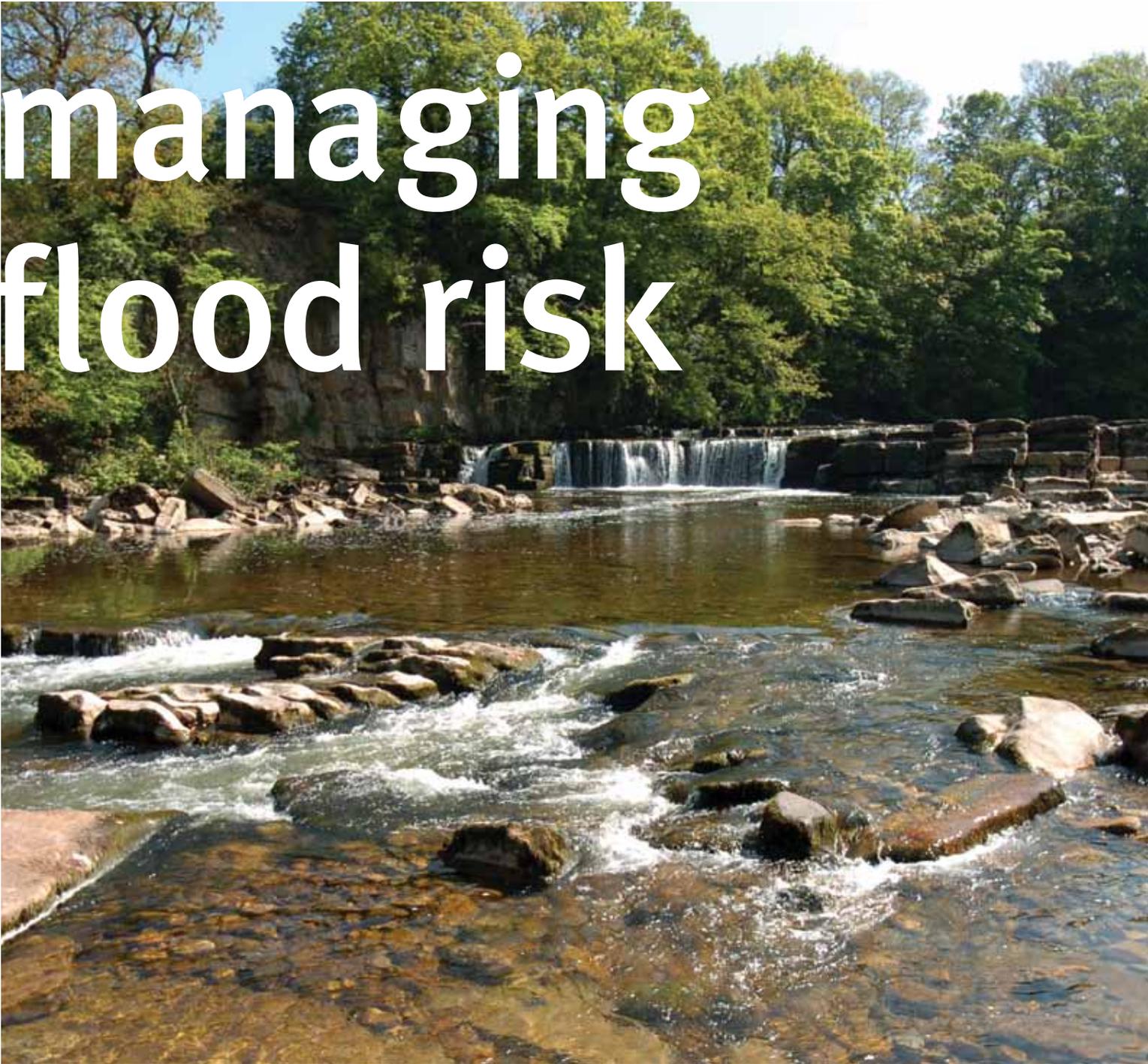


Ouse Catchment Flood Management Plan

Summary Report December 2010



managing flood risk

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December 2010

Introduction



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

The Ouse 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, ground water, 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 ground water 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.

The risk of flooding is significant within the Ouse CFMP area. The key sources of flood risk are river, tidal and surface water flows. Analysis shows that during a one

per cent annual probability river flood, 31327 properties are at risk of flooding. This figure does not take into consideration the defences which currently reduce risk in the catchment. The risks from surface water have not been fully explored within this CFMP although flooding from surface water has been recorded in the catchment.

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. We have worked with others including Planning and Local Authorities, Internal Drainage Boards, Yorkshire Water, Yorkshire Wildlife Trust and Natural England to develop this CFMP.

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 necfmps@environment-agency.gov.uk or alternatively paper copies can be viewed at our Yorkshire offices.



David Dangerfield
Yorkshire and North East Regional Director

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The purpose of a CFMP in managing flood risk

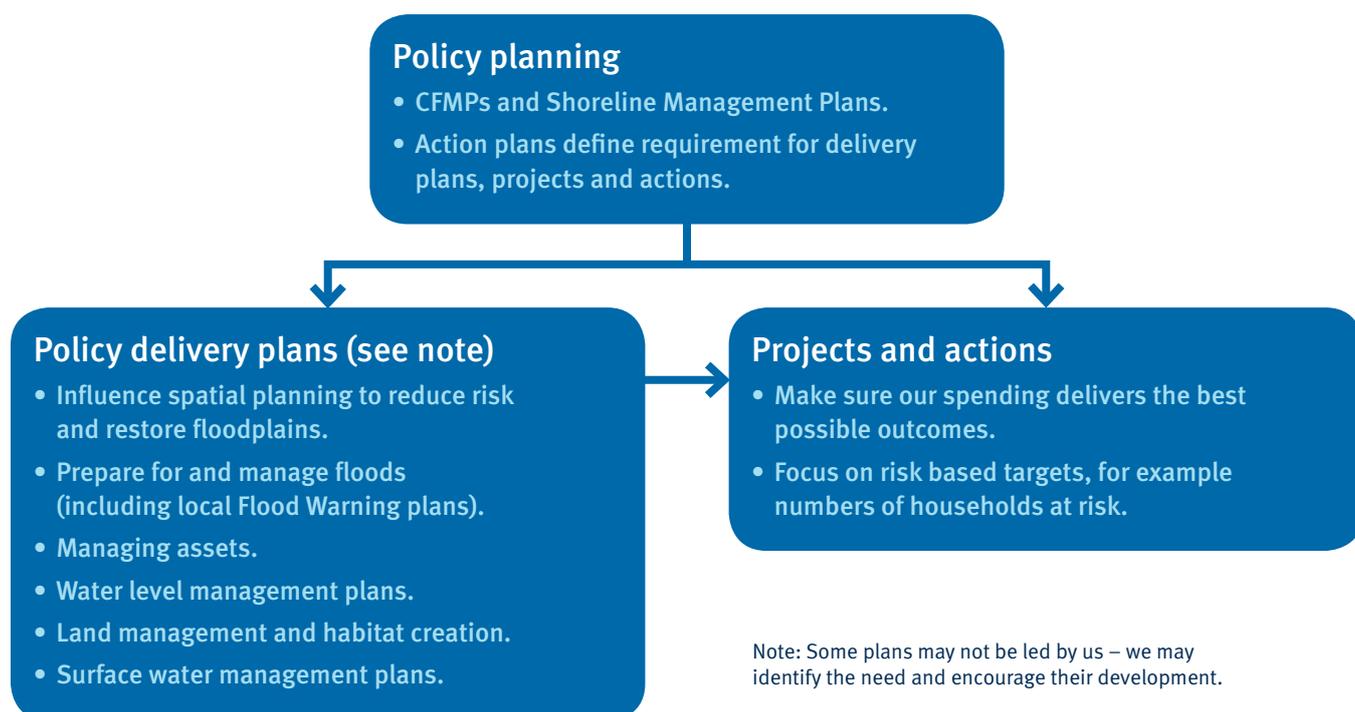
CFMPs help us to understand the scale and extent of flooding now and in the future, and set policies for managing flood risk within the catchment. CFMPs should be used to inform planning and decision making by key stakeholders such as:

- 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;

- IDBs, water companies and other utilities to help plan their activities in the wider context of the catchment;
- Transportation planners;
- Land owners, farmers and land managers that 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. The following actions and their implementation will be subject to further appraisal and funding, and prioritised by their supporting evidence. The CFMP is a living document and actions will be updated as necessary to reflect changing responsibilities and delivery mechanisms.

Figure 1 shows the relationship between CFMPs, delivery plans, projects and actions



Catchment overview

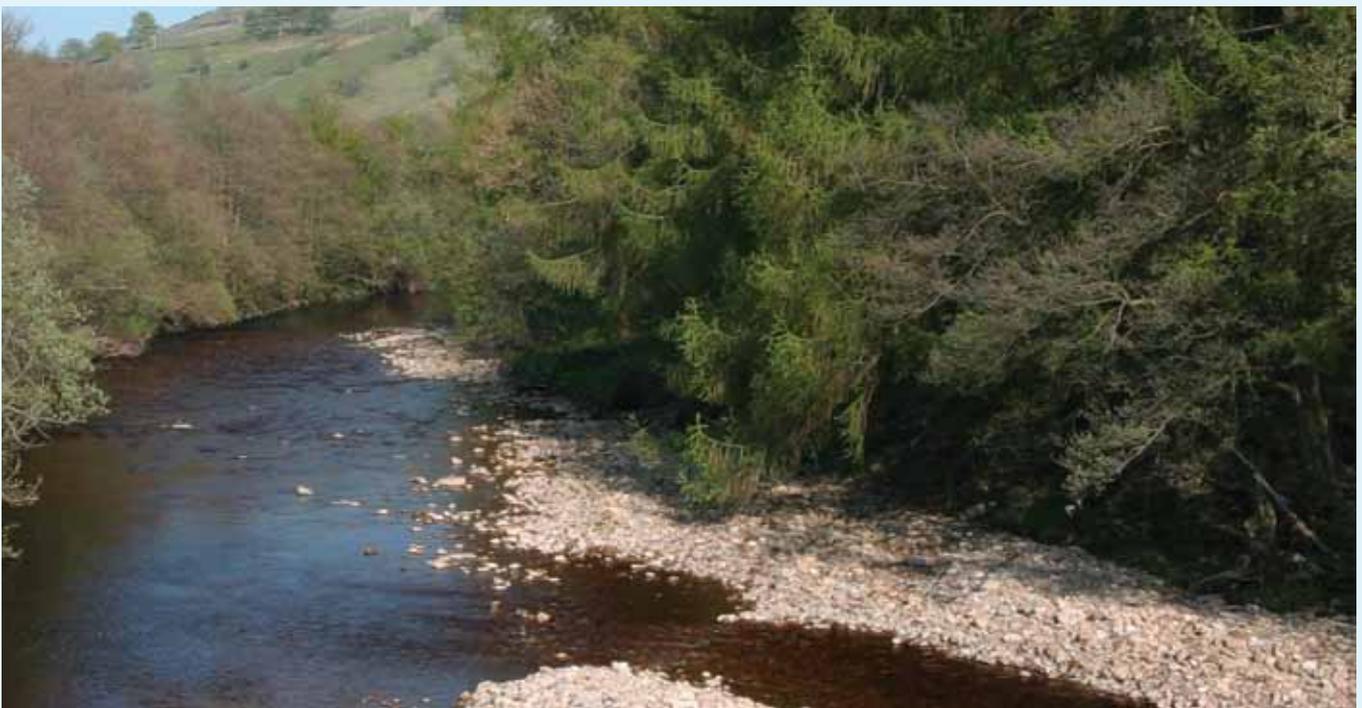
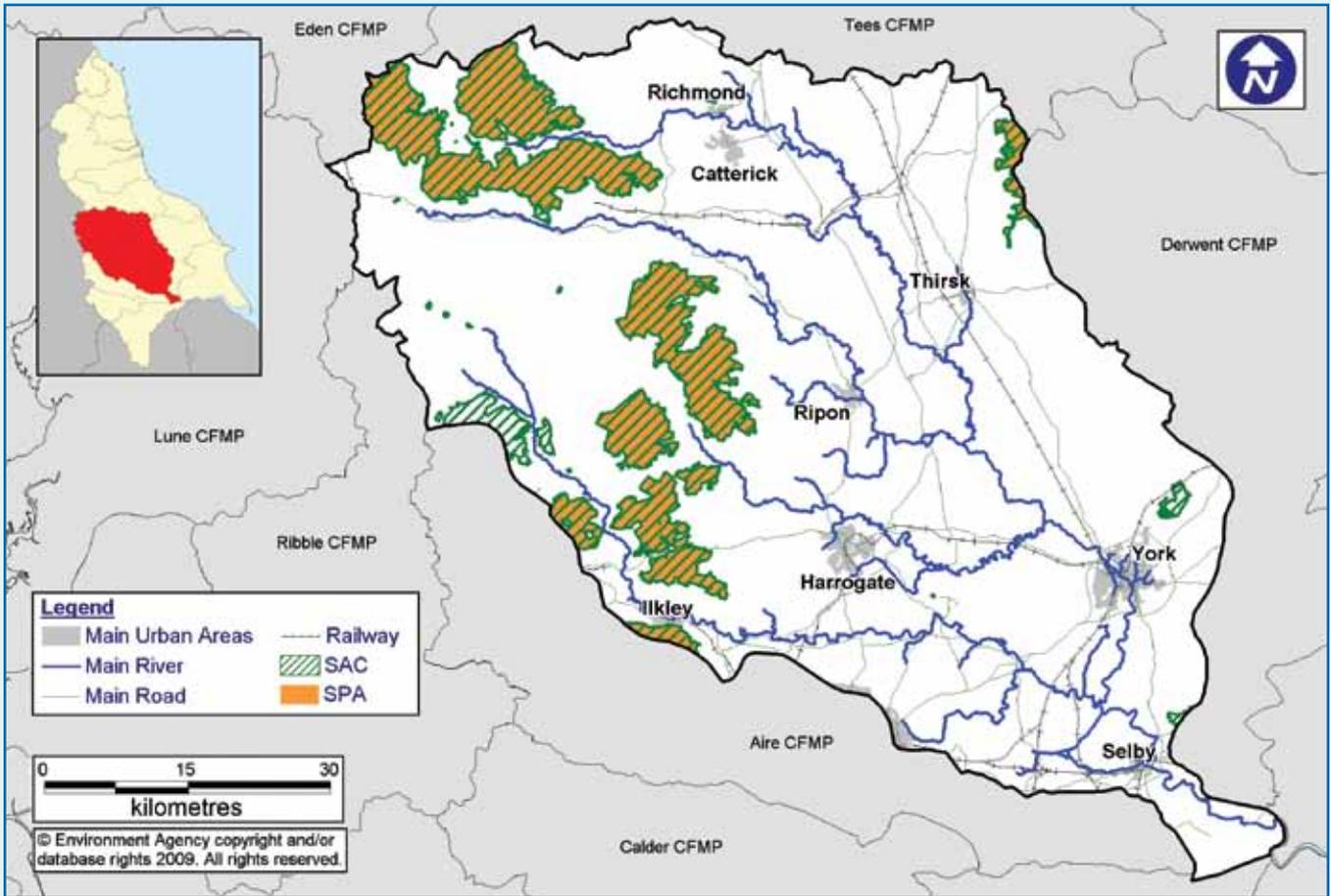
The Ouse CFMP study-area covers approximately 4,847 square kilometres. There are nearly 606,000 people living within the CFMP area. There are four major river systems that come together to form the River Ouse CFMP study-area. The Rivers Swale; Ure; Nidd; and Wharfe. The CFMP area can be split into nine sub-catchments; the Upper Swale, Lower Swale and Wiske, Upper Ure, Middle and Lower Ure, Nidd, Upper Wharfe, Middle and Lower Wharfe, Upper Ouse and Foss and the Lower Ouse. The lower catchment is influenced by the tides as the River Ouse is tidal to Naburn and the River Wharfe is tidal to Tadcaster. The headwaters of the main river systems are characterised by steeper river gradients which flow through generally rural areas which are scattered with small settlements. In contrast, downstream of Ripon on the River Ouse, the area is generally low lying with wide floodplains. 95 per cent of the CFMP area comprises agricultural land. This is important to the local economy as nearly 55 per cent of this is classified as between grades 1 and 3: excellent to moderate quality productive land.

The CFMP area covers the districts of Bradford, Craven, East Riding of Yorkshire, Hambleton, Harrogate, Leeds, Richmondshire, Ryedale, Selby, and York. Urban land use occupies 2.2 per cent of the CFMP area. The area is vital to the regional economy as York and Harrogate fall within the 'Golden Triangle' as a vital commuter district for the city of Leeds.

The CFMP area has a wealth of environmental and culturally recognised sites. These include 132 Sites of Special Scientific Interest (SSSIs), 10 Special Area for Conservation (SACs) and 3 Special Protection Area (SPAs). Culturally there are 861 Scheduled Ancient Monuments (SAMs), 1 World Heritage Site at 'Studley Royal Park and Ruins of Fountains Abbey, and 32 Registered Parks and Garden.

The Ouse CFMP is bordered by five other Yorkshire and North East Region CFMP areas, the Hull & Coastal Streams, Derwent, Tees, Aire and Don CFMPs. It is also bordered by the Eden, Lune and Ribble CFMPs which are managed by the Environment Agency's North West Region.

Map 1. The location and extent of the Ouse CFMP area



↑ The River Ouse

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 per cent flood has a 1 per cent chance or 0.01 probability of occurring in any one year.

As part of the CFMP process, we have developed a catchment wide broadscale model to determine the risk of fluvial flooding, from both main and non-main rivers, if defences were not in place. It is vital that we understand this level of risk in the event that defences are overtopped or fail. The flood risks quoted in this report are for the one per cent flood without the defences in place.

The Ouse catchment has a long history of flooding. The earliest recorded flood is in York in 1263 and there are numerous historical accounts of flooding occurring within the catchment since. Particularly notable floods are those of 1947 and 1982 which had a severe impact upon the lower Ouse. The highest recorded flood occurred in 2000 when over 550 properties flooded between Linton-on-Ouse and Selby.

Currently the main sources of flood risk within the catchment are:

- from rivers, which takes place throughout the CFMP area
- the tidal influence is present downstream of Naburn
- surface water drainage and sewers have the potential to affect most urban areas in the catchment and flooding has been recorded in places such as Northallerton and York.

We do not currently have good information on the true risk of flooding from sources other than rivers. However, it is estimated that in autumn 2000, 30 per cent of all properties flooded were from non river or tidal sources rising to 54 per cent for the summer 2007 floods. We therefore recognise the need to understand flood risk from other sources better.

What is at risk?

Within the Ouse catchment there are over 31,000 properties at risk from a one per cent flood from rivers, without taking into account flood defences. There are over 372 kilometres of flood defences that reduce the probability of flooding in some communities.

The analysis of flooding to environmental sites shows there are over 12.2 square kilometres SSSI (64 sites), 3.6 square kilometres of SAC (5 Sites) and 2.18 square kilometres of SPA (2 Sites) are affected by flooding during a one per cent probability flood. Of these sites 2 SSSI sites are negatively impacted by flooding, 20 SSSI are positively effected by flooding.

Where is the risk?

Flood risk is spread throughout the Ouse CFMP area. Table 1 below outlines some of the key communities with over 100 properties at risk of flooding, not taking into consideration defences. The areas with highest risk include Selby/Barlby, Goole and York.

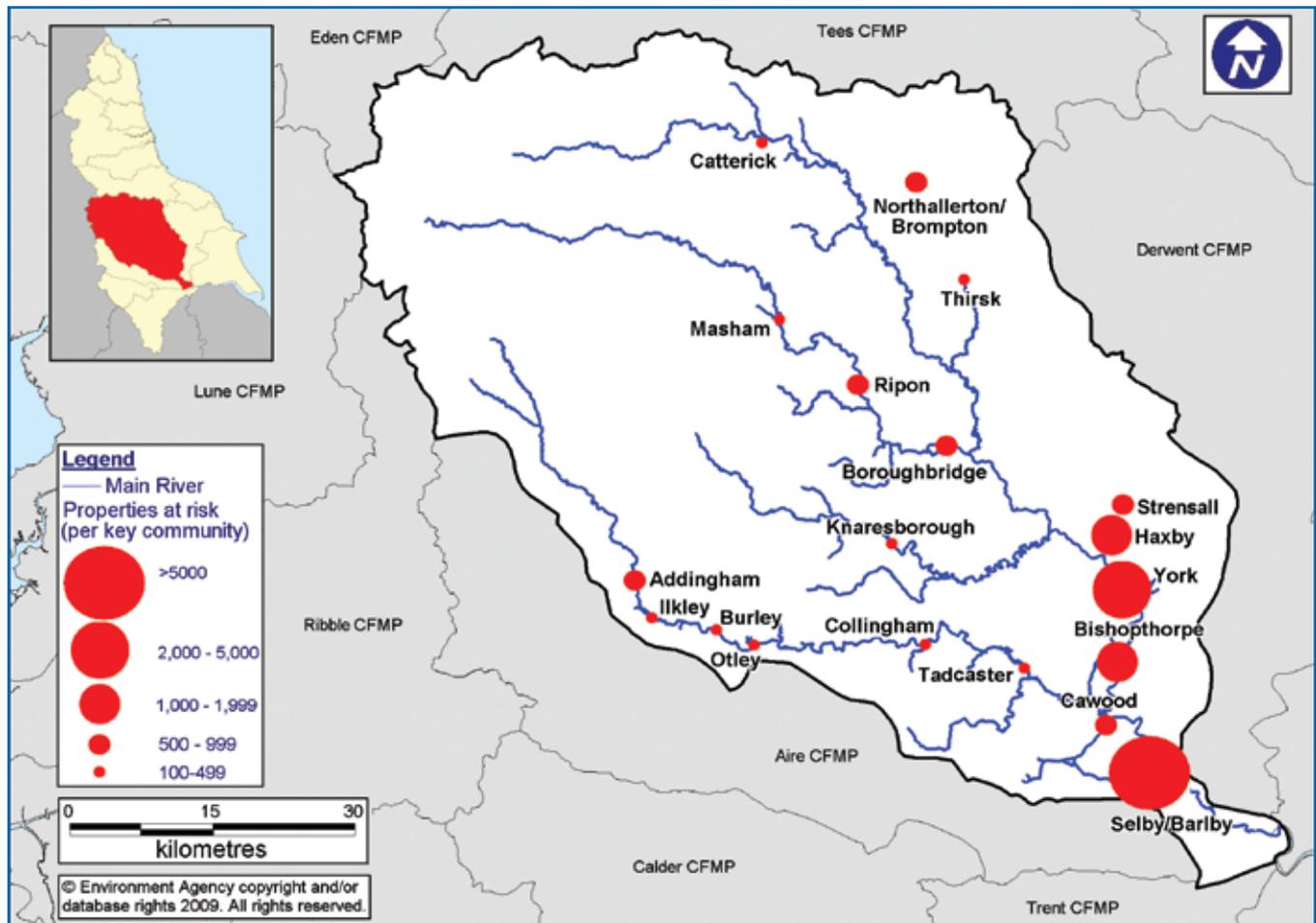
Table 1. Locations of towns and villages with 100 or more properties at risk in a 1% annual probability river flood

Number of properties at risk	Locations
>5000	Selby/Barlby, Goole
2,000 to 5,000	York
1,000 to 2,000	Haxby, Bishopthorpe
500 to 1,000	Northallerton/Brompton, Ripon, Boroughbridge, Addingham, Strensall, Cawood
100 to 500	Catterick, Thirsk, Masham, Knaresborough, Ilkley, Burley, Otley, Collingham, Tadcaster

Table 2. Critical infrastructure at risk:

97 gas and electricity assets
38 educational facilities
36 health facilities
14 wastewater treatment works
5 Emergency Services Buildings

Map 2. Properties at risk of flooding in the Ouse catchment



How we currently manage flood risk in the catchment

The catchment has a long history of flooding which has resulted in a number of engineering schemes being implemented to reduce the risk of flooding. Within the Ouse catchment there are over 370 kilometres of defences and over 400 other structures such as the Foss Barrier, pumping stations, screens, culverts and sluices. These defences offer various standards of protection within the Ouse catchment but the majority offer a minimum standard of protection of around one in 25 years, or a 4 per cent chance. Defences are located in the main urban areas such as York, Goole and Selby as well as through areas of agricultural land.

The following activities are also carried out to reduce the probability of flooding.

- Maintaining the above defences, including regular inspection to ensure condition is maintained;
 - Maintaining over 645 kilometres of river channels including removal of blockages likely to increase flood risk;
 - Working with local authorities to influence the location and layout of development, ensuring that inappropriate development is not allowed in the floodplain through the application of PPS25.
 - Maintaining the above defences, including regular inspection to ensure condition is maintained;
 - Providing a flood forecasting and warning service to over 18000 properties across the CFMP area. This warning service also alerts our professional partners and emergency responders to instigate flood response;
 - Promoting awareness of flooding to organisations and members of the public so they are prepared in case they need to take action at times of flooding;
 - Promote resilience and resistance measures for those properties already in the floodplain.
- Further activities are carried out which reduce the consequences of flooding in the catchment including:
- Understanding where flooding is likely by flood risk mapping

The impact of climate change and future flood risk

The effect that flooding will have in the future is influenced by a range of issues such as climate change, changes in land use (e.g. development), and changes in how land is managed.

Within the Ouse Catchment we carried out a catchment sensitivity analysis to a number of future flood risk drivers. These included:

- Slowing runoff by large scale changes to agricultural practices;
- Increased urbanisation;
- Impact of climate change.

Of these scenarios the changes in agricultural land management had the potential to decrease flows by up to 10 per cent indicating that the catchment was sensitive to land management change. To gain this scale of benefit in downstream flood risk locations, changes across the whole catchment would be required, however some benefit to locations with a smaller catchment upstream are achievable. Actions to deliver this could also yield multiple benefits such as reducing sediment

input which would help landowners and farmers and also deliver objectives of the Water Framework Directive.

The catchment was not sensitive to increased urban development as the total area of urban development is small compared to the total catchment area and the implementation of PPS25 reduces development within flood risk areas and controls the drainage from new development.

The Ouse catchment is most sensitive to the impacts of climate change. The key predictions for the impact of climate change are:

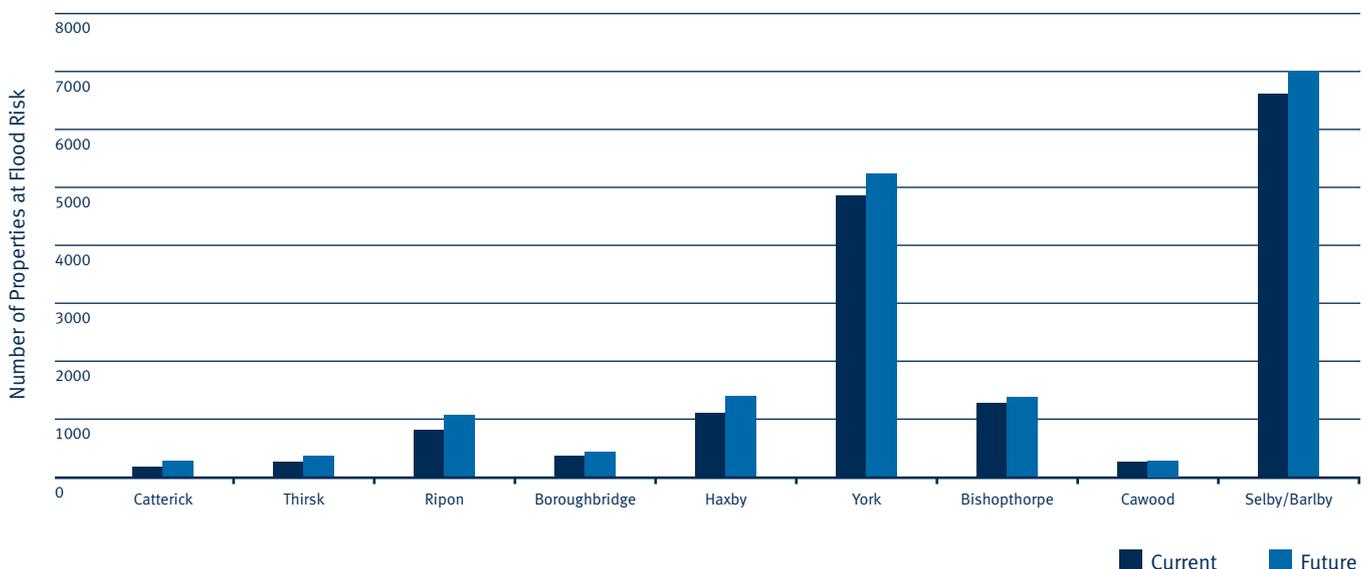
- More frequent and intense storms causing more widespread and regular flooding from drainage systems and some rivers;
- Increased winter rainfall increasing the likelihood of large-scale flood events.

To represent this an increase of 20 per cent was applied to predicted river flows. The predicted rainfall increases were input into

the broadscale modelling of the catchment. In total the properties at risk of flooding from rivers rises from 31327 currently to 32387 in the future during the one per cent flood which is around a five per cent increase in properties at risk (this doesn't include future increases in the Upper Humber area due to complexities of flooding our modelling was unable to produce the necessary outputs for future flood risk). This indicates that the catchment is not sensitive to climate change. The increased flows are attenuated through the catchment as flood flows will spill onto the extensive floodplains. The frequency of flooding will increase but the washlands in the catchment again help to reduce the increases with almost 25000 properties at risk during the future 1.3 per cent flood. Figure 2 below shows the increase in fluvial flood risk across the catchment for the one per cent flood.

The increased intensity of rainfall will increase the occurrence of surface water and sewer flooding as existing drainage networks will be stretched to cope with the additional volumes of water.

Figure 2. Current and future (2100) flood risk to property from a one per cent annual probability river flood, not taking into account current flood defences.



Future direction for flood risk management

Approaches in each sub-area

Flood risk is not the same in all of the catchment. We have divided the Ouse catchment into ten sub-areas which have similar physical characteristics, sources of flooding and level of risk. We have identified the most appropriate approach to managing flood risk for each of the sub-areas and allocated one of six generic flood risk management policies, shown in Table 3.

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.

In the following sections we outline the approach in each sub-area by highlighting:

- key issues and messages for each sub-area;
- our policy and vision for future management ;
- key actions to deliver the policy.

Map 3. Catchment sub-areas

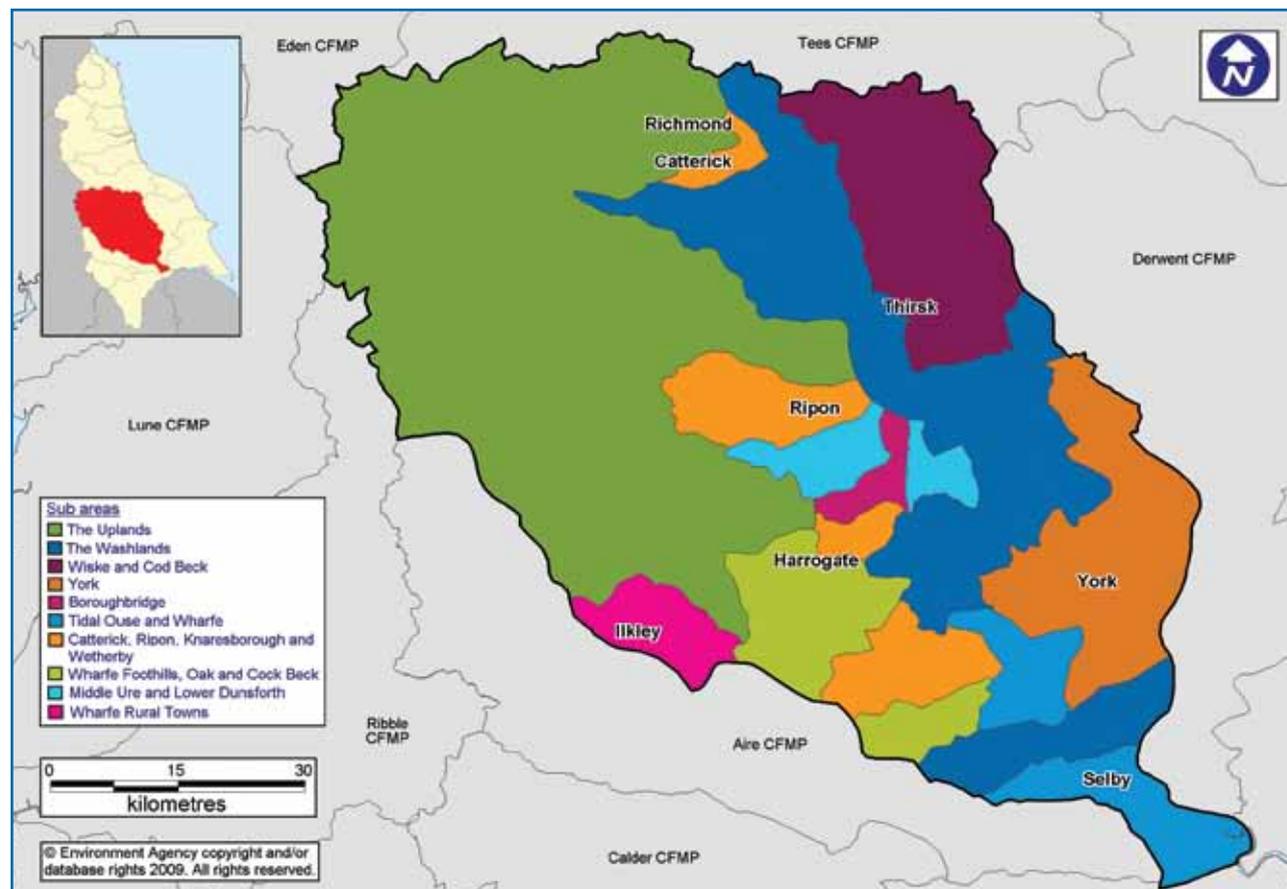


Table 3 Policy options

→ 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.

The Uplands

Our key partners are:

Local Authorities

landowners and farmers

Natural England

The minerals industry

Yorkshire Water

RSPB

Yorkshire Wildlife Trust

The issues in this sub-area

The Uplands sub-area includes a large area to the north and west of the catchment. It includes largely rural areas although there are still pockets of flood risk throughout the sub-area including areas around the communities of Pateley Bridge, Masham and Richmond. Currently there are 1416 properties identified as at risk during the undefended one per cent flood and this is predicted to rise to 1511 properties in the future. The steep topography of the sub-area and the higher than average annual rainfall results in frequent instances of rapid rainfall runoff, resulting a rise in river levels. The steep gradients of the rivers mean that flood waters flow rapidly through the sub-area. The landscape also makes the urban areas, such as Richmond, Pateley Bridge and Ramsgill susceptible to surface water flooding.

The vision and policy

Policy Option 6 has been chosen for the Uplands sub-area. Flooding can be generated quickly by rapid runoff from these upland areas and flood risk is dispersed throughout the area. Our vision is that we will take action to reduce the risk by working with land owners to implement changes to the way land is managed such as blocking grips, gill planting and other measures that will reduce the rate of run off from the upland areas. We will also seek opportunities to provide environmentally sensitive flood storage areas although the topography of the sub-area will mean that these are likely to be small scale in nature. Implementing this policy will offer benefits to communities locally and downstream that suffer from flash flooding. We will also, in partnership with others, investigate solutions to the risk of surface water flooding across the sub-area.

The key messages

- Flows generated in this sub-area were significant in contributing to the autumn 2000 floods that affected York severely.
- Dispersed flood risk to property means that it is not feasible to defend all local properties
- Fast flowing flood waters result in high hazard to communities affected by flooding.
- Short lead times mean that raising flood awareness is important to manage risk to people and property.

Actions to implement the policy

- Produce a system asset management plan to determine the requirements for maintaining existing FCRM infrastructure whilst increasing channel roughness elsewhere in the policy unit to hold back water.
- Work with landowners and other organisations to change the way land is managed and slow the rate at which floods are generated. Reducing runoff, soil erosion and increasing channel roughness on the upland headwaters of the Ure, Swale, Nidd and Wharfe could reduce flood risk locally and immediately downstream.
- Carry out a flood warning feasibility study to address the potential to extend our flood warning service coverage for Gilling West, Masham and Hambleton Beck.
- Investigate creating flood storage areas to manage flood risk. Sites that should be investigated further include Cover Valley, Bishopdale and historic mineral workings.
- Carry out a washland optimisation study to identify the operational and maintenance requirements and identify the optimum level of storage.
- Work in partnership with the LLFA to reduce the risk of flooding from surface water in areas such as Pateley Bridge and Ramsgill.
- Investigate the potential of increasing storage in reservoirs to reduce flows downstream.



↑ Pateley Bridge

The Washlands

Our key partners are:

Highways Agency

Forestry Commission

Natural England

Landowners and farmers

Local Authorities

Yorkshire Water

English Heritage

Internal Drainage Boards

The issues in this sub-area

This sub-area covers a large part of the mid catchment. It covers the large areas of strategic washlands throughout the catchment which play a vital role in regulating flood flows and reducing flood risk. Many of the areas which benefit from actions in this sub-area are located outside of the sub-area although key communities within the sub-area at risk of flooding include Sherburn in Elmet, Cawood/Wistow and Topcliffe. In total there are 943 properties in the area at risk during the one per cent undefended flood and this is predicted to rise to 1157 in the future. Flooding generally builds slowly and the flood waters remain in the washland areas for an extended period following a flood event. Additionally there are some surface water flooding issues due to “tide locking” of drainage systems.

The vision and policy

Policy Option 6 has been selected for this sub-area. The risk of flooding is low and property affected is dispersed throughout the area. Our vision is that by reducing peak flows in the rivers we will reduce flood risk downstream and locally. We will carry out a washland optimisation study in order to ensure the existing washlands are operating for maximum flood risk reduction benefit. We will seek further opportunities to store flood waters on all the rivers but in particular on the Bishops Dyke. Old gravel extraction sites within the sub-area may present an opportunity for flood storage. We will also promote land management changes which may help to reduce run off in the sub-area to further reduce flood peaks in the rivers. Work will also be carried out to investigate surface water flooding issues within the sub-area.

The key messages

- Washlands in this sub-area are vital tools for managing local and downstream risk.
- There is often extensive flooding of agricultural land.

Actions to implement the policy

- Produce a system asset management plan to determine the requirements for maintaining

existing defences and optimising flood storage.

- Determine in greater detail the risk of flooding to the A1(M) and A19. If required, ensure alternative emergency routes are reviewed.
- Investigate the potential for creating flood storage areas to manage flood risk both locally and downstream.
- Work with landowners and other organisations to change the way land is managed and slow the rate at which floods are generated on Bedale, Scorton and Birdforth Becks, as well as Bishop's Dyke.
- Carry out a washland optimisation study. This should: identify the operational and maintenance requirements for the successful operation of sites; identify the optimum level of storage to reduce the risk of flooding.
- Carry out a study to extend our flood warning coverage.
- Work in partnership with North Yorkshire County Council to reduce the risk of flooding from surface water. This should include investigation of areas known to be susceptible to surface water flooding in the Cawood and Bishop's Dyke policy unit..
- Establish and maintain a register of structures or features which are likely to have a significant effect on flood risk in their area together with information about them.

Wiske and Cod Beck

Our key partners are:

Local Authorities

Natural England

RSPB

Yorkshire Wildlife Trust

Yorkshire Water

Highways Agency and/or local highways authority

Landowners and farmers

Cod Beck and River Wiske IDBs

The issues in this sub-area

This sub-area includes the River Wiske and the Cod Beck in the north east of the Ouse catchment. Flood risk is currently high with 1171 properties identified as at risk of flooding from the one per cent undefended flood. Over 1050 of these properties lie within the communities of Northallerton, Brompton and Thirsk. In the future the risk of flooding is expected to increase to 1330 properties throughout the sub-area. In addition to river flooding, flooding from surface water and sewers has been recorded in the sub-area. Within parts of the Cod Beck system the topography leads to the potential of flash flooding with a short period of time between rainfall and the onset of flooding which means that flooding can be very hazardous in these areas.

The vision and policy

Policy Option 5 has been selected for this sub-area. Our vision for the sub-area is that the risk of flooding from all sources, particularly flash flooding and surface water, will be reduced. This will involve reviewing and implementing flood alleviation schemes for Thirsk, Northallerton and Brompton and also examining the capacity of drains and sewers to ensure they can cope with increased rainfall. Reducing runoff into Cod Beck and Willow Beck through changes to the way land is managed will help to reduce flood risk.

The key messages

- Thunderstorms can cause flash flooding to small communities in this sub-area.
- There are a number of bridges and other structures that have the potential to cause channel blockages.
- There are surface water flooding issues in the sub-area.

Actions to implement the policy

- Determine the most sustainable approach to managing existing assets to ensure that the risk of flooding is still reduced.

- Develop feasibility studies to help to reduce flood risk in Thirsk.
- Continue to work closely with our partners to implement the River Wiske FAS to reduce the risk of fluvial flooding in Northallerton, Brompton and Romanby.
- Work with landowners and other organisations to change the way land is managed across the policy unit and slow the rate at which floods are generated.
- Work in partnership with North Yorkshire County Council to reduce the risk of flooding from surface water.
- Produce a register of culverts and outfalls, identify capacity and geo-morphological issues.
- Carry out a feasibility study to expand the flood warning service to cover all properties in Thirsk and where possible, properties in Dalton.
- Determine the risk of flooding to the East Coast railway and the A19. Following the identification of flood risk, ensure alternative routes and emergency plans are developed.

York

Our key partners are:

Local Authorities

Internal Drainage Boards

Yorkshire Water

Natural England

English Heritage

Landowners and farmers

The issues in this sub-area

This sub-area covers the River Ouse from just upstream of York to Kelfield downstream. The sub-area has a long history of regular flooding with a large number of properties at risk of flooding. There are a number of defences through the area but there is still a high risk with 8200 properties at risk during the one per cent annual probability flood, assuming no flood defences, this could rise to 8232 in the future. This estimate does not take account of the Foss Barrier though so it may overstate the risk. There is also a record of surface water flooding within the sub-area. Flooding from the Ouse is the result of prolonged rain in the upper Ouse catchment and takes a long time to develop. However, the smaller urban watercourses through York are susceptible to rapid flooding. The washlands upstream are important in reducing risk and our flood warning service is vital in reducing the consequences of flooding.

The vision and policy

Policy Option 5 has been selected for this sub-area, as our vision is to reduce existing flood risk. Several areas have been identified through the Ouse Strategy Study where improvements could be justifiable. We will continue to explore the best way to reduce risk in the area and also promote our flood warnings service to encourage sign up. A flood risk mapping study for Stillingfleet Beck is being carried out and will determine if it is possible to improve the defences in that location. Surface water flooding also represents a risk within the urban centres of the sub-area. We will promote the development of a surface water management plan which will identify the scale of the risk and recommend improvements which will be promoted and implemented where feasible.

The key messages

- Washlands to the south of York play a role in managing the risk in downstream areas such as Selby.
- Surface water flooding and flooding from smaller watercourses such as Burdyke, Tang Hall Beck and Blue Beck is common.
- Washlands upstream play a crucial role in managing the risk in York.

Actions to implement the policy

- Work in partnership to identify the requirements for reducing flood risk at key locations.
- Produce a system asset management plan to determine the most sustainable approach to managing existing assets to ensure that the risk of flooding is still reduced.
- Work in partnership with City of York Council to reduce the risk of flooding from surface water.
- Establish and maintain a register of structures or features which are likely to have a significant effect on flood risk in their area together with information about them.
- Ensure that the reviews/updates undertaken by the City of York Council of their internal and multi-agency flood emergency plans take adequate account of changes in flood risk.
- Carry out a flood warning feasibility study to address the potential to extend our flood warning service.
- With English Heritage identify flood risk to Scheduled Ancient Monuments and the proposed World Heritage Site.
- Work with landowners and other organisations to change the way land is managed on the River Foss and slow the rate at which floods are generated.
- Review the current pumping regime for pumping stations at Holbeck and Burdyke.

Boroughbridge

Our key partners are:

Local Authorities

Claro Internal Drainage Boards

Natural England

Landowners and farmers

Yorkshire Wildlife Trust

The issues in this sub-area

The sub-area includes a short stretch of the River Ure. Flood risk is centred almost totally on the Boroughbridge urban area. Defences within Boroughbridge provide a high standard of defence to the south of the town although the areas of Langthorpe and Milby Island are undefended. Flooding can also occur from the River Tutt where pumps help to regulate flows. Currently with defences there are 198 properties at risk during the one per cent flood. In the future this risk may increase to 300 properties and without defences the future risk could be as high as 448 properties. Two important major roads (A1(M), A161) are at risk in the sub-area and lead to major disruption both locally and regionally when flooded.

The vision and policy

Policy Option 4 has been selected for the sub-area, our vision for the Boroughbridge area is that existing defences on the south bank of the River Ure will be maintained. As well as this, pumping on the River Tutt will be reviewed to ensure that pumps can cope with any expected increase in flows caused by climate change. We will look for opportunities to reduce flows entering the Tutt through changes in land management. In summary we will work in partnership to ensure that flood risk will not increase due to climate change.

The key messages

- Properties on the southern river bank of Boroughbridge benefit from flood defences but are still at risk from the River Tutt.
- Previous studies have shown that it is unlikely to be viable to reduce risk to properties elsewhere in Boroughbridge.

Actions to implement the policy

- Produce a system asset management plan to determine the best approach to managing existing assets that ensures that the current standard of protection is maintained into the future and investment increases to take climate change into account.

- Review and implement feasibility studies for alleviation schemes in and around Boroughbridge, Milby Island and Langthorpe.
- Explore the possibility of using Staveley Reserve in the future to store water on the River Tutt in times of flood.
- Provide information and advice to property owners and businesses on improving flood resilience and flood proofing of properties.
- Carry out a washland optimisation study of the current washlands at Aldbrough Ings. This study should identify the operational and maintenance requirements and identify the optimum level of storage to reduce the risk of flooding locally and downstream.
- Identify the long term approach to the River Tutt pumping regime taking into consideration the implications of climate change.
- Work with landowners and other organisations to change the way land is managed on the River Tutt and slow the rate at which floods are generated.

Tidal Ouse and Wharfe

Our key partners are:

Local Authorities

Natural England

Yorkshire Water

Highways Agency

RSPB

Yorkshire Wildlife Trust

Landowners and farmers

Internal Drainage Boards

The issues in this sub-area

The sub-area includes the tidal Wharfe and the Ouse from Selby down to Goole. Flooding comes from both fluvial and fluvial/tidal combinations and surface water. Extensive defences and pumping throughout the sub-area reduce the risk of flooding. Without the defences a total of 13370 properties would be at risk during the 1 per cent flood which may rise to 14123 properties in the future. This future risk does not include future risk in the Upper Humber area as the nature of flooding is complex and we have not been able to produce

the necessary outputs from our modelling. However, currently there are defences within the sub-area which reduce this risk. New defences within Selby protect a large number of properties in the main risk area. Pumping also plays a part in reducing flood risk in the area. Our flood warning service is also vital in reducing the consequences of flooding in the sub-area.

The vision and policy

Policy Option 4 has been selected for this area. The majority of risk in the sub-area is located within the Selby area. Recent defences have reduced risk in the area but climate change has the potential to increase risk as this area can be affected by both increased fluvial flows and increased sea levels and higher tidal flows. We will look to create some storage on smaller watercourses and address known low spots on current defences. Studies into the pumping regime will be carried out to ensure that these can keep pace with future increases in fluvial flows.

The key messages

- Pumping is vital in this sub area and may have to increase to cope with higher rainfall in the future.
- Flood storage on Selby Dam and Bishop's Dyke could reduce risk further.
- If there were no defences, hazard would be extremely high.
- Action to address low spots in defences could be important to prevent flooding in Selby and Cawood.
- The Upper Humber Study has studied the combined effects of river and tidal flows in the upper Humber area.

Actions to implement the policy

- Produce a System Asset Management Plan to determine the best approach to managing existing assets that ensures that the current level of risk is managed into the future.
- Following completion of the managed realignment study in the Lower Wharfe, we will do further modelling to find out how effective the washlands are.
- Work in partnership with the relevant Lead Local Flood Authority to reduce the risk of flooding from surface water.
- Identify the long term approach to the current pumping regime. This study should highlight the long term sustainable approach to flood risk management, of which pumping is one possibility, whilst taking into consideration the implications of climate change.
- Investigate the best ways to manage the risk of flooding around Goole.
- Investigate the need for flood risk reduction between Barmby and Boothferry as well as the Rawcliffe area.



↑ The opening of the Selby flood alleviation scheme

Catterick, Ripon, Knaresborough and Wetherby

Our key partners are:

Local Authorities

Yorkshire Water

Natural England

Forestry Commission

Yorkshire Forward

Property developers

Landowners and farmers

Ministry of Defence

The minerals industry

Highways Agency

on drainage systems as well as increase run off which will need to be controlled through careful management.

The vision and policy

Policy Option 5 has been chosen for this sub-area. Under this option we will work to reduce the risk of flooding. A flood alleviation scheme is already being implemented at Ripon and improvements to existing defences will be explored in Catterick and Collingham. We will investigate the feasibility of providing defences in other areas and will investigate alternative funding sources where government funded schemes are not currently viable. We will encourage alternative land management to reduce runoff in the rural areas and through surface water management plans will work with North Yorkshire County Council to develop options that reduce surface water flooding in the towns. Our flood warning service plays an important role in reducing the consequences of flooding but take up in the sub-area is patchy. We will work with others to promote this service to improve take up to help reduce the impact of flooding.

The key messages

- A study has previously been carried out into reducing risk in Catterick.
- The Ripon flood alleviation scheme is planned to be completed by 2011.
- There is a local levy scheme proposed that will address risk in Collingham at Mill Beck Green.
- Flood defences reduce the frequency of flooding but cannot prevent it altogether.
- The Ripon Defra Multi-objective project has looked at ways to manage land to reduce flood risk.
- Hazard is high in this area and set to increase.

The issues in this sub-area

The sub-area covers a number of dispersed towns throughout the catchment where flood risk is high, currently there are 2280 properties at risk during an undefended one per cent flood. In the future this risk could increase to 2799 properties. There is a risk of surface water and sewer flooding in most of the towns. There are a number of defences in some of the towns which do lower risk slightly but they do not offer a high standard of protection. Development pressure is also focused on these existing urban areas and could increase pressure

Actions to implement the policy

- Produce a System Asset Management Plan to determine the most sustainable approach to managing existing and new assets to ensure that the risk of flooding is still reduced.
- Work with landowners and other organisations to change the way land is managed to slow the rate at which floods are generated on smaller tributaries such as Brough Beck and the Rivers Laver and Skell.
- Carry out a feasibility study to extend our flood warning service for Bramham and Collingham Beck.
- Continue to work closely with our partners to implement the Ripon FAS
- Further understand the potential for utilising current mineral works for creating future flood storage areas to manage flood risk both locally and downstream.
- Develop and review feasibility studies for flood alleviation schemes in Tadcaster, Mill Beck Green, Knaresborough and Catterick.
- Ensure that the reviews/updates undertaken by North Yorkshire County Council and Harrogate Borough Council of their internal and multi-agency flood emergency plans take adequate account of changes.



↑ The Ripon flood alleviation scheme planned to be opened in 2011

Wharfe Foothills, Cock and Oak Beck

Our key partners are:

Local Authorities

Natural England

Individual land owners

Highways Agency and/or local highways authority

Landowners and farmers

The issues in this sub-area

The sub-area includes Cock Beck and part of the River Wharfe as well as Oak Beck and the River Crimple which flow through the town of Harrogate. Flood risk is low compared to the Ouse catchment in general. Currently during the one per cent undefended flood there are 177 properties at risk which may rise to 205 in the future. There are some small defences which offer a low standard of protection and reduce the current risk to 151 properties. There is some risk to key road links such as the A61 which could lead to disruption during flood events. The small catchment areas of these watercourses make them prone to rapid flooding as rainfall on the catchment can enter the river system quickly.

The vision and policy

Under **Policy Option 3** we will continue with present levels of activity. We will work with the lead local flood authorities to assess and reduce the risk of flooding from surface water. The results of this will be used within the planning process to ensure that existing surface water flooding problems are not increased through development. We will also investigate structures which can cause blockages in the channels and ensure that maintenance programmes deal with the clearing of these on a regular basis to reduce the risk of blockages in the future. We will continue to promote sustainable land management to manage runoff in rural parts of the catchment.

The key messages

- Surface water is a mechanism for flooding.
- Channel obstructions such as the A61 road bridge could be adding to the risk of flooding from the River Crimple.
- Managing runoff from agricultural land will help to reduce risk to downstream urban areas.
- There are controlled washlands at Harewood that protect downstream areas.
- Improving flood awareness and the resilience of properties at risk will help to minimise any future increase in risk.

Actions to implement the policy

- Produce a system asset management plan to determine the most effective approach to channel maintenance and managing informal FCRM assets under current levels of investment.
- Carry out an assessment of infrastructure which acts as a flood defence. Where necessary, those structures integral to flood risk management should be designated as 'third party assets' and maintained to a high standard.
- Work in partnership with the relevant lead local flood authority to investigate reducing the risk of flooding from surface water.
- Work with landowners and other organisations to change the way land is managed on Cock Beck, Oak Beck and the River Crimple and slow the rate at which floods are generated.
- Establish and maintain a register of structures or features which are likely to have a significant effect on flood risk in their area together with information about them. Use this register to identify structures which may cause blockages within the sub-area. Where possible, remove or modify these structures. If not feasible to remove or modify, ensure procedures are in place to monitor and clear blockages during high flows.
- Determine in detail the consequences of closures during flooding to the A659 and the A61. Where possible ensure the routes remain operational during a flood or ensure alternative routes and emergency plans are developed and reviewed periodically.



↑ The area covers Cock, Oak and Crimple Beck

Middle Ure and Lower Dunsforth

Our key partners are:

Natural England

Internal Drainage Boards

Landowners and farmers

RSPB

Yorkshire Wildlife Trust.

The issues in this sub-area

This sub-area includes parts of the River Ure and Swale in the middle of the Ouse catchment. Current undefended risk across the sub-area is low with only 144 properties at risk during the one per cent flood and this only increases to 149 in the future. Current defences in Lower Dunsforth are constructed to the one per cent standard and reduce the current risk to 81 properties across the whole sub-area. Some agricultural land benefits from pumping to help drain land behind defences.

The vision and policy

Under **Policy Option 3** we will continue to maintain the existing defences around Lower Dunsforth as they provide a flood risk management function protecting around 60 properties. As there is little change in risk with climate change the current flood risk management approach will continue to ensure that risks are managed in the future. The existing pumping will continue to stop land flooding.

The key messages

- Washlands in this area reduce risk to more urbanised downstream areas.
- There is often extensive flooding of agricultural land.
- Flooding in Roecliffe could be very hazardous because of the depth and velocity of the river at this point.
- Land management changes could help prevent surface water problems.

Actions to implement the policy

- Produce a System Asset Management Plan to determine the most sustainable approach to managing existing assets to ensure that the risk of flooding is still reduced.
- Contribute to the Flood Risk Management Regional Habitat Creation Programme. This programme should investigate the opportunity for creating wetlands at the confluence of the Rivers Ure and Swale.
- Identify the long term approach to the current pumping regime. This study should highlight the long term sustainable approach to flood risk management, of which pumping is one possibility, whilst taking into consideration the implications of climate change.
- Work with landowners and other organisations to change the way land is managed across the policy unit and slow the rate at which floods are generated.
- Carry out a washland optimisation study to establish how the washlands can manage flood risk in a more sustainable way.



↑ The River Swale

Wharfe Rural Towns

Our key partners are:

Local Authorities

Yorkshire Water

Internal Drainage Boards

Highways Agency

Natural England

Landowners and farmers.

The issues in this sub-area

This sub-area covers the River Wharfe from Addingham downstream to Otley. Flood risk is spread along the River Wharfe with concentrations in the towns of Ilkley, Burley-in-Wharfedale, Otley and Addingham. Currently there are 1453 properties identified at a risk of flooding during the one per cent undefended flood which could increase to 1571 properties in the future. Defences in the sub-area reduce the risk, although there is not a consistent standard of protection through the sub-area. Surface water flooding can be a problem in the sub-area in these urban areas.

The vision and policy

Policy Option 5 has been selected for this sub-area. The area contains urban areas along the Wharfe and properties are spread along the river corridor. As well as the Wharfe, there are smaller streams and becks draining the moors which can be a source of flood risk. Previous investigations into reducing risk have not identified options which are likely to be funded in the short term. These studies will be revisited and at the same time action will be taken to deliver small scale reductions in risk through flood proofing, and increased flood warning take up.

The key messages

- Centres of flood risk are Ilkley, Otley, Addingham and Burley-in-Wharfedale.
- There are large expanses of grassland between the urban areas which naturally act to store water.
- Runoff from Ilkley and Denton Moors can cause surface water flooding.

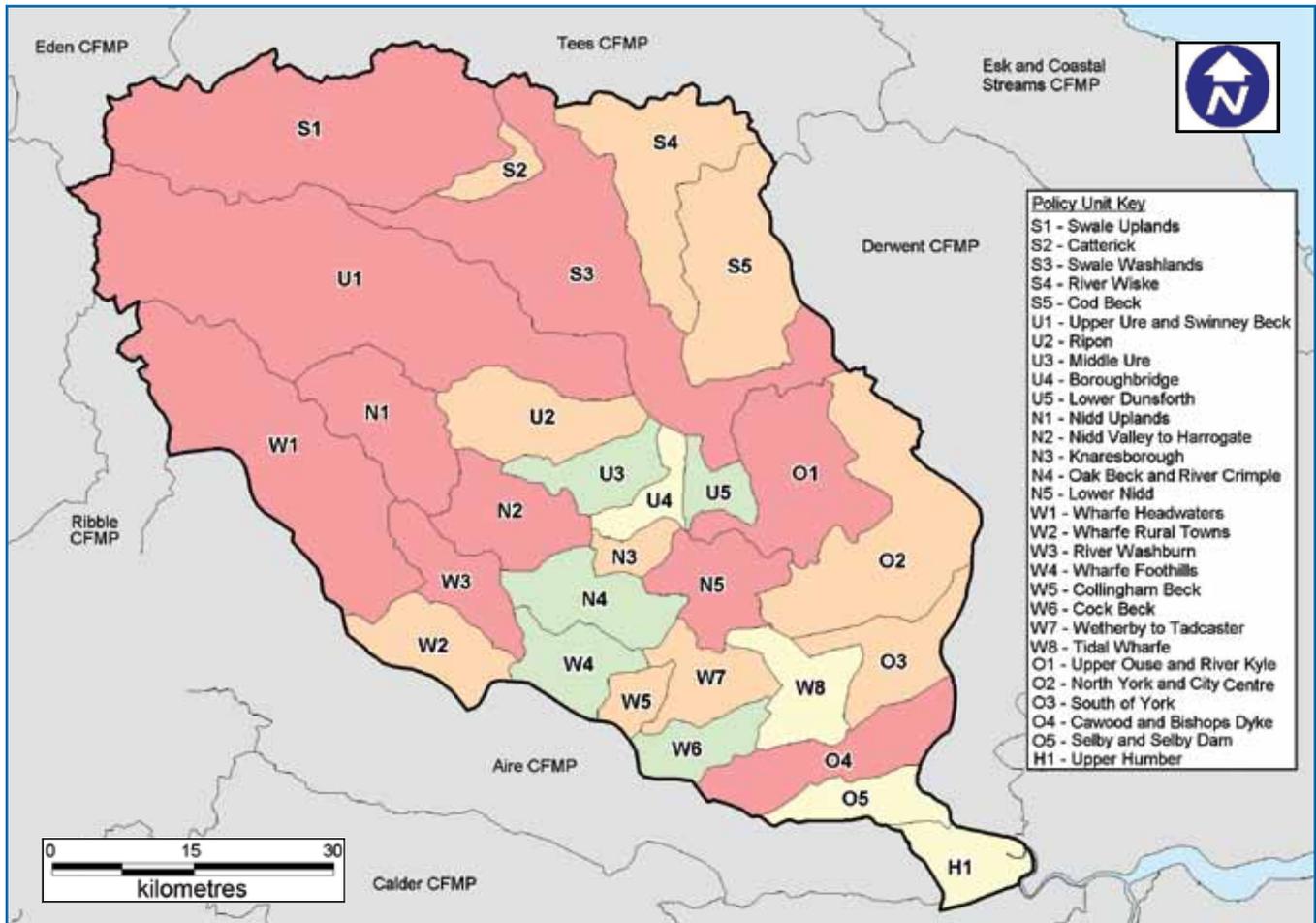
Actions to implement the policy

- Review a system asset management plan for the sub-area to determine the most sustainable approach to managing existing assets to ensure that the risk of flooding is still reduced.
- Work in partnership to identify a viable and sustainable approach to managing flood risk within the Wharfe Rural Towns sub-area. This will include the appraisal of all suitable options.
- Work with landowners and other organisations to change the way land is managed to slow the rate at which floods are generated. Actions to be considered include: reducing stocking density, gill planting, grip blocking and floodplain woodland.
- Determine in greater detail the risk of flooding and the consequences of closures during flooding to the A65. Where possible ensure that key routes remain operational during a flood event or ensure alternative routes and emergency plans are developed and reviewed periodically.



↑ The River Wharfe

Map of CFMP policies



Policy Options

- Policy 3:** Continue with existing or alternative actions to manage flood risk at the current level.

- Policy 4:** Take action to sustain the current scale of flood risk to the future.

- Policy 5:** Take further action to reduce flood risk.

- Policy 6:** Take action with others to store water or manage runoff in locations that provide overall flood risk reduction or environmental benefits, locally or elsewhere in the catchment.

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