Flood Risk Management Strategy

Ayrshire

SEPA

Scottish Environment Protection Agency

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Foreword

Flooding can affect us all. The risk of flooding and its impacts can't be removed entirely from our lives but it can be managed. This strategy takes our knowledge and understanding of flooding and turns it into a set of actions that are planned, prioritised and co-ordinated to tackle flooding in the areas where it affects us the most.

Approximately 7,800 residential and 2,700 non-residential properties are at risk of flooding in the Ayrshire Local Plan District. Irvine (including Dreghorn), Kilmarnock (including Hurlford), Prestwick and Ayr are just some of the areas where the impacts of flooding can be found. The annual damages across the region are estimated to be £17 million, largely from river flooding. Across Scotland we now estimate 108,000 properties to be at risk, with the expected annual flood damage being in the region of £252 million.

We can expect these numbers to increase. Changes to the climate, how we live and how we use the land bring more and more people and property into flood risk.

Although the risk of flooding will never be removed entirely, this strategy describes the ambition for managing flooding and the priorities for action. A Local Flood Risk Management Plan co-ordinated by North Ayrshire Council provides additional detail on the responsibility for delivery, funding and coordination of actions across the Local Plan District. Taken together, these documents describe the commitment of public bodies to address flooding.

This Flood Risk Management Strategy is published by SEPA and has been approved by Scottish Ministers. It has been produced with the support and collaboration of North Ayrshire Council, East Ayrshire Council, South Ayrshire Council, Scottish Water and others with an interest in flood management. SEPA took account of the views received through two public consultations carried out during the development of the strategy and its supporting information.

How we plan for and manage our flood risk has far reaching consequences for Scotland's communities. As well as targeting action and resources in the areas where they can achieve most, the strategies also help to increase awareness of flood risk and improve understanding of how it can affect us.

Terry A'Hearn

Chief Executive Officer
SEPA

Flood Risk Management Strategy

Ayrshire Local Plan District

Annexes

Flood Risk Management Strategy

Ayrshire Local Plan District

Section 1: Flood risk management in Scotland

Ayrshire Local Plan District

1 Flood risk management in Scotland

1.1 What is a Flood Risk Management Strategy?

Flood Risk Management Strategies have been developed to reduce the devastating and costly impact of flooding in Scotland. They coordinate the efforts of all organisations that tackle flooding, be it in our cities or rural areas and be it from rivers, the sea or from surface water. The strategies concentrate the work of these organisations to where the risk of flooding and benefits of investment are greatest.

By publishing these strategies, we are giving individuals, communities and businesses the information to better manage their own responsibilities. Everyone can take action with the confidence of knowing what others are doing and when they are doing it.

Flood Risk Management Strategies set out the short to long term ambition for flood risk management in Scotland. The strategies state the objectives, as agreed by responsible authorities, for tackling floods in high risk areas. Actions that will then deliver these objectives are described and prioritised in six-year planning cycles. The decisions are based on the best evidence available on the causes and consequences of flooding. Through this risk-based and plan-led approach, flood management will improve for individuals, communities and businesses at risk in Scotland.

Each strategy should be read alongside its Local Flood Risk Management Plan. The Local Flood Risk Management Plans have been developed by local authorities and provide additional local detail on the funding and delivery timetable for actions between 2016 and 2021. The publication date of the Local Flood Risk Management Plans is June 2016. Both the Flood Risk Management Strategy and Local Flood Risk Management Plan will be updated every six years.

These Flood Risk Management Strategies are approved by Scottish Ministers and published by SEPA, Scotland's strategic flood risk management authority. They have been prepared in collaboration with all 32 local authorities, Scottish Water and other organisations with a responsibility or interest in managing flooding. They are required under the Flood Risk Management (Scotland) Act 2009 and the European Commission's Floods Directive. The actions proposed to manage flood risk in high risk areas have been developed using the best available information at the time. The number of actions that are actually delivered over the six years set out in the strategy will depend on a number of factors including funding availability, and community engagement issues such as potential objections to a particular flood protection scheme.

1.2 How to read this Strategy

Each Flood Risk Management Strategy has three sections:

Section 1 contains background information on the approach taken in Scotland to manage flooding. It explains the duties and aims of organisations involved in tackling flooding, including how they work together and how flood risk management planning is linked to other government policies and initiatives.

Section 2 is the most important section for those individuals and communities seeking to understand their flood risk and its management. For priority areas (called Potentially Vulnerable Areas) there is a short description of the causes and consequences of flooding. The agreed objectives are clearly set out. And, most importantly, the actions that will deliver these objectives are prioritised and described. Section 3 includes supporting information on the sources of flooding in wider river catchments and coastal areas. A glossary is also provided.

1.3 Managing flooding in Scotland

Flood risk management in Scotland aims to manage flooding in a sustainable way. Sustainable flood risk management considers where floods are likely to occur in the future and takes action to reduce their impact without moving the problem elsewhere. It considers all sources of flooding, whether from rivers, the sea or from surface water. It delivers actions that will meet the needs of present and future generations whilst also protecting and enhancing the environment.

The sustainable approach to managing flood risk works on a six year planning cycle, progressing through the key stages outlined below.

Identifying priority areas at significant flood risk

The first step to delivering a risk-based, sustainable and plan-led approach to flood risk management was SEPA's **National Flood Risk Assessment**, which was published in 2011. The assessment considered the likelihood of flooding from rivers, groundwater and the sea, as well as flooding caused when heavy rainfall is unable to enter drainage systems or the river network. The likelihood of flooding was examined alongside the estimated impact on people, the economy, cultural heritage and the environment. It significantly improved our understanding of the causes and consequences of flooding, and identified areas most vulnerable to floods.

Based on the National Flood Risk Assessment, SEPA identified areas where flooding was considered to be nationally significant. These areas are based on catchment units as it is within the context of the wider catchment that flooding can be best understood and managed. These nationally significant catchments are referred to as **Potentially Vulnerable Areas**. In Scotland, 243 Potentially Vulnerable Areas were identified. They are estimated to contain 92% of the total number of properties at risk.

A small number of Candidate Potentially Vulnerable Areas were identified after the National Flood Risk Assessment in light of new information that warranted further assessment and appraisal. They are included in the flood risk management planning process. The National Flood Risk Assessment will be updated to inform each subsequent planning cycle.

Improving the understanding of flooding

SEPA developed **flood hazard and flood risk maps** between 2012 and 2014. These maps improved our understanding of flooding and helped inform the subsequent selection of actions to manage flood risk in Potentially Vulnerable Areas. The flood hazard maps show information such as the extent of flooding, water level, as well as depth and velocity where appropriate. The flood risk maps provide detail on the impacts on people, the economy, cultural heritage and the environment.

In 2012 SEPA also developed an **assessment of the potential for natural flood management**. The assessment produced the first national source of information on where natural flood management actions would be most effective within Scotland.

Flood hazard and flood risk maps and the assessment of the potential for natural flood management can be viewed on the SEPA website www.sepa.org.uk.

Identifying objectives and selecting actions

The objectives and actions to manage flooding will provide the long-term vision and practical steps for delivering flood risk management in Scotland.

Working collaboratively with local partnerships, SEPA has agreed the objectives for addressing the main flooding impacts. Actions that could deliver these agreed objectives have been appraised for their costs and benefits to ensure the right combinations are identified and prioritised. The actions considered in the development of this strategy include structural actions (such as building floodwalls, restoring flood plains, or clearance and repair works to rivers) and non-structural actions (such as flood warning, land use planning or improving our emergency response). Structural and non-structural actions should be used together to manage flood risk effectively.

An assessment of the potential for natural flood management was used to help identify opportunities for using the land and coast to slow down and store water. Natural flood management actions were recommended in areas where they could contribute to the management of flood risk. In such instances these actions were put forward as part of flood protection or natural flood management studies.

Climate change and future flood risk

The UK Climate Projections (UKCP09) report predicts that climate change may lead to warmer and drier summers, warmer and wetter winters with less snow, and more extreme temperature and rainfall events. The predicted increase in rainfall is expected to variably increase the potential for river and surface water flooding, and similarly, there is expected to be a rise in sea levels that will vary around the coastline.

The predicted increases in flood risk described in Section 3 are solely based on the impact of a changing climate on the magnitude of flooding; they do not take into account any potential increase due to population change, development pressures or urban creep, nor do they take into account any mitigation as a result of actions contained in this or future Flood Risk Management Strategies.

Flood Risk Management Strategies and Local Flood Risk Management Plans

For flood risk management purposes, Scotland has been divided into 14 **Local Plan Districts**. Each Local Plan District will have a set of complementary plans: Flood Risk Management Strategies produced by SEPA, and Local Flood Risk Management Plans produced by a lead local authority. Flood Risk Management Strategies and Local Flood Risk Management Plans aim to make a strong and lasting contribution to sustainable flood risk management, and will be at the heart of efforts to tackle flooding in Scotland. They will help to target and maximise the benefit of public investment.

1.4 How the Flood Risk Management Strategy was developed

Partnership working

Many organisations and individuals are involved in helping to improve flood management in Scotland. A piecemeal approach to tackle flooding does not work.

Flooding is too complex, and the causes and impacts too complicated for any single organisation to address alone. Flooding disregards local authority boundaries and cuts across the responsibilities of organisations such as SEPA, Scottish Water and emergency responders. To be successful, flood management requires coordination among organisations as set out in this strategy. A willingness to collaborate by those responsible for flood management is essential.

This strategy has been developed in partnership by:

- East Ayrshire Council, North Ayrshire Council (lead local authority) and South Ayrshire Council;
- Scottish Water; and,
- SEPA.

These organisations are working more closely together than ever before. In local partnerships, here and throughout Scotland, SEPA has provided the technical analysis and ensured a consistent national approach is taken. It has provided the evidence upon which to make sensible, informed decisions. Local authorities and Scottish Water have made sure that local knowledge and expertise has informed the decision-making.

Consultation, engagement and advice

SEPA has been keen to hear from the people and communities that live under the threat of flooding to ensure that our technical analysis of the risks is accurate and that efforts to manage flooding are targeted to where most can be achieved. SEPA held two public consultations during the development of the Flood Risk Management Strategies. The first was on the general approach to flood risk management planning and the identification of priority areas (2011); the second, held jointly with local authorities, was on the understanding of flooding in these priority areas and on the objectives and actions to manage flooding (2015).

Further advice has been sought from relevant organisations at key stages. The strategies have benefited from Local Advisory Groups, providing important community and area-based knowledge on both the causes and consequences of flooding and on the appropriate actions for future management. Local Advisory Groups have been especially helpful in considering flood risk management planning in the context of wider plans and initiatives. The Clyde and Loch Lomond and Ayrshire Local Advisory Group includes representatives from a range of sectors, including government agencies, National Park Authorities, local authorities, non-government organisations, utility companies and land and asset managers.

In producing the Flood Risk Management Strategy, SEPA has also taken advice from a National Flood Management Advisory Group. Over 50 member organisations, reflecting the national importance and impact of flooding on our communities, economy, environment and cultural heritage, have been invited at key stages to provide comment and input.

Some of the work carried out by SEPA has been complex and technical in nature for which we have sought professional advice. Through membership of the Scottish Advisory and Implementation Forum for Flooding (SAIFF), we have received assistance from local authorities, Scottish Water, Forestry Commission Scotland, the National Park Authorities and other key interested organisations. We have also developed some of our methods by working with other organisations with similar responsibilities within the UK and Europe. We have specifically worked with the Environment Agency and English local authorities in the cross border areas.

SEPA's chief statutory function in flood risk management planning is to prioritise future actions across Scotland. To do this, SEPA made a technical, risk-based assessment of the costs and impacts of actions. This independent assessment was used alongside information from partner organisations to jointly agree priorities and identify indicative delivery dates for actions. A National Prioritisation Advisory Group, with representatives from the Scottish Government, COSLA, Scottish Water and local authorities, was established to provide guidance to SEPA on the priority of flood risk management actions, having considered both the technical ranking prepared by SEPA and issues of local priority.

Strategic Environmental Assessment and Habitats Regulation Appraisal

SEPA undertook a strategic environmental assessment to assess the significant environmental effects of the Flood Risk Management Strategies. Our assessment was published in an environmental report, and we consulted the public on our findings. We have published a post-adoption statement, which describes how we have taken account of the environmental assessment and the consultation responses, and how we will monitor any significant environmental effects of the Flood Risk Management Strategies.

We also undertook a Habitats Regulations Appraisal to ensure that the Flood Risk Management Strategies will not adversely affect the integrity of Special Areas of Conservation and Special Protection Areas. We consulted Scottish Natural Heritage and Natural England on our appraisal method and took their views into account. We have applied mitigation measures where required.

1.5 Roles and responsibilities for flood risk management planning

Individuals have a personal responsibility to protect themselves and their property from flooding. However, public bodies have responsibilities too and are working together to reduce the impacts of flooding in Scotland. Responsibility for flood risk management planning falls primarily to SEPA, local authorities and Scottish Water. Some of the key roles are outlined below and more information is available from the SEPA website.

Your responsibilities

Organisations and individuals have responsibilities to protect themselves from flooding. Being prepared by knowing what to do and who to contact if flooding happens can help you reduce the damage and disruption flooding can have on your life.

The first step to being prepared is signing up to Floodline so you can receive messages to let you know where and when flooding is likely to happen. Other useful tools and advice on how to be prepared are available on the Floodline website, including a quick guide to who to contact in the event of a flood. For more information visit: www.floodlinescotland.org.uk. You can also check how your area could be affected by flooding by looking at SEPA's flood maps.

SEPA

SEPA is Scotland's national flood forecasting, flood warning and strategic flood risk management authority. We have a statutory duty to produce Scotland's Flood Risk Management Strategies. As described above, we work closely with other organisations responsible for managing flood risk through a network of partnerships

and stakeholder groups to ensure that a nationally consistent approach to flood risk management is adopted.

SEPA also has a responsibility to identify where in Scotland there is the potential for natural flood management techniques to be introduced. Natural flood management uses the natural features of the land to store and slow down the flow of water.

In running Floodline, we provide direct warnings, live flooding information and advice on how to prepare for or cope with the impacts of flooding 24 hours a day, seven days a week. To help us forecast for flooding we work in partnership with the Met Office through the Scottish Flood Forecasting Service. SEPA has piloted surface water flood forecasting to help urban areas improve their resilience to and preparedness for flooding. The development and wider roll-out of this service is being considered alongside the technical, resource and communication challenges associated with providing surface water flooding guidance.

To raise awareness of flooding at a national level SEPA runs education initiatives, community engagement programmes and an annual campaign to promote the useful advice and information available through Floodline. We work in partnership with local authorities, Neighbourhood Watch Scotland, Ready Scotland and others to share our resources and help to promote preparedness and understanding of how flood risk is managed.

Local authorities and lead local authorities

Local authorities work together for flood risk management planning purposes through a lead local authority. The lead local authority must perform several important functions over and above the general flood-related duties and powers given to local authorities. Most significantly, the lead local authority, having contributed with other local authorities to the production of the Flood Risk Management Strategy, must prepare a Local Flood Risk Management Plan. Although the lead local authority is responsible for the production of the plan, its content will be drawn from and agreed by all relevant local authorities, other responsible authorities and SEPA. Local authorities have been working collaboratively in the manner described above to develop these Local Flood Risk Management Plans.

It is the responsibility of your local authority to implement its flood protection actions agreed within the Flood Risk Management Strategy, including new schemes or engineering works and their statutory requirements to monitor, clear and maintain watercourses. You can help your local authority to manage flooding by letting them know if debris is blocking watercourses or if flood defences have been tampered with.

During severe flooding, local authorities will work with the emergency services and coordinate shelter for people evacuated from their homes.

Scottish Water

Scottish Water is a responsible authority for flood risk management and is working closely with SEPA, local authorities and others to coordinate plans to manage flood risk.

Scottish Water has the public drainage duty and is responsible for foul drainage and the drainage of rainwater run-off from roofs and any paved ground surface from the boundary of properties. Additionally, Scottish Water helps to protect homes from

flooding caused by sewers either overflowing or becoming blocked. Scottish Water is not responsible for private pipework or guttering within the property boundary.

National parks

The two National Park Authorities, Loch Lomond and Trossachs National Park and Cairngorms National Park, were designated as responsible authorities for flood risk management purposes in 2012. Both have worked with SEPA, local authorities and Scottish Water to help develop Flood Risk Management Strategies and Local Flood Risk Management Plans. They also fulfil an important role in land use planning, carrying out or granting permission for activities that can play a key role in managing and reducing flood risk.

Other organisations

- The **Scottish Government** oversees the implementation of the Flood Risk Management (Scotland) Act 2009, which requires the production of Flood Risk Management Strategies and Local Flood Risk Management Plans. Scottish Ministers are responsible for setting the policy framework for how organisations collectively manage flooding in Scotland. Scottish Ministers have also approved this Flood Risk Management Strategy.

- **Scottish Natural Heritage** has provided general and local advice in the development of this Flood Risk Management Strategy. Flooding is seen as natural process that can maintain the features of interest at many designated environmental sites, so Scottish Natural Heritage helps to ensure that any changes to patterns of flooding do not adversely affect the natural environment. Scottish Natural Heritage also provides advice on the impacts of Flood Protection Schemes and other land use development on designated sites and species.

- **Forestry Commission Scotland** was designated in 2012 as a responsible authority for flood risk management planning purposes and has engaged in the development of the Flood Risk Management Strategies through national and Local Advisory Groups. This reflects the widely held view that forestry can play a significant role in managing flooding.

- During the preparation of the flood risk management plans **Network Rail** and **Transport Scotland** have undertaken works to address flooding at a number of frequently flooded sites. Further engagement is planned with SEPA and local authorities to identify areas of future work. There is the opportunity for further works to be undertaken during the first flood risk management planning cycle although locations for these works are yet to be confirmed.

- **Utility companies** have undertaken site specific flood risk studies for their primary assets and have management plans in place to mitigate the effects of flooding to their assets and also minimise the impacts on customers.

- The **Met Office** provides a wide range of scientific support, forecasts and weather warnings. SEPA and the Met Office work together through our partnership the Scottish Flood Forecasting Service.

- The **emergency services** provide emergency support when flooding occurs and can coordinate evacuations. You should call the emergency services on 999 if you are concerned about your safety or the safety of others and act immediately on any advice provided.

- **Historic Environment Scotland** considers flooding as part of its regular assessments of historic sites. As such, flooding is considered as one of the many factors which inform the development and delivery of its management and maintenance programmes.

1.6 Links with other plans and policies

River basin management planning

River basin management aims to protect and improve the condition of our rivers, lochs, estuaries and coastal waters. Taking action to reduce flood risk in Scotland provides an opportunity to connect with plans to improve the quality of Scotland's water environment at the same time. For example, coordination between river basin management and flood risk management can reduce flood risk, whilst improving water quality and biodiversity.

SEPA is leading the delivery of River Basin Management Plans and Flood Risk Management Strategies and has worked to ensure that there is integration and coordination between them. This coordination, particularly in regard to consultation and engagement, will be important for stakeholders many of whom have an interest in the objectives of both plans.

Land use and spatial planning

Land use planning decisions are one of the most powerful tools available to manage flood risk. The alignment of flood risk management and land use planning policy is pivotal to achieving sustainable flood risk management. Decisions relating to flood risk management can have significant implications for the location of development and, likewise, decisions relating to the location of development can impact on flood risk. Land use planning has the potential to contribute to sustainable flood risk management through the location, use and design of new development and the redevelopment of existing areas. Actions that deliver national level land use planning policies are summarised in Annex 2.

SEPA is a statutory consultee providing advice on planning applications with regards to flood risk. Guidance aims to minimise flood risk to development and ensure no adverse effects occur elsewhere.

Land use planning objectives and actions have been agreed with responsible authorities, which will ensure that flood risk is adequately taken into account throughout the planning process.

Emergency planning and response

Emergency plans are prepared under the Civil Contingencies Act 2004. They are in place across Scotland and are prepared by Category 1 and 2 Responders, such as Police Scotland and the Scottish Ambulance Service. Emergency plans ensure the effective management of response to emergencies. Emergency plans can either be generic and deal with all emergencies or specific to deal with, for example, flooding. The information contained in the Flood Risk Management Strategies can be used to inform wider emergency response plans for flooding.

Many organisations have specific roles and responsibilities during an emergency response to a flood for example, local authorities, the Scottish Fire and Rescue Services, Police Scotland and SEPA. In many cases, this response is augmented by the work of voluntary organisations, communities and individuals. During an

emergency, the response by these agencies will be co-ordinated through regional and local resilience partnerships.

Scottish Water investment plans

There is a close relationship between Flood Risk Management Strategies and Scottish Water's investment plans. Sewer flooding is not considered in detail in this strategy although it remains a high priority for Scottish Water and its customers. Scottish Water's close involvement in flood risk management planning aims to ensure that there is strong coordination between the management of sewer and surface water flooding and the actions to be taken forward by local authorities.

1.7 Supporting information

Sources of flooding described in this strategy

The Flood Risk Management Strategy addresses the risk of flooding from rivers, the coast and surface water. The risk of flooding from rivers is usually due to rainfall causing a river to rise above bank level spreading out and inundating adjacent areas. Coastal flooding is where the risk is from the sea. Sea levels can change in response to tidal cycles or atmospheric conditions. Over the longer term sea levels and coastal flood risk may change due to climate change. Surface water flooding happens when rainwater does not drain away through the normal drainage systems or soak into the ground, but lies on or flows over the ground instead. There can be interactions between these sources of flooding, but for the purposes of this strategy they are dealt with independently.

The following aspects of flooding have not been incorporated into this strategy:

- **Groundwater** is generally a contributing factor to flooding rather than the primary source. It is caused by water rising up from underlying rocks or flowing from springs.

- **Reservoir breaches** have been assessed under separate legislation (Reservoirs (Scotland) Act 2011). Further information and maps can be found on SEPA's website.

- The Flood Risk Management (Scotland) Act 2009 does not require SEPA or responsible authorities to assess or manage **coastal erosion**. However, SEPA has included consideration of erosion in the Flood Risk Management Strategies by identifying areas that are likely to be susceptible to erosion and where erosion can exacerbate flood risk. As part of considering where actions might deliver multiple benefits, we have looked to see where the focus of coastal flood risk management studies coincides with areas of high susceptibility to coastal erosion. Subsequent detailed studies and scheme design will need to consider coastal erosion in these areas.

- **Coastal flood modelling.** The information on coastal flooding used to set objectives and identify actions is based on SEPA modelling using simplified coastal processes and flooding mechanisms at work during a storm. Wave overtopping cannot be accurately modelled at a national scale due to the importance of local factors such as prevailing wind conditions, the depth and profile of the near-shore sea bed or the influence of any existing defences or management structures. As a result, coastal flood risk may be underestimated in some areas. Conversely, in locations with wide and flat floodplains, the modelling may overestimate flood risk. To address this, in a number of locations where

more detailed local models were available they have been incorporated into the development of the Flood Risk Management Strategies. Where wave overtopping has been specifically identified as a concern – but where no further detailed modelling is available – particular compensation has been made in the selecting actions to address coastal flood risk.

Commonly used terms

Below are explanatory notes for commonly used terms in this strategy. A glossary of terms is also available.

- **Reference to flood risk.** During the development of this strategy flood risk has been assessed over a range of likelihoods. For consistency in reporting information within the strategies, unless otherwise stated, all references to properties or other receptors being 'at risk of flooding' refer to a medium likelihood flood (up to a 1 in 200 chance of flooding in any given year). By exception, references will be made to high or low risk flooding, which should be taken to mean a 1 in 10 chance/likelihood or 1 in 1000 chance/likelihood of flooding in any given year respectively.

Chance / likelihood of flooding	
High	1 in 10 year
Medium	1 in 200 year
Low	1 in 1000 year

- **Annual Average Damages** have been used to assess the potential economic impact of flooding within an area. Depending on its size or severity each flood will cause a different amount of damage to a given area. Annual Average Damages are the theoretical average economic damages caused by flooding when considered over a very long period of time. It does not mean that damage will occur every year: in many years there will be no damages, in some years minor damages and in a few years major damages may occur.
  High likelihood events, which occur more regularly, contribute proportionally more to Annual Average Damages than rarer events. Within the Flood Risk Management Strategies Annual Average Damages incorporate economic damages to the following receptors: residential properties, non-residential properties, vehicles, emergency services, agriculture and roads. They have been calculated based on the principles set out in the Flood Hazard Research Centre Multi-Coloured Handbook (2010).

- **History of flooding.** The history of flooding sections of this document report floods that have occurred up to July 2015.

1.8. Next steps and monitoring progress

Flood risk management planning has progressed significantly in recent years. Scotland now has the most advanced nationally consistent and locally informed understanding of the causes and consequences of flooding that it has ever had. SEPA is committed to improving this knowledge and understanding during subsequent planning cycles, accepting that these first Flood Risk Management Strategies are based on the best available current knowledge and data.

SEPA has prioritised actions based on funding assumptions provided by Scottish Government and the capacity of local authorities to deliver within the next six years. Lead local authorities will provide an interim report on the progress of delivering all

actions in the Local Flood Risk Management Plan not earlier than two years and not later than three years from its publication. A final report will also be prepared at the end of the first planning cycle.

A second set of Flood Risk Management Strategies and Local Flood Risk Management Plans will be published in December 2021 and June 2022 respectively.

Licensing acknowledgements

Full data licensing acknowledgements can be found in Annex 3 of this strategy.

Flood Risk Management Strategy

Ayrshire Local Plan District

This section is the most relevant for individuals, communities and businesses seeking to understand their local flood risk and its management. There is an overview of the Local Plan District, as well as further detail for every Potentially Vulnerable Area. For each Potentially Vulnerable Area, there is a short description of the causes and consequences of flooding. The agreed objectives are clearly set out and, most importantly, the actions that will deliver these objectives are prioritised and described.

Section 2: Understanding and managing flooding

2.1 Summary of flooding in the Ayrshire Local Plan District

The Ayrshire Local Plan District extends from Largs in the north to Ballantrae in the south and includes the Isle of Arran and Great Cumbrae (see Figure 2). The district has a total area of 3,100km^2. The area spans seven local authorities and it has 18 Potentially Vulnerable Areas, and one candidate Potentially Vulnerable Area.

Flood risk in Ayrshire

There are approximately 7,800 residential properties and approximately 2,700 non-residential properties with a risk of flooding within the Local Plan District. This equates to approximately 10% of all properties at risk of flooding nationally. Within the Local Plan District, approximately 5% of the residential properties and over 16% of non-residential properties are at risk and it is estimated that 90% of these properties are located within Potentially Vulnerable Areas. The Annual Average Damages from flooding (see glossary) are approximately £17 million.

River flooding is the main source of flooding in the Local Plan District, closely followed by surface water flooding (Figure 1). The Annual Average Damages caused by river flooding are £12 million, those caused by surface water flooding are £3.1 million and those caused by coastal flooding are £1.3 million.

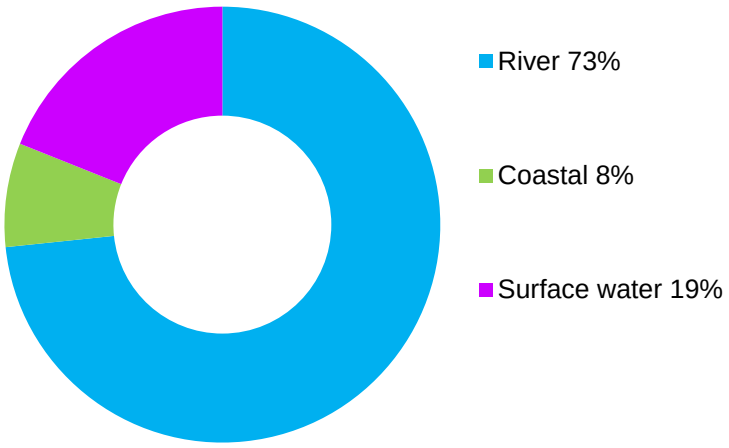


Figure 1: Annual Average Damages by flood source

Table 1 shows the main areas, number of properties at risk and the Annual Average Damages caused by flooding. This includes damages to residential properties, non-residential properties, transport and agriculture. Please note that economic damages to airports and rail infrastructure were not assessed as strategic information on damages at this scale is not available.

	Residential and non-residential properties at risk of flooding	Annual Average Damages
Irvine (including Dreghorn)	2,000	£4.7 million
Kilmarnock (including Hurlford)	1,300	£1.2 million
Prestwick/Ayr	1,100	£1.7 million
Troon	930	£430,000
Kilbirnie	850	£1.3 million
Saltcoats/Ardrossan	610	£450,000
Newmilns/Greenholm	420	£550,000
Galston	400	£620,000
Largs	290	£200,000
Stevenston	250	£490,000

Table 1: Main areas at risk of flooding

Background information on the Ayrshire Local Plan District

The extent of the Ayrshire Local Plan District and the location of the Potentially Vulnerable Areas are shown in Figure 2. The main urban areas within the district are Kilmarnock, Irvine and Ayr and it has a population of approximately 370,000 people.

The largest river catchment is the River Ayr, which flows through the centre of the district. Other watercourses include: the River Doon, the River Garnock, the River Girvan and the River Irvine. The area is predominantly rural with large areas of agricultural grazing in the lower catchments. The upper catchments have large sections of woodland and heather grassland, especially in the east of the district and on the Isle of Arran. The urban areas are largely concentrated along the mainland coast, with further concentration of urban areas along the River Irvine valley.

The coastal area of the Ayrshire Local Plan District covers approximately 300km of coastline including the Firth of Clyde, Great Cumbrae and the Isle of Arran.

Further details of flood risk from distinct sources can be found in the river, coastal and surface water sections of this report.

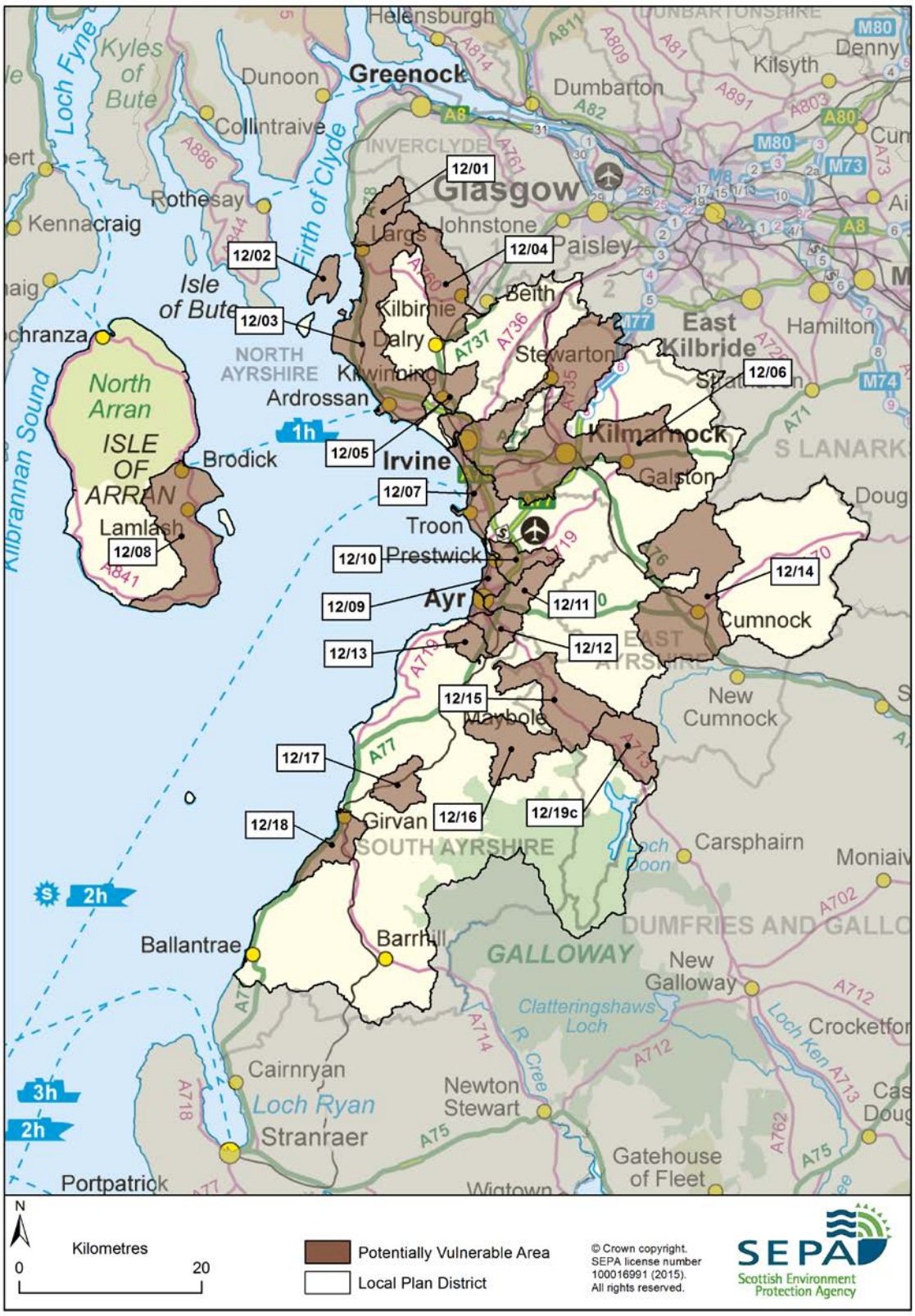


Figure 1: Ayrshire Local Plan District with Potentially Vulnerable Areas identified

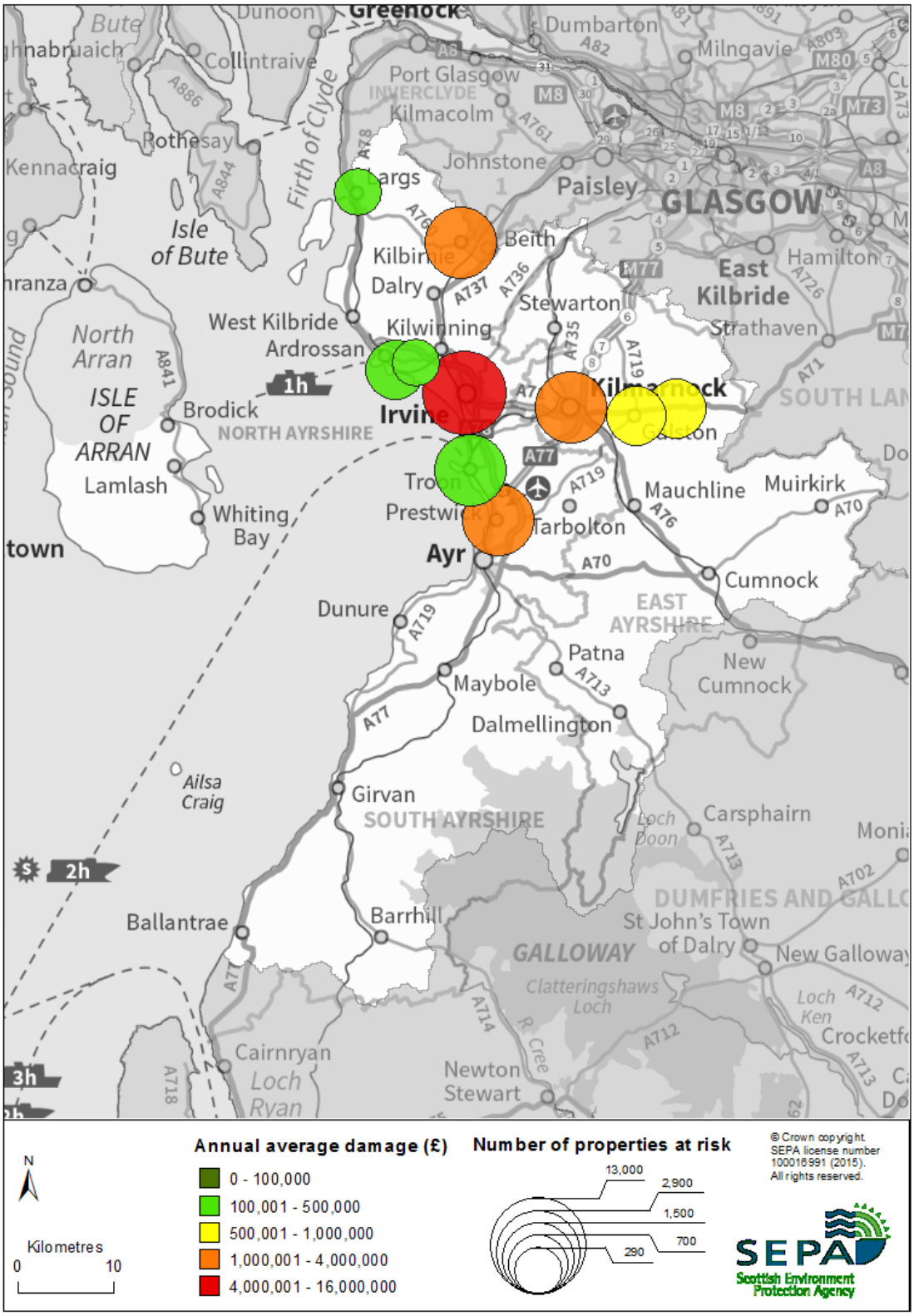


Figure 2: Ayrshire Local Plan District showing areas with most properties at risk of flooding and associated damages

Objectives and actions in the Ayrshire Local Plan District

The objectives are the shared aims for managing flooding. Actions describe where and how flood risk will be managed. Objectives and actions have been set by SEPA and agreed by flood risk management responsible authorities following consultation.

Some flood risk management objectives and actions apply to all areas, whether designated as a Potentially Vulnerable Area or not. For example, flood risk can be managed through national planning policy or as part of ongoing statutory duties for local authorities. The focus of this Flood Risk Management Strategy is to manage flood risk in Potentially Vulnerable Areas where specific actions apply in addition to the generic actions listed below. Further detail on specific actions can be found in the relevant Potentially Vulnerable Area chapter. Local authorities may have further information on how they manage flooding across their area.

Target area	Objective(s)	ID	Indicators
Applies across Ayrshire Local Plan District	Avoid an overall increase in flood risk	12039	• 7,800 residential properties • 2,700 non-residential properties • 17,160 people
Applies across Ayrshire Local Plan District	Reduce overall flood risk	12082	• 7,800 residential properties • 2,700 non-residential properties • 17,160 people

Action (ID):	**FLOOD FORECASTING** (120820009)		
Objective (ID):	**Reduce overall flood risk.** (12082)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	**SELF HELP** (120820011)		
Objective (ID):	**Reduce overall flood risk.** (12082)		
Delivery lead:	–		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and the Resilient Communities Initiative, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	**AWARENESS RAISING** (120820013)		
Objective (ID):	**Reduce overall flood risk.** (12082)		
Delivery lead:	Responsible authorities		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. Local authorities will be undertaking additional awareness raising activities, further details will be set out in the Local FRM Plans.		

Action (ID):	**MAINTENANCE** (120820007)		
Objective (ID):	**Reduce overall flood risk.** (12082)		
Delivery lead:	Local authority, asset / land managers		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. The local authorities produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk.		

Action (ID):	**EMERGENCY PLANS / RESPONSE** (120820014)		
Objective (ID):	**Reduce overall flood risk.** (12082)		
Delivery lead:	Category 1 and 2 Responders		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (120390001)		
Objective (ID):	**Avoid an overall increase in flood risk.** (12039) **Reduce overall flood risk.** (12082)		
Delivery lead:	Planning authority		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		

2.2 Potentially Vulnerable Areas

The table below summarises the actions to manage flood risk in the Potentially Vulnerable Areas of this Local Plan District. Further detail is provided in each Potentially Vulnerable Area.

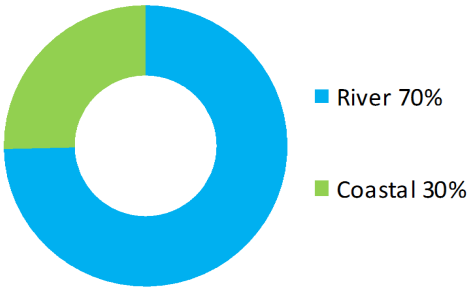
PVA	Flood protection scheme/ works	Natural flood management works	New flood warning	Flood protection study	Natural flood management study	Surface water plan/study	Strategic mapping and modelling	Maintain flood protection scheme*	Maintain flood warning*	Flood forecasting	Property level protection scheme	Community flood action groups	Self help	Awareness raising	Maintenance	Site protection plans	Emergency plans/ response	Planning policies
12/01				✓			✓	N/A	N/A	✓			✓	✓	✓		✓	✓
12/02	✓			✓			✓	✓	✓	✓			✓	✓	✓		✓	✓
12/03	✓		✓	✓		✓	✓	✓	✓	✓			✓	✓	✓		✓	✓
12/04	✓		✓		✓		✓	N/A	N/A	✓			✓	✓	✓		✓	✓
12/05			✓	✓		✓	✓	N/A	N/A	✓			✓	✓	✓		✓	✓
12/06			✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓
12/07		✓		✓		✓	✓	✓	✓	✓			✓	✓	✓		✓	✓
12/08				✓				✓	✓	✓			✓	✓	✓		✓	✓
12/09		✓		✓		✓	✓	✓	✓	✓			✓	✓	✓		✓	✓
12/10			✓			✓	✓	N/A	N/A	✓			✓	✓	✓		✓	✓
12/11			✓			✓	✓	N/A	N/A	✓			✓	✓	✓		✓	✓
12/12							✓	N/A	✓	✓			✓	✓	✓		✓	✓
12/13							✓	N/A	N/A	✓			✓	✓	✓		✓	✓
12/14				✓			✓	N/A	N/A	✓	✓		✓	✓	✓		✓	✓
12/15				✓			✓	✓	N/A	✓			✓	✓	✓		✓	✓
12/16								N/A	N/A	✓			✓	✓	✓		✓	✓
12/17								N/A	N/A	✓			✓	✓	✓		✓	✓
12/18				✓			✓	✓	✓	✓			✓	✓	✓		✓	✓
12/19c				✓				N/A	N/A	✓			✓	✓	✓		✓	✓

*Note: N/A is used where there is no formal Flood Protection Scheme or flood warning scheme present.

Noddsdale Water (Potentially Vulnerable Area 12/01)

Local Plan District	Local authority	Main catchment
Ayrshire	North Ayrshire Council	Noddsdale Water

Summary of flooding impacts



At risk of flooding

- 30 residential properties
- £68,000 Annual Average Damages

(damages by flood source shown left)

Summary of objectives to manage flooding

Objectives have been set by SEPA and agreed with flood risk management authorities. These are the aims for managing local flood risk. The objectives have been grouped in three main ways: by reducing risk, avoiding increasing risk or accepting risk by maintaining current levels of management.

Many organisations, such as Scottish Water and energy companies, actively maintain and manage their own assets including their risk from flooding. Where known, these actions are described here. Scottish Natural Heritage and Historic Environment Scotland work with site owners to manage flooding where appropriate at designated environmental and/or cultural heritage sites. These actions are not detailed further in the Flood Risk Management Strategies.

Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	*Maintain flood warning*	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Noddsdale Water (Potentially Vulnerable Area 12/01)

Local Plan District	Local authority	Main catchment
Ayrshire	North Ayrshire Council	Noddsdale Water

Background

This Potentially Vulnerable Area is located in the north of the Ayrshire Local Plan District and is approximately 20km^2, from North Burnt Hill to the north of Largs Bay (shown below).

There are approximately 30 residential properties at risk of flooding. The Annual Average Damages are approximately £68,000.

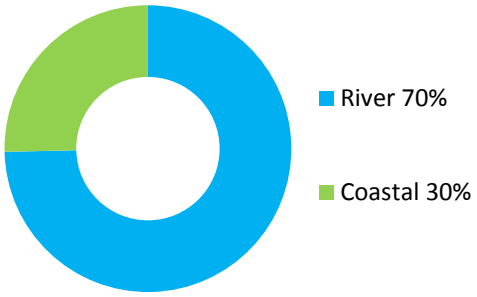


Figure 1: Annual Average Damages by flood source

Summary of flooding impacts

River flooding in this area comes from several small tributaries of the Noddsdale Water. These small watercourses present a potential impact to residential properties and roads. However, due to the small catchment size, they have not been modelled in the national assessment and are not included within the tables and figures presented below. This flooding source has however been considered within the objectives and actions to manage flooding.

The national assessment attributes river flooding primarily to the Noddsdale Water, with the majority of impacts in the north of Largs. A flood risk assessment for the Noddsdale Water identified areas between Noddleburn Road and the A78 at risk from river flooding, and a local depression downstream of the A78 at risk from high tides and storm surges. The study also identified erosion problems to the banks of the Noddsdale Water within Largs. Green bank protection work was completed at the back of Glen Avenue to reduce further erosion of the public path.

There is potential for a restriction in capacity along the Noddsdale Water at the A78, Greenock Road, which may cause flooding to the road network, there have also been cases of blockages to the bridge connecting Noddleburn Meadow and Noddleburn Road.

On the lower reaches of the Noddsdale Water there is potential for interaction between coastal and river flooding where low lying properties are at risk. North

Ayrshire Council has coastal defences which provide both flood and erosion protection. There are revetments, seawalls and embankments in Netherhall, north of the Noddsdale Water.

Surface water mapping indicates a number of localised areas within the north of Largs that may be at risk of flooding. Historical records support this assessment. The areas at highest risk from surface water flooding will require the preparation of surface water management plans.

The risk of flooding to people and property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1. The damages associated with floods of different likelihood are shown in Figure 2.

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 30 to 70.

Residential properties affected by river and coastal flooding experience the highest economic impact at approximately 98% of the damages. The location of the impacts of flooding is shown in Figure 3. Most of the impacts are within Largs with flooding to people and utilities.

History of flooding

There are several records of river flooding in Netherhall in the north of Largs. On all occasions, the watercourse responsible is the Kil Burn. The floods occurred between 2002 and 2004 and mostly impacted residential properties and gardens. There are two records of surface water flooding, occurring in 1999 near Brisbane Glen Road and Routenburn Road which threatened residential properties.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 930)	<10	30	50
Non-residential properties (total 10)	<10	<10	<10
People	<10	80	110
Community facilities	0	0	0
Utilities assets	<10	<10	<10
Transport links - roads (km)	0.1	0.1	0.1
Environmental designated areas (km^2)	0	0	0
Designated cultural heritage sites	0	0	0
Agricultural land (km^2)	0.1	0.1	0.2

Table 1: Summary of flooding impacts[1]

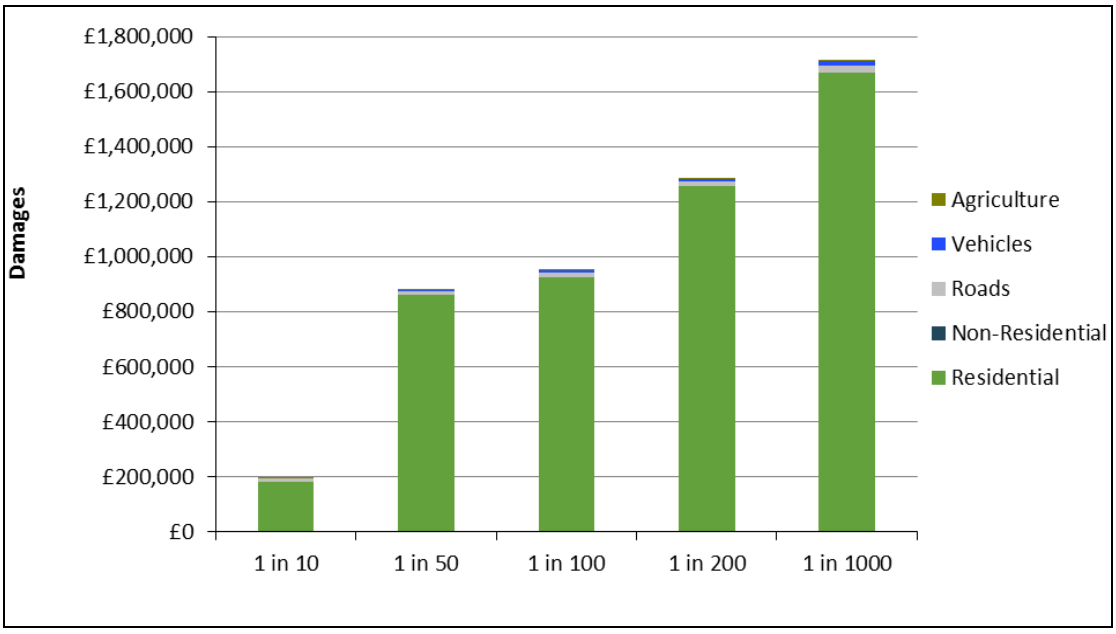


Figure 2: Damages by flood likelihood

[1] Some receptors are counted more than once if flooded from multiple sources

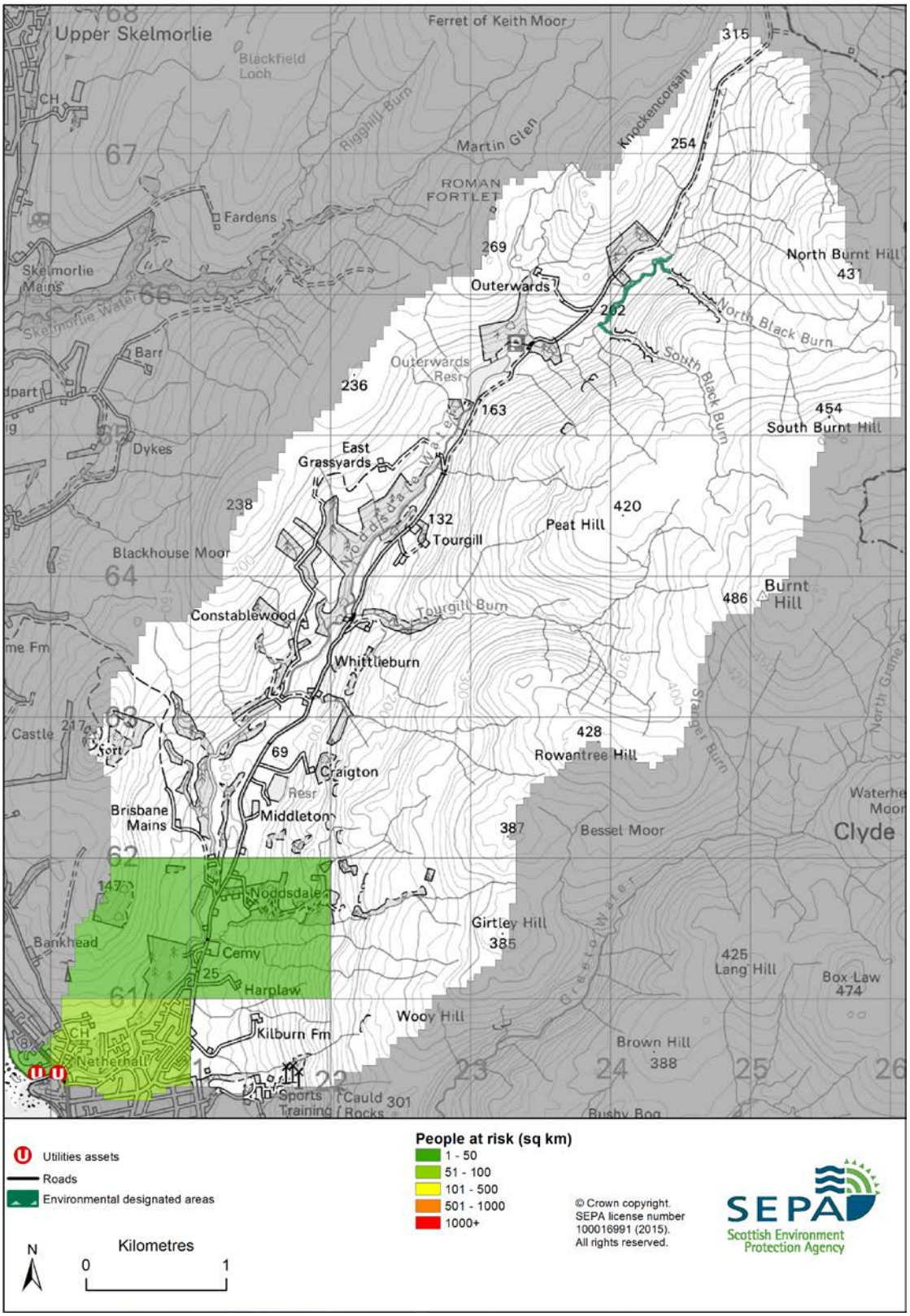
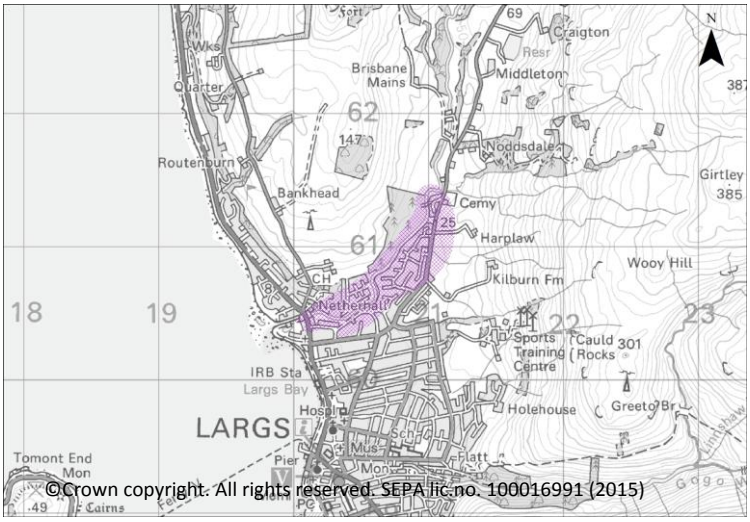


Figure 3: Impacts of flooding

Objectives to manage flooding in Potentially Vulnerable Area 12/01

Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target areas have been set to focus actions; they do not necessarily correspond to areas at risk in SEPA's flood map. The objectives below have been set for Noddsdale Water Potentially Vulnerable Area.

Reduce the risk of river flooding to residential properties in the north east of Largs

Indicators:	Target area:
There have been frequent reports of flooding from small watercourses, not currently covered within the strategic mapping.	
Objective ID: 12001	

Target area	Objective	ID	Indicators within PVA
Applies across Ayrshire Local Plan District	Avoid an overall increase in flood risk	12039	• 30 residential properties • £68,000 Annual Average Damages
Applies across Ayrshire Local Plan District	Reduce overall flood risk	12082	• 30 residential properties • £68,000 Annual Average Damages
Applies across Ayrshire Local Plan District	Organisations such as Scottish Water, energy companies and Historic Environment Scotland actively maintain and manage their own assets, including the risk of flooding. These actions are not detailed further in the Flood Risk Management Strategies.		

Actions to manage flooding in Potentially Vulnerable Area 12/01

Actions describe where and how flood risk will be managed. These actions have been set by SEPA and agreed with flood risk management authorities following consultation. Selection of actions to deliver the agreed objectives was based on a detailed assessment and comparison of economic, social and environmental criteria. The actions shaded and then described below have been selected as the most appropriate for Noddsdale Water Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	*Maintain flood warning*	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Action (ID):	**FLOOD PROTECTION STUDY** (120010005)		
Objective (ID):	Reduce the risk of river flooding to residential properties in the north east of Largs (12001)		
Delivery lead:	North Ayrshire Council		
Priority:	National:	Within local authority:	
	84 of 168	**4 of 5**	
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	A study is recommended to further investigate the feasibility of a flood protection scheme focusing on modification of conveyance by upgrading culverts in the Brisbane Glen Road area and property level protection. This study should also consider the potential for natural flood management to reduce runoff to the small burns in the area. Other actions may also be considered to select the most sustainable combination of actions.		
Potential impacts			
Economic:	The flood protection study should consider how to reduce flood risk to 28 residential properties in this location, with potential damages avoided of up to £4.5 million. The economic impact of natural flood management actions is difficult to define. However, these actions can reduce flood risk for high likelihood events.		
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. Natural flood management actions can restore and enhance natural environments and create opportunities for recreation and tourism. There may be negative impacts through disturbance to the local community during the construction phase.		

Environmental:	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. Natural flood management actions can have a positive impact by restoring and enhancing natural habitats. To be in accord with the flood risk management strategy, the responsible authority should seek to ensure as part of the study that the action will not have an adverse effect on the integrity of the Renfrewshire Heights Special Protection Area. There is the potential for runoff control actions to have an impact on the Renfrewshire Heights Site of Special Scientific Interest. Downstream of this culvert there may be negative impacts on water quality through increased erosion and sedimentation on the Noddsdale Water; however, there is the potential for improvements to fish passage from upgrading of the culverts.

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (120820019)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Scottish Water		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	Scottish Water will review the assessment of flood risk within the highest risk sewer catchments to improve knowledge and understanding of surface water flood risk.		

Action (ID):	**FLOOD FORECASTING** (120820009)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 Responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	**SELF HELP** (120820011)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	—		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and Resilient Communities initiatives, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	**AWARENESS RAISING** (120820013)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Responsible authorities		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. From 2016 SEPA will engage with the community through local participation in national initiatives, including partnership working with Neighbourhood Watch Scotland. In addition, SEPA will engage with local authorities and community resilience groups where possible. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

Action (ID):	**MAINTENANCE** (120820007)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	North Ayrshire Council, asset / land managers		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. They produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk.		

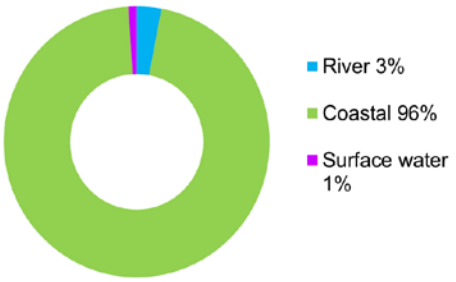
Action (ID):	**EMERGENCY PLANS/RESPONSE** (120820014)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Category 1 and 2 Responders		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (120390001)		
Objective (ID):	Avoid an overall increase in flood risk (12039) Reduce overall flood risk (12082)		
Delivery lead:	Planning authority		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		

Great Cumbrae Island (Potentially Vulnerable Area 12/02)

Local Plan District	Local authority	Main catchment
Ayrshire	North Ayrshire Council	Great Cumbrae coastal

Summary of flooding impacts



At risk of flooding

- local studies identify 800 residential and non-residential properties
- £2.2 million Annual Average Damages

(damages by flood source shown left)

Summary of objectives to manage flooding

Objectives have been set by SEPA and agreed with flood risk management authorities. These are the aims for managing local flood risk. The objectives have been grouped in three main ways: by reducing risk, avoiding increasing risk or accepting risk by maintaining current levels of management.

Many organisations, such as Scottish Water and energy companies, actively maintain and manage their own assets including their risk from flooding. Where known, these actions are described here. Scottish Natural Heritage and Historic Environment Scotland work with site owners to manage flooding where appropriate at designated environmental and/or cultural heritage sites. These actions are not detailed further in the Flood Risk Management Strategies.

Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

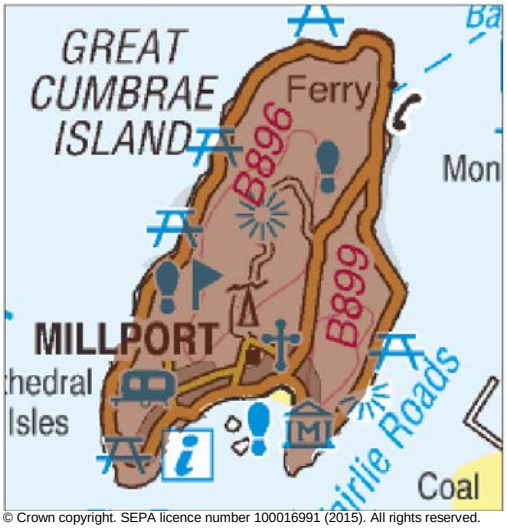
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	Maintain flood warning	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Great Cumbrae Island (Potentially Vulnerable Area 12/02)

Local Plan District	Local authority	Main catchment
Ayrshire	North Ayrshire Council	Great Cumbrae coastal

Background

This Potentially Vulnerable Area is approximately 10km^2. It encompasses all of Great Cumbrae Island located in the Firth of Clyde, to the west of Largs (shown below).



Local studies have shown approximately 800 residential properties to be at risk. The Annual Average Damages are approximately £2.2 million.

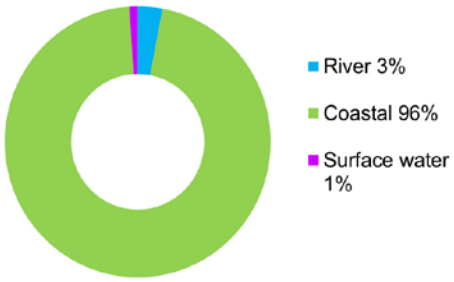


Figure 1: Annual Average Damages by flood source

Summary of flooding impacts

The national assessment shows that flooding within the area is primarily from coastal sources with a limited impact from surface water; however, there have also been reports of river flooding from the Mill Burn. The catchment size threshold used for the river study however, means that no watercourses on the island were modelled.

Due to the limitations of the national modelling approach the risk identified by the national assessment underestimated the risk in the area. North Ayrshire Council has undertaken further studies which identified a risk to approximately 780 properties from coastal flooding, including wave overtopping and erosion. A further 30 properties were identified at risk of river flooding from the Mill Burn. Coastal flooding is also likely to impact sections of road infrastructure including the B896.

Due to the discrepancy between the values from the national assessment and the local study no tables or figures from the national assessment have been provided. The information from areas studied by North Ayrshire Council will be reviewed for use when updating the national mapping. Objectives and actions have been identified to reduce the identified flood risk.

There are only a small number of areas at risk of surface water flooding. These areas tend to coincide with the locations of small reservoirs and lochs. There is one location, to the north of Kames Bay, which indicates that surface water flooding may impact residential properties.

History of flooding

The Millport area has suffered severe coastal flooding dating back to 1912. The most recent report of coastal floods occurred in late December 2012 and early January 2013, which included significant seafront erosion. Annual coastal floods have been reported to affect approximately 20 residential properties. The largest coastal event occurred in January 1991 which caused extensive flooding of Millport, damage to shops, the promenade and the seafront infrastructure.

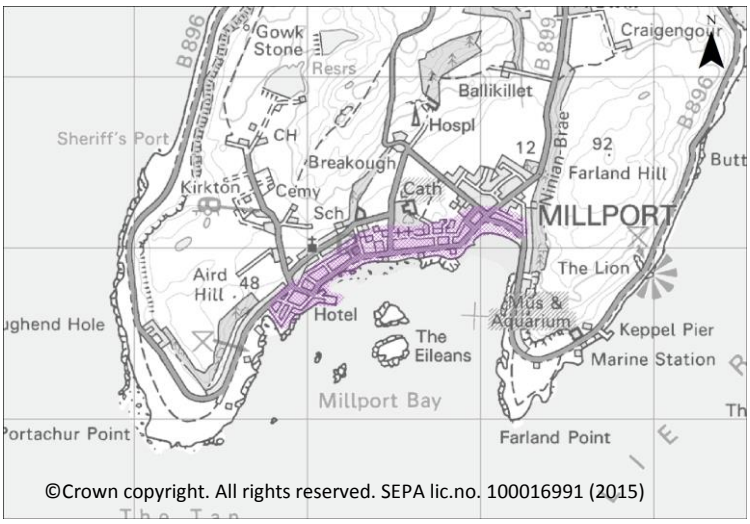
River flooding in the area has been reported from the Mill Burn in Millport. The largest impact was reported on the 22 May 2014 when the burn overtopped its banks and caused flooding to Golf Road, Crawford Street and Miller Street which resulted in flooding to five residential properties and a non-residential property. The event also caused severe damage to the road surface, culverts and masonry garden walls. On the 8 January 2004 the Mill Burn overtopped its banks and flooded Golf Road near Nether Kirkton Farm causing some flood water to flow onto Cardiff Street. On the 10 August 2004 the Mill Burn overflowed onto Golf Road, flooding the road and preventing access. On the 4 October 2004 floodwaters flowed down Cardiff Street threatening multiple properties. There were multiple events in December 1999 when the Mill Burn overflowed at Nether Kilkton, flooding gardens and streets.

Surface water floods were reported in Millport on the 27 February 2007 when blocked road gullies in Glasgow Street caused the flooding of properties.

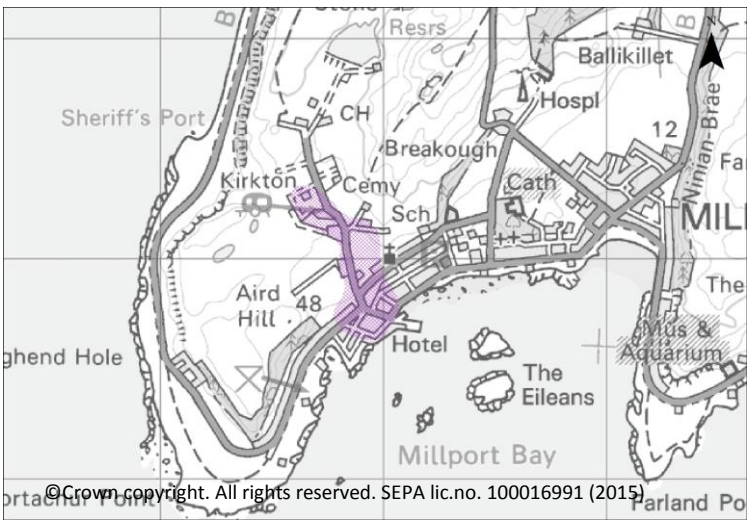
Objectives to manage flooding in Potentially Vulnerable Area 12/02

Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target areas have been set to focus actions; they do not necessarily correspond to areas at risk in SEPA's flood map. The objectives below have been set for Great Cumbrae Island Potentially Vulnerable Area.

Reduce the risk of coastal flooding to residential properties and non-residential properties in Millport

Indicators:	Target area:
• 780 properties • £1.8 million Annual Average Damages	
Objective ID: 12002	

Reduce the risk of river flooding to residential properties in Millport along the Mill Burn

Indicators:	Target area:
• 30 residential properties • Caravan park	
Objective ID: 12003	

Target area	Objective	ID	Indicators within PVA
Applies across Ayrshire Local Plan District	Avoid an overall increase in flood risk	12039	Local studies show: • 800 properties at risk • £2.2 million Annual Average Damages
Applies across Ayrshire Local Plan District	Reduce overall flood risk	12082	Local studies show: • 800 properties at risk • £2.2 million Annual Average Damages
Applies across Ayrshire Local Plan District	Organisations such as Scottish Water, energy companies and Historic Environment Scotland actively maintain and manage their own assets, including the risk of flooding. These actions are not detailed further in the Flood Risk Management Strategies.		

Actions to manage flooding in Potentially Vulnerable Area 12/02

Actions describe where and how flood risk will be managed. These actions have been set by SEPA and agreed with flood risk management authorities following consultation. Selection of actions to deliver the agreed objectives was based on a detailed assessment and comparison of economic, social and environmental criteria. The actions shaded and then described below have been selected as the most appropriate for Great Cumbrae Island Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	Maintain flood warning	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Action (ID):	**FLOOD PROTECTION SCHEME/WORKS** (120020006)		
Objective (ID):	Reduce the risk of coastal flooding to residential properties and non-residential properties in Millport (12002)		
Delivery lead:	North Ayrshire Council		
Priority:	National:	Within local authority:	
	10 of 42	**1 of 3**	
Status:	**Under development**	Indicative delivery:	**2016-2021**
Description:	It is recommended that the council progress work on the proposed coastal flood protection scheme for Millport. A flood risk assessment and economic appraisal have been developed which have identified options to manage flooding in the area. The current option includes the creation of a breakwater with flood walls. These will also protect against wave overtopping and erosion. It is recommended that the options are further developed including an assessment of property level protection included to supplement the primary actions.		
Potential impacts			
Economic:	The proposed scheme may benefit 730 residential and non-residential properties at risk of flooding in this location, damages avoided are estimated to be £65 million. The flood protection scheme has an estimated benefit cost ratio of 5.2.		
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community.		
Environmental:	Flood protection schemes can have both positive and negative impacts on the ecological quality of the environment depending on how they are designed. The scheme has the potential to impact on Kames Bay Site of Special Scientific Interest and consultation with Scottish Natural Heritage is recommended during scheme design.		

Action (ID):	**FLOOD PROTECTION SCHEME/WORKS** (120030006)		
Objective (ID):	Reduce the risk of river flooding to residential properties in Millport along the Mill Burn (12003)		
Delivery lead:	North Ayrshire Council		
Priority:	National:		Within local authority:
	30 of 42		**3 of 3**
Status:	**Under development**	Indicative delivery:	**2016-2021**
Description:	It is recommended that the council progress work on the proposed flood protection work on the Mill Burn in Millport. The Mill Burn Flood Risk Assessment has provided information along with an economic appraisal which identifies potential options to mitigate flooding. Initial remedial work has helped to reduce the level of risk in the area however further analysis should be carried out to establish the remaining level of risk and the most sustainable combination of actions to manage this risk.		
Potential impacts			
Economic:	The proposed scheme may benefit 31 residential properties and 9 non-residential properties in this location, damages avoided are estimated to be £1.9 million. The flood protection scheme has an estimated benefit cost ratio of 1.8.		
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community.		
Environmental:	Flood protection schemes can have both positive and negative impacts on the ecological quality of the environment depending on how they are designed.		

Action (ID):	**FLOOD PROTECTION STUDY** (121030005)		
Objective (ID):	Reduce the risk of coastal flooding to residential properties and non-residential properties in Millport (12002)		
Delivery lead:	North Ayrshire Council and South Ayrshire Council		
Priority:	National:		Within local authority:
	8 of 168		**1 of 5**
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	A shoreline management plan is recommended, this study is not limited to Potentially Vulnerable Areas but should cover the whole of the Ayrshire coastline and any areas beyond this which may be influenced by changes in coastal processes. The study should investigate flooding and coastal erosion, wave overtopping and the current coastal protection offered. The study will help to develop an understanding of coastal issues and identify where further work may be required to mitigate against flooding.		
Potential impacts			

Economic:	The study should consider how to reduce flood risk along the Ayrshire coastline. For the entire study area potential damages avoided are estimated to be up to £26 million.
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community.
Environmental:	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. This study is proposed for the coastline. Future works could improve the condition of the estuary or degrade it. Opportunities to improve the condition of the estuary should be considered by coordinating with river basin management planning.

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (120820016)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	SEPA will seek to incorporate additional surface water data into the flood maps to improve understanding of flood risk. Approximately 1,300km² of improved surface water data is currently available within this Local Plan District. The inclusion of additional surface water hazard data resulting from the completion of local authority surface water management plans and Scottish Water Integrated Catchment Management Studies will be considered as these projects are completed.		

Action (ID):	**MAINTAIN FLOOD PROTECTION SCHEME** (120020017)		
Objective (ID):	Reduce the risk of coastal flooding to residential properties and non-residential properties in Millport (12002)		
Delivery lead:	North Ayrshire Council		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	There is a combination of manmade defences, including seawalls, revetments and breakwaters along Millport Bay which provide some protection to Millport. The planned works aong Millport Bay will look at altering the current defences, until this time these defences will be maintained, and will continue to manage flooding according to the design standard at the time of construction. If the defences remain the same levels of flood risk are likely to increase over time as a consequence of climate change.		

Action (ID):	**MAINTAIN FLOOD WARNING** (120820030)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Continue to maintain the Millport Seafront flood warning area which is part of the Firth of Clyde coastal flood warning scheme.		

Action (ID):	**FLOOD FORECASTING** (120820009)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 Responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	**SELF HELP** (120820011)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	—		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and Resilient Communities initiatives, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	**AWARENESS RAISING** (120820013)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Responsible authorities		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. From 2016 SEPA will engage with communities and promote Floodline using most the appropriate mix of methods for the area. These could include direct mailings, education activities, participation in local events and relevant flooding messages in the media. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

Action (ID):	**MAINTENANCE** (120820007)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	North Ayrshire Council, asset / land managers		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. They produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk.		

Action (ID):	**EMERGENCY PLANS/RESPONSE** (120820014)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Category 1 and 2 Responders		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (120390001)		
Objective (ID):	Avoid an overall increase in flood risk (12039) Reduce overall flood risk (12082)		
Delivery lead:	Planning authority		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		

Largs to Stevenston (Potentially Vulnerable Area 12/03)

Local Plan District	Local authority	Main catchment
Ayrshire	North Ayrshire Council	Saltcoats to Largs coastal

Summary of flooding impacts

At risk of flooding

- 960 residential properties
- 380 non-residential properties
- £1.2 million Annual Average Damages

(damages by flood source shown left)

Summary of objectives to manage flooding

Objectives have been set by SEPA and agreed with flood risk management authorities. These are the aims for managing local flood risk. The objectives have been grouped in three main ways: by reducing risk, avoiding increasing risk or accepting risk by maintaining current levels of management.

Many organisations, such as Scottish Water and energy companies, actively maintain and manage their own assets including their risk from flooding. Where known, these actions are described here. Scottish Natural Heritage and Historic Environment Scotland work with site owners to manage flooding where appropriate at designated environmental and/or cultural heritage sites. These actions are not detailed further in the Flood Risk Management Strategies.

Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

Flood protection scheme/works	*Natural flood management works*	New flood warning	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	Maintain flood warning	Awareness raising	Surface water plan/study	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Largs to Stevenston (Potentially Vulnerable Area 12/03)

Local Plan District	Local authority	Main catchment
Ayrshire	North Ayrshire Council	Saltcoats to Largs coastal

Background

This Potentially Vulnerable Area is approximately 100km^2. It is located in the north of the Ayrshire Local Plan District and extends from Stevenston, Saltcoats and Ardrossan in the south, to Waterhead Moor in the north (shown below). It incorporates the towns of Largs and West Kilbride.

The area has a risk of river, coastal and surface water flooding. The majority of damages are caused by surface water flooding.

There are approximately 960 residential properties and 380 non-residential properties at risk of flooding. The Annual Average Damages are approximately £1.2 million.

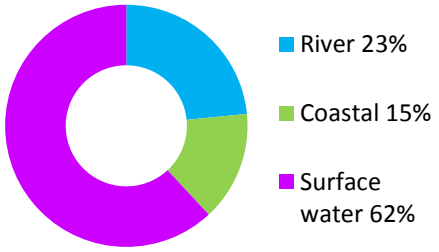


Figure 1: Annual Average Damages by flood source

Summary of flooding impacts

Surface water flooding is likely to impact the Ardrossan, Saltcoats and West Kilbride areas where a large number of residential properties are at risk. There is also potential for flooding of agricultural land in the north west of the area. The areas at highest risk from surface water flooding will require the preparation of surface water management plans.

River flooding occurs throughout the area but is primarily attributed to the Gogo Water. Largs has the potential to be affected by river flooding, which is most likely to occur to the west of the A78 Irvine Road and to the main rail link south of Largs station. West Kilbride is another area where there is a notable risk of river flooding. The Kilbride Burn, which flows south towards West Kilbride, passes beneath the B781 and the main rail link north of West Kilbride rail station. There are a number of constrictions within this area that are likely to cause the water within the Kilbride Burn to overflow. A study on the Kilbride Burn, West Kilbride was undertaken to assess the local impact of river flooding. The study identified Cubrieshaw Bridge as a constraint to river flows. Areas at risk are primarily agricultural land, although residential areas are also at risk. River flooding to land and properties is also likely to occur within Ardrossan from the Master Gott Burn, which is largely culverted.

Coastal flooding is not widespread in this area however there are a number of residential and non-residential properties at risk, particularly near Saltcoats. Three other areas at risk include the north side of West Kilbride, the vicinity of Ardrossan Harbour and a residential area adjacent to Auchenharvie Golf Course.

It should be noted that along the coastline there may be an additional level of risk due to wave overtopping which was not taken into account at the modelling stage of this assessment. As a consequence areas at risk of flooding may not have been identified.

There is the potential for interaction between sources of flooding within the area which may affect the A78 and land adjacent to the RSPB reserve.

The risk of flooding to people and property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1. The damages associated with floods of different likelihood are shown in Figure 2. Residential properties affected by surface water flooding experience the highest economic impact at approximately 40% of the damages. Non-residential properties also provide a substantial portion of the damages.

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 960 to 2,000 and the number of non-residential properties from approximately 380 to 710.

The location of the impacts of flooding is shown in Figure 3. Most of the impacts are within Largs, Ardrossan, Saltcoats and Stevenston with a number of different receptors impacted. The A78 is at risk of flooding at various locations including Fairlie and Ardrossan.

History of flooding

There has been regular flooding in this area for a number of years, with river flooding being the most prevalent. This has been predominately in Ardrossan, Largs and West Kilbride with reports of floods impacting roads, properties and gardens in 2002 and 2003. The most recent river flooding occurred in March and October 2004 in Saltcoats when the Penny Burn flooded the West Bryehill industrial estate.

Surface water flooding has been reported in Ardrossan, West Kilbride and Fairlie in the months of October, November and December in 1999 and 2000, with the biggest impact to roads, properties and gardens.

There have been a number of coastal floods in the area with the most recent occurring in December 2013 to January 2014 in Saltcoats. The most significant coastal flood within the area, impacting properties and people, occurred in Fairlie in November 1912.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 25,000)	220	960	1,600
Non-residential properties (total 2,000)	90	380	600
People	490	2,100	3,400
Community facilities	<10 Emergency services	<10 Includes: emergency services and healthcare facilities	<10 Includes: emergency services and healthcare facilities
Utilities assets	10	20	30
Transport links - roads (km)	5.5 (of which 2.4 is A road)	12.3 (of which 4.9 is A road)	15.6 (of which 6.4 is A road)
Transport links - rail (km)	4.0	10.8	12.5
Environmental designated areas (km^2)	0.9	1.0	1.0
Designated cultural heritage sites	5	6	10
Agricultural land (km^2)	1.0	1.4	1.8

Table 1: Summary of flooding impacts[1]

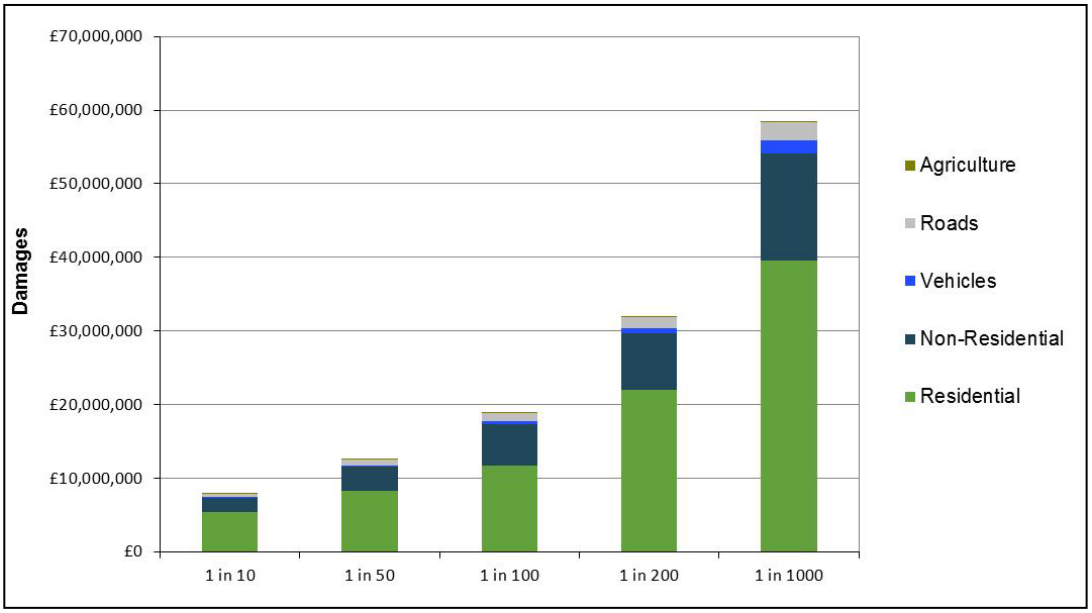


Figure 2: Damages by flood likelihood

[1] Some receptors are counted more than once if flooded from multiple sources

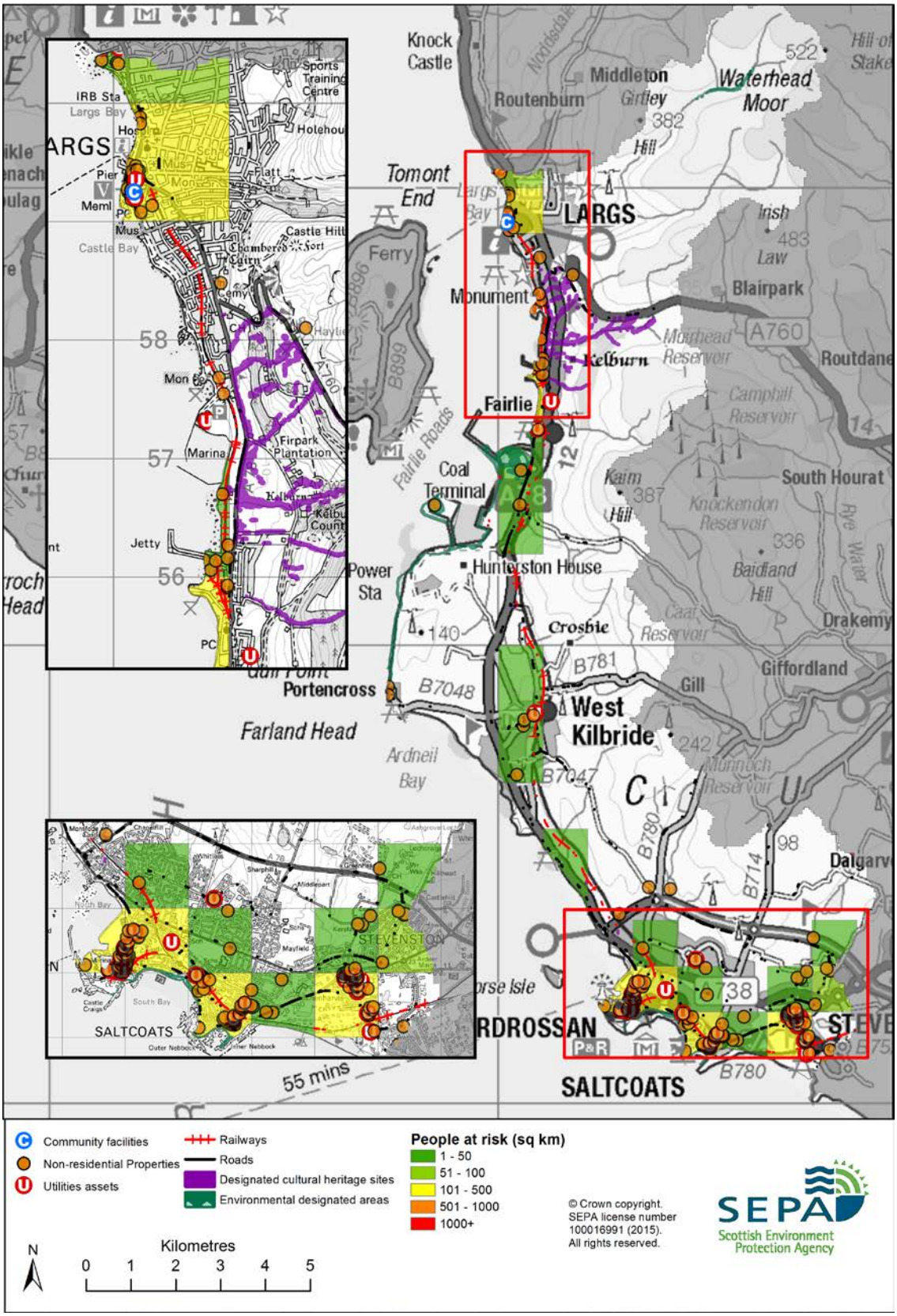


Figure 3: Impacts of flooding

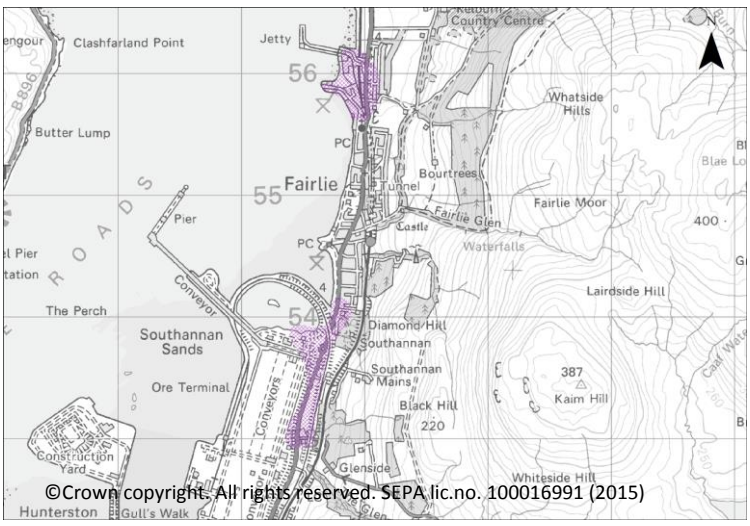
Objectives to manage flooding in Potentially Vulnerable Area 12/03

Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target areas have been set to focus actions; they do not necessarily correspond to areas at risk in SEPA's flood map. The objectives below have been set for Largs to Stevenston Potentially Vulnerable Area.

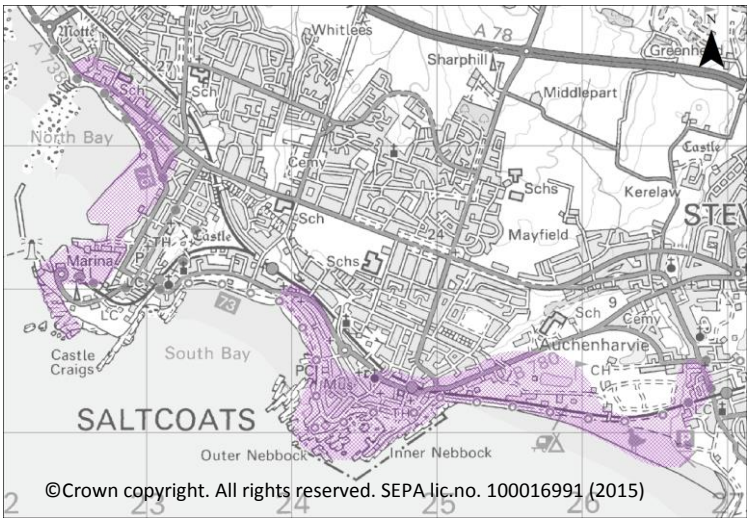
Reduce the risk of river and coastal flooding to residential properties in Largs

Indicators:	Target area:
• 200 residential properties • £140,000 Annual Average Damages	
Objective ID: 12004	

Reduce the risk of river flooding to residential properties and non-residential properties in Fairlie

Indicators:	Target area:
• <10 residential properties • <10 non-residential properties • £19,000 Annual Average Damages	
Objective ID: 12006	

Reduce the risk of coastal flooding to residential properties in Ardrossan, Saltcoats and Stevenston

Indicators:	Target area:
• 10 residential properties • £29,000 Annual Average Damages	
Objective ID: 12009	

Target area	Objective	ID	Indicators within PVA
Saltcoats	Reduce the physical or disruption risk related to the transport network for rail.	12300	• 70m of rail track at 4 locations
Kilwinning, Saltcoats, Ardrossan and Stevenston	Reduce the economic damages and risk to people from surface water flooding in Kilwinning, Saltcoats, Ardrossan and Stevenston	12041	* See note below
Applies across Ayrshire Local Plan District	Avoid an overall increase in flood risk	12039	• 960 residential properties • £1.2 million Annual Average Damages
Applies across Ayrshire Local Plan District	Reduce overall flood risk	12082	• 960 residential properties • £1.2 million Annual Average Damages
Applies across Ayrshire Local Plan District	Organisations such as Scottish Water, energy companies and Historic Environment Scotland actively maintain and manage their own assets, including the risk of flooding. These actions are not detailed further in the Flood Risk Management Strategies.		

* This objective will be monitored using surface water flood risk across the Potentially Vulnerable Area. For 12/03 there are 560 residential properties at risk and Annual Average Damages of £780,000.

Actions to manage flooding in Potentially Vulnerable Area 12/03

Actions describe where and how flood risk will be managed. These actions have been set by SEPA and agreed with flood risk management authorities following consultation. Selection of actions to deliver the agreed objectives was based on a detailed assessment and comparison of economic, social and environmental criteria. The actions shaded and then described below have been selected as the most appropriate for Largs to Stevenston Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	*Natural flood management works*	New flood warning	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	Maintain flood warning	Awareness raising	Surface water plan/study	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Action (ID):	**FLOOD PROTECTION SCHEME/WORKS** (120060006)		
Objective (ID):	Reduce the risk of river flooding to residential properties and non-residential properties in Fairlie (12006)		
Delivery lead:	Transport Scotland and Network Rail		
Status:	**Under development**	Indicative delivery:	**2016-2021**
Description:	North Ayrshire Council, Transport Scotland and Network Rail are all working in partnership on the Keppen Burn Culvert Upgrade. These works are at detailed design stage.		
Potential impacts			
Economic:	The economic impacts have not been defined at this stage.		
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. Natural flood management actions can restore and enhance natural environments and create opportunities for recreation and tourism.		
Environmental:	Flood protection schemes can have both positive and negative impacts on the ecological quality of the environment depending on how they are designed.		

Action (ID):	**FLOOD PROTECTION SCHEME/WORKS** (12300021)
Objective (ID):	Reduce the physical or disruption risk related to the transport network for rail. (12300)
Delivery lead:	Network Rail

Status:	**Under development**	Indicative delivery:	**2016-2021**
Description:	Network Rail will carry out civil engineering work which will reduce flood risk to identified sections of the rail network within this PVA		

Action (ID):	**NEW FLOOD WARNING** (120820010)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Not started**	Indicative delivery:	**post 2021**
Description:	The area under consideration includes properties in Fairlie affected by coastal flooding. Flood warning in this location can potentially be delivered through an extension to the Firth of Clyde flood forecasting system and warning scheme. Further assessment will help to determine appropriate timescales for delivery.		

Action (ID):	**FLOOD PROTECTION STUDY** (121030005)		
Objective (ID):	Reduce the risk of river and coastal flooding to residential properties in Largs (12004)		
Delivery lead:	North Ayrshire Council and South Ayrshire Council		
Priority:	National:	Within local authority:	
	8 of 168	**1 of 5**	
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	A shoreline management plan is recommended, this study is not limited to Potentially Vulnerable Areas but should cover the whole of the Ayrshire coastline and any areas beyond this which may be influenced by changes in coastal processes. The study should investigate flooding and coastal erosion, wave overtopping and the current coastal protection offered. The study will help to develop an understanding of coastal issues and identify where further work may be required to mitigate against flooding.		
Potential impacts			
Economic:	The study should consider how to reduce flood risk along the Ayrshire coastline. For the entire study area potential damages avoided are estimated to be up to £26 million.		
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community.		
Environmental:	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. This study is proposed for the coastline. Irvine Bay (water body ID 200021), within this study area, is identified by river basin management planning to be at less than good status. Opportunities to improve the condition of the estuary should be considered by coordinating with river basin management planning.		

Action (ID):	**FLOOD PROTECTION STUDY** (120040005)		
Objective (ID):	Reduce the risk of river and coastal flooding to residential properties in Largs (12004)		
Delivery lead:	North Ayrshire Council		
Priority:	National:	Within local authority:	
	90 of 168	**5 of 5**	
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	A study is recommended to further investigate the river and coastal flood risk in Largs and if there is significant interaction between the two. The study should include updating the existing modelling on the Gogo Water, and further investigation into enhancing and extending the existing coastal defences. The Ayrshire Shoreline Management Plan (action 12103005) will also cover Largs and should be used to provide background information for this study.		
Potential impacts			
Economic:	The flood protection study should consider how to reduce flood risk to 201 residential properties and 72 non-residential properties in this location, with potential damages avoided of up to £3.7 million.		
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community and socially vulnerable people located within the flood protection study area. In addition there are one educational building and five utilities which have been identified as potentially benefitting from this action. There may be negative impacts through disturbance to the local community during the construction phase.		
Environmental:	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. There are no international, national or local level environmental designations that are likely to be impacted by this action. There is likely to be a loss of natural and semi-natural habitat in the footprint and vicinity of the defences. There is the potential for negative impacts on local water quality and disturbance to flora and fauna in Largs Bay and at the downstream end of the Gogo Water during the construction period. There is the potential for negative impacts to the numerous listed buildings in the area, and their setting, in particular the public fountain, the War Memorial and the harbour.		

Action (ID):	**SURFACE WATER PLAN/STUDY** (120411018)
Objective (ID):	Reduce the economic damages and risk to people from surface water flooding in Kilwinning, Saltcoats, Ardrossan and Stevenston (12041)
Delivery lead:	North Ayrshire Council

Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	The area must be covered by a surface water management plan or plans that set objectives for the management of surface water flood risk and identify the most sustainable actions to achieve the objectives.		

Action (ID):	**SURFACE WATER PLAN/STUDY** (120411019)		
Objective (ID):	Reduce the economic damages and risk to people from surface water flooding in Kilwinning, Saltcoats, Ardrossan and Stevenston (12041)		
Delivery lead:	Scottish Water in partnership with North Ayrshire Council		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	An integrated catchment study will be carried out to support the surface water management plan process and improve knowledge and understanding of surface water flood risk and interactions with other sources of flooding e.g. with the sewer network, watercourses and the sea.		

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (120820016)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	SEPA will seek to develop flood mapping in the Ayr to Ardrossan area to improve understanding of coastal flood risk. The extent and timing of improvements will depend on detailed scoping and data availability. Where this work coincides with local authority studies, SEPA will work collaboratively to ensure consistent modelling approaches are applied.		

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (120820019)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Scottish Water		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	Scottish Water will review the assessment of flood risk within the highest risk sewer catchments to improve knowledge and understanding of surface water flood risk.		

Action (ID):	**MAINTAIN FLOOD PROTECTION SCHEME** (120040017)		
Objective (ID):	Reduce the risk of river and coastal flooding to residential properties in Largs (12004)		
Delivery lead:	North Ayrshire Council		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Largs Flood Protection Scheme was constructed in 2002 and consists of a concrete seawall from Old Fish Quay to Gogo Water. This scheme provides protection to the area up to a 200 year flood. The Gogo Street Flood Protection Scheme was completed in 2013 to mitigate flooding from the Gogo Water to a standard of protection of a 1 in 75 year flood. These schemes will be maintained, and will continue to manage flooding according to the design standard at the time of construction. Levels of flood risk are likely to increase over time as a consequence of climate change.		

Action (ID):	**MAINTAIN FLOOD PROTECTION SCHEME** (120090017)		
Objective (ID):	Reduce the risk of coastal flooding to residential properties in Ardrossan, Saltcoats and Stevenston (12009)		
Delivery lead:	North Ayrshire Council		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Saltcoats Flood Protection Scheme was constructed in 2006 and consists of breakwaters, seawalls and flood banks at Outer Nebbock. This scheme provides protection to the area up to a 200 year flood. This scheme will be maintained, and will continue to manage flooding according to the design standard at the time of construction. Levels of flood risk are likely to increase over time as a consequence of climate change.		

Action (ID):	**MAINTAIN FLOOD WARNING** (120820030)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Continue to maintain the Largs Fort Street, Largs Seafront and Saltcoats Harbour flood warning areas which are part of the Firth of Clyde coastal flood warning scheme.		

Action (ID):	**FLOOD FORECASTING** (120820009)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 Responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	**SELF HELP** (120820011)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	—		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and Resilient Communities initiatives, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	**AWARENESS RAISING** (120820013)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Responsible authorities		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. SEPA will engage with communities and promote Floodline using most the appropriate mix of methods for the area. These could include direct mailings, education activities, participation in local events and relevant flooding messages in the media. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

Action (ID):	**MAINTENANCE** (120820007)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	North Ayrshire Council, asset / land managers		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. They produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk.		

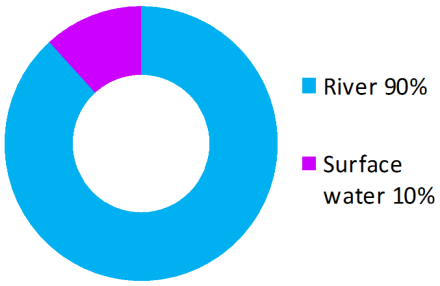
Action (ID):	**EMERGENCY PLANS/RESPONSE** (120820014)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Category 1 and 2 Responders		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (120390001)		
Objective (ID):	Avoid an overall increase in flood risk (12039) Reduce overall flood risk (12082)		
Delivery lead:	Planning authority		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		

Upper Garnock catchment (Potentially Vulnerable Area 12/04)

Local Plan District	Local authority	Main catchment
Ayrshire	North Ayrshire Council, Renfrewshire Council	River Garnock

Summary of flooding impacts



At risk of flooding

- 810 residential properties
- 100 non-residential properties
- £790,000 Annual Average Damages

(damages by flood source shown left)

Summary of objectives to manage flooding

Objectives have been set by SEPA and agreed with flood risk management authorities. These are the aims for managing local flood risk. The objectives have been grouped in three main ways: by reducing risk, avoiding increasing risk or accepting risk by maintaining current levels of management.

Many organisations, such as Scottish Water and energy companies, actively maintain and manage their own assets including their risk from flooding. Where known, these actions are described here. Scottish Natural Heritage and Historic Environment Scotland work with site owners to manage flooding where appropriate at designated environmental and/or cultural heritage sites. These actions are not detailed further in the Flood Risk Management Strategies.

Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

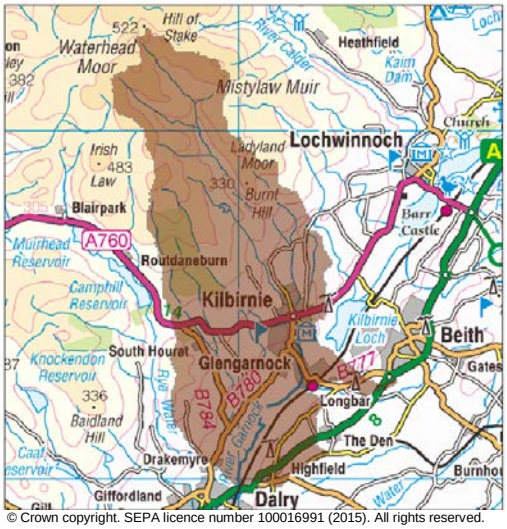
Flood protection scheme/works	*Natural flood management works*	New flood warning	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	Natural flood management study	*Maintain flood warning*	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Upper Garnock catchment (Potentially Vulnerable Area 12/04)

Local Plan District	Local authority	Main catchment
Ayrshire	North Ayrshire Council, Renfrewshire Council	River Garnock

Background

This Potentially Vulnerable Area is located in the north of the Ayrshire Local Plan District, between Dalry and Clyde Muirshiel Regional Park and it is approximately 50km^2 (shown below).



There are approximately 810 residential properties and 100 non-residential properties at risk of flooding. The Annual Average Damages are approximately £790,000.

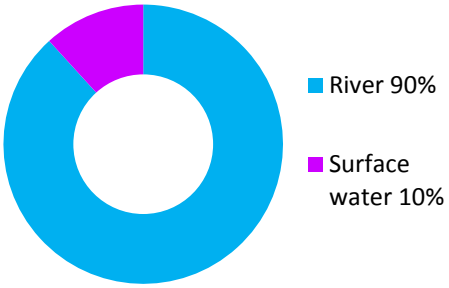


Figure 1: Annual Average Damages by flood source

Summary of flooding impacts

River flooding in the area is primarily attributed to the River Garnock which flows from north to south through the town of Kilbirnie and towards Dalry. A large number of residential and non-residential properties are at risk in the town. Flooding may occur to transport routes (notably the A737 and A760) and within the town. A number of areas of river erosion have also been noted in Kilbirnie. To the north of Kilbirnie the floodplain is restricted as it flows through a steep sided valley; however, there are substantial areas of flooding to the south, which would predominantly impact agricultural land. These southern floodplains are located upstream of the town of Dalry. The Rye Water flows into Dalry from the north west with a risk of flooding to an industrial area which may be attributed to the downstream confluence of the Rye Water and the Garnock Water.

Surface water flooding within the area occurs predominantly in rural locations, or is potentially combined with flooding to smaller watercourses. Areas in the north of Dalry are at risk of combined surface water and river flooding.

The risk of flooding to people and property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1. The damages associated with floods of different likelihood are shown in Figure 2. Residential properties affected by river flooding experience the highest economic impact at approximately 80% of the damages.

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 810 to 1040 and the number of non-residential properties from approximately 100 to 120.

The location of the impacts of flooding is shown in Figure 3. Most of the impacts from flooding are south of the A760 at Kilbirnie, these include flooding risk to people, non-residential properties, community facilities, utilities, roads and railways. The A760 itself is at risk of flooding at Kilbirnie.

History of flooding

There has been regular flooding reported within this area. River flooding accounts for almost all records which date back to the late 19th Century and are predominantly from Kilbirnie and Glengarnock. Flooding from the River Garnock on 9 August 2004, 1 August 2008 and 28 September 2010 caused impact to properties, gardens, roads and people in Kilbirnie and Glengarnock.

Surface water floods are infrequent within this area, with only one recent report from November 1999 when residential properties flooded. Prior to this, surface water flooding was last attributed as the cause of flooding in 1882.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 3,900)	70	810	990
Non-residential properties (total 280)	<10	100	120
People	160	1,800	2,000
Community facilities	0	<10 Including: educational buildings and emergency services	<10 Including: educational buildings and emergency services
Utilities assets	<10	20	20
Transport links - road (km)	1.1	2.0 (of which 0.1 is A road)	2.9 (of which 0.1 is A road)
Transport links - rail (km)	0.5	2.4	2.8
Environmental designated areas (km^2)	0	0	0
Designated cultural heritage sites	2	2	2
Agricultural land (km^2)	1.6	2.0	2.1

Table 1: Summary of flooding impacts[1]

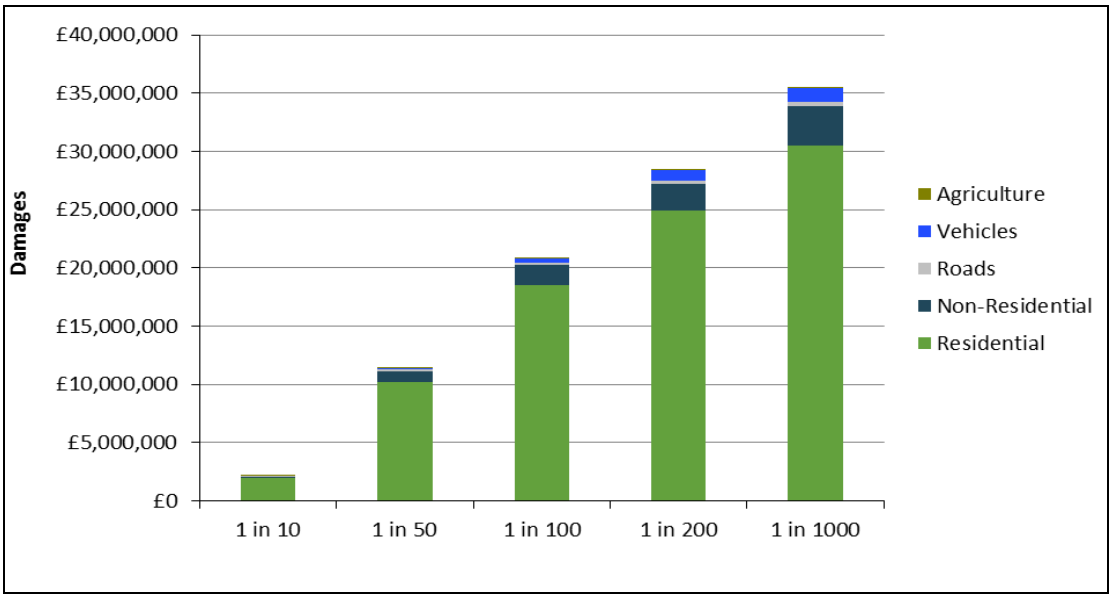


Figure 2: Damages by flood likelihood

[1] Some receptors are counted more than once if flooded from multiple sources

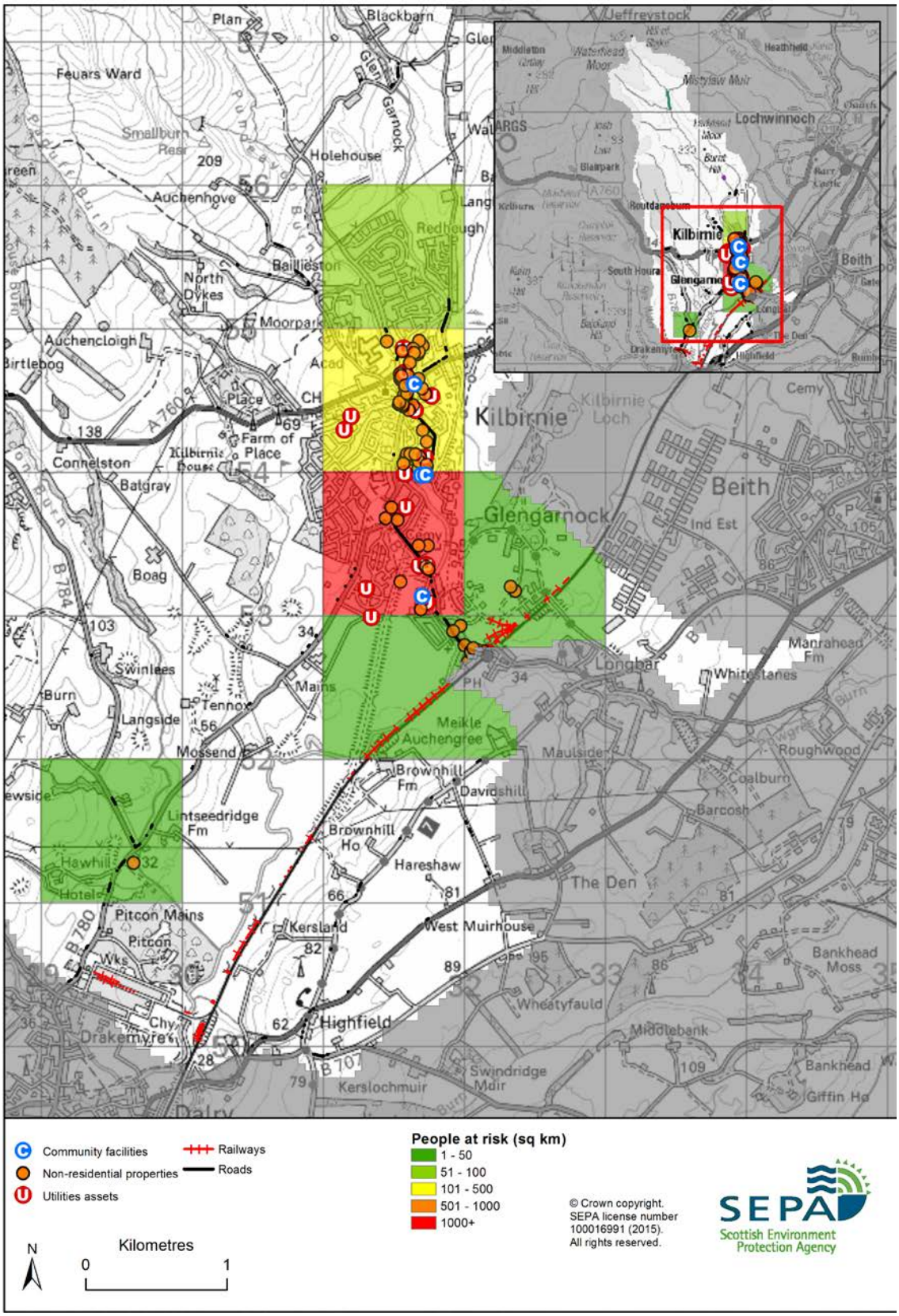


Figure 3: Impacts of flooding

Objectives to manage flooding in Potentially Vulnerable Area 12/04

Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target areas have been set to focus actions; they do not necessarily correspond to areas at risk in SEPA's flood map. The objectives below have been set for the Upper Garnock catchment Potentially Vulnerable Area.

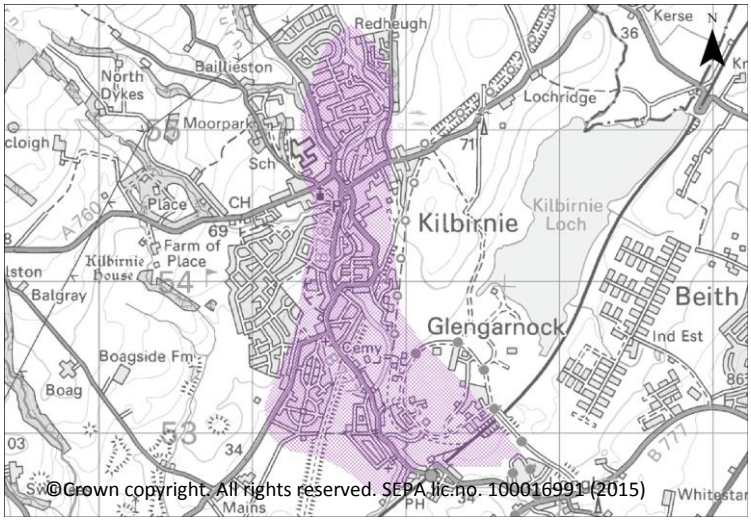
Reduce the risk of river and surface water flooding to residential properties and non-residential properties in Kilbirnie, Glengarnock and Longbar

Indicators:

- 780 residential properties
- 100 non-residential properties
- £720,000 Annual Average Damages

Objective ID: 12010

Target area:



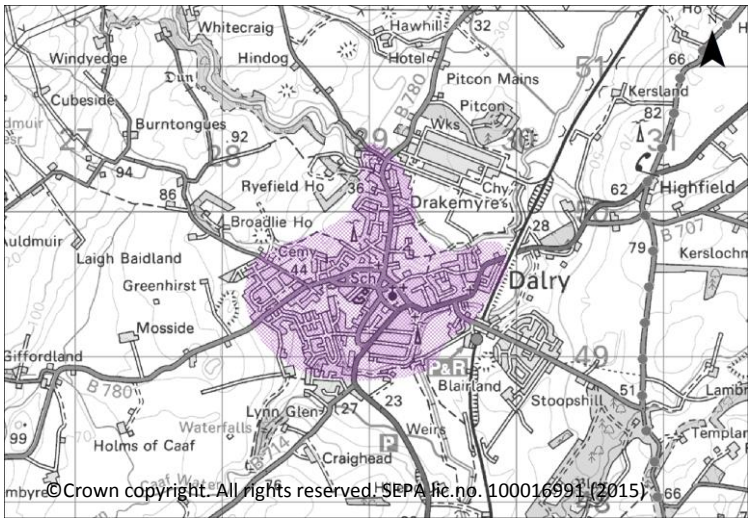
Reduce the risk of river and surface water flooding to residential properties and non-residential properties in Dalry

Indicators:

- 70 residential properties
- <10 non-residential properties
- £380,000 Annual Average Damages

Objective ID: 12102

Target area:



Target area	Objective	ID	Indicators within PVA
Applies across Ayrshire Local Plan District	Avoid an overall increase in flood risk	12039	• 810 residential properties • £790,000 Annual Average Damages
Applies across Ayrshire Local Plan District	Reduce overall flood risk	12082	• 810 residential properties • £790,000 Annual Average Damages
Applies across Ayrshire Local Plan District	Organisations such as Scottish Water, energy companies and Historic Environment Scotland actively maintain and manage their own assets, including the risk of flooding. These actions are not detailed further in the Flood Risk Management Strategies.		

Actions to manage flooding in Potentially Vulnerable Area 12/04

Actions describe where and how flood risk will be managed. These actions have been set by SEPA and agreed with flood risk management authorities following consultation. Selection of actions to deliver the agreed objectives was based on a detailed assessment and comparison of economic, social and environmental criteria. The actions shaded and then described below have been selected as the most appropriate for the Upper Garnock catchment Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	*Natural flood management works*	New flood warning	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	Natural flood management study	*Maintain flood warning*	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Action (ID):	**FLOOD PROTECTION SCHEME/WORKS** (120100006)		
Objective (ID):	Reduce the risk of river and surface water flooding to residential properties and non-residential properties in Kilbirnie, Glengarnock and Longbar (12010)		
Delivery lead:	North Ayrshire Council		
Priority:	National:	Within local authority:	
	12 of 42	**2 of 3**	
Status:	**Under development**	Indicative delivery:	**2016-2021**
Description:	It is recommended that the council progress work on the proposed flood protection scheme on the upper River Garnock. detailed modelling and options assessment has been carried out with an economic assessment of action. The proposed scheme consisting of storage and direct defences would provide protection to properties in Kilbirnie and Glengarnock from the River Garnock and Powgree Burn. Once that scheme has been completed the flood mapping for the River Garnock should be revised to identify the areas protected by the scheme and any remaining residual risk now and in the future.		
Potential impacts			
Economic:	The proposed scheme on the upper River Garnock, may benefit 470 residential and non-residential properties at risk of flooding in this location, damages avoided are estimated to be £61 million. The flood protection scheme has an estimated benefit cost ratio of 4.3.		
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. There may be negative impacts through disturbance to the local community during the construction phase.		

Environmental:	Flood protection schemes can have both positive and negative impacts on the ecological quality of the environment depending on how they are designed. River Garnock (water body ID 10381), within this study area, is identified by river basin management planning to be at less than good status. Opportunities to improve the condition of the estuary should be considered by coordinating with river basin management planning. There are no international, national or local level environmental designations that are likely to be impacted by this action. There is likely to be a loss of natural and semi-natural habitat in the direct footprint of the engineered storage and defences. Downstream of the storage action there may be negative impacts on water quality through increased erosion and sedimentation. Implementation of the storage action will have permanent negative impacts on the water body morphology. There is the potential for negative impacts on local water quality downstream of works during the construction period.

Action (ID):	**FLOOD PROTECTION SCHEME/WORKS** (121020006)		
Objective (ID):	Reduce the risk of river and surface water flooding to residential properties and non-residential properties in Dalry (12102)		
Delivery lead:	North Ayrshire Council		
Priority:	National:	Within local authority:	
	12 of 42	**2 of 3**	
Status:	**Under development**	Indicative delivery:	**2016-2021**
Description:	It is recommended that the council progress work on the proposed flood protection scheme on the upper River Garnock. Detailed modelling and options assessment have been carried out with an economic assessment of actions. The proposed scheme consisting of storage and direct defences would provide protection to properties in Dalry from the River Garnock and Rye Water. Once that scheme has been completed the flood mapping for the River Garnock should be revised to identify the areas protected by the scheme and any remaining residual risk now and in the future.		
Potential impacts			
Economic:	The proposed scheme on the upper River Garnock, may benefit 470 residential and non-residential properties in this location, damages avoided are estimated to be £61 million. The flood protection scheme has an estimated benefit cost ratio of 4.3.		
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. There may be negative impacts through disturbance to the local community during the construction phase.		
Environmental:	Flood protection schemes can have both positive and negative impacts on the ecological quality of the environment depending on how they are designed. This flood protection scheme is proposed for a number of rivers. The physical condition of the River Garnock (water body ID 10381) is identified by river basin management planning to be at less than good status. Future works could improve the condition of the river or degrade it. Opportunities to improve the condition of the river should be considered by coordinating with river basin management planning. There are no international, national or		

Environmental:	local level environmental designations that are likely to be impacted by this action. There is likely to be a loss of natural and semi-natural habitats and displacement of species in the footprint and vicinity of the defences. There is the potential for negative impacts on local water quality downstream of works during the construction period.

Action (ID):	**NEW FLOOD WARNING** (120820010)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Ongoing**	Indicative delivery:	**2016-2021**
Description:	Continue with the development and implementation of a flood warning scheme on the River Garnock. Detail of communities that will benefit from the warnings will be determined during scheme development.		

Action (ID):	**NATURAL FLOOD MANAGEMENT STUDY** (120100003)		
Objective (ID):	Reduce the risk of river and surface water flooding to residential properties and non-residential properties in Kilbirnie, Glengarnock and Longbar (12010)		
Delivery lead:	North Ayrshire Council		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	It is recommended that a natural flood management study should be undertaken to further investigate the potential benefit of runoff control and sediment management around Kilbirnie and Glengarnock. A previous assessment of the potential benefit of these actions on the upper River Garnock has been carried out during the work on the upper River Garnock flood protection scheme. However, this study should focus on the potential benefit of these actions to the tributaries of the River Garnock, and how these combined actions may reduce risk on the River Garnock.		
Potential impacts			
Economic:	The economic impact of natural flood management actions is difficult to define. However, these actions can reduce flood risk for high likelihood events. In this location, it has been estimated that 59 residential and non-residential properties could potentially benefit from natural flood management actions.		
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community and socially vulnerable people located within the natural flood management study area. In addition there are two utilities which have been identified as potentially benefitting from this action. Natural flood management actions can restore and enhance natural environments and create opportunities for recreation and tourism.		
Environmental:	Natural flood management actions can have a positive impact on the ecological quality of the environment by restoring and enhancing natural habitats. This study is proposed for the River Garnock (water		

Environmental:	body ID 10381). The physical condition of this river is identified by river basin management planning to be at less than good status. Natural flood management actions are likely to improve the condition of rivers. Proposed actions should be coordinated with river basin management planning. Proposed runoff control in the upper catchment area north west of Murchan Hill has the potential to impact upon the Renfrewshire Heights Special Area of Conservation and Site of Special Scientific Interest. To be in accord with the flood risk management strategy, the responsible authority should seek to ensure as part of the study that the action will not have an adverse effect on the integrity of the Renfrewshire Heights Special Protection Area. Runoff control in the lower catchment area, to the north west of Kilbirnie, is unlikely to impact these designated sites. There is the potential for the existing ecosystems in the area to be impacted through a change of land use if woodland planting is undertaken. In areas of grazing grassland this could improve biodiversity; however, in the bog areas from Blacks Law to High Blaeberry Craigs this would have significant negative impacts. Depending on the status of the bog there may, however, be potential for some land management activities, such as drain blocking. There are likely to be improvements in water quality through reduced agricultural chemical and sediment runoff, which will have positive impacts on the terrestrial and freshwater habitats and species in the area. There are likely to be local improvements in water quality through reduced sedimentation; however, increased flows may have localised erosion impacts downstream. Sediment management works and bank restoration may cause the short term loss of some habitats and displacement of species, which should recolonise and return to the area following sediment management activities. There is the potential for improved water quality, reduced sediment and reduced scour in the River Garnock. There is also the potential for a slight increase in carbon storage with this action, provided the upland bogs are not negatively impacted upon. There is the potential for woodland planting to impact upon the setting of Glengarnock Castle. Bank restoration and sediment management activities on the River Garnock have the potential to temporarily impact upon the heritage features of Glengarnock Castle and the Kilbirnie heritage conservation area.

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (120820019)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Scottish Water		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	Scottish Water will carry out an assessment of flood risk within the highest risk sewer catchments to improve knowledge and understanding of surface water flood risk.		

Action (ID):	**FLOOD FORECASTING** (120820009)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 Responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	**SELF HELP** (120820011)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	—		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and Resilient Communities initiatives, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	**AWARENESS RAISING** (120820013)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Responsible authorities		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. From 2016 SEPA will undertake flood risk education and awareness raising activities. In addition, SEPA will engage with community resilience groups and participate in property level protection events delivered by the Scottish Flood Forum where possible. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

Action (ID):	**MAINTENANCE** (120820007)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	North Ayrshire Council, Renfrewshire Council, asset / land managers		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. They produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk.		

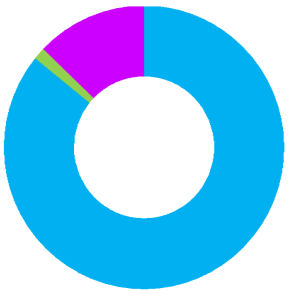
Action (ID):	**EMERGENCY PLANS/RESPONSE** (120820014)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Category 1 and 2 Responders		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (120390001)		
Objective (ID):	Avoid an overall increase in flood risk (12039) Reduce overall flood risk (12082)		
Delivery lead:	Planning authority		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		

Kilwinning (Potentially Vulnerable Area 12/05)

Local Plan District	Local authority	Main catchment
Ayrshire	North Ayrshire Council	River Garnock

Summary of flooding impacts



At risk of flooding

- 170 residential properties
- 50 non-residential properties
- £400,000 Annual Average Damages

(damages by flood source shown left)

Summary of objectives to manage flooding

Objectives have been set by SEPA and agreed with flood risk management authorities. These are the aims for managing local flood risk. The objectives have been grouped in three main ways: by reducing risk, avoiding increasing risk or accepting risk by maintaining current levels of management.

Many organisations, such as Scottish Water and energy companies, actively maintain and manage their own assets including their risk from flooding. Where known, these actions are described here. Scottish Natural Heritage and Historic Environment Scotland work with site owners to manage flooding where appropriate at designated environmental and/or cultural heritage sites. These actions are not detailed further in the Flood Risk Management Strategies.

Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

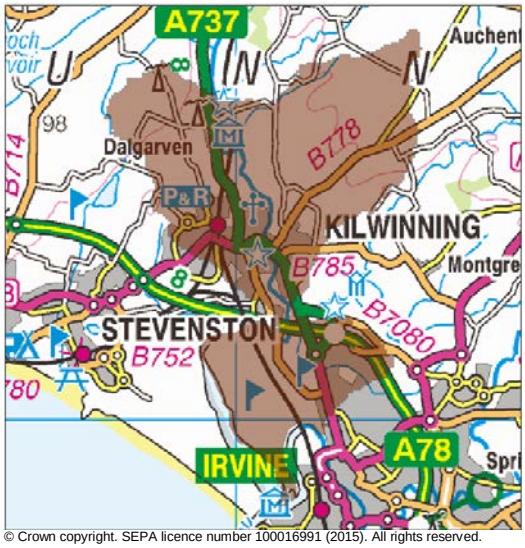
Flood protection scheme/works	*Natural flood management works*	New flood warning	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	*Maintain flood warning*	Awareness raising	Surface water plan/study	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Kilwinning (Potentially Vulnerable Area 12/05)

Local Plan District	Local authority	Main catchment
Ayrshire	North Ayrshire Council	River Garnock

Background

This Potentially Vulnerable Area is located to the north of Irvine and includes a large proportion of Kilwinning. It is approximately 30km^2 (shown below).



The area has a risk of river, surface water and coastal flooding. The majority of damages are caused by river flooding predominately from the River Garnock, River Irvine and the Bannoch Burn.

There are approximately 170 residential properties and 50 non-residential properties at risk of flooding. The Annual Average Damages is approximately £400,000.

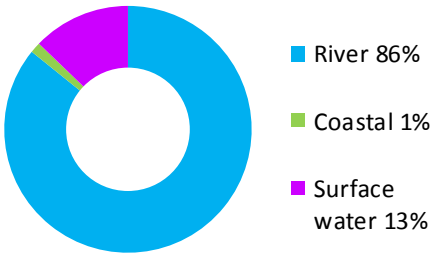


Figure 1: Annual Average Damages by flood source

Summary of flooding impacts

River flooding from the River Garnock, River Irvine and the Bannoch Burn present risk to residential and non-residential properties within Kilwinning and to the area south of the A78, where the Irvine Golf Club and former industrial area are deemed at risk. There are also transport routes at risk, notably railway lines and the A737 and A78. A flood study for the Bannoch Burn completed in February 2014 identified that the culverted section of the Bannoch Burn is lacking capacity and can contribute to flooding.

Surface water flooding is predicted to impact the residential area of Kilwinning with considerable potential disruption along the A737. The areas at highest risk from surface water flooding will require the preparation of surface water management plans.

There is a small risk from coastal flooding over the lower reaches of the River Garnock where there is a tidal influence but no residential or non-residential properties are predicted to be affected.

The risk of flooding to people and property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1. The damages associated with floods of different likelihood are shown in Figure 2.

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 170 to 220 and the number of non-residential properties from approximately 50 to 60.

The location of the impacts of flooding is shown in Figure 3. Most of the impacts from are within Kilwinning and Irvine. These include flooding risk to people, non-residential properties, utilities, roads and railways. The A78 is at risk of flooding between Kilwinning and Irvine. Three designated cultural heritage sites are at risk of flooding, and small areas of environmentally designated sites (approximately 1.5km^2) are also at risk.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 7,700)	60	170	200
Non-residential properties (total 380)	10	50	60
People	130	380	440
Community facilities	0	<10 Healthcare facilities	<10 Healthcare facilities
Utilities assets	<10	<10	<10
Transport links - roads (km)	1.7 (of which 0.4 is A road)	4.2 (of which 1.0 is A road)	4.6 (of which 1.4 is A road)
Transport links - rail (km)	0.1	2.3	2.4
Environmental designated areas (km^2)	1.3	1.5	1.6
Designated cultural heritage sites	3	3	3
Agricultural land (km^2)	2.6	3.4	3.8

Table 1: Summary of flooding impacts[1]

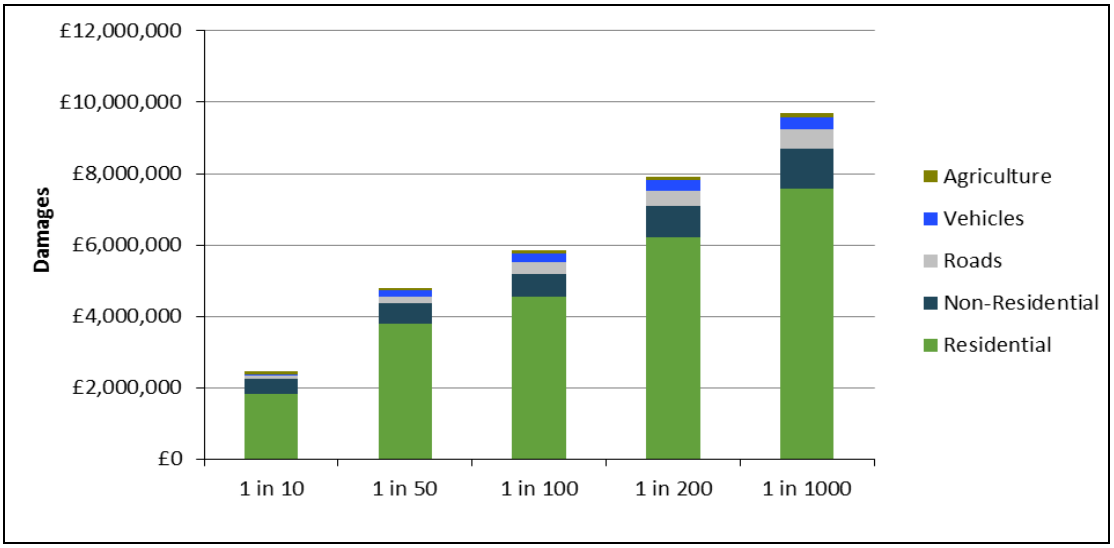


Figure 2: Damages by flood likelihood

[1] Some receptors are counted more than once if flooded from multiple sources

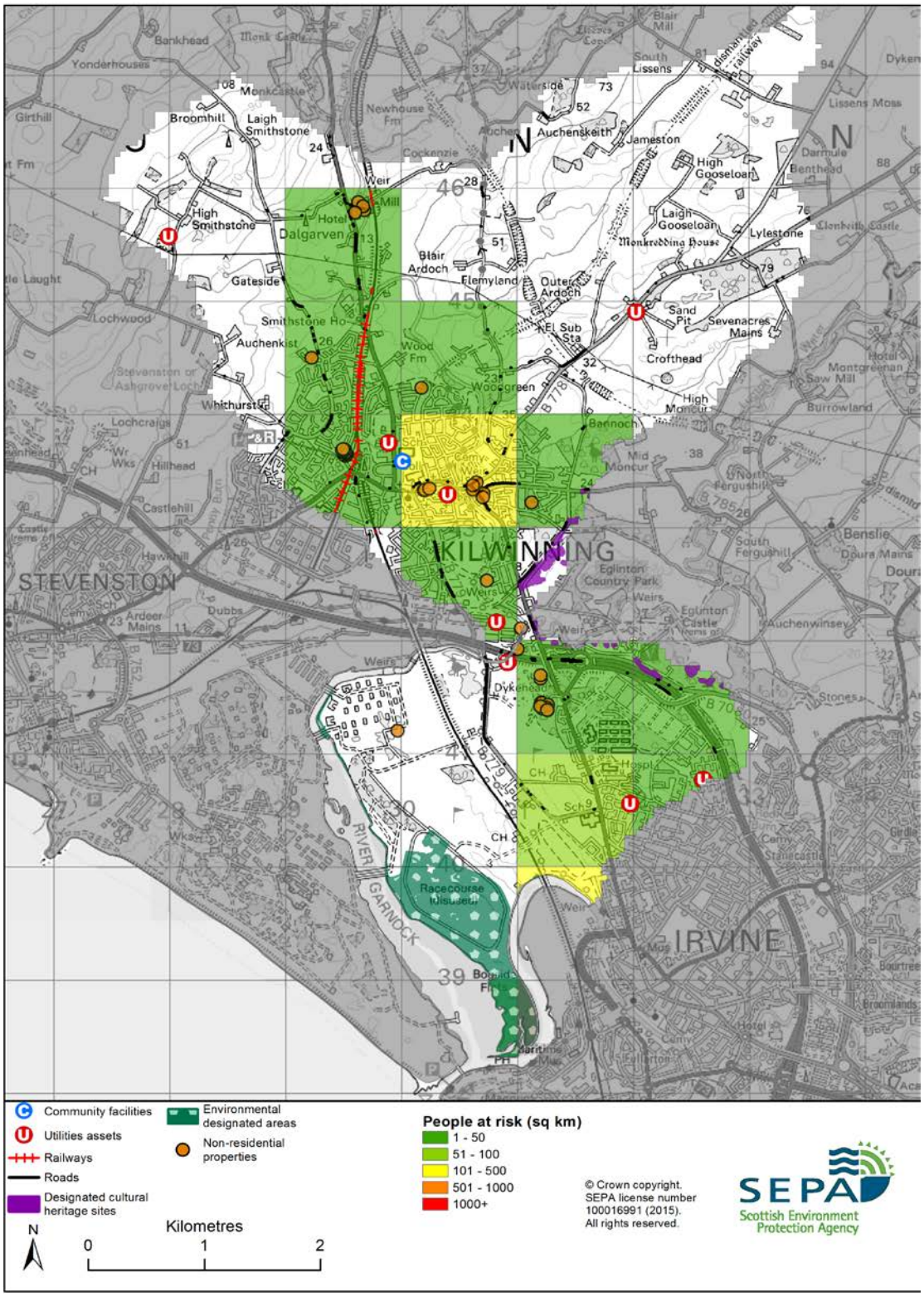


Figure 3: Impacts of flooding

History of flooding

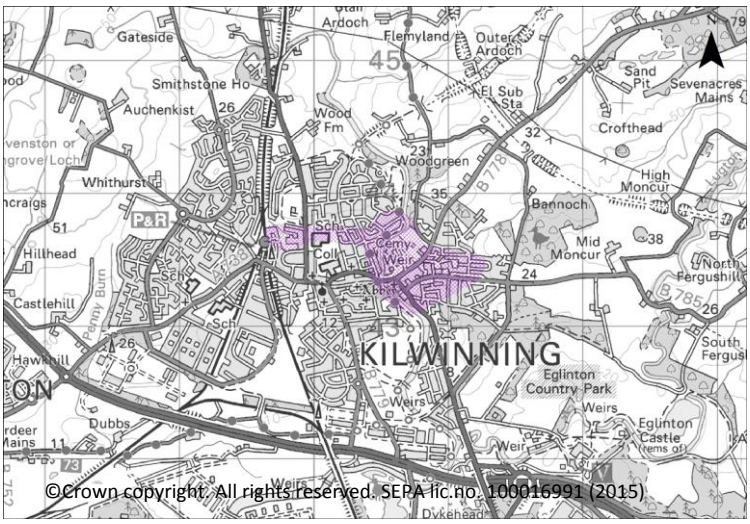
River flooding is the most commonly reported flood source in the area although there is no discernible pattern or clustering. There have been reports of flooding from the Bannoch Burn between 2004 and 2014, including flooding to the A737 trunk road. On the 22 October 2013 the Bannoch Burn flooded at Redstone Avenue and Fergushill Road, Kilwinning resulting in some properties being evacuated. An event of similar magnitude also occurred on the 29 September 2010.

River floods have also been attributed to the Red Burn and Wood Burn. In 2006 the Wood Burn flooded properties in Gavin Way and The Meadows. In 2004 the Red Burn flooded an area of the Kilwinning road.

Objectives to manage flooding in Potentially Vulnerable Area 12/05

Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target areas have been set to focus actions; they do not necessarily correspond to areas at risk in SEPA's flood map. The objectives below have been set for Kilwinning Potentially Vulnerable Area.

Reduce the risk of river flooding to residential properties and non-residential properties in Kilwinning

Indicators:	Target area:
• 90 residential properties • <10 non-residential properties • £240,000 Annual Average Damages	
Objective ID: 12013	

Target area	Objective	ID	Indicators within PVA
Kilwinning, Saltcoats, Ardrossan and Stevenston	Reduce the economic damages and risk to people from surface water flooding in Kilwinning, Saltcoats, Ardrossan and Stevenston	12041	* See note below
Irvine	Reduce the economic damages and risk to people from surface water flooding in Irvine	12042	* See note below
Applies across Ayrshire Local Plan District	Avoid an overall increase in flood risk	12039	• 170 residential properties • £400,000 Annual Average Damages
Applies across Ayrshire Local Plan District	Reduce overall flood risk	12082	• 170 residential properties • £400,000 Annual Average Damages
Applies across Ayrshire Local Plan District	Organisations such as Scottish Water, energy companies and Historic Environment Scotland actively maintain and manage their own assets, including the risk of flooding. These actions are not detailed further in the Flood Risk Management Strategies.		

* This objective will be monitored using surface water flood risk across the Potentially Vulnerable Area. For 12/05 there are 70 residential properties at risk and Annual Average Damages of £52,000.

Actions to manage flooding in Potentially Vulnerable Area 12/05

Actions describe where and how flood risk will be managed. These actions have been set by SEPA and agreed with flood risk management authorities following consultation. Selection of actions to deliver the agreed objectives was based on a detailed assessment and comparison of economic, social and environmental criteria. The actions shaded and then described below have been selected as the most appropriate for Kilwinning Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	*Natural flood management works*	New flood warning	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	*Maintain flood warning*	Awareness raising	Surface water plan/study	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Action (ID):	**NEW FLOOD WARNING** (120820010)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Ongoing**	Indicative delivery:	**2016-2021**
Description:	Continue with the development and implementation of a flood warning scheme on the River Garnock. Detail of communities that will benefit from the warnings will be determined during scheme development.		

Action (ID):	**FLOOD PROTECTION STUDY** (120130005)		
Objective (ID):	Reduce the risk of river flooding to residential properties and non-residential properties in Kilwinning (12013)		
Delivery lead:	North Ayrshire Council		
Priority:	National:	Within local authority:	
	43 of 168	**3 of 5**	
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	As part of the Stevenston Point integrated catchment study further hydraulic modelling will be undertaken on the Wood Burn. Upgrading of culverts on the Wood Burn will be appraised as part of that detailed study along with sustainable drainage systems. In addition, it is recommended that a study is undertaken, to further investigate the feasibility of a flood protection scheme focusing on,		

	modification of control structures by removing a weir and construction of a river wall along the River Garnock. This study should take account of the proposed defences on the River Garnock. It should also consider the potential for runoff control and sediment management within the catchment and the natural flood management study on the River Garnock and tributaries. Other actions may also be considered to select the most sustainable combination of actions.
Potential impacts	
Economic:	The flood protection study should consider how to reduce flood risk to 85 residential properties and 5 non-residential properties in this location, with potential damages avoided of up to £7.1 million. The economic impact of natural flood management actions is difficult to define. However, these actions can reduce flood risk for high likelihood events. In this location, it has been estimated that 49 residential and non-residential properties could potentially benefit from natural flood management actions.
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community and socially vulnerable people located within the flood protection study area. Natural flood management actions can restore and enhance natural environments and create opportunities for recreation and tourism. There may be negative impacts through disturbance to the local community during the construction phase.
Environmental:	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. Natural flood management actions can have a positive impact by restoring and enhancing natural habitats. This study is proposed for a number of rivers. Part of the River Garnock (water body ID 10379) is identified by river basin management planning to be at less than good status for its physical condition. Future works could improve the condition of the rivers or degrade them. Opportunities to improve the condition of the rivers should be considered by coordinating with river basin management planning. There are no international, national or local level environmental designations that are likely to be significantly impacted by this action. Downstream of these culverts there may be negative impacts on water quality through increased erosion and sedimentation on the River Garnock. There is the potential for improvements to fish passage from upgrading of the culverts and weir removal. Increased flows from removal of this weir may cause increased erosion and sedimentation on the River Garnock. There is likely to be a direct loss of natural and semi-natural habitat and displacement of species in the footprint and vicinity of the direct defences. There is the potential for negative impacts on local water quality downstream of works during the construction period. However, there is the potential for slight positive impacts on water quality from the implementation of sustainable drainage systems in the area. There is also the potential for negative impacts on the Kilwinning Bridge listed heritage structure.

Action (ID):	**SURFACE WATER PLAN/STUDY** (120410018)
Objective (ID):	Reduce the economic damages and risk to people from surface water flooding in Kilwinning, Saltcoats, Ardrossan and Stevenston (12041)

Delivery lead:	North Ayrshire Council		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	The area must be covered by a surface water management plan or plans that set objectives for the management of surface water flood risk and identify the most sustainable actions to achieve the objectives.		

Action (ID):	**SURFACE WATER PLAN/STUDY** (120410019)		
Objective (ID):	Reduce the economic damages and risk to people from surface water flooding in Kilwinning, Saltcoats, Ardrossan and Stevenston (12041)		
Delivery lead:	Scottish Water in partnership with North Ayrshire Council		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	An integrated catchment study will be carried out to support the surface water management plan process and improve knowledge and understanding of surface water flood risk and interactions with other sources of flooding e.g. with the sewer network, watercourses and the sea.		

Action (ID):	**SURFACE WATER PLAN/STUDY** (120420018)		
Objective (ID):	Reduce the economic damages and risk to people from surface water flooding in Irvine (12042)		
Delivery lead:	North Ayrshire Council		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	The area must be covered by a surface water management plan or plans that set objectives for the management of surface water flood risk and identify the most sustainable actions to achieve the objectives.		

Action (ID):	**SURFACE WATER PLAN/STUDY** (120420019)		
Objective (ID):	Reduce the economic damages and risk to people from surface water flooding in Irvine (12042)		
Delivery lead:	Scottish Water in partnership with North Ayrshire Council		
Status:	**Ongoing**	Indicative delivery:	**2016-2021**
Description:	An integrated catchment study for Irvine is under development which will assess flood mitigation actions in detail. As this study progresses it should further investigate in detail the potential benefit of natural flood management for runoff control to Irvine.		

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (120820019)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Scottish Water		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	Scottish Water will review the assessment of flood risk within the highest risk sewer catchments to improve knowledge and understanding of surface water flood risk.		

Action (ID):	**FLOOD FORECASTING** (120820009)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 Responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	**SELF HELP** (120820011)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	—		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and Resilient Communities initiatives, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	**AWARENESS RAISING** (120820013)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Responsible authorities		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. From 2016 SEPA will engage with the community through local participation in national initiatives, including partnership working with Neighbourhood Watch Scotland. In addition, SEPA will engage with local authorities and community resilience groups where possible. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

Action (ID):	**MAINTENANCE** (120820007)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Local authorities, asset / land managers		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. They produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk.		

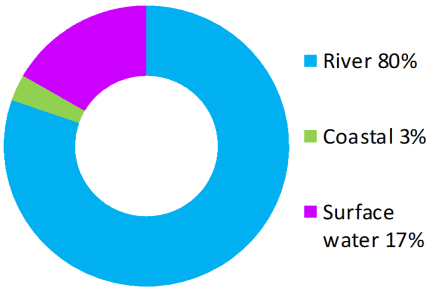
Action (ID):	**EMERGENCY PLANS/RESPONSE** (120820014)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Category 1 and 2 Responders		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (120390001)		
Objective (ID):	Avoid an overall increase in flood risk (12039) Reduce overall flood risk (12082)		
Delivery lead:	Planning authority		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		

River Irvine and Annick Water catchments (Potentially Vulnerable Area 12/06)

Local Plan District	Local authority	Main catchment
Ayrshire	East Ayrshire Council, East Renfrewshire Council, North Ayrshire Council, South Ayrshire Council	River Irvine

Summary of flooding impacts



At risk of flooding

- 2,900 residential properties
- 1,200 non-residential properties
- £7.1 million Annual Average Damages

(damages by flood source shown left)

Summary of objectives to manage flooding

Objectives have been set by SEPA and agreed with flood risk management authorities. These are the aims for managing local flood risk. The objectives have been grouped in three main ways: by reducing risk, avoiding increasing risk or accepting risk by maintaining current levels of management.

Many organisations, such as Scottish Water and energy companies, actively maintain and manage their own assets including their risk from flooding. Where known, these actions are described here. Scottish Natural Heritage and Historic Environment Scotland work with site owners to manage flooding where appropriate at designated environmental and/or cultural heritage sites. These actions are not detailed further in the Flood Risk Management Strategies.

Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

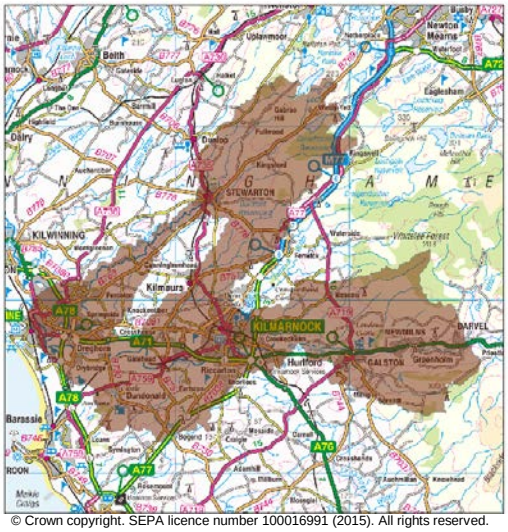
Flood protection scheme/works	*Natural flood management works*	New flood warning	Community flood action groups	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	Maintain flood warning	Awareness raising	Surface water plan/study	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

River Irvine and Annick Water catchments (Potentially Vulnerable Area 12/06)

Local Plan District	Local authority	Main catchment
Ayrshire	East Ayrshire Council, East Renfrewshire Council, North Ayrshire Council, South Ayrshire Council	River Irvine

Background

This Potentially Vulnerable Area is in the centre of the Ayrshire Local Plan District and covers an extensive section of the River Irvine catchment, including the towns of Kilmarnock and Irvine (shown below). The area is centred on Kilmarnock, extending west to the Irvine coast and north encompassing Stewarton with an area of approximately 220km^2.



The area has a risk of river, surface water and coastal flooding. The majority of damages are caused by river flooding predominately from the River Irvine and Annick Water.

There are approximately 2,900 residential properties and 1,200 non-residential properties at risk of flooding. The Annual Average Damages are approximately £7.1 million.

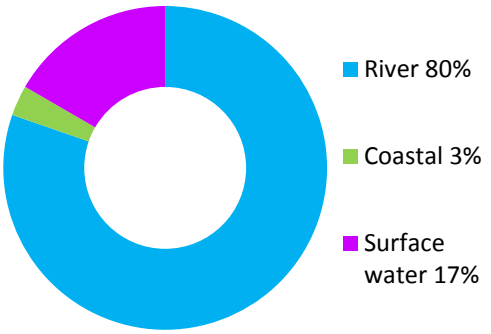


Figure 1: Annual Average Damages by flood source

Summary of flooding impacts

River flooding within the area is primarily from the River Irvine, which flows west towards the Firth of Clyde. There are also a number of tributaries of the River Irvine including the Annick Water, Carmel Water, Fenwick Water, Cessnock Water and Kilmarnock Water, which all present a risk to people, properties and transport routes. There are also a number of structures on the Annick Water within the Stewarton area which could possibly impede the flow of flood water. This may contribute towards a heightened risk of flooding to local properties, particularly in the area where the B778 crosses the Annick Water.

There are sections of road and rail infrastructure at risk of flooding, notably; the M77, A71, A76, A77 and A78, which could affect access to Irvine and other main access routes.

There are approximately 620 residential properties at risk of surface water flooding around Irvine, Kilmarnock and Galston. The areas at highest risk from surface water flooding will require the preparation of surface water management plans.

The tidal weir downstream of the Marress Bridge in Irvine limits the impact from coastal flooding in the area, with no residential properties at identified at risk.

The risk of flooding to people and property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1. The damages associated with floods of different likelihood are shown in Figure 2. Residential properties affected by river flooding experience the highest economic impact at approximately 50% of the damages. Non-residential properties also contribute a notable portion of the damages.

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 2,900 to 4,000 and the number of non-residential properties from approximately 1,200 to 1,500.

The location of the impacts of flooding is shown in Figure 3. Most of the impacts are within Kilmarnock, Irvine, Galston and Newmilns and include flooding to people, non-residential properties, community facilities, utilities, roads and railways. The A71 is at risk of flooding at various locations including Kilmarnock and Irvine. Thirteen designated cultural heritage sites are at risk of flooding, along with small areas of environmentally designated sites.

History of flooding

There have been frequent reports of river flooding in this area for a number of years. The most notable floods occurred in 1852, 1873, 1909 and 1932, which impacted people and caused damage to properties.

Waterside in Irvine was flooded in December 1994 when the south west of Scotland was affected by severe flooding. Although the December 1994 flooding affected the south west of Scotland, flow records from the SEPA gauge at Shewalton show that flows in the River Irvine have been exceeded on two other occasions since the records started in 1977. The largest flow was recorded in 1980, followed by 1977 and 1994. Waterside may have also flooded in 1979 and 1981, as high flows were recorded on both of these dates. This would indicate that Waterside has flooded at least three times, but most likely five times since 1977.

The most recent flooding in the area occurred in December 2014. This affected properties along the River Irvine and Kilmarnock Water. The River Irvine, Kilmarnock Water and Back Burn are also known to have flooded in 2008 which mainly affected the Riccarton and Newmilns area in Kilmarnock. On 18 July 2007 a prolonged and intense thunderstorm caused the Caffle Burn to overtop at Kilnholm Street garages in Newmilns. The Back Burn also overtopped on High Street where 25 residential properties and numerous commercial properties were affected by the flood waters.

Surface water floods have also been reported to SEPA in Irvine, Kilmarnock, Galston and Newmilns, but with only minor impacts on the local area.

	1 in 10	1 in 200	1 in 1000
	High likelihood	Medium likelihood	Low likelihood
Residential properties (total 51,000)	400	2,900	3,900
Non-residential properties (total 5,000)	250	1,200	1,500
People	890	6,500	8,500
Community facilities	0	10 Includes: educational buildings, emergency services and healthcare facilities	10 Includes: educational buildings, emergency services and healthcare facilities
Utilities assets	20	80	100
Transport links - roads (km)	16.4 (of which 0.1 is motorway and 2.8 is A road)	37.0 (of which 0.2 is motorway and 8.7 is A road)	41.2 (of which 0.2 is motorway and 9.8 is A road)
Transport links - rail (km)	2.2	5.1	5.1
Environmental designated areas (km^2)	<0.1	<0.1	<0.1
Designated cultural heritage sites	8	13	22
Agricultural land (km^2	8.7	11.0	12.1

Table 1: Summary of flooding impacts[1]

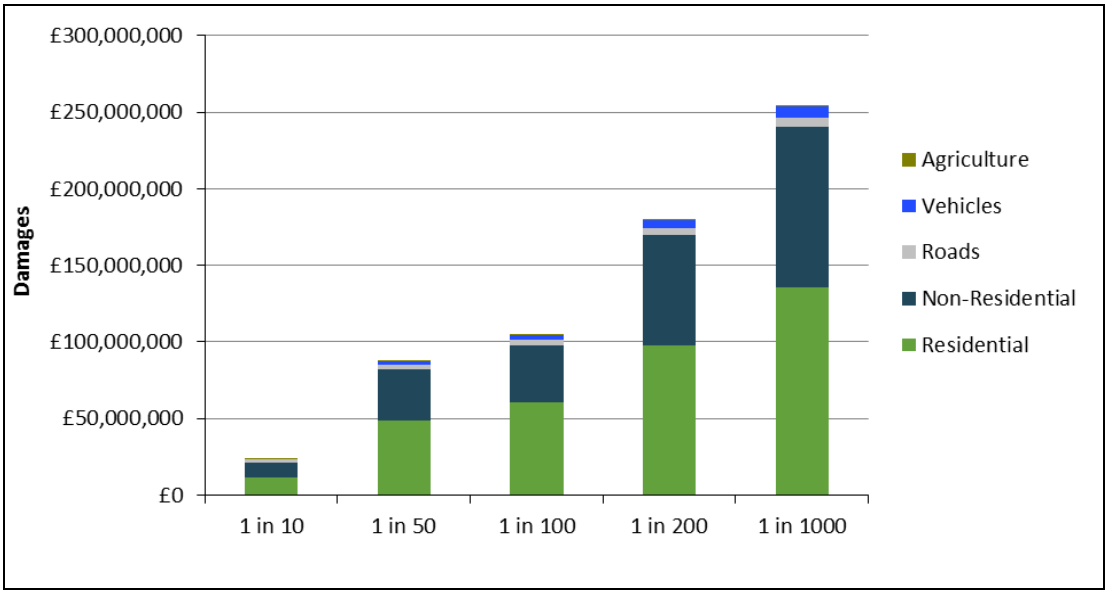


Figure 2: Damages by flood likelihood

[1] Some receptors are counted more than once if flooded from multiple sources

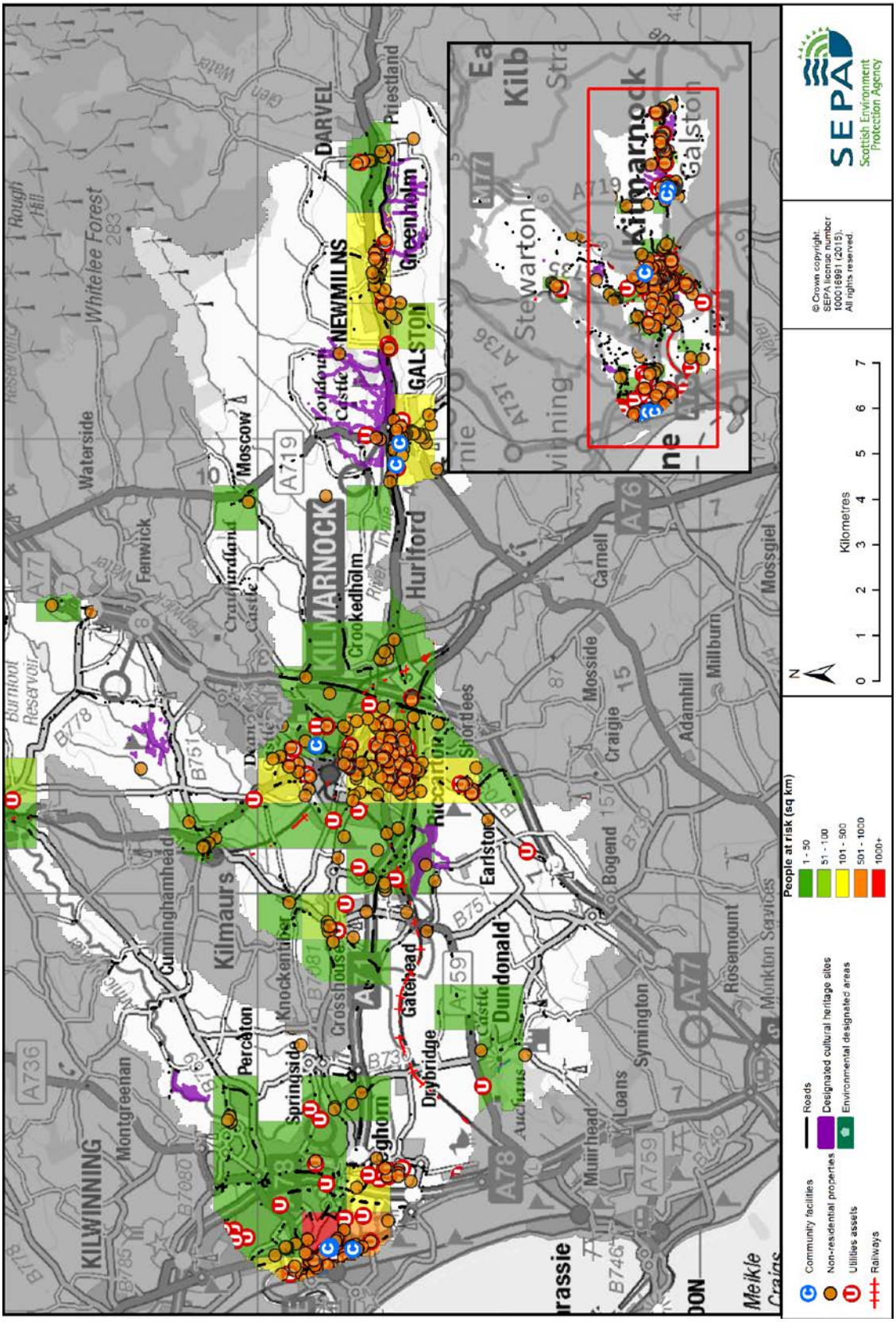


Figure 3: Impacts of flooding

Objectives to manage flooding in Potentially Vulnerable Area 12/06

Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target areas have been set to focus actions; they do not necessarily correspond to areas at risk in SEPA's flood map. The objectives below have been set for River Irvine and Annick Water catchments Potentially Vulnerable Area.

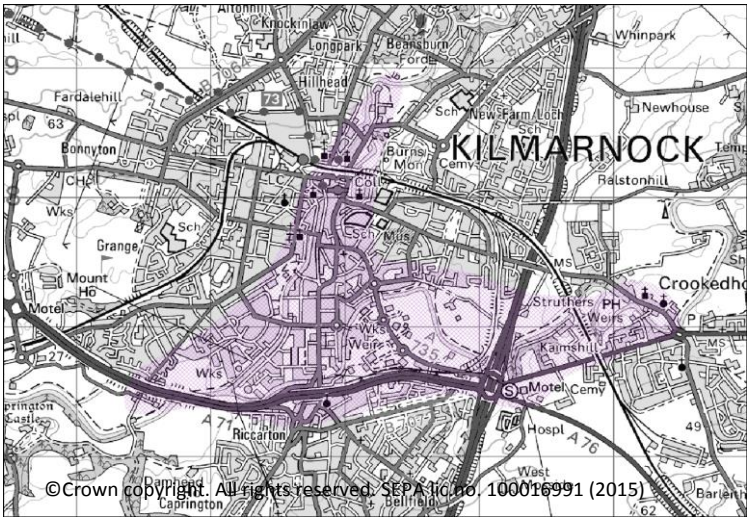
Reduce the risk of flooding from the River Irvine and the Kilmarnock Water in Kilmarnock

Indicators:

- 420 residential properties
- 400 non-residential properties
- £820,000 Annual Average Damages

Objective ID: 12015

Target area:



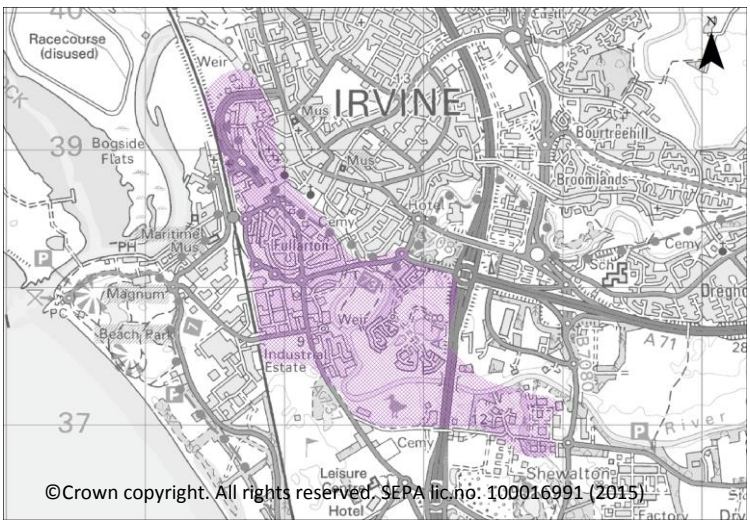
Reduce the risk of flooding from the River Irvine and the Annick Water combined with surface water, to residential properties and non-residential properties in Irvine

Indicators:

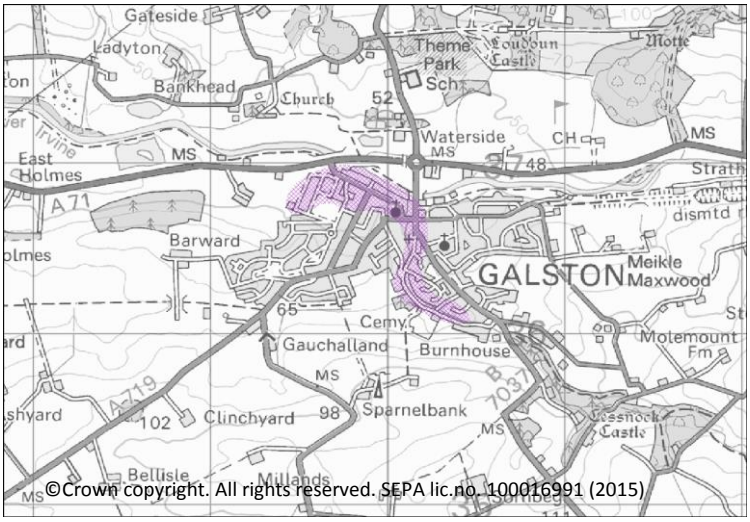
- 1,000 residential properties
- 190 non-residential properties
- £3.3 million Annual Average Damages

Objective ID: 12017

Target area:



Reduce the risk of flooding from the River Irvine in Galston

Indicators:	Target area:
• 280 residential properties • 90 non-residential properties • £120,000 Annual Average Damages	
Objective ID: 12019	

Target area	Objective	ID	Indicators within PVA
Kilmarnock and Greenholm	Reduce the economic damages and risk to people from surface water flooding in Kilmarnock and Greenholm	12040	* See note below
Irvine	Reduce the economic damages and risk to people from surface water flooding in Irvine	12042	* See note below
Applies across Ayrshire Local Plan District	Avoid an overall increase in flood risk	12039	• 2,900 residential properties • £7.1 million Annual Average Damages
Applies across Ayrshire Local Plan District	Reduce overall flood risk	12082	• 2,900 residential properties • £7.1 million Annual Average Damages
Applies across Ayrshire Local Plan District	Organisations such as Scottish Water, energy companies and Historic Environment Scotland actively maintain and manage their own assets, including the risk of flooding. These actions are not detailed further in the Flood Risk Management Strategies.		

* This objective will be monitored using surface water flood risk across the Potentially Vulnerable Area. For 12/06 there are 620 residential properties at risk and Annual Average Damages of £1.2 million.

Actions to manage flooding in Potentially Vulnerable Area 12/06

Actions describe where and how flood risk will be managed. These actions have been set by SEPA and agreed with flood risk management authorities following consultation. Selection of actions to deliver the agreed objectives was based on a detailed assessment and comparison of economic, social and environmental criteria. The actions shaded and then described below have been selected as the most appropriate for River Irvine and Annick Water catchments Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	*Natural flood management works*	New flood warning	Community flood action groups	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	Maintain flood warning	Awareness raising	Surface water plan/study	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Action (ID):	**NEW FLOOD WARNING** (120820010)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	The area under consideration includes properties in Newmilns affected by flooding from the River Irvine. It should also be clarified whether the risk at Galston comes from the River Irvine or the Burn Anne as this could impact on the potential for provision of warnings at Galston. For areas where the risk is from the Irvine an update to the flood forecasting system will be required. Another area under consideration includes properties in Kilmarnock affected by flooding from the Kilmarnock Water and River Irvine. An update to the existing flood forecasting system will be required to deliver flood warning in thislocation. Flood warning is also required for properties mainly in Irvine and Stewarton affected by flooding from the Annick Water. Full scoping, infrastructure and a flood forecasting system will be required to develop a new flood warning scheme in this area.		

Action (ID):	**FLOOD PROTECTION STUDY** (120150005)
Objective (ID):	Reduce the risk of flooding from the River Irvine in Galston (12019) Reduce the risk of flooding from the River Irvine and the Kilmarnock Water in Kilmarnock (12015)
Delivery lead:	East Ayrshire Council

Priority:	National:		Within local authority:
	37 of 168		**1 of 4**
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	A study is recommended to further investigate the flood risk from the River Irvine and Kilmarnock Water. The study will look at the actions that have previously been implemented in the area to assess the level of protection that is offered within Kilmarnock and in other areas along the River Irvine valley including Galston. Depending on the findings from the study there may be the requirement to look at enhancing the current defences or complimentary actions which could help to improve the level of protection offered. One of the actions that should be investigated is a property level protection scheme.		
Potential impacts			
Economic:	The flood protection study should consider how to reduce flood risk to 400 residential properties and 420 non-residential properties in this location, with potential damages avoided of up to £24 million.		
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community.		
Environmental:	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. Further impacts will be assessed by the local authority.		

Action (ID):	**SURFACE WATER PLAN/STUDY** (120400018)		
Objective (ID):	Reduce the economic damages and risk to people from surface water flooding in Kilmarnock and Greenholm (12040)		
Delivery lead:	Scottish Water in partnership with East Ayrshire Council		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	The area must be covered by a surface water management plan or plans that set objectives for the management of surface water flood risk and identify the most sustainable actions to achieve the objectives.		

Action (ID):	**SURFACE WATER PLAN/STUDY** (120400019)		
Objective (ID):	Reduce the economic damages and risk to people from surface water flooding in Kilmarnock and Greenholm (12040)		
Delivery lead:	East Ayrshire Council		
Status:	**Ongoing**	Indicative delivery:	**2016-2021**
Description:	An integrated catchment study for Kilmarnock is under development which will support the assess the most sustainable combination of actions to mitigate flooding.		

Action (ID):	**SURFACE WATER PLAN/STUDY** (120421018)		
Objective (ID):	Reduce the risk of flooding from the River Irvine and the Annick Water combined with surface water, to residential properties and non-residential properties in Irvine (12017) Reduce the economic damages and risk to people from surface water flooding in Irvine (12042)		
Delivery lead:	North Ayrshire Council		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	The area must be covered by a surface water management plan or plans that set objectives for the management of surface water flood risk and identify the most sustainable actions to achieve the objectives.		

Action (ID):	**SURFACE WATER PLAN/STUDY** (120421019)		
Objective (ID):	Reduce the risk of flooding from the River Irvine and the Annick Water combined with surface water, to residential properties and non-residential properties in Irvine (12017) Reduce the economic damages and risk to people from surface water flooding in Irvine (12042)		
Delivery lead:	Scottish Water in partnership with North Ayrshire Council		
Status:	**Ongoing**	Indicative delivery:	**2016-2021**
Description:	An integrated catchment study for Irvine is under development which will assess flood mitigation actions in detail. As this study progresses it should further investigate in detail the potential benefit of natural flood management for runoff control to Irvine.		

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (120820016)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	SEPA will seek to develop flood mapping in the River Irvine area to improve understanding of flood risk. The extent and timing of improvements will depend on detailed scoping and data availability. Where this work coincides with local authority studies, SEPA will work collaboratively to ensure consistent modelling approaches are applied. SEPA will seek to incorporate additional surface water data into the flood maps to improve understanding of flood risk. Approximately 1,300km² of improved surface water data is currently available within this Local Plan District. The inclusion of additional surface water hazard data resulting from the completion of local authority surface water management plans and Scottish Water Integrated Catchment Management Studies will be considered as these projects are completed.		

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (120820019)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Scottish Water		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	Scottish Water will review the assessment of flood risk within the highest risk sewer catchments to improve knowledge and understanding of surface water flood risk.		

Action (ID):	**MAINTAIN FLOOD PROTECTION SCHEME** (120150017)		
Objective (ID):	Reduce the risk of flooding from the River Irvine and the Kilmarnock Water in Kilmarnock (12015)		
Delivery lead:	East Ayrshire Council		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Kilmarnock Flood Protection Scheme was designed to mitigate flooding from the River Irvine in the Riccarton and Crookedholm areas of Kilmarnock. The scheme includes flood walls, flood embankments, channel improvements, storage areas and control structures and has a standard of protection of 100 years. These defences will be maintained, and will continue to manage flooding according to the design standard at the time of construction. Levels of flood risk are likely to increase over time as a consequence of climate change.		

Action (ID):	**MAINTAIN FLOOD PROTECTION SCHEME** (120170017)		
Objective (ID):	Reduce the risk of flooding from the River Irvine and the Annick Water combined with surface water, to residential properties and non-residential properties in Irvine (12017)		
Delivery lead:	North Ayrshire Council		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Defences along the banks of the Irvine River protects properties in the Waterside up to a 20 year flood. These defences will be maintained, and will continue to manage flooding according to the design standard at the time of construction. Levels of flood risk are likely to increase over time as a consequence of climate change.		

Action (ID):	**MAINTAIN FLOOD WARNING** (120820030)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Continue to maintain the Irvine Waterside/Low Green flood warning area in Irvine and the Queen's Drive, New Mill Road and Samson Avenue flood warning area in Kilmarnock which are part of the Irvine river flood warning scheme.		

Action (ID):	**FLOOD FORECASTING** (120820009)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 Responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	**COMMUNITY FLOOD ACTION GROUPS** (120820012)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Community		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Although not part of a community flood action group the public take an active interest in flooding issues within Galston and inform the council about debris in the watercourse.		

Action (ID):	**SELF HELP** (120820011)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	—		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and Resilient Communities initiatives, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	**AWARENESS RAISING** (120820013)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Responsible authorities		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. From 2016 SEPA will engage with the community through local participation in national initiatives, including partnership working with Neighbourhood Watch Scotland. In addition, SEPA will engage with local authorities and community resilience groups where possible. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

Action (ID):	**MAINTENANCE** (120820007)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Local authorities, asset / land managers		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. They produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk.		

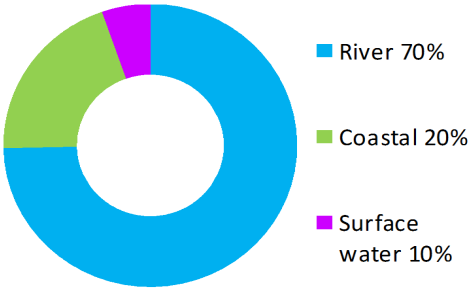
Action (ID):	**EMERGENCY PLANS/RESPONSE** (120820014)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Category 1 and 2 Responders		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (120390001)		
Objective (ID):	Avoid an overall increase in flood risk (12039) Reduce overall flood risk (12082)		
Delivery lead:	Planning authority		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		

Irvine to Troon (Potentially Vulnerable Area 12/07)

Local Plan District	Local authority	Main catchment
Ayrshire	North Ayrshire Council, South Ayrshire Council	Monkton to Irvine coastal

Summary of flooding impacts



At risk of flooding

- 1,000 residential properties
- 520 non-residential properties
- £1.3 million Annual Average Damages

(damages by flood source shown left)

Summary of objectives to manage flooding

Objectives have been set by SEPA and agreed with flood risk management authorities. These are the aims for managing local flood risk. The objectives have been grouped in three main ways: by reducing risk, avoiding increasing risk or accepting risk by maintaining current levels of management.

Many organisations, such as Scottish Water and energy companies, actively maintain and manage their own assets including their risk from flooding. Where known, these actions are described here. Scottish Natural Heritage and Historic Environment Scotland work with site owners to manage flooding where appropriate at designated environmental and/or cultural heritage sites. These actions are not detailed further in the Flood Risk Management Strategies.

Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

Flood protection scheme/works	Natural flood management works	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	Maintain flood warning	Awareness raising	Surface water plan/study	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Irvine to Troon (Potentially Vulnerable Area 12/07)

Local Plan District	Local authority	Main catchment
Ayrshire	North Ayrshire Council, South Ayrshire Council	Monkton to Irvine coastal

Background

This Potentially Vulnerable Area is located on the west coast of the Ayrshire Local Plan District between Monkton and Irvine. It is approximately 30km^2 (shown below).

There are approximately 1,000 residential properties and 520 non-residential properties at risk of flooding. The Annual Average Damages are approximately £1.3 million.

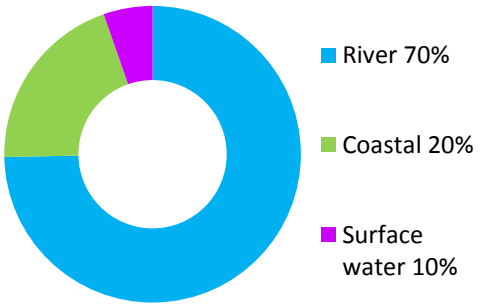


Figure 1: Annual Average Damages by flood source

Summary of flooding impacts

River flooding is predicted in Irvine from a number of small burns. One area shown to be at risk is Muirhead, with flooding attributed to the Darley Burn. This burn is culverted beneath the A759 which may cause flood water to collect upstream, affecting a number of residential properties. Sections of road and rail routes are also predicted to be impacted by flooding (notably the A78).

The area has frontage onto the Firth of Clyde, with a number of areas at risk. The area with the highest projected risk is Troon Harbour between Port Ranald Drive and South Beach Esplanade, where a number of residential properties could experience coastal flooding. Historically at this location waves have overtopped seawalls and flood water has become trapped. Past reports indicate that the shorefront to the north of Troon has exhibited periods of accumulation and erosion of sand dunes. Interaction between sources of coastal and river flooding is expected to occur in the lower reaches of the River Irvine and Gailes Burn. There is also a possibility of interaction between river and surface water flooding around Muirhead. It is locally understood that flooding generally occurs during heavy rainfall and is accentuated by high tidal conditions.

Surface water flooding is predicted to affect properties and transport routes in the area, with a potential interaction between river and surface water flooding. The areas at highest risk from surface water flooding require the preparation of surface water management plans.

The risk of flooding to people and property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1. The damages associated with floods of different likelihood are shown in Figure 2. Residential properties affected by river flooding experience the highest economic impact at approximately 65% of the damages.

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 1,000 to 1,600 and the number of non-residential properties from approximately 520 to 690.

The location of the impacts of flooding is shown in Figure 3. Most of the impacts are within Irvine and Troon with flooding to people, non-residential properties, community facilities, utilities, roads and railways.

History of flooding

There are very few recorded floods within this area. River and surface water floods were reported in Barassie and Loans areas with limited impact to people and property. Coastal flooding took place at Titchfield Road in Troon in January 2014 resulting in short term road closures and the flooding of gardens. There have also been reports of coastal flooding in Troon in 1911, 1912, 1938 and 1936 which flooded seafront roads and shops.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 8,200)	50	1,000	1,400
Non-residential properties (total 1,100)	<10	520	660
People	110	2,300	3,000
Community facilities	0	<10 Includes: educational buildings and healthcare facilities	<10 Includes: educational buildings and healthcare facilities
Utilities assets	<10	20	30
Transport links - roads (km)	1.3 (of which 0.3 is A road)	4.8 (of which 0.6 is A road)	6.7 (of which 0.7 is A road)
Transport links - rail (km)	0.7	1.7	2.0
Environmental designated areas (km^2)	0.6	0.6	0.6
Designated cultural heritage sites	3	3	3
Agricultural land (km^2)	0.9	1.2	1.7

Table 1: Summary of flooding impacts[1]

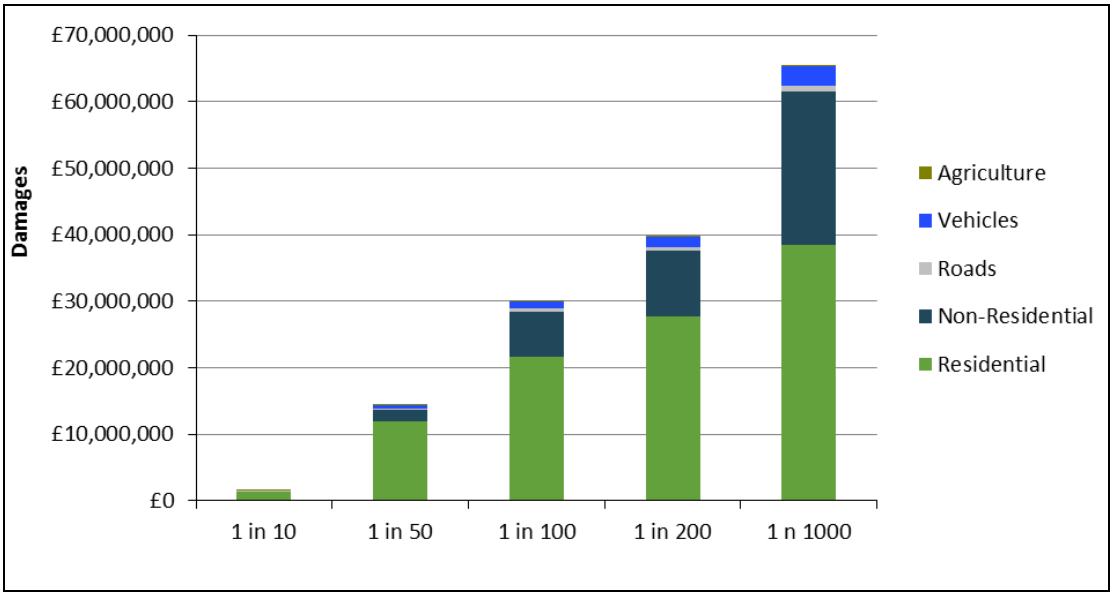


Figure 2: Damages by flood likelihood

[1] Some receptors are counted more than once if flooded from multiple sources

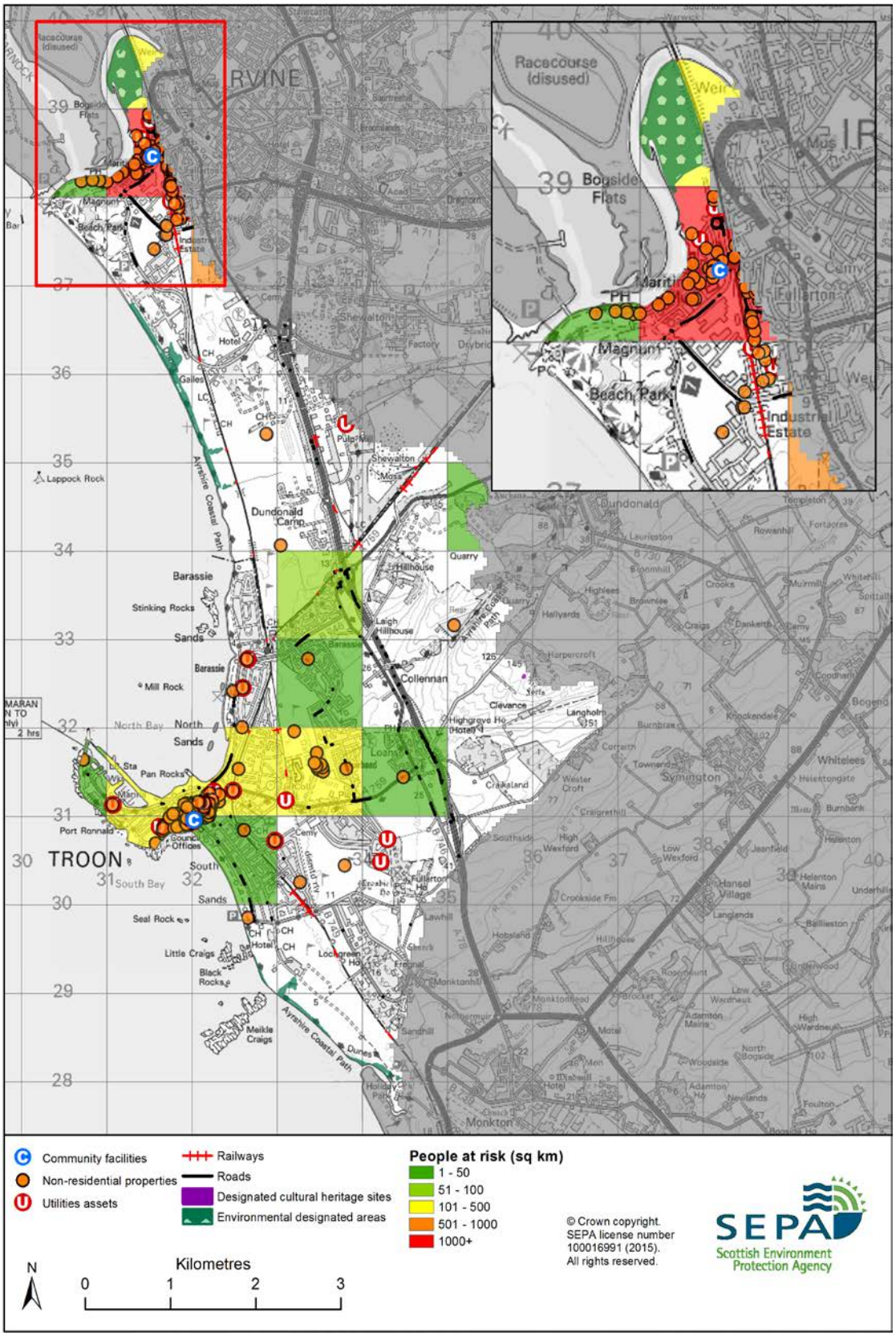
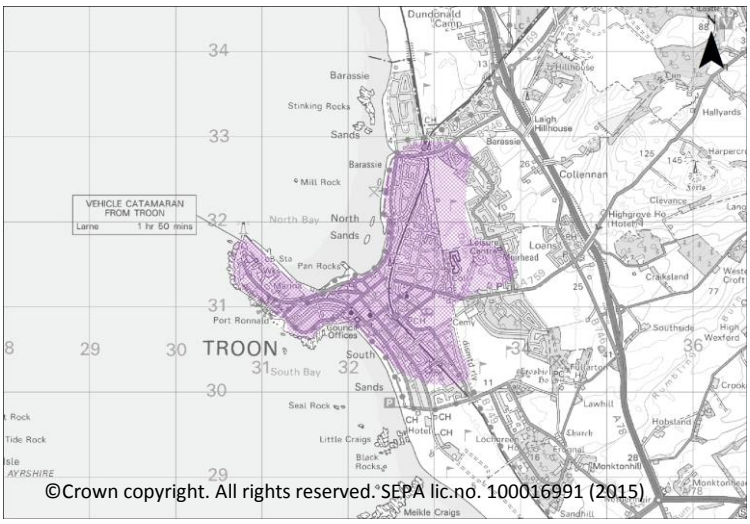


Figure 3: Impacts of flooding

Objectives to manage flooding in Potentially Vulnerable Area 12/07

Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target areas have been set to focus actions; they do not necessarily correspond to areas at risk in SEPA's flood map. The objectives below have been set for Irvine to Troon Potentially Vulnerable Area.

Reduce the risk of coastal and surface water flooding to non-residential properties in Troon

Indicators:	Target area:
• 410 non-residential properties • £85,000 Annual Average Damages	
Objective ID: 12020	

Target area	Objective	ID	Indicators within PVA
Irvine	Reduce the economic damages and risk to people from surface water flooding in Irvine	12042	* See note below
Applies across Ayrshire Local Plan District	Avoid an overall increase in flood risk	12039	• 1,000 residential properties • £1.3 million Annual Average Damages
Applies across Ayrshire Local Plan District	Reduce overall flood risk	12082	• 1,000 residential properties • £1.3 million Annual Average Damages
Applies across Ayrshire Local Plan District	Organisations such as Scottish Water, energy companies and Historic Environment Scotland actively maintain and manage their own assets, including the risk of flooding. These actions are not detailed further in the Flood Risk Management Strategies.		

* This objective will be monitored using surface water flood risk across the Potentially Vulnerable Area. For 12/07 there are 40 residential properties at risk and Annual Average Damages of £68,000.

Actions to manage flooding in Potentially Vulnerable Area 12/07

Actions describe where and how flood risk will be managed. These actions have been set by SEPA and agreed with flood risk management authorities following consultation. Selection of actions to deliver the agreed objectives was based on a detailed assessment and comparison of economic, social and environmental criteria. The actions shaded and then described below have been selected as the most appropriate for Irvine to Troon Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	Natural flood management works	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	Maintain flood warning	Awareness raising	Surface water plan/study	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Action (ID):	**NATURAL FLOOD MANAGEMENT WORKS** (120200004)		
Objective (ID):	Reduce the risk of coastal and surface water flooding to non-residential properties in Troon (12020)		
Delivery lead:	South Ayrshire Council		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	South Ayrshire Council are currently undertaking sand dune propagation in Troon, and some of the benefits of this actions are to help reduce the risk of coastal erosion and flooding. It is recommended that this should continue.		
Potential impacts			
Economic:	The economic impacts have not been defined at this stage.		
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. There may be negative impacts through disturbance to the local community during the construction phase.		
Environmental:	Natural flood management actions can have a positive impact on the ecological quality of the environment by restoring and enhancing natural habitats. These natural flood management works are proposed for Irvine Bay (water body ID 200021). The physical condition of this coastline is identified by river basin management planning to be at less than good status. Natural flood management works are likely to improve the condition of the coastline. Proposed actions should be coordinated with river basin management planning. Sand dune restoration on the north and south sands has the potential to impact upon the coastal processes and sediment supply to the Troon Golf Links and Foreshore Site of Special Scientific Interest and		

Environmental:	the Western Gailes Site of Special Scientific Interest. These impacts could be positive or negative and would require further study. Dune restoration in the area could provide greater areas of habitat for flora and fauna to colonise.

Action (ID):	**FLOOD PROTECTION STUDY** (121030005)		
Objective (ID):	Reduce the risk of coastal and surface water flooding to non-residential properties in Troon (12020)		
Delivery lead:	North Ayrshire Council and South Ayrshire Council		
Priority:	National:		Within local authority:
	8 of 168		**1 of 5**
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	A shoreline management plan is recommended, this study is not limited to Potentially Vulnerable Areas but should cover the whole of the Ayrshire coastline and any areas beyond this which may be influenced by changes in coastal processes. The study should investigate flooding and coastal erosion, wave overtopping and the current coastal protection offered. The study will help to develop an understanding of coastal issues and identify where further work may be required to mitigate against flooding.		
Potential impacts			
Economic:	The study should consider how to reduce flood risk along the Ayrshire coastline. For the entire study area potential damages avoided are estimated to be up to £26 million.		
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community.		
Environmental:	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. This study is proposed for the coastline. Ayr Estuary (water body ID 200018), within this study area, is identified by river basin management planning to be at less than good status. Opportunities to improve the condition of the estuary should be considered by coordinating with river basin management planning.		

Action (ID):	**FLOOD PROTECTION STUDY** (120200005)		
Objective (ID):	Reduce the risk of coastal and surface water flooding to non-residential properties in Troon (12020)		
Delivery lead:	South Ayrshire Council		
Priority:	National:		Within local authority:
	96 of 168		**2 of 3**
Status:	**Not started**	Indicative delivery:	**2022-2027**
Description:	A shoreline management plan is recommended for the Ayrshire coastline to gain a greater understanding of coastal issues and ensure potential mitigation actions will not create further issues elsewhere. In parallel a surface water management plan of Troon will examine		

	the surface water risk and examine actions to mitigate the risk including sustainable drainage systems. The output from these studies should be reviewed to identify the requirement to examine the feasibility of a flood protection scheme to protect against flooding in the area. Any further study should examine the most sustainable combination of actions to manage flooding.
Potential impacts	
Economic:	The flood protection study should consider how to reduce flood risk to 420 residential properties and 358 non-residential properties in this location, with potential damages avoided of up to £4 million.
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. In addition there are two community facilities, two educational buildings and two utilities which have been identified as potentially benefitting from this action. There may be negative impacts through disturbance to the local community during the construction phase and changes in visual amenity and land use as a result of this action.
Environmental:	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. This study is proposed for Irvine Bay (water body ID 200021). The physical condition of this coastline is identified by river basin management planning to be at less than good status. Future works could improve the condition of the coastline or degrade it. Opportunities to improve the condition of the coastline should be considered by coordinating with river basin management planning. The Troon Golf Links and Foreshore Site of Special Scientific Interest and the Western Gailes Site of Special Scientific Interest have the potential to be affected by any alteration in sediment movement or erosion patterns caused by the structures. Direct defences can lead to erosion of the sand dunes and beach within and along the coast from where the actions are proposed due to effects on coastal processes. This results in the loss of natural habitat and could increase flood risk to other areas currently protected by the sand dunes. This is particularly true in this area as there is long-shore drift. Changes to coastal processes could benefit the Troon Golf Links and Foreshore and the Western Gailes Sites of Special Scientific Interest by reducing erosion and increasing sediment supply, or result in an adverse effect through increased erosion and a reduction in sediment supply. There may be the permanent loss of habitat from the footprint of new defences. There is the potential for slight positive impacts on water quality from the implementation of sustainable drainage systems in the area. There is potential for negative impacts on the visual setting of the war memorial heritage structure on South Beach Esplanade and the setting of the Troon Heritage Conservation Area.

Action (ID):	**SURFACE WATER PLAN/STUDY** (120422018)
Objective (ID):	Reduce the economic damages and risk to people from surface water flooding in Irvine (12042)
Delivery lead:	North Ayrshire Council

Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	The area must be covered by a surface water management plan or plans that set objectives for the management of surface water flood risk and identify the most sustainable actions to achieve the objectives.		

Action (ID):	**SURFACE WATER PLAN/STUDY** (120422019)		
Objective (ID):	Reduce the economic damages and risk to people from surface water flooding in Irvine (12042)		
Delivery lead:	Scottish Water in partnership with North Ayrshire Council		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	An integrated catchment study for Irvine is under development which will assess flood mitigation actions in detail. As this study progresses it should further investigate in detail the potential benefit of natural flood management for runoff control to Irvine.		

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (120820016)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	SEPA will seek to develop flood mapping in the Ayr to Ardrossan area to improve understanding of coastal flood risk. The extent and timing of improvements will depend on detailed scoping and data availability. Where this work coincides with local authority studies, SEPA will work collaboratively to ensure consistent modelling approaches are applied.		

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (120820019)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Scottish Water		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	Scottish Water will review the assessment of flood risk within the highest risk sewer catchments to improve knowledge and understanding of surface water flood risk.		

Action (ID):	**MAINTAIN FLOOD PROTECTION SCHEME** (120200017)		
Objective (ID):	Reduce the risk of coastal and surface water flooding to non-residential properties in Troon (12020)		
Delivery lead:	South Ayrshire Council		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	In Troon there are sections of seawalls, rock armour and gabion mattresses running from the golf club to the harbour and north of the harbour to Beach Road. These defences offer some level of protection to the properties in this area. These defences will be maintained, and will continue to manage flooding according to the design standard at the time of construction. Levels of flood risk are likely to increase over time as a consequence of climate change.		

Action (ID):	**MAINTAIN FLOOD WARNING** (120820030)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Continue to maintain the Troon Coastal, Troon Central and Prestwick Links Road flood warning areas which are part of the Firth of Clyde coastal flood warning scheme.		

Action (ID):	**FLOOD FORECASTING** (120820009)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 Responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	**SELF HELP** (120820011)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	—		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and Resilient Communities initiatives, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	**AWARENESS RAISING** (120820013)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Responsible authorities		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. From 2016 SEPA will engage with the community through local participation in national initiatives, including partnership working with Neighbourhood Watch Scotland. In addition, SEPA will engage with local authorities and community resilience groups where possible. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

Action (ID):	**MAINTENANCE** (120820007)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Local authorities, asset / land managers		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. They produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk. South Ayrshire Council inspects the coastal defences in this area on an annual basis and undertakes additional reactive inspections as and when required. There is an annual prioritised maintenance programme for coastal defences in the South Ayrshire Council area		

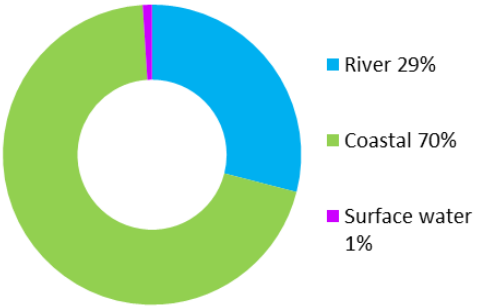
Action (ID):	**EMERGENCY PLANS/RESPONSE** (120820014)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Category 1 and 2 Responders		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (120390001)		
Objective (ID):	Avoid an overall increase in flood risk (12039) Reduce overall flood risk (12082)		
Delivery lead:	Planning authority		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		

Isle of Arran (Potentially Vulnerable Area 12/08)

Local Plan District	Local authority	Main catchment
Ayrshire	North Ayrshire Council	Brodick to Kilmory – Arran coastal

Summary of flooding impacts



At risk of flooding

- 120 residential properties
- 40 non-residential properties
- £390,000 Annual Average Damages

(damages by flood source shown left)

Summary of objectives to manage flooding

Objectives have been set by SEPA and agreed with flood risk management authorities. These are the aims for managing local flood risk. The objectives have been grouped in three main ways: by reducing risk, avoiding increasing risk or accepting risk by maintaining current levels of management.

Many organisations, such as Scottish Water and energy companies, actively maintain and manage their own assets including their risk from flooding. Where known, these actions are described here. Scottish Natural Heritage and Historic Environment Scotland work with site owners to manage flooding where appropriate at designated environmental and/or cultural heritage sites. These actions are not detailed further in the Flood Risk Management Strategies.

Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	Maintain flood warning	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	*Strategic mapping and modelling*	Flood forecasting	Self help	Maintenance	Planning policies

Isle of Arran (Potentially Vulnerable Area 12/08)

Local Plan District	Local authority	Main catchment
Ayrshire	North Ayrshire Council	Brodick to Kilmory – Arran coastal

Background

This Potentially Vulnerable Area is located on the Isle of Arran in the Firth of Clyde (shown below). The area stretches from Brodick Bay to Torrylinnwater Foot in the south of the island. It is approximately 90km^2.

River flooding is predominantly from the Strathwhillan Burn and the Glen Cloy Burn in the north of the area, as well as the Benlister Burn and the Monamore Burn. The majority of damages are caused by coastal flooding.

There are approximately 120 residential properties and 40 non-residential properties at risk of flooding. The Annual Average Damages are approximately £390,000.

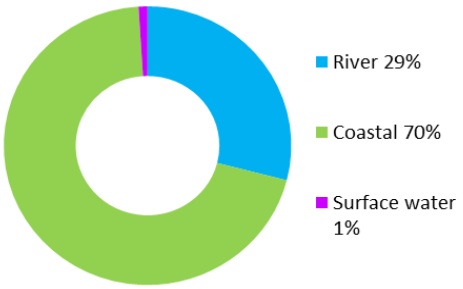


Figure 1: Annual Average Damages by flood source

Summary of flooding impacts

The Glen Cloy Burn and the Strathwhillan Burn affect areas in Brodick with risk to residential and non-residential properties. In Margnaheglish, the Blairmore Burn presents a risk of flooding to a number of residential properties. Flooding from the Benlister Burn is also predicted to affect residential and non-residential properties in Lamlash.

Coastal flooding is not widespread throughout the area, however, there a number of residential and non-residential areas at risk. The national assessment of coastal flood risk does not include flooding from wave overtopping. There is potential for an increased risk from coastal sources as wave overtopping is considered to be a risk in this area. In Brodick, coastal flooding is predicted to cause flooding of the A841 and nearby properties. Properties along the A841 within Lamlash and south toward the Benlister Burn are at risk of coastal flooding. Coastal erosion is known to occur in the area of Brodick beach and particularly at Brodick golf course.

Interaction between sources of coastal and river flooding is predicted to occur in the lower reaches of the four watercourses, the Glen Cloy Burn, Strathwhillan Burn, Blairmore Burn and Benlister Burn, where they enter the Firth of Clyde.

The risk of flooding to people and property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1. The damages associated with floods of different likelihood are shown in Figure 2. Residential properties affected by river flooding experience the highest economic impact at approximately 60% of the damages.

The location of the impacts of flooding is shown in Figure 3. Most impacts are within Brodick, Lamlash and Whiting Bay with flooding to people, non-residential properties and roads and to three designated cultural heritage sites along with small areas of environmentally designated sites.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 2,200)	40	120	200
Non-residential properties (total 380)	20	40	70
People	90	260	440
Community facilities	0	0	<10 Emergency services
Utilities assets	0	0	<10
Transport links - roads (km)	2.0	3.8	4.5
Environmental designated areas (km^2)	0	0.1	0.1
Designated cultural heritage sites	3	3	3
Agricultural land (km^2)	0.2	0.3	0.3

Table 1: Summary of flooding impacts[1]

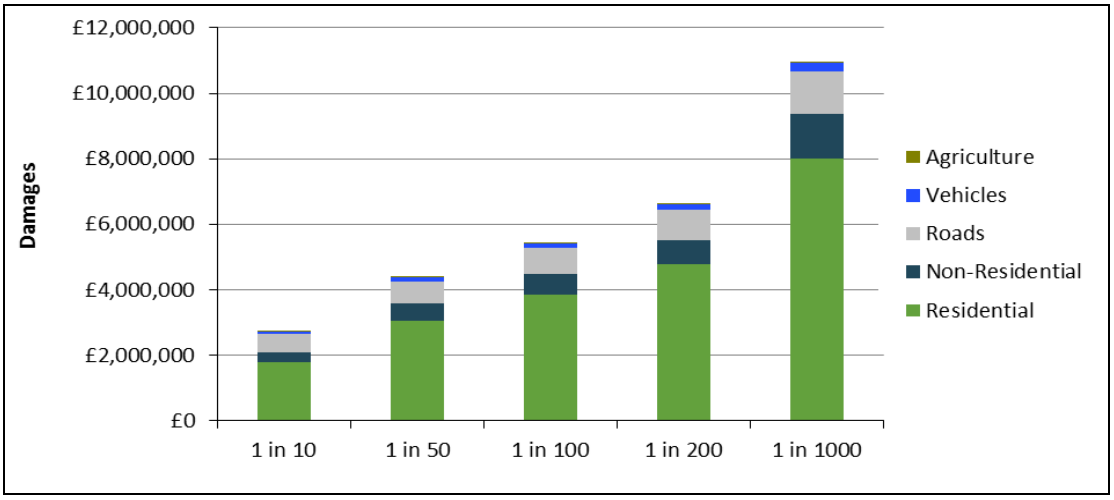


Figure 2: Damages by flood likelihood

[1] Some receptors are counted more than once if flooded from multiple sources

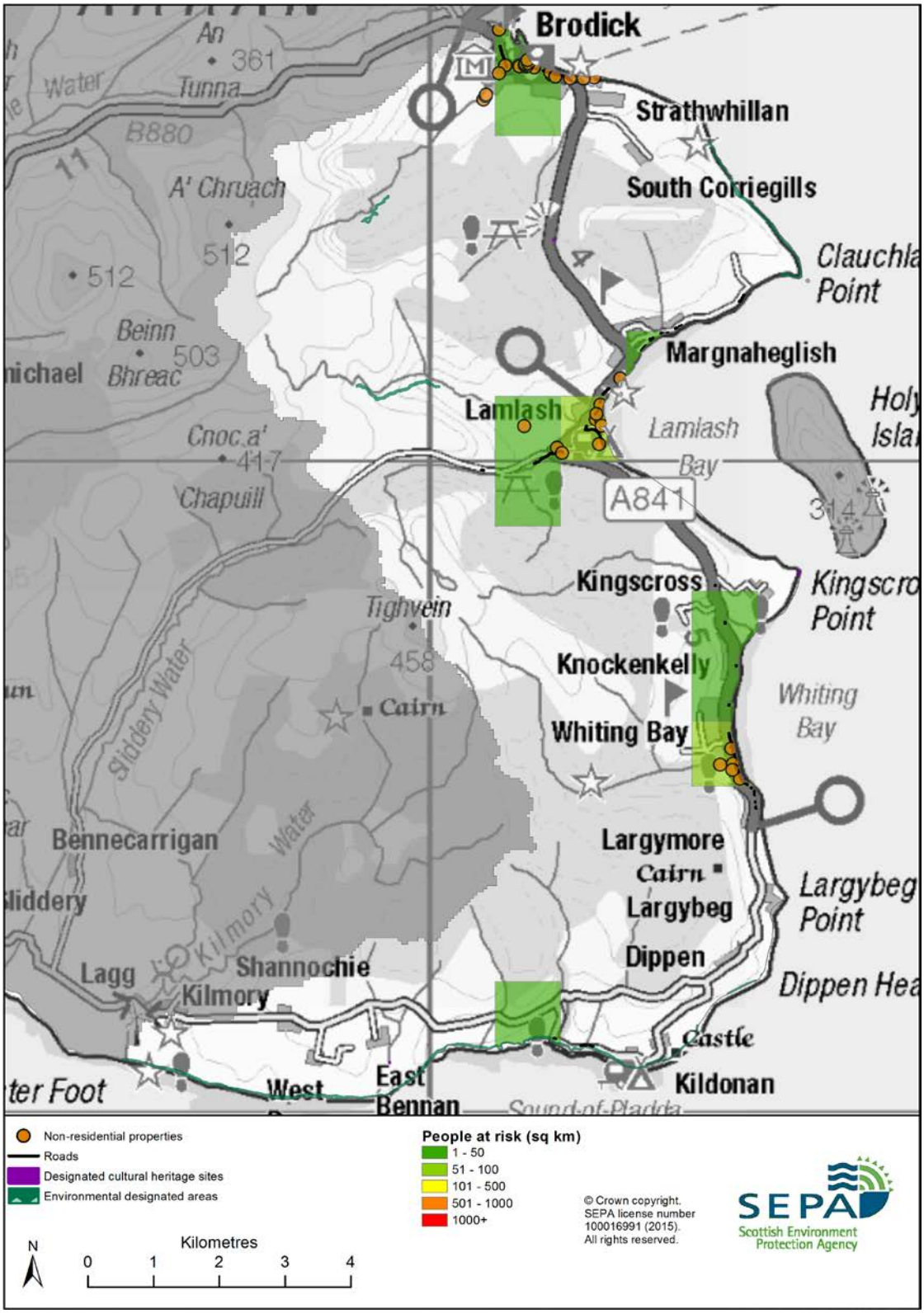


Figure 3: Impacts of flooding

History of flooding

On 19 June 2005, heavy overnight rain followed by a torrential thunderstorm led to flooding around Brodick. The Cloy Burn was blocked at Auchrannie Lodges by a large tree being washed down at Kilmichael and being held by a footbridge. Water from the Cloy Burn entered streets, gardens and properties in Glen Place and Glen Road.

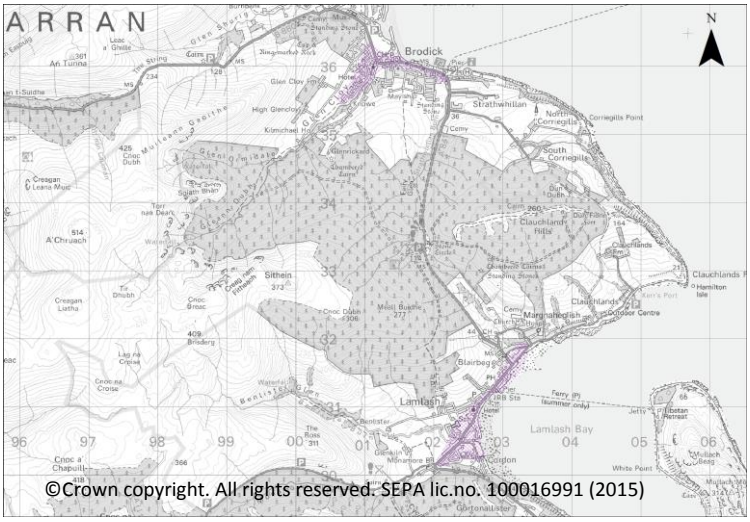
The Isle of Arran was hit by the worst flooding in more than 20 years in January 2014. Waves damaged coastal roads around the island and a tidal surge, combined with severe gale force winds, caused extensive flooding. The tides on the island were the highest seen since 5 January 1991. However, there were no reports of flooded properties on the island. There have been reports of coastal flooding at Lamlash with one such event occurring in August 1930 due to a tidal surge from the Firth of Clyde which flooded the harbour at Lamlash Bay.

Properties in Lamlash were also threatened by torrential rain on 10 August 2008 that triggered surface water runoff down Hillside Road and Park Terrace. In October 2004 river flooding caused flooding to the golf course road and residential gardens in Whiting Bay. There are also records from 2007 of flooding to roads and residential gardens.

Objectives to manage flooding in Potentially Vulnerable Area 12/08

Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target areas have been set to focus actions; they do not necessarily correspond to areas at risk in SEPA's flood map. The objectives below have been set for the Isle of Arran Potentially Vulnerable Area.

Reduce the risk of river and coastal flooding to residential properties in Brodick and Lamlash

Indicators:	Target area:
• 210 residential properties • £490,000 Annual Average Damages	
Objective ID: 12023	

Target area	Objective	ID	Indicators within PVA
Applies across Ayrshire Local Plan District	Avoid an overall increase in flood risk	12039	• 120 residential properties • £390,000 Annual Average Damages
Applies across Ayrshire Local Plan District	Reduce overall flood risk	12082	• 120 residential properties • £390,000 Annual Average Damages
Applies across Ayrshire Local Plan District	Organisations such as Scottish Water, energy companies and Historic Environment Scotland actively maintain and manage their own assets, including the risk of flooding. These actions are not detailed further in the Flood Risk Management Strategies.		

Actions to manage flooding in Potentially Vulnerable Area 12/08

Actions describe where and how flood risk will be managed. These actions have been set by SEPA and agreed with flood risk management authorities following consultation. Selection of actions to deliver the agreed objectives was based on a detailed assessment and comparison of economic, social and environmental criteria. The actions shaded and then described below have been selected as the most appropriate for the Isle of Arran Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	Maintain flood warning	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	*Strategic mapping and modelling*	Flood forecasting	Self help	Maintenance	Planning policies

Action (ID):	**FLOOD PROTECTION STUDY** (121030005)		
Objective (ID):	Reduce the risk of river and coastal flooding to residential properties in Brodick and Lamlash (12023)		
Delivery lead:	North Ayrshire Council and South Ayrshire Council		
Priority:	National:	Within local authority:	
	8 of 168	**1 of 5**	
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	A shoreline management plan is recommended, this study is not limited to Potentially Vulnerable Areas but should cover the whole of the Ayrshire coastline and any areas beyond this which may be influenced by changes in coastal processes. The study should investigate flooding and coastal erosion, wave overtopping and the current coastal protection offered. The study will help to develop an understanding of coastal issues and identify where further work may be required to mitigate against flooding.		
Potential impacts			
Economic:	The study should consider how to reduce flood risk along the Ayrshire coastline. For the entire study area potential damages avoided are estimated to be up to £26 million.		
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community.		
Environmental:	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment.		

Action (ID):	**FLOOD PROTECTION STUDY** (120230005)		
Objective (ID):	Reduce the risk of river and coastal flooding to residential properties in Brodick and Lamlash (12023)		
Delivery lead:	North Ayrshire Council		
Priority:	National:	Within local authority:	
	35 of 168	**2 of 5**	
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	A shoreline management plan is recommended for the Ayrshire coastline to gain a greater understanding of coastal issues and ensure potential mitigation actions will not create further issues elsewhere. A study is recommended to further investigate river flood risk combined with coastal flood risk to Brodick and Lamlash. This study should build on the work within the shoreline management plan to provide a detailed investigation of the current and future risk. The study should examine the most sustainable combination of actions to manage flooding.		
Potential impacts			
Economic:	The flood protection study should consider how to reduce flood risk to 178 residential properties and 31 non-residential properties in this location, with potential damages avoided of up to £20.3 million.		
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community.		
Environmental:	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. To be in accord with the flood risk management strategy, the responsible authority should seek to ensure as part of the study that the action will not have an adverse effect on the integrity of the Arran Moors Special Protection Area. Sand dune restoration at Brodick and Lamlash has the potential to impact upon the coastal processes and sediment supply in the area, with the potential for impacts on Claughlands Point Site of Special Scientific Interest. The impacts could be positive or negative and would require further study. Dune restoration in the area could provide greater areas of habitat for flora and fauna to colonise. There are no international level environmental designations that are likely to be directly impacted by this conveyance action. There is the potential for this action to have short term temporary impacts through disturbance to species and reduced water quality during construction. Increasing conveyance in these watercourses may increase erosion downstream of the action. There is likely to be a direct loss of natural and semi-natural habitat in the footprint and vicinity of the defences. There is the potential for temporary negative impacts on the connectivity to the Arran Moors Special Protection Area and Site of Special Scientific Interest along the Benlister Burn and Glen Cloy Burn during construction works. There is the potential for negative impacts on WFD status from this action. There are no local level environmental designations that are likely to be impacted by these actions. Improved design of the culverts may enable better fish		

Environmental:	passage. There may be temporary negative impacts to water quality during construction. There are unlikely to be significant impacts on heritage features from this action, however sensitive construction may be required in the vicinity of the Brodick Parish Church listed buildings.

Action (ID):	**MAINTAIN FLOOD PROTECTION SCHEME** (120230017)		
Objective (ID):	Reduce the risk of river and coastal flooding to residential properties in Brodick and Lamlash (12023)		
Delivery lead:	North Ayrshire Council		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	There are a range of formal and informal coastal defences in Brodick and Lamlash. These defences offer some level of protection to the properties in this area. These defences will be maintained, and will continue to manage flooding according to the design standard at the time of construction. Levels of flood risk are likely to increase over time as a consequence of climate change.		

Action (ID):	**MAINTAIN FLOOD WARNING** (120820030)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Continue to maintain the Arran Lamlash Cordon and the Arran Seafront and Montrose Terrace flood warning areas which are part of the Firth of Clyde coastal flood warning scheme.		

Action (ID):	**FLOOD FORECASTING** (120820009)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 Responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	**SELF HELP** (120820011)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	—		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and Resilient Communities initiatives, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	**AWARENESS RAISING** (120820013)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Responsible authorities		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. From 2016 SEPA will undertake flood risk education and awareness raising activities. In addition, SEPA will engage with community resilience groups and participate in property level protection events delivered by the Scottish Flood Forum where possible. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

Action (ID):	**MAINTENANCE** (120820007)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	North Ayrshire Council, asset / land managers		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. They produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk.		

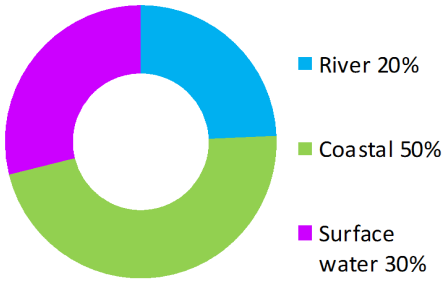
Action (ID):	**EMERGENCY PLANS/RESPONSE** (120820014)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Category 1 and 2 Responders		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (120390001)		
Objective (ID):	Avoid an overall increase in flood risk (12039) Reduce overall flood risk (12082)		
Delivery lead:	Planning authority		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		

Prestwick and Ayr (Potentially Vulnerable Area 12/09)

Local Plan District	Local authority	Main catchment
Ayrshire	South Ayrshire Council	Doonfoot to Monkton coastal

Summary of flooding impacts



At risk of flooding

- 300 residential properties
- 160 non-residential properties
- £240,000 Annual Average Damages

(damages by flood source shown left)

Summary of objectives to manage flooding

Objectives have been set by SEPA and agreed with flood risk management authorities. These are the aims for managing local flood risk. The objectives have been grouped in three main ways: by reducing risk, avoiding increasing risk or accepting risk by maintaining current levels of management.

Many organisations, such as Scottish Water and energy companies, actively maintain and manage their own assets including their risk from flooding. Where known, these actions are described here. Scottish Natural Heritage and Historic Environment Scotland work with site owners to manage flooding where appropriate at designated environmental and/or cultural heritage sites. These actions are not detailed further in the Flood Risk Management Strategies.

Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

Flood protection scheme/works	Natural flood management works	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	Maintain flood warning	Awareness raising	Surface water plan/study	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Prestwick and Ayr (Potentially Vulnerable Area 12/09)

Local Plan District	Local authority	Main catchment
Ayrshire	South Ayrshire Council	Doonfoot to Monkton coastal

Background

This Potentially Vulnerable Area is located on the west coast of the Ayrshire Local Plan District along the Prestwick and Ayr coastline. It is approximately 10km^2 (shown below).

There are approximately 300 residential properties and 160 non-residential properties at risk of flooding. The Annual Average Damages are approximately £240,000.

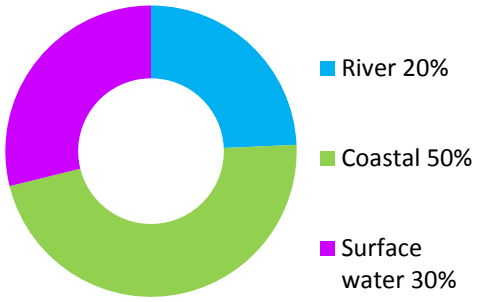


Figure 1: Annual Average Damages by flood source

Summary of flooding impacts

This area fronts onto the Firth of Clyde and has tidally influenced rivers, including the River Ayr which flows through the centre as far as the Nethermills weir at Victoria Bridge. The most notable area at risk of coastal flooding is Prestwick. This assessment does not include the impact of wave overtopping which is known to occur in Prestwick and Newton Shore, therefore the reported risk from coastal flooding may be underestimated. Cunning Park in Ayr is also predicted to flood, putting a large number of properties at risk.

River flooding is mainly attributed to the River Ayr, with properties along the course of the river impacted. River flooding is also attributed to a lesser extent to the Slaphouse Burn, which is located just outside the area and is predicted to impact properties in Cunning Park in Ayr.

In this area there are a large number of culverts and structures, plus the potential for interaction between river and surface water flooding. This complexity means that the strategic modelling used for this area carries more uncertainty than some other areas. A more detailed study of flooding and the interaction between different sources of flooding is currently underway, to improve the understanding of flooding in the area.

Interaction between coastal and river flooding is predicted to occur in the lower reaches of the River Ayr where it discharges to the Firth of Clyde.

Surface water flooding is shown to impact residential properties within the area of Whitletts, Heathfield, Lockside and Belmont, along with sections of main rail and road routes (notably the A77). The areas at highest risk from surface water flooding will require the preparation of surface water management plans.

The risk of flooding to people and property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1. The damages associated with floods of different likelihood are shown in Figure 2. Residential properties affected by coastal flooding experience the highest economic impact at approximately 40% of the damages. Non-residential properties also provide a notable proportion of the damages.

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 300 to 1,200 and the number of non-residential properties from approximately 160 to 340.

The location of the impacts of flooding is shown in Figure 3. Most of the impacts are within Prestwick and Ayr and flooding to people, non-residential properties, utilities, roads and railways.

History of flooding

Previous coastal and river flooding generally had limited impact to people or property and occurred infrequently. However in December 2013 and January 2014 tidal surges flooded the town of Prestwick. Surface water flooding has also been reported in November 2006 in Belmont.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 18,500)	<10	300	960
Non-residential properties (total 2,900)	10	160	290
People	20	670	2,000
Community facilities	0	0	<10 Educational buildings
Utilities assets	0	20	30
Transport links - roads (km)	0.5 (of which <0.1 is A road)	2.1 (of which <0.1 is A road)	2.4 (of which <0.1 is A road)
Transport links - rail (km)	0.1	3.8	3.8
Environmental designated areas (km^2)	0	0	0
Designated cultural heritage sites	1	1	2
Agricultural land (km^2)	0.1	0.1	0.3

Table 1: Summary of flooding impacts[1]

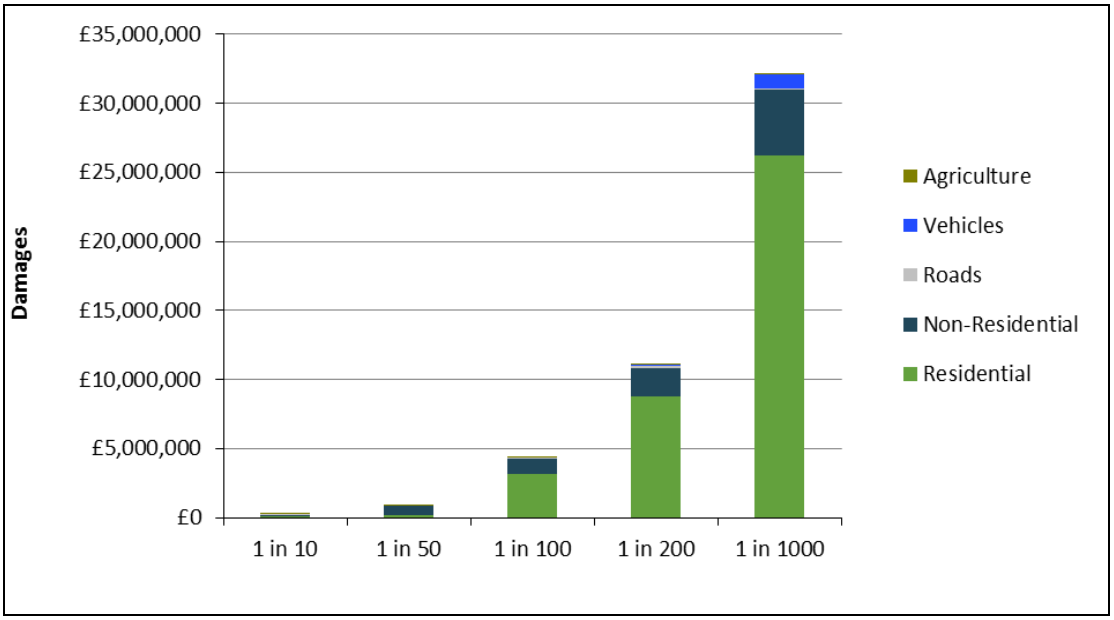


Figure 2: Damage by flood likelihood

[1] Some receptors are counted more than once if flooded from multiple sources

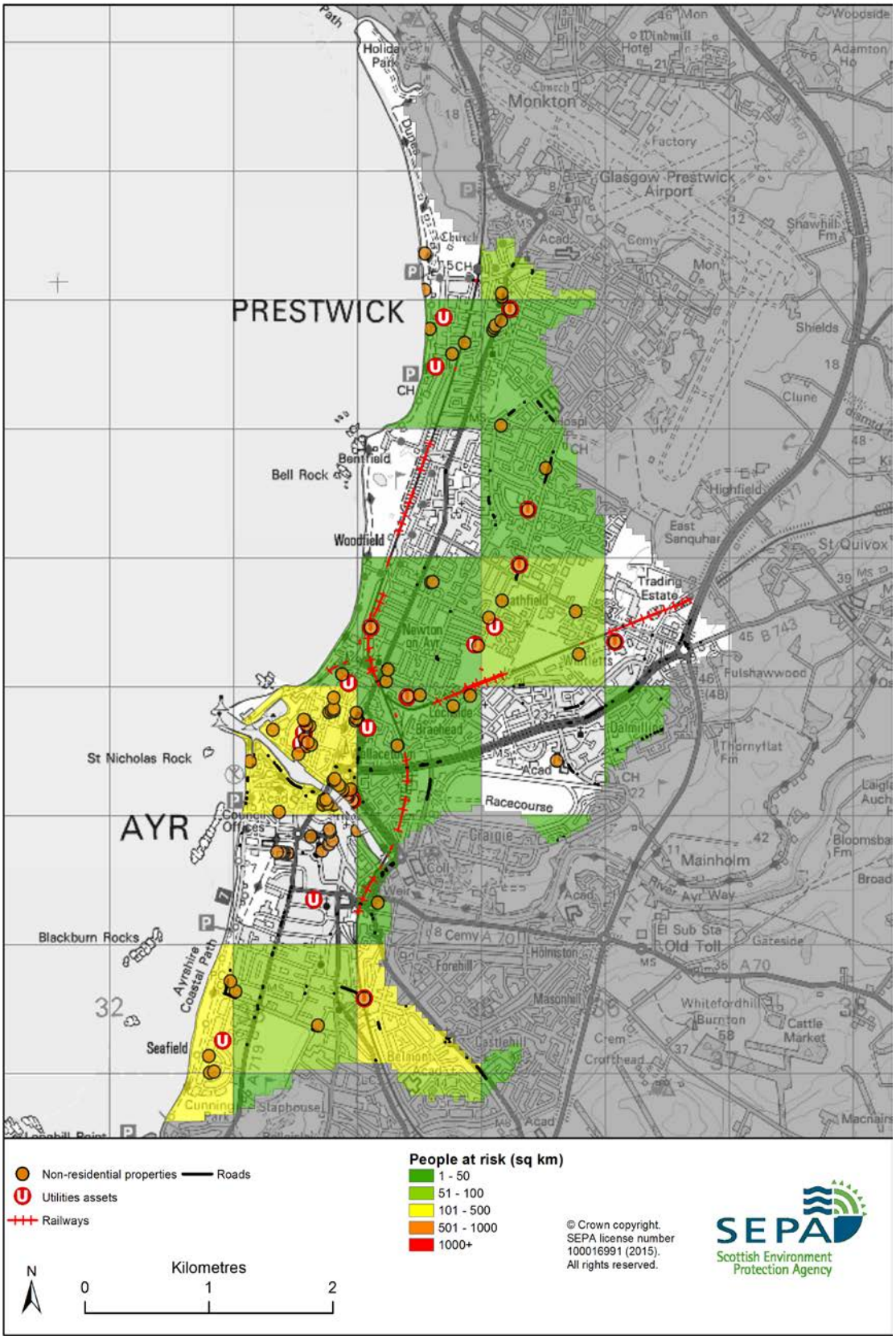
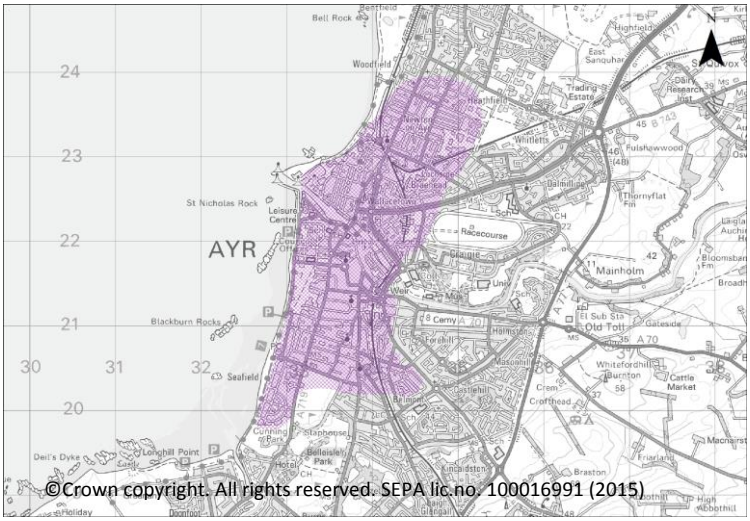


Figure 3: Impacts of flooding

Objectives to manage flooding in Potentially Vulnerable Area 12/09

Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target areas have been set to focus actions; they do not necessarily correspond to areas at risk in SEPA's flood map. The objectives below have been set for Prestwick and Ayr Potentially Vulnerable Area.

Reduce the risk of coastal and surface water flooding to residential properties and non-residential properties in Ayr

Indicators:	Target area:
• 230 residential properties • 120 non-residential properties • £170,000 Annual Average Damages	
Objective ID: 12024	

Target area	Objective	ID	Indicators within PVA
Prestwick and Ayr	Reduce the economic damages and risk to people from surface water flooding in Prestwick and Ayr	12043	* See note below
Applies across Ayrshire Local Plan District	Avoid an overall increase in flood risk	12039	• 300 residential properties • £240,000 Annual Average Damages
Applies across Ayrshire Local Plan District	Reduce overall flood risk	12082	• 300 residential properties • £240,000 Annual Average Damages
Applies across Ayrshire Local Plan District	Organisations such as Scottish Water, energy companies and Historic Environment Scotland actively maintain and manage their own assets, including the risk of flooding. These actions are not detailed further in the Flood Risk Management Strategies.		

* This objective will be monitored using surface water flood risk across the Potentially Vulnerable Area. For 12/09 there are 120 residential properties at risk and Annual Average Damages of £69,000.

Actions to manage flooding in Potentially Vulnerable Area 12/09

Actions describe where and how flood risk will be managed. These actions have been set by SEPA and agreed with flood risk management authorities following consultation. Selection of actions to deliver the agreed objectives was based on a detailed assessment and comparison of economic, social and environmental criteria. The actions shaded and then described below have been selected as the most appropriate for Prestwick and Ayr Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	Natural flood management works	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	Maintain flood warning	Awareness raising	Surface water plan/study	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Action (ID):	**NATURAL FLOOD MANAGEMENT WORKS** (120240004)		
Objective (ID):	Reduce the risk of coastal and surface water flooding to residential properties and non-residential properties in Ayr (12024)		
Delivery lead:	South Ayrshire Council		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	South Ayrshire Council are currently undertaking sand dune propagation in Ayr, and some of the benefits of this action are to help reduce the risk of coastal erosion and flooding. It is recommended that this should continue.		
Potential impacts			
Economic:	The economic impact of natural flood management actions is difficult to define. However, these actions can reduce flood risk for high likelihood events.		
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. Natural flood management actions can restore and enhance natural environments and create opportunities for recreation and tourism.		
Environmental:	Natural flood management actions can have a positive impact on the ecological quality of the environment by restoring and enhancing natural habitats. Sand dune restoration offshore of Seafield in Ayr has the potential to impact upon the coastal processes and sediment supply to the Maidens to Doonfoot Site of Special Scientific Interest and the Troon Golf Links and Foreshore Site of Special Scientific Interest. The impacts could be positive or negative and would require further study. Dune restoration in the area could provide greater areas of habitat for flora and fauna to colonise.		

Action (ID):	**FLOOD PROTECTION STUDY** (121030005)		
Objective (ID):	Reduce the risk of coastal and surface water flooding to residential properties and non-residential properties in Ayr (12024)		
Delivery lead:	North Ayrshire Council and South Ayrshire Council		
Priority:	National:		Within local authority:
	8 of 168		**1 of 5**
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	A shoreline management plan is recommended, this study is not limited to Potentially Vulnerable Areas but should cover the whole of the Ayrshire coastline and any areas beyond this which may be influenced by changes in coastal processes. The study should investigate flooding and coastal erosion, wave overtopping and the current coastal protection offered. The study will help to develop an understanding of coastal issues and identify where further work may be required to mitigate against flooding.		
Potential impacts			
Economic:	The study should consider how to reduce flood risk along the Ayrshire coastline. For the entire study area potential damages avoided are estimated to be up to £26 million.		
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community.		
Environmental:	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. Ayr Estuary (water body ID 200018), within this study area, is identified by river basin management planning to be at less than good status. Opportunities to improve the condition of the estuary should be considered by coordinating with river basin management planning.		

Action (ID):	**FLOOD PROTECTION STUDY** (120240005)		
Objective (ID):	Reduce the risk of coastal and surface water flooding to residential properties and non-residential properties in Ayr (12024)		
Delivery lead:	South Ayrshire Council		
Priority:	National:		Within local authority:
	122 of 168		**3 of 3**
Status:	**Not started**	Indicative delivery:	**2022-2027**
Description:	The shoreline management plan for the Ayrshire coastline will help to provide an understanding of coastal issues and ensure potential mitigation actions will not create further issues elsewhere. In parallel a surface water management plan of Ayr will examine the surface water risk and examine actions to mitigate the risk including sustainable drainage systems. The output from these studies should be reviewed to identify the requirement to examine the feasibility of a flood protection scheme to		

	protect against flooding in the area. Any further study should examine the most sustainable combination of actions to manage flooding.
Potential impacts	
Economic:	The flood protection study should consider how to reduce flood risk to 112 residential properties and 19 non-residential properties in this location, with potential damages avoided of up to £1.5 million.
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. In addition there is one utility which has been identified as potentially benefitting from this action. There may be negative impacts through disturbance to the local community during the construction phase.
Environmental:	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. A flood protection study is proposed for Ayr Estuary (water body ID 200018). The physical condition of this estuary is identified by river basin management planning to be at less than good status. Future works could improve the condition of the estuary or degrade it. Opportunities to improve the condition of the estuary should be considered by coordinating with river basin management planning. The Maidens to Doonfoot Site of Special Scientific Interest and the Troon Golf Links and Foreshore Site of Special Scientific Interest have the potential to be affected by any alteration in sediment movement or erosion patterns caused by the seawalls. Direct defences can lead to erosion of the sand dunes and beach within and along the coast from where the actions are proposed due to effects on coastal processes. There may also be the permanent loss of habitat from the footprint of new structures. This could increase flood risk to other areas currently protected by the sand dunes. There is the potential for slight positive impacts on water quality from the implementation of sustainable drainage systems in the area. There is the potential for negative impacts on heritage structures on the Esplanade, at the harbour, and at the protected bridges along the Ayr Estuary. There is potential for negative impacts on the visual setting of the war heritage structures on the Esplanade and the setting of the Ayr Central Heritage Conservation Area.

Action (ID):	**SURFACE WATER PLAN/STUDY** (120431018)		
Objective (ID):	Reduce the economic damages and risk to people from surface water flooding in Prestwick and Ayr (12043)		
Delivery lead:	South Ayrshire Council		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	The area must be covered by a surface water management plan or plans that set objectives for the management of surface water flood risk and identify the most sustainable actions to achieve the objectives.		

Action (ID):	**SURFACE WATER PLAN/STUDY** (120431019)		
Objective (ID):	Reduce the economic damages and risk to people from surface water flooding in Prestwick and Ayr (12043)		
Delivery lead:	Scottish Water in partnership with South Ayrshire Council		
Status:	**Ongoing**	Indicative delivery:	**2016-2021**
Description:	An integrated catchment study for Prestwick and Ayr is under development which will assess the most sustainable combination of actions to mitigate flooding.		

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (120820016)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	SEPA will seek to develop flood mapping in the Ayr to Ardrossan area to improve understanding of coastal flood risk. The extent and timing of improvements will depend on detailed scoping and data availability. Where this work coincides with local authority studies, SEPA will work collaboratively to ensure consistent modelling approaches are applied.		

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (120820019)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Scottish Water		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	Scottish Water will review the assessment of flood risk within the highest risk sewer catchments to improve knowledge and understanding of surface water flood risk.		

Action (ID):	**MAINTAIN FLOOD PROTECTION SCHEME** (120240017)		
Objective (ID):	Reduce the risk of coastal and surface water flooding to residential properties and non-residential properties in Ayr (12024)		
Delivery lead:	South Ayrshire Council		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The South Pier protects the entrance of Ayr Harbour from the action of waves while also reducing siltation in the channel. An existing seawall runs from the South Pier to the mouth of the River Doon, the purpose of which is to protect coastal erosion however it also provides a limited level of flood protection to the area. These defences will be maintained, and will continue to manage flooding according to the design standard at the time of construction. Levels of flood risk are likely to increase over time as a consequence of climate change.		

Action (ID):	**MAINTAIN FLOOD WARNING** (120820030)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Continue to maintain the Ayr Seafield the Prestwick Links Road flood warning areas which are part of the Firth of Clyde coastal flood warning scheme.		

Action (ID):	**FLOOD FORECASTING** (120820009)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 Responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	**SELF HELP** (120820011)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	—		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and Resilient Communities initiatives, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	**AWARENESS RAISING** (120820013)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Responsible authorities		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. From 2016 SEPA will work towards raising awareness of flood risk through partnership activities with Transport Scotland and local infrastructure operators. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

Action (ID):	**MAINTENANCE** (120820007)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	South Ayrshire Council, asset / land managers		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. They produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk. South Ayrshire Council has a number of structures which help to protect Ayr and Prestwick from coastal flooding. These include concrete seawalls, sheet pile walls, rock armour and gabions. South Ayrshire Council inspects the coastal structures on an annual basis and undertakes additional reactive inspections as and when required.		

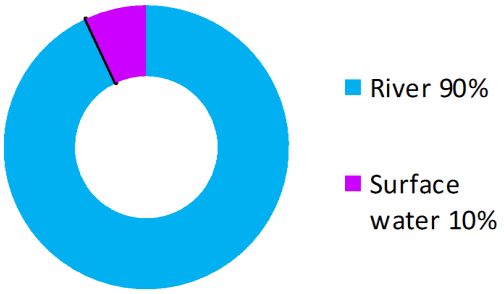
Action (ID):	**EMERGENCY PLANS/RESPONSE** (120820014)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Category 1 and 2 Responders		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (120390001)		
Objective (ID):	Avoid an overall increase in flood risk (12039) Reduce overall flood risk (12082)		
Delivery lead:	Planning authority		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		

Pow Burn catchment (Potentially Vulnerable Area 12/10)

Local Plan District	Local authority	Main catchment
Ayrshire	South Ayrshire Council	Pow Burn

Summary of flooding impacts



At risk of flooding

- 410 residential properties
- 20 non-residential properties
- £940,000 Annual Average Damages

(damages by flood source shown left)

Summary of objectives to manage flooding

Objectives have been set by SEPA and agreed with flood risk management authorities. These are the aims for managing local flood risk. The objectives have been grouped in three main ways: by reducing risk, avoiding increasing risk or accepting risk by maintaining current levels of management.

Many organisations, such as Scottish Water and energy companies, actively maintain and manage their own assets including their risk from flooding. Where known, these actions are described here. Scottish Natural Heritage and Historic Environment Scotland work with site owners to manage flooding where appropriate at designated environmental and/or cultural heritage sites. These actions are not detailed further in the Flood Risk Management Strategies.

Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

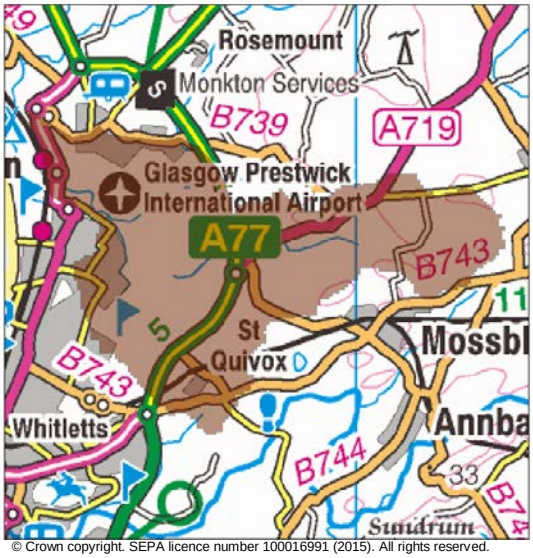
Flood protection scheme/works	*Natural flood management works*	New flood warning	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	*Maintain flood warning*	Awareness raising	Surface water plan/study	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Pow Burn catchment (Potentially Vulnerable Area 12/10)

Local Plan District	Local authority	Main catchment
Ayrshire	South Ayrshire Council	Pow Burn

Background

This Potentially Vulnerable Area is located on the west coast of the Ayrshire Local Plan District, east of Prestwick and is approximately 10km^2. It includes Prestwick Airport (shown below).



The area has a risk of river and surface water flooding. The majority of damages are caused by river flooding, predominately from the Ladykirk Burn and the Pow Burn.

There are approximately 410 residential properties and 20 non-residential properties at risk of flooding. The Annual Average Damages are approximately £940,000.

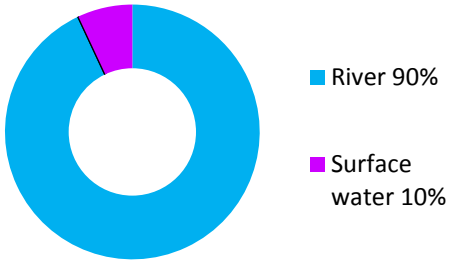


Figure 1: Annual Average Damages by flood source

Summary of flooding impacts

Flooding from the Ladykirk Burn is predicted at Shields and Prestwick, where it discharges to the Pow Burn. Flooding from the Pow Burn is predicted to impact Prestwick Airport and residential properties around Newdykes. The Ladykirk and Pow Burns are culverted at Prestwick Airport and through Prestwick, which may contribute to flooding.

Surface water flooding is predicted to directly impact residential properties in the area south of Newdykes, Prestwick St Cuthbert Golf Course and at the eastern boundary of the airport where the Ladykirk Burn is culverted. Interaction between river and surface water flooding is likely to occur in the residential area south of Newdykes. The areas at highest risk from surface water flooding will require the preparation of surface water management plans.

The risk of flooding to people and property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1. The damages associated with floods of different likelihood are shown in Figure 2. Residential properties affected by river flooding experience the highest economic impact at approximately 90% of the damages.

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 410 to 490.

The location of the impacts of flooding is shown in Figure 3. Most of the impact is located near Prestwick International Airport with flooding to properties and infrastructure.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 1,900)	240	410	490
Non-residential properties (total 190)	10	20	30
People	540	920	1,100
Community facilities	0	0	<10 Educational buildings
Utilities assets	<10	<10	<10
Transport links - roads (km)	0.3 (of which <0.1 is A road)	0.9 (of which <0.1 is A road)	0.9 (of which <0.1 is A road)
Transport links - rail (km)	<0.1	<0.1	<0.1
Transport links - airports	0	1	1
Environmental designated areas (km^2)	0	0	0
Designated cultural heritage sites	2	2	2
Agricultural land (km^2)	3.0	5.8	0.6

Table 1: Summary of flooding impacts[1]

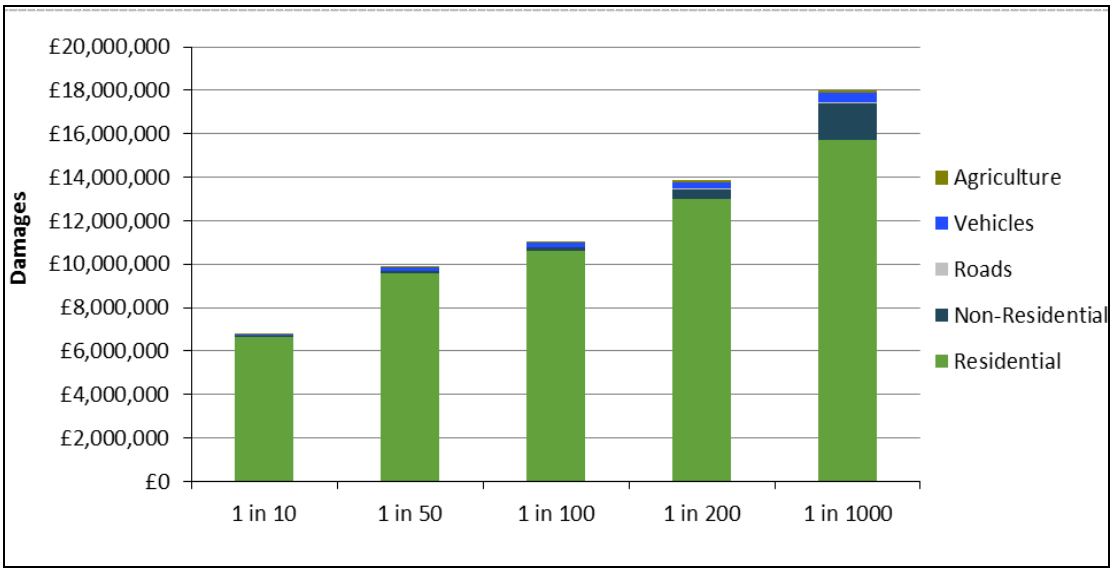


Figure 2: Damages by flood likelihood

[1] Some receptors are counted more than once if flooded from multiple sources

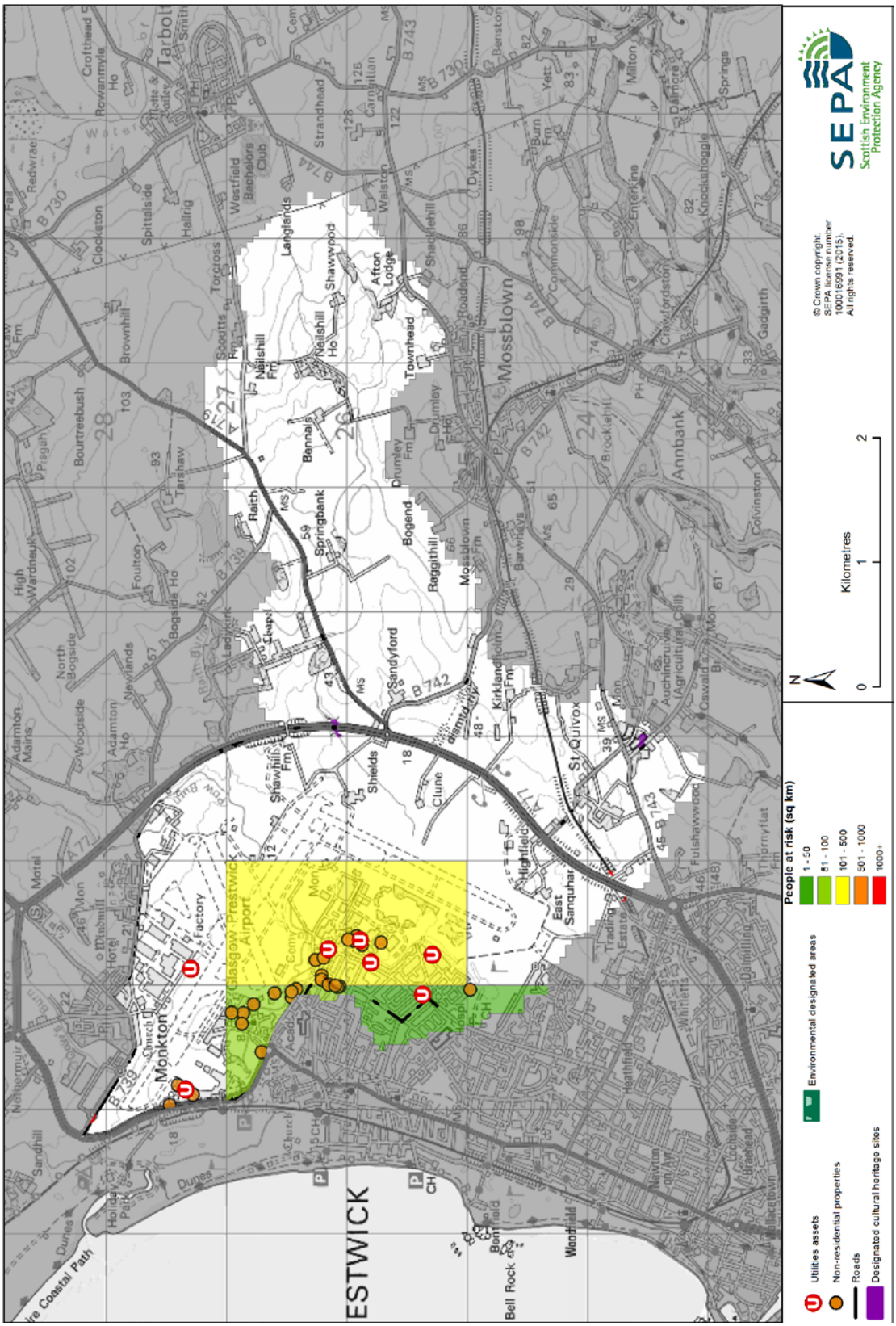


Figure 3: Impacts of flooding

History of flooding

Prestwick International Airport was closed on the 20 December 2012 when heavy rains flooded the runway, resulting in delays and flights being diverted to Edinburgh. The Pow Burn, which runs under the main runway, flooded causing extensive problems in the airport vicinity and the surrounding area. The A77 was also closed between the Meiklewood interchange and the Dutchhouse roundabout.

Objectives to manage flooding in Potentially Vulnerable Area 12/10

Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target areas have been set to focus actions; they do not necessarily correspond to areas at risk in SEPA's flood map. The objectives below have been set for the Pow Burn catchment Potentially Vulnerable Area.

Target area	Objective	ID	Indicators within PVA
Prestwick and Ayr	Reduce the economic damages and risk to people from surface water flooding in Prestwick and Ayr	12043	* See note below
Applies across Ayrshire Local Plan District	Avoid an overall increase in flood risk	12039	• 410 residential properties • £940,000 Annual Average Damages
Applies across Ayrshire Local Plan District	Reduce overall flood risk	12082	• 410 residential properties • £940,000 Annual Average Damages
Applies across Ayrshire Local Plan District	Organisations such as Scottish Water, energy companies and Historic Environment Scotland actively maintain and manage their own assets, including the risk of flooding. These actions are not detailed further in the Flood Risk Management Strategies.		

* This objective will be monitored using surface water flood risk across the Potentially Vulnerable Area. For 12/10 there are 40 residential properties at risk and Annual Average Damages of £59,000.

Actions to manage flooding in Potentially Vulnerable Area 12/10

Actions describe where and how flood risk will be managed. These actions have been set by SEPA and agreed with flood risk management authorities following consultation. Selection of actions to deliver the agreed objectives was based on a detailed assessment and comparison of economic, social and environmental criteria. The actions shaded and then described below have been selected as the most appropriate for the Pow Burn catchment Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	*Natural flood management works*	New flood warning	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	*Maintain flood warning*	Awareness raising	Surface water plan/study	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Action (ID):	**NEW FLOOD WARNING** (120820010)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	The area under consideration includes properties in Prestwick affected by flooding from the Pow Burn. Further feasibility assessment will be required to assess the delivery potential of a flood warning scheme in this location.		

Action (ID):	**SURFACE WATER PLAN/STUDY** (120432018)		
Objective (ID):	Reduce the economic damages and risk to people from surface water flooding in Prestwick and Ayr (12043)		
Delivery lead:	South Ayrshire Council		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	The area must be covered by a surface water management plan or plans that set objectives for the management of surface water flood risk and identify the most sustainable actions to achieve the objectives.		

Action (ID):	**SURFACE WATER PLAN/STUDY** (120432019)		
Objective (ID):	Reduce the economic damages and risk to people from surface water flooding in Prestwick and Ayr (12043)		
Delivery lead:	Scottish Water in partnership with South Ayrshire Council		
Status:	**Ongoing**	Indicative delivery:	**2016-2021**
Description:	An integrated catchment study for Prestwick and Ayr is under development which will assess the most sustainable combination of actions to mitigate flooding.		

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (120820016)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	SEPA will seek to incorporate additional surface water data into the flood maps to improve understanding of flood risk. Approximately 1,300km² of improved surface water data is currently available within this Local Plan District. The inclusion of additional surface water hazard data resulting from the completion of local authority surface water management plans and Scottish Water Integrated Catchment Management Studies will be considered as these projects are completed.		

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (120820019)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Scottish Water		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	Scottish Water will review the assessment of flood risk within the highest risk sewer catchments to improve knowledge and understanding of surface water flood risk.		

Action (ID):	**FLOOD FORECASTING** (120820009)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 Responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	**SELF HELP** (120820011)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	—		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and Resilient Communities initiatives, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	**AWARENESS RAISING** (120820013)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Responsible authorities		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. From 2016 SEPA will work towards raising awareness of flood risk through partnership activities with Transport Scotland and local infrastructure operators. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

Action (ID):	**MAINTENANCE** (120820007)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	South Ayrshire Council, asset / land managers		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. They produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk.		

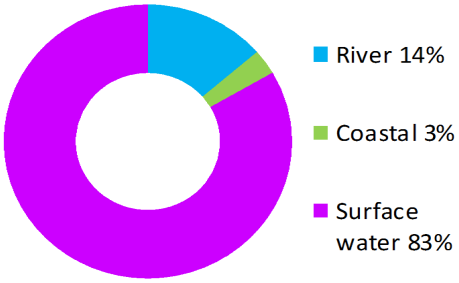
Action (ID):	**EMERGENCY PLANS/RESPONSE** (120820014)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Category 1 and 2 Responders		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (120390001)		
Objective (ID):	Avoid an overall increase in flood risk (12039) Reduce overall flood risk (12082)		
Delivery lead:	Planning authority		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		

River Ayr catchment (Potentially Vulnerable Area 12/11)

Local Plan District	Local authority	Main catchment
Ayrshire	South Ayrshire Council	River Ayr

Summary of flooding impacts



At risk of flooding

- 90 residential properties
- <10 non-residential properties
- £72,000 Annual Average Damages

(damages by flood source shown left)

Summary of objectives to manage flooding

Objectives have been set by SEPA and agreed with flood risk management authorities. These are the aims for managing local flood risk. The objectives have been grouped in three main ways: by reducing risk, avoiding increasing risk or accepting risk by maintaining current levels of management.

Many organisations, such as Scottish Water and energy companies, actively maintain and manage their own assets including their risk from flooding. Where known, these actions are described here. Scottish Natural Heritage and Historic Environment Scotland work with site owners to manage flooding where appropriate at designated environmental and/or cultural heritage sites. These actions are not detailed further in the Flood Risk Management Strategies.

Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

Flood protection scheme/works	*Natural flood management works*	New flood warning	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	*Maintain flood warning*	Awareness raising	Surface water plan/study	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

River Ayr catchment (Potentially Vulnerable Area 12/11)

Local Plan District	Local authority	Main catchment
Ayrshire	South Ayrshire Council	River Ayr

Background

This Potentially Vulnerable Area spans Ayr and Mossblown (shown below). It is approximately 20km^2.

The area has a risk of river surface water and coastal flooding. The majority of damages are caused by surface water flooding.

There are approximately 90 residential properties at risk of flooding. The Annual Average Damages are approximately £72,000.

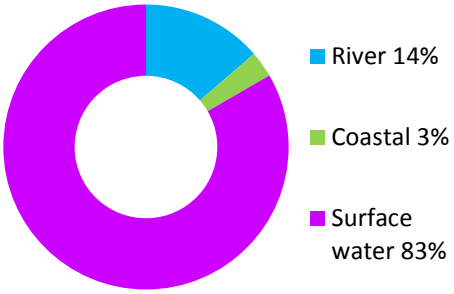


Figure 1: Annual Average Damages by flood source

Summary of flooding impacts

Surface water flooding presents the greatest risk in the area, with residential areas in Forehill and Craigie at risk along with risk to main road and rail routes. The areas at highest risk from surface water flooding will require the preparation of surface water management plans.

The River Ayr meanders through the area from the east and is the main source of river flooding. The Water of Coyle merges with the River Ayr at Barclaugh where flooding would mostly affect surrounding agricultural land. The floodplain of the River Ayr is relatively narrow but residential and non-residential properties, and a small number of utilities, are at risk as it flows through Ayr.

The risk of flooding to people and property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1. The damages associated with floods of different likelihood are shown in Figure 2. Residential properties affected by surface water flooding experience the highest economic impact at approximately 50% of the damages.

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 90 to 110.

The location of the impacts of flooding is shown in Figure 3. Most of impacts are within Ayr and Annbank. This includes flooding to people, non-residential properties, utilities and roads. Railways are at risk at Mossblown and two designated cultural heritage sites are also at risk.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 5,200)	<10	90	110
Non-residential properties (total 210)	<10	<10	10
People	<10	200	240
Community facilities	0	0	<10 Healthcare facilities
Utilities assets	0	<10	<10
Transport links - roads (km)	1.1 (of which 0.2 is A road)	2.1 (of which 0.3 is A road)	2.3 (of which 0.4 is A road)
Transport links - rail (km)	0.8	1.8	1.9
Environmental designated areas (km^2)	0	0	0
Designated cultural heritage sites	2	2	2
Agricultural land (km^2)	0.2	0.4	0.6

Table 1: Summary of flooding impacts[1]

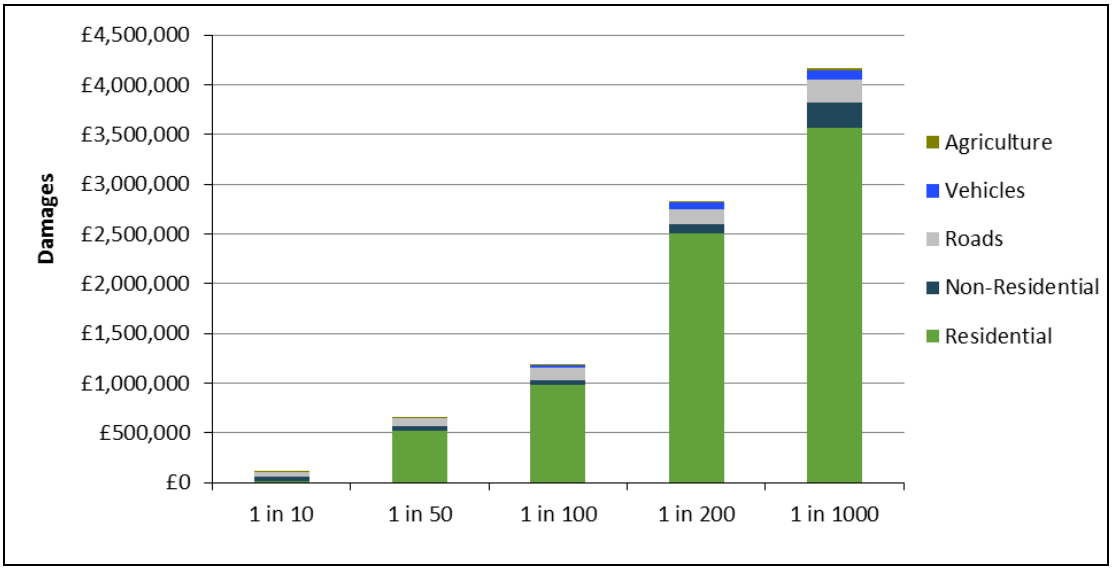


Figure 2: Damages by flood likelihood

[1] Some receptors are counted more than once if flooded from multiple sources

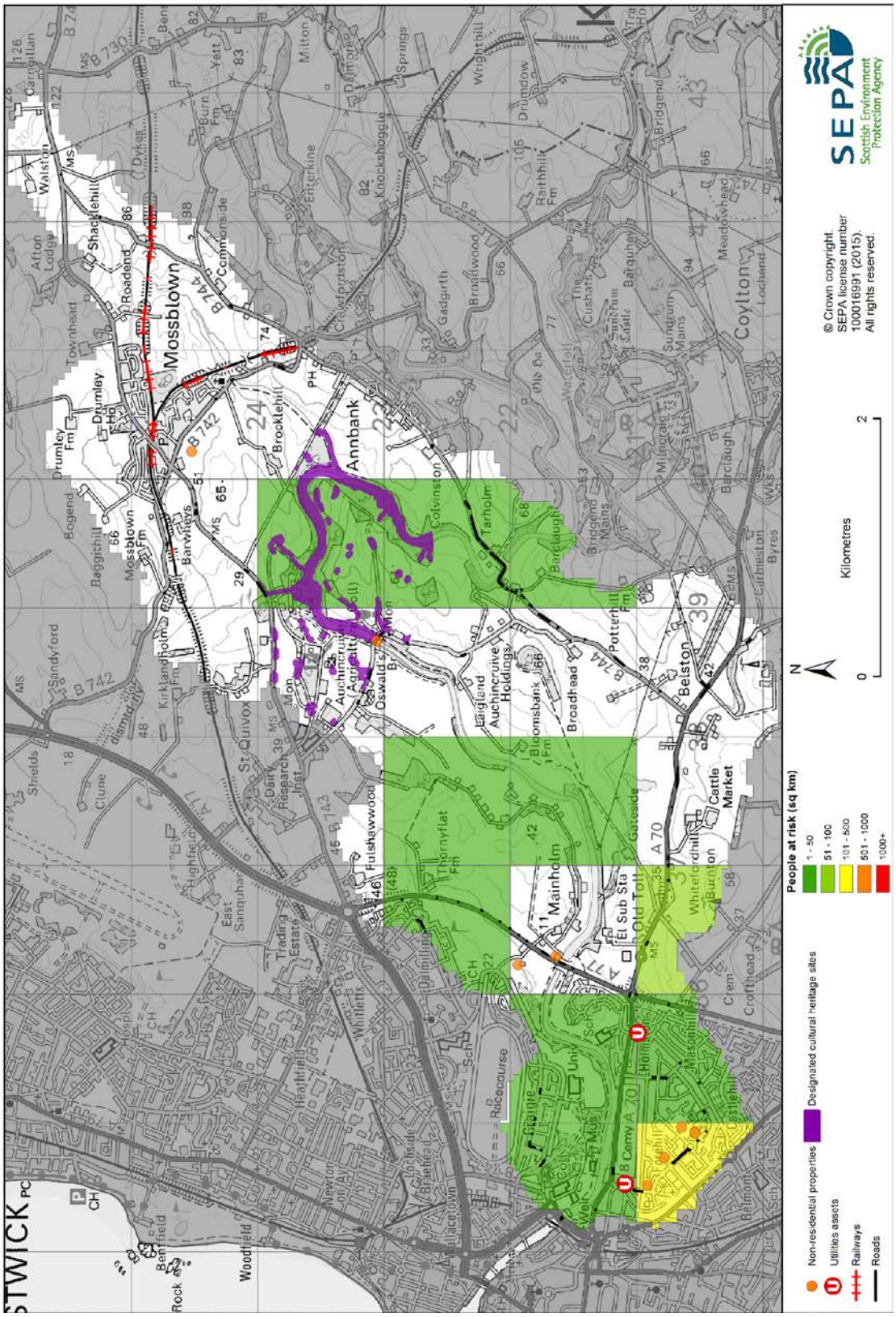


Figure 3: Impacts of flooding

History of flooding

Although flooding has been recorded within this area as far back as 1739 there has been limited impact on people and property. The last record was in October 1977 when the River Ayr had its highest recorded flows, although there were no recorded impacts on properties or people in the local area.

Objectives to manage flooding in Potentially Vulnerable Area 12/11

Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target areas have been set to focus actions; they do not necessarily correspond to areas at risk in SEPA's flood map. The objectives below have been set for the River Ayr catchment Potentially Vulnerable Area.

Target area	Objective	ID	Indicators within PVA
Prestwick and Ayr	Reduce the economic damages and risk to people from surface water flooding in Prestwick and Ayr	12043	* See note below
Applies across Ayrshire Local Plan District	Avoid an overall increase in flood risk	12039	• 90 residential properties • £72,000 Annual Average Damages
Applies across Ayrshire Local Plan District	Reduce overall flood risk	12082	• 90 residential properties • £72,000 Annual Average Damages
Applies across Ayrshire Local Plan District	Organisations such as Scottish Water, energy companies and Historic Environment Scotland actively maintain and manage their own assets, including the risk of flooding. These actions are not detailed further in the Flood Risk Management Strategies.		

* This objective will be monitored using surface water flood risk across the Potentially Vulnerable Area. For 12/11 there are 90 residential properties at risk and Annual Average Damages of £61,000.

Actions to manage flooding in Potentially Vulnerable Area 12/11

Actions describe where and how flood risk will be managed. These actions have been set by SEPA and agreed with flood risk management authorities following consultation. Selection of actions to deliver the agreed objectives was based on a detailed assessment and comparison of economic, social and environmental criteria. The actions shaded and then described below have been selected as the most appropriate for the River Ayr catchment Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	*Natural flood management works*	New flood warning	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	*Maintain flood warning*	Awareness raising	Surface water plan/study	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Action (ID):	**NEW FLOOD WARNING** (120820010)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	The area under consideration includes properties affected by flooding from the River Ayr. Full scoping, infrastructure and a flood forecasting system will be required before a flood warning service can be delivered in this area. Communities that will benefit from a warning will be identified during development of the scheme.		

Action (ID):	**SURFACE WATER PLAN/STUDY** (120430018)		
Objective (ID):	Reduce the economic damages and risk to people from surface water flooding in Prestwick and Ayr (12043)		
Delivery lead:	South Ayrshire Council		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	The area must be covered by a surface water management plan or plans that set objectives for the management of surface water flood risk and identify the most sustainable actions to achieve the objectives.		

Action (ID):	**SURFACE WATER PLAN/STUDY** (120430019)		
Objective (ID):	Reduce the economic damages and risk to people from surface water flooding in Prestwick and Ayr (12043)		
Delivery lead:	Scottish Water in partnership with South Ayrshire Council		
Status:	**Ongoing**	Indicative delivery:	**2016-2021**
Description:	An integrated catchment study will be carried out to support the surface water management plan process and improve knowledge and understanding of surface water flood risk and interactions with other sources of flooding e.g. with the sewer network, watercourses and the sea.		

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (120820019)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Scottish Water		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	Scottish Water will review the assessment of flood risk within the highest risk sewer catchments to improve knowledge and understanding of surface water flood risk.		

Action (ID):	**FLOOD FORECASTING** (120820009)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 Responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	**SELF HELP** (120820011)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	—		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and Resilient Communities initiatives, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	**AWARENESS RAISING** (120820013)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Responsible authorities		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. From 2016 SEPA will engage with the community through local participation in national initiatives, including partnership working with Neighbourhood Watch Scotland. In addition, SEPA will engage with local authorities and community resilience groups where possible. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

Action (ID):	**MAINTENANCE** (120820007)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	South Ayrshire Council, asset / land managers		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. They produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk.		

Action (ID):	**EMERGENCY PLANS/RESPONSE** (120820014)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Category 1 and 2 Responders		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (120390001)		
Objective (ID):	Avoid an overall increase in flood risk (12039) Reduce overall flood risk (12082)		
Delivery lead:	Planning authority		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		

Ayr east (Potentially Vulnerable Area 12/12)

Local Plan District	Local authority	Main catchment
Ayrshire	South Ayrshire Council	River Ayr

Summary of flooding impacts

At risk of flooding

- 290 residential properties
- 10 non-residential properties
- £720,000 Annual Average Damages

(damages by flood source shown left)

Summary of objectives to manage flooding

Objectives have been set by SEPA and agreed with flood risk management authorities. These are the aims for managing local flood risk. The objectives have been grouped in three main ways: by reducing risk, avoiding increasing risk or accepting risk by maintaining current levels of management.

Many organisations, such as Scottish Water and energy companies, actively maintain and manage their own assets including their risk from flooding. Where known, these actions are described here. Scottish Natural Heritage and Historic Environment Scotland work with site owners to manage flooding where appropriate at designated environmental and/or cultural heritage sites. These actions are not detailed further in the Flood Risk Management Strategies.

Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

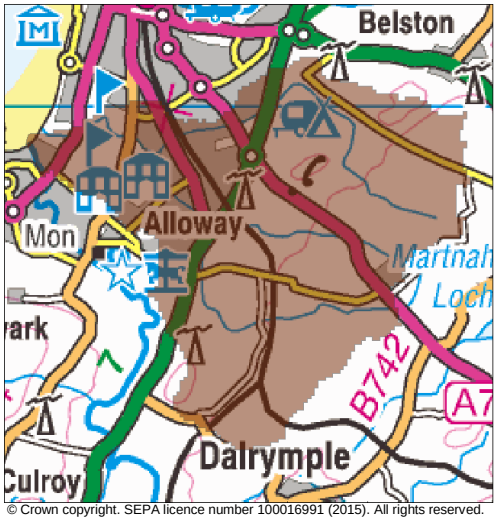
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	Maintain flood warning	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Ayr east (Potentially Vulnerable Area 12/12)

Local Plan District	Local authority	Main catchment
Ayrshire	South Ayrshire Council	River Ayr

Background

This Potentially Vulnerable Area is located to the south of Ayr and has an area of approximately 20km^2 (shown below). It incorporates the Alloway, Mountcharles and Rozelle areas of Ayr and the rural catchments of the Slaphouse and Annfield Burns.



There are approximately 290 residential properties and 10 non-residential properties at risk of flooding. The Annual Average Damages are approximately £720,000.

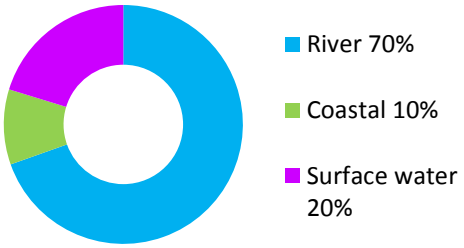


Figure 1: Annual Average Damages by flood source

Summary of flooding impacts

River flooding from the Slaphouse Burn is predicted to impact, the residential area to the south of Cunning Park and the area around Belleisle Park. At the confluence of the Annfield Burn and the Slaphouse Burn, in Rozelle, residential properties and cultural heritage sites are predicted to be at risk of flooding. Just to the south of the Potentially Vulnerable Area, the River Doon is predicted to affect the Mountcharles and Alloway areas of Ayr.

There are approximately 70 residential properties at risk from surface water flooding, notably to the south of Cunning Park. Flooding may also affect sections of the road and rail network (notably the A77). The areas at highest risk from surface water flooding have been prioritised. These priority areas were identified using SEPA flood models, supplemented with historical flood information and, where available, more detailed modelling from local authorities. These priority areas require the preparation of surface water management plans, the details of which can be found in Section 2.

This area has a very short frontage onto the Firth of Clyde where there is potentially a risk to the residential area south of Cunning Park from coastal flooding.

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 290 to 390.

The risk of flooding to people and property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1. The damages associated with floods of different likelihood are shown in Figure 2. Residential properties affected by river flooding experience the highest economic impact at approximately 70% of the damages.

The location of the impacts of flooding is shown in Figure 3. Most of impacts are within Rozelle and Kincaidston with flooding to people, non-residential properties, utilities and roads. Railways are at risk of flooding at Broomberry and Pleasantfield. Two designated cultural heritage sites are also at risk of flooding.

	1 in 10	1 in 200	1 in 1000
	High likelihood	Medium likelihood	Low likelihood
Residential properties (total 3,900)	130	290	360
Non-residential properties (total 130)	<10	10	10
People	280	640	790
Community facilities	0	<10 Emergency services	<10 Emergency services
Utilities assets	<10	<10	<10
Transport links – roads (km)	0.6 (of which 0.1 is A road)	1.8 (of which 0.4 is A road)	2.2 (of which 0.6 is A road)
Transport links - rail (km)	1.1	1.5	1.7
Environmental designated areas (km^2)	0	0	0
Designated cultural heritage sites	2	2	2
Agricultural land (km^2)	0.3	0.5	0.5

Table 1: Summary of flooding impacts[1]

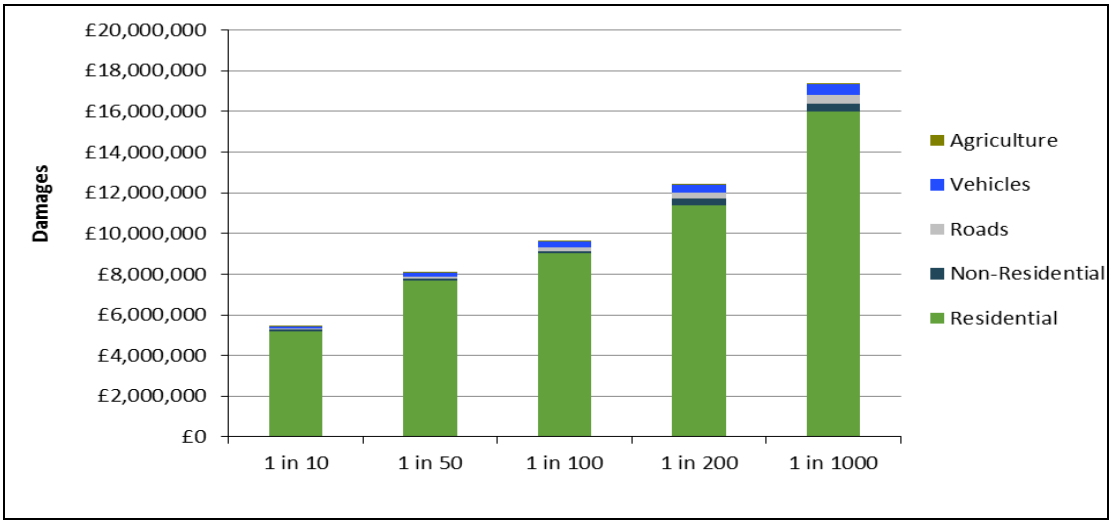


Figure 2: Damages by flood likelihood

History of flooding

There have been recent reports of flooding within this area. Both river and surface water flooding occurred in 2008 impacting residential properties and gardens in Doonfoot Road, Willow Park and Taybank Drive, Ayr.

[1] Some receptors are counted more than once if flooded from multiple sources

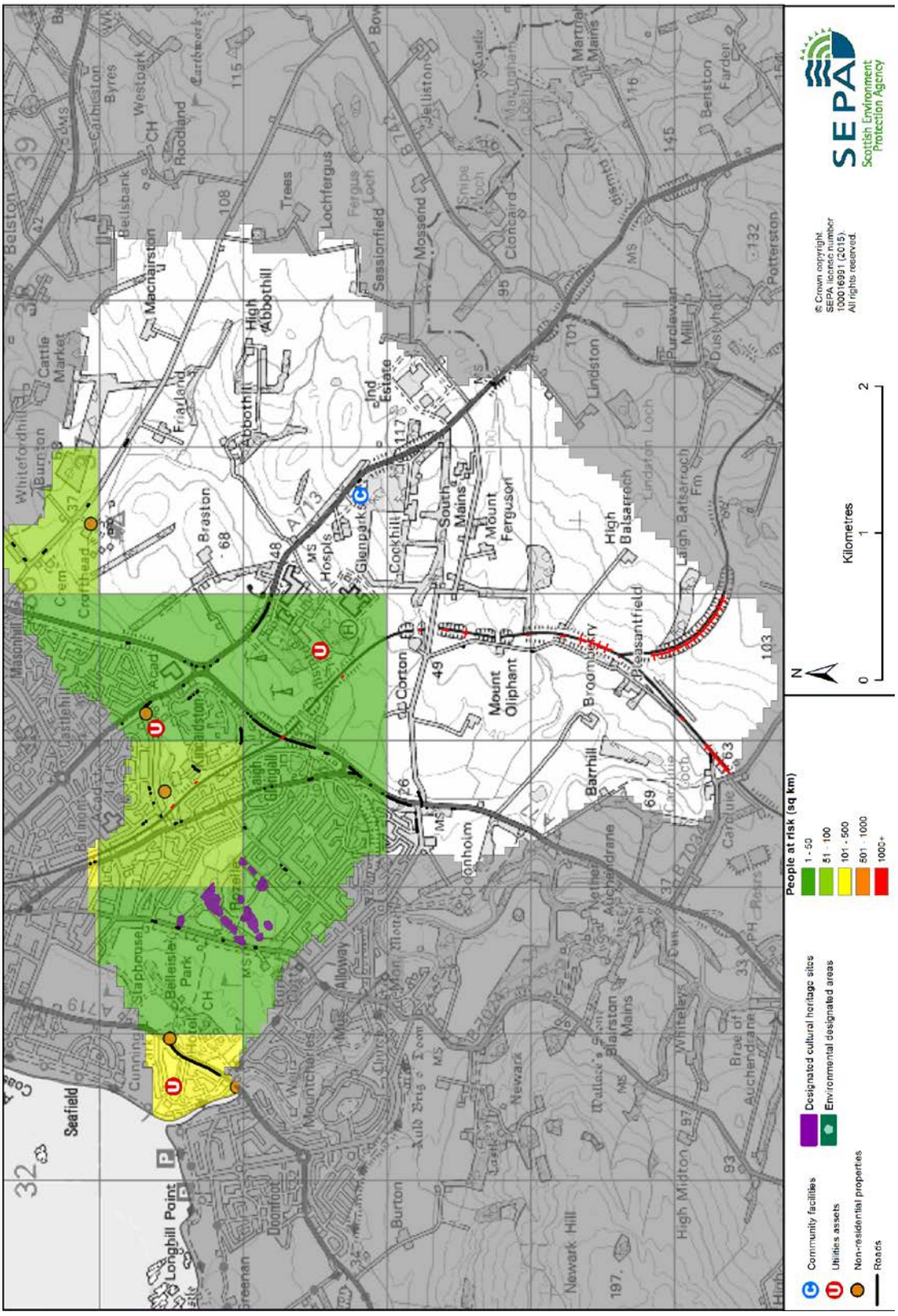


Figure 3: Impacts of flooding

Objectives to manage flooding in Potentially Vulnerable Area 12/12

Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target areas have been set to focus actions; they do not necessarily correspond to areas at risk in SEPA's flood map. The objectives below have been set for Ayr east Potentially Vulnerable Area.

Target area	Objective	ID	Indicators within PVA
Applies across Ayrshire Local Plan District	Avoid an overall increase in flood risk	12039	• 290 residential properties • £720,000 Annual Average Damages
Applies across Ayrshire Local Plan District	Reduce overall flood risk	12082	• 290 residential properties • £720,000 Annual Average Damages
Applies across Ayrshire Local Plan District	Organisations such as Scottish Water, energy companies and Historic Environment Scotland actively maintain and manage their own assets, including the risk of flooding. These actions are not detailed further in the Flood Risk Management Strategies.		

Actions to manage flooding in Potentially Vulnerable Area 12/12

Actions describe where and how flood risk will be managed. These actions have been set by SEPA and agreed with flood risk management authorities following consultation. Selection of actions to deliver the agreed objectives was based on a detailed assessment and comparison of economic, social and environmental criteria. The actions shaded and then described below have been selected as the most appropriate for Ayr east Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	Maintain flood warning	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (120820016)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	SEPA will seek to develop flood mapping in the Ayr to Ardrossan area to improve understanding of coastal flood risk. The extent and timing of improvements will depend on detailed scoping and data availability. Where this work coincides with local authority studies, SEPA will work collaboratively to ensure consistent modelling approaches are applied.		

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (120820019)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Scottish Water		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	Scottish Water will review the assessment of flood risk within the highest risk sewer catchments to improve knowledge and understanding of surface water flood risk.		

Action (ID):	**MAINTAIN FLOOD WARNING** (120820030)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Continue to maintain the Ayr Seafield flood warning area which is part of the Firth of Clyde coastal flood warning scheme.		

Action (ID):	**FLOOD FORECASTING** (120820009)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 Responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	**SELF HELP** (120820011)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	—		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and Resilient Communities initiatives, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	**AWARENESS RAISING** (120820013)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Responsible authorities		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. From 2016 SEPA will engage with the community through local participation in national initiatives, including partnership working with Neighbourhood Watch Scotland. In addition, SEPA will engage with local authorities and community resilience groups where possible. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

Action (ID):	**MAINTENANCE** (120820007)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	South Ayrshire Council, asset / land managers		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. They produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk.		

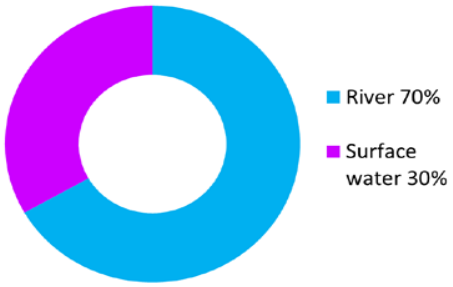
Action (ID):	**EMERGENCY PLANS/RESPONSE** (120820014)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Category 1 and 2 Responders		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (120390001)		
Objective (ID):	Avoid an overall increase in flood risk (12039) Reduce overall flood risk (12082)		
Delivery lead:	Planning authority		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		

Ayr south (Potentially Vulnerable Area 12/13)

Local Plan District	Local authority	Main catchment
Ayrshire	South Ayrshire Council	River Doon

Summary of flooding impacts



At risk of flooding

- 20 residential properties
- 10 non-residential properties
- £40,000 Annual Average Damages

(damages by flood source shown left)

Summary of objectives to manage flooding

Objectives have been set by SEPA and agreed with flood risk management authorities. These are the aims for managing local flood risk. The objectives have been grouped in three main ways: by reducing risk, avoiding increasing risk or accepting risk by maintaining current levels of management.

Many organisations, such as Scottish Water and energy companies, actively maintain and manage their own assets including their risk from flooding. Where known, these actions are described here. Scottish Natural Heritage and Historic Environment Scotland work with site owners to manage flooding where appropriate at designated environmental and/or cultural heritage sites. These actions are not detailed further in the Flood Risk Management Strategies.

Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	*Maintain flood warning*	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Ayr south (Potentially Vulnerable Area 12/13)

Local Plan District	Local authority	Main catchment
Ayrshire	South Ayrshire Council	River Doon

Background

This Potentially Vulnerable Area is located to the south of Ayr (shown below). It is approximately 10km^2 which includes Newark, Mountcharles, Alloway and Carcluie.

There are approximately 20 residential properties and 10 non-residential properties at risk of flooding. The Annual Average Damages are approximately £40,000.

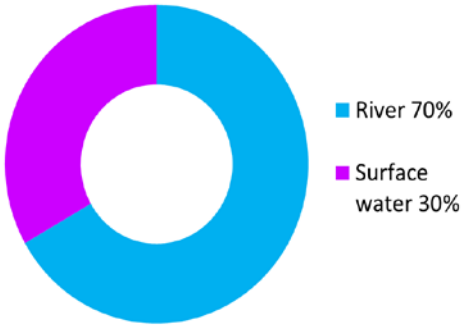


Figure 1: Annual Average Damages by flood source

Summary of flooding impacts

River flooding is primarily from the River Doon which flows in a northerly direction towards Ayr before discharging to the Firth of Clyde. Flooding from the River Doon is predicted to affect residential areas of Mountcharles and Alloway, and agricultural land from Doonholm to Monkwood. The main road link at risk is the A77.

Surface water flooding is likely to occur on agricultural and de-forested areas of land, particularly those low lying areas adjacent to the River Doon. There is potential for interaction with river flooding in this location.

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 20 to 30.

The risk of flooding to people and property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1. The damages associated with floods of different likelihood are shown in Figure 2. Residential properties affected by river flooding experience the highest economic impact at approximately 50% of the damages. Non-residential properties also provide a notable portion of the damages.

The location of the impacts of flooding is shown in Figure 3. Most of the impacts are within Alloway, Brae of Auchendrane and Nether Auchendrane. The railway line is at risk of flooding at Carcluie.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 1,100)	<10	20	30
Non-residential properties (total 70)	<10	10	10
People	<10	40	60
Community facilities	0	<10 Educational buildings	<10 Educational buildings
Utilities assets	0	<10	<10
Transport links - roads (km)	0.3 (of which 0.1 is A road)	0.6 (of which 0.3 is A road)	0.7 (of which 0.3 is A road)
Transport links - rail (km)	0.4	0.4	0.4
Environmental designated areas (km^2)	0	0	0
Designated cultural heritage sites	6	7	7
Agricultural land (km^2)	0.3	0.4	0.4

Table 1: Summary of flooding impacts[1]

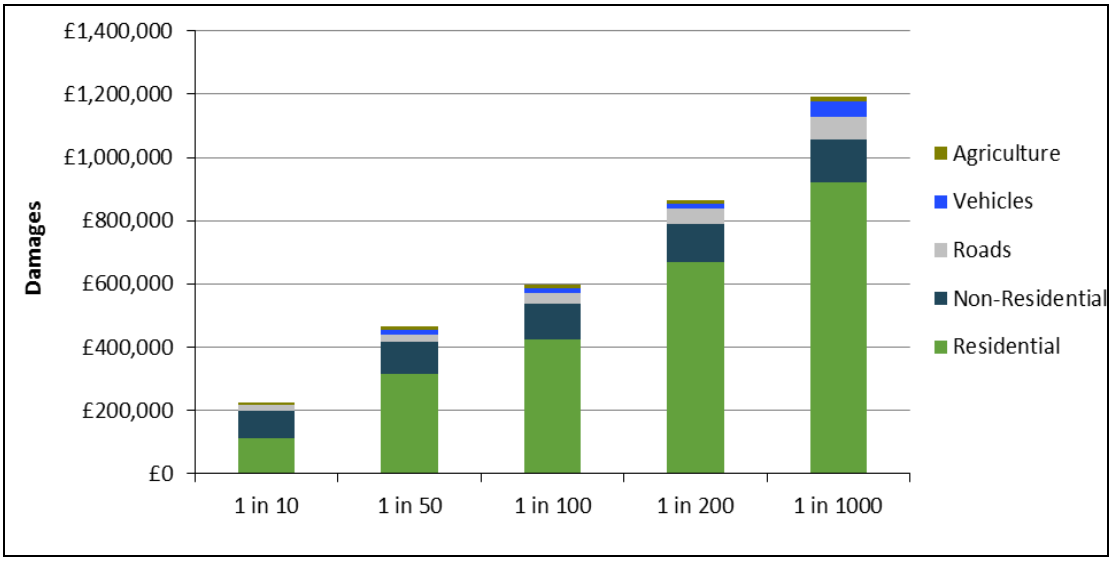


Figure 2: Damages by flood likelihood

History of flooding

The majority of records within the area involve the River Doon where floods have affected the adjacent low lying land. These records start in 1857 with the last record being from October 1977, which described the river as having the highest recorded flows. These flood have had limited impacts to properties.

[1] Some receptors are counted more than once if flooded from multiple sources

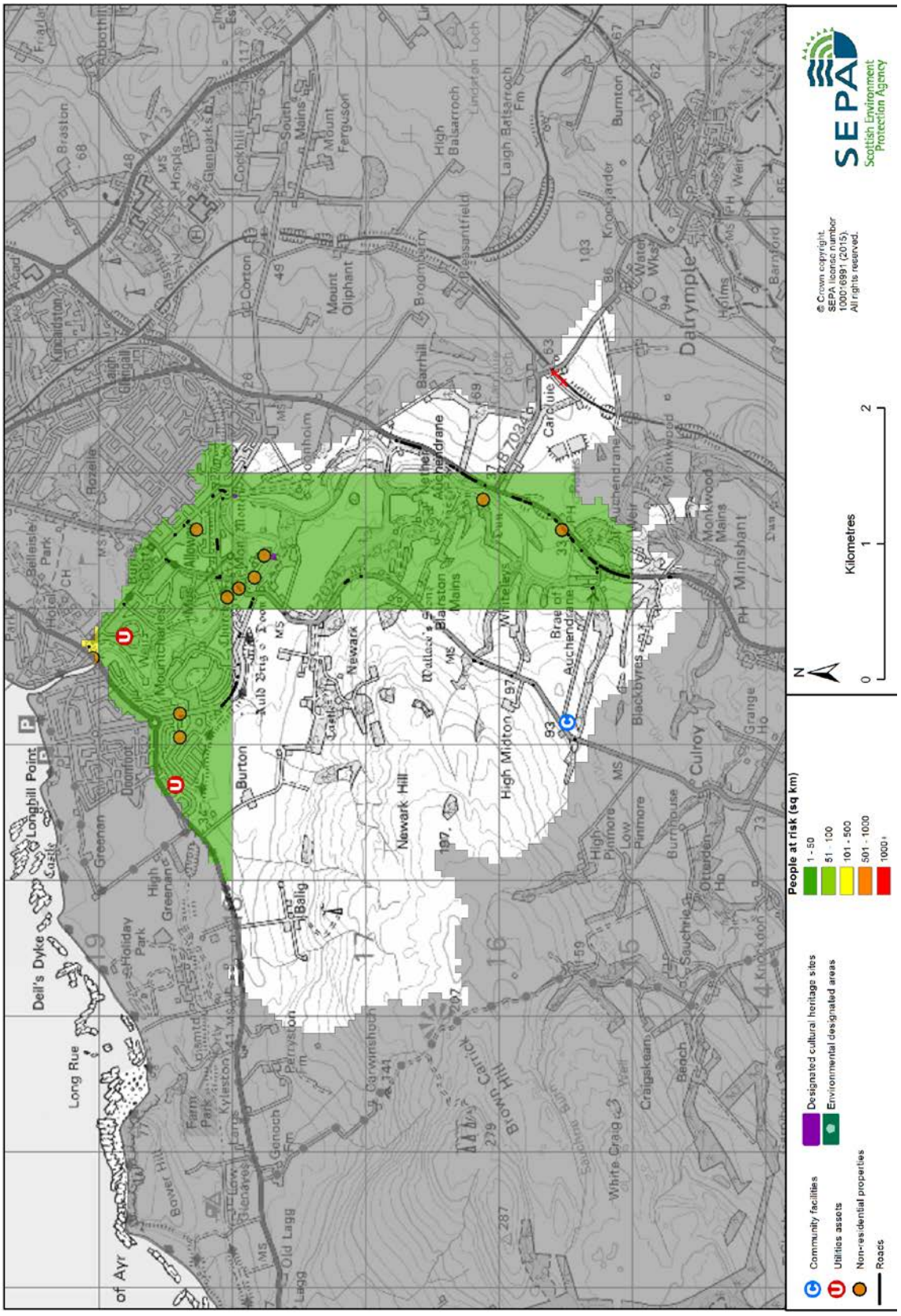


Figure 3: Impacts of flooding

Objectives to manage flooding in Potentially Vulnerable Area 12/13

Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target areas have been set to focus actions; they do not necessarily correspond to areas at risk in SEPA's flood map. The objectives below have been set for Ayr south Potentially Vulnerable Area.

Target area	Objective	ID	Indicators within PVA
Applies across Ayrshire Local Plan District	Avoid an overall increase in flood risk	12039	• 20 residential properties • £40,000 Annual Average Damages
Applies across Ayrshire Local Plan District	Reduce overall flood risk	12082	• 20 residential properties • £40,000 Annual Average Damages
Applies across Ayrshire Local Plan District	Organisations such as Scottish Water, energy companies and Historic Environment Scotland actively maintain and manage their own assets, including the risk of flooding. These actions are not detailed further in the Flood Risk Management Strategies.		

Actions to manage flooding in Potentially Vulnerable Area 12/13

Actions describe where and how flood risk will be managed. These actions have been set by SEPA and agreed with flood risk management authorities following consultation. Selection of actions to deliver the agreed objectives was based on a detailed assessment and comparison of economic, social and environmental criteria. The actions shaded and then described below have been selected as the most appropriate for Ayr south Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	*Maintain flood warning*	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (120820019)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Scottish Water		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	Scottish Water will review the assessment of flood risk within the highest risk sewer catchments to improve knowledge and understanding of surface water flood risk.		

Action (ID):	**FLOOD FORECASTING** (120820009)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 Responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	**SELF HELP** (120820011)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	—		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and Resilient Communities initiatives, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	**AWARENESS RAISING** (120820013)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Responsible authorities		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. From 2016 SEPA will engage with the community through local participation in national initiatives, including partnership working with Neighbourhood Watch Scotland. In addition, SEPA will engage with local authorities and community resilience groups where possible. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

Action (ID):	**MAINTENANCE** (120820007)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	South Ayrshire Council, asset / land managers		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. They produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk.		

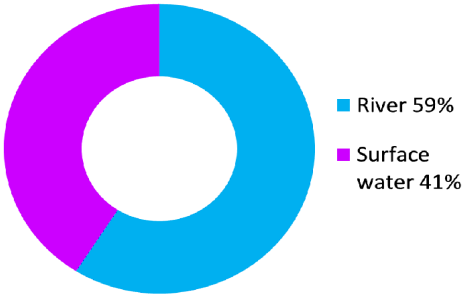
Action (ID):	**EMERGENCY PLANS/RESPONSE** (120820014)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Category 1 and 2 Responders		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (120390001)		
Objective (ID):	Avoid an overall increase in flood risk (12039) Reduce overall flood risk (12082)		
Delivery lead:	Planning authority		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		

Cumnock and Catrine (Potentially Vulnerable Area 12/14)

Local Plan District	Local authority	Main catchment
Ayrshire	East Ayrshire Council	River Ayr

Summary of flooding impacts



At risk of flooding

- 330 residential properties
- 240 non-residential properties
- £970,000 Annual Average Damages

(damages by flood source shown left)

Summary of objectives to manage flooding

Objectives have been set by SEPA and agreed with flood risk management authorities. These are the aims for managing local flood risk. The objectives have been grouped in three main ways: by reducing risk, avoiding increasing risk or accepting risk by maintaining current levels of management.

Many organisations, such as Scottish Water and energy companies, actively maintain and manage their own assets including their risk from flooding. Where known, these actions are described here. Scottish Natural Heritage and Historic Environment Scotland work with site owners to manage flooding where appropriate at designated environmental and/or cultural heritage sites. These actions are not detailed further in the Flood Risk Management Strategies.

Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

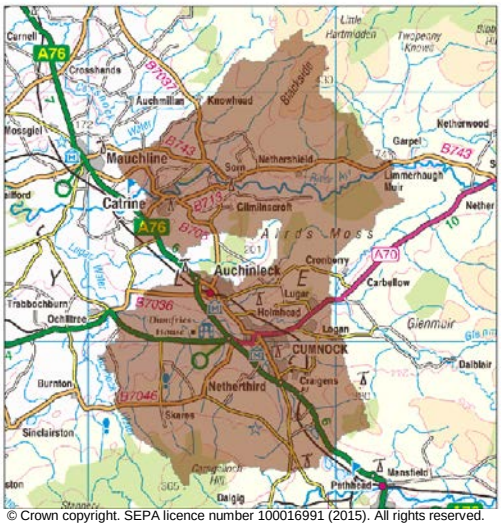
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	Property level protection scheme	*Site protection plans*
Flood protection study	*Natural flood management study*	*Maintain flood warning*	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Cumnock and Catrine (Potentially Vulnerable Area 12/14)

Local Plan District	Local authority	Main catchment
Ayrshire	East Ayrshire Council	River Ayr

Background

This Potentially Vulnerable Area is located in the east of the Ayrshire Local Plan District and is approximately 130km^2. This area includes much of Catrine and Sorn in the north as well as Auchinlock, Cumnock and Netherthird in the south (shown below).



There are approximately 330 residential properties and 240 non-residential properties at risk of flooding. The Annual Average Damages are approximately £970,000.

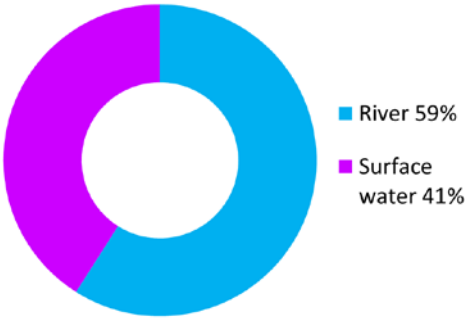


Figure 1: Annual Average Damages by flood source

Summary of flooding impacts

River flooding in this area is attributed to the River Ayr and its tributaries. The River Ayr flows in a westerly direction in the north of the area, impacting upon a number of residential and non-residential properties, community facilities and utilities within Catrine and Sorn. In the south the Lugar Water (a tributary of the River Ayr) flows in a westerly direction through Lugar and Cumnock, affecting a number of residential and non-residential properties. In addition to the Lugar Water, Cumnock is also affected by river flooding from the Glaisnock Burn, a tributary of the Lugar Water which flows in a northerly direction through the centre of the town. The Auchinleck Burn is a further tributary of the Lugar Water and is predicted to impact upon residential properties and non-residential properties in the village of Auchinleck. Sections of railway line and the road network are also at risk of flooding (notably the A70 and A76).

Surface water flooding is generally located in low lying areas adjacent to the various watercourses which flow through the area. Cumnock also has isolated pockets of predicted surface water flooding in areas throughout the town. There is an existing surface water flood attenuation area upstream of Cumnock which can be further utilised if there is to be more development in the town.

Two historic opencast mines, Dalfad and Powharnal, are situated upstream of Potentially Vulnerable Area in proximity to the River Ayr and the Glenmuir Water. There is a potential flood risk relating to water overflowing from these mines should the necessary levels of maintenance and pumping not be provided.

The risk of flooding to people and property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1. The damages associated with floods of different likelihood are shown in Figure 2. Residential properties affected by river flooding experience the highest economic impact at approximately 45% of the damages. Non-residential properties also provide a substantial share of the damages.

The location of the impacts of flooding is shown in Figure 3. Most of the impacts are within Catrine, Sorn and Cumnock with flooding to properties and infrastructure.

History of flooding

There have been infrequent reports of flooding impacting properties and people in this area. On 31 July 1998 there were reports of a river overtopping and significant surface water run-off from high grounds in Cumnock. On 9 August 1994, river flooding resulted in a massive power loss and the flooding of road and rail transport links near Auchinlock.

Surface water flooding was reported in Mauchline in August 2009 which flooded a primary school playground due to heavy overland flows from farmland.

	1 in 10	1 in 200	1 in 1000
	High likelihood	Medium likelihood	Low likelihood
Residential properties (total 8,000)	120	330	350
Non-residential properties (total 1,200)	140	240	280
People	260	730	770
Community facilities	<10 Educational buildings	<10 Educational buildings	<10 Includes: educational buildings and emergency services
Utilities assets	<10	10	10
Transport links - roads (km)	2.1 (of which 0.3 is A road)	4.3 (of which 0.8 is A road)	5.2 (of which 1.0 is A road)
Transport links - rail (km)	2.3	3.8	4.2
Environmental designated areas (km^2)	0.3	0.5	0.5
Designated cultural heritage sites	9	9	11
Agricultural land (km^2)	2.1	2.7	2.9

Table 1: Summary of flooding impacts[1]

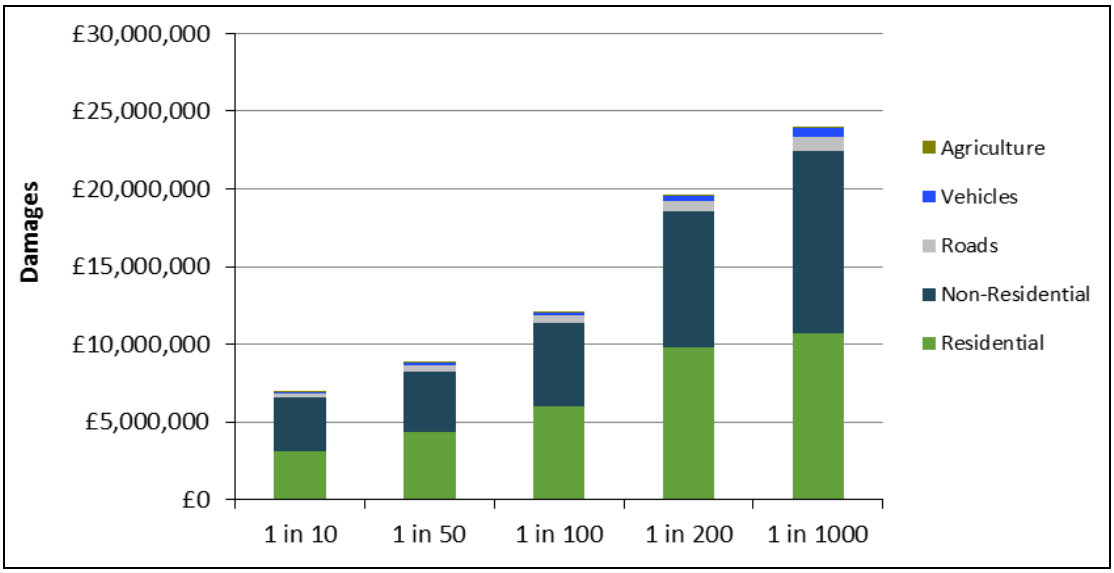


Figure 2: Damages by flood likelihood

[1] Some receptors are counted more than once if flooded from multiple sources

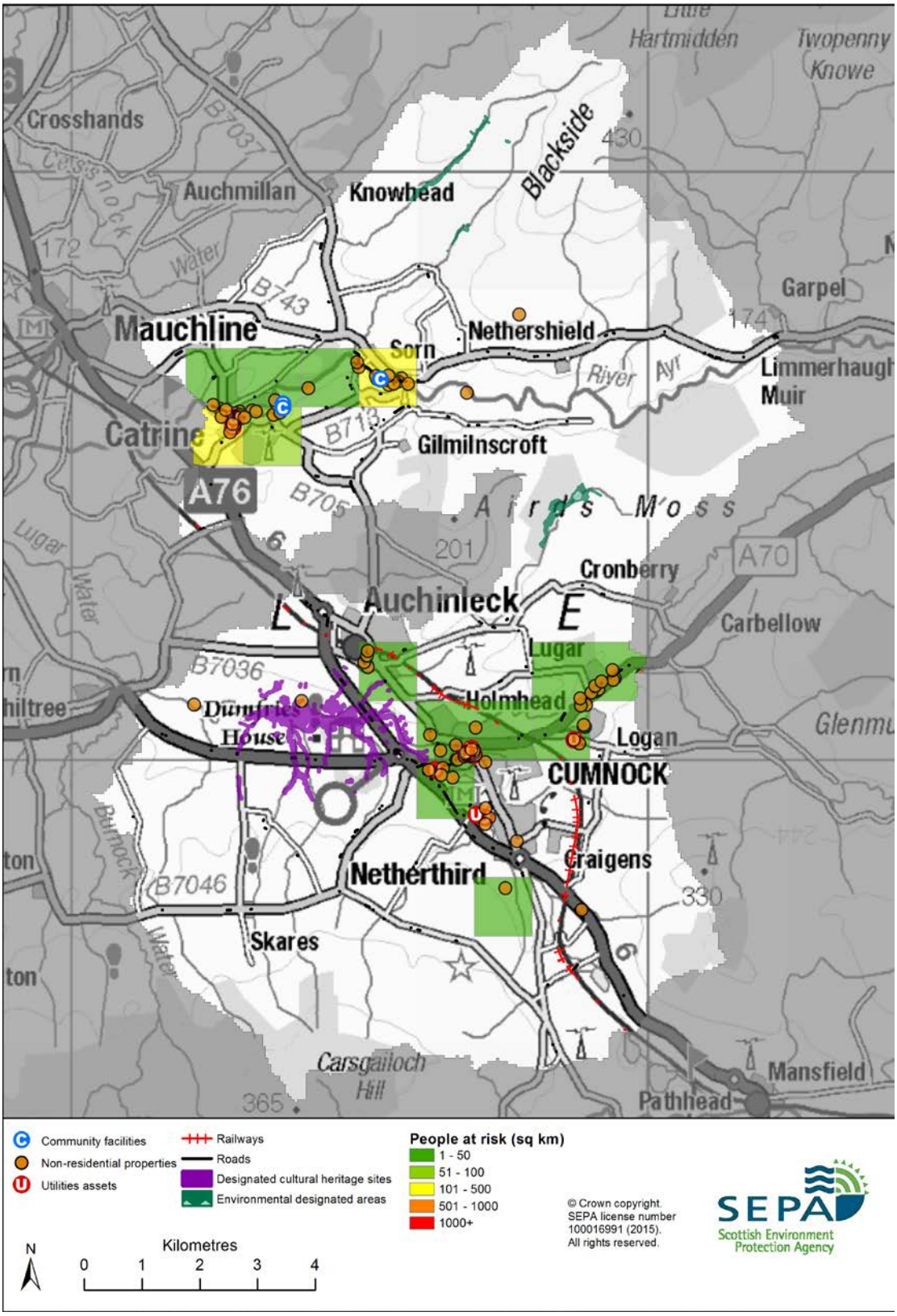
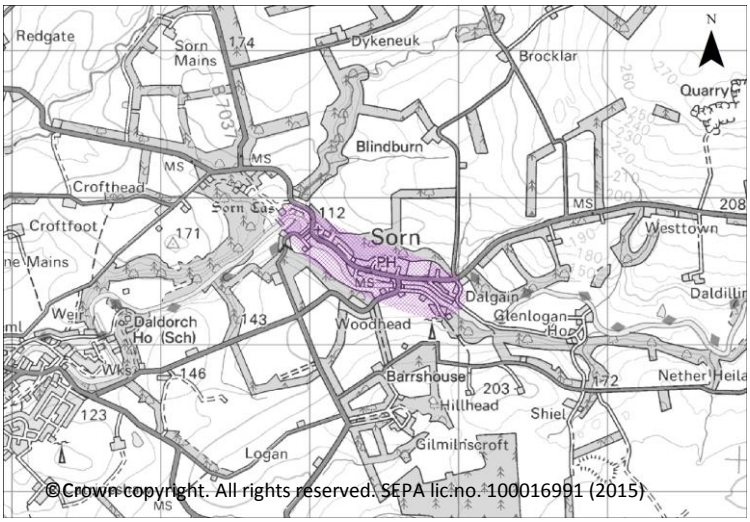


Figure 3: Impacts flooding

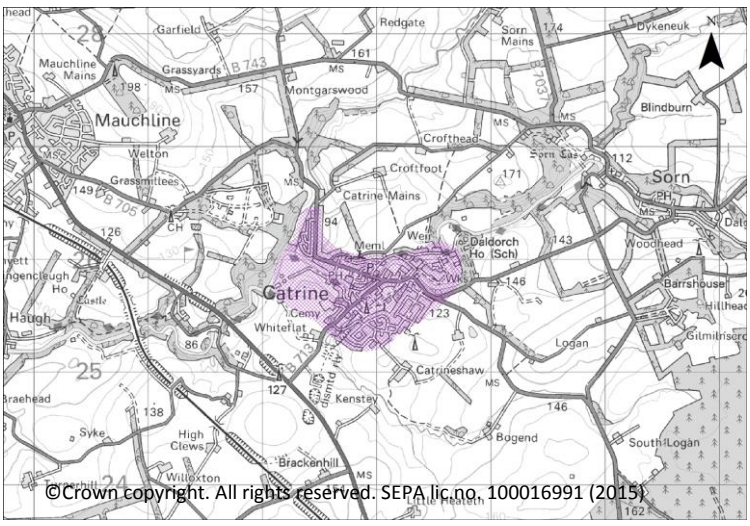
Objectives to manage flooding in Potentially Vulnerable Area 12/14

Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target areas have been set to focus actions; they do not necessarily correspond to areas at risk in SEPA's flood map. The objectives below have been set for Cumnock and Catrine Potentially Vulnerable Area.

Reduce the risk of the River Ayr flooding to residential properties in Sorn

Indicators:	Target area:
• 60 residential properties • £90,000 Annual Average Damages	
Objective ID: 12029	

Reduce the risk of flooding from the River Ayr to residential properties and non-residential properties in Catrine

Indicators:	Target area:
• 170 residential properties • 60 non-residential properties • £260,000 Annual Average Damages	
Objective ID: 12030	

Target area	Objective	ID	Indicators within PVA
Applies across Ayrshire Local Plan District	Avoid an overall increase in flood risk	12039	• 330 residential properties • £970,000 Annual Average Damages
Applies across Ayrshire Local Plan District	Reduce overall flood risk	12082	• 330 residential properties • £970,000 Annual Average Damages
Applies across Ayrshire Local Plan District	Organisations such as Scottish Water, energy companies and Historic Environment Scotland actively maintain and manage their own assets, including the risk of flooding. These actions are not detailed further in the Flood Risk Management Strategies.		

Actions to manage flooding in Potentially Vulnerable Area 12/14

Actions describe where and how flood risk will be managed. These actions have been set by SEPA and agreed with flood risk management authorities following consultation. Selection of actions to deliver the agreed objectives was based on a detailed assessment and comparison of economic, social and environmental criteria. The actions shaded and then described below have been selected as the most appropriate for Cumnock and Catrine Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	Property level protection scheme	*Site protection plans*
Flood protection study	*Natural flood management study*	*Maintain flood warning*	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Action (ID):	**FLOOD PROTECTION STUDY** (120300005)		
Objective (ID):	Reduce the risk of flooding from the River Ayr to residential properties and non-residential properties in Catrine (12030)		
Delivery lead:	East Ayrshire Council		
Priority:	National:	Within local authority:	
	55 of 168	**2 of 4**	
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	A study is recommended to further investigate the feasibility of a flood protection scheme along the River Ayr, focusing on sections of river wall and property level protection which could provide some protection against shallow, high frequency floods. Other actions may also be considered to select the most sustainable combination of actions.		
Potential impacts			
Economic:	The flood protection study should consider how to reduce flood risk to 111 residential properties and 45 non-residential properties in this location, with potential damages avoided of up to £5.8 million.		
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community and socially vulnerable people located within the flood protection study area. In addition there are two educational buildings and two utilities which have been identified as potentially benefitting from this action. There may be negative impacts through disturbance to the local community during the construction phase.		
Environmental:	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. There may be negative impacts on the Catrine Voes		

Environmental:	and Woodland Local Nature Reserve through the direct footprint of defences. There is likely to be a loss of natural and semi-natural habitats and displacement of species in the footprint and vicinity of the defences. There is the potential for negative impacts on local water quality downstream of works during the construction period, which have the potential for temporary negative impacts on the Howford Bridge Site of Special Scientific Interest which is downstream on the River Ayr. However, there is the potential for slight positive impacts on water quality from the implementation of sustainable drainage systems in the area. With direct defences there is the potential for impacts upon the setting of the Catrine Heritage Conservation Area, the Catrine Mill Water Works Scheduled Monument, the many listed buildings in the area and views of the river in the town.

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (120820016)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	SEPA will seek to incorporate additional surface water data into the flood maps to improve understanding of flood risk. Approximately 1,300km² of improved surface water data is currently available within this Local Plan District. The inclusion of additional surface water hazard data resulting from the completion of local authority surface water management plans and Scottish Water Integrated Catchment Management Studies will be considered as these projects are completed.		

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (120820019)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Scottish Water		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	Scottish Water will review the assessment of flood risk within the highest risk sewer catchments to improve knowledge and understanding of surface water flood risk.		

Action (ID):	**FLOOD FORECASTING** (120820009)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 Responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	**PROPERTY LEVEL PROTECTION SCHEME** (120290008)		
Objective (ID):	Reduce the risk of the River Ayr flooding to residential properties in Sorn (12029)		
Delivery lead:	East Ayrshire Council		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	Property level protection should be further assessed as it will provide some protection against shallow, high frequency floods.		

Action (ID):	**SELF HELP** (120820011)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	—		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and Resilient Communities initiatives, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	**AWARENESS RAISING** (120820013)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Responsible authorities		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. From 2016 SEPA will engage with the community through local participation in national initiatives, including partnership working with Neighbourhood Watch Scotland. In addition, SEPA will engage with local authorities and community resilience groups where possible. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

Action (ID):	**MAINTENANCE** (120820007)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	East Ayrshire Council, asset / land managers		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. They produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk.		

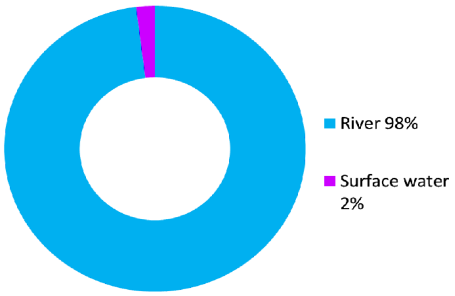
Action (ID):	**EMERGENCY PLANS/RESPONSE** (120820014)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Category 1 and 2 Responders		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (120390001)		
Objective (ID):	Avoid an overall increase in flood risk (12039) Reduce overall flood risk (12082)		
Delivery lead:	Planning authority		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		

Dalrymple to Patna (Potentially Vulnerable Area 12/15)

Local Plan District	Local authority	Main catchment
Ayrshire	East Ayrshire Council, South Ayrshire Council	River Doon

Summary of flooding impacts



At risk of flooding

- 90 residential properties
- 20 non-residential properties
- £120,000 Annual Average Damages

(damages by flood source shown left)

Summary of objectives to manage flooding

Objectives have been set by SEPA and agreed with flood risk management authorities. These are the aims for managing local flood risk. The objectives have been grouped in three main ways: by reducing risk, avoiding increasing risk or accepting risk by maintaining current levels of management.

Many organisations, such as Scottish Water and energy companies, actively maintain and manage their own assets including their risk from flooding. Where known, these actions are described here. Scottish Natural Heritage and Historic Environment Scotland work with site owners to manage flooding where appropriate at designated environmental and/or cultural heritage sites. These actions are not detailed further in the Flood Risk Management Strategies.

Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

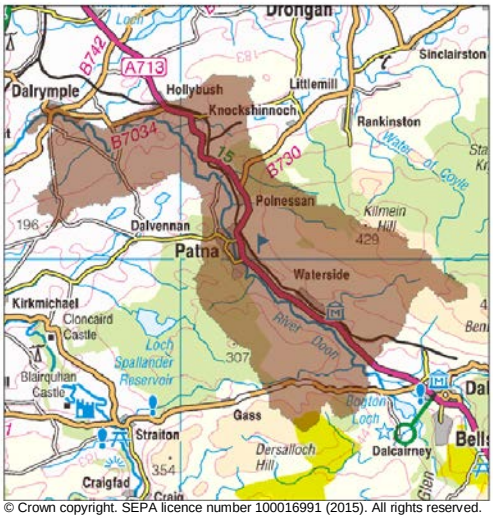
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	*Maintain flood warning*	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Dalrymple to Patna (Potentially Vulnerable Area 12/15)

Local Plan District	Local authority	Main catchment
Ayrshire	East Ayrshire Council, South Ayrshire Council	River Doon

Background

This Potentially Vulnerable Area is located to the south east of the Ayrshire Local Plan District is approximately 50km^2 (shown below). It encompasses an area along the River Doon between the village of Dalrymple and Bogton Loch.



There are approximately 90 residential properties and 20 non-residential properties at risk of flooding. The Annual Average Damages are approximately £120,000.

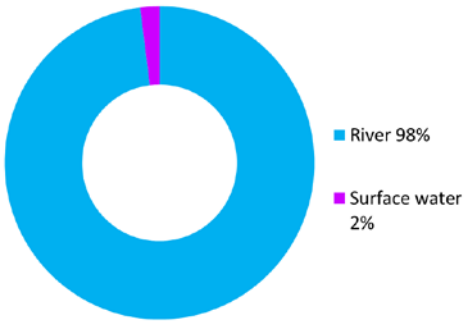


Figure 1: Annual Average Damages by flood source

Summary of flooding impacts

This area is situated within the River Doon catchment where land use is primarily hill pasture and forestry. The River Doon affects a number of residential and non-residential properties in the villages of Dalrymple, Patna and Waterside. Areas of agricultural land to the south of Waterside are also predicted to be affected by river flooding. Doon Dam on Loch Doon straddles the boundary between Ayrshire and Solway. During most conditions Loch Doon helps to reduce the force of flows however if left open during extreme conditions this dam can contribute to flooding downstream.

Surface water flooding is predicted within the natural floodplain of the River Doon on land used for agricultural purposes. There are fewer than 10 residential properties at risk however, sections of road and rail infrastructure are at risk of surface water flooding (notably the A713).

A now closed opencast mine, Dunstonhill, is situated to the east of Polnessan. There is a potential flood risk relating to water overflowing from this mine should the necessary levels of maintenance and pumping not be provided.

The risk of flooding to people and property, as well as to community facilities, utilities, transport routes, designated sites and agricultural land is summarised in Table 1. The damages associated with floods of different likelihood are shown in Figure 2.

Residential properties affected by river flooding experience the highest economic impact at approximately 75% of the damages.

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 90 to 110.

The impact of flooding is shown in Figure 3. Most of impacts are within Dalrymple and Patna with flooding to people, non-residential properties and roads.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 1,500)	20	90	100
Non-residential properties (total 260)	10	20	20
People	30	190	220
Community facilities	0	0	0
Utilities assets	0	<10	<10
Transport links - roads (km)	0.8	1.8	2.2
Transport links - rail (km)	0.6	0.5	0.6
Environmental designated areas (km²)	<0.1	<0.1	<0.1
Designated cultural heritage sites	8	8	8
Agricultural land (km²)	2.0	2.3	2.4

Table 1: Summary of flooding impacts[1]

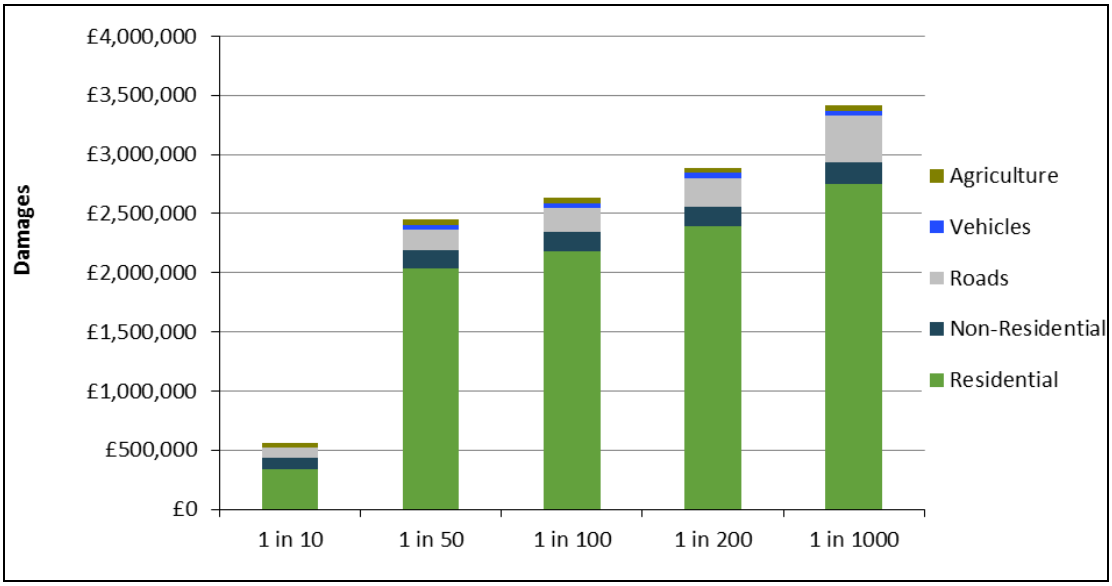


Figure 2: Damages by flood likelihood

[1] Some receptors are counted more than once if flooded from multiple sources

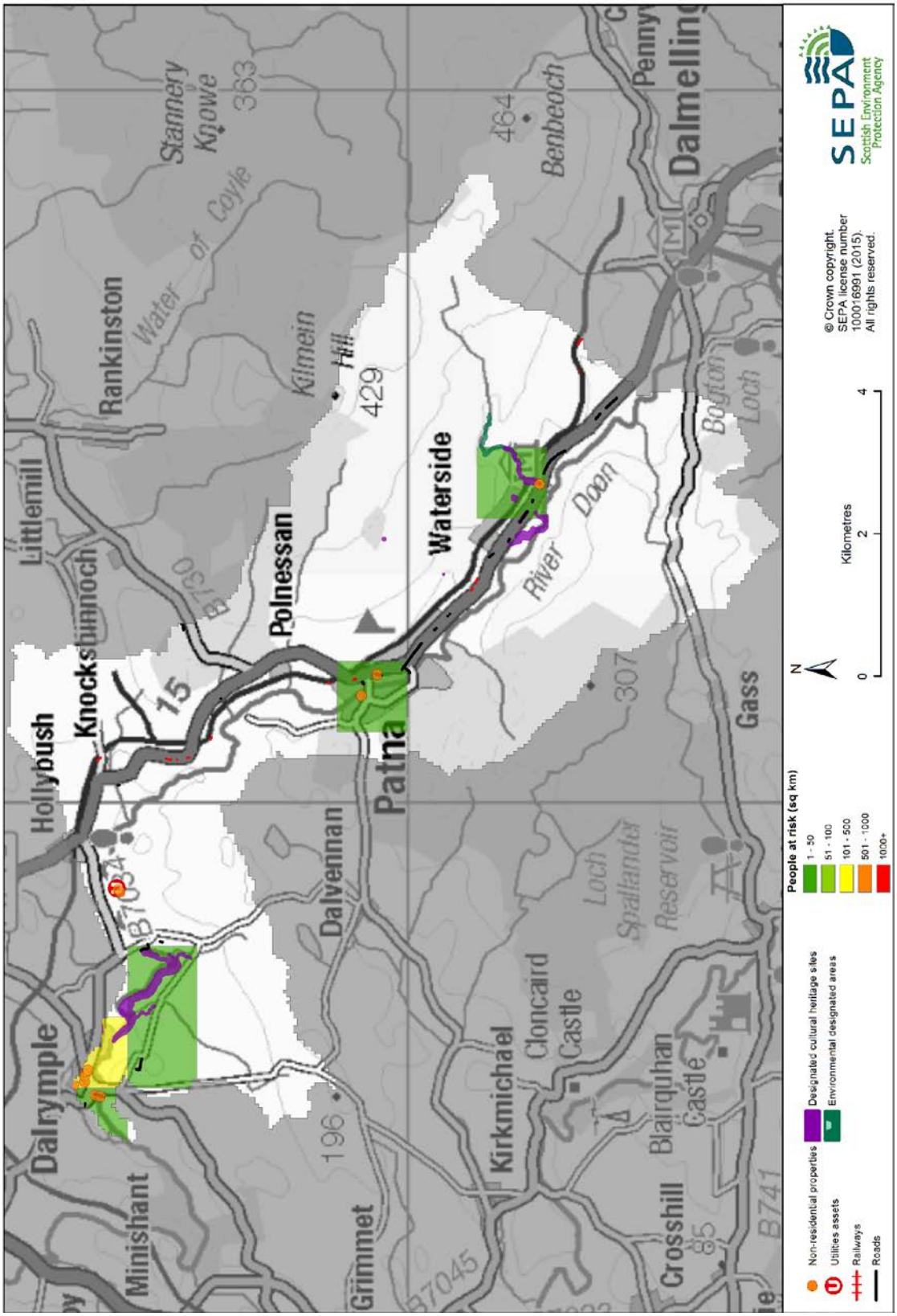


Figure 3: Impacts of flooding

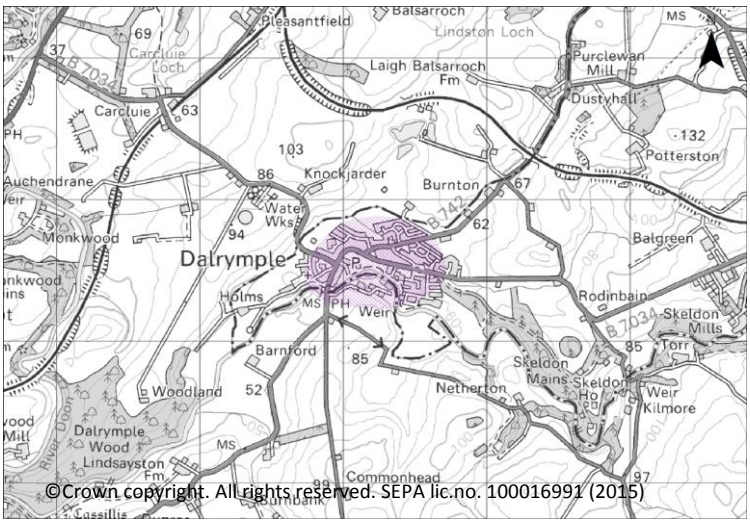
History of flooding

Flooding within the area was reported in October and November 2009, which resulted in two road closures in Patna and the closure of the B7037 and B741. The B741 is reported to flood regularly between the Muck Bridge and the River Doon Bridge, with flooding experienced on 11 September 2000, 25 October 2000 and 6 December 1999.

Objectives to manage flooding in Potentially Vulnerable Area 12/15

Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target areas have been set to focus actions; they do not necessarily correspond to areas at risk in SEPA's flood map. The objectives below have been set for Dalrymple to Patna Potentially Vulnerable Area.

Reduce the risk of flooding from the River Doon and the Primpton Burn, to residential properties in Dalrymple

Indicators:	Target area:
• 140 residential properties • £160,000 Annual Average Damages	
Objective ID: 12031	

Target area	Objective	ID	Indicators within PVA
Applies across Ayrshire Local Plan District	Avoid an overall increase in flood risk	12039	• 90 residential properties • £120,000 Annual Average Damages
Applies across Ayrshire Local Plan District	Reduce overall flood risk	12082	• 90 residential properties • £120,000 Annual Average Damages
Applies across Ayrshire Local Plan District	Organisations such as Scottish Water, energy companies and Historic Environment Scotland actively maintain and manage their own assets, including the risk of flooding. These actions are not detailed further in the Flood Risk Management Strategies.		

Actions to manage flooding in Potentially Vulnerable Area 12/15

Actions describe where and how flood risk will be managed. These actions have been set by SEPA and agreed with flood risk management authorities following consultation. Selection of actions to deliver the agreed objectives was based on a detailed assessment and comparison of economic, social and environmental criteria. The actions shaded and then described below have been selected as the most appropriate for Dalrymple to Patna Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	*Maintain flood warning*	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Action (ID):	**FLOOD PROTECTION STUDY** (120310005)		
Objective (ID):	Reduce the risk of flooding from the River Doon and the Primpton Burn, to residential properties in Dalrymple (12031)		
Delivery lead:	East Ayrshire Council		
Priority:	National:	Within local authority:	
	136 of 168	**4 of 4**	
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	A study is recommended to further investigate the feasibility of a flood protection scheme, focusing on modification of conveyance through an historic bridge and construction of direct defences. The study should also explore the feasibility of changing the current operating procedure of Loch Doon to increase the level of storage. Given the other uses of the loch this may not be possible and discussions with Scottish Power should commence at the beginning of this study. Other actions may also be considered to select the most sustainable combination of actions.		
Potential impacts			
Economic:	The flood protection study should consider how to reduce flood risk to 29 residential properties and 3 non-residential properties in this location, with potential damages avoided of up to £1.1 million.		
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community and socially vulnerable people located within the flood protection study area. There may be negative impacts through disturbance to the local community during the construction phase.		
Environmental:	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the		

Environmental:	environment. There is the potential for impacts on the Loch Doon and Ness Glen Sites of Special Scientific Interest with the storage action. There is the potential for loss of existing natural terrestrial habitats due to increased water levels; however, there could be an increase in wetland habitats. Incorporation of hydro power dams to the scheme could have negative impacts on fish passage. Downstream of these actions there may be negative impacts on water quality through increased erosion and sedimentation, which has the potential to impact upon Bogton Loch Site of Special Scientific Interest. Implementation of the storage action will have permanent negative impacts on the water body morphology. There is likely to be a loss of habitat and displacement of species in the short term during modification works which are likely to re-establish and return in the medium to long term. However, this is likely to be permanent in the footprint and vicinity of the direct defences. There is the potential for negative impacts on local water quality downstream of works during the construction period. There is the potential for impacts on the protected monuments, properties in care and listed buildings in and around Loch Doon from the storage action. With direct defences there is the potential for impacts on the setting of the Dalrymple Heritage Conservation Area, Dalrymple Bridge listed structure, the Skeldon House garden and designed landscape conservation area and views of the river in the town.

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (120820016)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	SEPA will seek to incorporate additional surface water data into the flood maps to improve understanding of flood risk. Approximately 1,300km² of improved surface water data is currently available within this Local Plan District. The inclusion of additional surface water hazard data resulting from the completion of local authority surface water management plans and Scottish Water Integrated Catchment Management Studies will be considered as these projects are completed.		

Action (ID):	**MAINTAIN FLOOD PROTECTION SCHEME** (120310017)		
Objective (ID):	Reduce the risk of flooding from the River Doon and the Primpton Burn, to residential properties in Dalrymple (12031)		
Delivery lead:	East Ayrshire Council		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	An existing overflow channel on the Primpton Burn reduces the flood risk from the watercourse. This channel will be maintained, and will continue to manage flooding according to the design standard at the time of construction. Levels of flood risk are likely to increase over time as a consequence of climate change. The local authority should investigate the current benefit which is offered by the scheme.		

Action (ID):	**FLOOD FORECASTING** (120820009)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 Responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	**SELF HELP** (120820011)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	—		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and Resilient Communities initiatives, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	**AWARENESS RAISING** (120820013)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Responsible authorities		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. From 2016 SEPA will engage with the community through local participation in national initiatives, including partnership working with Neighbourhood Watch Scotland. In addition, SEPA will engage with local authorities and community resilience groups where possible. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

Action (ID):	**MAINTENANCE** (120820007)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Local authorities, asset / land managers		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. They produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk.		

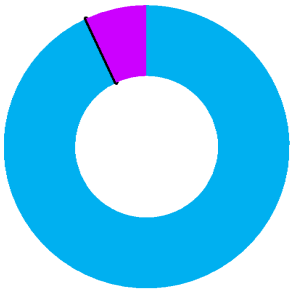
Action (ID):	**EMERGENCY PLANS/RESPONSE** (120820014)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Category 1 and 2 Responders		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (120390001)		
Objective (ID):	Avoid an overall increase in flood risk (12039) Reduce overall flood risk (12082)		
Delivery lead:	Planning authority		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		

Straiton (Potentially Vulnerable Area 12/16)

Local Plan District	Local authority	Main catchment
Ayrshire	East Ayrshire Council, South Ayrshire Council	Water of Girvan

Summary of flooding impacts



At risk of flooding

- 20 residential properties
- <10 non-residential properties
- £45,000 Annual Average Damages

(damages by flood source shown left)

Summary of objectives to manage flooding

Objectives have been set by SEPA and agreed with flood risk management authorities. These are the aims for managing local flood risk. The objectives have been grouped in three main ways: by reducing risk, avoiding increasing risk or accepting risk by maintaining current levels of management.

Many organisations, such as Scottish Water and energy companies, actively maintain and manage their own assets including their risk from flooding. Where known, these actions are described here. Scottish Natural Heritage and Historic Environment Scotland work with site owners to manage flooding where appropriate at designated environmental and/or cultural heritage sites. These actions are not detailed further in the Flood Risk Management Strategies.

Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

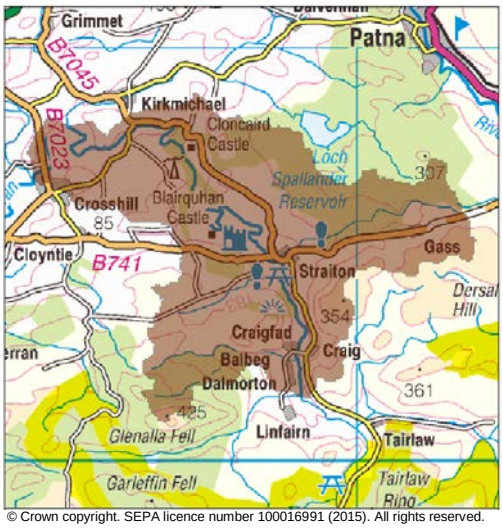
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	*Maintain flood warning*	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	*Strategic mapping and modelling*	Flood forecasting	Self help	Maintenance	Planning policies

Straiton (Potentially Vulnerable Area 12/16)

Local Plan District	Local authority	Main catchment
Ayrshire	East Ayrshire Council, South Ayrshire Council	Water of Girvan

Background

This Potentially Vulnerable Area is located to the south east of the Ayrshire Local Plan District and is centred around the village of Straiton and Blairquhan Castle (shown below). It is approximately 40km^2.



The area has a risk of river and surface water flooding. The majority of damages are caused by river flooding.

There are approximately 20 residential properties at risk of flooding. The Annual Average Damages are approximately £45,000.

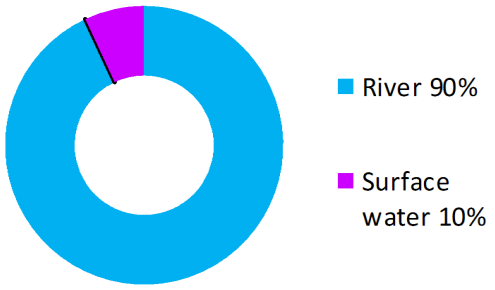


Figure 1: Annual Average Damages by flood source

Summary of flooding impacts

River flooding in this area is primarily attributed to the Water of Girvan. It flows in a north westerly direction through the village of Straiton where there is a predicted risk to residential properties and road infrastructure. Additionally, there are historical reports of the bridge at Fowlers Croft silting and causing a blockage problem.

Surface water flooding is likely to occur on low lying agricultural land adjacent to the Water of Girvan.

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 20 to 30.

The risk of flooding to people and property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1. The damages associated with floods of different likelihood are shown in Figure 2. Residential properties affected by river flooding experience the highest economic impact at approximately 40% of the damages. Roads infrastructure also provides a notable portion of the damages.

The location of the impacts of flooding is shown in Figure 3. Most of the impacts are within Straiton with flooding to people, non-residential properties, utilities and roads.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 300)	<10	20	30
Non-residential properties (total 40)	<10	<10	<10
People	<10	30	60
Community facilities	0	0	0
Utilities assets	0	<10	<10
Transport links - roads (km)	1.0	1.4	1.6
Environmental designated areas (km^2)	0	0	0
Designated cultural heritage sites	2	3	3
Agricultural land (km^2)	1.4	1.7	1.8

Table 1: Summary of flooding impacts[1]

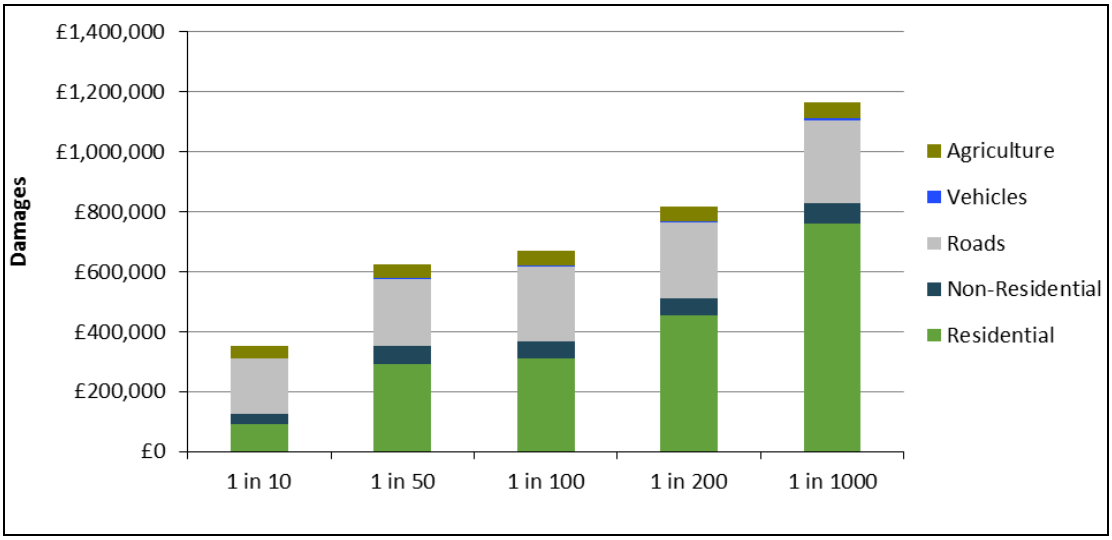


Figure 2: Damages by flood likelihood

[1] Some receptors are counted more than once if flooded from multiple sources

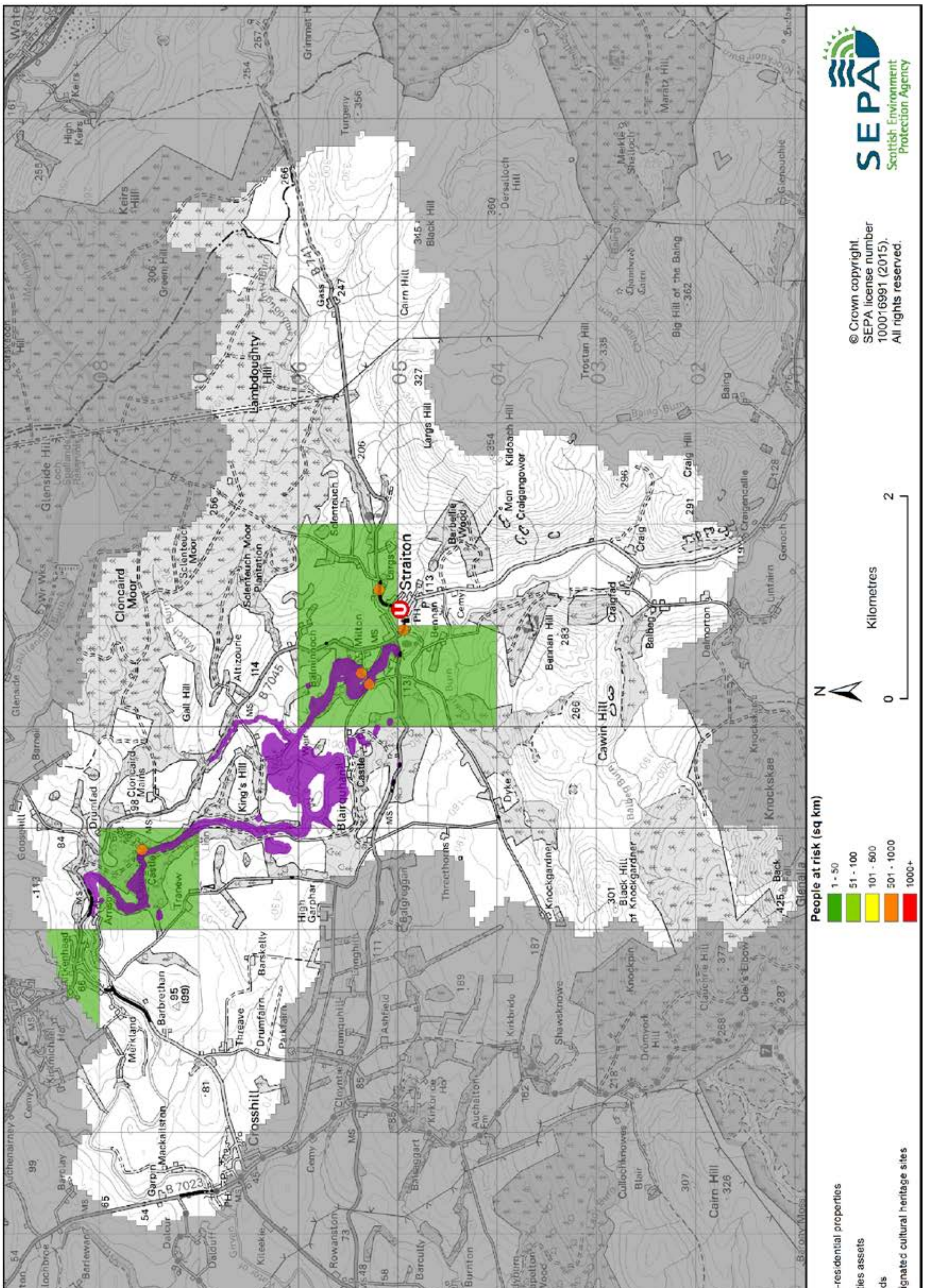


Figure 3: Impacts of flooding

History of flooding

There is a limited recorded flood history within the area. All incidents relate to river flooding or drainage issues. The Crosshill area in particular has been subject to river flooding which has originated from the Water of Girvan. These floods, which were reported between January 1869 and August 2008, have impacted local roads, gardens and some properties.

Objectives to manage flooding in Potentially Vulnerable Area 12/16

Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target areas have been set to focus actions; they do not necessarily correspond to areas at risk in SEPA's flood map. The objectives below have been set for Straiton Potentially Vulnerable Area.

Target area	Objective	ID	Indicators within PVA
Applies across Ayrshire Local Plan District	Avoid an overall increase in flood risk	12039	• 20 residential properties • £45,000 Annual Average Damages
Applies across Ayrshire Local Plan District	Reduce overall flood risk	12082	• 20 residential properties • £45,000 Annual Average Damages
Applies across Ayrshire Local Plan District	Organisations such as Scottish Water, energy companies and Historic Environment Scotland actively maintain and manage their own assets, including the risk of flooding. These actions are not detailed further in the Flood Risk Management Strategies.		

Actions to manage flooding in Potentially Vulnerable Area 12/16

Actions describe where and how flood risk will be managed. These actions have been set by SEPA and agreed with flood risk management authorities following consultation. Selection of actions to deliver the agreed objectives was based on a detailed assessment and comparison of economic, social and environmental criteria. The actions shaded and then described below have been selected as the most appropriate for Straiton Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	*Maintain flood warning*	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	*Strategic mapping and modelling*	Flood forecasting	Self help	Maintenance	Planning policies

Action (ID):	**FLOOD FORECASTING** (120820009)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 Responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	**SELF HELP** (120820011)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	—		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and Resilient Communities initiatives, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	**AWARENESS RAISING** (120820013)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Responsible authorities		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. From 2016 SEPA will engage with the community through local participation in national initiatives, including partnership working with Neighbourhood Watch Scotland. In addition, SEPA will engage with local authorities and community resilience groups where possible. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

Action (ID):	**MAINTENANCE** (120820007)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Local authorities, asset / land managers		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. They produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk.		

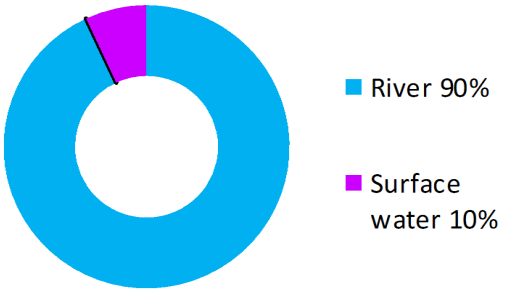
Action (ID):	**EMERGENCY PLANS/RESPONSE** (120820014)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Category 1 and 2 Responders		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (120390001)		
Objective (ID):	Avoid an overall increase in flood risk (12039) Reduce overall flood risk (12082)		
Delivery lead:	Planning authority		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		

Dailly (Potentially Vulnerable Area 12/17)

Local Plan District	Local authority	Main catchment
Ayrshire	South Ayrshire Council	Water of Girvan

Summary of flooding impacts



At risk of flooding

- <10 residential properties
- <10 non-residential properties
- £38,000 Annual Average Damages

(damages by flood source shown left)

Summary of objectives to manage flooding

Objectives have been set by SEPA and agreed with flood risk management authorities. These are the aims for managing local flood risk. The objectives have been grouped in three main ways: by reducing risk, avoiding increasing risk or accepting risk by maintaining current levels of management.

Many organisations, such as Scottish Water and energy companies, actively maintain and manage their own assets including their risk from flooding. Where known, these actions are described here. Scottish Natural Heritage and Historic Environment Scotland work with site owners to manage flooding where appropriate at designated environmental and/or cultural heritage sites. These actions are not detailed further in the Flood Risk Management Strategies.

Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

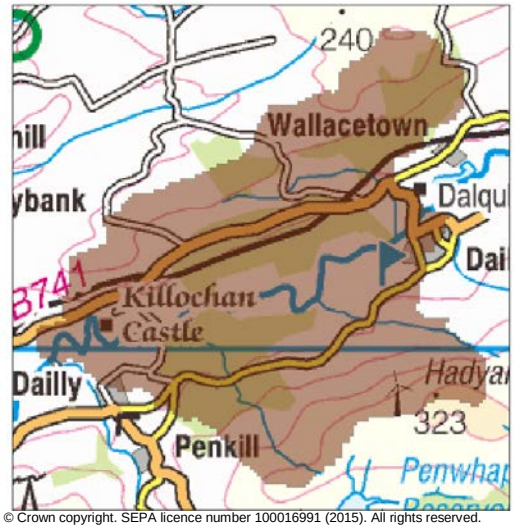
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	*Maintain flood warning*	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	*Strategic mapping and modelling*	Flood forecasting	Self help	Maintenance	Planning policies

Dailly (Potentially Vulnerable Area 12/17)

Local Plan District	Local authority	Main catchment
Ayrshire	South Ayrshire Council	Water of Girvan

Background

This Potentially Vulnerable Area is located in the south east of the Ayrshire Local Plan District and is approximately 20km^2 (shown below).



The area is within the Water of Girvan catchment and incorporates the village of Dailly and forest areas such as Drummuck, Blaweary and Blackpark Wood.

There are less than ten residential properties and non-residential properties at risk of flooding. The Annual Average Damages are approximately £38,000.

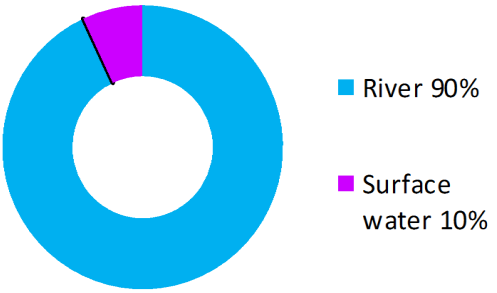


Figure 1: Annual Average Damages by flood source

Summary of flooding impacts

River flooding in this area is primarily attributed to the Water of Girvan. There is a risk of river flooding to a small number of properties situated within Dailly, downstream of the Water of Girvan confluence with the Dobbingstone Burn.

Surface water flooding is predicted to primarily affect small areas of low lying agricultural land adjacent to the Water of Girvan with very limited risk to residential properties

The risk of flooding to people and property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1. The damages associated with floods of different likelihood are shown in Figure 2. Residential properties affected by river flooding experience the highest economic impact at approximately 60% of the damages.

The location of the impacts of flooding is shown in Figure 3. Most of the impacts are within Dailly with flooding to people, non-residential properties and roads. The railway is at risk of flooding at various locations including Dalquharran Mains.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 350)	<10	<10	30
Non-residential properties (total 140)	<10	<10	<10
People	<10	20	60
Community facilities	0	0	0
Utilities assets	0	0	0
Transport links -road (km)	0.4	0.8	1.2
Transport links - rail (km)	0.6	0.5	0.7
Environmental designated areas (km^2)	0	0	0
Designated cultural heritage sites	4	4	4
Agricultural land (km^2)	0.8	0.9	1.0

Table 1: Summary of flooding impacts[1]

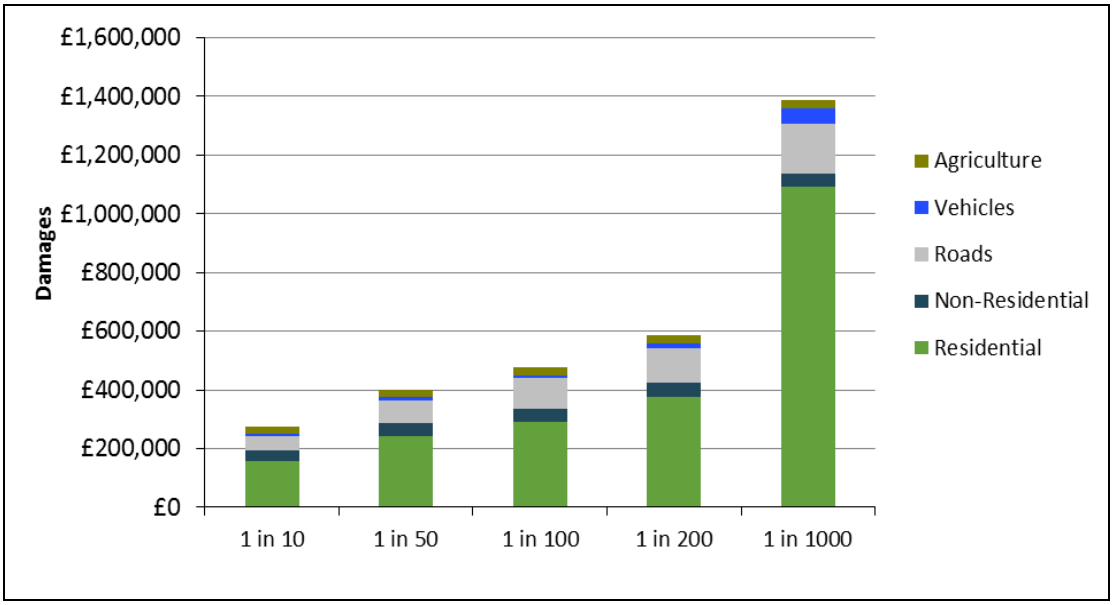


Figure 2: Damages by flood likelihood

History of flooding

There have been no floods recorded within this area which have affected properties.

[1] Some receptors are counted more than once if flooded from multiple sources

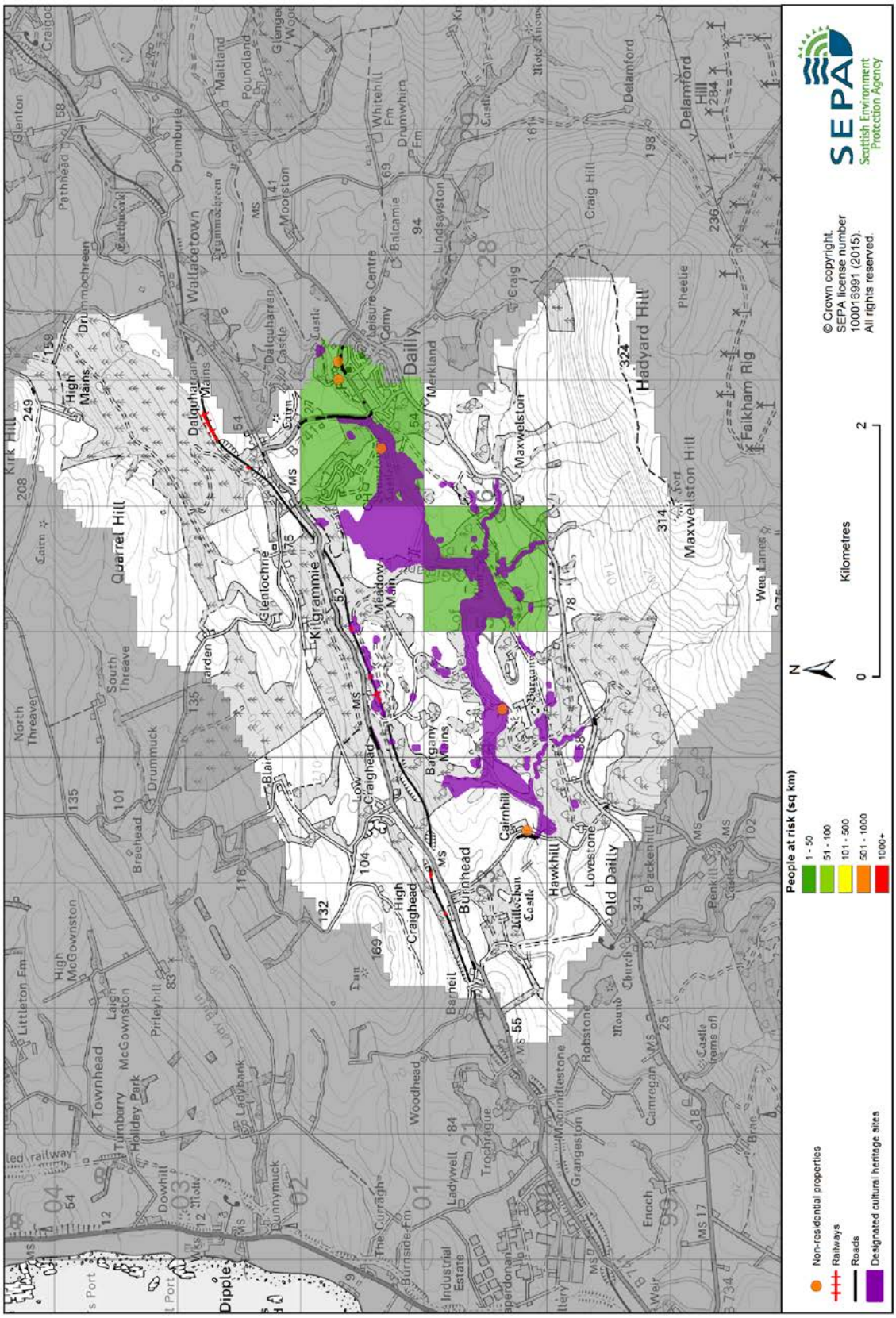


Figure 3: Impacts of flooding

Objectives to manage flooding in Potentially Vulnerable Area 12/17

Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target areas have been set to focus actions; they do not necessarily correspond to areas at risk in SEPA's flood map. The objectives below have been set for Dailly Potentially Vulnerable Area.

Target area	Objective	ID	Indicators within PVA
Applies across Ayrshire Local Plan District	Avoid an overall increase in flood risk	12039	• <10 residential properties • £38,000 Annual Average Damages
Applies across Ayrshire Local Plan District	Reduce overall flood risk	12082	• <10 residential properties • £38,000 Annual Average Damages
Applies across Ayrshire Local Plan District	Organisations such as Scottish Water, energy companies and Historic Environment Scotland actively maintain and manage their own assets, including the risk of flooding. These actions are not detailed further in the Flood Risk Management Strategies.		

Actions to manage flooding in Potentially Vulnerable Area 12/17

Actions describe where and how flood risk will be managed. These actions have been set by SEPA and agreed with flood risk management authorities following consultation. Selection of actions to deliver the agreed objectives was based on a detailed assessment and comparison of economic, social and environmental criteria. The actions shaded and then described below have been selected as the most appropriate for Dailly Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	*Maintain flood warning*	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	*Strategic mapping and modelling*	Flood forecasting	Self help	Maintenance	Planning policies

Action (ID):	**FLOOD FORECASTING** (120820009)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 Responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	**SELF HELP** (120820011)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	—		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and Resilient Communities initiatives, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	**AWARENESS RAISING** (120820013)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Responsible authorities		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. From 2016 SEPA will engage with the community through local participation in national initiatives, including partnership working with Neighbourhood Watch Scotland. In addition, SEPA will engage with local authorities and community resilience groups where possible. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

Action (ID):	**MAINTENANCE** (120820007)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	South Ayrshire Council, asset / land managers		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. They produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk.		

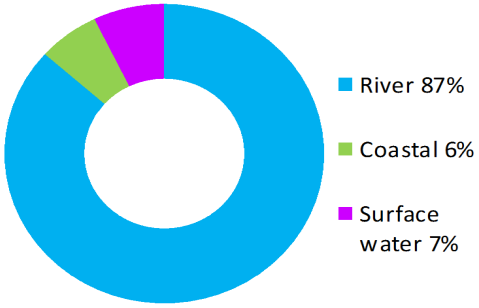
Action (ID):	**EMERGENCY PLANS/RESPONSE** (120820014)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Category 1 and 2 Responders		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (120390001)		
Objective (ID):	Avoid an overall increase in flood risk (12039) Reduce overall flood risk (12082)		
Delivery lead:	Planning authority		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		

Girvan (Potentially Vulnerable Area 12/18)

Local Plan District	Local authority	Main catchment
Ayrshire	South Ayrshire Council	Girvan to Lendalfoot coastal

Summary of flooding impacts



At risk of flooding

- 110 residential properties
- 30 non-residential properties
- £220,000 Annual Average Damages

(damages by flood source shown left)

Summary of objectives to manage flooding

Objectives have been set by SEPA and agreed with flood risk management authorities. These are the aims for managing local flood risk. The objectives have been grouped in three main ways: by reducing risk, avoiding increasing risk or accepting risk by maintaining current levels of management.

Many organisations, such as Scottish Water and energy companies, actively maintain and manage their own assets including their risk from flooding. Where known, these actions are described here. Scottish Natural Heritage and Historic Environment Scotland work with site owners to manage flooding where appropriate at designated environmental and/or cultural heritage sites. These actions are not detailed further in the Flood Risk Management Strategies.

Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

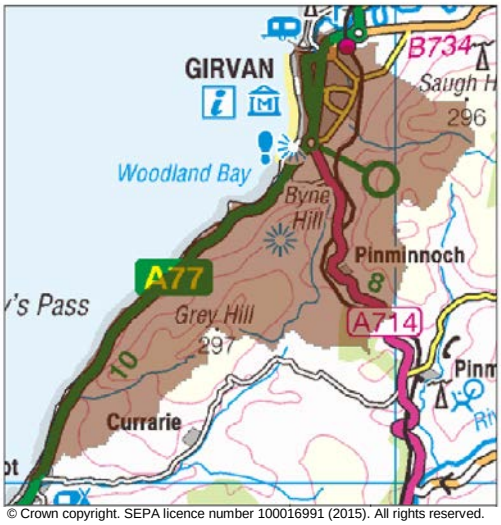
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	Maintain flood warning	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Girvan (Potentially Vulnerable Area 12/18)

Local Plan District	Local authority	Main catchment
Ayrshire	South Ayrshire Council	Girvan to Lendalfoot coastal

Background

This Potentially Vulnerable Area is located in the south of the Ayrshire Local Plan District on the west coast between Girvan and Lendalfoot (shown below). It incorporates the towns of Girvan and Pinminnoch and is approximately 20km^2.



There are approximately 110 residential properties and 30 non-residential properties at risk of flooding. The Annual Average Damages are approximately £220,000.

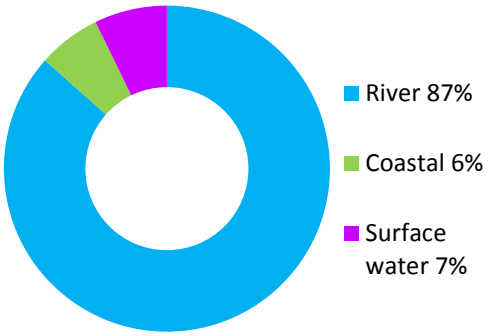


Figure 1: Annual Average Damages by flood source

Summary of flooding impacts

River flooding within this area is primarily attributed to the Mill Burn which flows in a north westerly direction through Girvan before joining the Water of Girvan immediately downstream of the A77. This is expected to impact a number of residential and non-residential properties, along with sections of the road and rail network (notably the A77). The Water of Girvan is outwith the Potentially Vulnerable Area boundary to the north but as the larger watercourse, it is likely to contribute to flooding on the lower reaches of the Mill Burn. The Mill Burn primarily flows as an open channel through a largely residential area with culverts beneath a number of roads in the area. The Myoch Burn, which flows in a westerly direction approximately 500m to the south of Girvan, is another source of river flooding which predominately affects agricultural land but also presents a risk to a caravan park.

The only urban areas at risk of surface water flooding are in the vicinity of the Mill Burn in Girvan.

There is limited risk from coastal flooding which is concentrated around the mouth of the Water of Girvan. At this location a number of residential and non-residential properties and sections of road are predicted to experience flooding.

Interaction between the various flooding sources is likely to occur on the lower reaches of watercourses as they enter the sea. High river flows in the Mill Burn and tidal surges have the potential to produce the highest impacts. Other watercourses which are likely to produce a combined effect of river and coastal flooding are the Water of Girvan and Myoch Burn. The Doune Burn and Mill Burn catchment have been studied by South Ayrshire Council to understand the flooding from these watercourses and the tidal effects of the Water of Girvan.

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 110 to 130 and the number of non-residential properties from 30 to 40.

The risk of flooding to people and property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1. The damages associated with floods of different likelihood are shown in Figure 2. Residential properties affected by river flooding experience the highest economic impact at approximately 80% of the damages.

The location of the impacts of flooding is shown in Figure 3. Most of the impacts are within Girvan with flooding to people, non-residential properties, utilities and roads.

History of flooding

Most local flood records relate to Girvan. On Friday 3 January 2014 Girvan was hit by a series of floods. Flood warnings were issued by the SEPA for the esplanade at Girvan. The high tide and waves affected the harbour and Golf Course Road in the town was closed for a limited period. Another relatively recent coastal flood occurred in December 1991, causing major flooding of the esplanade at Girvan. Other coastal events have occurred in 1894, 1892 and 1913 which were reported to damage roads and properties along the seafront. The Water of Girvan is known to have burst its banks in October 1998 and 2000 with minor impact on the area.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 3,200)	50	110	130
Non-residential properties (total 330)	<10	30	40
People	100	250	290
Community facilities	0	0	0
Utilities assets	0	<10	<10
Transport links - roads (km)	0.1 of A road	0.5 (of which 0.3 is A road)	0.7 (of which 0.4 is A road)
Transport links - rail (km)	0.3	0.1	0.5
Environmental designated areas (km^2)	0.2	0.2	0.2
Designated cultural heritage sites	0	0	0
Agricultural land (km^2)	0.1	0.1	0.1

Table 1: Summary of flooding impacts[1]

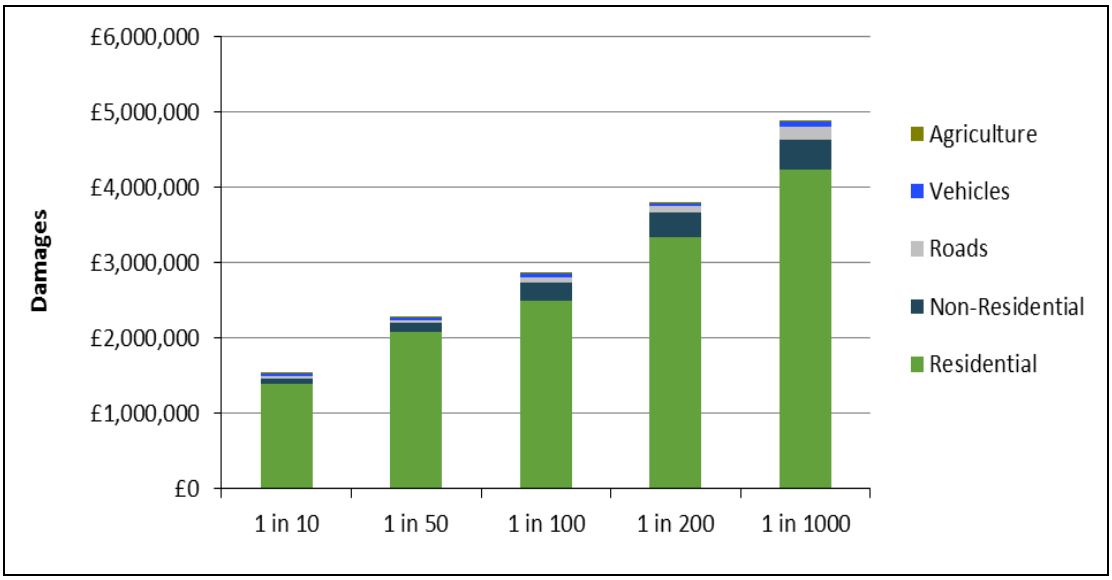


Figure 2: Damages by flood likelihood

[1] Some receptors are counted more than once if flooded from multiple sources

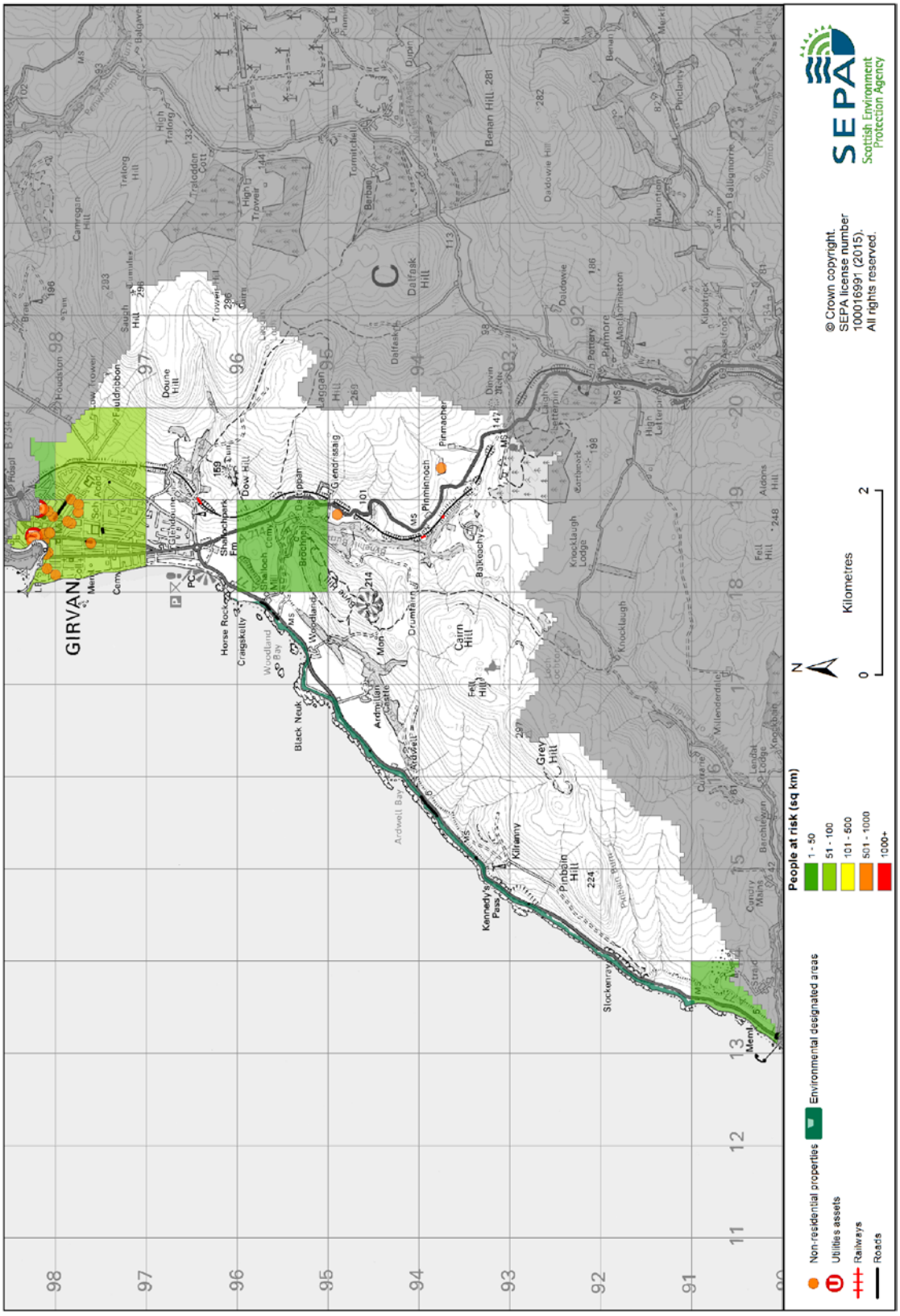


Figure 3: Impacts of flooding

Objectives to manage flooding in Potentially Vulnerable Area 12/18

Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target areas have been set to focus actions; they do not necessarily correspond to areas at risk in SEPA's flood map. The objectives below have been set for Girvan Potentially Vulnerable Area.

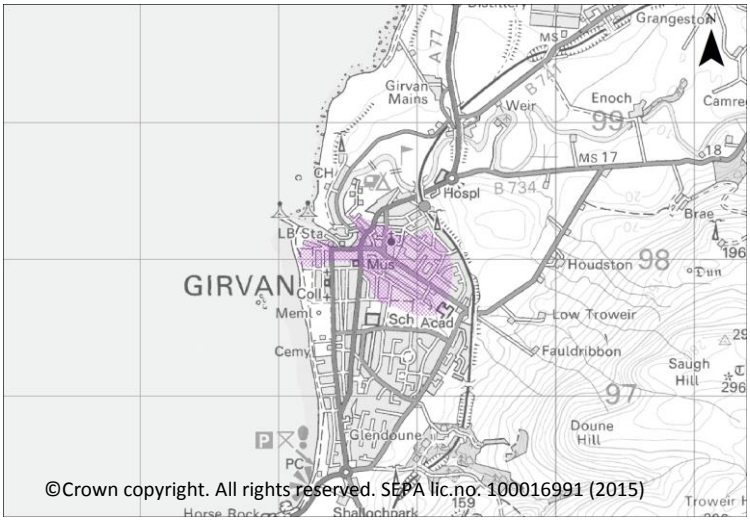
Reduce the risk of river and coastal flooding to residential properties and non-residential properties in Girvan

Indicators:

- 100 residential properties
- 30 non-residential properties
- £180,000 Annual Average Damages

Objective ID: 12032

Target area:



Target area	Objective	ID	Indicators within PVA
Applies across Ayrshire Local Plan District	Avoid an overall increase in flood risk	12039	• 110 residential properties • £220,000 Annual Average Damages
Applies across Ayrshire Local Plan District	Reduce overall flood risk	12082	• 110 residential properties • £220,000 Annual Average Damages
Applies across Ayrshire Local Plan District	Organisations such as Scottish Water, energy companies and Historic Environment Scotland actively maintain and manage their own assets, including the risk of flooding. These actions are not detailed further in the Flood Risk Management Strategies.		

Actions to manage flooding in Potentially Vulnerable Area 12/18

Actions describe where and how flood risk will be managed. These actions have been set by SEPA and agreed with flood risk management authorities following consultation. Selection of actions to deliver the agreed objectives was based on a detailed assessment and comparison of economic, social and environmental criteria. The actions shaded and then described below have been selected as the most appropriate for Girvan Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	Maintain flood warning	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Action (ID):	**FLOOD PROTECTION STUDY** (121030005)		
Objective (ID):	Reduce the risk of river and coastal flooding to residential properties and non-residential properties in Girvan (12032)		
Delivery lead:	North Ayrshire Council and South Ayrshire Council		
Priority:	National:	Within local authority:	
	8 of 168	**1 of 5**	
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	A shoreline management plan is recommended, this study is not limited to Potentially Vulnerable Areas but should cover the whole of the Ayrshire coastline and any areas beyond this which may be influenced by changes in coastal processes. The study should investigate flooding and coastal erosion, wave overtopping and the current coastal protection offered. The study will help to develop an understanding of coastal issues and identify where further work may be required to mitigate against flooding.		
Potential impacts			
Economic:	The study should consider how to reduce flood risk along the Ayrshire coastline. For the entire study area potential damages avoided are estimated to be up to £26 million.		
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community.		
Environmental:	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment.		

Action (ID):	**FLOOD PROTECTION STUDY** (120320005)		
Objective (ID):	Reduce the risk of river and coastal flooding to residential properties and non-residential properties in Girvan (12032)		
Delivery lead:	South Ayrshire Council		
Priority:	National:	Within local authority:	
	75 of 168	**1 of 3**	
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	The shoreline management plan for the Ayrshire coastline will help to provide a broad view of coastal issues and ensure potential mitigation actions will not create further issues elsewhere. A study is recommended to further investigate river flood risk combined with coastal flood risk to Girvan. This study should build on the work within the shoreline management plan to provide a detailed investigation of the current and future risk. The study should examine the most sustainable combination of actions to manage flooding.		
Potential impacts			
Economic:	The flood protection study should consider how to reduce flood risk to 99 residential properties and 15 non-residential properties in this location, with potential damages avoided of up to £4.7 million. The economic impact of natural flood management actions is difficult to define. However, these actions can reduce flood risk for high likelihood events. In this location, it has been estimated that 42 residential and non-residential properties could potentially benefit from natural flood management actions.		
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. In addition there are two utilities which have been identified as potentially benefitting from this action. Natural flood management actions can restore and enhance natural environments and create opportunities for recreation and tourism. There may be negative impacts through disturbance to the local community during the construction phase.		
Environmental:	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. This study is proposed for the Girvan Estuary (water body ID 200014). The physical condition of this estuary is identified by river basin management planning to be at less than good status. Future works could improve the condition of the estuary or degrade it. Opportunities to improve the condition of the estuary should be considered by coordinating with river basin management planning. There are no international, national or local level environmental designations that are likely to be impacted by this action. There is likely to be a loss of semi-natural habitats in the footprint of the storage. Downstream of the new structures there may be slight negative impacts on water quality through increased erosion and sedimentation on the Mill Burn. Introduction of a control structure may cause a build up of sediment in the Mill Burn, and potentially increased localised erosion on the Girvan Estuary. There is the potential for introduction of wetland habitats to the storage area, which would provide increased biodiversity to this suburban parkland		

Environmental:	area. There is likely to be a the loss of habitat and displacement of species in the short term during culvert modification works; however, these are likely to re-establish and return in the medium to long term. There is the potential for short term water quality impacts on the Girvan Estuary during works. There is the potential for impediment to fish passage from the introduction of a control structure. There is the potential for impacts on the local townscape in the area of Victory Park.

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (120820016)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	SEPA will seek to develop flood mapping in the Ayr to Ardrossan area to improve understanding of coastal flood risk. The extent and timing of improvements will depend on detailed scoping and data availability. Where this work coincides with local authority studies, SEPA will work collaboratively to ensure consistent modelling approaches are applied.		

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (120820019)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Scottish Water		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	Scottish Water will carry out an assessment of flood risk within the highest risk sewer catchments to improve knowledge and understanding of surface water flood risk.		

Action (ID):	**MAINTAIN FLOOD PROTECTION SCHEME** (120320017)		
Objective (ID):	Reduce the risk of river and coastal flooding to residential properties and non-residential properties in Girvan (12032)		
Delivery lead:	South Ayrshire Council		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	There are a number of sections of coastal defences in Girvan which provide some protection to the area. These defences will be maintained, and will continue to manage flooding according to the design standard at the time of construction. Levels of flood risk are likely to increase over time as a consequence of climate change.		

Action (ID):	**MAINTAIN FLOOD WARNING** (120820030)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Continue to maintain the Girvan Esplanade flood warning area which is part of the Firth of Clyde coastal flood warning scheme.		

Action (ID):	**FLOOD FORECASTING** (120820009)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 Responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	**SELF HELP** (120820011)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	—		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and Resilient Communities initiatives, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	**AWARENESS RAISING** (120820013)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Responsible authorities		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. From 2016 SEPA will engage with the community through local participation in national initiatives, including partnership working with Neighbourhood Watch Scotland. In addition, SEPA will engage with local authorities and community resilience groups where possible. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

Action (ID):	**MAINTENANCE** (120820007)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	South Ayrshire Council, asset / land managers		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. They produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk.		

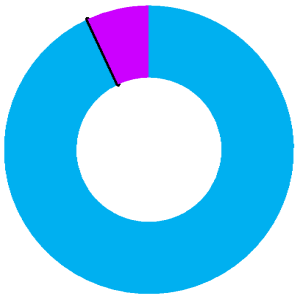
Action (ID):	**EMERGENCY PLANS/RESPONSE** (120820014)		
Objective (ID):	Reduce overall flood risk (12082)		
Delivery lead:	Category 1 and 2 Responders		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (120390001)		
Objective (ID):	Avoid an overall increase in flood risk (12039) Reduce overall flood risk (12082)		
Delivery lead:	Planning authority		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		

Dalmellington (Candidate Potentially Vulnerable Area 12/19c)

Local Plan District	Local authority	Main catchment
Ayrshire	South Ayshire Council	Muck Water

Summary of flooding impacts



At risk of flooding

- 50 residential properties
- 40 non-residential properties
- £140,000 Annual Average Damages

(damages by flood source shown left)

Summary of objectives to manage flooding

Objectives have been set by SEPA and agreed with flood risk management authorities. These are the aims for managing local flood risk. The objectives have been grouped in three main ways: by reducing risk, avoiding increasing risk or accepting risk by maintaining current levels of management.

Many organisations, such as Scottish Water and energy companies, actively maintain and manage their own assets including their risk from flooding. Where known, these actions are described here. Scottish Natural Heritage and Historic Environment Scotland work with site owners to manage flooding where appropriate at designated environmental and/or cultural heritage sites. These actions are not detailed further in the Flood Risk Management Strategies.

Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

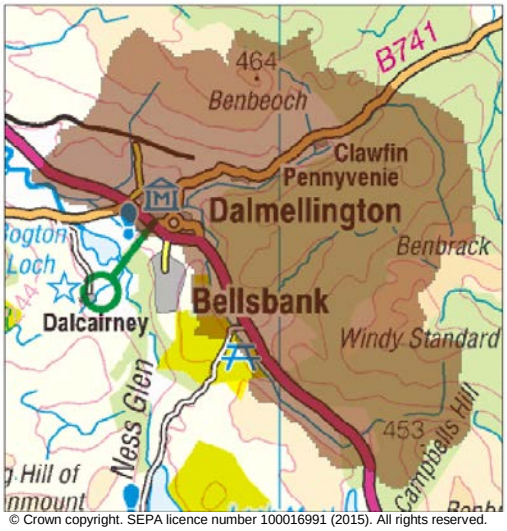
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	*Maintain flood warning*	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	*Strategic mapping and modelling*	Flood forecasting	Self help	Maintenance	Planning policies

Dalmellington (Candidate Potentially Vulnerable Area 12/19c)

Local Plan District	Local authorities	Main catchment
Ayrshire	East Ayrshire Council	Muck Water

Background

This candidate Potentially Vulnerable Area is located to the south of the Ayrshire Local Plan District around Dalmellington and is approximately 35km^2 (shown below).



There are approximately 50 residential properties and 40 non-residential properties at risk of flooding. The total Annual Average Damages are approximately £140,000.

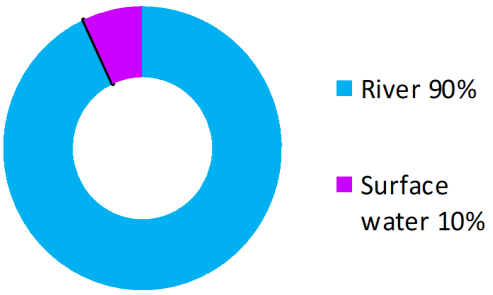


Figure 1: Annual Average Damages by flood source

Summary of flooding impacts

This area was not originally identified as a Potentially Vulnerable Area in 2011. However, updated information on flood risk from the new hazard maps identified that this area should be regarded as a candidate Potentially Vulnerable Area due to the risk to people and properties.

River flooding poses the largest flood risk to the area, with the majority being to residential properties within Dalmellington. The Muck Water flows from the south of through a steep forest area parallel to the A713 before flowing through Dalmellington after which it joins the River Doon. The Linn Water originates in forests to the north and flows around Dalmellington. The Linn Water joins the Muck Water to the south west of the town before joining the River Doon. The River Doon flows to the south of the candidate Potentially Vulnerable Area boundary where there is a wide floodplain at Bogton Loch. The largest area of flood risk is to the south west of Dalmellington near the confluence of the three watercourses. There are sections of road and rail infrastructure at risk of flooding (notably the A713 and B741).

There are a small number of isolated areas at risk of surface water flooding and these are predominantly in rural locations.

The risk of flooding to people and property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1. The damages associated with floods of different likelihood are shown in Figure 2.

Damages to residential properties experience the highest economic impact at approximately 60% of the damages.

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 50 to 60.

The location of the impacts of flooding is shown in Figure 3.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 810)	20	50	50
Non-residential properties (total 210)	30	40	40
People	50	110	110
Community facilities	0	<10 Emergency services	<10 Emergency services
Utilities assets	<10	<10	<10
Transport links – road (km)	1.1	1.6	2.5
Transport links - rail (km)	0.1	0.1	0.1
Environmental designated areas (km^2)	0.1	0.2	0.2
Designated cultural heritage sites	2	2	2
Agricultural land (km^2)	0.5	0.7	1.2

Table 1: Summary of flooding impacts[1]

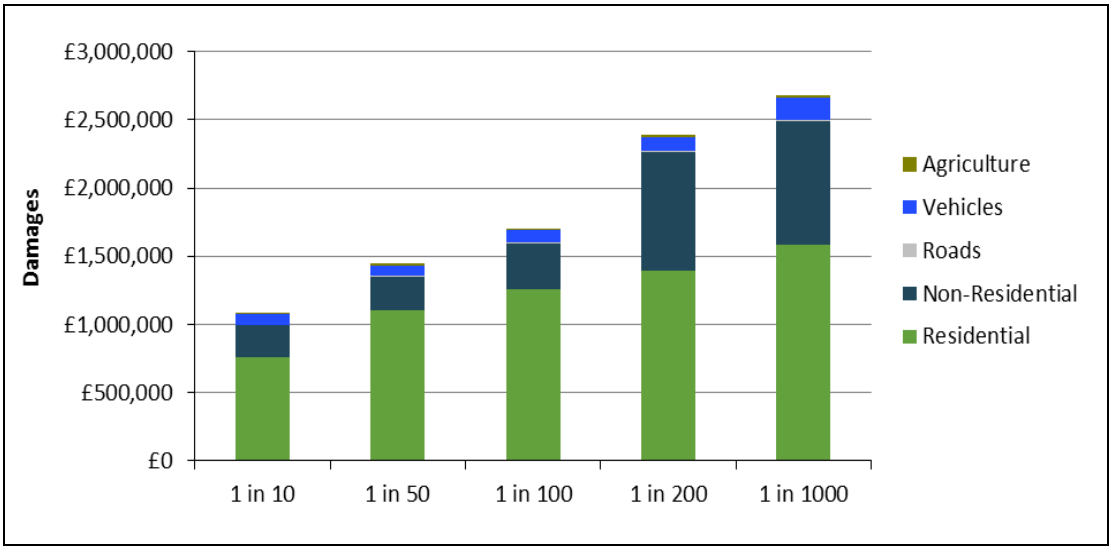


Figure 2: Damages by flood likelihood

[1] Some receptors are counted more than once if flooded from multiple sources

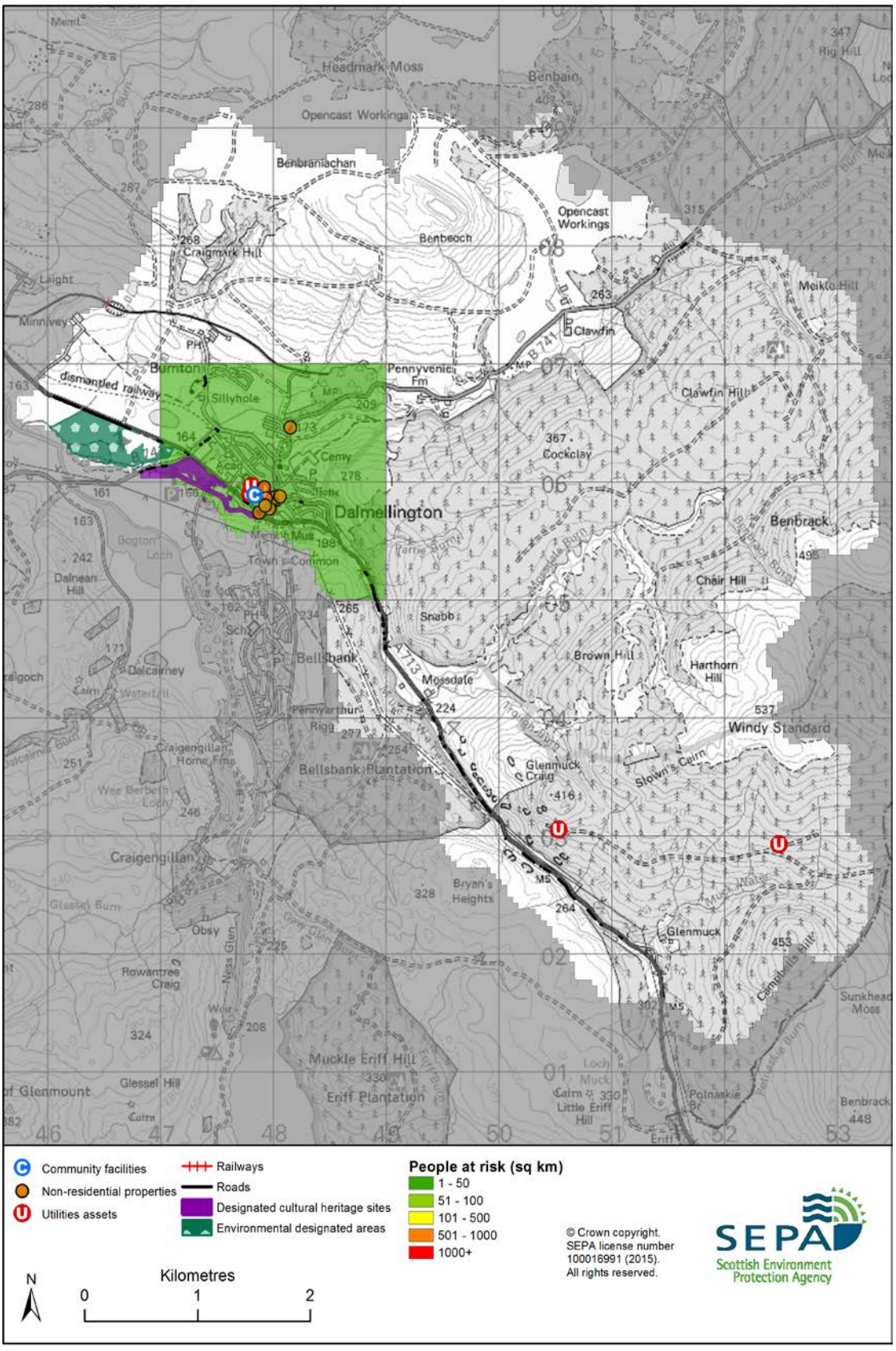


Figure 3: Impacts of flooding

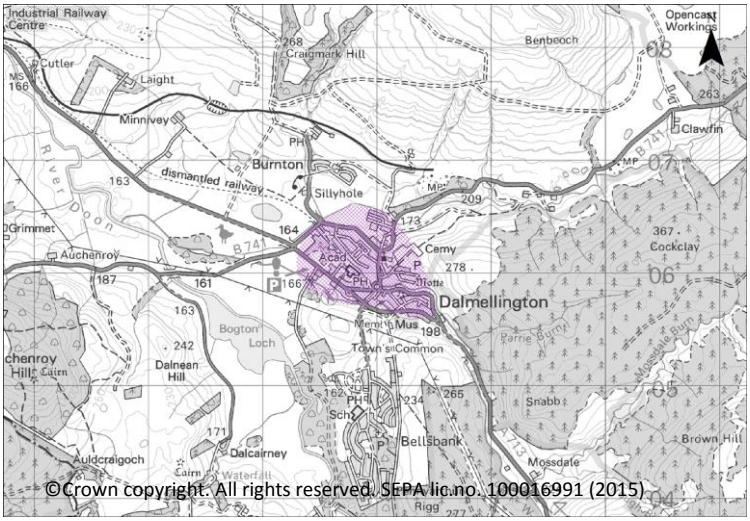
History of flooding

There is a limited local history of flooding. Flooding from the Muck Water in 2009 resulted in overtopping of the B741 Bridge and closure of the B741. Further records of flooding from the Muck Water and the River Doon resulted in flooding to agricultural land and roads but there was little damage to properties reported.

Objectives to manage flooding in Potentially Vulnerable Area 12/19c

Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target areas have been set to focus actions; they do not necessarily correspond to areas at risk in SEPA's flood map. The objectives below have been set for Dalmellington Candidate Potentially Vulnerable Area.

Reduce the risk of flooding from the Muck Water, to residential properties in Dalmellington

Indicators:	Target area:
• 40 residential properties • £81,000 Annual Average Damages	
Objective ID: 12033	

Target area	Objective	ID	Indicators within PVA
Applies across Ayrshire Local Plan District	Avoid an overall increase in flood risk	12039	• 50 residential properties • £140,000 Annual Average Damages
Applies across Ayrshire Local Plan District	Reduce overall flood risk	12101	• 50 residential properties • £140,000 Annual Average Damages
Applies across Ayrshire Local Plan District	Organisations such as Scottish Water, energy companies and Historic Environment Scotland actively maintain and manage their own assets, including the risk of flooding. These actions are not detailed further in the Flood Risk Management Strategies.		

Actions to manage flooding in Potentially Vulnerable Area 12/19c

Actions describe where and how flood risk will be managed. These actions have been set by SEPA and agreed with flood risk management authorities following consultation. Selection of actions to deliver the agreed objectives was based on a detailed assessment and comparison of economic, social and environmental criteria. The actions shaded and then described below have been selected as the most appropriate for Dalmellington Candidate Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	*Maintain flood warning*	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	*Strategic mapping and modelling*	Flood forecasting	Self help	Maintenance	Planning policies

Action (ID):	**FLOOD PROTECTION STUDY** (120330005)		
Objective (ID):	Reduce the risk of flooding from the Muck Water, to residential properties in Dalmellington (12033)		
Delivery lead:	East Ayrshire Council		
Priority:	National:	Within local authority:	
	110 of 168	**3 of 4**	
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	A study is recommended to further investigate the feasibility of a flood protection scheme along the Muck Water, focusing on sections of river walls. Other actions may also be considered to select the most sustainable combination of actions.		
Potential impacts			
Economic:	The flood protection study should consider how to reduce flood risk to 14 residential properties in this location, with potential damages avoided of up to £2.8 million.		
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community and socially vulnerable people located within the flood protection study area. There may be negative impacts through disturbance to the local community during the construction phase and changes in visual amenity and land use as a result of this action.		
Environmental:	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. There is likely to be a loss of semi-natural habitats and displacement of species in the footprint and vicinity of the defences. There is the potential for negative impacts on local water quality		

Environmental:	downstream of works during the construction period, which has the potential for slight temporary impacts on the Dalmellington Moss Site of Special Scientific Interest. There is the potential for impacts on the setting of the Dalmellington Heritage Conservation Area and the Doon Tavern and Dalmellington Inn listed buildings.

Action (ID):	**FLOOD FORECASTING** (121010009)		
Objective (ID):	Reduce overall flood risk (12101)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 Responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	**SELF HELP** (121010011)		
Objective (ID):	Reduce overall flood risk (12101)		
Delivery lead:	—		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and Resilient Communities initiatives, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	**AWARENESS RAISING** (121010013)		
Objective (ID):	Reduce overall flood risk (12101)		
Delivery lead:	Responsible authorities		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. From 2016 SEPA will engage with the community through local participation in national initiatives, including partnership working with Neighbourhood Watch Scotland. In addition, SEPA will engage with local authorities and community resilience groups where possible. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

Action (ID):	**MAINTENANCE** (121010007)		
Objective (ID):	Reduce overall flood risk (12101)		
Delivery lead:	South Ayrshire Council, asset / land managers		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. They produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk.		

Action (ID):	**EMERGENCY PLANS/RESPONSE** (121010014)		
Objective (ID):	Reduce overall flood risk (12101)		
Delivery lead:	Category 1 and 2 Responders		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (120390001)		
Objective (ID):	Avoid an overall increase in flood risk (12039) Reduce overall flood risk (12101)		
Delivery lead:	Planning authority		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		

Flood Risk Management Strategy

Ayrshire Local Plan District

This section provides supplementary information on the characteristics and impacts of river, coastal and surface water flooding. Future impacts due to climate change, the potential for natural flood management and links to river basin management are also described within these chapters.

Detailed information about the objectives and actions to manage flooding are provided in Section 2.

Section 3: Supporting information

3.1 Introduction

In the Ayrshire Local Plan District, river flooding is reported across three distinct river catchments. Coastal flooding and surface water flooding are reported across the whole Local Plan District.

A summary of the number of properties and Annual Average Damages from river, coastal and surface water flooding is outlined in Table 1.

	Total number of properties at risk[1]	Annual Average Damages	Local authority
River catchments			
Doon catchment group	730	£1.6 million	Dumfries and Galloway Council, East Ayrshire Council, South Ayrshire Council.
Irvine and Ayr catchment group	5,900	£10 million	Dumfries and Galloway Council, East Ayrshire Council, East Renfrewshire Council, North Ayrshire Council, Renfrewshire Council, South Ayrshire Council South Lanarkshire Council.
Isle of Arran catchment group	110	£170,000	North Ayrshire Council
Coastal flooding			
Ayrshire coastal area	1,500	£1.3 million	East Ayrshire Council, North Ayrshire Council, South Ayrshire Council.
Surface water flooding			
Ayrshire Local Plan District	3,100	£3.2 million	Dumfries and Galloway Council, East Ayrshire Council, East Renfrewshire Council, North Ayrshire Council, Renfrewshire Council, South Lanarkshire Council South Ayrshire Council.

Table 1: Summary of flood risk from various sources within the Ayrshire Local Plan District

[1] Total number of residential and non-residential properties at risk of flooding.

3.2 River flooding

Ayrshire Local Plan District

This section provides supplementary information on river flooding at the catchment level. It provides an overview of the catchment's natural characteristics, flood risk and the existing actions to manage flooding. It outlines the likely impact of climate change and the potential for natural flood management.

Detailed information about the objectives and actions to manage flooding are provided in Section 2.

In the Ayrshire Local Plan District, river flooding is reported across three distinct river catchments, shown below.

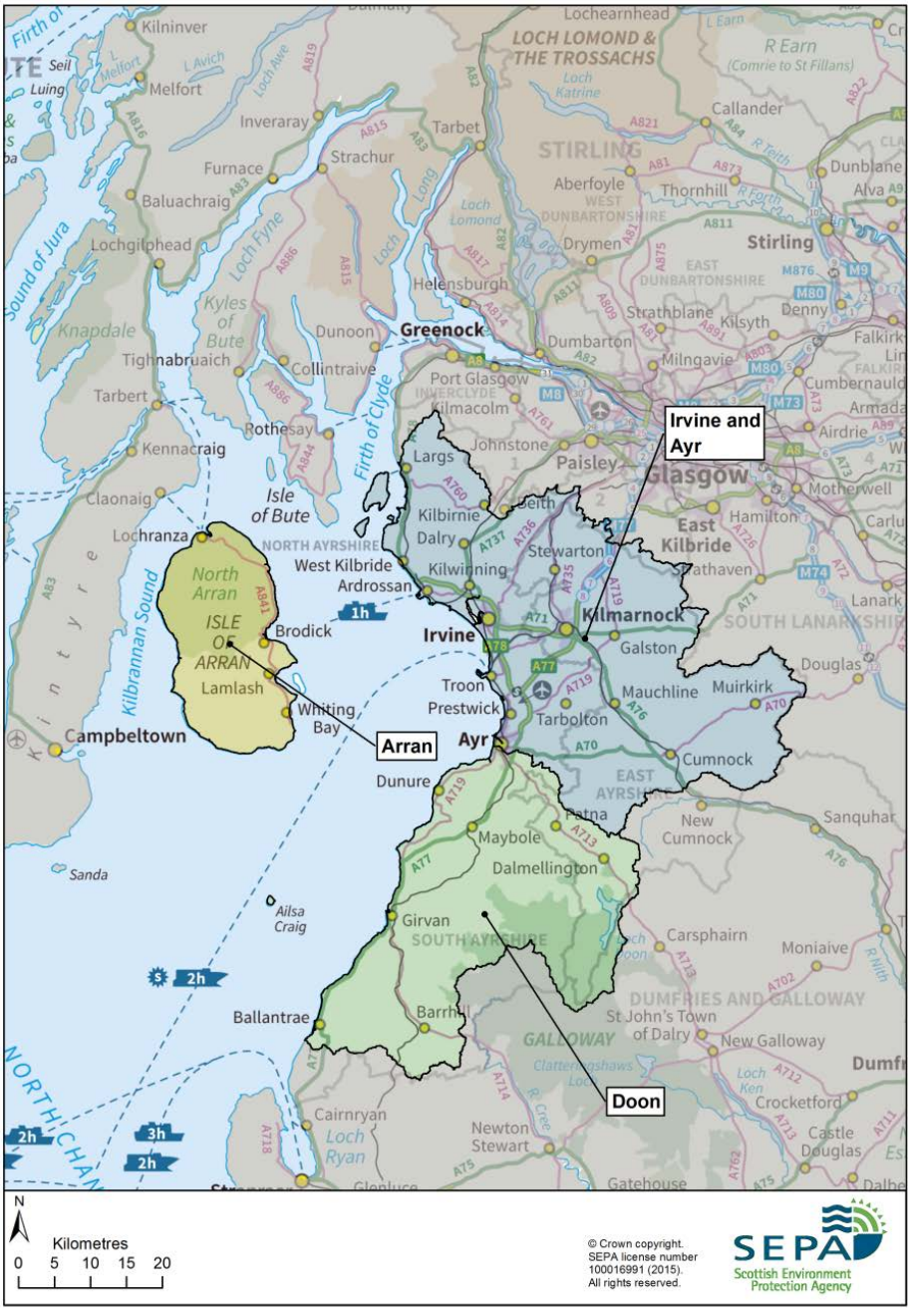


Figure 1: River catchments within the Ayrshire Local Plan District

River flooding
Doon catchment group

Catchment overview

The River Doon catchment group is located in the Ayrshire Local Plan District and covers an area of over 1,080km^2. The catchment area is over 97% rural with less than 3% of the area identified as urban and an approximate population of 46,000. This catchment group includes areas of three local authorities; Dumfries and Galloway Council, East Ayrshire Council and South Ayrshire Council.

There are three main river catchments within the area: the River Doon, the Water of Girvan and the River Stinchar. The River Doon catchment is located in the north of the area where it flows through a number of small settlements and towns including Dalmellington, Patna, Dalrymple, and Alloway before discharging to the sea at Doonfoot. The Water of Girvan catchment is central in this catchment group, where it receives a number of tributaries and flows through Straiton, Kirkmichael and Dailly, before entering the sea at Girvan. The River Stinchar catchment dominates the south of the Doon catchment group, where it flows in a south westerly direction through Barr, Pinwheery and Colmonell before entering the sea at Ballantrae.

The average annual rainfall in the area broadly typical for Scotland, with values ranging between 1,359mm and 1,566mm in the lowland areas to 1,636mm and 1,803mm in the upper parts of the catchment.

Flood risk in the catchment

Approximately 600 residential properties are predicted to be at risk of river flooding, 64% of which are located within a Potentially Vulnerable Area and an additional 10% in candidate Potentially Vulnerable Areas. Approximately 130 non-residential properties are predicted to be at risk of river flooding, 41% of which are located within a Potentially Vulnerable Area. There are seven Potentially Vulnerable Areas within this catchment area and one candidate Potentially Vulnerable Area as shown in Figure 1:

- Ayr east (12/12)
- Ayr south (12/13)
- Dalrymple to Patna (12/15)
- Straiton (12/16)
- Dailly (12/17)
- Girvan (12/18)
- Dalmellington (12/19c).

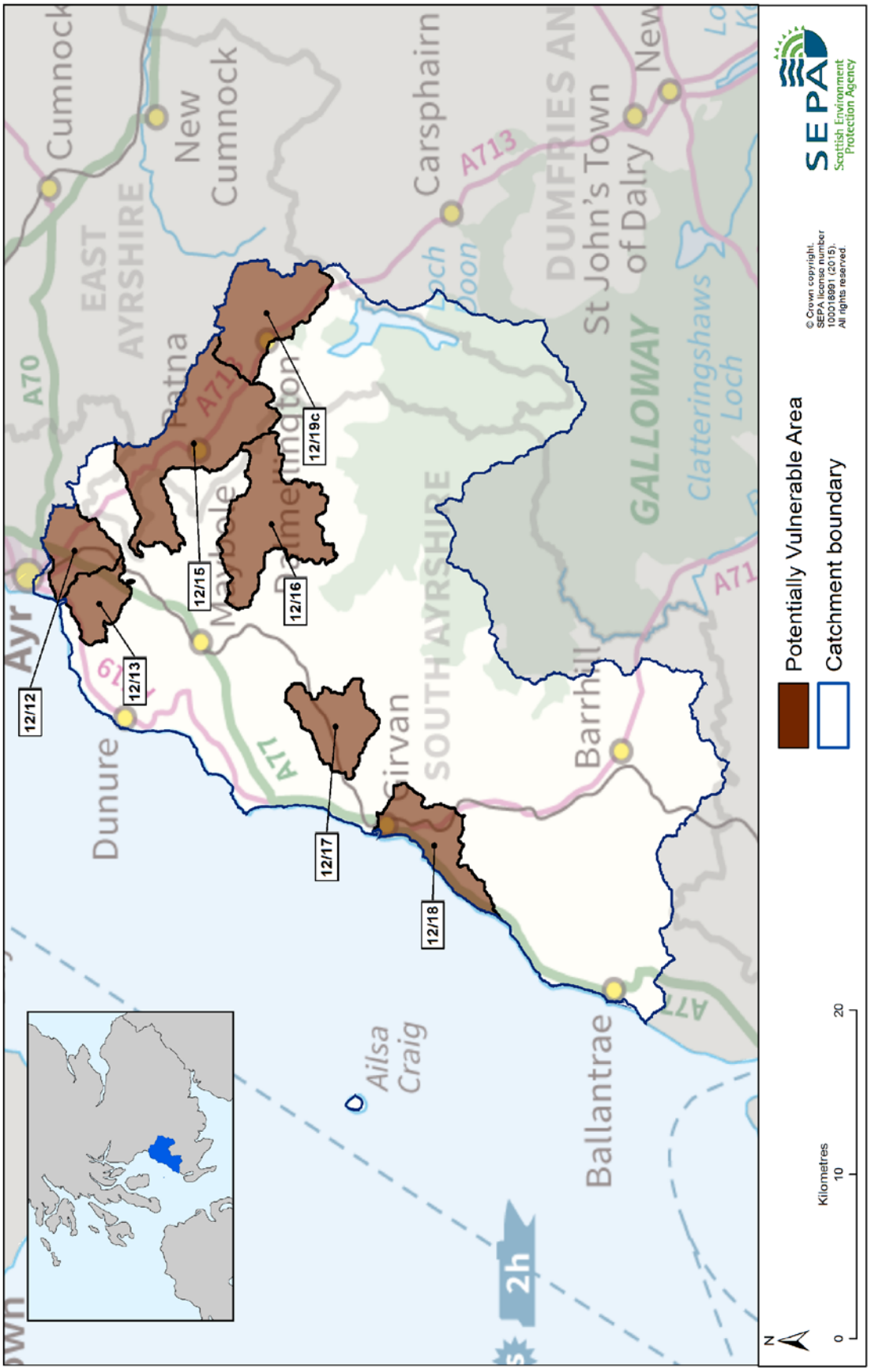


Figure 1: River catchment for the Doon catchment group

Main areas at risk

The main areas at risk of river flooding can be seen in Table 1, which shows the number of properties at risk and the Annual Average Damages caused by river flooding. This includes damages to residential and non-residential properties, transport and agriculture. Ayr and Dalrymple are the main areas at risk from river flooding.

	Residential and non-residential properties at risk of river flooding	Annual Average Damages
Ayr	170	£370,000
Dalrymple	140	£170,000
Girvan	130	£220,000
Dalmellington	80	£110,000
Kirkmichael	40	£64,000
Barr	20	£60,000
Barrhill	10	£46,000

Table 1: Main areas at risk of river flooding

Economic activity and infrastructure at risk

The Annual Average Damages caused by river flooding in the Doon catchment group are approximately £1.6 million, which accounts for almost 13% of the estimated Annual Average Damages from river flooding within the Ayrshire Local Plan District. The damages are distributed as follows:

- 75% residential properties (£1.2 million)
- 8% non-residential properties (£120,000)
- 6% emergency services (£98,000)
- 4% roads (£65,000)
- 4% agriculture (£63,000)
- 3% vehicles (£40,000).

Figure 2 shows the distribution of Annual Average Damages throughout the catchment group. The highest concentration of damages can be seen in south of Ayr, Barr, Barrhill and Dalrymple.

Please note that economic damages to rail were not assessed as information on damages at a strategic scale is not available.

Table 2 shows further information about infrastructure and agricultural land at risk of flooding within this catchment.

	Number at risk	Further detail
Community facilities	<10	Includes: educational buildings and emergency services
Utility assets	10	Includes: electricity substations and Scottish Water assets
Roads (km)	6.6	Notably: A77 between Prestwick and Girvan, A713
Railway routes (km)	1.0	Railway between Minishant, Girvan and Wallacetown
Agricultural land (km²)	27	

Table 2: Infrastructure and agricultural land at risk of river flooding

Designated environmental and cultural heritage sites at risk

Within the catchment group it is estimated that approximately 25 designated cultural heritage sites are at risk of river flooding. These sites include; scheduled monuments, gardens and designed landscapes and listed buildings.

Approximately 13 km^2 of environmental designated area is at risk of river flooding. This includes Special Areas of Conservation (<1km^2), Special Protection Areas (<1km^2) and Sites of Special Scientific Interest (11km^2).

History of flooding

There is a long history of flooding within the Doon catchment group which tends to have localised impact on properties with more widespread flooding in agricultural areas. The River Doon has been known to flood land and roads in Dalmellington and Patna, most recently in November 2009 with flooding also occurring from the Muck Water resulting in road closures.

Levels on the River Doon in October 1977 were identified as the highest recorded levels on the river at that time.

The earliest and most significant flooding recorded in the area occurred in 1814 when snow melt coincided with an already swollen River Doon to cause flooding to properties in Dalrymple with depths greater than one metre reported in some places.

Further detail about the history of flooding in this area is available in the relevant Potentially Vulnerable Area chapters of this document.

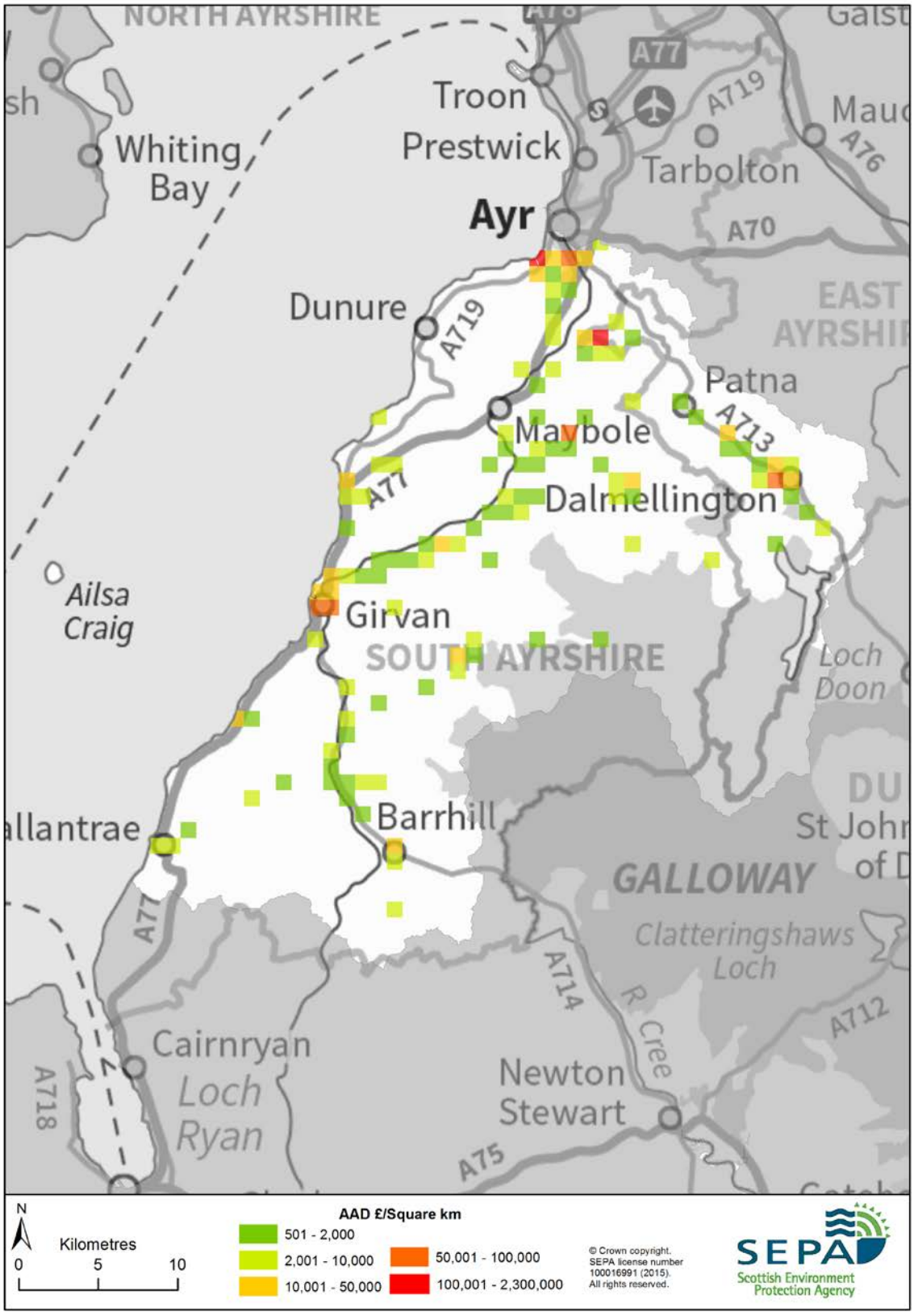


Figure 2: Annual Average Damages from river flooding

Managing flood risk

A range of public bodies have responsibility for managing flood risk in Scotland and they are working closer than ever before to target action in the areas where the greatest benefit can be gained. Members of the public also have a role to play and are the first line of defence against flooding by taking action to protect themselves and their property from flooding. Further information about roles and responsibilities is provided in Section 1.

Climate change and future flood risk

The UK Climate Projections (UKCP09) predicts that climate change may lead to warmer and drier summers, warmer and wetter winters with less snow, and more extreme temperature and rainfall. The predicted increase in rainfall and river flows may increase the potential for river flooding.

Under the UKCP09 high emissions scenario for 2080, average peak river flows for the Isle of Arran catchment may increase by 44%[1]. This would potentially increase the number of residential properties at risk of river flooding from approximately 600 to 760 and the number of non-residential properties from approximately 130 to 150.

The predicted increases in flood risk are solely based on the impact of a changing climate on the magnitude of flooding; they do not take into account any potential increase due to population change, development pressures or urban creep, nor do they take into account any mitigation as a result of actions contained in this or future Flood Risk Management Strategies.

Potential for natural flood management

The assessment of the potential for natural flood management is shown on SEPA's flood maps (http://www.sepa.org.uk/environment/water/flooding/flood-maps/). The maps indicate the potential for wave attenuation and estuarine surge attenuation. They show areas where natural flood management could be effective and where further detailed assessment should take place. This information was used to identify where local authorities could include natural flood management as part of flood risk management schemes and studies. The proposed schemes and studies are listed in the relevant Potentially Vulnerable Area chapters of this document.

Runoff reduction

Scattered locations throughout the catchment group show potential for runoff reduction. Large areas of high potential have been identified to the east of Carrick Forest in close proximity to Barr, which is at risk from river flooding. There are also areas of potential runoff reduction in proximity upstream of Girvan and Ayr.

Floodplain storage

There are potential areas for floodplain storage identified on the River Doon, upstream of Patna. Downstream of this area the Doon contributes to flood risk within the Dalrymple and Doonfoot areas.

[1] From the study 'An assessment of the vulnerability of Scotland's river catchments and coasts to the impacts of climate change' (CEH, 2011)

The Water of Girvan has medium and high potential areas for floodplain storage between Crosshill and Girvan. Incorporating flood storage has the potential to reduce flood risk in areas such as Girvan, Old Dailly and Dailly.

Areas with floodplain storage potential are also identified along the River Stinchar between Colmonell and Pinwherry and between Asselfoot and Barr. The River Stinchar contributes to flood risk downstream in Ballantrae and Colmonell.

Sediment management

Most deposition occurs along the River Doon between Dalcairney and Patna. Upstream of Girvan, which is an area identified at risk due to river flooding, the Water of Girvan appears stable with balanced areas of erosion and deposition. Other smaller tributaries in the area appear mostly balanced apart from some notable areas of erosion which occur near Carrick Forest, Macaterick, Mullwharchar, along Ness Glen and Glenalla Fell. Incorporating sediment management measures in these tributaries may potentially reduce flood risk downstream.

River flooding
Irvine and Ayr catchment group

Catchment overview

The Irvine and Ayr catchment group is located within the Ayrshire Local Plan District, covering an area of approximately 1,500km^2. The area is almost 94% rural with the remainder urban, and an approximate population of 330,000. This catchment group includes areas of seven local authorities; Dumfries and Galloway Council, East Ayrshire Council, East Renfrewshire Council, North Ayrshire Council, Renfrewshire Council, South Lanarkshire Council and South Ayrshire Council.

There are three main river catchments which are the River Garnock, the River Irvine and the River Ayr. The River Garnock is the main river catchment in the north of the catchment group, flowing south through the towns of Kilbirnie, Glengarnock, Dalry, and Kilwinning before joining the River Irvine and entering the sea at Irvine harbour. The River Irvine is the main river catchment in the centre of the catchment group, flowing east to west, passing through Newmilns, Galston, Kilmarnock and Irvine, before discharging to the sea at Irvine. The River Ayr catchment dominates the south of the catchment group and flows in the same direction as the River Irvine through Muirkirk, Catrine and Annbank before entering the sea at Ayr.

The average annual rainfall in this area is broadly typical for Scotland, ranging between 1,211mm and 1,552mm in the lowland areas to 1,294 and 1,756mm in the upper parts of the catchment.

Flood risk in the catchment

Approximately 4,700 residential properties are predicted to be at risk of river flooding, 96% of which are located within a Potentially Vulnerable Area. Approximately 1,200 non-residential properties are predicted to be at risk of river flooding, 93% of which are located within a Potentially Vulnerable Area. There are 10 Potentially Vulnerable Areas at risk of river flooding situated within this catchment as shown in Figure 1:

- Noddsdale Water (12/01)
- Largs to Stevenston (12/03)
- Upper Garnock catchment (12/04)
- Kilwinning (12/05)
- River Irvine and Annick Water catchments (12/06)
- Irvine to Troon (12/07)
- Prestwick and Ayr (12/09)
- Pow Burn catchment (12/10)
- River Ayr catchment (12/11)
- Cumnock and Catrine (12/14).

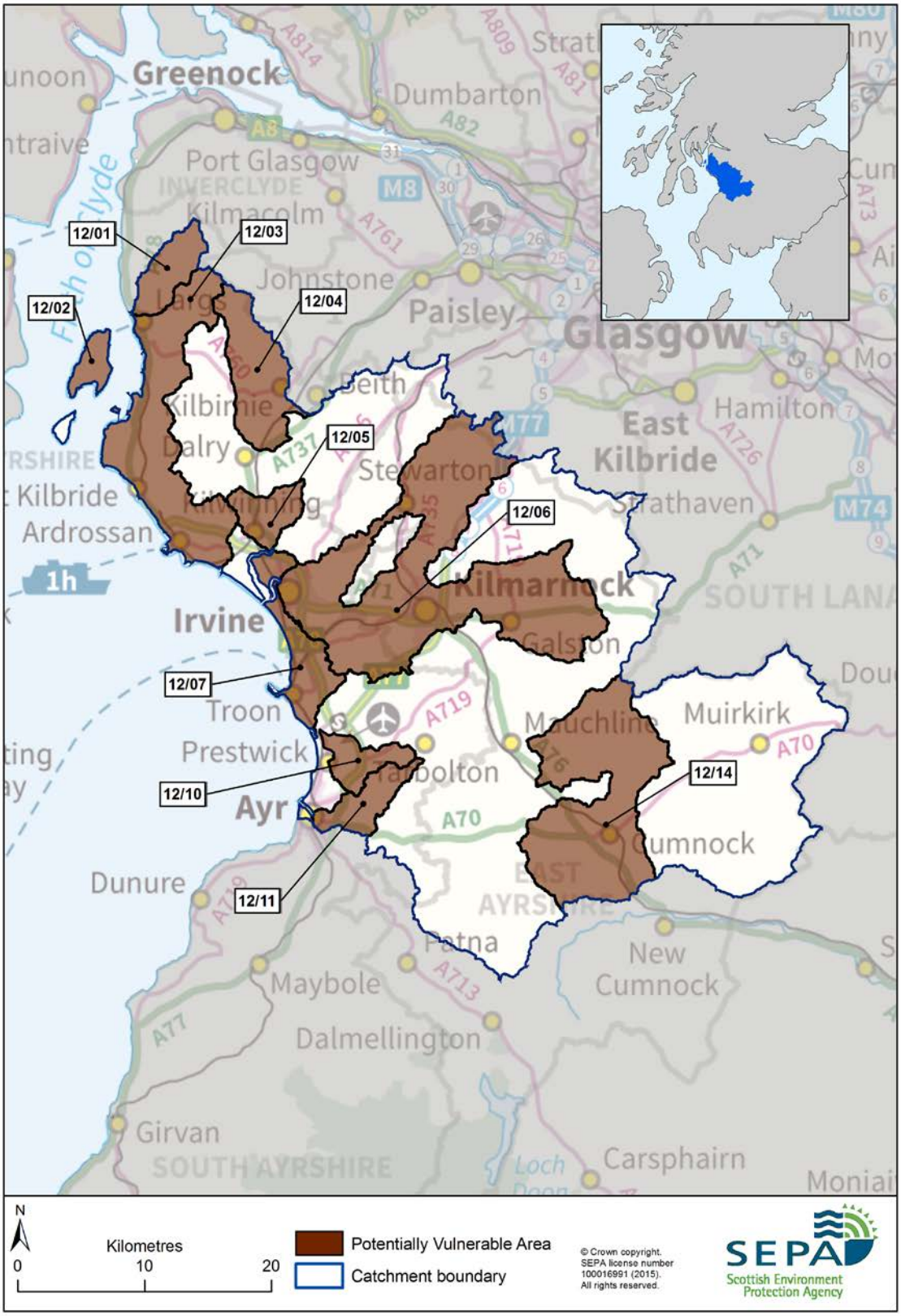


Figure 1: River catchment for the Irvine and Ayr catchment group

Main areas at risk

The main areas at risk of river flooding can be seen in Table 1, which shows the number of properties at risk and the Annual Average Damages caused by river flooding. This includes damages to residential and non-residential properties, transport and agriculture. Irvine has been identified as the main area at risk.

	Residential and non-residential properties at risk of river flooding	Annual Average Damages
Irvine (including Dreghorn)	1,700	£4.5 million
Kilmarnock (including Hurlford)	820	£940,000
Kilbirnie	790	£710,000
Prestwick / Ayr	480	£1.0 million
Galston	380	£130,000
Newmilns / Greenholm	310	£370,000
Catrine	210	£270,000
Kilwinning	90	£240,000
Lochwinnoch	90	£150,000
Troon / Barassie	90	£130,000
Stevenston	80	£120,000
Cumnock / Logan	70	£160,000
Dalry	50	£370,000

Table 1: Main areas at risk of river flooding

Economic activity and infrastructure at risk

The Annual Average Damages from river flooding are estimated to be approximately £10 million, which accounts for approximately 86% of the estimated Annual Average Damages from river flooding within the Local Plan District. The damages are distributed as follows:

- 63% residential properties (£6.6 million)
- 23% non-residential properties (£2.4 million)
- 5% emergency services (£560,000)
- 4% roads (£400,000)
- 3% vehicles (£300,000)
- 2% agriculture (£100,000).

Figure 2 shows the distribution of Annual Average Damages throughout the catchment. The figure shows that the greatest concentrations of damages are in Kilmarnock, Irvine, Kilbirnie and Prestwick.

Table 2 shows further information about infrastructure and agricultural land at risk of flooding within this catchment.

	Number at risk	Further detail
Community facilities	20	Includes: educational buildings, emergency services and healthcare facilities
Utility assets	80	Includes: electricity substations, telecommunications, oil refining, gas regulating, mineral and fuel extraction and gas production and distribution
Roads (km)	19.7	Notably: A71 at Kilmarnock, Newmilns and Darvel A78 in Largs and Stevenston A737 in Irvine A76 between Cumnock and Kilmarnock A77 M77 to Kilmarnock from Glasgow
Railway routes (km)	4.7	Kilmarnock to New Cumnock Glengarnock to Stevenston West Kilbride in the north-west of the area.
Agricultural land (km^2)	50	

Table 2: Infrastructure and agricultural land at risk of river flooding

Designated environmental and cultural heritage sites at risk

Within the catchment there are approximately 32 designated cultural heritage sites are at risk of river flooding. These sites include scheduled monuments, gardens and designed landscapes and listed buildings. Approximately 6km^2 of environmental designated areas are at risk of river flooding. This includes Special Areas of Conservation (<1km^2), 1 Special Protection Area (2km^2) and Sites of Special Scientific Interest (4km^2).

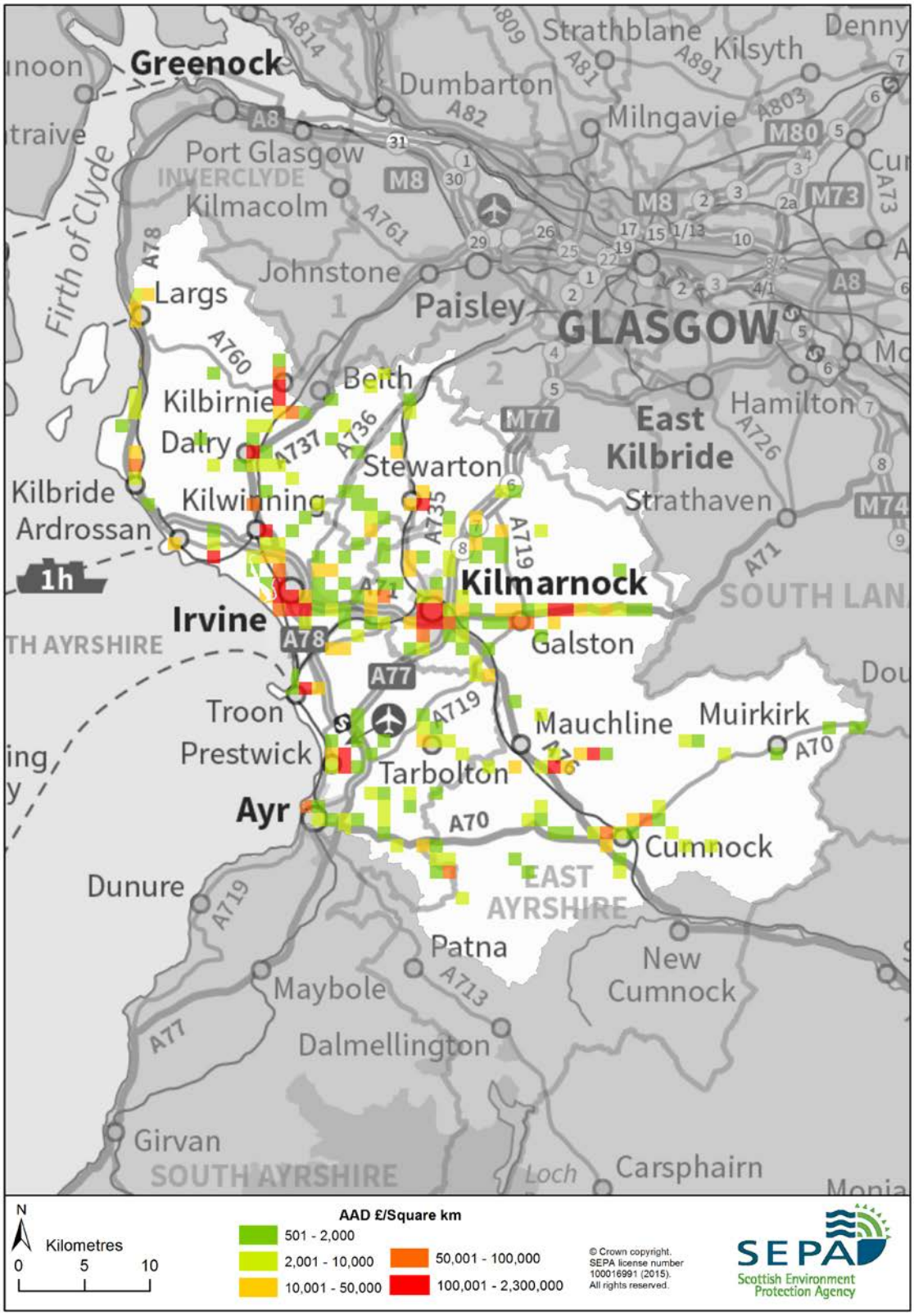


Figure 2: Annual Average Damages from river flooding

History of flooding

There has been a long history of flooding impacting properties and people in this catchment group. The greatest damage from flooding occurred in Kilbirnie and Glengarnock where on three occasions (9 August 2004, 1 August 2008 and 28 September 2010) flooding from the River Garnock and tributaries caused flooding to a large number of properties and roads, further downstream there has also been regular flooding recently. In October 2013 the Bannoch Burn flooded Kilwinning with records showing that since 2004 there have been three incidents of flooding at this location.

There is also the potential for significant infrastructure disruption due to flooding in this area as seen when Prestwick International Airport was closed on the 20 December 2012. This was due heavy rain causing the Pow Burn to burst its banks. This flooding was combined with surface water flooding.

The most recent flooding within the catchment group occurred on 22 December 2014 with flooding from the River Irvine and Kilmarnock Water caused damage to properties including a retail park in Kilmarnock.

The earliest flood was recorded in 1739 in Ayr, and there was a significant regional flooding in 1852 with flooding to towns along the River Irvine and Kilmarnock Water including, Galston, Newmills,and Kilmarnock. Water levels were reported up to horse head level. Since then flooding has occurred on a number of occasions in Kilmarnock with some of the most notable flooding reported in January 1932 when 150 families were rescued after due to flooding from the River Irvine and Kilmarnock Water.

Further detail about the history of flooding in this area is available in the relevant Potentially Vulnerable Area chapters of this document.

Managing flood risk

A range of public bodies have responsibility for managing flood risk in Scotland and they are working more closely than ever before to target action in the areas where the greatest benefit can be gained. Members of the public also have a role to play and are the first line of defence against flooding by taking action to protect themselves and their property from flooding. Further information about roles and responsibilities is provided in Section 1.

This section describes the existing actions that are in place to manage flood risk and are in addition to the information presented in the relevant Potentially Vulnerable Area chapter of this document.

Flood protection schemes

East Ayrshire Council has completed a number of flood protection schemes within the catchment group area including:

- Formal flood defences in Galston consisting of clad sheet pile walls and earth embankments on the River Irvine in Crookedholm and the Burn Anne (2008)
- Kilmarnock is defended by clad sheet pile walls, constructed on the Kilmarnock Water, 1998, and on the River Irvine in 2000;

- Attenuation ponds at Milton and Galston were constructed to relieve localised flooding issues.

North Ayrshire Council has completed two flood protection schemes within the catchment group area including:

- A low earth bund constructed along the banks of the River Irvine to reduce the risk of flooding to Waterside to a 1 in 20 year return period, based on the Waterside flood risk management study.
- A formal defence scheme in Glengarnock constructed in 1973.

River flood warning schemes

SEPA operates a flood warning scheme in the Irvine and Ayr catchment group area. Flood Warnings are issued when river flooding is forecast for the flood warning areas. There are two river flood warning areas which are Irvine Waterside / Low Green in Irvine and Queen's Drive, New Mill Road and Samson Avenue in Kilmarnock, as shown in Figure 3 and Table 3. Table 3 shows the total number of properties in the flood warning area and the percentage of those properties that have signed up to receive flood warnings. Note that this is not the number of properties at risk of flooding.

Flood warning area (FWA)	River	Properties within FWA	% of properties registered May 2014
Irvine Waterside / Low Green (Irvine)	Irvine	30	47%
Queen's Drive, New Mill Road and Samson Avenue (Kilmarnock)	Irvine	180	12%

Table 3: Flood warning areas

North Ayrshire Council is currently working in partnership with SEPA to develop a flood warning scheme for the Upper Garnock. As part of its flood warning service development, SEPA aims to provide a new river flood warning scheme for the River Garnock by the end of 2016 with objectives of reducing the impact of flooding and improving the preparedness and response of communities and responders.

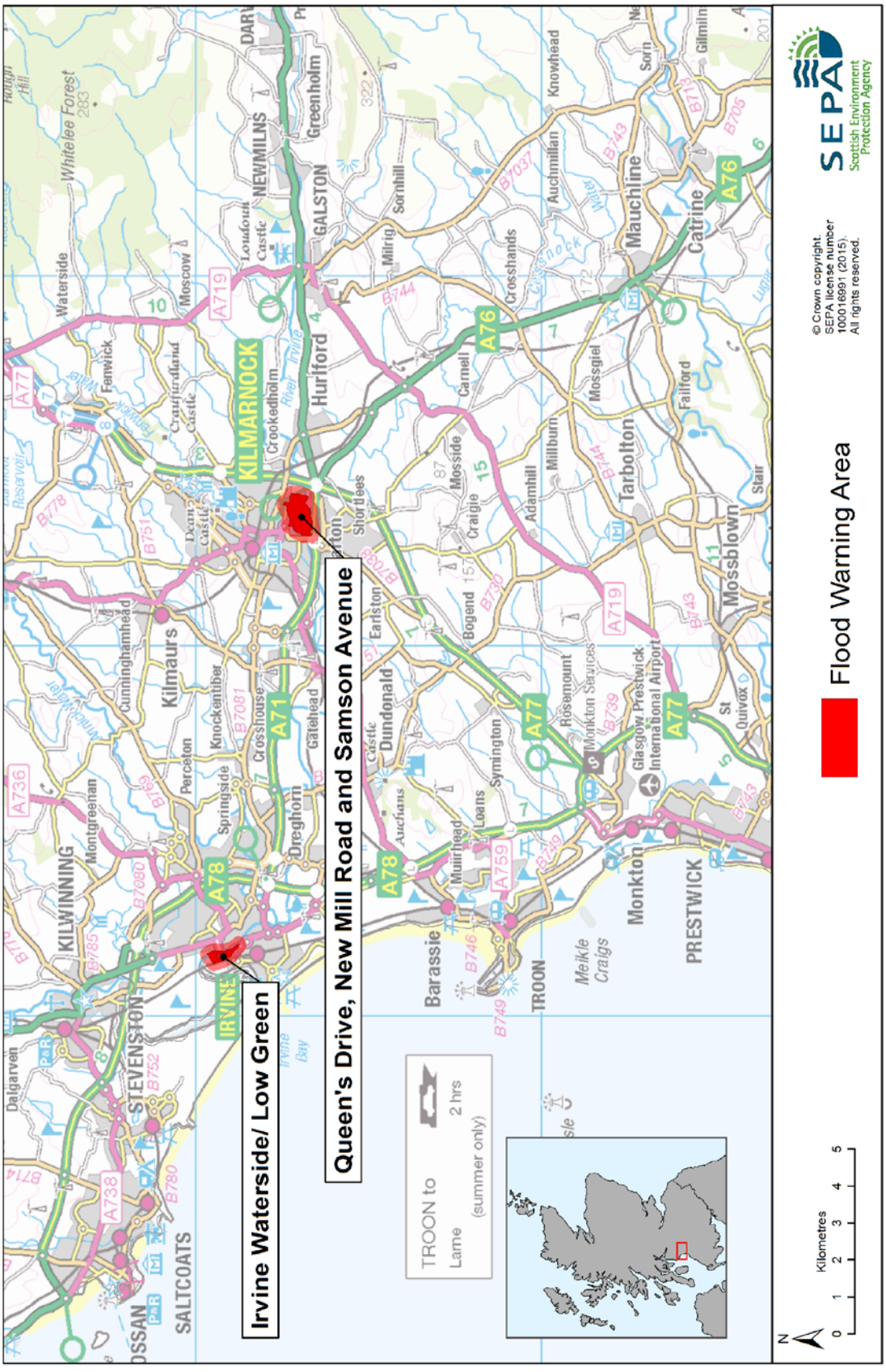


Figure 3: Flood warning areas

Climate change and future flood risk

The UK Climate Projections (UKCP09) predicts that climate change may lead to warmer and drier summers, warmer and wetter winters with less snow, and more extreme temperature and rainfall. The predicted increase in rainfall and river flows may increase the potential for river flooding.

Under the UKCP09 high emissions scenario for 2080, average peak river flows for the Irvine and Ayr catchment group may increase by 44%[1]. This would potentially increase the number of residential properties at risk of river flooding from approximately 4,700 to 7,000 and the number of non-residential properties from approximately 1,200 to 1,800.

The predicted increases in flood risk are solely based on the impact of a changing climate on the magnitude of flooding; they do not take into account any potential increase due to population change, development pressures or urban creep, nor do they take into account any mitigation as a result of actions contained in this or future Flood Risk Management Strategies.

Potential for natural flood management

The assessment of the potential for natural flood management is shown on SEPA's flood maps (http://www.sepa.org.uk/environment/water/flooding/flood-maps/). The maps indicate the potential for wave attenuation and estuarine surge attenuation. They show areas where natural flood management could be effective and where further detailed assessment should take place. This information was used to identify where local authorities could include natural flood management as part of flood risk management schemes and studies. The proposed schemes and studies are listed in the relevant Potentially Vulnerable Area chapters of this document.

Runoff reduction

The assessment shows that there are areas with potential for runoff reduction and floodplain storage throughout the River Garnock, River Irvine and River Ayr catchments. The highest density of areas for potential runoff reduction is outside of Kilmarnock. A notable area of high potential for floodplain storage is situated along the Water of Fail, a tributary of the River Ayr, close to Tarbolton. Another notable area of potential storage is identified along the River Garnock between Longbar and Dalry.

Sediment management

The assessment for sediment management shows that the River Ayr and River Irvine have stretches of high deposition and high erosion upstream of flood risk areas. Another area of high deposition exists on the River Irvine in Irvine, where again there is flood risk. Incorporating sediment management measures in some of these rivers may potentially reduce flood risk downstream.

[1] From the study 'An assessment of the vulnerability of Scotland's river catchments and coasts to the impacts of climate change' (CEH, 2011)

River flooding
Isle of Arran catchment group

Catchment overview

The Isle of Arran is located within the Ayrshire Local Plan District. It covers an area of approximately 2,240km^2, which is approximately 98% rural and 2% urban with a population of around 7,300. The Isle of Arran is within the North Ayrshire Council area.

In the north of the island there are hills with elevations of up to 874m, falling steeply to sea level. In the south of the island there are lower and more gradual slopes, with a maximum elevation of 512m.

Due to the size of the island there are no major rivers within the area. There are a series of burns leading from the upland areas to Firth of Clyde and Kilbrannan Sound.

Rainfall for this area is above the national annual average at 1,965mm.

Flood risk in the catchment

There are approximately 90 residential properties at risk of river flooding 82% of which are located within a Potentially Vulnerable Area. Approximately 20 non-residential properties are predicted to be at risk of river flooding 65% of which are located within a Potentially Vulnerable Area. There is one Potentially Vulnerable Areas at risk of river flooding situated within this catchment as shown in Figure 1.

Main areas at risk

The main areas at risk of river flooding can be seen in Table 1, which shows the number of properties at risk and the Annual Average Damages caused by river flooding. This includes damages to residential and non-residential properties, transport and agriculture.

	Residential properties at risk of river flooding	Annual Average Damages
Lamlash	30	£25,000
Brodick	10	£9,400

Table 1: Main areas at risk of river flooding

Economic activity and infrastructure at risk

The Annual Average Damages caused by river flooding within the Isle of Arran are approximately £170,000. The damages are distributed as follows:

- 70% residential properties (£120,000)
- 11% non-residential properties (£18,000)
- 7% emergency services (£12,000)
- 5% roads (£9,000)
- 5% agriculture (£8,000)
- 2% vehicles (£3,000).

Figure 2 shows the distribution of Annual Average Damages throughout the Isle of Arran. The figure shows the highest concentration of damages is in Lamlash. Table 2 shows further information about infrastructure and agricultural land at risk of flooding within the Isle of Arran.

	Number at risk	Further detail
Community facilities	0	
Utility assets	0	
Roads (km)	0.3	A841 between Lochranzra and Sannox
Agricultural land (km²)	5	

Table 2: Infrastructure and agricultural land at risk of river flooding

Designated environmental and cultural heritage sites at risk

Within the Isle of Arran it is estimated that seven designated cultural heritage sites are at risk of river flooding. These sites include: scheduled monuments, gardens and designed landscapes and listed buildings.

Approximately 3km^2 of environmental designated areas are at risk of river flooding. This includes a Special Protection Area (1km^2) and Sites of Special Scientific Interest (2km^2).

History of flooding

There is little recorded major river flooding to properties on the Isle of Arran. Recent river flooding includes, March 2009 at Corrie where water flowed into gardens.

On 19 June 2005 heavy overnight rain followed by thunderstorms led to flooding around Brodick. The Cloy Burn was blocked at Auchrannie Lodges by a footbridge being washed down at Kilmichael. Water from the Cloy Burn entered streets, gardens and properties.

Further detail about the history of flooding in this area is available in the relevant Potentially Vulnerable Area chapters of this document.

Managing flood risk

A range of public bodies have responsibility for managing flood risk in Scotland and they are working closer than ever before to target action in the areas where the greatest benefit can be gained. Members of the public also have a role to play and are the first line of defence against flooding by taking action to protect themselves and their property from flooding. Further information about roles and responsibilities is provided in Section 1.

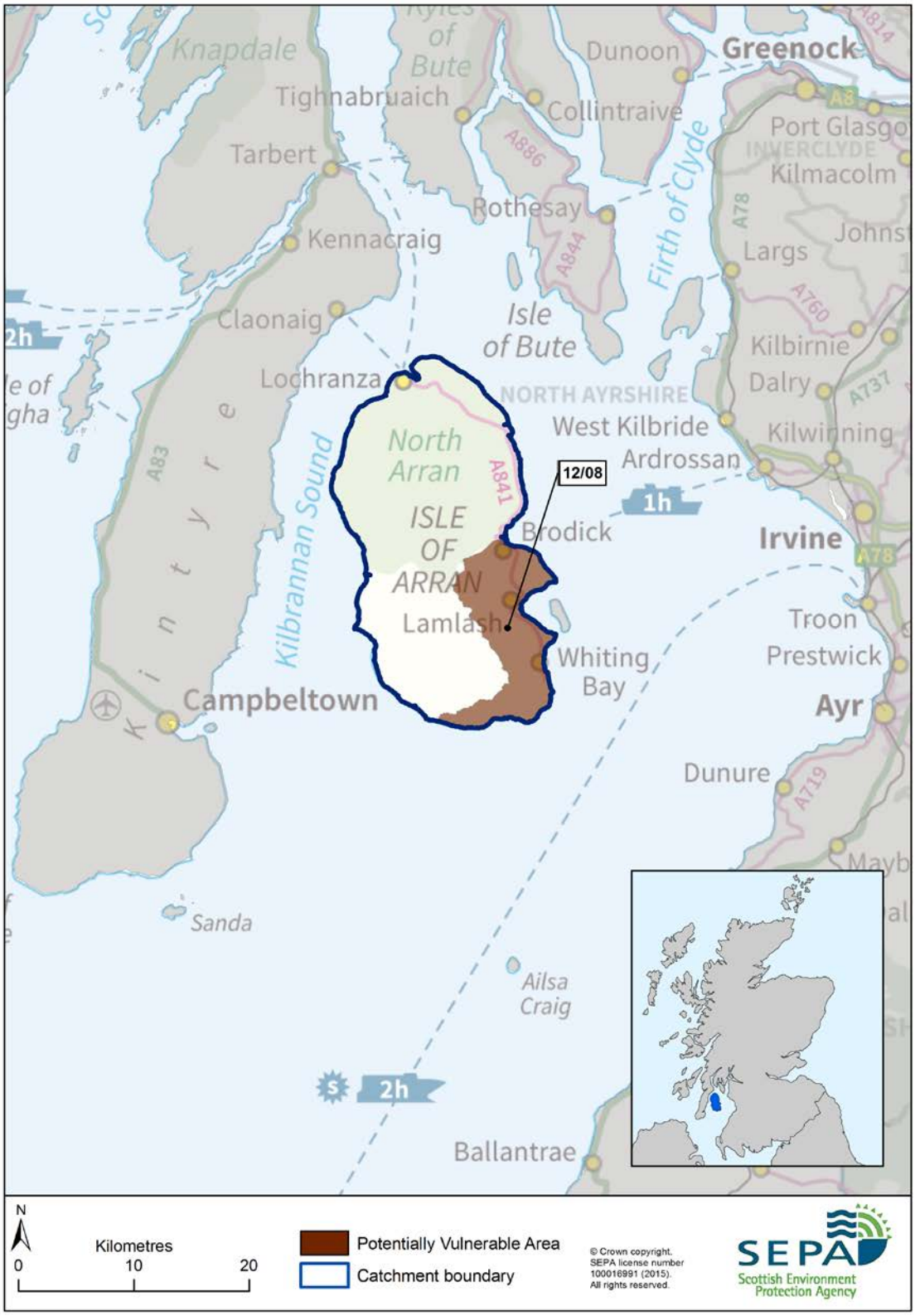


Figure 1: River catchment for the Isle of Arran catchment group

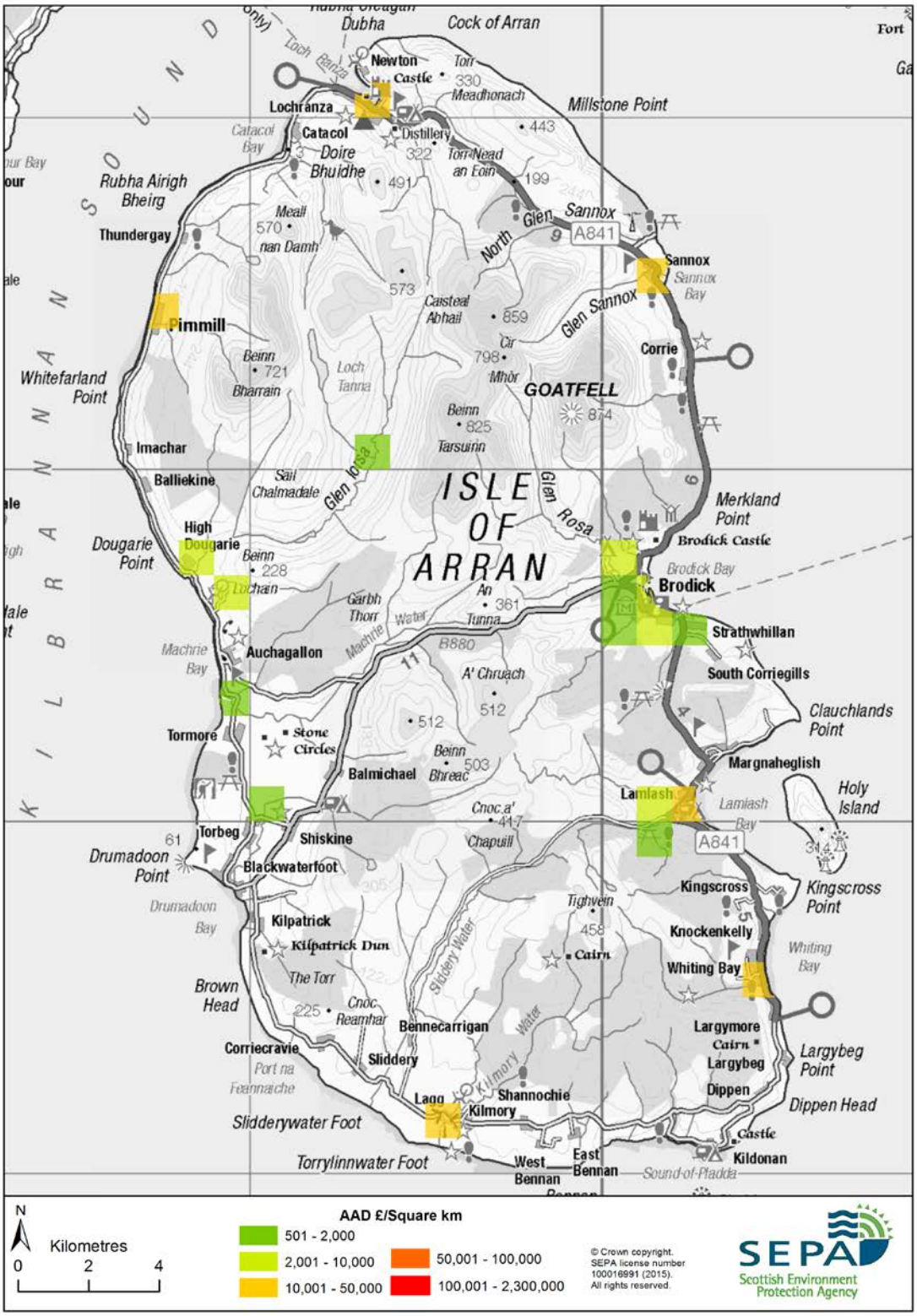


Figure 2: Annual Average Damages from river flooding

Climate change and future flood risk

The UK Climate Projections (UKCP09) predicts that climate change may lead to warmer and drier summers, warmer and wetter winters with less snow, and more extreme temperature and rainfall. The predicted increase in rainfall and river flows may increase the potential for river flooding.

Under the UKCP09 high emissions scenario for 2080, average peak river flows for the Isle of Arran catchment may increase by 44%[1]. This would potentially increase the number of residential properties at risk of river flooding from approximately 90 to 130 and the number of non-residential properties at risk of river flooding from approximately 20 to 40.

The predicted increases in flood risk are solely based on the impact of a changing climate on the magnitude of flooding; they do not take into account any potential increase due to population change, development pressures or urban creep, nor do they take into account any mitigation as a result of actions contained in this or future Flood Risk Management Strategies.

Potential for natural flood management

The assessment of the potential for natural flood management is shown on SEPA's flood maps (http://www.sepa.org.uk/environment/water/flooding/flood-maps/). The maps indicate the potential for wave attenuation and estuarine surge attenuation. They show areas where natural flood management could be effective and where further detailed assessment should take place. This information was used to identify where local authorities could include natural flood management as part of flood risk management schemes and studies. The proposed schemes and studies are listed in the relevant Potentially Vulnerable Area chapters of this document.

Runoff reduction

The assessment shows that almost all of the Isle of Arran has potential for runoff reduction although there may be restricted ability to alter the land cover in some of the steeper areas. There are large areas of potential for runoff reduction upstream of Brodick and Lamlash in the east, as well as Lochranza in the north.

[1] From the study 'An assessment of the vulnerability of Scotland's river catchments and coasts to the impacts of climate change' (CEH, 2011)

3.3 Coastal flooding

Ayrshire Local Plan District

This chapter provides supplementary information on flooding for coastal areas. It provides an overview of the natural characteristics of the coast, a summary of flood risk within the coastal area and a brief history of flooding. It also outlines the likely impact of climate change and the potential for natural flood management.

Information about the objectives and actions to manage flood risk are provided in in Section 2.

Coastal overview

The coastal area of the Ayrshire Local Plan District covers approximately 300km of coastline including the Firth of Clyde, Great Cumbrae and the Isle of Arran. There are several coastal communities in this area including Troon, Largs, Prestwick/Ayr, Salcoats/Ardrossan and Irvine.

Flood risk

There are estimated to be approximately 940 residential properties and 540 non-residential properties at risk of coastal flooding. This risk has been calculated from the inland projection of still water levels. Additionally there are potential impacts from locally generated wave mechanisms affecting the coastline. Local coastal modelling, including wave overtopping in Millport, has shown approximately an additional 780 properties at risk. There are 12 Potentially Vulnerable Areas in this Local Plan District at risk of coastal flooding as listed below. Potentially Vulnerable area 12/10 is near the coast although has no damage from coastal flooding (Figure 1).

- Noddsdale Water (12/01)
- Great Cumbrae Island (12/02)
- Largs to Stevenston (12/03)
- Kilwinning (12/05)
- River Irvine and Annick Water catchments (12/06)
- Irvine to Troon (12/07)
- Isle of Arran (12/08)
- Prestwick and Ayr (12/09)
- River Ayr catchment (12/11)
- Ayr east (12/12)
- Ayr south (12/13)
- Girvan (12/18).

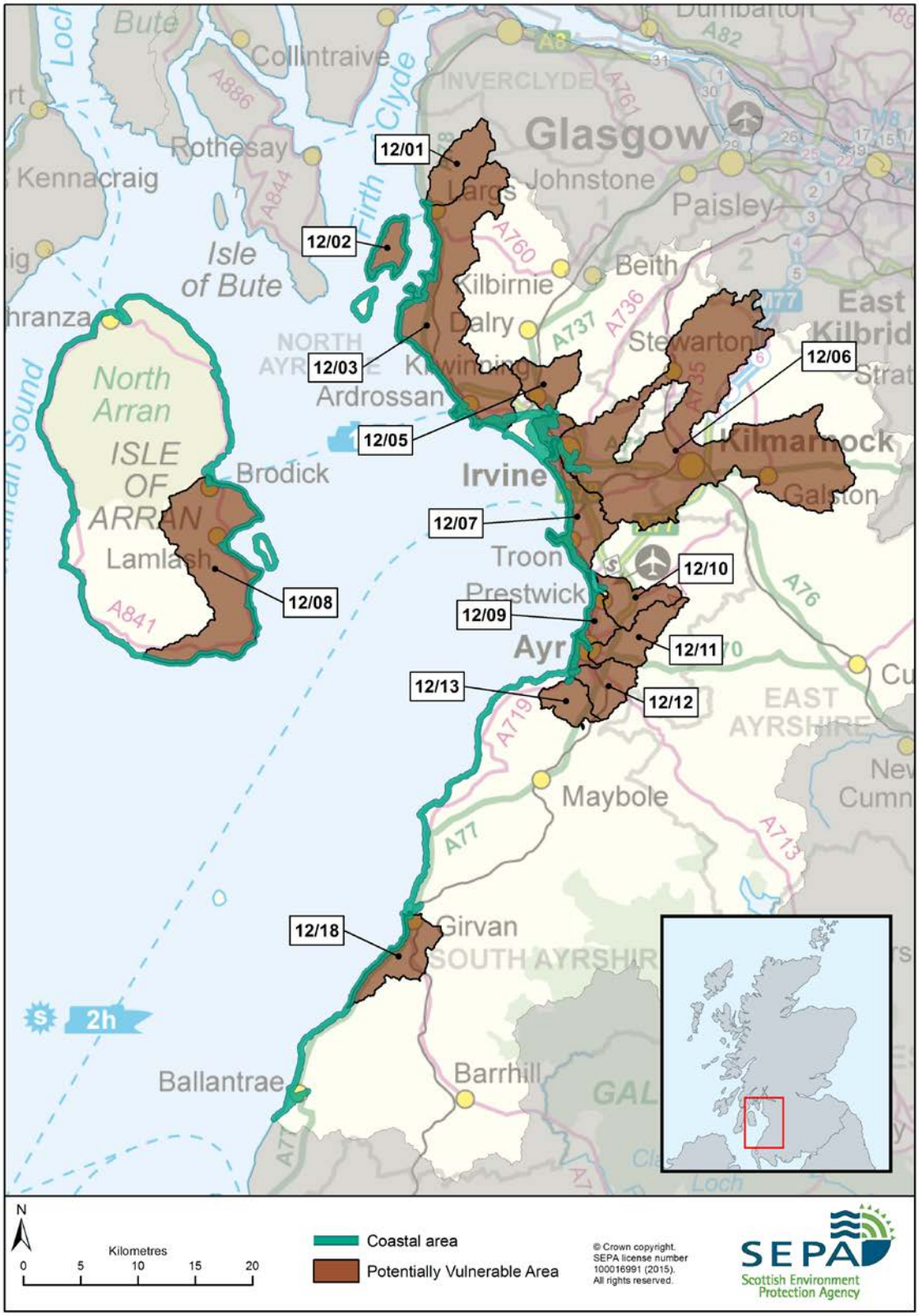


Figure 1: Local Plan District coastal area and Potentially Vulnerable Areas with a risk of coastal flooding

Main areas at risk

The ten areas at the greatest risk of coastal flooding can be seen in Table 1. Table 1 shows the number of properties at risk and the total Annual Average Damages caused by coastal flooding for each of these areas. This includes damages to residential and non-residential properties, transport and agriculture. The property count for Millport comes from a local authority study, while all other values are from a SEPA study.

	Residential and non-residential properties at risk of coastal flooding	Annual Average Damages
Troon	780	£250,000
Millport	780	£2.2 million
Largs	240	£130,000
Prestwick/Ayr	210	£190,000
Fairlie	70	£20,000
Lamlash	30	£110,000
Brodick	30	£25,000
Irvine (including Dreghorn)	20	£220,000
Girvan	20	£20,000
Stevenston	10	£8,000

Table 1: Main areas at risk of coastal flooding

Economic activity and infrastructure at risk

The Annual Average Damages caused by coastal flooding within this coastal area are approximately £1.3 million. The damages are distributed as follows:

- 48% residential properties (£630,000)
- 30% non-residential properties (£400,000)
- 16% roads (£210,000)
- 4% emergency services (£60,000)
- 1% vehicles (£30,000)
- 1% Agriculture (£10,000).

There is potential for damages all along the Ayrshire coastline with the highest damages predicted to occur to properties, shops and services in Ayr, Irvine Troon and Lamlash. Figure 2 shows the Annual Average Damages throughout the coastal area.

In addition, golf courses such as Turnberry, Prestwick and Royal Troon are potentially significant local economic drivers that could be affected by coastal erosion and flooding.

Please note that economic damages to rail were not assessed as information on damages at a strategic scale is not available.

Table 2 shows further information about infrastructure and agricultural land at risk of coastal flooding.

	Number at risk	Further detail
Community facilities	<10	Educational buildings
Utility assets	20	Includes: electricity substations and telephone exchanges
Roads (km)	4	Notably: A78 between Fairlie and Largs, the A719 and the A841
Railway routes (km)	0.5	Notably between Fairlie and Largs
Agricultural land (km^2)	4.6	

Table 2: Infrastructure and agricultural land at risk of coastal flooding

Designated environmental and cultural heritage sites at risk

Within the catchment it is estimated that approximately 18 designated cultural heritage sites are at risk of coastal flooding. These sites include; scheduled monuments, gardens and designed landscapes and listed buildings.

Approximately 24 environmental designated areas are at risk of coastal flooding, 23 of which are Sites of Special Scientific Interest with one Special Protection Area. These include the Girvan to Ballantrae coast, south coast of Arran, Portencross coast, Ballochmartin Bay, Ardrossan to Saltcoats coast, Ballantrae shingle beach, Kames Bay, Turnberry Dunes, Troon golf links and foreshore and Bogside Flats.

History of coastal flooding

The most recent notable coastal flooding occurred between December 2013 and January 2014, which affected the entire south west coast of Scotland. In particular Millport, Largs, Saltcoats, Troon, Girvan, Prestwick and Fairlie were severely affected, with properties and roads affected. Some of this flooding was due to wave overtopping. On the Isle of Arran levels the levels were the highest seen since 5 January 1991.

In December 1994, incidents of coastal flooding affecting Troon were reported. Coastal floods were also reported in January 1991 and November 1991 affecting the Fairlie, Girvan and Ardrossan. Similar locations were affected by coastal floods on 5 January 1991 when high tides and storm surges caused extensive flooding to towns in the area and damaged seafront infrastructure.

The earliest coastal flood recorded happened in August 1930 which resulted in the harbour at Lamlash Bay flooding due to a tidal surge in the Firth of Clyde.

Further detail about the history of flooding in this area is available in the relevant Potentially Vulnerable Area chapters of this document.

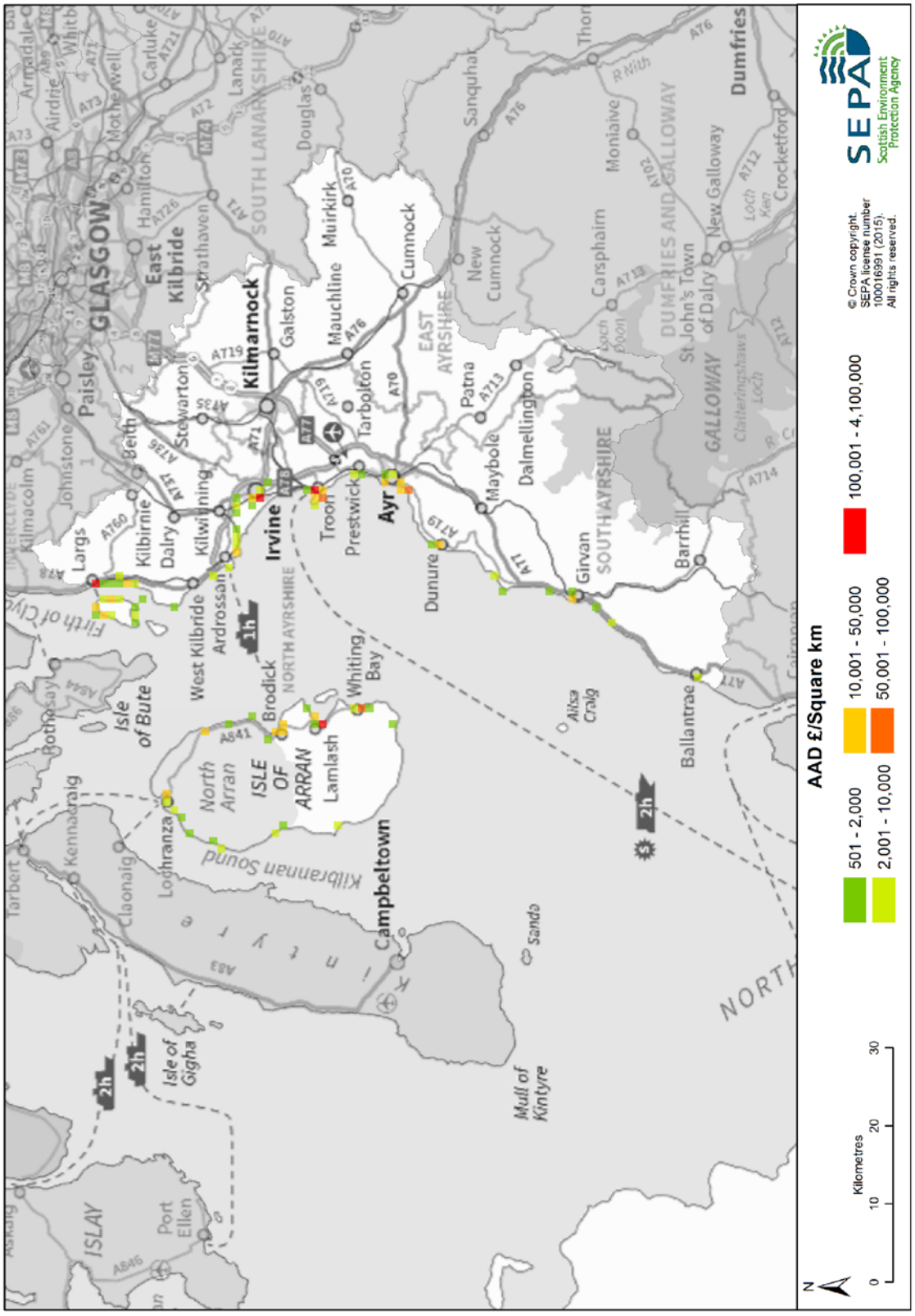


Figure 2: Annual Average Damages from coastal flooding

Managing flood risk

A range of public bodies have responsibility for managing flood risk in Scotland and they are working closer than ever before to target action in the areas where the greatest benefit can be gained. Members of the public also have a role to play and are the first line of defence against flooding by taking action to protect themselves and their property from flooding. Further information about roles and responsibilities is provided in Section 1.

This section describes the existing actions that are in place to manage flood risk and are in addition to the information presented in the relevant Potentially Vulnerable Area chapter of this document.

Flood protection schemes

The coastal flood protection schemes that have been identified in the area are summarised below:

- Largs Flood Protection Scheme (2002) which reduces flooding from coastal sources and the Gogo Burn. The scheme also includes the installation of a rock revetment, rock groynes and the encasement of the existing sea wall.
- Saltcoats Flood Protection Scheme (2006) is designed to reduce coastal flooding including wave overtopping to Saltcoats town centre.
- Ayr South Pier Flood Protection Scheme was completed in 1825 and offers some protection to the entrance of the Harbour while minimising siltation of the navigation channel into the harbour.

In addition to the formal flood protection schemes there are large areas of this coastline that have a hard shoreline, which includes reinforcement structures. Reinforcement structures use materials such as rock armour, man-made armour, revetments, retaining walls, gabion baskets, seawalls and sheet piling to protect vulnerable coastlines or harbours from erosion.

The location and type of existing coastal defences in this Local Plan District are shown in Figure 4.

Coastal flood warning schemes

Flood warning area (FWA)	Properties within FWA	% of properties registered May 2014
Largs Seafront	65	35%
Millport Seafront	147	16%
Largs Fort Street	212	3%
Troon Coastal	1,421	17%
Troon Central	677	14%
Prestwick Links Road	20	40%
Ayr Seafield	407	15%
Girvan Esplanade	49	24%
Saltcoats Harbour	432	16%
Arran Seafront and Montrose Terrace (Whiting Bay)	21	33%
Arran Lamlash Cordon (Lamlash Bay)	19	21%

Table 3: Flood warning areas

There are 11 coastal flood warning areas within this Local Plan District, as shown in Table 3 and Figure 3. Table 3 shows the total number of properties in the flood warning area and the percentage of those properties that have signed up to receive flood warnings. Note that this is not the number of properties at risk of flooding.

Climate change and future flood risk

UK Climate Projections (UKCP09) predicts that climate change may increase sea levels. The magnitude of sea level rise varies around the coastline.

For the UKCP09 high emissions scenario, the predicted average sea level increase for the Solway Local Plan District is between 0.46m-0.47m by 2080. This may increase the number of residential properties at risk of coastal flooding from approximately 940 to 2,100 and the number of non-residential from approximately 540 to 860. Coastal flood modelling by SEPA has not taken into account the impacts of future climate change on wave overtopping or storminess, which could increase the number of people affected by coastal flooding.

The predicted increases in flood risk are solely based on the impact of a changing climate on the magnitude of flooding; they do not take into account any potential increase due to population change, development pressures or urban creep, nor do they take into account any mitigation as a result of actions contained in this or future Flood Risk Management Strategies.

Potential for natural flood management

The assessment of the potential for natural flood management is shown on SEPA's flood maps (http://www.sepa.org.uk/environment/water/flooding/flood-maps/). The maps indicate the potential for wave attenuation and estuarine surge attenuation. They show areas where natural flood management could be effective and where further detailed assessment should take place. This information was used to identify where local authorities could include natural flood management as part of flood risk

management schemes and studies. The proposed schemes and studies are listed in the relevant Potentially Vulnerable Area chapters of this document.

Wave energy dissipation

The assessment shows that there are a number of areas showing high potential for wave energy dissipation. Most notably these are:

- along the coastline between Largs Bay and Little Brigurd
- along the coast of Great Cumbrae, with high potential areas for attenuation along Ballochmartin Bay in the east and Millport Bay in the south
- along the coastline at Troon
- a number of locations along the Isle of Arran coastline.

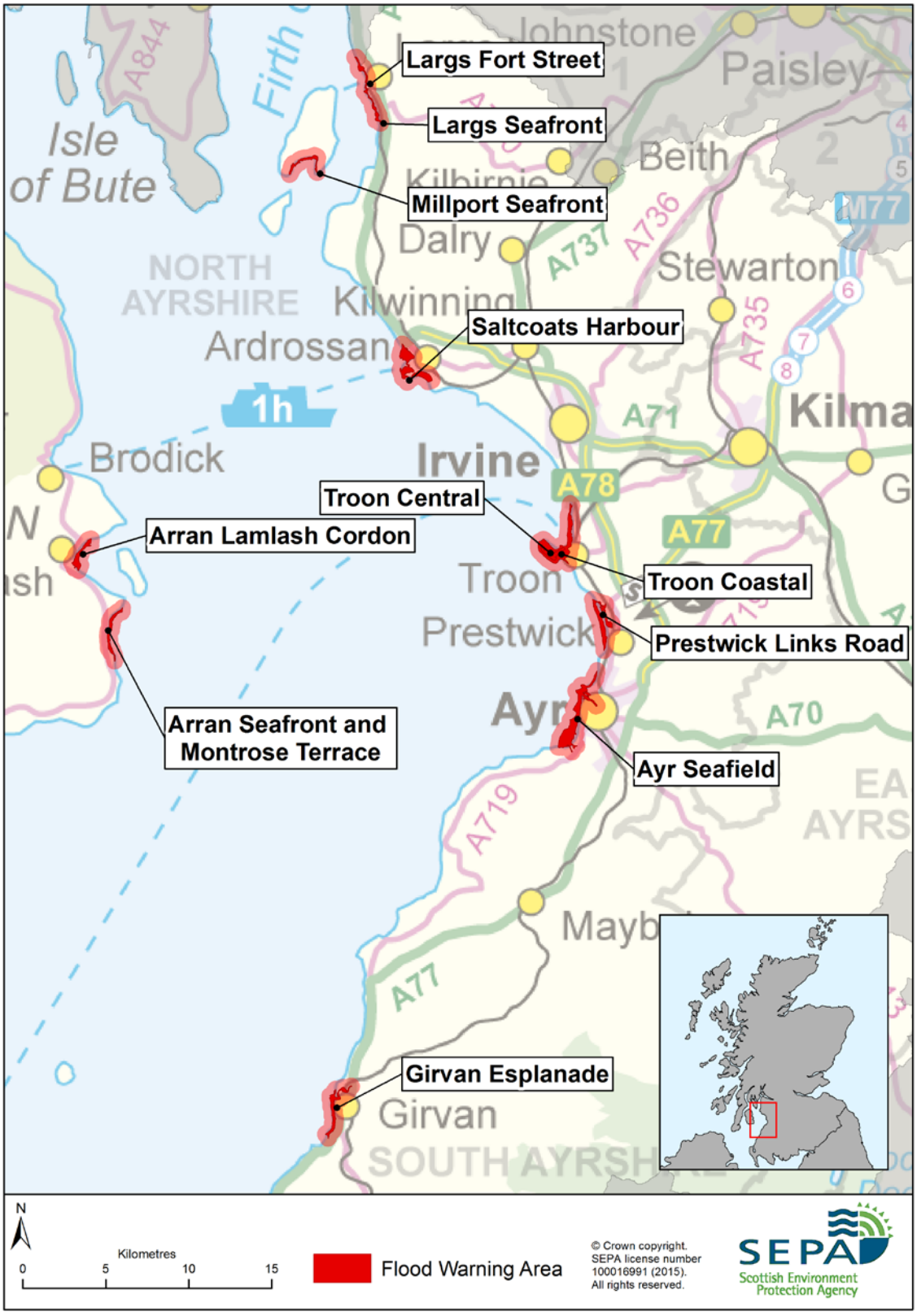


Figure 3: Flood warning areas

Figure 4: Coastal protection for coastal area

3.4 Surface water flooding

Ayrshire Local Plan District

This chapter provides supplementary information on surface water flooding across the Local Plan District. It provides an overview of the main areas at risk and the history of surface water flooding. The predicted impacts on infrastructure are also identified. The impacts on environmental sites and agricultural land have not been assessed.

Information about the objectives and actions to manage flood risk are provided in Section 2.

Flood risk

Within the Ayrshire Local Plan District there are approximately 1,900 residential and 1,200 non-residential properties at risk of surface water flooding. It is estimated that 95% of these properties are located within Potentially Vulnerable Areas.

Main areas at risk

Table 1 provides a list of the main areas at risk of surface water flooding. The damages include impacts to residential and non-residential properties, vehicles, emergency services and roads.

	Residential and non-residential properties at risk of surface water flooding	Average Annual Damages
Saltcoats / Ardrossan	560	£470,000
Kilmarnock (including Hurlford)	560	£460,000
Prestwick / Ayr	380	£280,000
Stevenston	240	£240,000
Cumnock / Logan	140	£360,000
Irvine (including Dreghorn)	140	£60,000
Galston	120	£290,000
Kilbirnie	110	£94,000
Kilwinning	110	£45,000
Newmilns / Greenholm	70	£260,000
Troon	90	£60,000
Kilmaurs	40	£10,000

Table 1: Main areas at risk of surface water flooding

Economic activity and infrastructure at risk

The Annual Average Damages caused by surface water flooding within this catchment are approximately £3.2 million. The damages are distributed as follows:

- 46% residential properties (£1.5 million)
- 41% non-residential properties (£1.3 million)
- 6% roads (£190,000)
- 6% emergency services (£180,000)
- 1% vehicles (£34,000).

Figure 1 shows the distribution of Annual Average Damages from surface water flooding across the Local Plan District. The highest Annual Average Damages are located in Ardrossan, Kilmarnock and Cumnock. The main type of economic activity impacted is retail.

Please note that economic damages to rail were not assessed as information on damages at a strategic scale was not available.

Table 2 shows the approximate numbers of further infrastructure assets which are at risk of flooding within this Local Plan District.

	Number at risk	Further detail
Community facilities	10	Includes; educational buildings, healthcare facilities and emergency services.
Utility assets	140	Includes; electricity substations, electricity generation and fuel extraction sites.
Roads (km)	264	Includes; A78 and A77
Railway routes (km)	39	Includes; Ayrshire coast line
Airports	1	

Table 2: Infrastructure at risk of surface water flooding

Designated environmental and cultural heritage sites at risk

Within the Local Plan District it is estimated that approximately 70 designated cultural heritage sites have a risk of surface water flooding. These sites include; scheduled monuments, gardens and designed landscapes and listed buildings.

The impact of surface water flooding on environmental sites has not been assessed and is assumed to be relatively low.

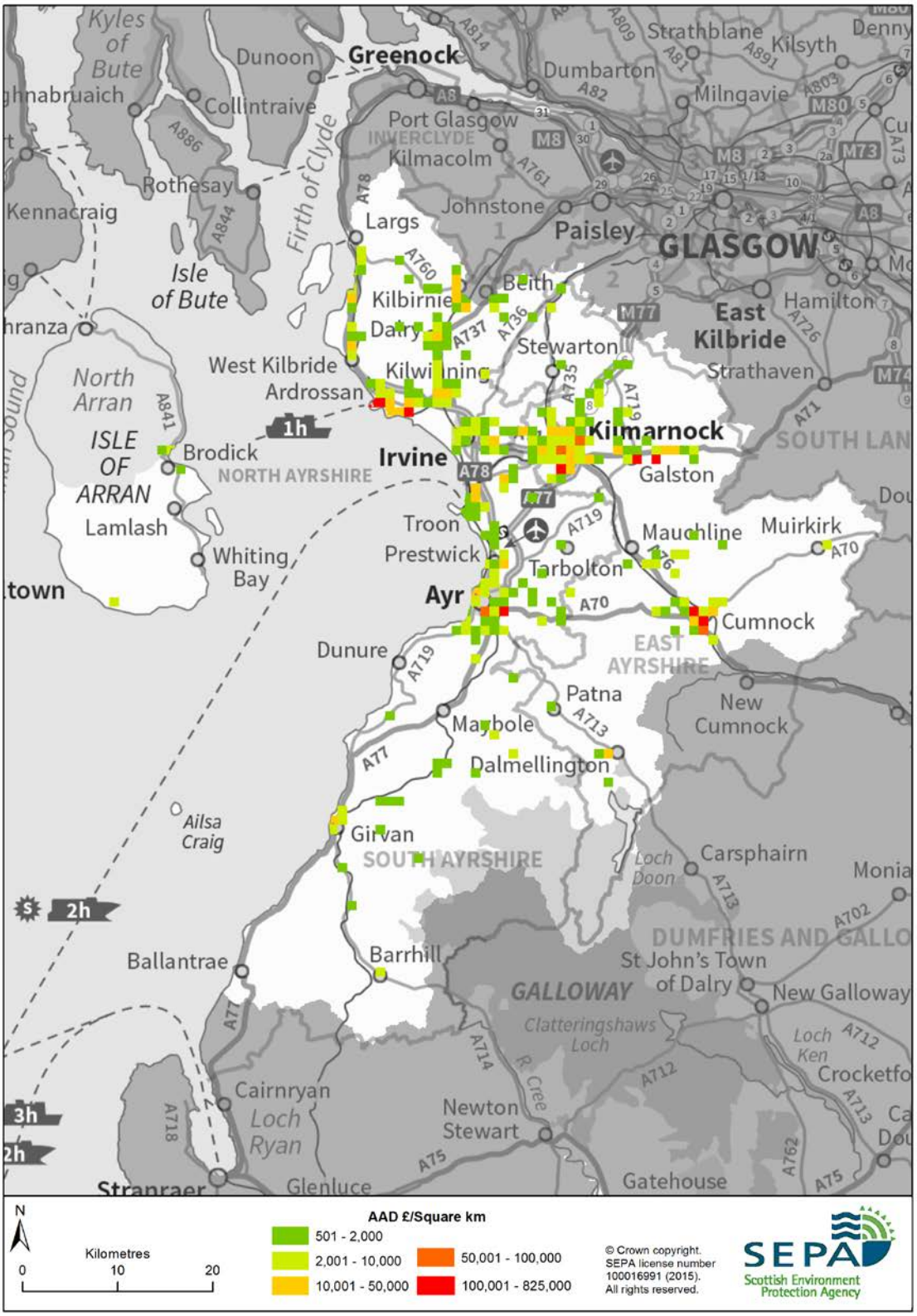


Figure 1: Annual Average Damages from surface water flooding

History of surface water flooding

There have been 74 surface water related floods reported to SEPA within the Ayrshire Local Plan District. The most notable floods occurred on the 20 September 2012 in Ayr, Prestwick and Kilmarnock, following an estimated 1:70 year rainfall event. A combination of both river and surface water flooding resulted in the closure of Glasgow Prestwick Airport for over 12 hours. There were also several incidents of surface water flooding reported in Largs on the 29 October 2000.

There are four historic opencast mines within the district; Dunstonhill, Dalfad, Powharnal and Spireslack. Dunstonhill is situated within Potentially Vulnerable Area 12/15, Spireslack is in Potentially Vulnerable Area 12/19c, while Dalfad and Powharnal are situated upstream of Potentially Vulnerable Area 12/14. The condition of these mines is reported to be deteriorating as a result of a reduction in maintenance, including pumping to reduce water levels. This brings about an increased risk of flooding due to rising mine and lagoon water levels.

Managing flood risk

Surface water management priority areas

The areas at highest risk from surface water flooding have been prioritised. These priority areas were identified using SEPA flood models, supplemented with historical flood information and, where available, more detailed modelling from local authorities. These priority areas require the preparation of surface water management plans, the details of which can be found in Section 2.

A range of public bodies have responsibility for managing flood risk in Scotland and they are working closer than ever before to target action in the areas where the greatest benefit can be gained. Members of the public also have a role to play and are the first line of defence against flooding by taking action to protect themselves and their property from flooding. Further information about roles and responsibilities is provided in Section 1.

Climate Change and Future Flood Risk

UK Climate Projections (UKCP09) predicts that climate change may lead to warmer and drier summers, warmer and wetter winters with less snow, and more extreme temperature and rainfall. The pluvial modelling undertaken considered climate change scenarios with a 20% increase in rainfall intensity.

Under these conditions it is estimated that the number of residential properties at risk of surface water flooding may increase from approximately 1,900 to 2,000. The number of non-residential properties at risk of surface water flooding may increase from approximately 1,100 to 1,200.

The predicted increases in flood risk are solely based on the impact of a changing climate on the magnitude of flooding; they do not take into account any potential increase due to population change, development pressures or urban creep, nor do they take into account any mitigation as a result of actions contained in this or future Flood Risk Management Strategies.

Annex 1: Glossary

Term	Definition
Accretion	Accumulation of sediment.
Actions	Actions describe where and how flood risk will be managed. These actions have been set by SEPA and agreed with flood risk management authorities following consultation. Selection of actions to deliver the agreed objectives has been based on a detailed assessment and comparison of economic, social and environmental criteria.
Annual Average Damages (AAD)	Depending on its size or severity each flood will cause a different amount of damage to a given area. Annual Average Damages are the theoretical average economic damages caused by flooding when considered over a very long period of time. It does not mean that damage will occur every year: in many years there will be no damages, in some years minor damages and in a few years major damages may occur. High likelihood events, which occur more regularly, contribute proportionally more to AADs than rarer events. Within the Flood Risk Management Strategies AADs incorporate economic damages to the following receptors: residential properties, non-residential properties, vehicles, emergency services, agriculture and roads. They have been calculated based on the principles set out in the Flood Hazard Research Centre Multi-Coloured Handbook (2010).
Appraisal	Appraisal is the process of defining objectives, examining options and weighing up the costs, benefits, risks and uncertainties before a decision is made. The FRM Strategy appraisal method is designed to set objectives and identify the most sustainable combination of actions to tackle flooding from rivers, sea and surface water.
Appraisal baseline	Defines the existing level of flood risk under the current flood risk management regime.
Awareness raising	Public awareness, participation and community support are essential components of sustainable flood risk management. SEPA and the responsible authorities have a duty to raise public awareness of flood risk. This is undertaken both individually and collaboratively by a range of organisations. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact.
Bathing waters	Bathing waters are classed as protected areas under Annex IV of the Water Framework Directive (WFD). There are 84 designated bathing waters in Scotland. [i]
Benefit cost ratio (BCR)	A benefit cost ratio summarises the overall value for money of an action or project. It is expressed as the ratio of benefits to costs (both expressed as present value monetary values). A ratio of greater than 1:1 indicates that the economic benefits associated with an action are greater than the economic costs of implementation; therefore this is taken as the threshold of economic viability. It should be acknowledged that it is not always possible to accurately estimate economic values for all elements of benefit, and BCR is just one a number of techniques used in appraisal.
Blue infrastructure	Blue infrastructure is often complementary to 'green infrastructure' and includes sustainable drainage systems, swales (shallow, broad and vegetated channels designed to store and/or convey runoff and remove pollutants[ii]), wetlands, rivers, canals (and their banks) and other watercourses[iii]
Candidate Potentially Vulnerable Area (PVAc)	Candidate PVAs are those areas identified after the National Flood Risk Assessment (2011), as a result of new information, where the impact of flooding is potentially sufficient to justify further assessment and appraisal. They will be considered for inclusion as new PVAs in the next flood risk management planning cycle.
Catchment	All the land drained by a river and its tributaries.

Term	Definition
Category 1 and 2 Responders (Cat 1 / 2)	Category 1 and 2 Responders are defined as part of the Civil Contingencies Act 2004 which seeks to minimise disruption in the event of an emergency. Category 1 Responders are 'core' responders: local authorities, police, fire and rescue services, ambulance service, NHS health boards, SEPA and the Maritime and Coastguard Agency. Category 2 Responders are key co-operating responders in support of Category 1 Responders. These include gas and electricity companies, rail and air transport operators, harbour authorities, telecommunications providers, Scottish Water, the Health and Safety Executive and NHS National Services Scotland[iv].
Channel improvement	Where work has been carried out on a river channel allowing an increase in the volume of water it can carry.
Characterisation	Provides a description of the natural characteristics of catchments, coastlines and urban areas in terms of hydrology, geomorphology, topography and land use. It also includes the characterisation of existing levels of flood risk and existing flood risk management activity.
Coastal flooding	Flooding that results from high sea levels or a combination of high sea levels and stormy conditions. The term coastal flooding is used under the Flood Risk Management (Scotland) Act 2009, but in some areas it is also referred to as tidal flooding and covers areas such as estuaries and river channels that are influenced by tidal flows.
Combined sewer	Combined sewers transport sewage from homes and industry as well as carrying surface water runoff from gutters, drains and some highways. Heavy or prolonged rainfall can rapidly increase the flow in a combined sewer until the amount of water exceeds sewer capacity.
Combined sewer (overflow) (CSO)	Combined sewer overflows are purposely designed structures to ensure any excess water from sewerage systems is discharged in a controlled way and at a specific managed location.
Community facility	Within the FRM Strategies this term includes: Emergency Services (Police, Fire, Ambulance, Coastguard, Mountain Rescue) Educational Buildings (crèche, nursery, primary, secondary, further, higher and special education premises) Healthcare facilities: hospitals, health centres and residential care homes
Community flood action groups	Community flood action groups are community based resilience groups which, on behalf of local residents and business, help to prepare for and minimise the effects of flooding. They reflect the interests of their local communities and may differ in composition and remit. There are over 60 groups already established in Scotland. The Scottish Flood Forum provides support for both new and existing groups.
Confluence	Where two or more rivers meet.
Conveyance	Conveyance is a measure of the carrying capacity of a watercourse. Increasing conveyance enables flow to pass more rapidly and reducing conveyance slows flow down. Both actions can be effective in managing flood risk depending on local conditions.
Cultural heritage site	Historic Environment Scotland maintains lists of buildings of special architectural or historic interest; these buildings are referred to as 'listed buildings'. The highest level of designation is a World Heritage Site. Other designations included in this assessment are scheduled monuments, gardens and designed landscapes, and battlefields.
Culvert	A pipe, channel or tunnel used for the conveyance of a watercourse or surface drainage water under a road, railway, canal or other obstacle.
Damages	Flood damages are categorised as direct or indirect i.e. as a result of the flood water itself, or subsequent knock on effects. Damage to buildings and contents caused by flood water are an example of direct damages, whilst loss of industrial production, travel disruption or stress and anxiety are indirect. Some damages can be quantified in monetary terms, and others can only be described.

Term	Definition
	The potential damages avoided by implementation of a flood risk management action are commonly referred to as the benefits of that action. When comparing the effectiveness of different actions, it is useful to consider estimated damages and damages avoided across the lifespan of the action. Within the FRM Strategies, a 100 year appraisal period has been used as standard. This allows costs, damages and benefits across this time frame to be compared in present value terms. See also 'Annual Average Damages'
Demountable defences	A temporary flood barrier is one that is only installed when the need arises, that is, when flooding is forecast. A demountable flood defence is a particular type of temporary defence that requires built-in parts and therefore can only be deployed in one specific location.[v]
Deposition	A natural process leading to an accumulation of sediment on a river bed, floodplain or coastline.
Economic impact	An assessment of the economic value of the positive and negative effects of flooding and / or the actions taken to manage floods.
Embankment	Flood embankments are engineered earthfill structures designed to contain high river levels or protect against coastal flooding. They are commonly grass-covered, but may need additional protection against erosion by swiftly flowing water, waves or overtopping.
Emergency plans / response	Emergency response plans are applicable for all types of flooding. They set out the steps to be taken during flooding in order to maximise safety and minimise impacts where possible. Under the Civil Contingencies Act, Category 1 Responders have a duty to maintain emergency plans. Emergency plans may also be prepared by individuals, businesses, organisations or communities.
Environmental impact	A change in the environment as a result of an action or activity. Impacts can be positive or negative and may vary in significance, scale and duration.
Environmental Impact Assessment (EIA)	Environmental Impact Assessment (EIA) is a process which identifies the potential environmental impacts, both negative and positive, of a proposal.
Environmental sites / environmental designated areas/ environmentally designated sites	Areas formally designated for environmental importance, such as Sites of Special Scientific Interest (SSSI), Special Protection Area (SPA) or Special Areas of Conservation (SAC).
Episodic erosion	Erosion induced by a single event, such as a storm.
Erosion	A natural process leading to the removal of sediment from a river bed, bank or floodplain or coastline.
Estuarine surge attenuation	A reduction in the wave energy caused by storm surge. Breakwaters (barriers built out into the sea to protect a coast or harbour from the force of waves) or habitats such as saltmarsh can slow down and reduce the inland impact of storm surges (the rising of the sea due to wind and atmospheric pressure changes associated with storms), thereby reducing coastal flood risk.
Estuary	A coastal body of water usually found where a river meets the sea; the part of the river that is affected by tides.
Fault (fault line)	A break or fracture in the earth's crust as a result of the displacement of one side with respect to the other. In Scotland the Great Glen Fault is a major geological fault line cutting diagonally across the Highlands from Fort William to Inverness.
Flash flood	A flood that occurs a short period of time after high intensity rainfall or a sudden snow melt. A sudden increase in the level and velocity of the water body is often characteristic of these events, leaving a short time for warning or actions.
Flashy watercourse	A 'flashy' river or watercourse has a short lag time (the delay between peak rainfall intensity and peak river discharge), high peak discharge, and quickly returns to average flow. Rivers with these characteristics

Term	Definition
	can be prone to flooding and leave a short time for warning or actions.
Flood	In the terms of the FRM Act, 'flood' means a temporary covering by water, from any source, of land not normally covered by water. This does not include a flood solely from a sewerage system, as a result of normal weather or infrastructure drainage. A flood can cause significant adverse impacts on people, property and the environment. drainage.
Flood bund	A constructed retaining wall, embankment or dyke designed to protect against flooding to a specified standard of protection.
Flood defence	Infrastructure, such as flood walls, embankments or flood storage intended to protect an area against flooding to a specified standard of protection.
Flood extent	The area that has been affected by flooding, or is at risk of flooding fror one or more sources for a particular likelihood.
Flood forecasting	SEPA operates a network of over 250 rainfall, river and coastal monitoring stations throughout Scotland that generate data 24 hours a day. This hydrological information is combined with meteorological information from the Met Office. A team of experts then predict the likelihood and timing of river, coastal and surface water flooding. This joint initiative between SEPA and the Met Office forms the Scottish Flood Forecasting Service.
Flood frequency	The probability that a particular size/severity of flood will occur in a given year (see likelihood).
Flood gate	An adjustable, sometimes temporary, barrier used as a flood defence to control the flow of water within a water system or during a flood. Flood gates can also be part of operational flood defences or protect individual buildings or sites.
Flood guard	Flood guards cover a variety of types of door and window barriers that can be fitted to individual properties and operated by the owners / occupiers prior to a flood event. They act as a physical barrier to water entering the property and can provide protection against frequent and relatively shallow flooding.
Flood hazard	In terms of the FRM Act, hazard refers to the characteristics (extent, depth, velocity) of a flood.
Flood hazard map	Flood hazard maps are required by the FRM Act to show information that describes the nature of a flood in terms of the source, extent, water level or depth and, where appropriate, velocity of water. Flood hazard and risk maps are referred to collectively as flood maps and are available on the SEPA website.
Flood Prevention Scheme / Flood Protection Scheme (FPS)	A flood protection scheme, as defined by the FRM Act, is a scheme by a local authority for the management of flood risk within the authority area. This includes defence measures (flood prevention schemes) formerly promoted under the Flood Prevention (Scotland) Act 1961.
Flood protection study	Flood protection studies aim to refine understanding of the hazard and risk associated with flooding in a particular area, catchment or coastline. They will involve detailed assessment of flood hazard and / or risk and may develop options for managing flood risk.
Flood protection works	Flood protection works can include the same flood defence measures that would make up a formal Flood Protection Scheme but without the legal process, protections and requirements that would come by delivering the works as a scheme.
Flood risk	A measure of the combination of the likelihood of flooding occurring and the associated impacts on people, the economy and the environment.
Flood Risk Assessment (FRA)	Flood Risk Assessments are detailed studies of an area where flood risk may be present. These are often used to inform planning decisions, may help to develop flood schemes and have also contributed to the National Flood Risk Assessment.

Term	Definition
Flood Risk Management (Scotland) Act 2009 (FRM Act)	The flood risk management legislation for Scotland. It transposes the EC Floods Directive into Scots Law and aims to reduce the adverse consequences of flooding on communities, the environment, cultural heritage and economic activity.
Flood risk management cycle	Under the FRM Act flood risk management planning is undertaken in six year cycles. The first planning cycle is 2015 – 2021. The first delivery cycle is lagged by approximately 6 months and is from 2016 - 2022.
Flood Prevention (Scotland) Act 1961	The Flood Prevention (Scotland) Act 1961 gave local authorities discretionary powers to make and build flood prevention schemes. It was superseded by the Flood Risk Management (Scotland) Act 2009.
Flood Risk Management Local Advisory Groups	FRM Local Advisory Groups are stakeholder groups convened to advise SEPA and lead local authorities in the preparation of Flood Risk Management Plans. SEPA and lead local authorities must have regard to the advice they provide.
Flood Risk Management Plans (FRM Plans)	A term used in the FRM Act. FRM Plans set out the actions that will be taken to reduce flood risk in a Local Plan District. They comprise Flood Risk Management Strategies, developed by SEPA, and Local Flood Risk Management Plans produced by lead local authorities.
Flood Risk Management Strategy (FRM Strategy)	Sets out a long-term vision for the overall reduction of flood risk. They contain a summary of flood risk in each Local Plan District, together with information on catchment characteristics and a summary of objectives and actions for Potentially Vulnerable Areas.
Flood risk map	Complements the flood hazard maps published on the SEPA website providing detail on the impacts of flooding on people, the economy and the environment. Flood hazard and risk maps are referred to collectively as flood maps and are available on the SEPA website.
Flood wall	A flood defence feature used to defend an area from flood water to a specified standard of protection.
Flood Warning area (FWA)	A Flood Warning area is where SEPA operates a formal Flood Monitoring Scheme to issue targeted Flood Warning messages for properties located in the area.[vi]
Flood warning scheme	A flood warning scheme is the network of monitoring on a coastal stretch or river, which provides SEPA with the ability to issue Flood Warnings.
Floods Directive	European Directive 2007/60/EC on the Assessment and Management of Flood Risks builds on and is closely related to the Water Framework Directive (see river basin management planning). It was transposed into Scots Law by the Flood Risk Management (Scotland) Act 2009. The Directive requires Member States to assess if all watercourses and coastlines are at risk from flooding, to map the flood extent, assets and humans at risk in these areas and to take adequate and coordinated measures to reduce this flood risk[vii].
Floodplain	Area of land that borders a watercourse, an estuary or the sea, over which water flows in time of flood, or would naturally flow but for the presence of flood defences and other structures where they exist.
Floodplain storage	Floodplains naturally store water during high flows. Storage can be increased through natural or man-made features to increase flood depth or slow flows in order to reduce flooding elsewhere.
Gabion	A metal cage filled with rocks often used in river bank protection.
Green infrastructure	The European Commission defines green infrastructure as “the use of ecosystems, green spaces and water in strategic land use planning to deliver environmental and quality of life benefits. It includes parks, open spaces, playing fields, woodlands, wetlands, road verges, allotments and private gardens. Green infrastructure can contribute to climate change mitigation and adaptation, natural disaster risk mitigation, protection against flooding and erosion as well as biodiversity conservation.” See also ‘blue infrastructure’[viii]

Term	Definition
Groundwater flooding	This type of flooding is caused by water rising up from underlying rocks or flowing from springs. In Scotland groundwater is generally a contributing factor to flooding rather than the primary source.
Integrated catchment study (ICS)	In urban areas, the causes of flooding are complex because of the interactions between rivers, surface water drainage and combined sewer systems and tidal waters. Scottish Water works with SEPA and local authorities to assess these interactions through detailed studies.
Land use planning (LUP)	The process undertaken by public authorities to identify, evaluate and decide on different options for the use of land, including consideration of long term economic, social and environmental objectives and the implications for different communities and interest groups.
Lead local authority	A local authority responsible for leading the production, consultation, publication and review of a Local Flood Risk Management Plan.
Likelihood of flooding	The chance of flooding occurring. **High likelihood**: A flood is likely to occur in the defined area on average once in every ten years (1:10). Or a 10% chance of happening in any one year. **Medium likelihood:** A flood is likely to occur in the defined area on average once in every two hundred years (1:200). Or a 0.5% chance of happening in any one year. **Low likelihood:** A flood is likely to occur in the defined area on average once in every thousand years (1:1000). Or a 0.1% chance of happening in any one year.
Local Flood Risk Management Plans (Local FRM Plan)	Local Flood Risk Management Plans, produced by lead local authorities, will take forward the objectives and actions set out in Flood Risk Management Strategies. They will provide detail on the funding, timeline of delivery, arrangements and co-ordination of actions at the local level during each six year FRM planning cycle.
Local Nature Reserve (LNR)	A Local Nature Reserve is a protected area of land designated by a local authority because of its local special natural interest and / or educational value. Local authorities select and designate local nature reserves using their powers under the National Parks and Access to the Countryside Act 1949[ix].
Local Plan District	Geographical areas for the purposes of flood risk management planning. There are 14 Local Plan Districts in Scotland.
Local Plan District Partnerships	Each LPD has established a local partnership comprised of local authorities, SEPA, Scottish Water and others as appropriate. These partnerships are distinct from the FRM Local Advisory Groups and they retain clear responsibility for delivery of the FRM actions set out in the Local Flood Risk Management Plans. It is the local partnership that makes decisions and supports the delivery of these plans.
Maintenance	Sections 18 and 59 of the Flood Risk Management (Scotland) Act 2009 put duties of watercourse inspection, clearance and repair on local authorities. In addition, local authorities may also be responsible for maintenance of existing flood protection schemes or defences.
Montane habitat	This habitat encompasses a range of natural or near-natural vegetation occurring in the montane zone, lying above or beyond the natural tree-line.
National Flood Management Advisory Group (NFMAG)	The National Flood Management Advisory Group provides advice and support to SEPA and, where required, Scottish Water, local authorities and other responsible authorities on the production of FRM Strategies and Local FRM Plans.
National Flood Risk Assessment (NFRA)	A national analysis of flood risk from all sources of flooding which also considers climate change impacts. Completed in December 2011 this provides the information required to undertake a strategic approach to flood management that identifies areas at flood risk that require further appraisal. The NFRA will be reviewed and updated for the second cycle of FRM Planning by December 2018.

Term	Definition
Natural flood management (NFM)	A set of flood management techniques that aim to work with natural processes (or nature) to manage flood risk.
Non-residential properties	Properties that are not used for people to live in, such as shops or other public, commercial or industrial buildings.
Objectives	Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding.
One in 200 year flood	See 'likelihood of flooding' and 'return period'.
Planning policies	Current national planning policies, Scottish Planning Policy and accompanying Planning Advice notes restrict development within the floodplain and limit exposure of new receptors to flood risk. In addition to national policies, local planning policies may place further requirements within their area of operation to restrict inappropriate development and prevent unacceptable risk.
Potentially Vulnerable Areas (PVA)	Catchments identified as being at risk of flooding and where the impact of flooding is sufficient to justify further assessment and appraisal. There were 243 PVAs identified by SEPA in the National Flood Risk Assessment and these are the focus of the first FRM planning cycle.
Property level protection	Property level protection includes flood gates, sandbags and other temporary barriers that can be used to prevent water from entering individual properties during a flood.
Property level protection scheme	Some responsible authorities may have a formal scheme to provide, install and maintain property level protection for properties.
Ramsar sites	Ramsar sites are wetlands of international importance designated under the Ramsar Convention.
Receptor	Refers to the entity that may be impacted by flooding (a person, property, infrastructure or habitat). The vulnerability of a receptor can be reduced by increasing its resilience to flooding.
Residual risk	The risk that remains after risk management and mitigation. This may include risk due to very severe (above design standard) storms or risks from unforeseen hazards.
Resilience	The ability of an individual, community or system to recover from flooding.
Responsible authority	Designated under the FRM (Scotland) Act 2009 and associated legislation as local authorities, Scottish Water and, from 21 December 2013, the National Park Authorities and Forestry Commission Scotland. Responsible authorities, along with SEPA and Scottish Ministers, have specific duties in relation to their flood risk related functions.
Return period	A measure of the rarity of a flood event. It is the statistical average length of time separating flood events of a similar size. (see likelihood)
Revetment	Sloping structures placed on banks or at the foot of cliffs in such a way as to deflect the energy of incoming water.
Riparian	The riparian area is the interface between land and a river or stream. For the purposes of FRM this commonly refers to the riparian owner, which denotes ownership of the land area beside a river or stream.
River basin management planning (RBMP)	The Water Environment and Water Services (Scotland) Act 2003 transposed the European Water Framework Directive into Scots law. The Act created the River Basin Management Planning process to achieve environmental improvements to protect and improve our water environment. It also provided the framework for regulations to control the negative impacts of all activities likely to have an impact on the water environment.
Runoff reduction	Actions within a catchment or sub-catchment to reduce the amount of runoff during rainfall events. This can include intercepting rainfall,

Term	Definition
	storing water, diverting flows or encouraging infiltration.
Scottish Advisory and Implementation Forum for Flooding (SAIFF)	The stakeholder forum on flooding set up by the Scottish Government to ensure legislative and policy aims are met and to provide a platform for sharing expertise and developing common aspirations and approaches to reducing the impact of flooding on Scotland's communities, environment, cultural heritage and economy.
Sediment balance	Within a river where erosion and deposition processes are equal over the medium to long-term resulting in channel dimensions (width, depth, slope) that are relatively stable.
Sediment management	Sediment management covers a wide range of activities that includes anything from the small scale removal of dry gravels to the dredging of whole river channels and the reintroduction of removed sediment into the water environment. Historically, sediment management has been carried out for several reasons, including reducing flood risk, reducing bank erosion, for use as aggregate and to improve land drainage.
Self help	Self help actions can be undertaken by any individuals, businesses, organisations or communities at risk of flooding. They are applicable to all sources, frequency and scales of flooding. They focus on awareness raising and understanding of flood risk.
Sewer flooding (and other artificial drainage system flooding)	Flooding as a result of the sewer or other artificial drainage system (e.g. road drainage) capacity being exceeded by rainfall runoff or when the drainage system cannot discharge water at the outfall due to high water levels (river and sea levels) in receiving waters.
Site protection plans	Site protection plans are developed to identify whether normal operation of a facility can be maintained during a flood. This may be due to existing protection or resilience of the facility or the network.
Shoreline Management Plan (SMP)	A Shoreline Management Plan is a large scale assessment of the coastal flood and erosion risks to people and the developed, historic and natural environment. It sets out a long-term framework for the management of these risks in a sustainable manner.
Site of Special Scientific Interest (SSSI)	Sites of Special Scientific Interest are protected by law under the Nature Conservation (Scotland) Act 2004 to conserve their plants, animals and habitats, rocks and landforms[x].
Source of flooding	The type of flooding. This can be coastal, river, surface water or groundwater.
Special Area of Conservation (SAC)	Special Areas of Conservation are strictly protected sites designated under the European Habitats Directive. The Directive requires the establishment of a European network of protected areas which are internationally important for threatened habitats and species[xi].
Special Protection Areas (SPA)	Special Protection Areas are strictly protected sites classified in accordance with the European Birds Directive. They are classified for rare and vulnerable birds (as listed in the Directive), and for regularly occurring migratory species[xii].
Standard of protection (SoP)	All flood protection structures are designed to be effective up to a specified flood likelihood (Standard of Protection). For events beyond this standard, flooding will occur. The chosen Standard of Protection will determine the required defence height and / or capacity.
Storage area	A feature that can be used to store floodwater, this can be natural in the form of low lying land or manmade such as a reservoir or modified landform.
Strategic Environmental Assessment (SEA)	A process for the early identification and assessment of the likely significant environmental effects, positive and negative, of activities. Often considered before actions are approved or adopted.
Strategic Flood Risk Assessment (SFRA)	A Strategic Flood Risk Assessment is designed for the purposes of specifically informing the Development Plan Process. A SFRA involves the collection, analysis and presentation of all existing and readily available flood risk information (from any source) for the area of interest. It constitutes a strategic overview of flood risk.

Term	Definition
Strategic mapping and modelling	Strategic mapping and modelling actions have been identified in locations where SEPA is planning to undertake additional modelling or analysis of catchments and coastlines, working collaboratively with local authorities where appropriate, to improve the national understanding of flood risk.
Surcharge	Watercourses and culverts can carry a limited amount of water. When they can no longer cope, they overflow, or 'surcharge'.
Surface water flooding	Flooding that occurs when rainwater does not drain away through the normal drainage systems or soak into the ground, but lies on or flows over the ground instead[xiii]
Surface water management plan (SWMP)	A plan that takes an integrated approach to drainage accounting for all aspects of urban drainage systems and produces long term and sustainable actions. The aim is to ensure that during a flood the flows created can be managed in a way that will cause minimum harm to people, buildings, the environment and business.
Surface water plan/study	The management of flooding from surface water sewers, drains, small watercourses and ditches that occurs, primarily in urban areas, during heavy rainfall. FRM Strategy actions in this category include: Surface Water Management Plans, Integrated Catchment Studies and assessment of flood risk from sewerage systems (FRM Act Section 16) by Scottish Water. These have been selected as appropriate for each Potentially Vulnerable Area.
Sustainable flood risk management	The sustainable flood risk management approach aims to meet human needs, whilst preserving the environment so that these needs can be met not only in the present, but also for future generations. The delivery of sustainable development is generally recognised to reconcile three pillars of sustainability – environmental, social and economic.
Sustainable drainage systems (SuDS)	A set of techniques designed to slow the flow of water. They can contribute to reducing flood risk by absorbing some of the initial rainfall and then releasing it gradually, thereby reducing the flood peak and helping to mitigate downstream problems. SuDS encourage us to take account of quality, quantity and amenity / biodiversity.
UK Climate Change Projections (UKCP09)	The leading source of climate change information for the UK. It can help users to assess their climate risks and plan how to adapt to a changing climate. The high emissions scenario refers to the SRES A1F1 emission scenario. See Annex 1 of the UKCP09 Climate change projections report for details.[xiv]
Utility assets	Within the FRM Strategies this refers to electricity sub stations, mineral and fuel extraction sites, telephone assets, television and radio assets.
Voe	A dialect term, common in place names and used to refer to a small bay or creek in Orkney or Shetland.
Vulnerability	A measure of how likely someone or something is to suffer long-term damage as a result of flooding. It is a combination of the likelihood of suffering harm or damage during a flood (susceptibility) and the ability to recover following a flood (resilience).
Wave energy dissipation	Process by which a wave loses its energy.
Wave overtopping	Wave overtopping occurs when water passes over a flood wall or other structure as a result of wave action. Wave overtopping may lead to flooding particularly in exposed coastal locations.

[i] http://apps.sepa.org.uk/bathingwaters/ accessed 14/10/2015 last updated 2015
[ii] http://www.susdrain.org/delivering-suds/using-suds/suds-components/swales-and-conveyance-channels/swales.html accessed 12/10/2015 last updated 2012
[iii] http://www.gov.scot/Resource/Doc/362219/0122541.pdf accessed 12/10/2015 last updated 2011
[iv] http://www.legislation.gov.uk/ukpga/2004/36/schedule/1 accessed 12/10/2015 last updated 2004
[v] http://evidence.environment-agency.gov.uk/FCERM/en/FluvialDesignGuide/Chapter9.aspx?pagenum=10 accessed 12/10/2015 last update 07/03/2012
[vii] http://ec.europa.eu/environment/water/flood_risk/ accessed 12/10/2015 last updated 17/09/2015
[viii] http://www.gov.scot/Resource/Doc/362219/0122541.pdf accessed 12/10/2015 last updated 2011

[ix] http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/local-designations/lnr/ accessed 12/10/2015 last updated 12/07/2015
[x] http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/national-designations/sssis/ accessed 12/10/2015 last updated 21/01/2015
[xi] http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/international-designations/sac/ accessed 12/10/2015 last updated 01/03/2013
[xii] http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/international-designations/spa/ accessed 12/10/2015 last updated 01/03/2013
[xiii] http://watermaps.environment-agency.gov.uk/wiyby/wiyby.aspx?topic=ufmfsw#x=357683&y=355134&scale=2 accessed 12/10/2015 last updated 12/10/2015
[xiv] http://ukclimateprojections.metoffice.gov.uk Document © Crown copyright 2009 accessed 01/12/15 last updated 30/04/2012

Annex 2: Land use planning

Flood risk management actions from national planning policies
AVOID DEVELOPMENT IN MEDIUM TO HIGH RISK AREAS a) **Planning authorities** work in partnership undertaking catchment-wide Strategic Flood Risk Assessments to inform their development plan allocations in line with SEPA's guidance and Land Use Vulnerability. b) **Planning authorities and SEPA** require the submission of flood risk assessments that accord with SEPA's *Technical Flood Risk Guidance for Stakeholders*, to support planning applications where there is a potential flood risk. The flood risk assessment should be used to demonstrate as far as possible that the development will be safe for its lifetime, without increasing flood risk elsewhere and, where possible, takes opportunities to reduce flood risk overall. c) **SEPA** ensures that its flood risk advice to planning authorities is clear and appropriate. SEPA, in consultation with planning authorities, undertakes an annual assessment of planning advice and its contribution to flood risk. d) **SEPA and planning authorities** engage at an early stage of the development plan process to agree appropriate forms of development to help inform the preparation and implementation of Strategic Flood Risk Assessments.
REDUCE IMPACTS TO EXISTING BUILDINGS a) **SEPA, planning authorities and local communities** are required to engage at an early stage of the development plan process to agree the best long term land uses for areas where relocation, abandonment and/or change of use have been identified to deliver sustainable flood risk management. Where possible, new land uses should aim to achieve multiple benefits for local communities such as the creation of blue / green infrastructure and increased resilience to climate change.
PROTECT AND ENHANCE NATURAL FEATURES THAT HAVE A POSITIVE IMPACT ON REDUCING OVERALL FLOOD RISK a) **SEPA and planning authorities** are required to engage early in the development plan process to identify opportunities for the restoration and protection of natural features which help manage flood risk. Opportunities should be maximised to achieve multiple benefits such as the development of green / blue infrastructure and improved place making. Areas of land that may contribute to flood management should be identified and protected.
NEW DEVELOPMENTS ARE DESIGNED TO ENSURE THAT SURFACE WATER DRAINAGE DOES NOT INCREASE FLOOD RISK ON OR OFF SITE a) **SEPA** prepares guidance for planning authorities and developers on the use of surface water hazard maps for land use planning purposes. b) **Planning authorities** support the implementation of Surface Water Management Plans, developed by the local authorities, through development plan allocations and policies. Surface Water Management Plans should take account of development opportunities that could contribute to the reduction of surface water flood risk. c) **SEPA** engages at an early stage of the development plan process to progress exemplar projects that demonstrate the potential for land use planning to mitigate surface water flooding and contribute to wider environmental benefits.
a) **NEW DEVELOPMENT IS RESILIENT TO PREDICTED FUTURE CHANGES IN CLIMATE Planning authorities** ensure that climate change is considered in Strategic Flood Risk Assessments and Flood Risk Assessments, based upon the best scientific evidence and the information requirements of planners to make informed decisions.

Table 1: Objectives and actions that reflect national Land Use Planning policies and guidance

Annex 3: Acknowledgements

SEPA gratefully acknowledges the cooperation and input that various parties have provided, including *inter alia*, the following organisations:

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Local authorities
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Further detail on the datasets that have been used in the development of the Flood Risk Management Strategies can be found in the Strategic Appraisal Methodology, which is available from the SEPA webpage.