



Asiantaeth yr
Amgylchedd Cymru
Environment
Agency Wales

Conwy and Clwyd Catchment Flood Management Plan

Summary Report January 2010



managing
flood risk

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Front cover image: Tu Hwnt i'r Bont and Pont Fawr over the River Conwy, Llanrwst © iStockphoto.com/lazortech

Introduction



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

The Conwy and Clwyd 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 Conwy and Clwyd CFMP area has a number of centres of population which, because of their coastal and estuarine locations, expose them to the combined potential risk from river, tidal and coastal flooding, for example Prestatyn, Rhyl and Kinmel Bay.

Urban drainage issues and surface water problems also contribute to the flooding in these localities. There is a long history of flooding in this CFMP area and over the last 50 years numerous engineering schemes have been implemented to manage the flood risk in conjunction with other management responses, for example St Asaph, Ruthin, Llanrwst and Trefriw.

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.

A handwritten signature in blue ink that reads "Chris Mills".

Chris Mills
Director Wales

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Image: The Conwy Valley

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.

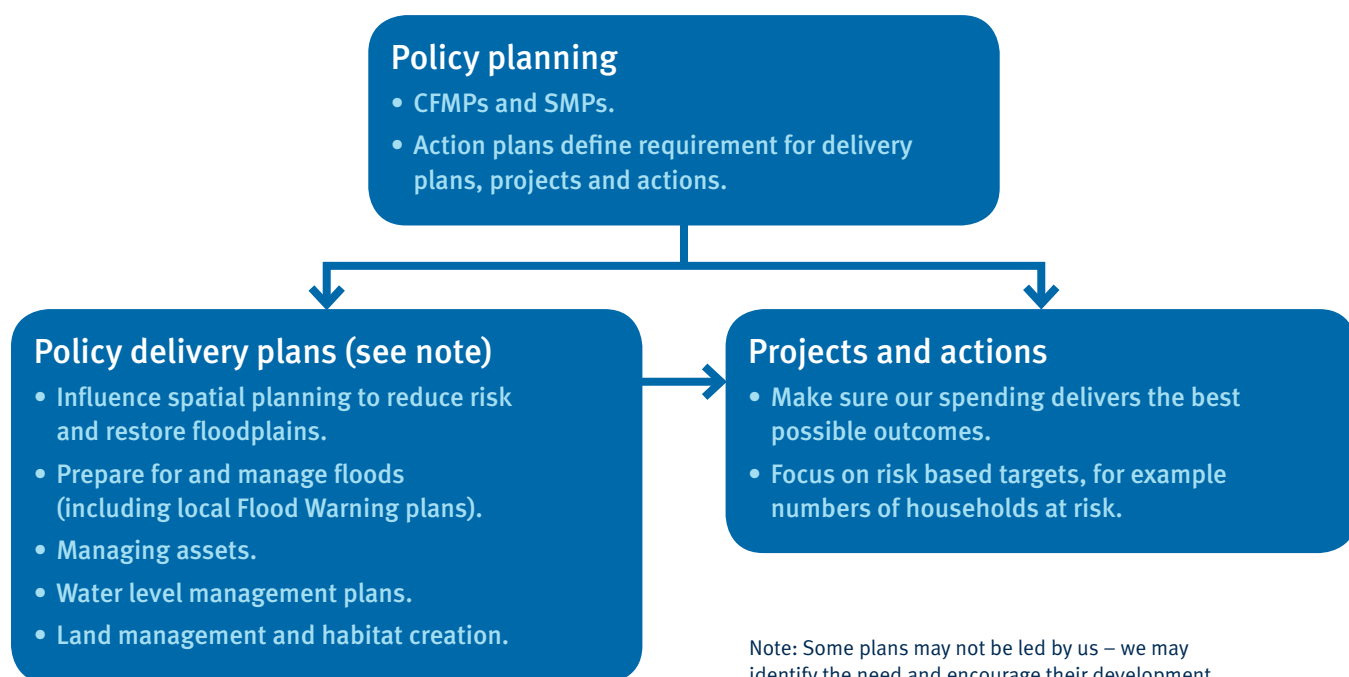
CFMPs aim to promote more sustainable approaches to managing flood risk.

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



Catchment overview

The Conwy and Clwyd CFMP covers a total area of approximately 1,500 km² and contains around 90,000 properties. It includes the two major catchments of the River Conwy to the West and the River Clwyd to the East. Other minor rivers also drain small catchment areas along the coast.

The main urban settlements include the coastal towns of Conwy, Llandudno, Colwyn Bay, Abergele, Prestatyn, Rhyl, Kinmel Bay and the inland communities of St Asaph, Denbigh, Ruthin, Llanrwst and Betws-Y-Coed. Beyond these urban centres the catchments are predominantly rural.

There are approximately 125 kilometres of main river; around 50 kilometres of this is in the Conwy catchment and 60 kilometres in the Clwyd. Upland parts of the Conwy catchment are steep and mountainous and within the Snowdonia National Park. Here, high rainfall leads to fast flowing and rapidly responding rivers. The lower reaches are flat and in part are affected by the tide. To the east of the Conwy estuary, the River Ganol and other minor rivers and watercourses flow at shallow gradients.

The River Clwyd catchment to the east is less steep in the higher

reaches than the Conwy but still responds rapidly to rainfall, flattening out near the coast to form a wide floodplain. The River Elwy is the main tributary of the River Clwyd and is faster responding than the Clwyd itself. There are also a number of smaller watercourses with varying but shallow gradients which flow across a wide coastal plain; the main watercourse to the east being Prestatyn Gutter and to the west the River Gele.

Within the coastal areas and as a result of the draw of Snowdonia National park, tourism is important. The rural hinterland is heavily dependent on agricultural production, in particular livestock rearing with sheep farming being the dominant activity with additional areas of commercial forest.

There are numerous designated nature conservation sites and historic environment assets in the CFMP area. There are nine Special Areas of Conservation (SAC), the Migneint-Arenig-Dduallt SAC also being a Special Protection Area (SPA) and 72 Sites of Special Scientific Interest. Almost a third of the CFMP area sits within the Snowdonia National Park.

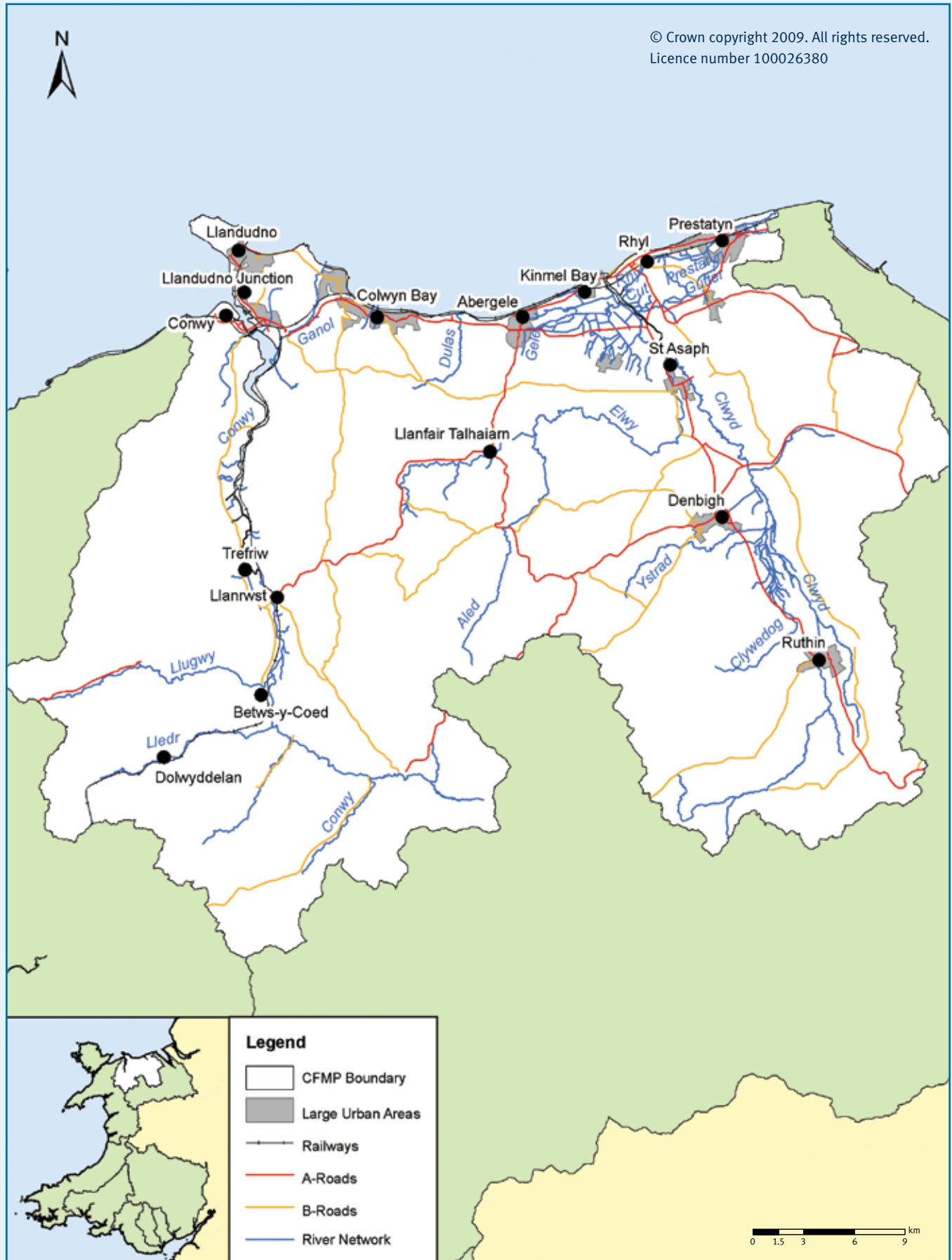
Map 1 shows the location, extent and main features of the Conwy and Clwyd CFMP area.

“Climate change will increase the severity and extent of flood risk from tidally influenced river flooding. The opportunity we all have is to manage the risk in an integrated and sustainable way.”



↑ River Elwy in St Asaph

Map 1. Location of the Conwy and Clwyd CFMP



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.

The Conwy and Clwyd catchments have a long history of flooding. Severe flooding affected the whole area both in February of 2004 and 2005, significantly impacting on the Conwy Valley and Llanrwst. Coastal flooding has caused some of the most disastrous flooding in North Wales. The Towyn Coastal flood event in 1990 which was caused by high tides and storm conditions affected 2,800 properties and closed the mainline railway.

The sources of flood risk are:

- **river flooding** from large main rivers presents a notable risk to Llanrwst, Trefriw, Ruthin, Conwy, St Asaph and the Clwyd Valley. Tributaries and small watercourses pose a notable flood risk to Dolwyddelan, Betws-y-Coed, Llanrwst, Trefriw, Mochdre, Abergele, Llanfair Talhaiarn and Denbigh;
- **tidally influenced river flooding** poses a potential risk to Rhyl, Kinmel Bay, Prestatyn, Llandudno Junction and Conwy;
- **surface water flooding** is experienced at varying locations catchment wide. Locations have been identified based on limited and anecdotal evidence and include Llandudno Junction and Conwy. We believe it to be an issue in many other locations but do not at present have recorded evidence;
- **sewer flooding** is caused by overloading of sewerage systems. Some locations suffer from repeated sewer flooding with homes in St Asaph and Prestatyn having experienced this type of flooding in recent years;
- **groundwater flooding** may affect localised areas within the CFMP area, however at a catchment scale this is not prevalent.

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.

There are currently approximately 3,200 properties across the CFMP area at risk from flooding during a 1% AEP river flood event and around 8,100 properties at risk from a 0.5% AEP predominantly tidal event. There are also a number of campsites and caravan parks which are also potentially at risk of flooding.

Flooding has an impact on some infrastructure, including some important road and rail links.

Approximately 8.3 per cent of the total land area of nature conservation sites, 13 scheduled monuments, 223 listed buildings and 11 per cent of grade 1 and 2 agricultural land is at risk of flooding from a 1% AEP river flood event. 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 all locations. Flood risk in all other areas has been considered in the development of the CFMP.

The main areas at risk from the 1% AEP event are Prestatyn, Llanrwst, Mochdre, Denbigh, Conwy, Dolwyddelan and Trefriw.

We recognise that there is potential risk from 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.

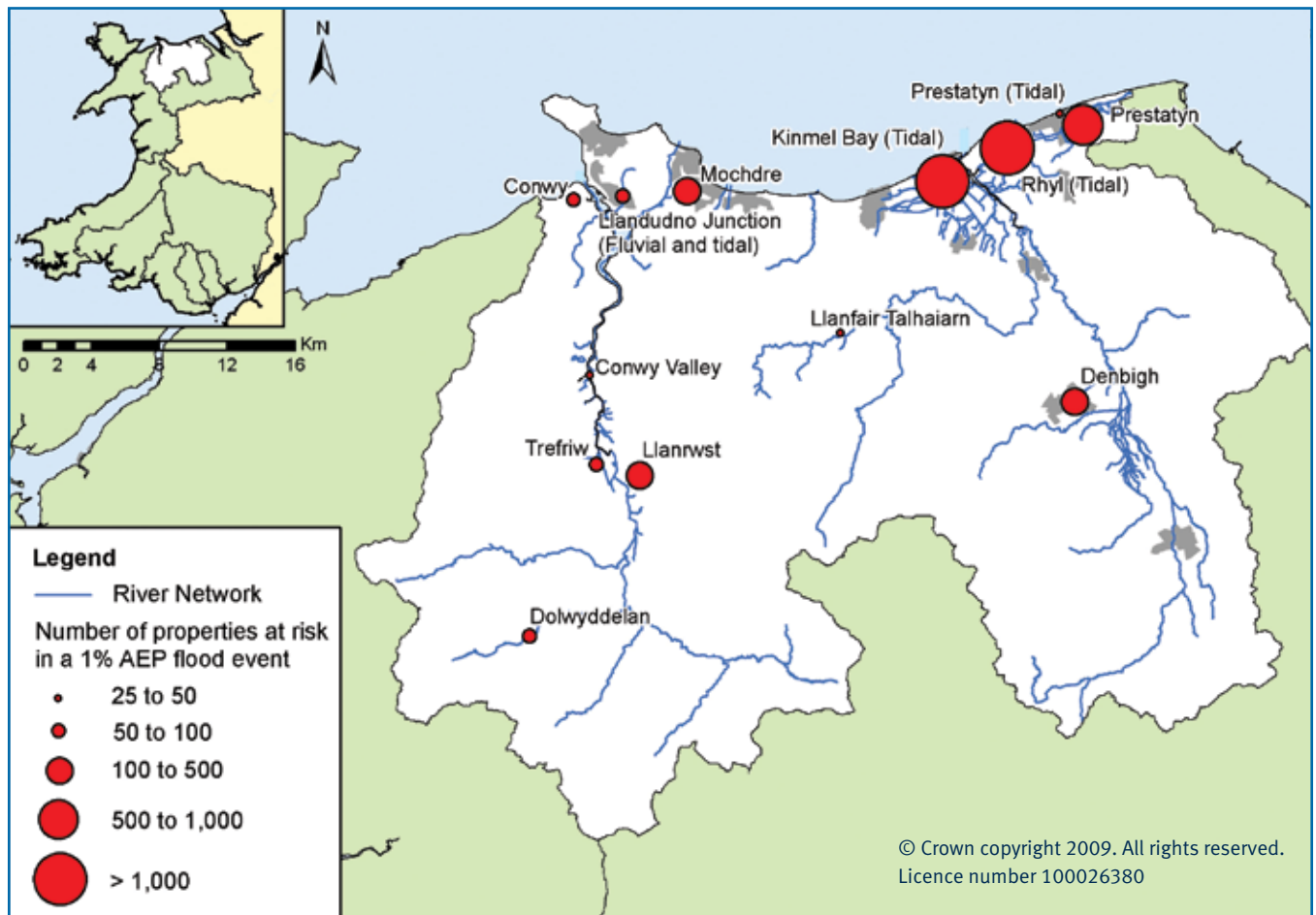
Table 1. Key locations currently at risk in a 1% AEP flood event

Number of properties at risk	Locations
> 1,000	Rhyl (tidal), Kinmel Bay (tidal)
500 to 1,000	Prestatyn
100 to 500	Denbigh, Mochdre, Llanrwst
50 to 100	Conwy, Llandudno Junction (river and tidal), Trefriw, Dolwyddelan
25 to 50	Llanfair Talhaiarn, Conwy Valley, Prestatyn (tidal)

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

19 Health Services
2 Hospitals
9 Emergency services
28 Public Services
12 Schools/colleges
59 Electricity and gas
1 Water Treatment Works
3 Sewage/waste water treatment works
A55 trunk road, A, B and minor roads. North Wales Coast and Conwy Valley railway links

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 focused on reducing the likelihood of flooding by building flood defences. Other measures have been used but not as a primary response 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 Llanwrst and St Asaph. More extensive defences are dominant in the coastal areas such as Prestatyn and Kinmel Bay.

Some of the ways in which we currently manage risk in the CFMP area 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 and we continually update our hydraulic models with the latest data in order to better understand flood risk and improve the quality of our flood maps.

- **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.

Flood risk strategy work currently underway in the tidal Clwyd will strengthen the development of our overall approach to present and future flood and coastal risk management.

We are involved in a pilot study in Prestatyn which, instigated by Welsh Assembly Government and Local Authorities, is looking at adaptation to climate change induced flooding from multiple sources.

We also work closely with local authorities to ensure their local development plans address flood risk.

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

We build, operate and maintain flood defences. There are approximately 32 kilometres of engineered flood defences in urban areas of the CFMP and around 68 kilometres of defences servicing rural localities. Recent defence improvements include those in Ruthin following the 2000 floods and in Llanrwst and Trefriw.

Flood risk management on rivers such as the Wydden in Llandudno Junction are highly dependant on engineered schemes, incorporating extensive culverted sections, flow controlled flood storage areas and management of the tidal influences.

Maintenance procedures differ from catchment to catchment. The work we carry out includes: blockage and debris removal from watercourses, asset inspection, management of flood storage areas and inspection and cleaning of grids and trash screens.

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

A Flood Forecasting Centre has been set up with the Met Office which allows us to continually improve and refine our flood forecasting capability.

We provide flood forecasting and flood warning services to those at risk to enable them to take action. Communities such as Llanrwst (river) and Kinmel Bay (coastal) directly benefit from these services.

- **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.



↑ River Clwyd in Ruthin

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.

The following scenario was used to analyse future flood risk:

- 20 per cent increase in peak river flows in all watercourses;
- a total sea level rise of one metre by the year 2100.

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 3,200 to around

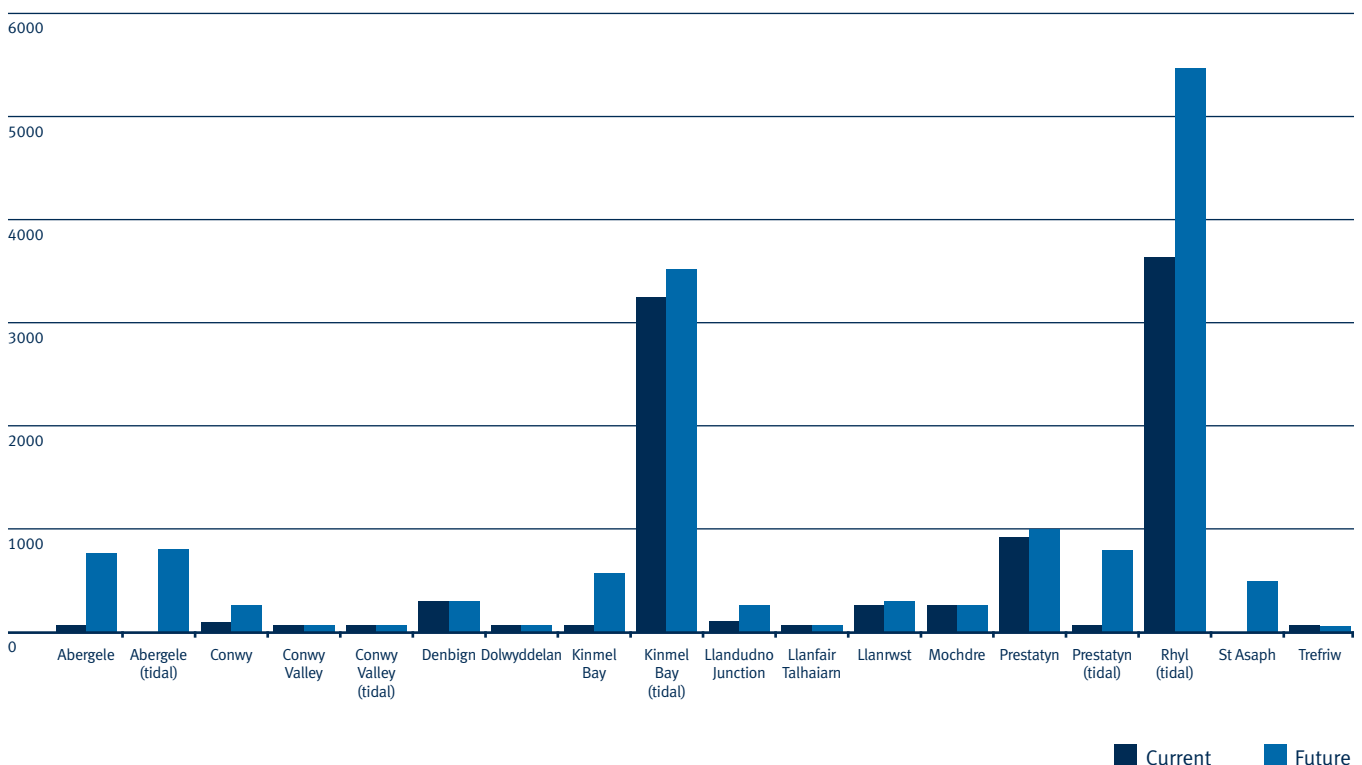
5,600, unless actions are taken to manage the increasing risks.

There is also potentially a significant risk to some coastal communities adjacent to estuaries. For a 0.5% AEP tidal event, the estimated number of properties at risk will increase from 8,100 to almost 16,000 in the future. There are also a number of campsites and caravan parks at risk.

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 Abergele, Prestatyn, Rhyl and Kinmel Bay. This is primarily due to the expected increase in sea level due to climate change.

Table 3 provides a summary of key locations at risk in the future. Future increase in flood risk 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 rainfall combine, resulting in more frequent, deeper and more extensive flooding in the future. The locations where this is likely to occur include Rhyl, Abergele, Kinmel Bay and Prestatyn in particular. There are also notable increases in flood risk from rivers in localities such as St Asaph, Conwy and Llandudno Junction. There are varying degrees of increasing flood risk for all main flood risk communities across the catchment in the future.

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



Transport links across the area are likely to be disrupted more frequently in the future. Although the length of railway lines and roads affected may not be significantly different to the present extents, the frequency and depth of flooding will increase.

There is approximately an 8 per cent increase in the total area of conservation sites affected in the future. No new sites are affected. Sites are likely to experience deeper and faster flowing water and to flood more frequently.

The number of historic environmental assets at risk of both river and tidal flooding increases slightly in the future.

The total area of agricultural land affected by river and tidal flooding will increase and flooding will become more frequent.

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.

Table 4 shows the infrastructure at risk in the future. The most notable increase is the number of gas and electricity sub-stations at risk (increased from 59 to 77). Future tidally induced flooding in Rhyl and Kinmel Bay could put many more community services at risk.



↑ The Conwy Valley looking down stream towards the Conwy Estuary

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

Number of properties at risk	Locations
> 1,000	Abergele, Rhyl (tidal), Kinmel Bay (tidal)
500 to 1,000	Prestatyn, Kinmel Bay, Abergele (tidal), Prestatyn (tidal)
100 to 500	Llandudno Junction (river and tidal), Mochdre, Llanrwst, Conwy, Denbigh, St Asaph
50 to 100	Trefriw, Dolwyddelan, Conwy Valley (tidal)
25 to 50	Llanfair Talhaiarn

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

25 Health Services
3 Hospitals
9 Emergency services
41 Public Services
15 Schools and colleges
77 Electricity and gas
1 Water Treatment Works
2 Sewage waste water treatment works
1 Telephone exchange
A55 trunk road, A, B and minor roads. North Wales Coast and Conwy Valley railway links

Future direction for flood risk management

Approaches in each sub-area

We have divided the Conwy and Clwyd catchments into 12 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 Conwy and Clwyd CFMP

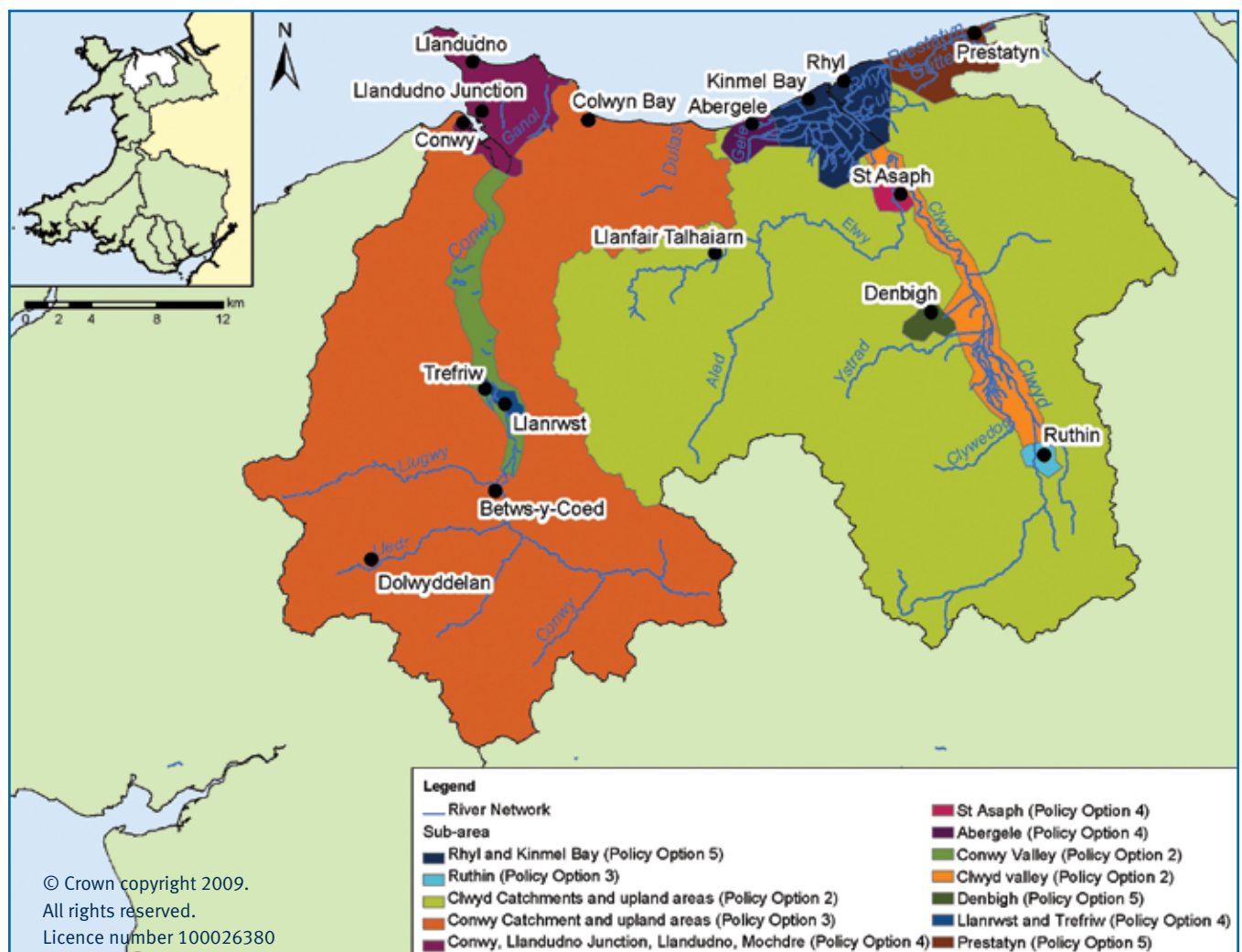


Table 5. Policy options

→ 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.

Conwy Catchment and Upland Areas

Our key partners are:

Conwy County Borough Council

Local communities

Landowners and managers

Countryside Council for Wales (CCW)

The issues in this sub-area

This large area is mainly rural, including a significant area of upland mountainous terrain, with scattered small villages and some larger settlements adjacent to rivers and the coast.

Most of the flooding is from the River Conwy and its tributaries. This affects people, property and infrastructure. There are areas of localised tidal flood risk and there has been localised surface water and sewer flooding.



↑ Upland River Conwy

There are few flood defences and flood risk across the area as a whole, is relatively low and is not expected to increase significantly in the future.

Approximately 360 properties are at risk from the 1% AEP flood event, rising to around 520 properties in the future. Much of this flood risk is dispersed, however some is concentrated in small communities e.g. Dolwyddelan.

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 all 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 replace them 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.

Actions to implement the policy include:

Review and rationalise our current actions to ensure they are appropriate and targeted to locations of greatest risk, e.g. future risk in Betws-y-Coed and Dolwyddelan.

Encourage and support our partners to produce local long term plans to manage all sources of flooding, particularly at Betws-y-Coed and Dolwyddelan. These plans should include an assessment of the consequences of flooding, and actions to manage these. They should consider future options and investment needs for defences, emergency planning and response, and development control issues.

Investigate options to improve the flood forecasting and warning service, including campsites.

Seek opportunities to store water or manage run-off to provide flood risk and environmental benefits, e.g. in the upper River Conwy catchment.

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

Llanrwst and Trefriw

Our key partners are:

Conwy County Borough Council

Local communities

Landowners and managers

Snowdonia National Park Authority

Network Rail

CCW

Emergency services

The issues in this sub-area

This area includes the communities of Llanrwst and Trefriw on the River Conwy. Flood risk comes from surface water run-off, sewer systems, river flooding from the River Conwy and its tributaries and tidally influenced river flooding. There was significant flooding in 2004 and 2005.



↑ River Conwy at Llanrwst

In the present 1% AEP river flood event, approximately 320 properties are at risk, increasing to around 370 in the future. A 0.5% AEP tidal event in the future will affect approximately 25 properties.

When completed, early in 2010, the ‘Conwy Valley Flood Alleviation Scheme’ will reduce the likelihood of flooding.

There is a significant risk to part of the railway and road network. Temporary residences are also at risk.

The vision and preferred policy

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

We will maintain the Conwy Valley flood alleviation scheme into the future. The scheme has been designed so we can potentially incorporate additions to the existing structures in the future.

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

Undertake hydraulic modelling of the tributaries through Llanrwst and Trefriw and tidal modelling of Trefriw, to better understand the flood risk. If appropriate, encourage and support our partners to produce a plan to manage the current and future risks.

Investigate options to improve tidal flood warning to Trefriw in the future and to campsites and other temporary residences.

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

Encourage and support Network Rail to undertake an assessment of their current and future risks to improve the resilience of Conwy Valley railway to flooding.

Conwy, Llandudno Junction, Mochdre and Ganol Valley

Our key partners are:

Conwy County Borough Council

Local communities

Dŵr Cymru Welsh Water.

CCW

River Ganol IDD

Emergency services

The issues in this sub-area

Mainly an urban area, partially exposed to the coast and estuary of the River Conwy. It includes the towns of Conwy, Llandudno, Llandudno Junction, Mochdre and Colwyn Bay. It also includes the River Ganol IDD. This area is a very important juncture point for road and rail networks.

Flooding occurs from the River Conwy and the River Ganol. There is also potential flood risk from the Afon Wydden and Gyffin. Surface water and sewer flooding can be an issue e.g. Llandudno.

Approximately 500 properties are currently at risk of flooding from a 1% AEP flood event, rising to around 920 in the future. During a 0.5% AEP tidal flood event approximately 500 properties are at risk, rising to around 6,000 properties in the future.

Overtopping of the sea defences along the Conwy estuary could result in widespread disruption to Llandudno Junction and the Ganol Valley.

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 or acceptable to increase their height in the future. Our vision also includes:

- increased emphasis on actions to manage the consequences of flooding;



↑ Junction of the River Ganol East and tidal River Conwy

- 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, particularly at Ganol Valley and Llandudno Junction. 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. Options to improve flood warning to temporary residences should be considered.

Engage and advise the local communities 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, particularly at Llandudno.

Encourage and support owners and operators of important infrastructure, to plan for and manage their current and future flood risks.

Conwy Valley

Our key partners are:

Conwy County Borough Council

Local communities

Landowners and managers

Conwy Valley IDD

Snowdonia National Park Authority

Network Rail

CCW

The issues in this sub-area

This area covers the rural Conwy Valley and includes the Conwy Valley IDD.

The partial conversion of the floodplain to agricultural land in the past, using defences to reduce flooding, has also reduced the flood storage capacity of the river valley. Isolated properties are at risk; some of which could experience significant risk in the future.

Agricultural land in the valley is of high value to the local farming community. In the future the valley will be subject to increasing river and tidally influenced flood risk. The Conwy Valley railway will also be exposed to increasing risk in the future.

Approximately 120 properties are at risk of flooding from a 1% AEP river flood event, rising to around

140 in the future. During a 0.5% AEP tidal flood event at least 20 properties are at risk, rising to 50 properties in the future.

Flood risk is comparatively low and is not expected to increase significantly in the future. Flood risk management activity is currently disproportionately high relative to the broad level of risk.

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 the overall level of flood risk management activity 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.

It may not be justifiable to continue to maintain our defences, to replace them 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.

Actions to implement the policy include:

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

Encourage and support opportunities for farmers to adopt land use and management approaches, which assist in achieving multiple benefits and reconnect the river to its floodplain.

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

Undertake a review of the Conwy Valley IDD to ensure flood risk management investment is appropriate.

Investigate options to improve flood warning to local communities including to temporary residencies.

Encourage and support Network Rail to undertake an assessment of their current and future risks to improve the resilience of Conwy Valley railway to flooding.



↑ Conwy Valley in flood, January 2008

Clwyd Catchment and Upland Areas

Our key partners are:

Conwy County Borough Council

Denbighshire County Council

Flintshire County Council

Local communities

Landowners and managers

CCW

The issues in this sub-area

This large area covers the main upland rural section of the Clwyd Catchment. Flooding mainly occurs from rivers and surface run-off. There are few flood defences. Historically areas have been drained using ‘grips’, shallow ditches cut into upland blanket bog.

Approximately 300 properties are currently at risk from a 1% AEP flood event, rising to around 330 in the future. The flood risk is generally dispersed across the large catchment area with a number of local concentrations of risk. Some campsites and other temporary residences are at risk of flooding.

Flood risk management activity is currently disproportionately high relative to the broad level of risk.

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 the overall level of flood risk management activity 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.

It may not be justifiable to continue to maintain our defences, to replace them 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.

Actions to implement the policy include:

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

Work with partners to investigate the flood risk in Llanfair Talhaiarn. If appropriate, encourage and support our partners to produce a plan to manage the current and future risks.

Seek opportunities to store water or manage run-off to provide flood risk and environmental benefits, e.g. in the upper catchments.

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

Investigate opportunities to improve the flood warning to local communities, campsites and temporary residences.



↑ View of the Clwyd upland areas

St Asaph

Our key partners are:

Denbighshire County Council

Local communities

Dŵr Cymru Welsh Water

Emergency services

Landowners and managers

The issues in this sub-area

This area consists of the market town of St Asaph on the River Elwy, a tributary of the River Clwyd.

Defences on both banks provide protection to the town for the present 1% AEP flood. Risk to properties at present is therefore very low from a 1% AEP river flood event, but in the future this will rise significantly.

We estimate, around 520 properties could be at risk in the future. There are a large number of residential and commercial areas which are low lying which would be at significant risk in higher magnitude flood events. Some properties would be inundated by deep flood water. The potential consequences of flooding are increased due to the presence of vulnerable groups.

Overtopping of defences now by extreme flood events could occur at any time. The likelihood of these events is low, but it could have serious consequences.

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. This community is 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;
- 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. 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.

We will continue to maintain our defences.

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

Investigate options to attenuate flood flows upstream of St Asaph.

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



↑ River Elwy in St Asaph

Prestatyn

Our key partners are:

Denbighshire County Council

Conwy County Borough Council

Local communities

Dŵr Cymru Welsh Water

CCW

Emergency services

The issues in this sub-area

Prestatyn is at flood risk from Prestatyn Gutter. This could be made worse by tidally influenced flooding via the Rhyl Cut watercourse. There are surface water and sewer flooding issues.

Approximately 910 properties are currently at risk from the 1% AEP river flood event, rising to around 990 in the future. There are maintained channels and local defences. Pumping stations are essential for managing river flood risk.

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

Since 2008 we have been working with partner organisations on the Prestatyn Pilot study. This study will help to shape the integrated management of flood risk in this locality from all sources of flooding.

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 and pumping stations will continue to have a 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.

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.



↑ The coastal lowland of Prestatyn

Actions to implement the policy include:

Continue to support the production and implementation of the Prestatyn pilot study.

Encourage and support our partners to produce local long term plans to manage all sources of flooding. 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, pumping stations and tidal doors, emergency planning and response, and development control issues.

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

The potential tidal risk from Rhyl Cut will be investigated in greater detail as part of the response to the sub-area 8 (Rhyl and Kinmel Bay) flooding issues.

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

Rhyl and Kinmel Bay

Our key partners are:

Denbighshire County Council

Conwy County Borough Council

Local communities

Dŵr Cymru Welsh Water

CCW

Emergency services

Infrastructure owners and operators

Approximately 7,600 properties are currently at risk from the 0.5% AEP tidal flood event, rising to around 9,900 in the future. This risk is primarily for the River Clwyd Estuary. Some locations are potentially exposed to significant risk.

Key infrastructure is at risk in the present and future from tidal flooding. Tourism facilities are also numerous and at risk. In 1990, 2,800 properties were affected in Towyn by one of the UK's most significant coastal flood events.

- 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 Rhyl and Kinmel Bay. 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.

Flood risk management actions in this area will be informed by the Tidal Clwyd Flood Risk Management Strategy (which we are currently producing) and the North Wales and North West England SMP review.

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

Encourage and support owners and operators of important infrastructure, to plan for and manage their current and future flood risks.

The issues in this sub-area

This area consists of the coastal towns Rhyl, Kinmel Bay, Rhuddlan and Towyn. There are approximately 9.3 kilometres of defence on the River Clwyd. These defences protect against both river and tidal flooding in the Clwyd estuary.

There are less than 10 properties currently at risk from the 1% AEP river flood event, rising to around 600 in the future. The majority of this risk is in the lower reaches of the River Gele.



↑ Rhyl and Kinmel Bay coastal floodplain

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. In the future, sea level rise and additional development could considerably increase the flood risks.

Defences will continue to have a 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.

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

Abergele

Our key partners are:

Conwy County Borough Council

Local communities

Dŵr Cymru Welsh Water

Emergency services

The issues in this sub-area

This area comprises the coastal town of Abergele on the River Gele, a tributary of the River Clwyd.

Abergele town is at flood risk from the River Gele. The eastern extremes of the town are also potentially influenced by the Ffynnon-y-Ddol watercourse and the tidal River Clwyd. Existing defences along the River Gele on both banks offer varying standards of protection and the system is part reliant on pumping.



↑ River Gele

Capacity restrictions on some watercourse culverts are known to limit the efficiency of the system at times of high flows.

Recent assessment of flood risk, expanding on that of the CFMP analysis suggests present risk is also high. It is estimated in excess of 300 properties are currently at risk in a 1% AEP flood event rising to around 800 properties in the future.

We are currently investigating the feasibility of new flood alleviation works at Abergele.

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 and over time achieve a reduction in the length of culverts and flow restrictions.

If justifiable, we will implement new flood risk management works. We will continue to maintain our existing 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 Abergele. 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 opportunities to reduce flow restrictions and length of culverts over time.

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.

Investigate options to improve flood warning for flooding from the River Gele.

Clwyd Valley

Our key partners are:

Denbighshire County Council

Local communities

Landowners and managers

CCW

The issues in this sub-area

This area includes the rural Clwyd Valley. Parts of the Clwyd Valley have been extensively drained for agriculture, increasing run-off rates. The broad river valley floor is mainly used for grazing cattle with some arable horticulture. This land is the most productive within the CFMP area and is very important for the local agricultural economy.

Approximately 50 properties are at risk from the 1% AEP flood event, with little or no increase

expected in the future. The flood risk is dispersed across the large catchment with pockets of higher risk. The main sources of flooding are the Pentre Mill Stream and the River Clwyd affecting Pentre, Llanrhaedr and Rhewl.

Flood risk management expenditure is currently disproportionately high relative to the broad level of risk.

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 the overall level of flood risk management activity 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.

It may not be justifiable to continue to maintain our defences, to replace them 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.

Actions to implement the policy include:

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

Support land management changes by land owners where these deliver flood risk management or wider environmental benefits.

Support opportunities to store water, manage run-off and restore the natural run-off process, to provide flood risk and environmental benefits.

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

Investigate options to improve flood warning to local communities.



↑ View upstream into the Clwyd Valley

Denbigh

Our key partners are:

Denbighshire County Council

Local communities

Dŵr Cymru Welsh Water

Landowners and managers

CCW

Emergency services

There are a large number of properties at flood risk during higher frequency events in the urban centre of Denbigh, where properties are at risk from overflow of Henllan Brook.

Extreme flood events could occur at any time, either now or in the future. These have a low likelihood of occurrence but could have serious consequences in this area.

Actions to implement the policy include:

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

Investigate options to store water or reduce run-off upstream of Denbigh, to reduce the flood flows through the town.

Work with partners to sustain regular maintenance of Henllan Brook and improve access to the culvert inlet for maintenance during storm events.

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.

The issues in this sub-area

This area is the inland market town of Denbigh on Henllan Brook. This watercourse is culverted at the upstream extent of Denbigh and through the town, with a short section of open channel to the east. There are maintained watercourses but no defences in this area.

Approximately 320 properties are currently at risk in the 1% AEP flood event, with little or no increase expected in the future. Infrastructure would also be affected.



↑ The market town of Denbigh

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.

Management of the Henllan Brook culvert is critical to management of flood risk in Denbigh, both now and in the future. This is the responsibility of Denbighshire County Council, who are currently considering a range of flood risk management options.

Our vision includes a broader range of integrated actions to manage both current and future flood risks, including:

- 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.

Ruthin

Our key partners are:

Denbighshire County Council

Local communities

Dŵr Cymru Welsh Water

The issues in this sub-area

This area consists of the inland market town of Ruthin on the River Clwyd. It is situated downstream of the headwaters in the upper catchment.

This area is mostly urban with the River Clwyd running through the centre of the town and a tributary of the Clwyd from Llanfwrog, which is culverted under Mwrog Street. A recent diversion channel has been installed upstream of the culvert to alleviate high flows.

In the present 1% AEP river flood event no properties are believed to be at risk, with little change expected in the future. Recently upgraded flood defences protect properties in Ruthin from a 1% AEP river flood event.

Impact on infrastructure in the future is expected to be low, with the possibility of significant community disruption unlikely.

The vision and preferred policy

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

Ruthin is considered to be at relatively low risk of flooding both now and in the future due to the presence of recently upgraded defences.

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

Actions to implement the policy include:

Review and rationalise our actions as appropriate to manage flood risk at the current level.

Continued maintenance of our flood alleviation structures.

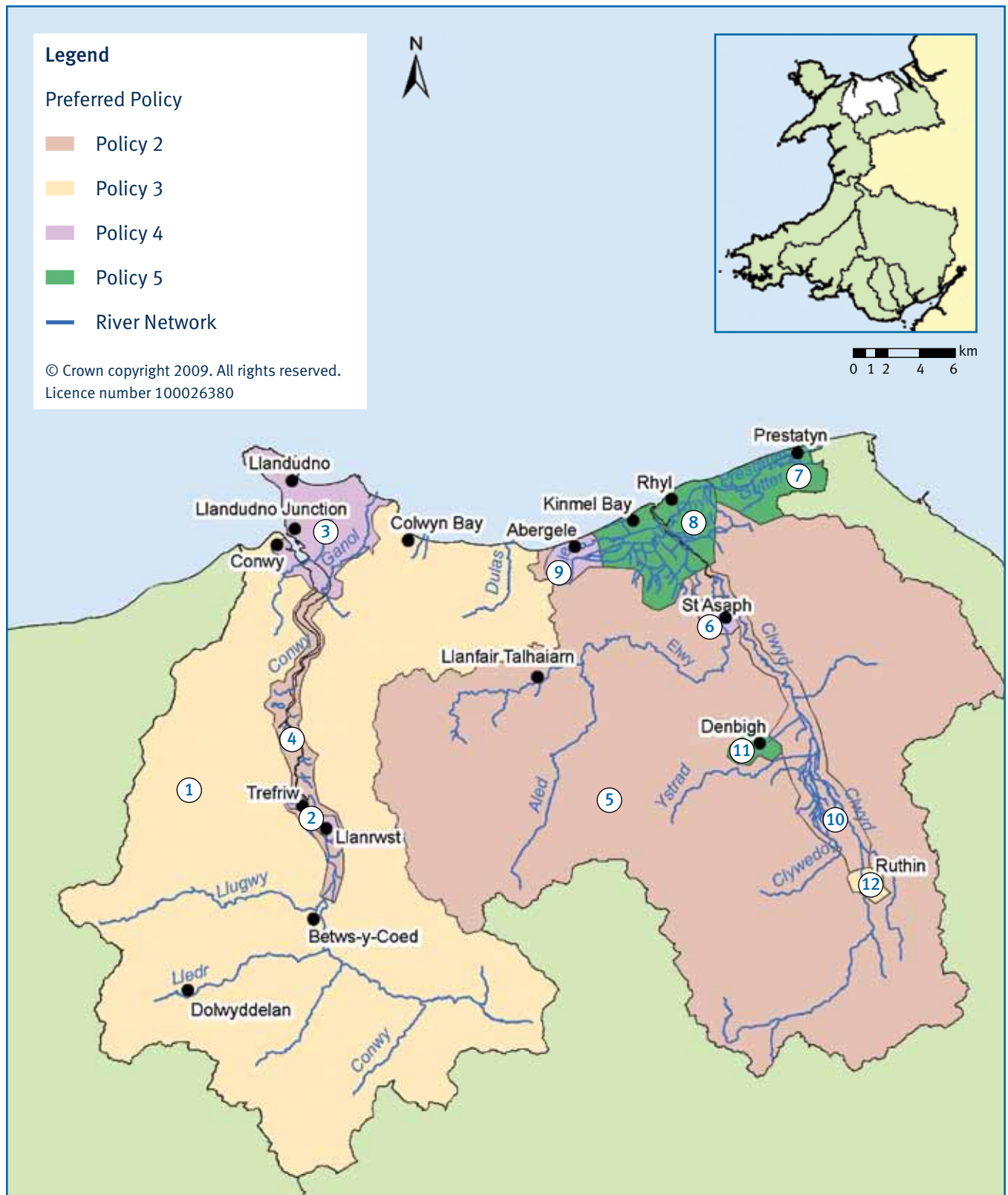
Maintain the flood warning service and investigate options to improve this as appropriate.

We will continue to monitor and advise. We will review our policy and actions if monitoring suggests these are inappropriate.



↑ Ruthin on the River Clwyd

Map of CFMP policies



■ Sub-area 1 – Conwy Catchment and Upland Areas

Flood risk is relatively low and is not expected to increase significantly in the future. We will manage the flood risk here by re-prioritising current or considering alternative flood risk management measures.

■ Sub-area 2 – Llanrwst and Trefriw

Flood risk is expected to increase in the future and the consequences of flooding here could potentially be high were there to be an overtop or breach of defences. Further flood risk actions will be required to manage future flood risk here.

■ Sub-area 3 – Conwy, Llandudno, Llandudno Junction and Mochdre

River and tidally influenced flood risk increases significantly in the future placing many more people and properties at risk. Further flood risk management actions will be required to manage this risk appropriately.

■ Sub-area 4 – Conwy Valley

Flood risk is comparatively low and is not expected to rise significantly in the future. In general, flood risk management activities will reduce in this area; however there are some specific properties that may require targeted actions in order to improve resilience to increased future risk.

■ Sub-area 5 – Clwyd Catchment and Upland Areas

Flood risk is relatively low and is not expected to rise significantly in the future. Flood risk management activities will reduce over time. The majority of at risk properties are within small villages where we will be able to manage the risk more efficiently.

■ Sub-area 6 – St Asaph

Flood risk here is considered to be appropriately managed at present, however future flood risk is predicted to be significantly higher. More action will be required to manage this risk appropriately. The consequences of flooding to this community from an extreme magnitude flood event are also potentially significant.

■ Sub-area 7 – Prestatyn

A significant number of properties are at risk in the present and future from a combination of river, surface water and sewer flooding. Further flood risk management actions are required to reduce this risk.

■ Sub-area 8 – Rhyl and Kinmel Bay

The tidally influenced flood risk is very high, potentially extreme, to some properties and is predicted to increase into the future were nothing to be done to respond to this risk. Further flood risk management action will be required to limit and reduce this risk, now and into the future.

■ Sub-area 9 – Abergele

Flood risk to the wider area of Abergele is found to increase markedly in the future. Present risk is also significant. Actions will be developed to manage both the present and future risk appropriately.

■ Sub-area 10 – Clwyd Valley

Flood risk is generally low and is not expected to rise significantly in the future. It is envisaged that there will be an overall reduction in flood risk management activities across this area. Some targeted actions will be required to manage higher than average risk.

■ Sub-area 11 – Denbigh

Flood risk is potentially high here and flooding could occur during fairly low magnitude rainfall events. Further flood risk management action is required in order to reduce flood risk.

■ Sub-area 12 – Ruthin

Flood risk to Ruthin is low and is likely to remain so into the future. The current level of flood risk management activities is thought appropriate and will be reviewed and reprioritised into the future as necessary.

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