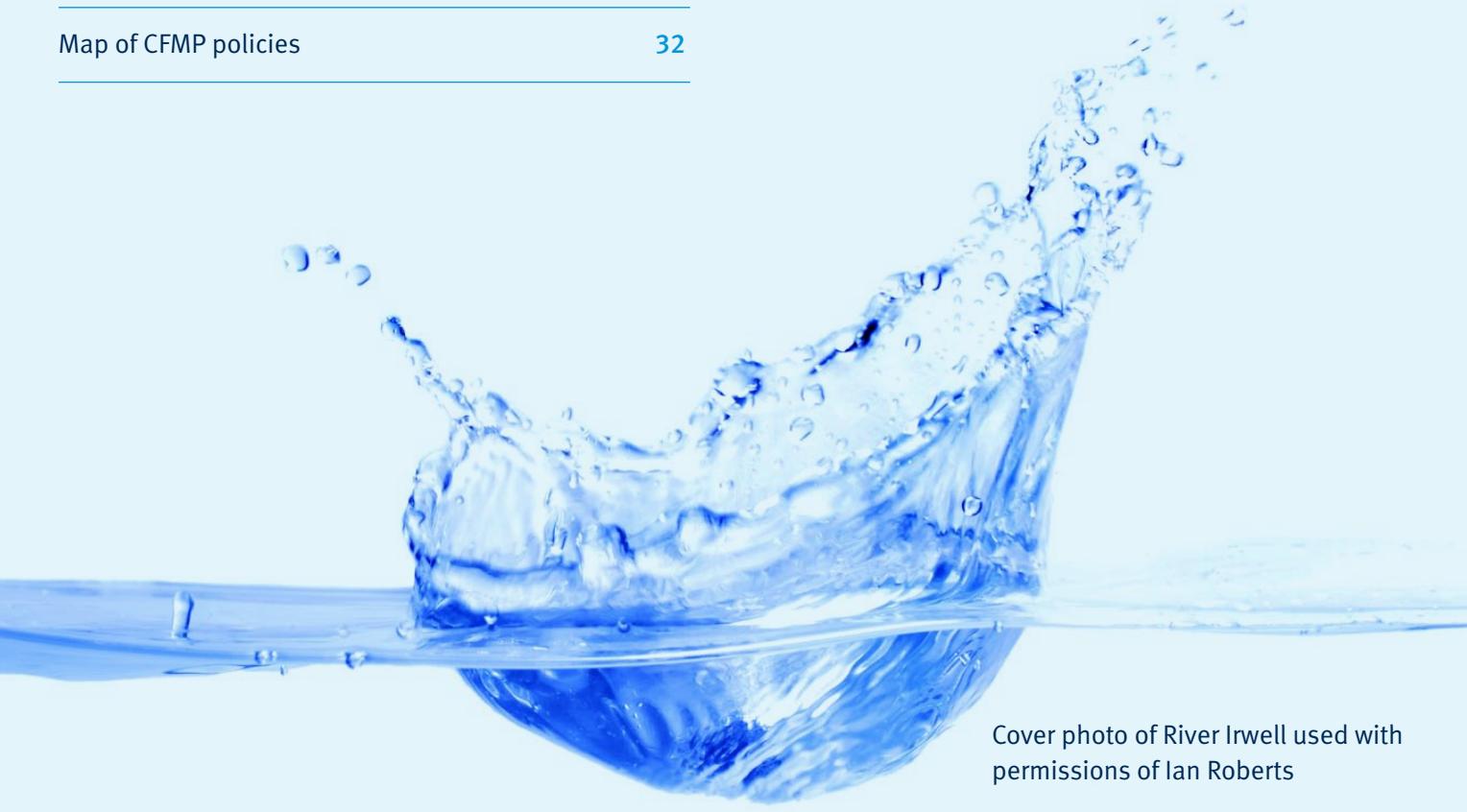
This is a summary of the main CFMP document, if you need to see the full document an electronic version can be obtained by emailing enquiries@environment-agency.gov.uk or alternatively paper copies can be viewed at any of our offices in North West Region.



Tony Dean
Regional Director

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Cover photo of River Irwell used with permissions of Ian Roberts

The purpose of a CFMP in managing flood risk

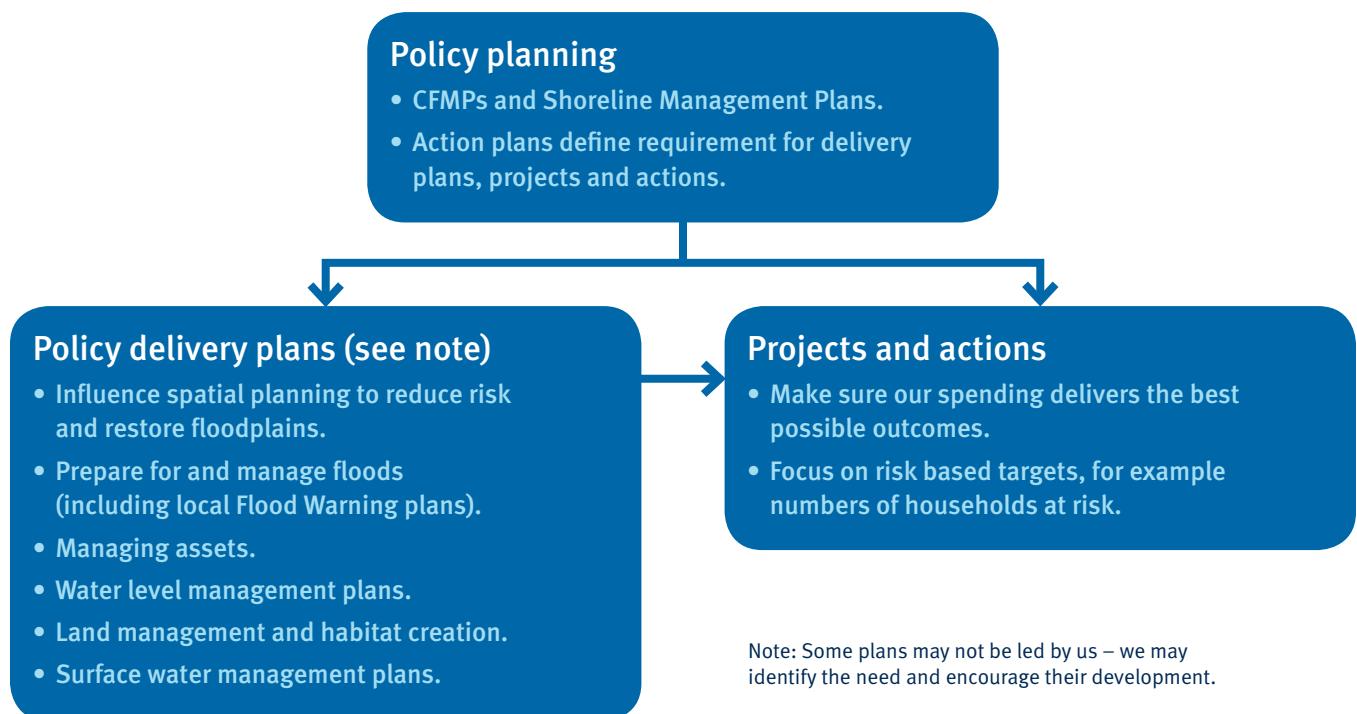
CFMPs help us to understand the scale and extent of flooding now and in the future, and set policies for managing flood risk within the catchment. CFMPs should be used to inform planning and decision making by key stakeholders such as:

- 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.
- 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.

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 River Irwell catchment drains the highly urbanised area to the north of Manchester. The catchment covers over 700 square kilometres and is home to over two million people. The towns with the highest populations include Manchester, Bolton, Oldham, Salford and Rochdale. The main rivers are the Irwell, Roch, Croal, Medlock and Irk, all of which flow (via the Irwell) into the Manchester Ship Canal.

The sources of the main rivers are found in the Pennines, where land rises to 450 metres above sea level in the north and east of the catchment. In the lower catchment, in the south and southwest, the elevation is 20 metres above sea level. A large proportion of the catchment's geology and soils are relatively impermeable, meaning that water is more likely to remain on the surface than drain through to groundwater. There are many towns and two cities within the catchment, along with agricultural areas which include pasture for sheep and cattle, some of which are in upland moorland areas.

The rapid expansion of industrial development in the late 19th century and its subsequent decline in the late 20th century has left many of the watercourses in the Irwell catchment in a heavily modified condition, with many kilometres of walled banks and culverts. The same industry means the catchment has a rich cultural heritage, including a wealth of

mill buildings, reservoirs and mill lodges. In addition there are a number of Scheduled Ancient Monuments (SAMs), and parts of Manchester and Salford have recently been nominated as candidates for World Heritage Status.

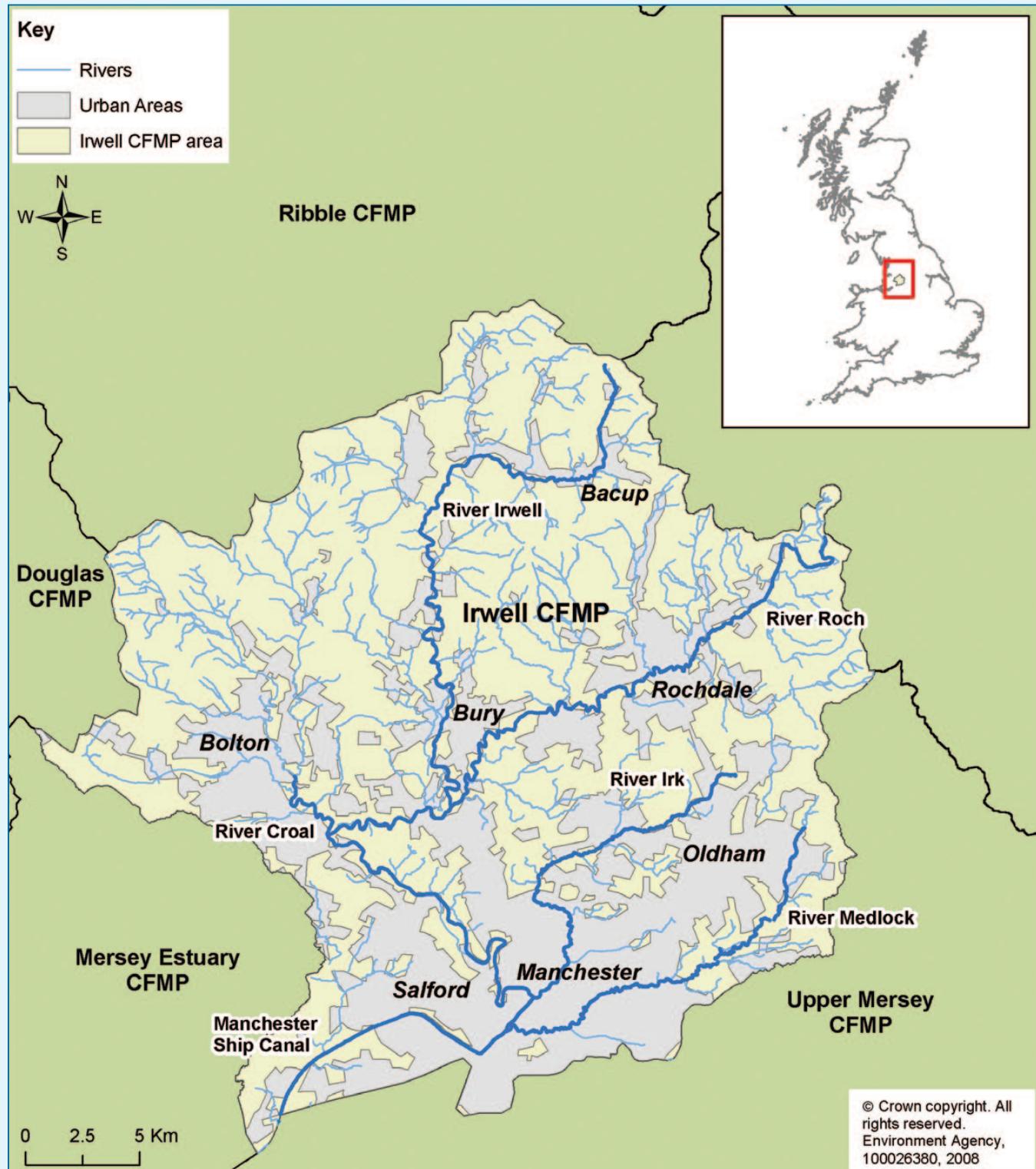
The highly urbanised nature of the catchment means it is one of the least naturally wooded areas in the North West. Despite the predominance of urban areas, there are numerous nature conservation sites of national and international importance, including 14 Sites of Special Scientific Interest (SSSIs) including, Nob End, Hodge Clough, Tonge River Section, Longworth Clough and Oak Field. Some of

the SSSIs are also Special Areas of Conservation (SACs) including The Rochdale Canal and The South Pennine Moors which is also a Special Protection Area (SPA).



↑ Flood storage Salford Basin in operation

Map 1 Irwell CFMP main features



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 quoted in this report are those that take account of flood defences already in place.

The Irwell Catchment has a history of flooding with Salford being the worst affected. In 1946 over 5000 properties were flooded from the River Irwell. A few years later Salford was flooded affecting 600 properties. The area has settlements close to the banks of the rivers due in part to the industrialisation in the 19th century. This means communities are at risk of flooding from the Irwell and its many tributaries. Rochdale flooded in 1991 affecting over 80 properties and Crawshawbooth flooded in 1999 affecting over 50 properties.

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

- River flooding in the upper catchment affects the relatively small settlements and towns such as Littleborough, Rochdale, Bacup, Haslingden, Ramsbottom, Stubbins, Whitworth and Rawtenstall. There is a short time

to peak in these generally narrow valleys, and the local population has insufficient time to react and reduce the consequences of flooding. The flooding regime in these areas is often described as “flashy”. The middle catchment is characterised by a flatter and lower topography. Settlements such as Bury, Radcliffe and Middleton are found here. The time to peak is around four to five hours and for fluvial flooding to occur here, it normally requires more widespread heavy rain and/or a prolonged period of wet weather. The lower catchment is where the topography is the lowest, and is the most extensively urbanised area of the catchment, with the cities of Manchester and Salford located here. Flooding is caused by widespread heavy rain and/or prolonged periods of wet weather throughout the catchment. The effects of these are twofold: firstly, dangerously fast flowing water and, secondly, large areas of ponded water up to two metres deep. The Irk and the Medlock join the Irwell in Manchester City centre and these rivers then flow into the Manchester Ship Canal where its flows are regulated.

- 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.

- Sewer flooding is usually caused by an inadequate sewer capacity or blockages within the network. Sewer flooding is known to affect parts of Rawtenstall, Rochdale and Littleborough, as well as Bolton and Oldham and in part is thought to be due to runoff surcharging the drainage systems. Sewers may also flood due to backing up as a result of high river water levels during times of flood. Areas within Salford and Manchester are known to be affected by this type of flooding, although there are limited records of this occurring in recent years. United Utilities have an ongoing programme of work to maintain and improve public sewers.
- Even though the Irwell CFMP area contains areas of permeable bedrock at or near the land surface and some underlying aquifers groundwater flooding is not seen as a major issue in the area.

What is at risk?

Using hydraulic models and floodmaps where no models exist we estimate that 7,500 properties in the catchment have a 1% chance of fluvial flooding each year. There are five areas of special scientific interest (Nob End, Hodge Clough, Tonge River Section, Longworth Clough and Oak Field) and one scheduled ancient monument within the 1% annual probability flood extent, which could be affected by a flood. The Rochdale Canal (SSSI and SAC) has a small area at risk in an extreme flood.

Where is the risk?

The catchment has a history of flooding. Salford, Rochdale and parts of the Rossendale Valley have been most affected by past fluvial flood events. In many of the areas at risk, socially vulnerable groups can be found who might find it difficult to recover from a major flooding incident. The rapid expansion of industrial development in the late 19th century and its subsequent decline in the late 20th century left the Irwell Catchment with an unfortunate legacy. Many of the watercourses are heavily modified and riverside development has resulted in approximately 5,000 properties at risk from main river flooding. There are over 1300 culverts in the catchment, the condition and capacity of which has a significant effect on flood risk. Radcliffe, Ramsbottom, Rochdale and Salford have areas where there is significant flood risk to people as either the depth of flooding or the velocity of the water is enough to pose a serious hazard in a significant flood event.

The map overleaf shows 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 carried out to quantify this potential risk.

Table 1. Locations of Towns and Villages with 100 or more properties at risk in a 1% annual probability river flood

Number of properties at risk	Locations
Over 1000	Salford, Manchester City Centre
500 to 1000	Rossendale Valley, Radcliffe, Rochdale Area
100 to 500	Swinton and Eccles, Bradford and Deansgate, Ramsbottom, Rural Areas, Bury, South Oldham/Droylsden, Bolton
50 to 100	North Oldham, Whitefield, Kearsley/Kersal, Milnrow/Shaw, Middleton/Chadderton
25 to 50	None

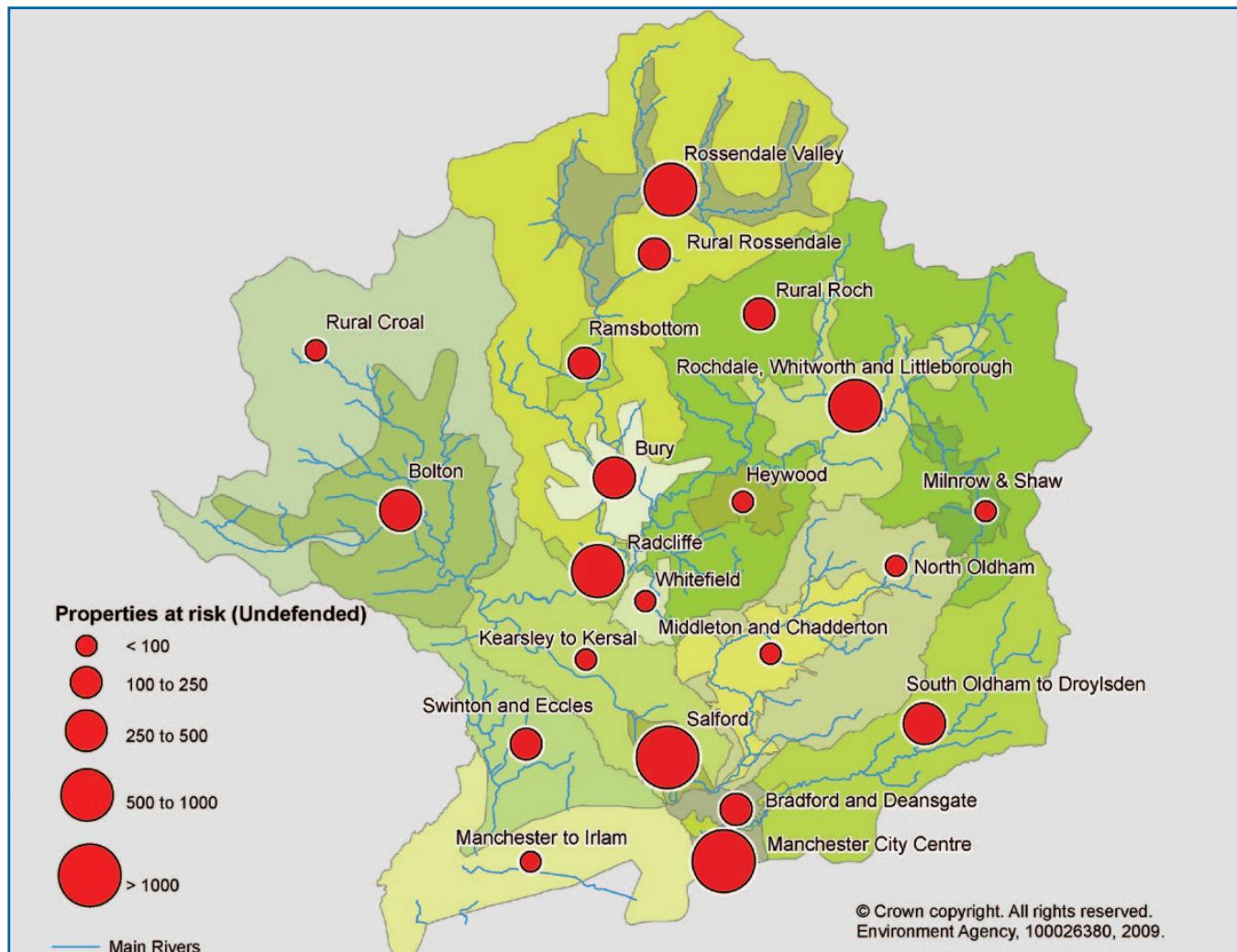
Table 2. Critical infrastructure at risk:

2.5km of Motorway, 8.5km of A-roads, 10 sections of railway line, 8 Police Stations, 3 Fire/Ambulance Stations, 176 Gas/Electricity assets, 1 Telephone Exchange, 5 Sewage Treatment Works, 1 Water Treatment Plant, 41 Schools, 21 Care Homes, 1 Hospital, 59 Health Centres.



↑ Salford Quays

Map 2 Risk to property across catchment for a 1% annual probability fluvial event (undefended)



How we currently manage the risk in the catchment

The Irwell Catchment contains a large amount of historic and more recently constructed flood defences. Some small local flood embankments protecting agricultural land are also evident, as are mill walls and industrial structures close to rivers that were not constructed to act as flood defences.

Recent schemes have benefited the following communities as follows:

- The construction in Salford of the River Irwell Flood Control Scheme. The scheme consists of flood walls, embankments, and

an off-line flood storage basin with a capacity of 650,000m³ and provides protection for a 1.3% Annual Probability Event (APE).

- Construction of flood defences in Ramsbottom, Rochdale and Littleborough provide design protection for a 1% event.

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 40km of raised defences and 1,300 culverts. The Environment Agency has to inspect and maintain a significant proportion of these structures, but many are owned by third parties.
- Enforcement where riparian owners and others carry out work detrimental to flood risk, or neglect their responsibilities.

The impact of climate change and future flood risk

- Identifying and promoting new flood alleviation schemes or studies where appropriate, such as in Manchester City Centre and in Salford where a second flood alleviation basin has been proposed. There is also strategy work ongoing in Ramsbottom, Radcliffe, Rossendale and for the Irk and Medlock.
- 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).

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 over 8000 properties in six areas of the Irwell catchment.
- Providing flood incident management.
- 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.

* Estimate from 0.5% flood outline

** Estimate from flood zone 2

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

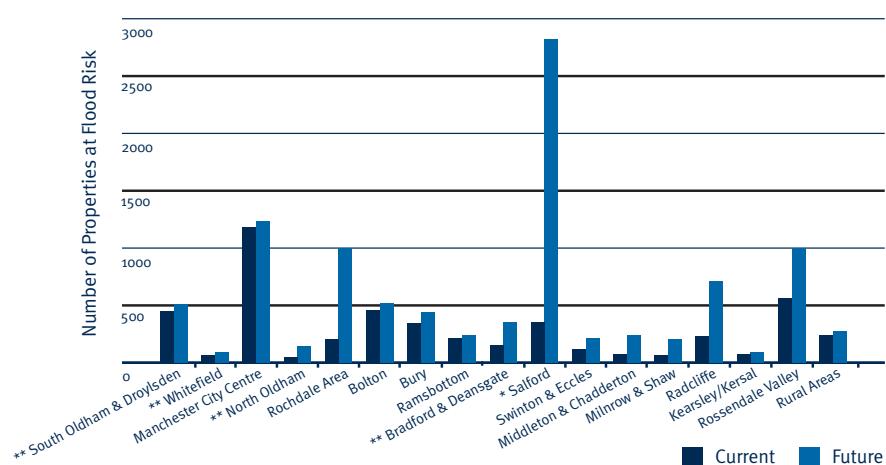
- More frequent and intense storms causing more widespread flooding from drainage systems and some rivers.
 - Wetter winters increasing the likelihood of large-scale flooding.
- The future scenarios used in the Irwell CFMP were:
- A 20% increase in peak flow in all watercourses. The predicted increase in flow can affect the frequency, timing, scale of flooding and the flood levels.
 - Increased urbanisation, up to 12%.

We estimate that by 2100 approximately 10,000 properties in the Irwell CFMP area could be at risk of fluvial flooding. This is a 30% increase compared to the current number. Flood levels are expected to increase by up to 1m at Salford, by 0.9m at Radcliffe and 0.5m in Rochdale by 2100. One additional environmental site is very close to the predicted future flood extent as are three further heritage sites, these may be at risk of flooding in the future. The flood depth and extent of flooding is expected to increase slightly at the sites in the current 1% flood extent.

Figure 2 shows the difference between current and future flood risk for a 1% annual probability event at key areas in the catchment (new data used where available).

Following on from the CFMP organisations need to work together to investigate flood risk from other sources (e.g. surface water and sewer flooding) in more detail.

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 Irwell 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 the Making Space for Water strategy. 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

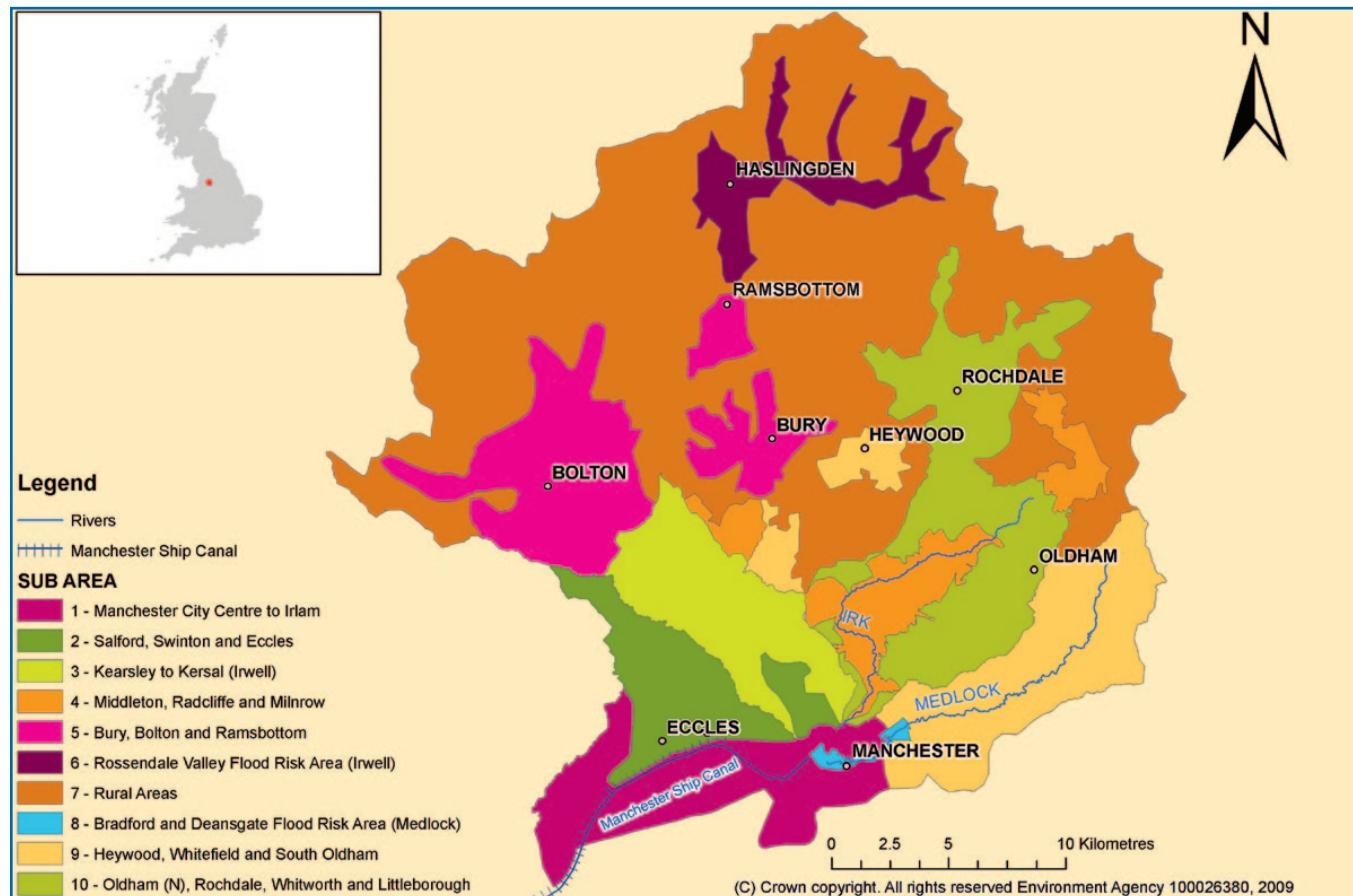


Table 3 Policy options

→ 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.

Manchester City Centre to Irlam

Our key partners are:

Manchester City Council

Salford City Council

Trafford Borough Council

Peel Ports

British Waterways

Flood maps indicate there are approximately 1,200 properties potentially at risk from river flooding in a 1% APE, although this does not currently indicate risk from the canal. There are also potential flood risk issues with increased development and surface water flooding. In the future, by 2100, we estimate 1,800 properties may be at risk in a 1% event.

Development adjacent to the Irwell, such as the recent Spinningfields and planned Irwell City Park is thought to be above likely flood levels, but potentially hundreds of commercial premises could be at risk in an extreme flood.

risk in this urban area and issues related to development.

The key messages

- Flood risk in the areas bounding the Manchester Ship Canal is currently low, but this relies on continued maintenance of the canal structures. Flood risk in the City Centre area is thought to be high, but this is based on limited information. There are no computer models of flood flows in parts of the city centre and further work is required to evaluate the flood risk.
- In Manchester City centre much of the flood risk management work is concerned with the continued maintenance of the ageing channel (walls) along the Irwell.
- Valuable commercial and retail premises line much of the river and canal, and there is potential for further development in the future - this could cause future problems with surface water flooding/drainage.
- Any future increase in flows from the Irwell catchment would affect the area and the Ship Canal, therefore any future flood risk management activities further upstream are important.

The issues in this sub-area

This is an urban area containing the centre of Manchester and the areas that line the land along the Manchester Ship Canal including Salford Quays and Trafford Park. It contains important cultural, industrial and commercial developments. In the centre of Manchester, the Irwell was previously navigable, and has a canal-like character, with raised walls creating a channel with a very large capacity to convey flows. Here the Rivers Irwell and Irk meet to form the Manchester Ship Canal that takes the flow downstream where the Medlock joins. Although the canal is used for navigation, it also plays a role in reducing flood risk in Manchester and other areas. The sluice structures that regulate the Ship Canal were designed to keep canal water levels relatively constant, and raised embankments and walls create a channel with a very large capacity to convey flows.

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.

Should flooding occur in the future, potential damages would be high due to the value of surrounding development. Therefore, a policy to take further action to prevent flood risk increasing in the future is justified. Initially this may be achieved by working in partnership with Peel Ports and with the City Councils to better understand flood

Proposed actions to implement the preferred policy

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

- Undertake more detailed studies to identify current and future flood risk in Manchester City Centre, including formation of a steering group with representatives from partner organisations.
- Develop a flood risk strategy for the Central Manchester area (including the non-main sections of the River Irwell) to improve understanding of flood risk and identify future management needs.
- Continue to provide advice on development issues so as not to increase direct flood risk and/or surface runoff.
- Undertake more detailed studies to identify current and future flood risk from the Manchester Ship Canal.
- Explore options to manage future increases in flow.



↑ River Medlock

Salford, Swinton and Eccles

Our key partners are:

Salford City Council

United Utilities

Landowners

The issues in this sub-area

Salford is an urban area with a mixture of residential and commercial property. It is the location of the largest historic flood in the Irwell catchment in 1946, when an estimated 5000 properties were flooded. The area is a key site for regeneration in the North West and many properties are located in the floodplain of the River Irwell.

In this policy area is the low lying suburban area that drains a number of small watercourses into the Manchester Ship Canal in the Swinton and Eccles area.

The main cause of flood risk in this area is insufficient channel capacity leading to flooding of small watercourses or culvert blockages this combined with development within the natural floodplain, increases surface water and sewer flooding.

Flood maps indicate that this policy area has nearly 2,000 properties at risk of flooding in a 1% APE, although flood maps are currently being revised in the Worsley Brook area.

In Salford New development has been carefully designed to be resilient to flooding, and a Flood Protection Scheme involving a storage basin was completed in 2005. This basin successfully protected Salford from flooding in January 2008. In the future, due to climate change, we estimate using flood maps over 3,000 properties may be at risk in a 1% event.

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.

Due to the high current and future risks to property and infrastructure, high levels of community disruption and risk to life if flooding occurred (Salford), the policy is to take further action to reduce risk. This will encompass an appraisal of the various flood risk management options for the sub-area and may include making properties more resistant and resilient to flood events and through effective planning and development control.

water levels in the future by up to one metre (Salford).

- Flood defences, including walls and a storage basin, protect Salford from most floods, but a very large event could bypass or overtop some of these defences.
- We provide a free flood warning service to over 7000 homes and businesses in this area, however sign up to the service is low which means that people may not be able to react in time to save possessions or leave the area.
- Numerous sites have been identified for development, with some of these covering a fairly substantial area - this could cause future problems with surface water flooding/drainage.
- There are a significant number of culverts within the area. The condition of the culverts and the flood risk that they pose vary widely. Limited channel capacity increases the flood risk and the problem is accelerated by increased debris build up and sedimentation.

The key messages

- Flood risk in area is high, with a historic record of flooding (incl. sewer flooding) and thousands of properties located in the floodplain. Predicted increase in

Proposed actions to implement the preferred policy

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

- Continue to provide advice on development issues, and ensure inappropriate development does not take place in flood risk areas, so as not to increase direct flood risk and/or surface run-off.
- Develop a Flood Risk Management Study for the Swinton and Eccles areas as part of the wider Glazebrook catchment study to assess viable options to reduce flood risk.
- Identify routes of culverts and monitor their condition. Undertake a risk based assessment where the condition and hydraulic capacity is unknown. Consider remedial work such as debris screens and removal of culverts where appropriate.
- Further investigations into the potential for a second flood storage basin in Salford or upstream, or look at alternatives to reduce future flood risk.
- Promote the Flood Warning Service to local residents and businesses to increase the number of people receiving warnings. Look to improve flood forecasts and timing of warnings.



↑ Irwell at Salford

Kearsley to Kersal

Our key partners are:

Salford City Council

Bolton Metropolitan Borough Council

United Utilities

The issues in this sub-area

The area has a variety of land uses including urban, agricultural, parkland and woodland areas. It is an area containing important infrastructure such as part of the M60 motorway, sewage treatment works at Ringley Fold, railways and a prison at Hall Hill. The area has environmental and cultural importance, with two Special Sites of Scientific Interest (SSSIs) located on the river banks. The risk from fluvial flooding is low. Flood maps indicate that 75 properties are at risk of flooding in a 1% event. It is estimated this will increase to 150 by 2100 due to the effects of climate change. An environmental risk is present at Ringley Fold Sewage Treatment Works which, if flooded, could cause ecological damage to the river.

shown that substantial upstream storage is required. There may be suitable land for this type of action in this sub-area. The policy is therefore to take action with others to store water or manage runoff in this area, to potentially reduce flood risk further downstream in Salford and Manchester.

The key messages

- Flood risk in this area is currently low, with the exception of isolated sites. Predicted future increase in water levels is low at 0.3 metres.
- Ash Clough and Nob End SSSIs should be protected from any negative impacts from river and flood management, operations have been highlighted which are likely to damage the SSSIs.
- We are producing a strategy for the Lower Irwell to look into the feasibility of flood storage in this area.

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.

A review of potential measures to combat future increases in flood risk across the whole catchment has

Proposed actions to implement the preferred policy

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

- Develop a Flood Risk Management Strategy for the Lower Irwell. This will focus on possible ways of reducing flood risk in Salford.
- Identify potential storage areas (either natural floodplain storage or sites for storage basins) in this area.
- Continue to provide advice on development issues so as not to increase direct flood risk and/or surface run-off, including working with United Utilities to assess flood risk to sewage treatment works.



↑ Ringley Old Bridge

Middleton, Radcliffe & Milnrow

Our key partners are:

Bury MBC

Manchester City Council

Rochdale MBC

Oldham MBC

local landowners

United Utilities

Lancashire County Council

flood defences (Radcliffe). Flooding problems may be made worse by build-ups of gravel and debris, and culvert capacity issues. Around Milnrow and Shaw rapid run-off from the steep-sided catchment, flows through extensively modified and constrained watercourses that can lead to flooding. There are also sewer-flooding problems identified at Crumpsall and Middleton, although the Crumpsall problems are remote from the main watercourse and not thought to be linked to high river levels in the Irk.

and regeneration. Reducing sewer flooding will help improve water quality within the Irk, and the lower parts of the Irwell.

The key messages

- Flood risk in this area is high, in some places the predicted increase in future water levels is around 0.8 metres. We need to better understand this level of flood risk, and decide whether it should be managed differently.
- Flood risk in this area is localised and in places it is linked to historical development along the watercourse which included modifying the river by straightening and culverting. There are some existing defences.
- Flood defences currently protect Close Park in Radcliffe and commercial land at Pioneer Mill and Redvales from most floods, but a very large event could bypass these structures. Some of the defences are in poor condition and it is uncertain whether these will continue to protect properties as they fall into disrepair, or if flood risk increases in the future.
- The Irwell Flood Warning Management Plan recommended that a Flood Warning System be developed in the area.
- Parts of this area will be redeveloped in the future, and may offer opportunities to reduce flood risk, for example, by restoring floodplain.

The issues in this sub-area

This sub-area consists of three separate urban areas much of it developed during the industrial revolution. There are still industrial and commercial buildings in use next to the rivers. The area extends from Manchester City Centre and follows the River Irk upstream through Cheetham Hill, Crumpsall, Middleton and Chadderton. It includes the areas around Radcliffe on the River Irwell and around its confluence with the Roch. Included also are Milnrow and Shaw in the upper part of the catchment on the River Beal, a significant tributary of the River Roch. Within the area, there is important infrastructure and a number of recorded historic and environmentally sensitive locations.

The main risk areas are at Radcliffe, Blackford Bridge, Pioneer Mills, Milnrow and Middleton. Flood maps indicate there are over 850 properties at risk of flooding in a 1% APE, 400 of which are currently protected by

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.

Current and future flood risk to property, infrastructure and the environment are high. Levels of community disruption and risk to life in this area necessitates a policy to take further action to reduce risk. This might include constructing new flood defences, improving current structures or decrepit channels. Communities and properties need to be made more resilient to flood events through effective planning

Proposed actions to implement the preferred policy

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

- Develop a Flood Risk Management Strategies for the Radcliffe area, for the River Beal, (as part of the River Roch) and for the River Irk (as part of a wider Central Manchester Strategy) to assess viable flood risk reduction options.
- Continue inspecting the condition of existing defences, investigating where appropriate local schemes to refurbish or improve defences where suitable.
- Identify and monitor culvert condition and undertake a risk-based assessment where the condition and hydraulic capacity is unknown; undertake remedial works where appropriate.
- Continue to provide advice on development issues so as not to increase direct flood risk and/or surface run-off.



↑ River Beal natural channel

Bury, Bolton and Ramsbottom

Our key partners are:

Bury Metropolitan Borough Council

Rossendale Borough Council

Bolton Metropolitan Borough Council

Landowners

The issues in this sub-area

This sub-area consists of three separate mainly urban areas. Bolton centre and settlements on the outskirts, along with the town of Ramsbottom.

The areas are located in the centre of the catchment where the gradient of the Irwell is flatter and surrounded by moorland. Much of the area grew rapidly during the Industrial Revolution with the development of mill buildings and commercial and residential properties on the floodplain. Most of the watercourses are heavily modified and contain a large number of culverts and weirs.

Bury does not have a history of significant flooding but Ramsbottom does have a history of flooding, and in 2000 a scheme was constructed which defends around 115 low lying properties from flooding. In Bolton, the principal sources of flood risk are from the abundance of culverts on ordinary watercourses and the capacity of the sewerage system. Fluvial flooding along the principal rivers of the Croal and Tonge has not been identified as a significant issue.

In the sub-area, around 1,000 properties are at risk of flooding in a 1% APE, mainly in Ramsbottom and Bury. In very large floods, areas of commercial and residential property in Bury are at risk in the Redvales and Elton districts as well as Blackford Bridge Waste Water Treatment Works. In Ramsbottom, a flood warning service is provided. The main contributing factors to flood risk are channel capacity problems, thought to be caused by sedimentation. Particular problem areas are around culverts that can block if debris is not cleared regularly. In the future due to climate change it is estimated around 1,200 properties will be at risk in a 1% event by 2100.

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 growth of urban areas, the need to maintain channel capacities and value of surrounding land justifies a policy to take further action to sustain current levels of flood risk in the future. This may include development and planning measures, such as identifying areas of floodplain storage, in preference to constructing new defences and long-term gravel/sediment management strategies where it is critical channel capacity is maintained. We will look to reduce flood risk from smaller watercourses that may otherwise

increase in the future due to increased urban development.

The key messages

- Flood risk in this area is currently low, and limited to localised areas, but development of land adjacent to the watercourse can increase risk. Greater flows are predicted due to climate change. This could cause future problems with surface water flooding/drainage.
- Many of the raised defences along the Irwell are believed to be in a poor condition, with concerns such as broken bricks and bare ground on the banks. There are many culverts, some in poor condition and some on minor tributaries. It is believed over 120 properties are near enough to be affected by high flows or flooding resulting from blockages.
- Flood risk in this area is currently managed with localised defences, but this relies on continued monitoring of channel capacity, sedimentation and operation of existing defences.
- Consideration should be given to long-term gravel/sediment management strategy for this and neighbouring areas with the aim of finding a more sustainable approach.
- In Bury, future increase in flows could potentially affect Nuttall Park, where there is a risk of environmental pollution due to the location of the wastewater infrastructure.

Proposed actions to implement the preferred policy

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

- Undertake studies in the Ramsbottom, Bolton and Bury areas to assess options to reduce future flood risk.
- Consider identifying potential flood storage areas.
- Review Gravel Management Strategies (Upper Irwell and Roch) to identify how sustainable sediment management influences flood risk in Ramsbottom and alter maintenance strategies as appropriate.
- Continue localised investigation of flooding from small watercourses, such as Bessy Brook, to assess feasibility of defences and install where suitable.
- Continue to provide advice on development issues so as not to increase direct flood risk and/or surface run-off.



↑ Ramsbottom Weir

Rosendale Valley

Our key partners are:

Rosendale Borough Council

Local Landowners

The issues in this sub-area

The towns in the Rosendale Valley have developed in narrow, steep sided valleys adjacent to the watercourse. They have a long history of flooding from the river, urban drainage and from surface run-off from fields and moorlands. Small settlements like Strongstry, Chatterton, Stubbins and Irwell Vale generally have little protection from floods. The area has many culverts on the main river, some of these are collapsing or have low capacity. Build-up of gravel and debris in the river might increase flood risk and gravel removal has been undertaken historically. Flood maps show around 650 properties are at risk of flooding in a 1% APE and by 2100 climate change is expected to increase this figure to 1,000 properties.

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.

Analysis of the water level at Stubbins, where there is a relatively wide floodplain, shows that climate change could result in a small increase in water level. Further upstream, where the channel is more confined by walls and the

valley sides, increases will be greater. We will take action to decrease flood risk, and to account for future increases in risk. Actions might involve maintaining channel capacity by ensuring culverts and river-side walls are in good condition, managing gravel where it increases flood risk, and increasing flood resilience.

The key messages

- Flood risk in this area is high, there is a history of flooding and hundreds of properties located along the river in the narrow valley of the Upper Irwell are at risk.
- There are few formal flood defences, but much of the channel is walled and there are many culverts. Some of these structures are in poor condition and future maintenance is essential; responsibility for these structures lies with the landowners.
- As the towns are quite high in the catchment, it is not possible to give flood warnings to all areas and where we do, we can only offer 2-3 hours warning of floods. Floods can occur rapidly due to the steep valleys and lack of natural floodplains.

Proposed actions to implement the preferred policy

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

- Carry out a study of flood risk in the Upper Irwell area to identify possible ways of reducing flood risk. This might include removing old walls and culverts where possible, or identify natural floodplains that could be used for flood storage. It should also include a review of how gravel affects flood risk and how its management could be changed in the future for flood risk and environmental gain.
- Look at culvert condition in urban areas, and undertake an assessment of risk where the condition and hydraulic capacity is unknown; carry out remedial works such as redesign or removal where possible for flood risk and environmental gain.
- Continue to provide advice on development issues so as not to increase direct flood risk and/or surface run-off.



↑ Irwell upper reaches

Rural Areas

Our key partners are:

Rossendale Borough Council

Blackburn with Darwen Borough Council

Burnley Borough Council

Bolton Metropolitan Borough Council

Rochdale Metropolitan Borough Council

Edge Forest

Natural England

Red Rose Forest

Local landowners

The issues in this sub-area

Located in the middle and north of the Irwell catchment, this area is mostly upland, surrounding the steep sided valleys of the Upper Irwell catchment and Rossendale Valley. This area contains the headwaters of the Roch and Spodden and the principal rivers that drain the Croal catchment. It is sparsely populated with the exception of some villages and historic industrial sites. The current level of flood risk to people and property is low, because of the low density of development.

The headwaters are characterised by moorland and large reservoirs such as Delph, Jumbles, Hollingworth Lake and Watergrove that regulate flows in the main tributaries.

There is another source of flooding is surface water run-off from steep fields and moorland, especially after heavy rainfall. There are frequent but isolated floods on brooks and streams, and some risk to individual properties from small tributaries with blocked culverts. The rural land use means that flooding does not create major risks. Approximately 240 properties have a 1% chance of flooding each year over this large rural sub-area. This is expected to increase to around 275 by 2100 due to climate change.

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.

Natural land cover in this area is likely to have been changed by grazing, peatland management and deforestation. These changes could contribute to increased run-off. Land management could potentially play a key role in reducing local flood risk by reducing rates of runoff, and may have a benefit further downstream in the more urbanised Rossendale Valley, Croal valley around Bolton and the Roch valley around Littleborough and Rochdale.

The key messages

- Flood risk in this area is low, due to low population and small streams.
- Actions to reduce run-off from the upper catchment could have local benefits and provide some help to reduce peak flows downstream.
- Part of this area near Rochdale is a site of international environmental importance and it is designated as a Sites of Special Scientific Interest (SSSI) on ecological and geological grounds, which may constrain flood risk actions.

Proposed actions to implement the preferred policy

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

- Explore ways of achieving land management change to reduce run-off from the upper catchment, for example through blocking of moorland grips, creation of storage ponds, targeted woodland creation.
- Part of this rural area is a site of international environmental importance and it is designated as a SSSI on ecological and geological grounds, which may constrain flood risk actions.



↑ Belmont Reservoir

Bradford and Deansgate

Our key partners are:

Manchester City Council

Landowners

Peel Ports

British Waterways

The issues in this sub-area

This is an urban area containing areas of high value commercial and residential properties, including the current BBC building on Oxford Road and several listed buildings along Deansgate. The River Medlock is highly modified in this area with a low gradient that increases the potential for sediment and debris to build up in the channel. The area contains no functional floodplain as the channel is deepened and the areas prone to flooding are paved and artificially drained. There is no detailed hydraulic model for the Medlock, therefore the scale of flood risk is not well understood, but currently we estimate using flood maps around 150 properties are thought to be at risk in a 1% event. Climate change is estimated to increase this to 350 by 2100. Just downstream of this area, the Medlock discharges into the Manchester Ship Canal via a number of syphons and sluices. The Environment Agency liaises with the Peel Ports over the operation of the sluices to ensure the Medlock can discharge freely during flood events.

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.

The high value of development in this area justifies a policy to take further action to reduce flood risk, initially by increasing understanding of the flood risks.

The key messages

- Historic flood risk in this area is thought to be low, but this is based on limited information as there are no computer models of flood flows in this part of the catchment.
- In the Bradford area, there is some large residential and commercial development adjacent to the new City of Manchester Stadium. Some proposed developments are located close to the watercourse - this could cause future problems with surface water flooding/drainage.
- Many walls along the Medlock are believed to be in poor condition, or are not formal defences. Approximately 2% of walls contain gaps either caused by deterioration or breaches.

Proposed actions to implement the preferred policy

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

- Investigate conveyance capacity, identify and mitigate flood risk in Tue Brook and Deys Brook.
- Establish policies within Local Development Frameworks that work towards long term protection and re-creation of watercourse corridors / floodplain through sustainable land use management.
- Encourage Sustainable Drainage Systems (SuDS) as a means of reducing overall flood risk and controlling pollution from urban run-off.



↑ River Medlock near UMIST

Heywood, Whitefield and South Oldham

Our key partners are:

Oldham Metropolitan Borough Council

Tameside Borough Council

Bury Metropolitan Borough Council

Rochdale Metropolitan Borough Council

hydraulic model for the Medlock; therefore the scale of flood risk is not well understood.

Heywood and Whitefield are not thought to be at significant risk from fluvial flooding but much of the area is urbanised so properties could be at risk if culverts become blocked or collapse. United Utilities has identified a number of potential sewer flooding sites within the Oldham and Failsworth areas.

The key messages

- Flood risk in the area is low as development is mostly situated above the floodplain and there are few formal defences.
- On the Medlock there are no computer models of flood flows so there is some uncertainty about the number of properties at risk. Many of the floodwalls along the Medlock are believed to be in poor condition and there are issues with sediment deposition.
- There are also over 100 culverts in the areas, for which the condition and capacity are unknown, these could pose a flooding risk these and may require future maintenance.
- Parts of the area on the River Roch may be included in a wider study of flood risk on that river.

The issues in this sub-area

This sub-area features three geographically separate areas with similar flood risk characteristics. There are urban areas in Droylsden, Openshaw, Failsworth and Oldham but also semi-rural land and open space around the Medlock, and in the east of the area. Whitefield sits to the south of the Roch/Irwell confluence. The land is generally flat but elevated above the river. The area contains some important road links including the M66 and M62/M60 motorways. Heywood is located on the River Roch, between Rochdale and Bury.

Flood maps identify approximately 500 properties are at risk in a 1% APE most of which are in the South Oldham to Droylsden area. We estimate this could increase to over 600 properties in the future due to climate change. There is no

The vision and preferred policy

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

A policy to continue with existing or alternative actions to manage flood risk at the current level was chosen as current management actions appear to be adequate and it is not thought that future climate change scenarios will increase the risk from fluvial flooding significantly. Options to reduce run-off and control development may present the most sustainable options to ensure no increase in flood risk. The proximity of a large number of properties to culverts justifies continuing the development of a prioritised inspection and maintenance regime.

Proposed actions to implement the preferred policy

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

- Develop hydraulic models for the Medlock to increase understanding and extent of flood risk.
- Carry out a study of flood risk on the River Roch to better understand the risk now and in the future, and identify possible management options.
- Develop a Flood Risk Management Strategy for the Medlock, as part of a wider Central Manchester Strategy, to increase understanding and extent of flood risk and suggest possible management options.
- Continue to provide advice on development issues so as not to increase direct flood risk and/or surface run-off.
- Identify and monitor culvert condition and undertake a risk-based assessment where the condition and hydraulic capacity is unknown; remedial works where appropriate.



↑ Parr Brook - Whitefield

North Oldham, Rochdale, Whitworth and Littleborough

Our key partners are:

Oldham Metropolitan Borough Council

Rochdale Metropolitan Borough Council

Rossendale Borough Council

Local landowners

United Utilities

in 2005, to reduce flood risk in Rochdale and Littleborough. We estimate over 750 properties have a 1% chance of flooding each year. In future, by 2100, we estimate this will increase to over 1,100 properties due to climate change. Culverts and bridges that obstruct high flows, as well as build up of gravel at some points in the river, increase flood risk.

with up to a half metre rise at the confluence of the River Spodden and Roch. The identified future increase in risk supports a policy to continue to do more to ensure that flood risk does not increase in the future.

The key messages

- Flood risk is high in the Rochdale area and combinations of high river levels and surface water run-off have been known to cause flooding. Risk in other parts of the sub-area is relatively low compared to other areas of the Irwell catchment.
- Maintenance of culverts on the relatively small watercourses is important to prevent any increase in flood risk.
- Limitations of the wider drainage and sewerage system have links to flood risk in some areas.
- There are plans to re-develop some parts of Rochdale town centre, including areas that are protected by floodwalls constructed in 2005.
- It is uncertain whether recent defences will protect properties if flood risk does increase in the future, and the level of protection the floodwalls offer will need to be reviewed as part of a study on the River Roch.

The issues in this sub-area

In the north of this sub-area is Rochdale and Littleborough, which sit to the upstream end of the River Roch, and Whitworth that lies along the River Spodden. The south of this sub-area covers the wider Irk catchment, comprising urban areas to the north and west of Oldham, and to the north of Middleton, and contains small tributaries of the River Irk and Moston Brook.

In the south of the area the risk of fluvial flooding is lower than in neighbouring areas, but some areas have a history of sewer flooding and there are many culverts that may need future maintenance. The town centre of Rochdale sits within a broad low-lying valley with steep sides and consequently, it crosses a corridor of high flood risk. The River Roch capital scheme was completed

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.

There are over 80 culverts in the area, a quarter of which have been assessed as needing remedial works in the short to medium term. The current level of fluvial flood risk is relatively low, and does not increase significantly with climate change. However the risk from sewer flooding appears to be a problem in certain areas (such as Failsworth and Moston). This could be addressed through improved integrated drainage. There are a number of areas that have been highlighted for future development, including in the city centre along the course of the Roch. This area is sensitive to increases in flow,

Proposed actions to implement the preferred policy

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

- Continue to provide advice on development issues so as not to increase direct flood risk and/or surface runoff.
- Continue to investigate causes of sewer flooding (including links to river processes) and the standards of service in relation to problems, followed by appropriate remedial works where necessary.
- Look at culvert condition and undertake an assessment of risk where the condition and hydraulic capacity is unknown and carry out remedial works such as redesign or removal, where possible, for flood risk and environmental gain.
- Carry out a study of flood risk on the River Roch (on a sub-catchment scale) to better understand the future flood risk, and identify possible management options. This may investigate a range of issues relating to recent flooding including reassessing standards of protection, gravel management and the potential for storage basins and local defences.



↑ River Roch at Rochdale

Map of CFMP policies



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