Asiantaeth yr Amgylchedd Cymru
Environment Agency Wales

River Dee
Catchment Flood Management Plan

Summary Report January 2010

managing flood risk

We are Environment Agency Wales. It's our job to look after your environment and make it a better place – for you, and for future generations.

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January 2010

Front cover image: River Dee at Llangollen © iStockphoto.com/BackyardProduction

Introduction

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

The River Dee 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.

The River Dee catchment has a history of flooding and flood risk. Management of flood risk in the catchment is undertaken through various means including regulation of the headwaters at Llyn Tegid. For some localities, such as the tidal area of the river and much of the river corridor between Bangor-on-Dee and Chester, defences are critical to protecting communities from flooding. The highest risk areas now and in the future, are those affected by tidally influenced flooding, for example the Deeside and Sealand conurbations and Chester.

We have worked with others to produce this CFMP, including: local authorities, water companies, environmental groups, land owners and land managers. Whilst there is broad support for this plan, local authorities have raised concerns about limited resources, prioritisation and the potential impact on current development and regeneration proposals. Also, land managers have raised concerns about how flood risk is managed in rural areas. 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.

This is a summary of the main CFMP document. If you need to see the full document, an electronic version may be obtained by emailing **enquiries@environment-agency.gov.uk**.

Chris Mills
Director Wales

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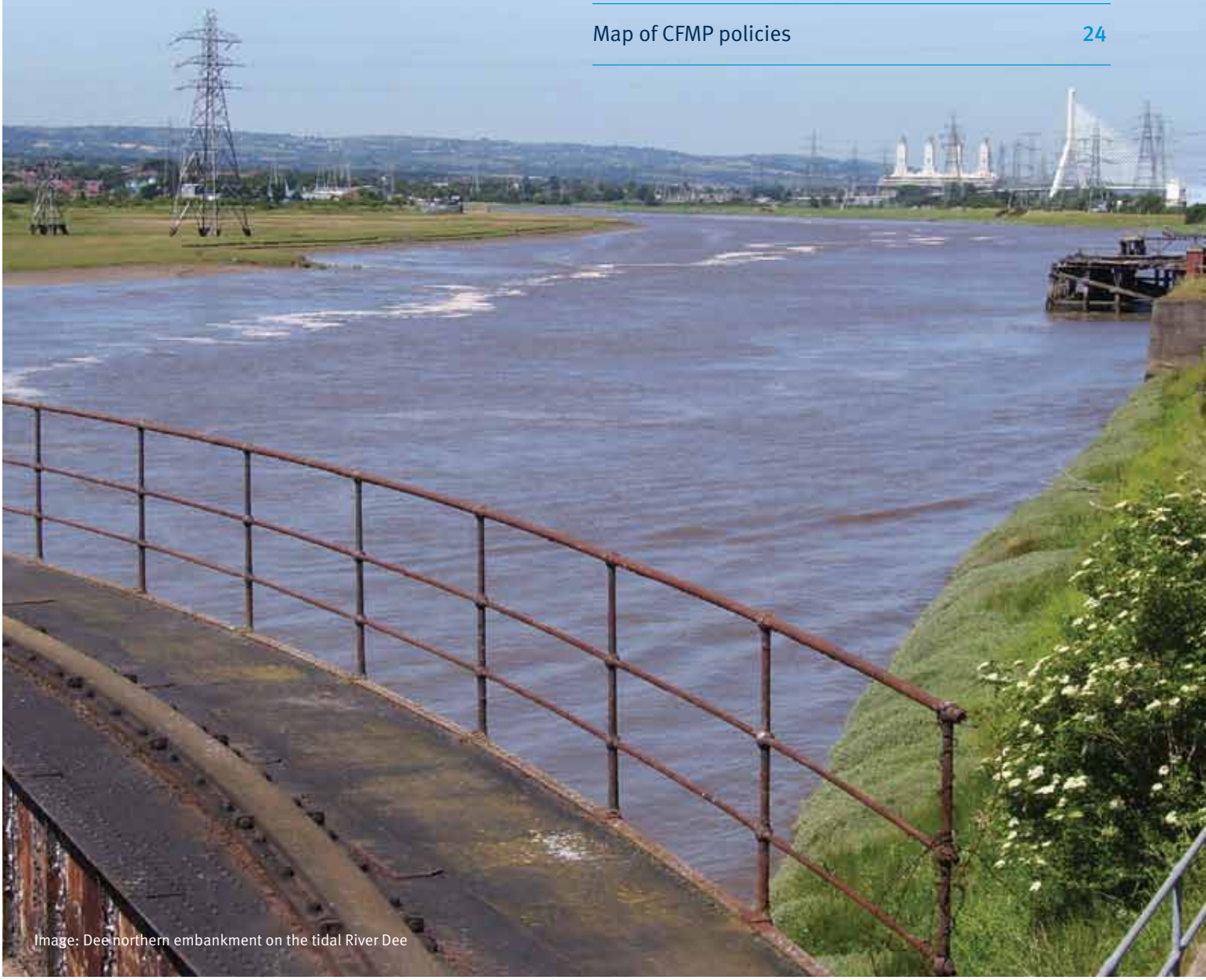


Image: Dee northern embankment on the tidal River Dee

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 catchments. CFMPs should be used to inform planning and decision making by key partners such as:

- the Environment Agency, who will use the plan to guide decisions on investment in further plans, projects and actions;
- local authorities, who can use the plan to inform spatial planning activities and emergency planning;
- internal drainage boards, water companies and other utility companies to help plan their activities in the wider context of the catchment;
- transportation planners; who can use the plan to inform their activities;
- land owners, farmers and land managers who manage and operate land for agriculture, conservation and amenity purposes;
- the public and businesses to enhance their understanding of flood risk and how it will be managed.

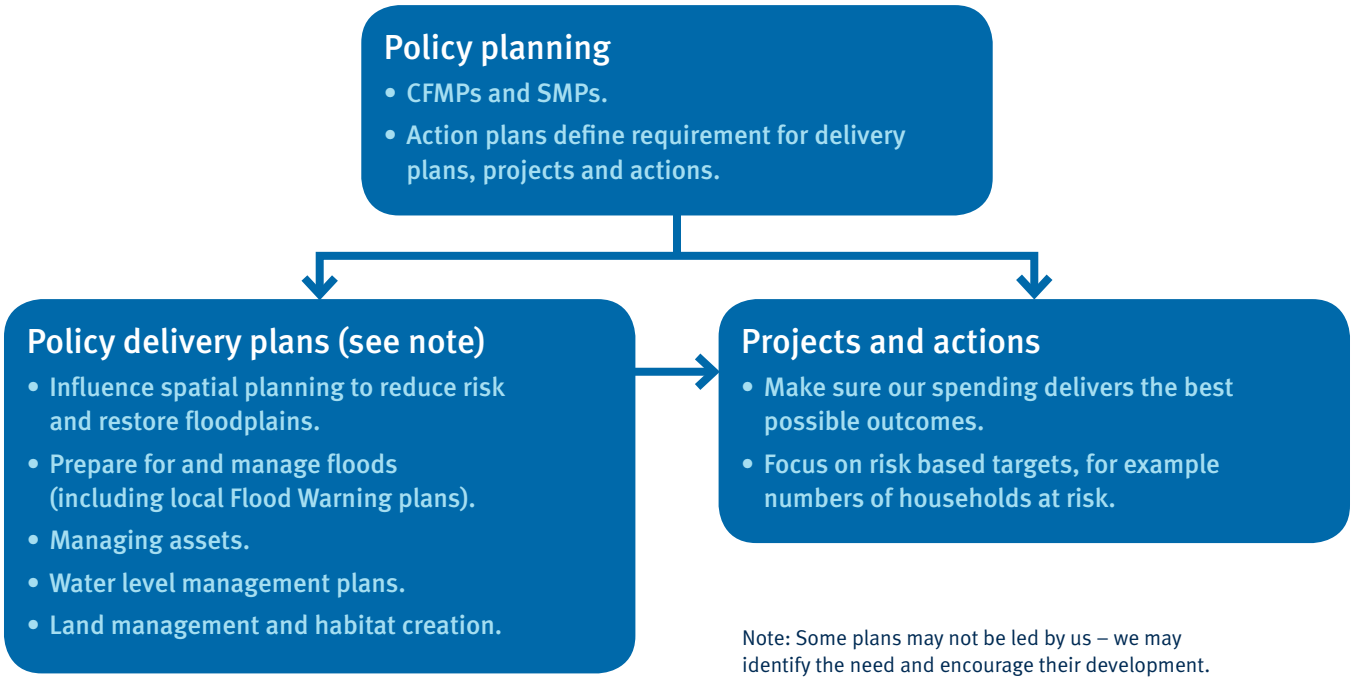
CFMPs aim to promote more sustainable approaches to managing flood risk.

The policies identified in the CFMP will be delivered through a combination of different approaches.

Together with our partners, we will implement these approaches through a range of delivery plans, projects and actions.

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

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



Note: Some plans may not be led by us – we may identify the need and encourage their development.

Catchment overview

The River Dee is 110 kilometres long from its source in the Snowdonia National Park to where its estuary discharges into Liverpool Bay. Upstream of Llyn Tegid the river is fast flowing in a narrow incised valley, whilst downstream of the lake the valley bottom and natural floodplain opens out to approximately one kilometre wide. The river once again follows a narrow incised valley through Llangollen and downstream to Erbistock (upstream of Bangor-on-Dee). Between Erbistock and Chester the floodplain is flat and very wide. Map 1 shows the location and extent of the CFMP area.

Downstream of Chester Weir the river was canalised over 200 years ago and flood defences, which are still maintained today, were constructed to protect land from tidal inundation. The River Dee is normally tidal up to Chester Weir. This boundary is exceeded for spring high tides and extreme tides when tidal influence can affect river levels as far upstream as Shocklach, 15 kilometres upstream of Chester Weir.

The natural river system is modified in the upper catchment through flow control at the Bala sluices located at the confluence of the River Dee and the River Tryweryn. The extensive section of natural river meanders below Bangor-on-Dee is one of the best examples of such features in England and Wales.

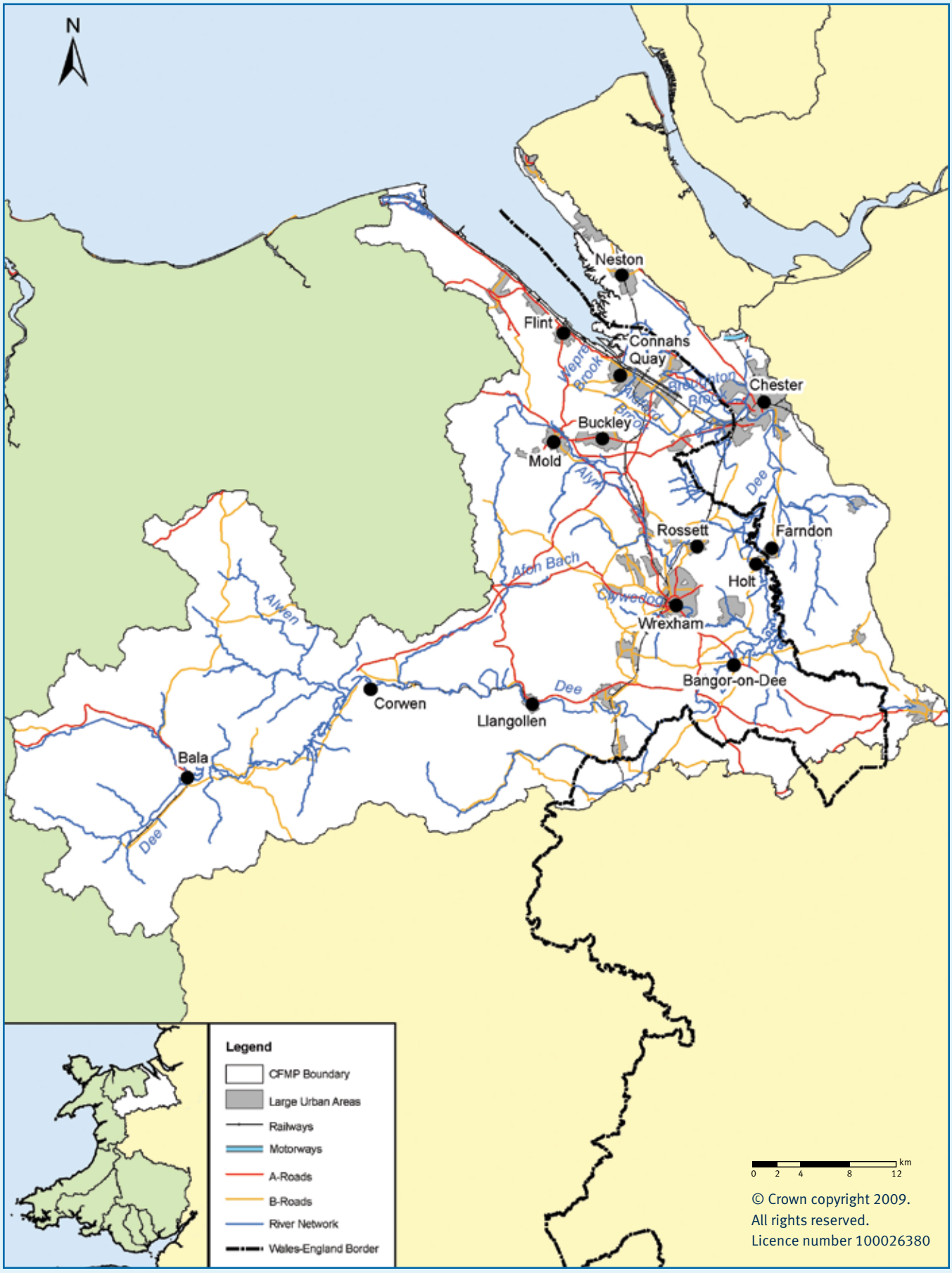
"One of the greatest challenges now and in the future will be to manage the consequences of flooding from the tidally influenced River Dee."

↑ Lower River Dee floodplain on the Cheshire Plain

The upland catchment is predominantly rural, with sheep farming on the poorer areas of grassland and significant areas of commercial forestry. There is intensive dairy farming on the fertile lowlands in and around Wrexham and on the Cheshire Plain, and arable farming in Wirral and Sealand. Only six per cent of the catchment is urban with Wrexham, Chester, and Deeside (the conurbation embracing Connah's Quay, Queensferry, Pentre, Sandcroft, Hawarden Airport, and Saltney) being the main urban centres accounting for over 60 per cent of the population. Tourism, cottage industries, retail, commercial and industrial activities in and around Chester, Wrexham, Deeside and the smaller towns are very important to the economy of this area.

The catchment is rich in biodiversity in terms of species and habitats. Approximately 16 per cent of the catchment is designated for its nature conservation value. The River Dee is designated as a site of special scientific interest (SSSI) and Llyn Tegid is a Ramsar site. The Dee Estuary has Special Protection Area (SPA), Special Area of Conservation (SAC) and Ramsar designations. Parts of the Clwydian Mountain Range are designated as an Area of Outstanding Natural Beauty (AONB). In all, 18 per cent of the catchment is within the Snowdonia National Park or has AONB designation.

Map 1. Location and extent of the River Dee CFMP area



Current and future flood risk

Overview of the current flood risk

Flood risk is the combination of two components; the likelihood (or probability) of a particular flood event occurring and the consequence (or impact) that the flood event would have if it occurred.

The probability of a flood event is the likelihood of a flood of that size occurring within a one year period. It is described as an annual exceedance probability (AEP) and is expressed as a percentage. For example, a 1% AEP flood event has a one per cent chance or 0.01 probability of occurring in any one year.

Unless otherwise stated, numbers in this report are based on the 1% AEP river flood event. More extreme events can occur at any time. The likelihood of an extreme event occurring is small, although the consequences are potentially very serious, particularly where defences could be overtopped.

Flooding has occurred at many locations throughout the River Dee CFMP area, mostly from the main River Dee and its major tributaries, but also from smaller watercourses. Significant floods were recorded in 1890, 1946, and 1964 and recently in 2000.

During Autumn 2000, exceptional rainfall caused widespread flooding throughout the catchment. Many areas, which had no record of flooding in living memory, were affected on this occasion.

The sources of flood risk are:

- **river flooding** occurs fairly frequently in the upper catchments of the River Dee, River Alwen and River Alyn. In the remainder of the River Dee catchment, floodplains are generally wider, with flooding affecting large areas of agricultural land and urban areas such as Wrexham, Mold, Chester, and the Deeside and Sealand communities;
- **tidally influenced river flooding** can occur when extreme tidal events coincide with high river flows. This affects all communities close to the river as far upstream as Shocklach Green. Tide locked outfalls affect locations in Deeside, Chester and Flint;
- **surface water flooding** is extensive in the Lower Dee (Mold and Wrexham) and Dee Estuary sub-catchments (Deeside, Sealand and Chester), and also in the lower reaches of the River Alyn catchment near the confluence with the River Dee;
- **sewer flooding** has occurred in Chester, Flint, Deeside, Mold, Coedpoeth and Rhosllannerchrugog. This information is based on historical incidents and does not necessarily indicate likely re-occurrence of this flooding in these localities;
- **groundwater flooding** has occurred in some areas and caused road flooding and some property flooding. These are localised issues and groundwater flood risk is considered to be low at a catchment scale.

What is at risk?

CFMPs assess how flood risk is likely to change in the next 100 years. They do this at a strategic level and not at a detailed, local level.

We used computer models to simulate river flows and produce indicative numbers of properties, infrastructure and environmental features at risk. These models take in to account the benefit of current flood defences. Where applicable, tidal influences on river flows have also been modelled. Where models are not available we have based our flood risk estimates on our Flood Maps, which do not include flood defences. Numbers produced are sufficient for the purposes of the CFMP only.

It is estimated that a 1% AEP flood event could affect approximately 4,200 properties across the CFMP.

There are 13 internationally designated sites and 30 SSSIs at risk from the 1% AEP flood event and 22 scheduled monuments. Depending on the nature of the environmental feature, flooding

may have a negative or positive impact. For example, flooding may create or enhance a habitat in some areas e.g. a new flood storage wetland, or have the potential to cause physical damage to the historic environment e.g. listed buildings and scheduled monuments.

Where is the risk?

To assess flood risk at a strategic level we have identified a number of key locations where we have carried out a more detailed analysis of flood risk. These are presented in Table 1 and Map 2. This is not an exhaustive list of locations. Flood risk in all other areas has been considered in the development of the CFMP.

The highest number of properties currently at risk from a 1% AEP flood event are located within Chester and Deeside. The areas which are classed as the most socially vulnerable to flooding are located in Bala, Cefn Mawr, Whitchurch, Mold and Chester.

We recognise there is potential risk from localised surface water and groundwater flooding in other areas of the CFMP, however there is limited information currently available.

Table 2 lists some of the infrastructure currently at risk in the CFMP area.

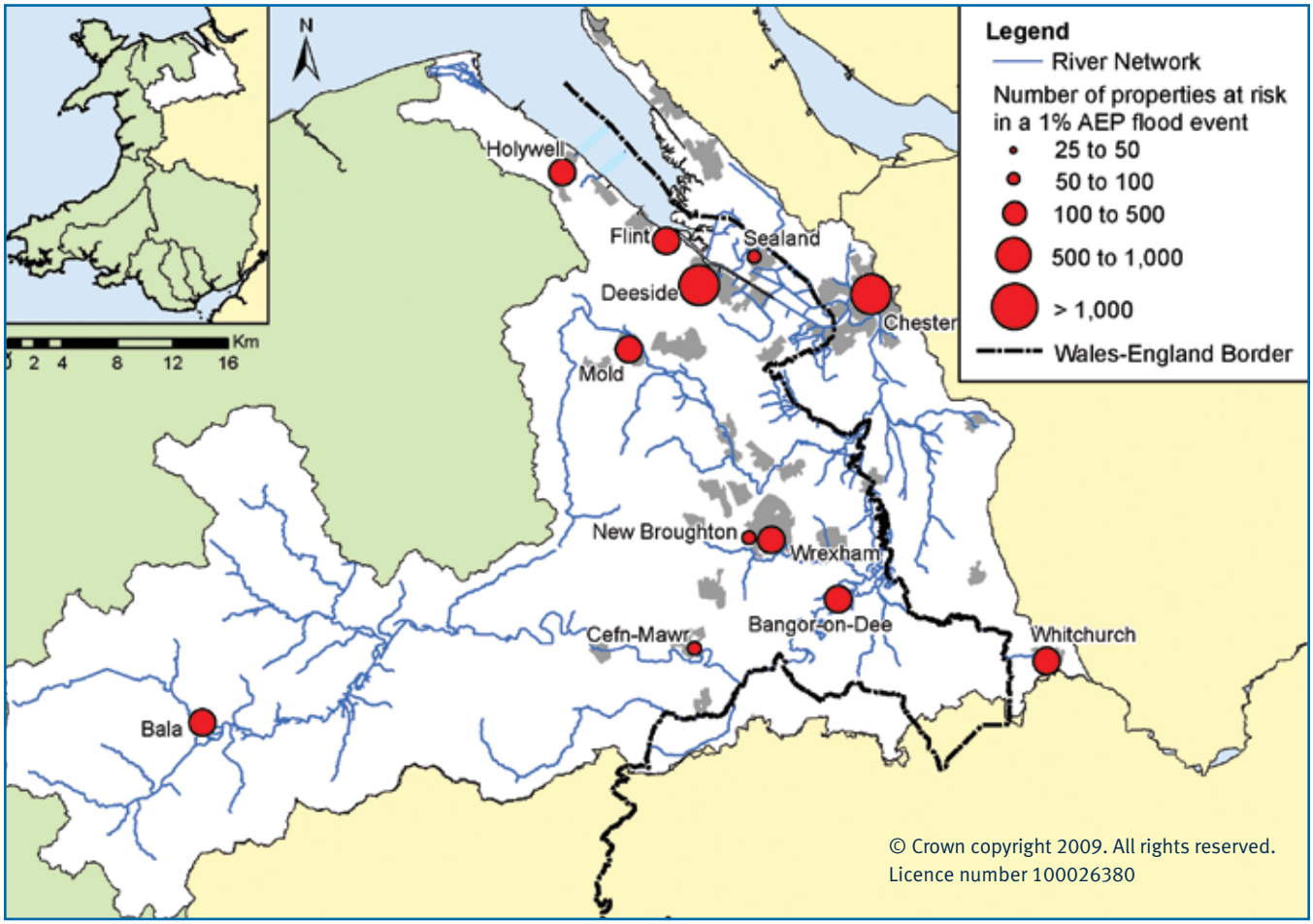
Table 1. Key locations currently at risk in a 1% AEP flood event

Number of properties at risk	Locations
› 1,000	None
500 to 1,000	Chester, Deeside
100 to 500	Bala, Bangor-on-Dee, Whitchurch, Wrexham, Mold, Flint, Holywell
50 to 100	Cefn Mawr Area, New Broughton, Sealand
25 to 50	None

Table 2. Infrastructure currently at risk in a 1% AEP flood event

30 electricity/gas plants
17 sewage/water treatment plants
3 telephone exchanges
12 schools
2 railway stations
25 kilometres of ‘A’ roads
13 kilometres of rail track

Map 2. Number of properties currently at risk in a 1% AEP flood event



How we currently manage the risk in the catchment

We can split the work we do to manage flood risk into two types:

- work which helps us to reduce the likelihood of a flood occurring, and
- work which helps us to deal with the consequences of flooding.

In the past, we have focussed on reducing the likelihood of flooding by building flood defences. Other measures have been used but not as a primary solution to flood risk. It is now widely recognised that managing flood risk to provide safe and sustainable communities will require more emphasis on the management of the consequences of flooding. This will include:

- promoting awareness of flooding so that organisations, communities and individuals are aware of the risk and are better prepared to take action in time of flood;
- providing flood warning services to those at risk, to enable them to take action;
- improved incident and emergency response by the emergency services and by those at risk from flooding;
- encouraging land use planning to take account of flood risk in determining the location, layout and design of new development;
- flood proofing properties and infrastructure to improve the resilience (reducing the damage from flood water) and the resistance (keeping water out) to avoid harm.

In this CFMP area, current flood risk management is mainly reliant on flood warning, development control and local defences at communities, such as Bangor-on-Dee. More extensive defences are dominant in the tidal Dee Estuary.

Some of the ways in which we currently manage risk in the catchment include:

- **flood risk mapping and data management** (understanding the risks now and in the future);

  Flood risk mapping is fundamental to understanding flood risk and managing it effectively.

  A number of flood risk mapping studies have recently been undertaken in order to better understand flood risk and improve the quality of our Flood Maps. We have recently been improving our Flood Maps in the tidal Dee area and the River Alyn catchment.

- **strategic planning and development control** (managing future risk and adapting to climate change);

  CFMPs and SMPs are an important part of strategic planning allowing us to look at a range of strategic measures. These include looking for opportunities to reduce run-off through better rural land management and restoration of floodplains through redevelopment of properties and infrastructure.

  We work with local authorities to ensure their local development plans address flood risk. We have worked with Denbighshire County Council and helped them produce a Strategic Flood Consequence Assessment to support their local development plan.

- **asset management and maintenance** (managing current risk);

  We build, operate and maintain flood defences in the CFMP area. We own and manage the sluice and flow control arrangements at Llyn Tegid reservoir. In the upper and middle catchments flood defences generally protect agricultural land with local schemes, including defences at Bala, the recently completed schemes at Rhydymwyn and Rossett, and the Trevalyn and Bangor-on-Dee schemes protecting urban communities.

- **flood forecasting and warning** (flood event management);

  We use the latest technology to monitor rainfall, river levels, tides and sea conditions and use this information to produce flood warnings.

  At present we forecast river levels on the main River Dee based on observed conditions. Flood forecasting models are in development for the main River Dee. Recent improvements to the flood forecasting model on the River Alyn are being developed and will be implemented in the future.

  In the River Dee catchment there is a well developed flood warning service providing flood warnings to 540 properties.

- **flood incident management** (responding to flooding events);

  Emergency response to flood events is mainly co-ordinated through Civil Contingency arrangements and Local Resilience Forums.

  Our role is to advise our partners through these arrangements. We support and participate in emergency response exercises.

↑ Horseshoe Falls on the River Dee near Llangollen

The impact of climate change and future flood risk

Future flood risk will be influenced by climate change, changes in land use (for example urban development) and rural land management. Sensitivity testing identified that the main driver of change to future flood risk is climate change. Urban development and changes to land management have much less impact on flood risk at the catchment-wide scale and are also unlikely to occur at the whole catchment scale.

The following scenario was used to analyse future flood risk:

- 20 per cent increase in flows;
- a total sea level rise of one metre by the year 2100;
- urban development increases in the urban areas of Wrexham, the Deeside conurbation and Chester;
- small changes to land management and agricultural practices throughout the majority of the catchment and larger changes (agricultural intensification and improved drainage) in the Cheshire Plain.

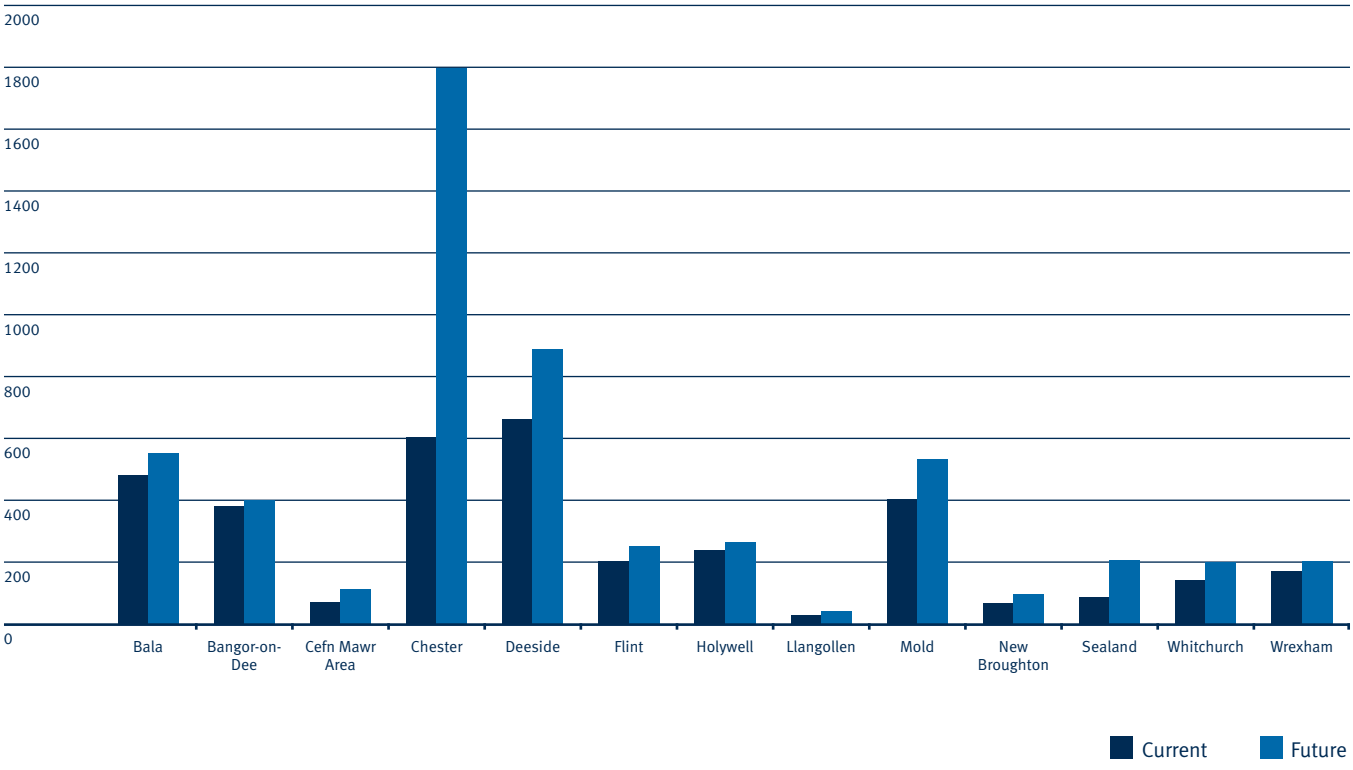
Assuming the current level of flood risk management continues, we estimate that by 2100 the number of properties at risk from the 1% AEP flood event will increase, from approximately 4,200 to around 6,400, unless actions are taken to manage the increasing risks.

Figure 2 shows the difference between current and future flood risks from a 1% AEP flood event, assuming current management activities. The most significant increases in future risk occur in Chester, Deeside and Mold.

Future increase in flood risk in the River Dee CFMP tends to be largest in towns located near the mouth of rivers, or where the tidal influence travels inland up an estuary. This is where the effects of sea level rise and increased river flows combine, resulting in more frequent, deeper and more extensive flooding.

Locations where this is likely to occur include the Deeside conurbation, Sealand and Chester. In Bala and Bangor-on-Dee the numbers of properties potentially at risk are already high and flood risk is predicted to increase. Localities such as Mold, Wrexham, Whitchurch and some other communities would experience flooding from more frequent, less severe flood events. Locations at greatest risk in the future are shown in Table 3.

Figure 2. Current and future (2100) numbers of properties at risk from a 1% AEP flood event



Wetter winters and more severe storm events are likely to lead to increased surface water. This may be of particular concern in communities such as Wrexham, the Deeside conurbation, Chester, Buckley and Rhosllanerchrugog and to a lesser extent in Mold, Flint, Holywell and Neston where such flooding is already an issue.

In the future, we do not expect the area of environmental and landscape designations at risk of flooding to increase significantly and we do not expect new sites to be flooded.

We expect surface water and groundwater flooding will increase. Organisations will need to work together to investigate and manage this flood risk in the future.

Potential increase in infrastructure at risk of flooding in the future is shown in Table 4. One of the most notable increases is the number of electricity/gas installations, from 30 in the present to 48 in the future. The distance of combined road and rail affected by flooding also potentially increases from 38 kilometres to 51 kilometres. Increases in infrastructure affected are greatest around the River Dee estuary and in particular in Chester and the Deeside conurbation.

Table 3. Key locations at risk in a future (2100) 1% AEP flood event

Number of properties at risk	Locations
› 1,000	Chester
500 to 1,000	Bala, Mold, Deeside
100 to 500	Cefn Mawr Area, Bangor-on-Dee, Whitchurch, Wrexham, Sealand, Flint, Holywell
50 to 100	New Broughton
25 to 50	Llangollen

Table 4. Infrastructure at risk in the future (2100) 1% AEP flood event

48 electricity/gas plants
18 sewage/water treatment plants
4 telephone exchanges
14 schools
6 railway stations
33 kilometres of 'A' roads
18 kilometres of rail track

↑ The lower River Dee floodplain

Future direction for flood risk management

Approaches in each sub-area

We have divided the River Dee catchment into 10 distinct 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. These are shown in Map 3 and Table 5.

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. Policy analysis and selection is based on flood risk across the entire CFMP area and not just the key locations referred to earlier.

Map 3. Sub-areas in the River Dee CFMP

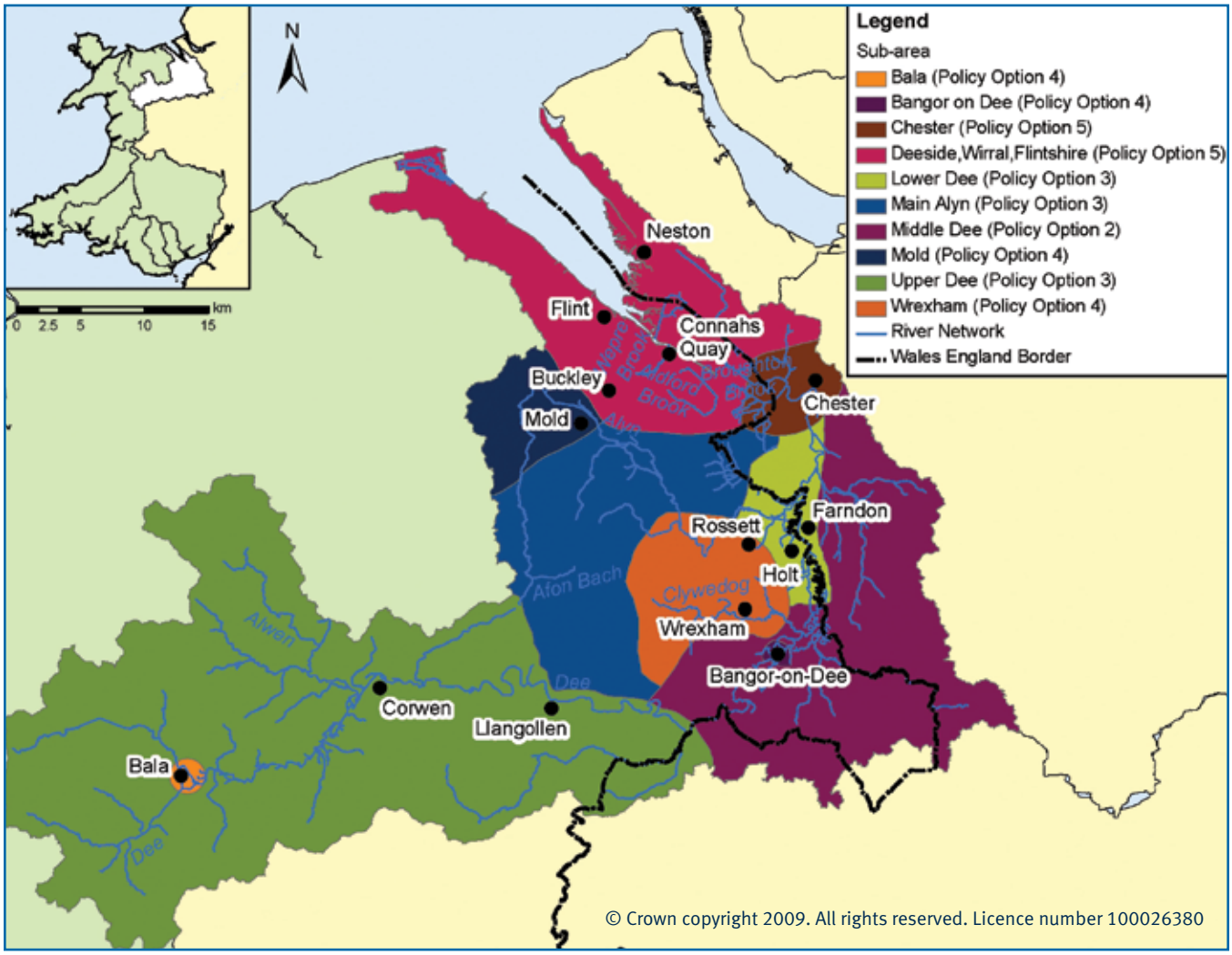


Table 5. Policy options

➜ 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.

Upper Dee

Our key partners are:

Local Authorities and communities

Landowners and managers

Snowdonia National Park Authority

Countryside Council for Wales (CCW)

The issues in this sub-area

This is a rural area which includes the source of the River Dee in the Snowdonia National Park to its confluence with the River Ceiriog between Llangollen and Erbistock.

Approximately 300 properties are currently at risk from the 1% AEP flood event, rising to around 450 properties in the future. Current flood risk mainly affects isolated and small groups of properties and agricultural land. Flooding is generally from river and surface water sources. International and nationally designated environmental sites are also affected by flooding.

↑ Upland River Dee Catchment

Flooding on the River Dee downstream of Llyn Tegid is part managed through the Bala flow control sluices. Raised defences protect Llanuwchlyn and communities between Llanderfel and Corwen.

The vision and preferred policy

Policy Option 3 – areas of low to moderate flood risk where we are generally managing existing flood risk effectively.

Our vision is to ensure our actions are appropriate and proportionate to the risks, now and in the future.

We will continue to control flood water flows at Bala, whilst it is justifiable to do so. We will continue to maintain our defences, but it may not be justifiable to increase their height in the future. Our vision also includes:

- increased emphasis on actions to manage the consequences of flooding;
- increased community and individual awareness of their flood risks and adoption of actions both can take to help themselves.

Actions to implement the policy include:

Review and rationalise our current actions to ensure they are appropriate and targeted to locations of greatest risk.

Encourage and support our partners to produce local long term plans to manage all sources of flooding, particularly at Llanuwchlyn and communities between Llanderfel and Corwen. These plans should include an assessment of the consequences of flooding, including from overtopping of defences and actions to manage these. They should consider future options and investment needs for defences, emergency planning and response, and development control issues.

Engage and advise the local community to encourage people at risk to take action to help themselves.

Review the flow control and storage regime for reservoirs in view of the potential impacts of climate change.

Develop an improved upper Dee catchment model to improve our understanding of flood risk.

Implement a flood forecasting model for the River Dee as a whole.

Encourage and support opportunities for land use and management change, which assist in achieving flood risk and wider benefits.

Main Alyn

Our key partners are:

Local Authorities and communities

Landowners and managers

Dŵr Cymru Welsh Water

CCW

The issues in this sub-area

This is a mainly rural area, particularly upstream of Mold. It includes the majority of the River Alyn valley, from its source to the confluence with the River Dee. It includes the communities of Gresford, Llay, Caergwrle and Hope but excludes Mold and Rhydymwyn which are in sub-area 8.

Approximately 200 properties are currently at risk from the 1% AEP flood event, rising to around 290 properties in the future. The main source of flooding is the River Alyn, but there are also areas of local surface water and sewer flooding. Main roads and other infrastructure are also at risk of flooding.

The main communities are protected against flooding from the River Alyn by schemes implemented since the 2000 floods.

International and nationally designated environmental sites, including Alyn Valley Woods SAC are affected by flooding.

The vision and preferred policy

Policy Option 3 – areas of low to moderate flood risk where we are generally managing existing flood risk effectively.

Our vision is to ensure our actions are appropriate and proportionate to the risks, now and in the future.

We will continue to maintain our defences, but it may not be justifiable to increase their height in the future. Our vision also includes:

- increased emphasis on actions to manage the consequences of flooding;
- increased community and individual awareness of their flood risks and adoption of actions both can take to help themselves.

Actions to implement the policy include:

Review and rationalise our current actions to ensure they are appropriate and targeted to locations of greatest risk.

Carry out a modelling study on the River Alyn to better understand the flood risk.

Encourage and support our partners to produce local long term plans to manage all sources of flooding, particularly for communities downstream of Mold. These plans should include an assessment of the consequences of flooding, including from overtopping of defences and actions to manage these. They should consider future options and investment needs for defences, emergency planning and response, and development control issues.

Engage and advise the local community, to encourage people at risk to take action to help themselves.

Encourage and support studies by partners to identify surface water and sewer flooding issues and management options.

Support opportunities to store water or manage run-off to provide flood risk and environmental benefits.

Encourage and support opportunities for land use and management change, which assist in achieving flood risk and wider benefits.

↑ River Alyn weir at Caergwrle

Sub-area 3

Middle Dee

Our key partners are:

Local Authorities and communities

Landowners and managers

Dŵr Cymru Welsh Water

CCW

The issues in this sub-area

This area covers the River Dee catchment from its confluence with the River Ceiriog to downstream of the confluence with the River Clywedog. It includes the communities of Overton, Whitchurch, Tattenhall and Malpas.

Approximately 220 properties are currently at risk from a 1% AEP flood event, rising to around 310 in the future. The main source of flooding is the River Dee, but there are local areas of surface water and sewer flooding, for example in Whitchurch and Tattenhall.

Main roads, infrastructure, international and nationally designated environmental sites, including the Dee Meanders SAC are affected by flooding.

Raised defences at Worthenbury reduce the likelihood of flooding from Wych and Emral Brooks. Raised defences downstream of Bangor-on-Dee, reduce the likelihood of flooding to agricultural land and buildings from the River Dee. Land drainage pumping stations in Worthenbury Meadows evacuate flood waters from this area.

The vision and preferred policy

Policy Option 2 – areas of low to moderate flood risk where we can generally reduce existing flood risk management actions.

Our vision is to reduce reliance and expenditure on the agricultural defences over time. We will follow a risk based approach to rationalise our current activities and target our actions and limited resources to locations of greatest risk.

We will continue to maintain our defences, but it may not be justifiable to continue to maintain these, or to increase their height in the future. Our vision also includes:

- increased emphasis on actions to manage the consequences of flooding;
- increased community and individual awareness of their flood risks and adoption of actions both can take to help themselves.

↑ Middle Dee floodplain

Actions to implement the policy include:

Work with partners to determine how the policy of reducing actions is most appropriately communicated and implemented.

Investigate with local communities and land managers the feasibility of changing management approaches for agricultural land, defences and land drainage pumping stations.

Develop flood resilience and climate change adaptation plans for pumping station assets.

Encourage and support our partners to produce local long term plans to manage all sources of flooding, particularly for Erbistock, Worthenbury, Malpas. These plans should include an assessment of the consequences of flooding, including from overtopping of defences and actions to manage these. They should consider future options and investment needs for defences, emergency planning and response, and development control issues.

Develop an updated catchment model, to include main tributaries in the middle Dee including Worthenbury Brook, River Clywedog and River Gwenfro.

Engage and advise the local community, to encourage people at risk to take action to help themselves.

Sub-area 4

Wrexham

Our key partners are:

Wrexham County Borough Council

Local communities

Dŵr Cymru Welsh Water

Emergency services

The issues in this sub-area

Mainly an urban area which includes Wrexham and outlying communities. The River Gwenfro flows from west to east through the centre of the town and joins the River Clywedog to the south east of Wrexham.

Approximately 250 properties are currently at risk of flooding from a 1% AEP flood event, increasing to around 290 in the future.

The main source of flooding to Wrexham town centre is the River Gwenfro. Locations to the south west of the town, such as Five Fords and Bowling Brook experience flooding from the River Clywedog.

Wrexham

Many urban locations within Wrexham and outlying towns experience flooding from surface water run-off and local sewer systems. This affects property and roads.

There are localised defences and engineered river walls on the River Gwenfro, through Wrexham and New Broughton, and on the River Clywedog south of Wrexham. Wrexham is identified for residential, commercial and industrial growth in the North East Wales/West Cheshire Sub Regional Strategy.

The vision and preferred policy

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

Our vision includes improved integration of actions by all parties to manage all sources of flood risk.

We will continue to maintain our defences, but it may not be justifiable to increase their height in the future. Our vision also includes:

- increased emphasis on actions to manage the consequences of flooding;
- increased community and individual awareness of their flood risks and adoption of actions both can take to help themselves.

Actions to implement the policy include:

Encourage and support our partners to produce local long term plans to manage all sources of flooding at Wrexham. These plans should include an assessment of the consequences of flooding, including from overtopping of defences, and actions to manage these. They should consider future options and investment needs for defences, emergency planning and response, and development control issues to avoid inappropriate development in high risk areas.

Seek to reduce the flow capacity restrictions and sources of blockages over time.

Include the Rivers Clywedog and Gwenfro in the River Dee, flood risk mapping, catchment model to better understand the risks.

Encourage and support studies by partners to identify surface water and sewer flooding issues and management options, particularly in Wrexham town centre area and New Broughton.

Engage and advise the local community, to encourage people at risk to take action to help themselves.

Lower Dee

Our key partners are:

Local Authorities and communities

Landowners and managers

CCW

The issues in this sub-area

This is mainly a rural area downstream of Worthenbury. It contains much of the Dee Meanders, and several settlements including Holt, Farndon, Rossett, Aldford and Eccleston.

Approximately 50 properties are currently at risk of flooding from a 1% AEP flood event, increasing to around 70 in the future. The main source of flooding is the River Dee, but there are communities that experience flooding from local watercourses and drainage systems, for example, Holt, Farndon and Eccleston.

Infrastructure and international and nationally designated environmental sites, including the Dee Meanders, are at flood risk.

There are raised defences at Holt, Rossett, Aldford, Eccleston and Trevalyn. Raised defences upstream of Shocklach protect agricultural land and buildings against flooding from the River Dee. There is a land drainage pumping station at Trevalyn.

The vision and preferred policy

Policy Option 3 – areas of low to moderate flood risk where we are generally managing existing flood risk effectively.

Our vision is to ensure our actions are appropriate and proportionate to the risks, now and in the future.

We will continue to maintain our defences, but it may not be justifiable to increase their height in the future. Our vision also includes:

- increased emphasis on actions to manage the consequences of flooding;
- increased community and individual awareness of their flood risks and adoption of actions they can take to help themselves.

↑ Holt Meadows in flood

Actions to implement the policy include:

Review and rationalise our current actions to ensure they are appropriate and targeted to locations of greatest risk.

Investigate with local communities and land managers the feasibility of changing management approaches for agricultural land, defences and land drainage pumping stations.

Encourage and support our partners to produce local long term plans to manage all sources of flooding, particularly at Holt, Rossett, Aldford, Eccleston, Almere Shocklach and Farndon. These plans should include an assessment of the consequences of flooding, including from overtopping of defences, and actions to manage these. They should consider future options and investment needs for defences, emergency planning and response, and development control issues to avoid inappropriate development in high risk areas.

Engage and advise the local community to encourage people at risk to take action to help themselves.

Sub-area 6

Deeside, Wirral and North Flintshire

Our key partners are:

- Local Authorities and communities
- Landowners and managers
- Water companies
- CCW
- Local Industries
- Emergency Services

The issues in this sub-area

This area includes the Dee Estuary and the urban areas of Deeside, Sealand, Flint, Holywell, Neston, Heswall and West Kirby and large tracts of agricultural land.

This area is important as a major industrial centre with large industrial plants and commercial premises such as Corus and Airbus. Deeside and Sealand conurbations are very flat with large areas of land below high spring tide levels.

↑ Northern embankment on the tidal River Dee

The River Dee channel between Chester Weir and the estuary mouth is canalised with substantial earth defences on both sides. These reduce the likelihood of tidal flooding, however tidally influenced flooding remains a significant risk to low lying areas.

Approximately 1,250 properties are currently at risk of flooding from a 1% AEP river flood event increasing to around 1,700 in the future. The dominant source of flooding is the River Dee.

Tidal levels can restrict the outflows from watercourses and drainage systems and exacerbate flooding behind defences.

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.

This is a heavily urbanised area with a complex interaction of flood sources and environmental features. In the future, sea level rise and additional development could increase the flood risks considerably, unless these are managed.

This area is dependent on flood defences to reduce the likelihood of flooding Overtopping of defences, now or in the future, by extreme flood events could have serious consequences.

Defences will continue to have a dominant role in reducing the likelihood of flooding, but we will seek a broader range of integrated actions to manage both current and future flood risks.

We will continue to maintain our defences, but it may not be justifiable or acceptable to increase their height in the future.

The outcome we seek is a complementary set of flood risk management actions by all partners at a local community level. These will include:

- increased emphasis on actions to manage the consequences of flooding from all sources;
- increased community and individual awareness of their flood risks and adoption of actions both can take to help themselves.

Actions to implement the policy include:

We will develop a Tidal Dee Flood Risk Management Strategy to identify the appropriate mix of actions to manage flood risk from all sources, now and into the future. We will engage with and seek the support of our partners to this strategy.

This strategy will inform and be informed by the North Wales and North West England SMP.

Chester

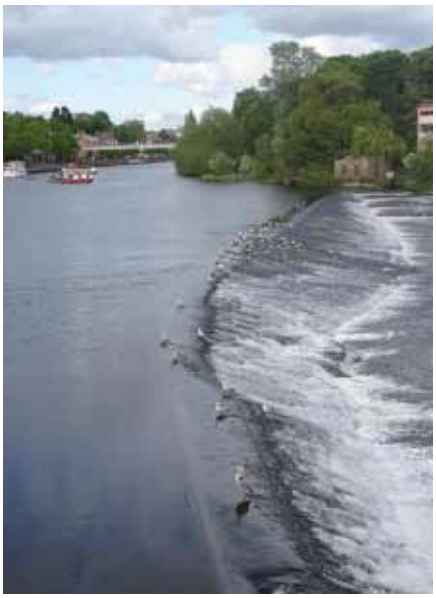
Our key partners are:

- Cheshire West and Chester Council
- Local communities
- Water Companies
- CCW
- Emergency services

The issues in this sub-area

This area includes the city of Chester and its immediate suburbs. It is a densely populated urban area interspersed with open spaces and parks and is a major commercial area in West Cheshire.

Approximately 600 properties are currently at risk of flooding from a 1% AEP river flood event, increasing to around 1,800 in the future.



↑ Chester Weir at low tide

The dominant source of flooding is the River Dee. Tidal levels can restrict the outflows from watercourses and drainage systems and exacerbate flooding behind defences.

Main roads and infrastructure installations are also at risk of flooding. The River Dee SAC, parkland and open spaces are exposed to flooding.

Raised defences on the canalised section of the River Dee from Chester Weir to the A548 road bridge protect Chester against tidal and river flooding. In the low lying areas to the west of the city on the north bank of the River Dee, raised defences protect residential and commercial property.

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.

Defences will continue to have a dominant role in reducing the likelihood of flooding, but we will seek a broader range of integrated actions to manage both current and future flood risks.

We will continue to maintain our defences, but it may not be justifiable or acceptable to increase their height in the future. The outcome we seek is a complementary set of flood risk management actions by all partners at a local community level. These will include:

- increased emphasis on actions to manage the consequences of flooding from all sources;
- increased community and individual awareness of their flood risks and adoption of actions both can take to help themselves.

Actions to implement the policy include:

Encourage and support our partners to produce local long term plans to manage all sources of flooding at Chester. These plans should include an assessment of the consequences of flooding, including from overtopping of defences, and actions to manage these. They should consider future options and investment needs for defences, emergency planning and response, and development control issues to avoid inappropriate development in high risk areas.

Engage and advise the local community to encourage people at risk to take action to help themselves.

Flood risk management actions will inform and be informed by the North Wales and North West England SMP and the Tidal Dee flood risk management strategy.

Mold

Our key partners are:

Flintshire County Council

Local communities

Dŵr Cymru Welsh Water

The issues in this sub-area

This area is centred around the towns of Mold and Rhydymwyn and is predominantly urban.

Approximately 440 properties are currently at risk from a 1% AEP flood event, increasing to around 540 in the future. Flood defences have recently been constructed to reduce the likelihood of flooding direct from the River Alyn.

Culverts and flow constrictions on the tributaries of the River Alyn also increase the likelihood of flooding in Mold.

↑ Mold Flood Alleviation Scheme, implemented in 2006

Many locations within Mold and outlying communities are at risk of flooding from surface water run-off, local watercourses and drainage systems.

Mold is one of the major areas in Flintshire identified for residential, commercial and industrial growth in North East Wales/West Cheshire.

The vision and preferred policy

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

Our vision includes improved integration of actions by all parties to manage all sources of flood risk, particularly local surface water and sewer flooding in Mold and Rhydymwyn.

Increased naturalisation of watercourses and a reduction of constrictions to flow and culverts. Particularly in urban areas, e.g. Mold.

We will continue to maintain our defences, but it may not be justifiable to increase their height in the future. Our vision also includes:

- increased emphasis on actions to manage the consequences of flooding from all sources;
- increased community and individual awareness of their flood risks and adoption of actions both can take to help themselves.

Actions to implement the policy include:

Encourage and support our partners to produce local long term plans to manage all sources of flooding at Mold. These plans should include an assessment of the consequences of flooding, including from overtopping of defences, and actions to manage these. They should consider future options and investment needs for defences, emergency planning and response, and development control issues to avoid inappropriate development in high risk areas.

Work with partners to deliver over time increased naturalisation of watercourses and a reduction of constrictions to flow and culverts in Mold.

Encourage and support studies by partners to identify surface water and sewer flooding issues and management options, in Mold and Rhydymwyn.

Include the Mold area in the River Dee Flood Forecasting Model.

Engage and advise the local community, to encourage people at risk to take action to help themselves.

Bangor-on-Dee

Our key partners are:

Wrexham County Borough Council

Local communities

Dŵr Cymru Welsh Water

CCW

The issues in this sub-area

This area consists of the small, mainly residential area of Bangor-on-Dee on the east bank of the River Dee. It sits within the Middle Dee sub-area.

Approximately 370 properties are currently at risk from a 1% AEP flood event, increasing to around 390 properties in the future.

There are flood defences at Bangor-on-Dee and upstream. In general, ground levels are one to two metres below the 1% AEP flood level and the defences are high in relation to some of the properties. Any overtopping or breach of the defences could have very serious consequences.

↑ The Old Dee Bridge in Bangor-on-Dee

Localised flooding in the north of the town is managed by a pumping station which removes storm water back-up when river levels are high.

The two main sources of flooding are from overtopping of the defences upstream of the town at Bangor racecourse and backing-up of drainage systems within the town during high river 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.

Our vision includes improved integration of actions by all parties to manage all sources of flood risk, particularly local surface water and sewer flooding.

This community is very dependent on flood defences to reduce the likelihood of flooding. We will continue to maintain our defences, but it may not be justifiable or acceptable to increase their height in the future. Our vision also includes:

- increased emphasis on actions to manage the consequences of flooding from all sources;
- increased community and individual awareness of their flood risks and adoption of actions both can take to help themselves.

Actions to implement the policy include:

Encourage and support our partners to produce a local long term plan to manage all sources of flooding at Bangor on Dee. This plan should include an assessment of the consequences of flooding, including from overtopping of defences, and actions to manage these. The plan should consider future options and investment needs for defences, emergency planning and response, and development control issues to avoid inappropriate development in high risk areas.

We will continue to maintain our defences and provide flood warnings.

Encourage and support studies by partners to identify surface water and sewer flooding issues and management options.

Engage and advise the local community, to encourage people at risk to take action to help themselves.

Encourage and support opportunities upstream in the catchment, to reduce local run-off through changes in land management and thereby potentially reducing peak flood levels at Bangor-on Dee.

Bala

Our key partners are:

Gwynedd Council

Local communities

Snowdonia National Park Authority

The issues in this sub-area

This area includes Bala town and its immediate surroundings. It is a small town in the Snowdonia National Park with mixed residential, commercial and light industrial areas. Tourism is an important means of income to local retailers and services.

The main flood risk is from the River Tryweryn to the north east of the town and wave action from Llyn Tegid (Bala Lake). This causes overtopping of the defences on the south west flank of the town. Localised surface water and sewer flooding are also an issue.

↑ Llyn Tegid (Bala Lake) foreshore 2009

Approximately 470 properties are currently at risk from the 1% AEP river flood event, rising to around 560 properties in the future. Flooding in the present is likely to be shallow and would generally lead to minor community disruption.

Climate change is expected to be the main cause of increased flood risk in the future.

Lower sections in the defences north of the town reduce the effective level of protection to Bala. The standard of protection of raised defences in the south west flank of Bala, depends on lake water levels which are regulated but which are also open to natural lake level fluctuations.

The vision and preferred policy

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

Our vision includes improved integration of actions by all parties to manage all sources of flood risk, particularly local surface water and sewer flooding.

We will continue to maintain our defences, but it may not be justifiable or acceptable to increase their height in the future. Our vision also includes:

- increased emphasis on actions to manage the consequences of flooding from all sources;
- increased community and individual awareness of their flood risks and adoption of actions both can take to help themselves.

Actions to implement the policy include:

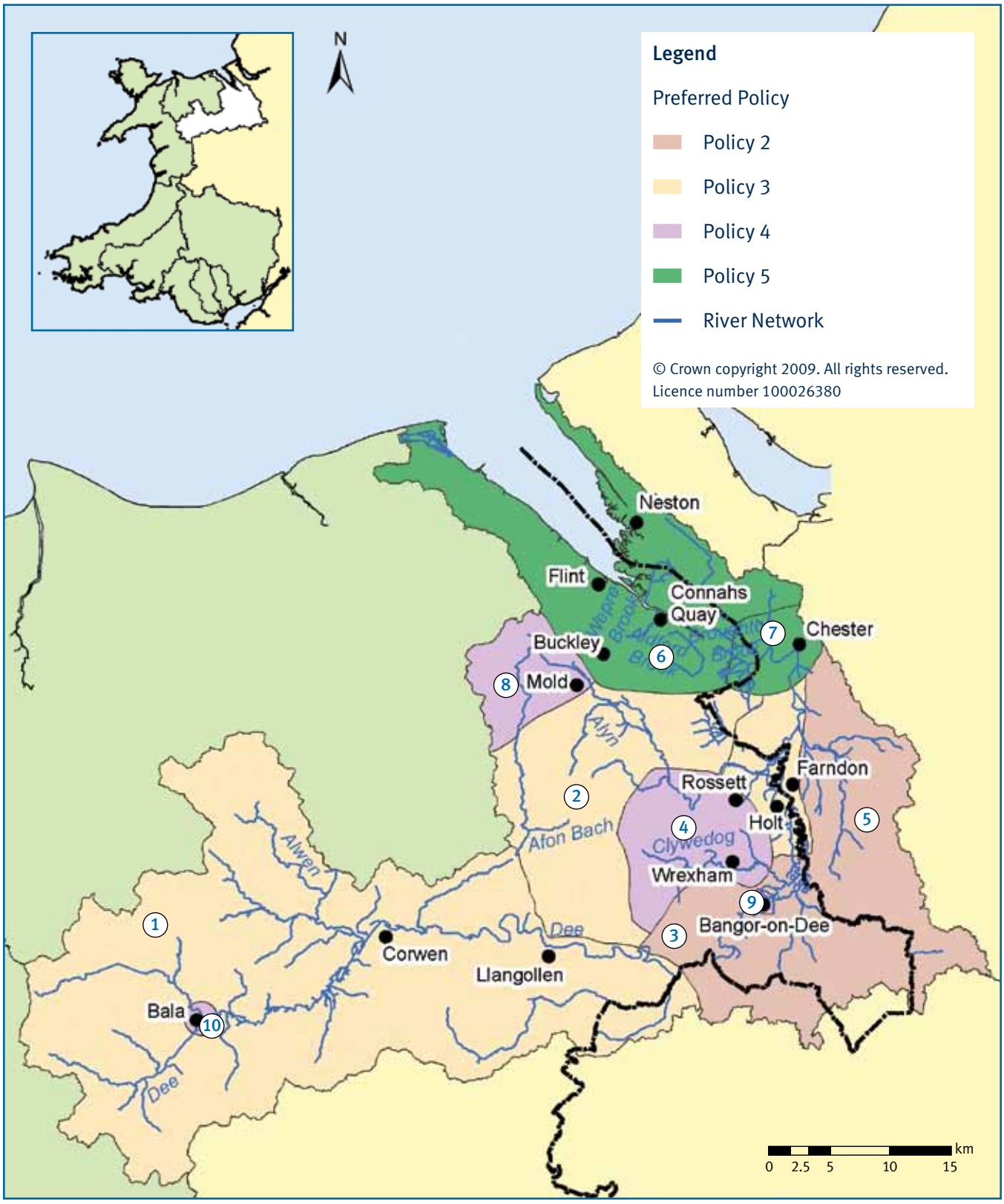
Encourage and support our partners to produce a local long term plan to manage all sources of flooding at Bala. This plan should include an assessment of the consequences of flooding, including from overtopping of defences, and actions to manage these. The plan should consider future options and investment needs for defences, emergency planning and response, and development control issues to avoid inappropriate development in high risk areas.

Encourage and support studies by partners to identify surface water and sewer flooding issues and management options.

Engage and advise the local community, to encourage people at risk to take action to help themselves.

Encourage and support an assessment of the impacts on the operational regime of Bala Lake of climate change, particularly with respect to flood risk management.

Map of CFMP policies



Sub-area 1 – Upper Dee

Flood risk is low to moderate for the present and future. Where risk increases in the future this will be managed by reprioritising current flood risk management activities.

Sub-area 2 – Main Alyn

Flood risk is low to moderate and is not expected to increase significantly in the future. Where risk does increase this will be managed by reprioritising current flood risk management activities.

Sub-area 3 – Middle Dee

Flood risk is comparatively low and is not expected to rise significantly in the future. Through adopting different land drainage management practices we would expect to be able to reduce reliance and expenditure on these.

Sub-area 4 – Wrexham

The current and future flood risk from river flooding to this area is moderate. Flood risk does increase in the future and is intensified by urban drainage issues. Flood risk management activity will need to increase to sustain the current level of protection into the future.

Sub-area 5 – Lower Dee

Flood risk is low across this area as a whole for the present and future. Where risk increases for specific communities in the future, this will be managed by reprioritising current flood risk management activities.

Sub-area 6 – Deeside Wirral and North Flintshire

The current and future flood risk is high, particularly along the river corridor, in low lying flat areas of Deeside and Sealand, and in towns along the estuary border. We will need to take action now and in the future to lower the risk of flooding to communities.

Sub-area 7 – Chester

The current and future flood risk is high and the disruption and damage caused by flooding is currently potentially high. We will need to take action now and in the future to lower the risk of flooding to communities in Chester.

Sub-area 8 – Mold

The present and future flood risk is moderate to high overall, with an increase in the extent of flooding in the future. Following an integrated management approach we will respond to the increased risk to these communities in the future with actions to sustain the present level of service.

Sub-area 9 – Bangor-on-Dee

There is potentially a high risk to this community at present and a high risk in the future due to increased river flows. Flood risk management activity will need to increase in response to the increasing risk posed by future change.

Sub-area 10 – Bala

The present risk is potentially high in Bala and the future flood risk high. Flood risk management activity will need to increase in response to the increasing risk posed by future change.

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