



# Flood Risk Management Strategy

## Orkney



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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 680 residential and 460 non-residential properties are at risk of flooding in the Orkney Local Plan District. Kirkwall is just one of the areas where the greatest impacts of flooding can be found. The annual damages across the region are estimated to be £4.2 million, largely from coastal 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 Orkney Islands 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 Orkney Islands 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



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# Orkney 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](http://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:

- Orkney Islands 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. The local authority 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 Orkney Islands Local Advisory Group include representatives from a range of sectors, including government agencies, the local authority, 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.

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.

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](http://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 a 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

# Flood Risk Management Strategy

## Orkney 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

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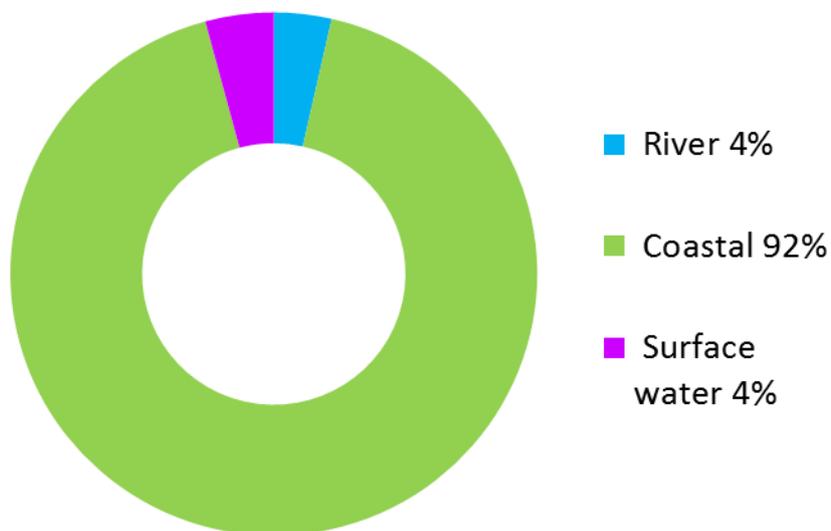
## 2.1 Summary of flooding in the Orkney Local Plan District

The Orkney Local Plan District comprises all of the Orkney Islands. It has an area of approximately 1,000km<sup>2</sup> and a coastline with a length of approximately 860km. There are eight Potentially Vulnerable Areas in the Orkney Local Plan District. Two of these are candidate Potentially Vulnerable Areas identified following a review of flood risk in Orkney. These have been included for further analysis (Figure 2).

### Flood risk in Orkney

There are approximately 680 residential properties and 460 non-residential properties at risk of flooding within the Local Plan District. This equates to less than 1% of all properties nationally. Within the Local Plan District, approximately 7% of all residential properties and 17% of all non-residential properties are at risk and it is estimated that 82% of these are located within Potentially Vulnerable Areas and candidate Potentially Vulnerable Areas. The Annual Average Damages from flooding (see glossary) are approximately £4.2 million, with an estimated 92% of the damages for the entire Local Plan District accounted for in the Potentially Vulnerable Areas.

The main source of flooding is from coastal flooding which accounts for approximately 94% of the Annual Average Damages (Figure 1). Annual Average Damages caused by coastal floods are £3.9 million, with those caused by river and surface water floods being approximately £150,000 and £170,000 respectively.



**Figure 1:** Annual Average Damages by flood source

Table 1 shows the number of properties at risk and the Annual Average Damages caused by flooding in the main areas within the Local Plan District. This includes damages to residential properties, non-residential properties, transport and agriculture. Please note that economic damages to airports are not included as information on damages at this scale is not available.

	Residential and non-residential properties at risk of flooding	Annual Average Damages
Kirkwall	750	£2.1 million
Sanday	80	£740,000
Stromness	70	£140,000
Stronsay	50	£250,000
Westray	60	£90,000
South Ronaldsay	50	£85,000

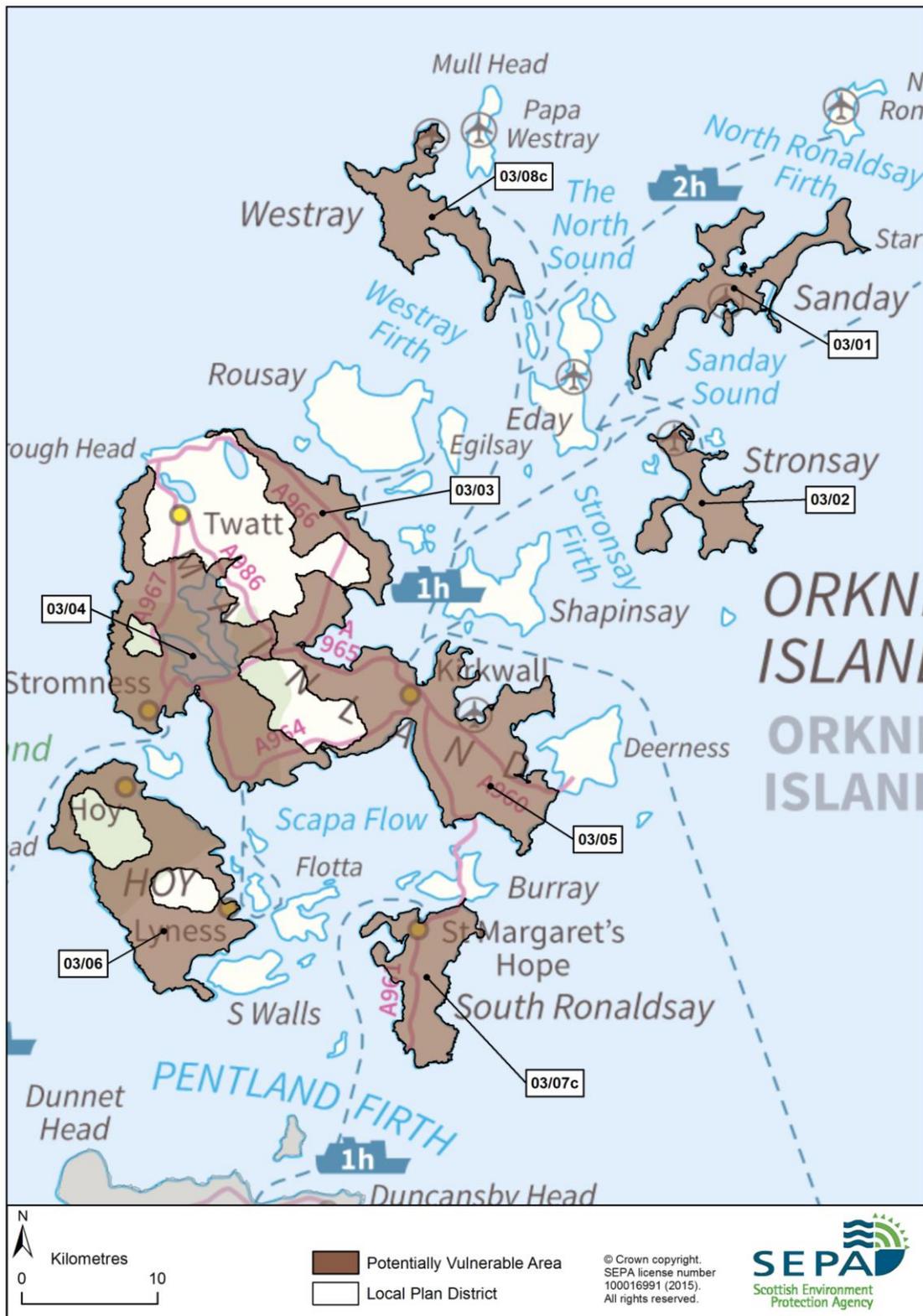
**Table 1:** Main areas at risk of flooding

### Background information on the Orkney Local Plan District

The extent of the Orkney Local Plan District and the location of the Potentially Vulnerable Areas are shown in Figure 2.

The population of the Orkney Islands is approximately 21,500. There are around 70 islands, of which 20 are inhabited. The largest settlement with a population of around 8,500 is Kirkwall.

Approximately 3% of the area of the Orkney Local Plan District is classified as urban. The main land cover across the Local Plan District is improved grassland covering 36% of the area and rough grassland covering 28% of the area. Heather grassland is also fairly common covering 14% of the area.



**Figure 2:** The Orkney Island Local Plan District with Potentially Vulnerable Areas identified

## Objectives and actions in the Orkney 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 the Orkney Local Plan District	Avoid an overall increase in flood risk	300001	<ul style="list-style-type: none"> <li>• 680 residential properties</li> <li>• 460 non-residential properties</li> <li>• 1,500 people</li> </ul>
Applies across the Orkney Local Plan District	Reduce overall flood risk	300002	<ul style="list-style-type: none"> <li>• 680 residential properties</li> <li>• 460 non-residential properties</li> <li>• 1,500 people</li> </ul>

<b>Action (ID):</b>	<b>FLOOD FORECASTING (3000020009)</b>		
<b>Objective (ID):</b>	<b>Reduce overall flood risk. (300002)</b>		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SELF HELP (3000020011)</b>		
<b>Objective (ID):</b>	<b>Reduce overall flood risk. (300002)</b>		
<b>Delivery lead:</b>	-		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>AWARENESS RAISING (3000020013)</b>		
<b>Objective (ID):</b>	<b>Reduce overall flood risk. (300002)</b>		
<b>Delivery lead:</b>	Responsible authorities		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p> <p>Local authorities will be undertaking additional awareness raising activities, further details will be set out in the Local FRM Plans.</p>		

<b>Action (ID):</b>	<b>MAINTENANCE (3000020007)</b>		
<b>Objective (ID):</b>	<b>Reduce overall flood risk. (300002)</b>		
<b>Delivery lead:</b>	Local authority, asset / land managers		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

<b>Action (ID):</b>	<b>EMERGENCY PLANS / RESPONSE (3000020014)</b>		
<b>Objective (ID):</b>	<b>Reduce overall flood risk. (300002)</b>		
<b>Delivery lead:</b>	Category 1 and 2 Responders		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

<b>Action (ID):</b>	<b>PLANNING POLICIES (3000010001)</b>		
<b>Objective (ID):</b>	<b>Avoid an overall increase in flood risk. (300001)</b> <b>Reduce overall flood risk. (300002)</b>		
<b>Delivery lead:</b>	Planning authority		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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
03/01			✓				✓	N/A	N/A	✓			✓	✓	✓		✓	✓
03/02			✓	✓				N/A	N/A	✓			✓	✓	✓		✓	✓
03/03			✓				✓	N/A	N/A	✓			✓	✓	✓		✓	✓
03/04			✓				✓	N/A	N/A	✓			✓	✓	✓		✓	✓
03/05	✓		✓	✓		✓	✓	N/A	N/A	✓			✓	✓	✓		✓	✓
03/06			✓	✓				N/A	N/A	✓			✓	✓	✓		✓	✓
03/07c			✓	✓				N/A	N/A	✓			✓	✓	✓		✓	✓
03/08c			✓	✓				N/A	N/A	✓			✓	✓	✓		✓	✓

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

## Sanday (Potentially Vulnerable Area 03/01)

Local Plan District	Local authority	Main catchment
Orkney	Orkney Islands Council	Sanday coastal

### Summary of flooding impacts



#### At risk of flooding

- 60 residential properties
- 20 non-residential properties
- £740,000 Annual Average Damages

(damages by flood source shown left)

Summary of flooding impacts

### 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.

Objectives

### Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

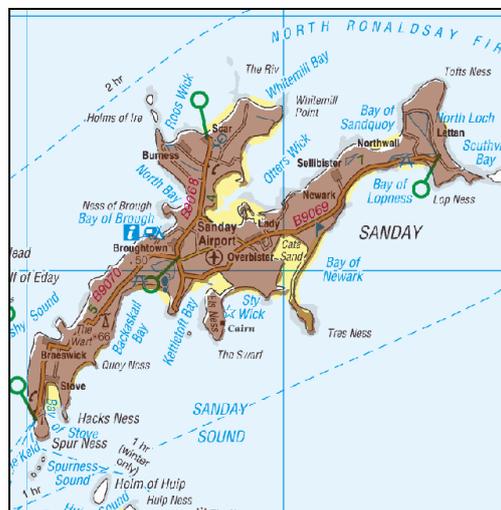
<i>Flood protection scheme/works</i>	<i>Natural flood management works</i>	<b>New flood warning</b>	<i>Community flood action groups</i>	<i>Property level protection scheme</i>	<i>Site protection plans</i>
<i>Flood protection study</i>	<i>Natural flood management study</i>	<i>Maintain flood warning</i>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

Actions

## Sanday (Potentially Vulnerable Area 03/01)

Local Plan District	Local authority	Main catchment
Orkney	Orkney Islands Council	Sanday coastal

### Background



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This Potentially Vulnerable Area covers the island of Sanday (shown left). It has an area of approximately 50km<sup>2</sup> and includes all the settlements on the island, the road network and the airport.

There are approximately 60 residential and 20 non-residential properties at risk of flooding.

The Annual Average Damages are estimated to be £740,000 with all of these attributed to coastal flooding.

### Summary of flooding impacts

Coastal flood risk affects extensive parts of the island, including the main settlements. There is the potential for the island to be split into two or more smaller islands during coastal floods.

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.

Roads affected by flooding include the B9068, B9069 and B9070. Flooding of roads affects commuting to the mainland and disrupts access to farmland, amenities and the emergency services. The air ambulance relies on access to the air strip, which becomes cut off when the road is flooded.

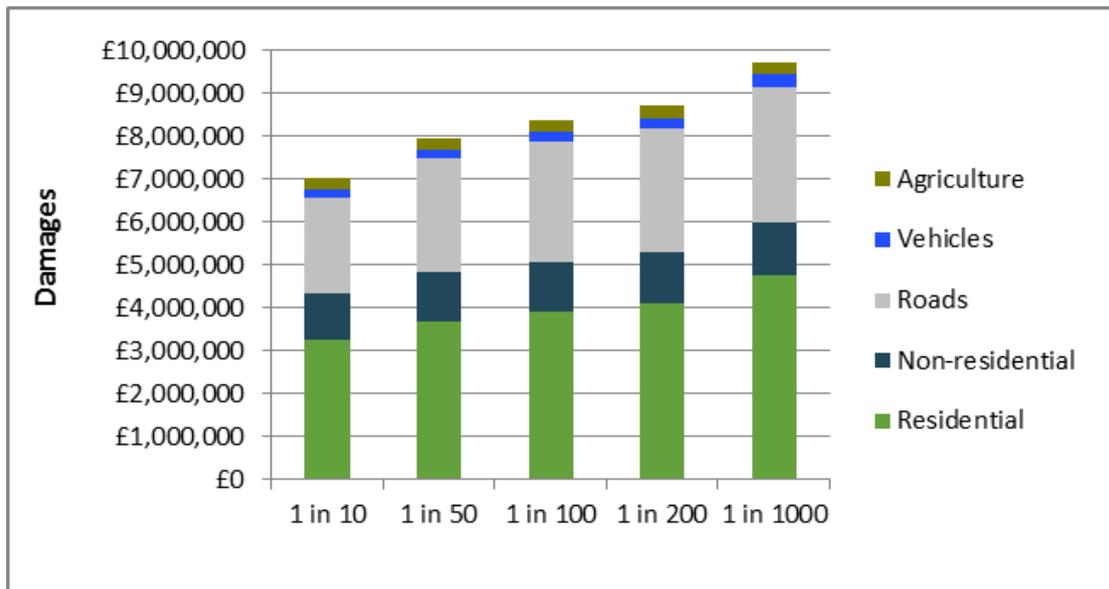
Eight designated cultural heritage sites, including scheduled monuments, are at risk of flooding. Significant areas of agricultural land and environmental importance are also at risk. The sites include East Sanday Coast Special Protection Area, Central Sanday Site of Special Scientific Interest (SSSI) and Northwall SSSI.

The damages associated with floods of different likelihood are shown in Figure 1. Residential properties and roads experience the greatest economic impact. Note that cultural heritage and environmental sites are not included in the estimation of the economic impact of flooding due to the difficulty in placing an economic value on these impacts.

The location of the impacts of flooding is shown in Figure 2.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 260)	30	60	70
Non-residential properties (total 70)	20	20	20
People	70	130	160
Community facilities	0	0	0
Utilities assets	0	0	0
Transport links (excluding minor roads)	Roads at 40 locations	Roads at 50 locations	Roads at 50 locations
Environmental designated areas (km <sup>2</sup> )	7	7	8
Designated cultural heritage sites	8	8	8
Agricultural land (km <sup>2</sup> )	11	13	14

**Table 1:** Summary of flooding impacts<sup>1</sup>



**Figure 1:** Damages by flood likelihood

<sup>1</sup> Some receptors are counted more than once if flooded from multiple sources

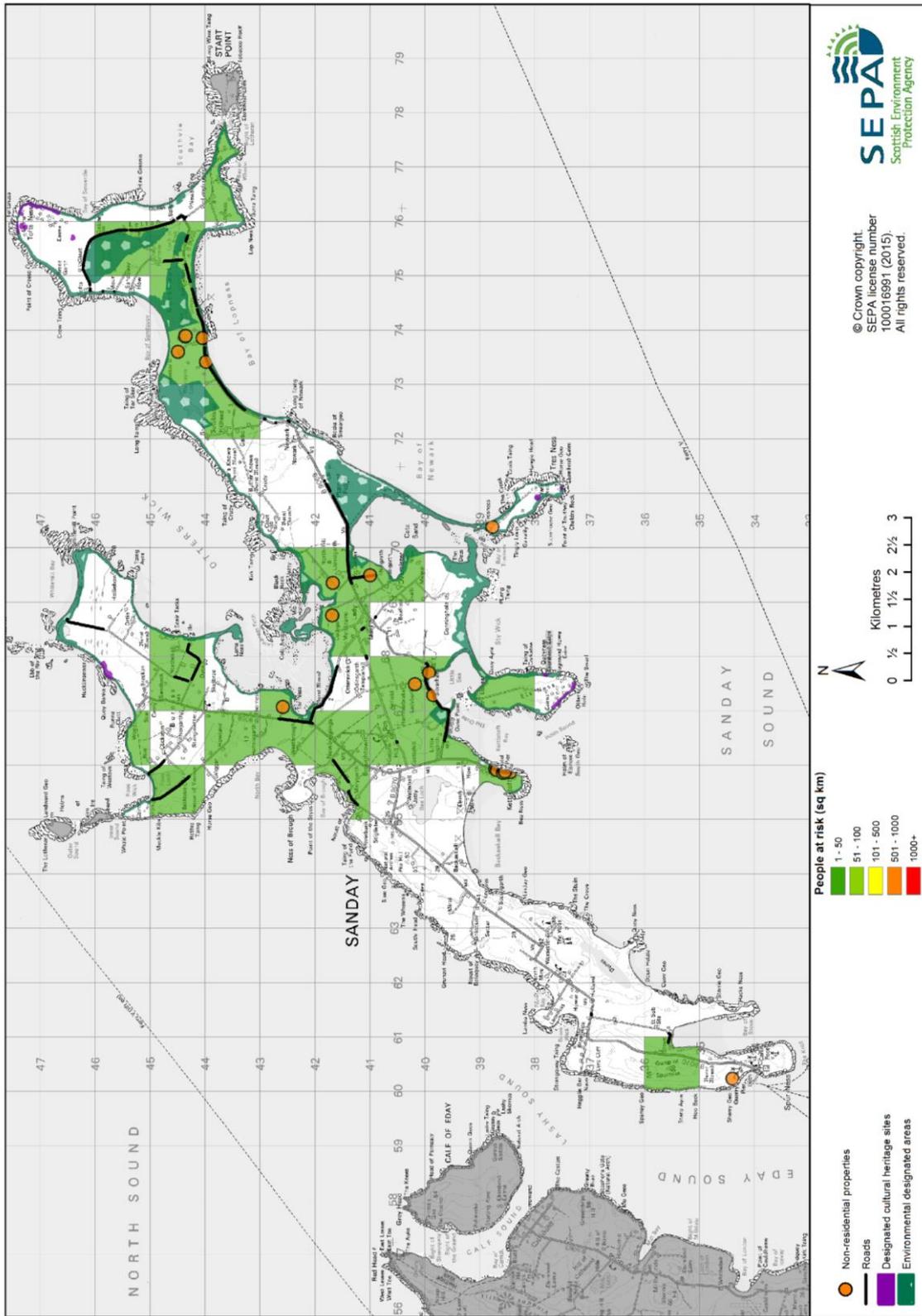


Figure 2: Impacts of flooding

## History of flooding

Anecdotal reports of flooding in Sanday have been noted at regular intervals in the last 100 years, often closely linked to other factors such as coastal erosion, which is very pertinent to the island given its topography and geology.

More recently, floods have been recorded affecting different areas of the island. In January 2005 a coastal storm destroyed a section of road and seawall at Cleat / Klondyke, damaged the sea wall at Tofts and a section of defences to the north of Kettletoft Bay increasing the vulnerability of the road to future events.

In August 2007, roads and fields flooded due to a burn being unable to cope with runoff from surrounding land. In January 2013 sea defences along the B9069 were breached at Isegarth causing flooding to the road.

## Objectives to manage flooding in Potentially Vulnerable Area 03/01

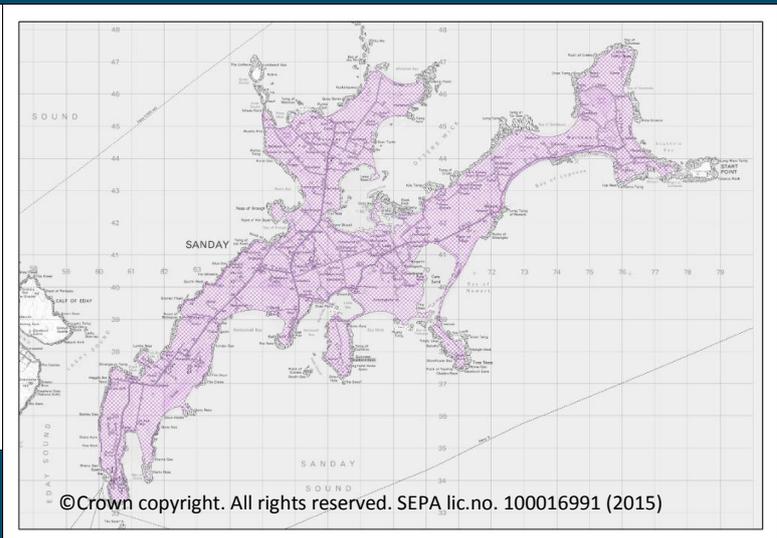
Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target 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 Sanday Potentially Vulnerable Area.

### Reduce risk in Sanday from coastal flooding

Indicators:

Target area:

- 110 people
- £350,000 Annual Average Damages from residential properties
- £110,000 Annual Average Damages from non-residential properties
- B9069 (Newark to Northwall, Little Isegarth to Silverhall)



Objective ID: 300101

Target area	Objective	ID	Indicators within PVA
Applies across Orkney Local Plan District	Avoid an overall increase in flood risk	300001	<ul style="list-style-type: none"> <li>• 60 residential properties</li> <li>• £740,000 Annual Average Damages</li> </ul>
Applies across Orkney Local Plan District	Reduce overall flood risk	300002	<ul style="list-style-type: none"> <li>• 60 residential properties</li> <li>• £740,000 Annual Average Damages</li> </ul>
Applies across Orkney 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 03/01

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 Sanday Potentially Vulnerable Area.

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

<b>Action (ID):</b>	<b>NEW FLOOD WARNING (3000020010)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	The area under consideration covers the coastline of the Orkney Islands. Forecasting capability is currently under development.		

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (3001010016)</b>		
<b>Objective (ID):</b>	Reduce risk in Sanday from coastal flooding (300101)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	SEPA will be seeking to develop the flood hazard mapping on Sanday to improve understanding of the coastal flood risk. The extent and timing of the completed improvements will be dependent on detailed scoping and data availability.		

<b>Action (ID):</b>	<b>FLOOD FORECASTING (3000020009)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p> <p>The Potentially Vulnerable Area is within the 'Orkney' flood alert area.</p>		

<b>Action (ID):</b>	<b>SELF HELP (3000020011)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	—		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

<b>Action (ID):</b>	<b>AWARENESS RAISING (3000020013)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	Responsible authorities		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p> <p>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.</p>		

<b>Action (ID):</b>	<b>MAINTENANCE (3000020007)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	Orkney Islands Council, asset / land managers		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

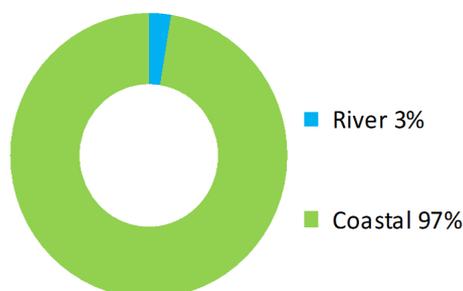
<b>Action (ID):</b>	<b>EMERGENCY PLANS/RESPONSE (3000020014)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	Category 1 and 2 Responders		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	Providing an emergency response to 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. Orkney Islands Council monitors the flood risk daily by comparing forecast tide and surge levels with land levels. This enables advanced warning of coastal flood events to be provided.		

<b>Action (ID):</b>	<b>PLANNING POLICIES</b> (3000010001)		
<b>Objective (ID):</b>	Avoid an overall increase in flood risk (300001) Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	Planning authority		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

## Stronsay (Potentially Vulnerable Area 03/02)

Local Plan District	Local authority	Main catchment
Orkney	Orkney Island Council	Stronsay coastal

### Summary of flooding impacts



#### At risk of flooding

- 40 residential properties
- 10 non-residential properties
- £250,000 Annual Average Damages

(damages by flood source shown left)

Summary of flooding impacts

### 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.

Objectives

### Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

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

Actions

## Stronsay (Potentially Vulnerable Area 03/02)

Local Plan District	Local authority	Main catchment
Orkney	Orkney Islands Council	Stronsay coastal

### Background

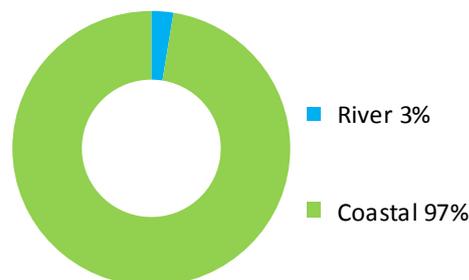
This Potentially Vulnerable Area covers the island of Stronsay (shown below). It is approximately 34km<sup>2</sup>.



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There are approximately 40 residential and 10 non-residential properties at risk of flooding.

The Annual Average Damages are estimated to be £250,000 with the majority caused by coastal flooding.



**Figure 1:** Annual Average Damages by flood source

### Summary of flooding impacts

Coastal flood risk is mainly focused around Whitehall in the north. Further areas of risk including low-lying land around Bay of Houseby and Holland in the south and to the west of Loch Rothiesholm where there is a risk of the village of Rothiesholm being cut off from the rest of the island.

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. Roads potentially affected by flooding include the B9060 and B9061 and the access road to the ferry terminal. Six designated cultural heritage sites, including scheduled monuments, are also at risk.

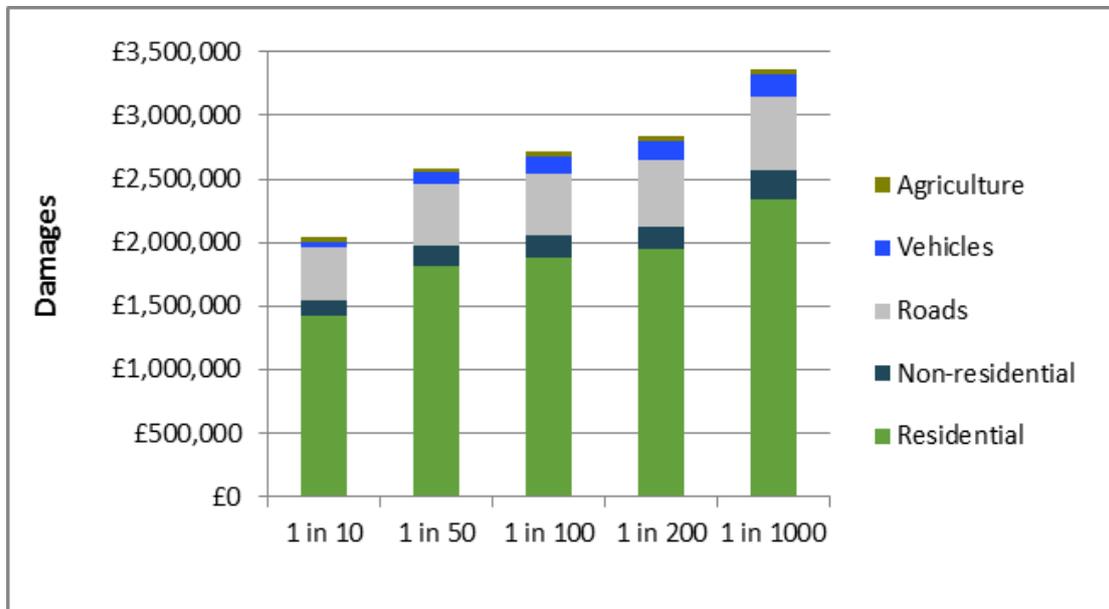
The risk of flooding to utilities in Table 1 does not include Scottish Water data. Scottish Water undertook a national assessment of above ground assets at medium likelihood of flooding (including water treatment works, wastewater treatment works, and pumping stations). Within this Potentially Vulnerable Area there is one asset identified as being at risk of flooding.

The damages associated with floods of different likelihood are shown in Figure 2. For this Potentially Vulnerable Area the highest damages are to residential properties followed by damages to roads. Note that cultural heritage and environmental sites are not included in the estimation of the economic impact of flooding due to the difficulty in placing an economic value on these impacts.

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

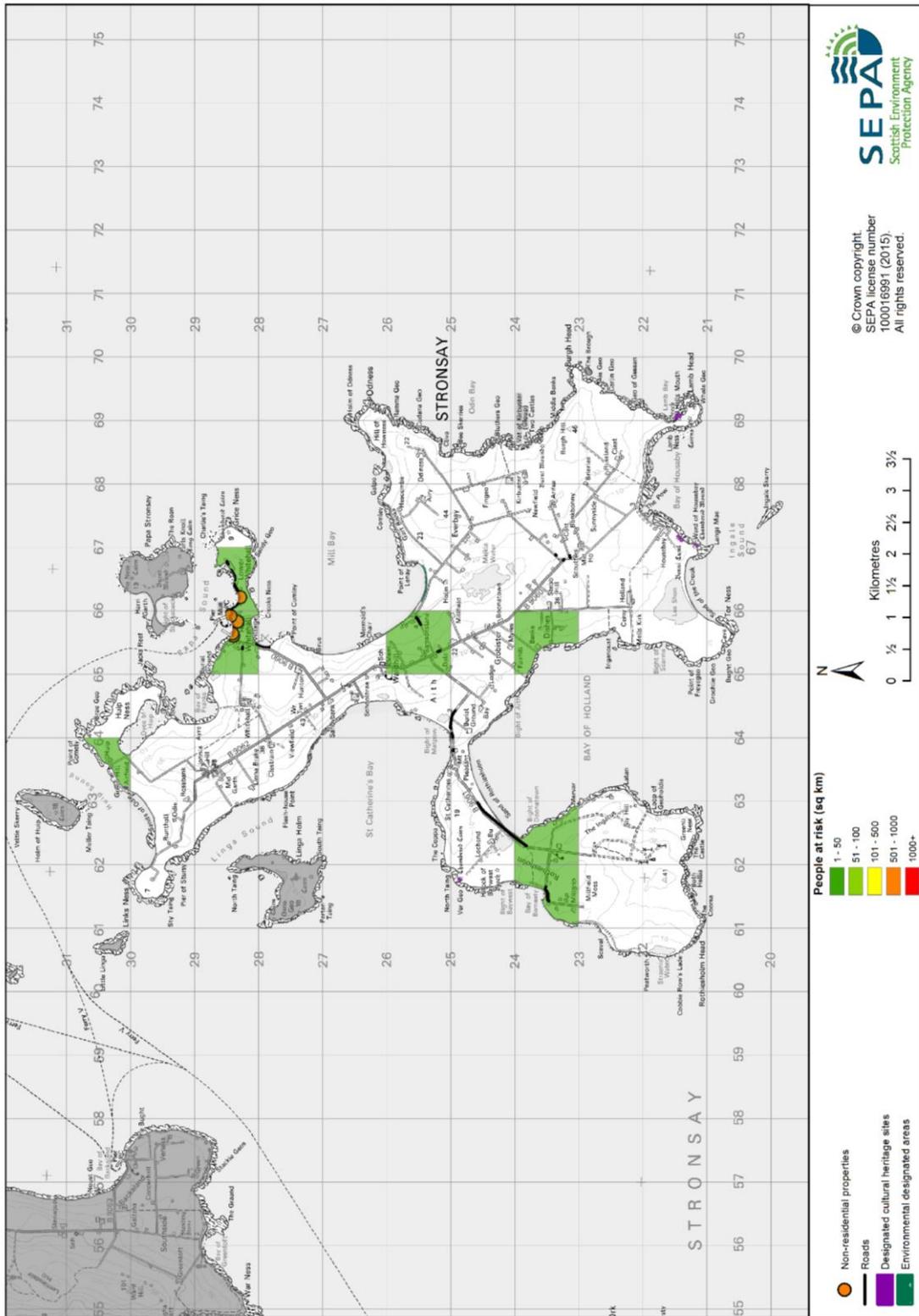
	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 180)	30	40	50
Non-residential properties (total 40)	<10	10	10
People	60	80	100
Community facilities	0	0	0
Utilities assets	0	0	0
Transport links (excluding minor roads)	Roads at 20 locations	Roads at 20 locations	Roads at 20 locations
Environmental designated areas (km <sup>2</sup> )	0	0	0
Designated cultural heritage sites	5	6	6
Agricultural land (km <sup>2</sup> )	1	2	2

**Table 1:** Summary of flooding impacts<sup>1</sup>



**Figure 2:** Damages by flood likelihood

<sup>1</sup> Some receptors are counted more than once if flooded from multiple sources



**Figure 3: Impacts of flooding**

## History of flooding

There is a recorded history of regular coastal flooding on Stronsay, particularly in Whitehall and Mill Bay, where the issue is exacerbated by wave action, the inability of outfalls to discharge freely due to high tide levels and the overtopping of existing coastal defences.

The most notable flood was the 1953 North Sea flood, which inundated seafront houses, damaged property and affected roads. More recent recorded floods include January 2005, when a winter storm caused damage and disruption across the island, including coastal flooding in Whitehall. Similar floods were recorded in November 2011 and December 2013 which flooded roads and property.

## Objectives to manage flooding in Potentially Vulnerable Area 03/02

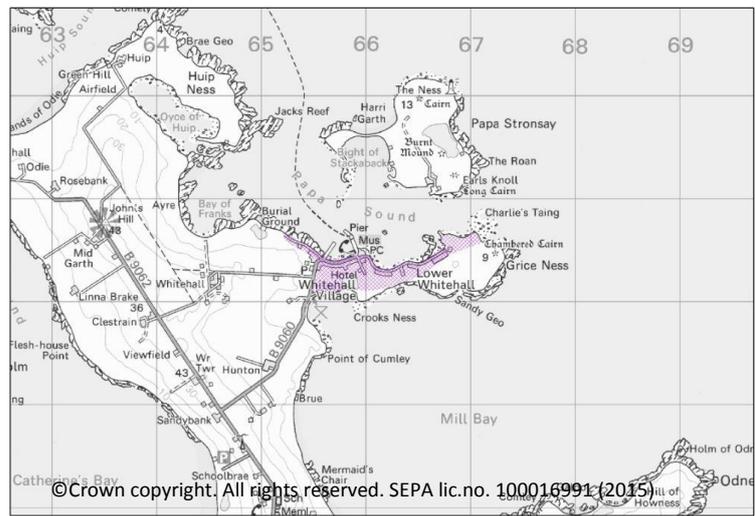
Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target 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 Stronsay Potentially Vulnerable Area.

### Reduce risk in Whitehall from coastal flooding

Indicators:

Target area:

- 50 people
- £120,000 Annual Average Damages from residential properties
- £11,000 Annual Average Damages from non-residential properties
- B9060 through Whitehall



Objective ID: 300201

Target area	Objective	ID	Indicators within PVA
Applies across Orkney Local Plan District	Avoid an overall increase in flood risk	300001	<ul style="list-style-type: none"> <li>• 40 residential properties</li> <li>• £250,000 Annual Average Damages</li> </ul>
Applies across Orkney Local Plan District	Reduce overall flood risk	300002	<ul style="list-style-type: none"> <li>• 40 residential properties</li> <li>• £250,000 Annual Average Damages</li> </ul>
Applies across Orkney 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 03/02

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 Stronsay Potentially Vulnerable Area.

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

<b>Action (ID):</b>	<b>NEW FLOOD WARNING (3000020010)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	The area under consideration covers the coastline of the Orkney Islands. Forecasting capability is currently under development.		

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (3002010005)</b>		
<b>Objective (ID):</b>	Reduce risk in Whitehall from coastal flooding (300201)		
<b>Delivery lead:</b>	Orkney Islands Council		
<b>Priority:</b>	National:	Within local authority:	
	<b>79 of 168</b>	<b>1 of 6</b>	
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	A flood protection study is required to consider flood protection works for Whitehall. The study should primarily focus on coastal management actions, direct defences and property level protection, but other actions may also be considered in order to develop the most sustainable range of options. The investigation will assess the impact from wave overtopping to confirm the existing risk and define the height and extent of flood protection works required.		

Potential impacts	
<b>Economic:</b>	The study could benefit 26 residential and seven non-residential properties at risk of flooding in this location, with potential damages avoided of up to £4.9 million.
<b>Social:</b>	The development of flood protection works following the study would potentially reduce risk to 57 people. A reduction in flood risk would have a positive benefit to the health and wellbeing of the community and socially vulnerable people. The B9060 would have reduced flood risk, therefore improving access across the town. Negative impacts through disturbance to the local community during the construction phase should be considered.
<b>Environmental:</b>	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. Opportunities to mitigate any environmental impacts may include design and timing of works. There is potential for positive impacts such as improving the aesthetics of the frontage if required, as well as negative impacts such as impacting on coastal habitats. There are no designated sites close to Whitehall.

<b>Action (ID):</b>	<b>FLOOD FORECASTING (3000020009)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p> <p>The Potentially Vulnerable Area is within the 'Orkney' flood alert area.</p>		

<b>Action (ID):</b>	<b>SELF HELP (3000020011)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	—		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

<b>Action (ID):</b>	<b>AWARENESS RAISING (3000020013)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	Responsible authorities		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p> <p>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.</p>		

<b>Action (ID):</b>	<b>MAINTENANCE (3000020007)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	Orkney Islands Council, asset / land managers		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

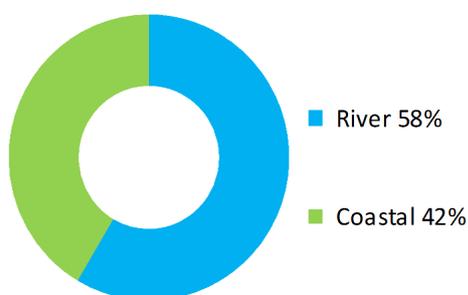
<b>Action (ID):</b>	<b>EMERGENCY PLANS/RESPONSE (3000020014)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	Category 1 and 2 Responders		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>Providing an emergency response 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.</p> <p>Orkney Islands Council monitors the flood risk daily by comparing forecast tide and surge levels with land levels. This enables advanced warning of coastal flood events to be provided.</p>		

<b>Action (ID):</b>	<b>PLANNING POLICIES (3000010001)</b>		
<b>Objective (ID):</b>	Avoid an overall increase in flood risk (300001) Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	Planning authority		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

# Orkney Mainland North (Potentially Vulnerable Area 03/03)

Local Plan District	Local authority	Main catchment
Orkney	Orkney Islands Council	Orkney coastal

## Summary of flooding impacts



### At risk of flooding

- <10 residential properties
- <10 non-residential properties
- £14,000 Annual Average Damages

(damages by flood source shown left)

Summary of flooding impacts

## 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.

Objectives

## Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

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

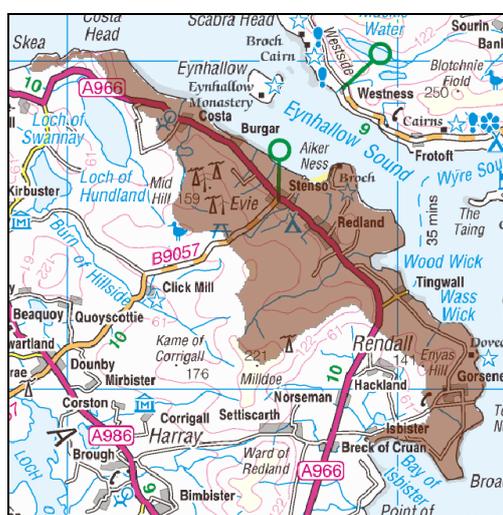
Actions

# Orkney Mainland North (Potentially Vulnerable Area 03/03)

Local Plan District	Local authority	Main catchment
Orkney	Orkney Islands Council	Orkney coastal

## Background

This Potentially Vulnerable Area is located on the north east coast of the Orkney Mainland (shown below). It is approximately 41km<sup>2</sup> and includes Costa, Evie Village, Tingwall, Woodwick, Broch of Gurness and Eynhallow Sound.

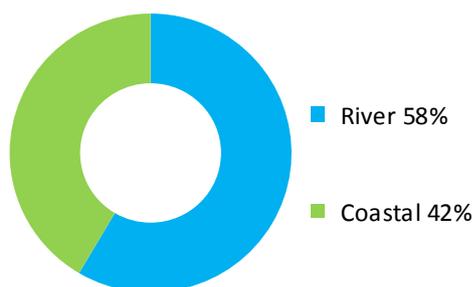


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The area extends along the coastline from the Bay of Isbister in the south east to Skea on the north coast. Peerie Water and several burns and lochs are within the area, including the Burn of Woodwick.

There are fewer than 10 residential and non-residential properties at risk of flooding.

The Annual Average Damages are estimated to be £14,000 with the majority caused by river flooding.



**Figure 1: Annual Average Damages by flood source**

## Summary of flooding impacts

There are no significant areas of coastal flood risk, but there are small areas of river flood risk around Isbister and Woodwick.

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.

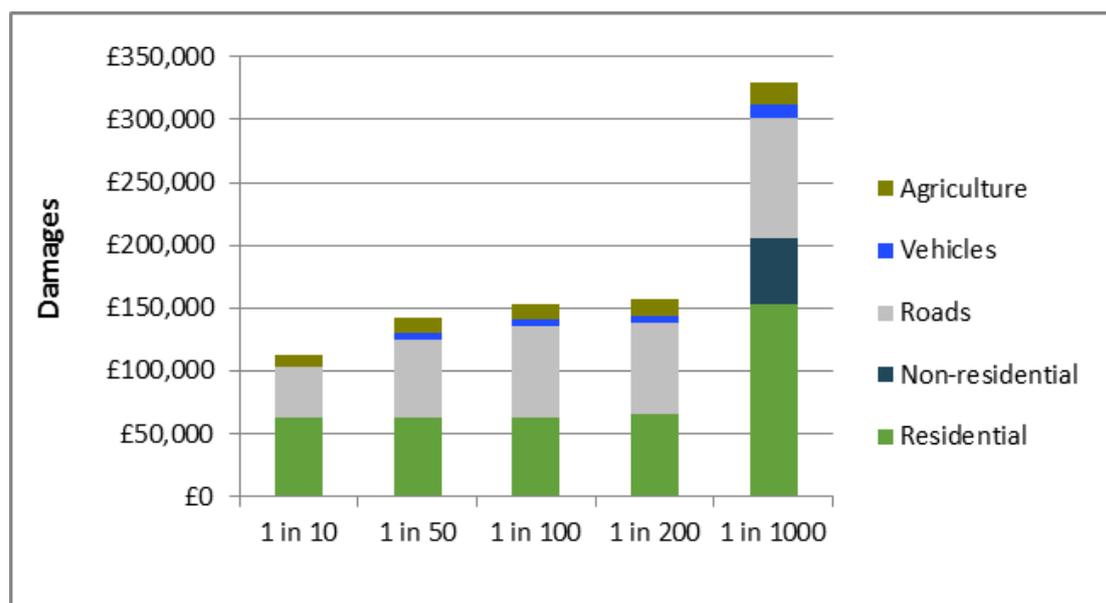
Roads potentially affected by flooding include the A966. There are 10 designated cultural heritage sites, including scheduled monuments, and small areas of environmental importance at risk of flooding. The sites include Orkney Mainland Moors and West Mainland Moors Special Protection Areas and Sites of Special Scientific Interest.

The damages associated with floods of different likelihood are shown in Figure 2. For this Potentially Vulnerable Area the highest damages are to residential properties followed by damages to roads. Note that cultural heritage and environmental sites are not included in the estimation of the economic impact of flooding due to the difficulty in placing an economic value on these impacts.

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 250)	<10	<10	<10
Non-residential properties (total 70)	<10	<10	<10
People	<10	<10	10
Community facilities	0	0	0
Utilities assets	0	0	0
Transport links (excluding minor roads)	Roads at <10 locations	Roads at <10 locations	Roads at <10 locations
Environmental designated areas (km <sup>2</sup> )	<0.1	<0.1	<0.1
Designated cultural heritage sites	9	10	10
Agricultural land (km <sup>2</sup> )	0.5	0.7	0.8

**Table 1:** Summary of flooding impacts<sup>1</sup>



**Figure 2:** Damages by flood likelihood

## History of flooding

There have been no recorded incidents of properties being flooded in this Potentially Vulnerable Area. Recorded floods have been minor, for example in September 2007, agricultural and roadside drainage systems were overwhelmed resulting in ponding of excess surface water on the A966 in Evie.

<sup>1</sup> Some receptors are counted more than once if flooded from multiple sources

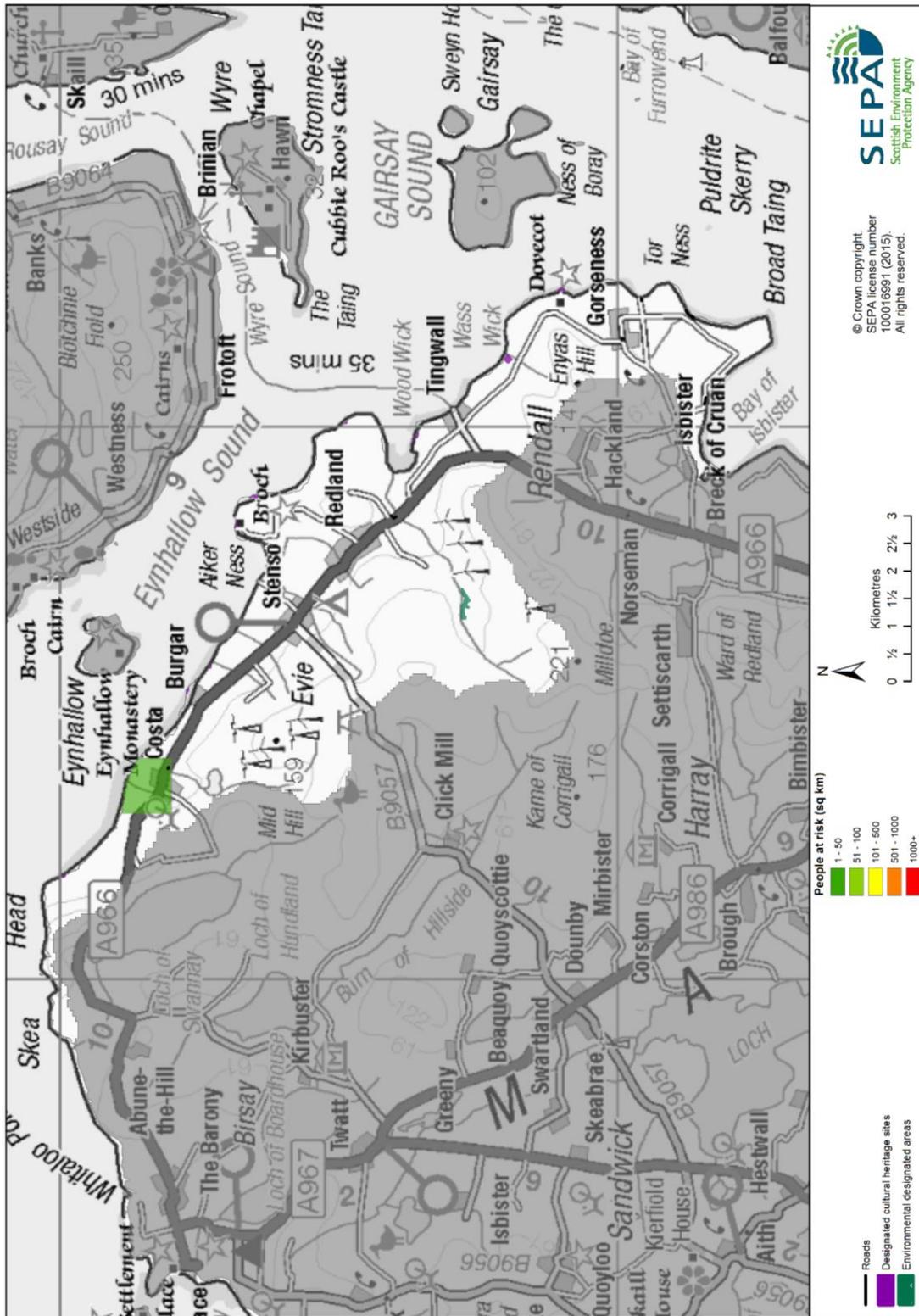


Figure 3: Impacts of flooding

## Objectives to manage flooding in Potentially Vulnerable Area 03/03

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 Orkney Mainland North Potentially Vulnerable Area.

Target area	Objective	ID	Indicators within PVA
Applies across Orkney Local Plan District	Avoid an overall increase in flood risk	300001	<ul style="list-style-type: none"> <li>• &lt;10 residential properties</li> <li>• £14,000 Annual Average Damages</li> </ul>
Applies across Orkney Local Plan District	Reduce overall flood risk	300002	<ul style="list-style-type: none"> <li>• &lt;10 residential properties</li> <li>• £14,000 Annual Average Damages</li> </ul>
Applies across Orkney 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 03/03

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 Orkney Mainland North Potentially Vulnerable Area.

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

<b>Action (ID):</b>	<b>NEW FLOOD WARNING (3000020010)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	The area under consideration covers the coastline of the Orkney Islands. Forecasting capability is currently under development.		

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (3000020016)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	<p>SEPA will be seeking to incorporate additional surface water hazard mapping information into the flood maps to improve understanding of flood risk. Approximately 200km<sup>2</sup> of improved data is currently available within this Local Plan District .</p> <p>SEPA will be seeking to develop the flood hazard mapping in the Orkney Mainland area to improve understanding of the coastal flood risk. The extent and timing of the completed improvements will be dependent on detailed scoping and data availability.</p>		

<b>Action (ID):</b>	<b>FLOOD FORECASTING (3000020009)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p> <p>The Potentially Vulnerable Area is within the 'Orkney' flood alert area.</p>		

<b>Action (ID):</b>	<b>SELF HELP (3000020011)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	—		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

<b>Action (ID):</b>	<b>AWARENESS RAISING (3000020013)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	Responsible authorities		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p> <p>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.</p>		

<b>Action (ID):</b>	<b>MAINTENANCE (3000020007)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	Orkney Islands Council, asset / land managers		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

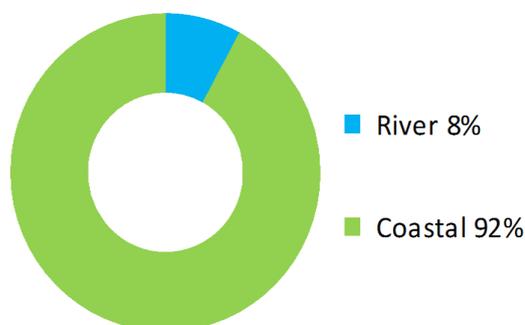
<b>Action (ID):</b>	<b>EMERGENCY PLANS/RESPONSE (3000020014)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	Category 1 and 2 Responders		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	Providing an emergency response to 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. Orkney Islands Council monitors the flood risk daily by comparing forecast tide and surge levels with land levels. This enables advanced warning of coastal flood events to be provided.		

<b>Action (ID):</b>	<b>PLANNING POLICIES</b> (3000010001)		
<b>Objective (ID):</b>	Avoid an overall increase in flood risk (300001) Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	Planning authority		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

## Stromness (Potentially Vulnerable Area 03/04)

Local Plan District	Local authority	Main catchment
Orkney	Orkney Islands Council	Loch of Stenness Orkney coastal

### Summary of flooding impacts



#### At risk of flooding

- 90 residential properties
- 40 non-residential properties
- £220,000 Annual Average Damages

(damages by flood source shown left)

Summary of flooding impacts

### 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.

Objectives

### Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

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

Actions

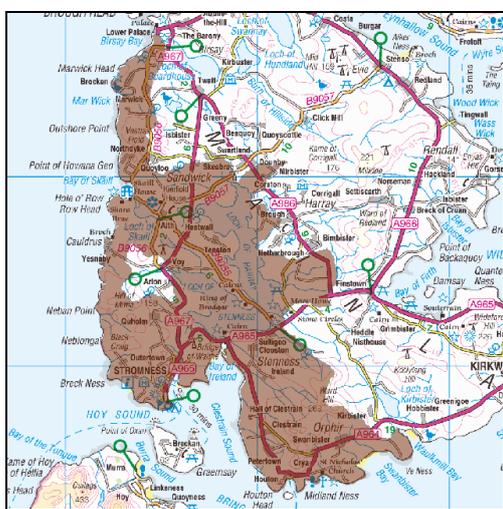
# Stromness (Potentially Vulnerable Area 03/04)

Local Plan District	Local authority	Main catchment
Orkney	Orkney Islands Council	Loch of Stenness, Orkney coastal

## Background

This Potentially Vulnerable Area is located on the south-west coast of Orkney Mainland (shown below). It is approximately 148km<sup>2</sup>.

The area includes Stromness, the Parishes of Stenness and Sandwick and Orphir Village.

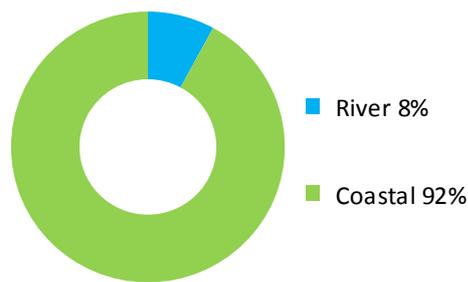


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The area extends from Birsay Bay in the north to Waulkmill Bay in the south and includes the Bay of Skail. It also includes the Loch of Stenness, Loch of Harray, Loch of Skail, and numerous smaller lochs and burns.

There are approximately 90 residential and 40 non-residential properties at risk of flooding.

The Annual Average Damages are estimated to be £220,000 with the majority caused by coastal flooding.



**Figure 1:** Annual Average Damages by flood source

## Summary of flooding impacts

Coastal flood risk affects parts of Stromness however many of the properties within the harbour area of Stromness have their floor levels raised on piers. Parts of Stenness village may also be at coastal flood 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 risk of flooding to utilities in Table 1 does not include Scottish Water data. Scottish Water undertook a national assessment of above ground assets at medium likelihood of flooding (including water treatment works, wastewater treatment works, and pumping stations). Within this Potentially Vulnerable Area there are four assets identified as being at risk of flooding.

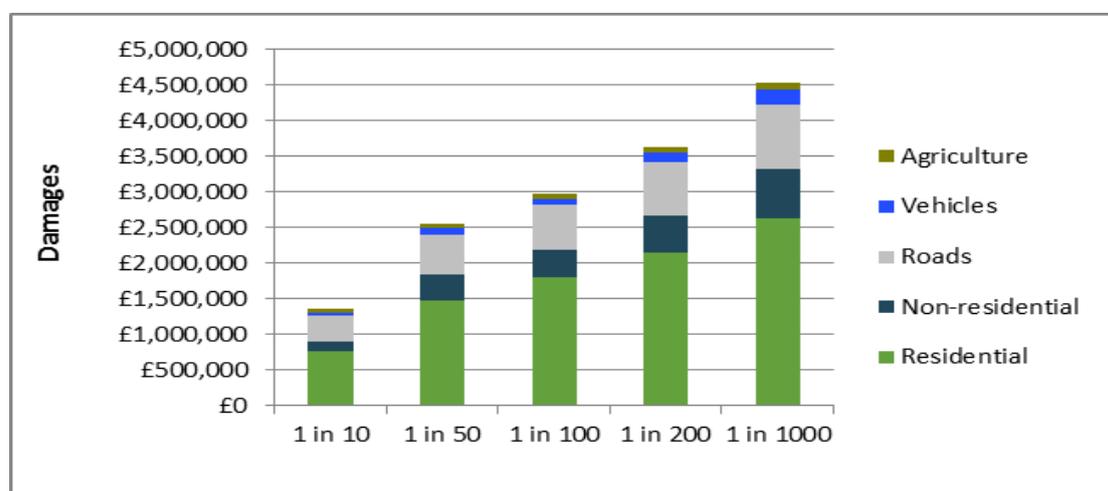
Roads potentially affected by flooding include the A964, A965, A967, A986, B9056, B9055 and the B9057. There are a large number of cultural heritage sites at risk of flooding including The Heart of Neolithic Orkney World Heritage Site which is a major and vital driver of the Orkney economy, and also the conservation areas of Stromness and Brodgar / Stenness. Large areas of environmental importance and agricultural land are also at risk of flooding.

The damages associated with floods of different likelihood are shown in Figure 2. The highest damages are to residential properties, followed by damages to roads. Note that cultural heritage and environmental sites are not included in the estimation of the economic impact of flooding due to the difficulty in placing an economic value on these impacts.

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

	1 in 10	1 in 200	1 in 1000
	High likelihood	Medium likelihood	Low likelihood
Residential properties (total 1,900)	20	90	110
Non-residential properties (total 460)	10	40	50
People	40	190	230
Community facilities	0	0	0
Utilities assets	0	0	0
Transport links (excluding minor roads)	Roads at 50 locations	Roads at 80 locations	Roads at 90 locations
Environmental designated areas (km <sup>2</sup> )	52	52	52
Designated cultural heritage sites	36	44	45
Agricultural land (km <sup>2</sup> )	3	4	5

**Table 1:** Summary of flooding impacts<sup>1</sup>



**Figure 2:** Damages by flood likelihood

<sup>1</sup> Some receptors are counted more than once if flooded from multiple sources

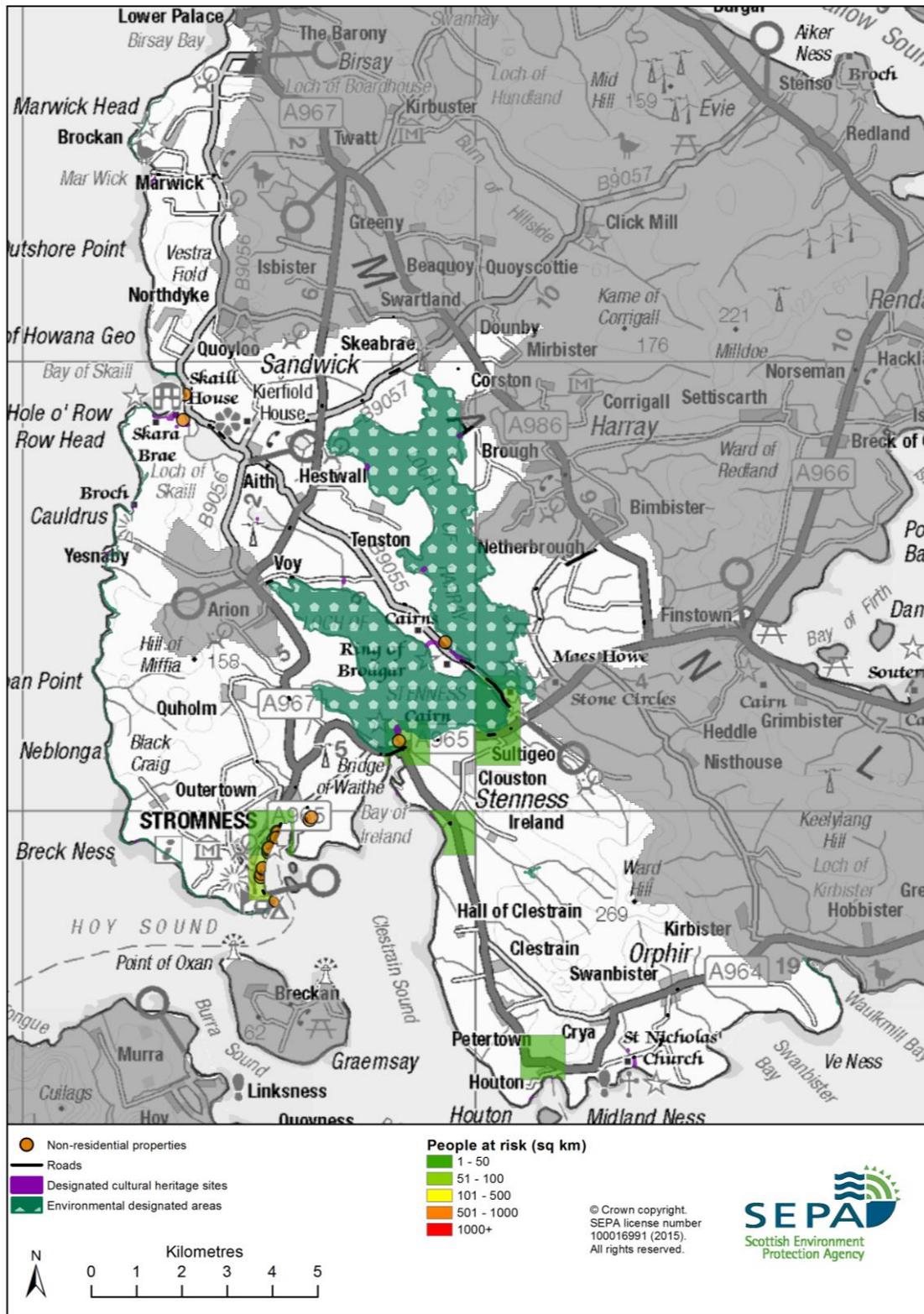


Figure 3: Impacts of flooding

## History of flooding

Floods within this Potentially Vulnerable Area have been recorded at regular intervals over the last 100 years, particularly in the town of Stromness, which is the second largest settlement in the Orkney Local Plan District and a vital ferry connection to the Scottish mainland.

The earliest recorded flood for Stromness was in 1909, when a river flood caused considerable damage to roads, crops and infrastructure. Other floods from rivers were recorded in 2004 when the May Burn flooded after heavy rain, inundating properties in Stromness town centre. In October 2006, extremely heavy rainfall resulted in the Mill Burn bursting its banks and drainage systems being overwhelmed causing flooding to roads, property and agricultural land.

Coastal flooding has been a consistent threat to Stromness due to its proximity to the sea. The 1953 North Sea flood resulted in flooding to the golf course and debris being washed-up along the coastline. More recently in January 2005, there was coastal flooding which affected properties in the town centre and along the sea front. Several minor coastal flood events have been noted in Stromness since 2005 causing flooding to roads and properties.

## Further information on flood hazard and risk

Statistics for the number of properties and number of people at risk have been updated based on evidence provided by Orkney Islands Council. There is however no suitable information available to update the estimated economic damages at this stage.

## Objectives to manage flooding in Potentially Vulnerable Area 03/04

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 Stromness Potentially Vulnerable Area.

Target area	Objective	ID	Indicators within PVA
Applies across Orkney Local Plan District	Avoid an overall increase in flood risk	300001	<ul style="list-style-type: none"> <li>• 90 residential properties</li> <li>• £220,000 Annual Average Damages</li> </ul>
Applies across Orkney Local Plan District	Reduce overall flood risk	300002	<ul style="list-style-type: none"> <li>• 90 residential properties</li> <li>• £220,000 Annual Average Damages</li> </ul>
Applies across Orkney 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 03/04

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 Stromness Potentially Vulnerable Area.

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

<b>Action (ID):</b>	<b>NEW FLOOD WARNING (3000020010)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	The area under consideration covers the coastline of the Orkney Islands. Forecasting capability is currently under development.		

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (3000020016)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	<p>SEPA will be seeking to incorporate additional surface water hazard mapping information into the flood maps to improve understanding of flood risk. Approximately 200km<sup>2</sup> of improved data is currently available within this Local Plan District .</p> <p>SEPA will be seeking to develop the flood hazard mapping in the Orkney Mainland area to improve understanding of the coastal flood risk. The extent and timing of the completed improvements will be dependent on detailed scoping and data availability.</p>		

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING</b> (3000020019)		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	Scottish Water		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>FLOOD FORECASTING</b> (3000020009)		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p> <p>The Potentially Vulnerable Area is within the 'Orkney' flood alert area.</p>		

<b>Action (ID):</b>	<b>SELF HELP</b> (3000020011)		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	—		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

<b>Action (ID):</b>	<b>AWARENESS RAISING (3000020013)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	Responsible authorities		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p> <p>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.</p>		

<b>Action (ID):</b>	<b>MAINTENANCE (3000020007)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	Orkney Islands Council, asset / land managers		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

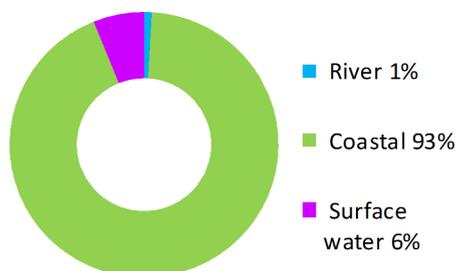
<b>Action (ID):</b>	<b>EMERGENCY PLANS/RESPONSE (3000020014)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	Category 1 and 2 Responders		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>Providing an emergency response 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.</p> <p>Orkney Islands Council monitors the flood risk daily by comparing forecast tide and surge levels with land levels. This enables advanced warning of coastal flood events to be provided.</p>		

<b>Action (ID):</b>	<b>PLANNING POLICIES (3000010001)</b>		
<b>Objective (ID):</b>	Avoid an overall increase in flood risk (300001) Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	Planning authority		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

## Kirkwall (Potentially Vulnerable Area 03/05)

Local Plan District	Local authority	Main catchment
Orkney	Orkney Islands Council	Orkney coastal

### Summary of flooding impacts



### At risk of flooding

- 490 residential properties
- 460 non-residential properties
- £2.5 million Annual Average Damages

(damages by flood source shown left)

Summary of flooding impacts

### 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.

Objectives

### Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

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

Actions

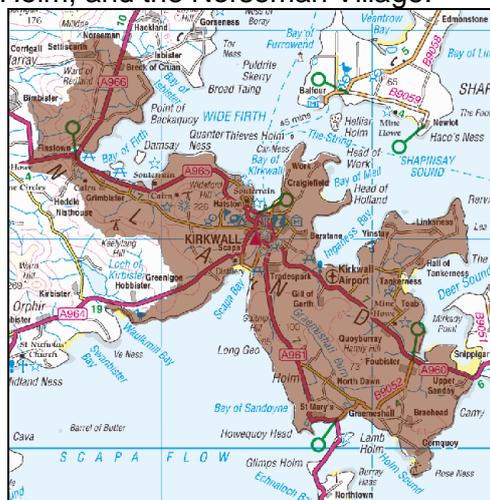
# Kirkwall (Potentially Vulnerable Area 03/05)

Local Plan District	Local authority	Main catchment
Orkney	Orkney Islands Council	Orkney coastal

## Background

This Potentially Vulnerable Area includes the south-east of Orkney Mainland (shown below). It is approximately 150km<sup>2</sup>.

The area includes the town of Kirkwall within the parish St Ola, and other parishes such as Firth, St. Andrews, Holm, and the Norseman Village.

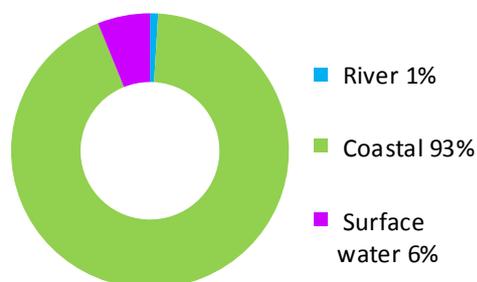


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The airport is located in this Potentially Vulnerable Area.

There are approximately 490 residential and 460 non-residential properties at risk of flooding.

The Annual Average Damages are estimated to be £2.5 million with the majority of these attributed to coastal flooding.



**Figure 1: Annual Average Damages by flood source**

## Summary of flooding impacts

Coastal flood risk is mainly focused on the town of Kirkwall with a significant part of the town to the south of the harbour located in the coastal floodplain. Part of this area of the town is also subject to surface water flooding and there is a known interaction between coastal and surface water flooding during periods of intense rainfall and high sea levels.

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 risk of flooding to utilities in Table 1 does not include Scottish Water data. Scottish Water undertook a national assessment of above ground assets at medium likelihood of flooding (including water treatment works, wastewater treatment works, and pumping stations). Within this Potentially Vulnerable Area there are two assets identified as being at risk of flooding.

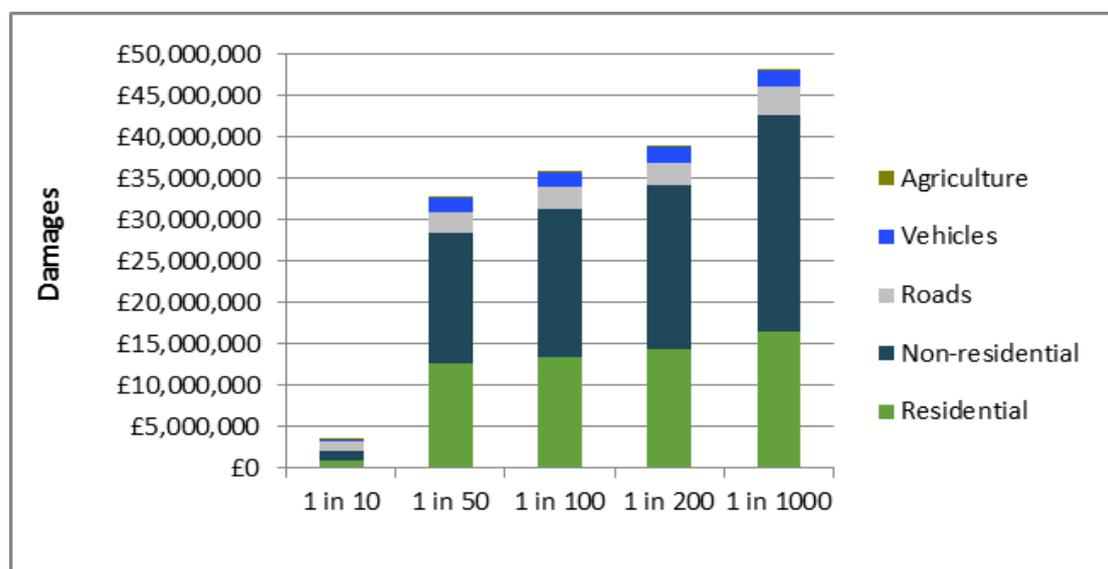
Three schools in Kirkwall are identified as being at risk of flooding, along with three buildings housing emergency services. Roads affected by flooding include the A960, A961, A963, A964, A965, A966, B9053, B9054 and B9148. There are 13 designated cultural heritage sites and small areas of environmental importance also at risk. The damages associated with floods of different likelihood are shown in Figure 2. Note that cultural heritage and environmental sites are not included in the estimation

of the economic impact of flooding due to the difficulty in placing an economic value on these impacts.

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 5,000)	30	490	540
Non-residential properties (total 1,200)	90	460	520
People	60	1,100	1,200
Community facilities	0	<10 Includes; educational buildings and emergency services	<10 Includes; educational buildings and emergency services
Utilities assets	<10	20	20
Transport links (excluding minor roads)	Roads at 180 locations	Roads at 280 locations	Roads at 280 locations
Environmental designated areas (km <sup>2</sup> )	<0.1	<0.1	<0.1
Designated cultural heritage sites	11	13	15
Agricultural land (km <sup>2</sup> )	2	3	4

**Table 1:** Summary of flooding impacts<sup>1</sup>



**Figure 2:** Damages by flood likelihood

<sup>1</sup> Some receptors are counted more than once if flooded from multiple sources

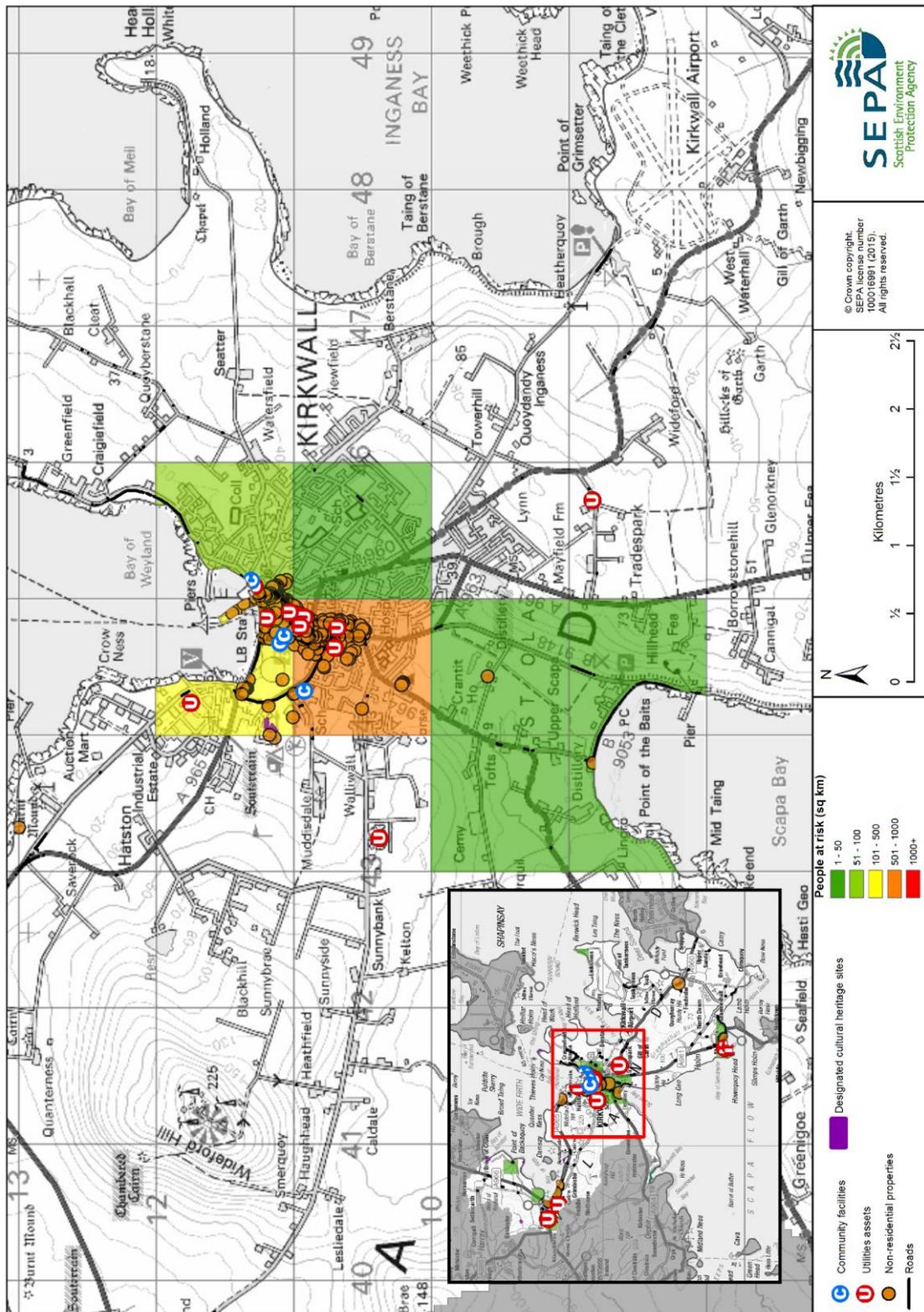


Figure 3: Impacts of flooding

## History of flooding

There have been many anecdotal reports and recorded floods documented within this Potentially Vulnerable Area over the last 130 years. Flooding has come from burns, surface water or coastal sources and often as a result of complex combinations, particularly where flows from outfalls are restricted by high sea levels.

Significant coastal floods recorded within the Potentially Vulnerable Area include the 1953 North Sea Flood which caused damage to civil infrastructure, properties, businesses and shipping.

More recently recorded coastal floods were in January 2005 when properties and large sections of roads within low lying coastal areas in Kirkwall, St Mary's and Finstown were flooded. The 2005 flood saw the harbour defences at Kirkwall being breached with minor overtopping, the pier at St Mary's being completely submerged and the A961 through the village also flooded. Significant surface water and river floods have been consistently recorded in Kirkwall and still occur occasionally despite improvements to the storm water drainage network. These instances are often linked to tidal influences on outfalls.

In October 2006, heavy rainfall resulted in flooding at Maitland's Burn in Finstown, whilst in Kirkwall the Peedie Sea, Muddisdale Burn, Crantit Burn, Burn of Wideford, and Papdale Burn were all affected. During this flood the volume of surface water entering the drainage system and water from overflowing watercourses resulted in the capacity of the drainage system being exceeded. Properties affected included three schools, a museum, four social clubs, a church, an art gallery and a water treatment works. Roads and agricultural land were also affected.

Less significant surface water floods also occurred across the area in August 2007, September 2007, January 2008, December 2012, October 2013 and November 2013 with the greatest impacts in Kirkwall.

## Further information on flood hazard and risk

Orkney Islands consider that surface water flood risk is underestimated for Kirkwall. However whilst there are good records of the extent of actual flooding there is no accurate record of the properties that have suffered from internal flooding.

## Objectives to manage flooding in Potentially Vulnerable Area 03/05

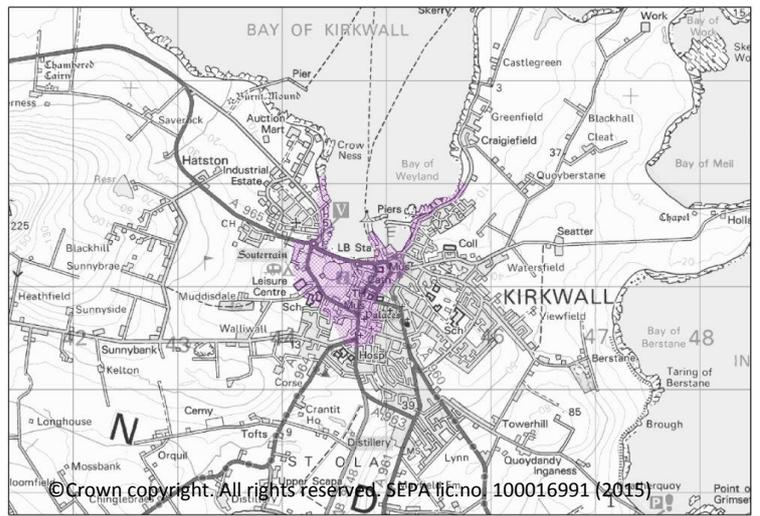
Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target 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 Kirkwall Potentially Vulnerable Area.

### Reduce risk in Kirkwall from coastal flooding

Indicators:

Target area:

- 900 people
- £810,000 Annual Average Damages from residential properties
- £960,000 Annual Average Damages from non-residential properties
- A965 Ayre Road
- A963 through Kirkwall



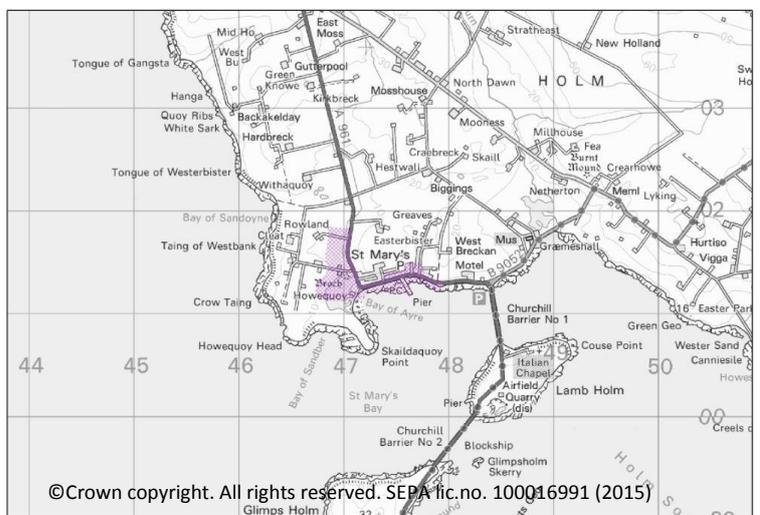
Objective ID: 300501

### Reduce risk in St Mary's from coastal flooding

Indicators:

Target area:

- 20 people
- £16,000 Annual Average Damages from residential properties
- £4,900 Annual Average Damages from non-residential properties
- A961 through St. Mary's



Objective ID: 300502

Target area	Objective	ID	Indicators within PVA
Kirkwall	Reduce risk from surface water flooding in Kirkwall	300506	* See note below
Applies across Orkney Local Plan District	Avoid an overall increase in flood risk	300001	<ul style="list-style-type: none"> <li>• 490 residential properties</li> <li>• £2.5 million Annual Average Damages</li> </ul>
Applies across Orkney Local Plan District	Reduce overall flood risk	300002	<ul style="list-style-type: none"> <li>• 490 residential properties</li> <li>• £2.5 million Annual Average Damages</li> </ul>
Applies across Orkney 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 03/05 there are 50 residential properties at risk and Annual Average Damages of £150,000.

## Actions to manage flooding in Potentially Vulnerable Area 03/05

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 Kirkwall Potentially Vulnerable Area.

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

<b>Action (ID):</b>	<b>FLOOD PROTECTION SCHEME/WORKS (3005010006)</b>		
<b>Objective (ID):</b>	Reduce risk in Kirkwall from coastal flooding (300501)		
<b>Delivery lead:</b>	Orkney Islands Council		
<b>Priority:</b>	National:		Within local authority:
	<b>6 of 42</b>		<b>1 of 1</b>
<b>Status:</b>	<b>Under development</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	A flood protection scheme is under development for the perimeter of the harbour in Kirkwall. The scheme will complement existing defences to reduce the flood risk in Kirkwall. The scheme includes the construction of direct defences and is being designed to a 1 in 200 year standard of protection including an allowance for climate change.		
<b>Potential impacts</b>			
<b>Economic:</b>	The flood protection scheme could reduce flood risk to 383 residential properties and 158 non-residential properties. Damages avoided of £15.1 million could be achieved. The benefit-cost ratio of the proposed works is 8.03.		
<b>Social:</b>	The flood protection scheme could reduce flood risk for an estimated 842 people. A reduction in flood risk would have a positive benefit to the health and wellbeing of the community and socially vulnerable people. The social vulnerability is higher than average with a high percentage of the residential properties in the area currently at flood risk. Roads (A960/A965), two emergency services, a school, two telecommunication and five energy/electricity production sites would also potentially benefit from the scheme.		

<b>Environmental:</b>	Flood protection works can have both positive and negative impacts on the ecological quality of the environment depending on how they are designed. One scheduled monument would potentially benefit from the flood protection works. The design should minimise visual impact of the flood protection works. There are no designated sites close to the area.
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<b>Action (ID):</b>	<b>NEW FLOOD WARNING</b> (3000020010)		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	The area under consideration covers the coastline of the Orkney Islands. Forecasting capability is currently under development.		

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY</b> (3005020005)		
<b>Objective (ID):</b>	Reduce risk in St Mary's from coastal flooding (300502)		
<b>Delivery lead:</b>	Orkney Islands Council		
<b>Priority:</b>	National:	Within local authority:	
	<b>146 of 168</b>	<b>4 of 6</b>	
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	A flood protection study is required to consider flood protection works for St Mary's. The study should primarily focus on coastal management actions, direct defences and property level protection, but other actions may also be considered in order to develop the most sustainable range of options. As localised defences may only be required the investigation should define the height and extent of the works.		
<b>Potential impacts</b>			
<b>Economic:</b>	The study could benefit seven residential and five non-residential properties at risk of flooding in this location, with potential damages avoided of up to £1.1 million.		
<b>Social:</b>	The development of flood protection works following the study would potentially reduce risk to 15 people. A reduction in flood risk would have a positive benefit to the health and wellbeing of the community and socially vulnerable people. The flood works would also potentially reduce risk to the B9052 road, which connects Mainland Orkney with South Ronaldsay, therefore access around the islands would be improved. Negative impacts through disturbance to the local community during the construction phase should be considered.		
<b>Environmental:</b>	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the		

<b>Environmental:</b>	environment. Opportunities to mitigate any environmental impacts may include design and timing of works. The scheduled monument would benefit from a reduction in flood risk.
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<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (3005060018)</b>		
<b>Objective (ID):</b>	Reduce risk from surface water flooding in Kirkwall (300506)		
<b>Delivery lead:</b>	Orkney Islands Council		
<b>Status:</b>	<b>Ongoing</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (3000020016)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	SEPA will be seeking to develop the flood hazard mapping in the Orkney Mainland area to improve understanding of the coastal flood risk. The extent and timing of the completed improvements will be dependent 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.		

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (3000020019)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	Scottish Water		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>FLOOD FORECASTING (3000020009)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p> <p>The Potentially Vulnerable Area is within the 'Orkney' flood alert area.</p>		

<b>Action (ID):</b>	<b>SELF HELP (3000020011)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	—		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

<b>Action (ID):</b>	<b>AWARENESS RAISING (3000020013)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	Responsible authorities		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p> <p>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.</p>		

<b>Action (ID):</b>	<b>MAINTENANCE (3000020007)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	Orkney Islands Council, asset / land managers		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p> <p>The majority of storm water flows in Kirkwall are diverted to the Peedie Sea which acts as a balancing reservoir for the town, storing storm water during high tides and then releasing this water automatically when tide levels allow. This action, implemented in the early 1990s together with the provision of a pumping station at Kirkwall Pier to deal with combined sewer flooding, has vastly improved the historic flooding issues which affected the low lying areas of Kirkwall. The level of the Peedie Sea is manually reduced in advance of heavy rainfall forecasts to maximise its capacity.</p>		

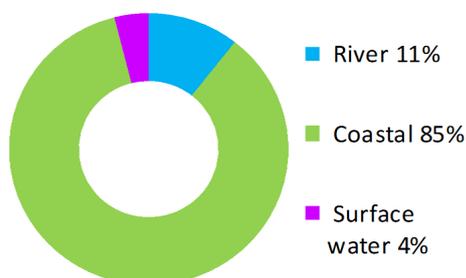
<b>Action (ID):</b>	<b>EMERGENCY PLANS/RESPONSE (3000020014)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	Category 1 and 2 Responders		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>Providing an emergency response 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.</p> <p>Orkney Islands Council monitors the flood risk daily by comparing forecast tide and surge levels with land levels. This enables advanced warning of coastal flood events to be provided.</p>		

<b>Action (ID):</b>	<b>PLANNING POLICIES</b> (3000010001)		
<b>Objective (ID):</b>	Avoid an overall increase in flood risk (300001) Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	Planning authority		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

## Hoy (Potentially Vulnerable Area 03/06)

Local Plan District	Local authority	Main catchment
Orkney	Orkney Islands Council	Hoy coastal

### Summary of flooding impacts



### At risk of flooding

- <10 residential properties
- <10 non-residential properties
- £28,000 Annual Average Damages

(damages by flood source shown left)

Summary of flooding impacts

### 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.

Objectives

### Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

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

Actions

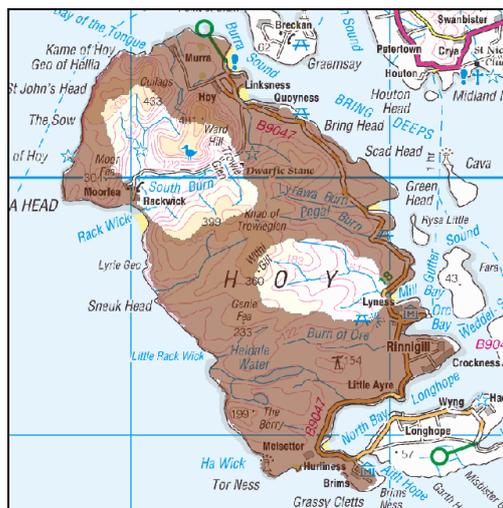
# Hoy (Potentially Vulnerable Area 03/06)

Local Plan District	Local authority	Main catchment
Orkney	Orkney Islands Council	Hoy coastal

## Background

This Potentially Vulnerable Area covers the island of Hoy (shown below). It is approximately 100km<sup>2</sup>.

The area includes Lyness, Moaness, Rackwick and Melsetter.

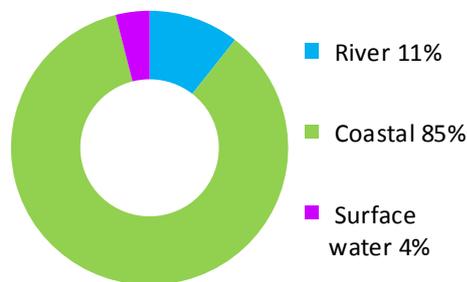


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The B9047 and causeway connecting Hoy to South Walls are within the area.

There are fewer than 10 residential and non-residential properties at risk of flooding.

The Annual Average Damages are estimated to be £28,000 with the majority attributed to coastal flooding.



**Figure 1: Annual Average Damages by flood source**

## Summary of flooding impacts

There is limited flood risk in this area, however the main focus is on the B9047 linking Hoy and South Walls; it is mainly vulnerable to flooding from wave overtopping.

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.

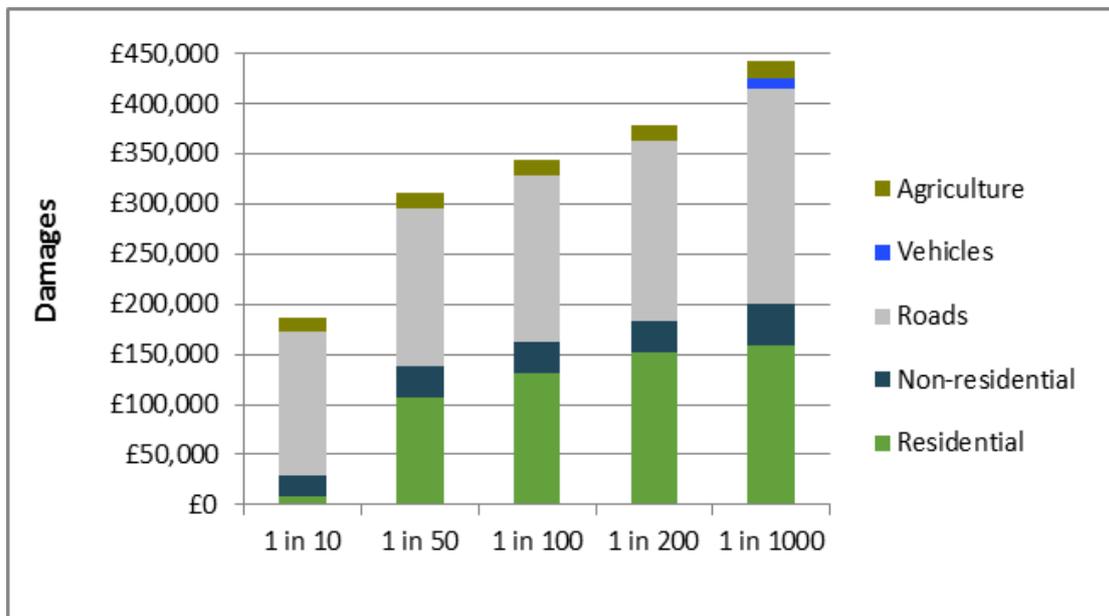
Roads potentially affected by flooding include the B9047 and B9048. Four designated cultural heritage sites, including scheduled monuments, and designated environmental sites are at risk. This includes the Hoy Special Protection Area and Special Area of Conservation.

The damages associated with floods of different likelihood are shown in Figure 2. For this Potentially Vulnerable Area the highest damages are to roads followed by damages to residential properties. Note that cultural heritage and environmental sites are not included in the estimate of the economic impact of flooding due to the difficulty in placing an economic value on these impacts.

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

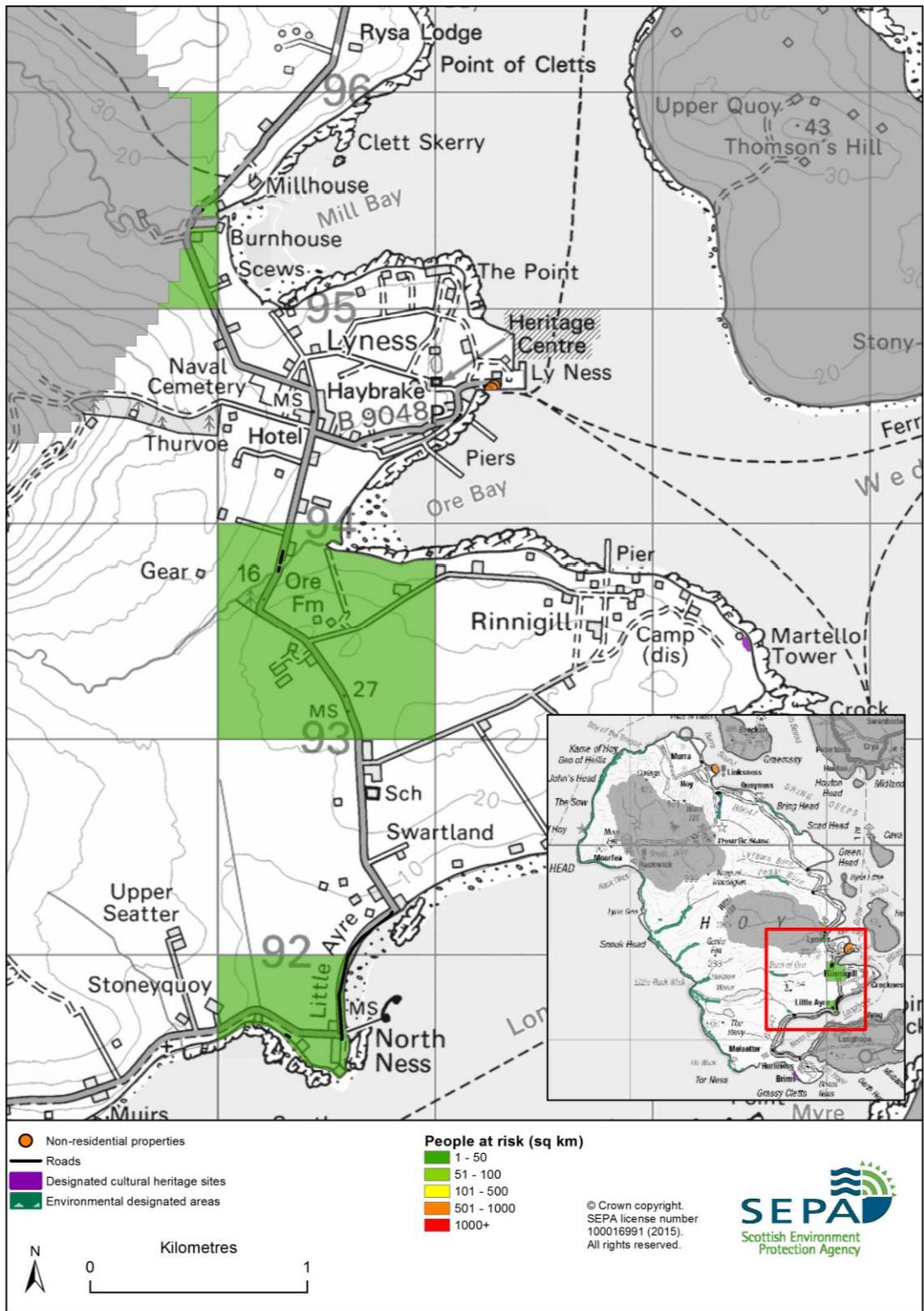
	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 140)	<10	<10	<10
Non-residential properties (total 70)	<10	<10	<10
People	<10	<10	<10
Community facilities	0	0	0
Utilities assets	0	0	0
Transport links (excluding minor roads)	Roads at 10 locations	Roads at 20 locations	Roads at 20 locations
Environmental designated areas (km <sup>2</sup> )	3	3	3
Designated cultural heritage sites	4	4	4
Agricultural land (km <sup>2</sup> )	0.8	0.9	1

**Table 1:** Summary of flooding impacts<sup>1</sup>



**Figure 2:** Damages by flood likelihood

<sup>1</sup> Some receptors are counted more than once if flooded from multiple sources



**Figure 3: Impacts of flooding**

## History of flooding

There have been very few floods recorded within this Potentially Vulnerable Area, due to the high topography of the majority of the island and the sparsely spread population.

In October 2006 extreme rainfall resulted in the Millburn swelling, which in turn caused structural damage to the Millburn Bridge, a vital section of the road network in the area. In December 2011, coastal flooding occurred when high sea levels and strong wave action resulted in damage to the coastal defence wall that protects the road deck at Longhope Ayre. Overtopping spread debris across the road making it impassable.

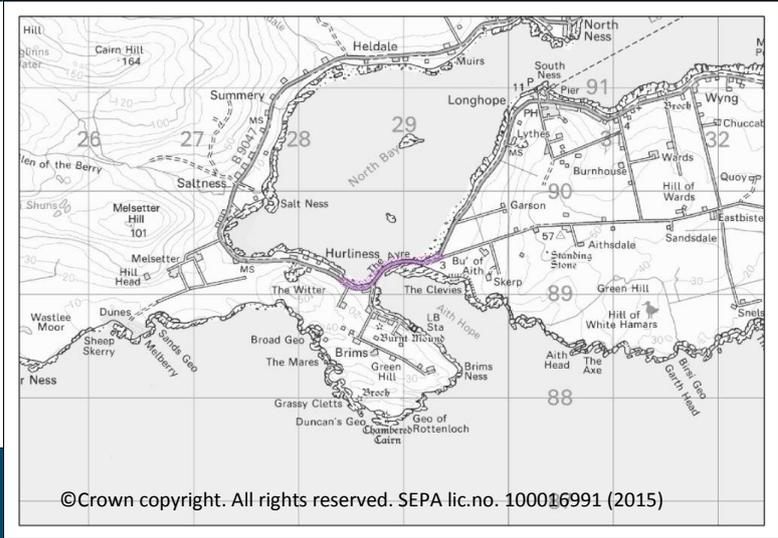
## Objectives to manage flooding in Potentially Vulnerable Area 03/06

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 Hoy Potentially Vulnerable Area.

### Reduce disruption to roads from coastal flooding with particular reference to the causeway linking Hoy to South Walls

Indicators: Target area:

- B9047 The Ayre
- Objective ID: 300601



Target area	Objective	ID	Indicators within PVA
Applies across Orkney Local Plan District	Avoid an overall increase in flood risk	300001	<ul style="list-style-type: none"> <li>• &lt;10 residential properties</li> <li>• £28,000 Annual Average Damages</li> </ul>
Applies across Orkney Local Plan District	Reduce overall flood risk	300002	<ul style="list-style-type: none"> <li>• &lt;10 residential properties</li> <li>• £28,000 Annual Average Damages</li> </ul>
Applies across Orkney 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 03/06

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 Hoy Potentially Vulnerable Area.

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

<b>Action (ID):</b>	<b>NEW FLOOD WARNING (3000020010)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	The area under consideration covers the coastline of the Orkney Islands. Forecasting capability is currently under development.		

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (3006010005)</b>		
<b>Objective (ID):</b>	Reduce disruption to roads from coastal flooding with particular reference to the causeway linking Hoy to South Walls (300601)		
<b>Delivery lead:</b>	Orkney Islands Council		
<b>Priority:</b>	National:	Within local authority:	
	<b>164 of 168</b>	<b>6 of 6</b>	
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	A flood protection study for the causeway is required to investigate the most suitable action for long term maintenance of the road. The study should primarily focus on coastal management actions to strengthen the existing road or actions to raise the height of the existing road, but other actions may also be considered in order to develop the most sustainable range of actions.		

Potential impacts	
<b>Economic:</b>	Reducing the flood impacts to the road (B9047) for high likelihood floods would result in potential damages avoided of up to £1,000. Although the quantified flood damages are small, there are wider benefits which should be investigated in the study.
<b>Social:</b>	The recommended actions from the proposed flood protection study would result in improved access between the islands of Hoy and South Walls during high likelihood floods and reduce to the risk to life. A reduction in flood risk would have a positive benefit to the health and wellbeing of the community and socially vulnerable people. Negative impacts through disturbance to the local community during the construction phase should be considered.
<b>Environmental:</b>	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. Opportunities to mitigate any environmental impacts may include design and timing of works. There may be impacts on coastal habitats through any potential increased disruption of natural processes, coastal squeeze and possible increase to coastal erosion risk.

<b>Action (ID):</b>	<b>FLOOD FORECASTING (3000020009)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p> <p>The Potentially Vulnerable Area is within the 'Orkney' flood alert area.</p>		

<b>Action (ID):</b>	<b>SELF HELP (3000020011)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	—		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

<b>Action (ID):</b>	<b>AWARENESS RAISING (3000020013)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	Responsible authorities		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p> <p>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.</p>		

<b>Action (ID):</b>	<b>MAINTENANCE (3000020007)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	Orkney Islands Council, asset / land managers		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

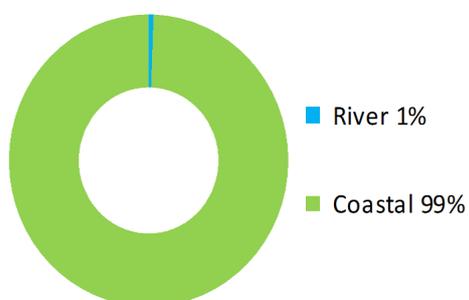
<b>Action (ID):</b>	<b>EMERGENCY PLANS/RESPONSE (3000020014)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	Category 1 and 2 Responders		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>Providing an emergency response 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.</p> <p>Orkney Islands Council monitors the flood risk daily by comparing forecast tide and surge levels with land levels. This enables advanced warning of coastal flood events to be provided.</p>		

<b>Action (ID):</b>	<b>PLANNING POLICIES (3000010001)</b>		
<b>Objective (ID):</b>	Avoid an overall increase in flood risk (300001) Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	Planning authority		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

## South Ronaldsay (Candidate Potentially Vulnerable Area 03/07c)

Local Plan District	Local authority	Main catchment
Orkney	Orkney Islands Council	Orkney coastal

### Summary of flooding impacts



#### At risk of flooding

- 50 residential properties
- <10 non-residential properties
- £85,000 Annual Average Damages

(damages by flood source shown left)

Summary of flooding impacts

### 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.

Objectives

### Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

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

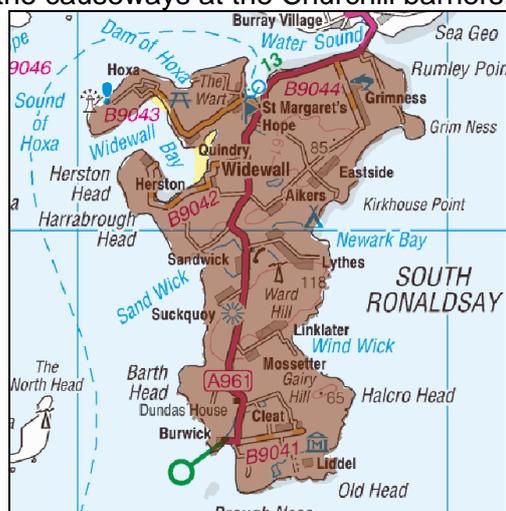
Actions

## South Ronaldsay (Candidate Potentially Vulnerable Area 03/07c)

Local Plan District	Local authority	Main catchment
Orkney	Orkney Islands Council	Orkney coastal

### Background

This candidate Potentially Vulnerable Area comprises the island of South Ronaldsay (shown below). It is approximately 50km<sup>2</sup>. South Ronaldsay is connected to Burray and the Orkney mainland by the A961, which crosses the causeways at the Churchill barriers.

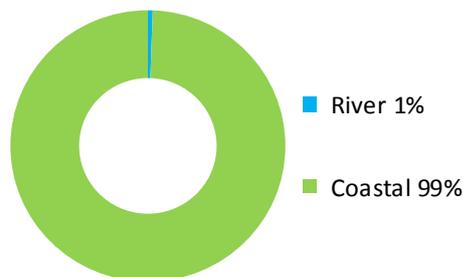


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The main centre of population is St Margaret's Hope. There is a vital ferry connection from St Margaret's Hope to the Scottish mainland.

There are approximately 50 residential and fewer than 10 non-residential properties at risk of flooding.

The Annual Average Damages are estimated to be £85,000 with nearly all caused by coastal flooding.



**Figure 1:** Annual Average Damages by flood source

### Summary of impacts of all sources of flooding

Coastal flood risk in this area is focused around St Margaret's Hope and on the A961 which connects Burray and South Ronaldsay to the mainland. Wave overtopping is the major contributing factor to flooding in these two 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.

Roads at risk of flooding are concentrated on the northern coast and in St Margaret's Hope including the access to Hope Primary School. St. Margaret's Hope is a major ferry connection to the Scottish mainland and the access road to the port is at risk of flooding. The ferry port at Burwick provides a foot passenger ferry to John O'Groats and the road leading to it is also at risk. The A961 Churchill Barriers are at risk of disruption due to wave overtopping with several road closures occurring each year.

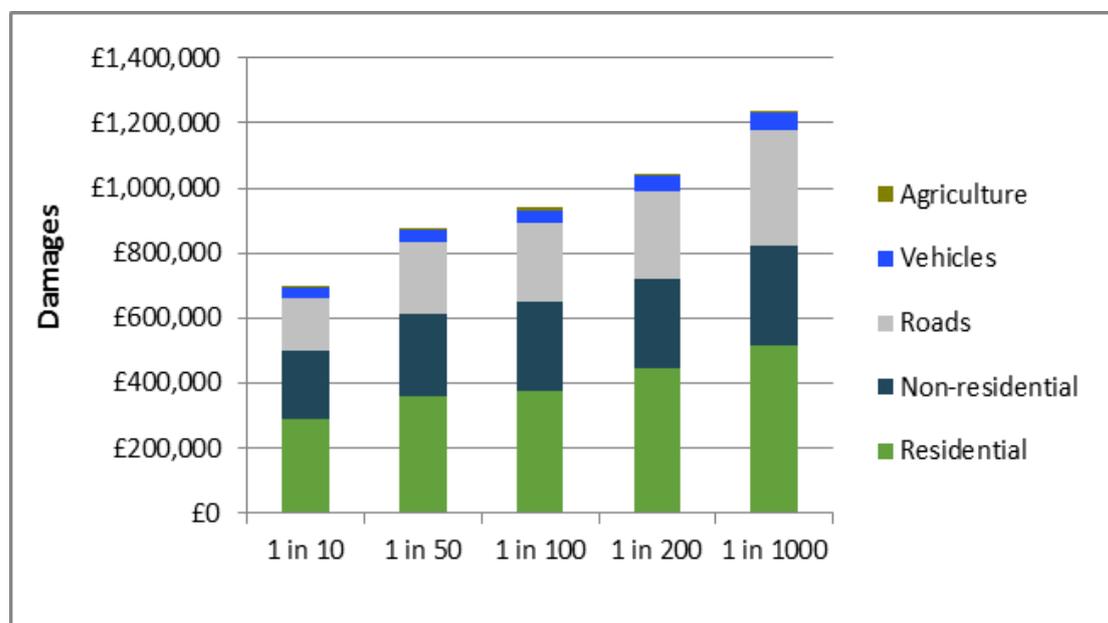
The damages associated with floods of different likelihood are shown in Figure 2. For this Potentially Vulnerable Area the highest damages are to residential properties followed by damages to roads and non-residential properties. Note that cultural heritage and environmental sites are not included in the estimation of the economic

impact of flooding due to the difficulty in placing an economic value on these impacts.

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 630)	20	50	70
Non-residential properties (total 210)	<10	<10	10
People	30	110	150
Community facilities	0	0	0
Utilities assets	0	0	0
Transport links (excluding minor roads)	Roads at 20 locations	Roads at 20 locations	Roads at 30 locations
Environmental designated areas (km <sup>2</sup> )	< 0.1	< 0.1	< 0.1
Designated cultural heritage sites	0	0	0
Agricultural land (km <sup>2</sup> )	0.1	0.2	0.2

**Table 1:** Summary of flooding impacts<sup>1</sup>



**Figure 2:** Damages by flood likelihood

<sup>1</sup> Some receptors are counted more than once if flooded from multiple sources

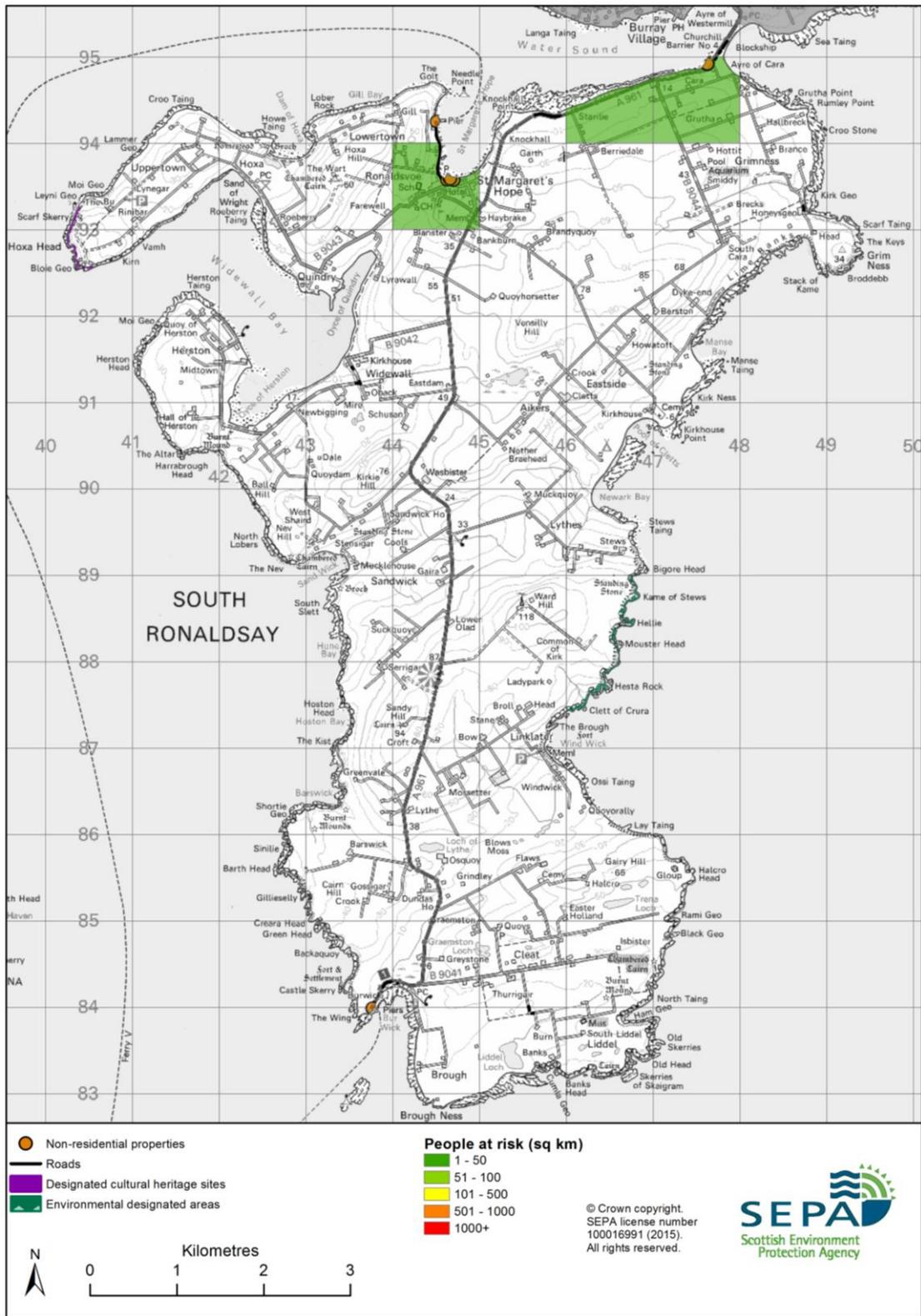


Figure 3: Impacts of flooding

## History of flooding

There is a long history of flooding in St Margaret's Hope, with records of floods in 1914, 1953, during the 1980s and 1990s, in January 2005 and more recently December 2013. The centre of the village is known to be at risk of coastal flooding, which is exacerbated by wave overtopping.

Between 1997 and 2009 the Cromarty Square area and coastal roads in St Margaret's Hope were occasionally affected by flooding due to high tides, heavy rainfall and blocked culverts. In 2009 a new access road into the village was built, the culvert upgraded and a regular inspection maintenance programme for the culvert was initiated, leaving the major threat to the village from coastal flooding.

A recorded coastal flood in January 2005 resulted in approximately 20 properties within the St Margaret's Hope Conservation Area being flooded together with many properties in the wider area of the village. This flood also closed off the access road to the ferry terminal.

The closure of the A961 causeway along the Churchill Barriers (in particular Barrier No.2) from wave action and overtopping is a major issue to those residents and businesses on South Ronaldsay and Burray. These conditions result in several road closures every year.

## Information on flood hazard and risk

The national flood maps do not take account of wave overtopping and as a result the damages attributed to this candidate Potentially Vulnerable Area are considered to be significantly underestimated. The number of properties and people at risk has been updated based on evidence provided by Orkney Islands Council. There is however no suitable information available to update the estimated economic damages at this stage.

## Objectives to manage flooding in Candidate Potentially Vulnerable Area 03/07c

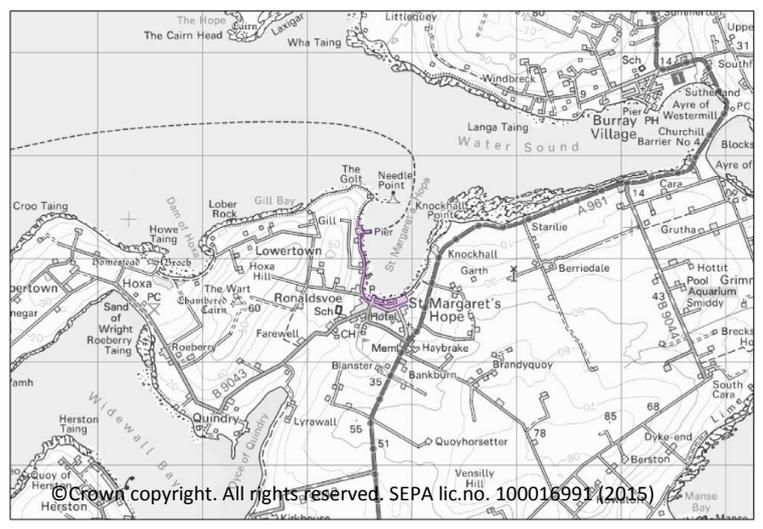
Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target 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 South Ronaldsay Candidate Potentially Vulnerable Area.

### Reduce coastal flood risk in St Margaret's Hope, including the access road to Hope school

Indicators:

- 40 people
- £98,000 Annual Average Damages from residential properties
- Front Road
- Back Road
- Cromarty Square

Target area:



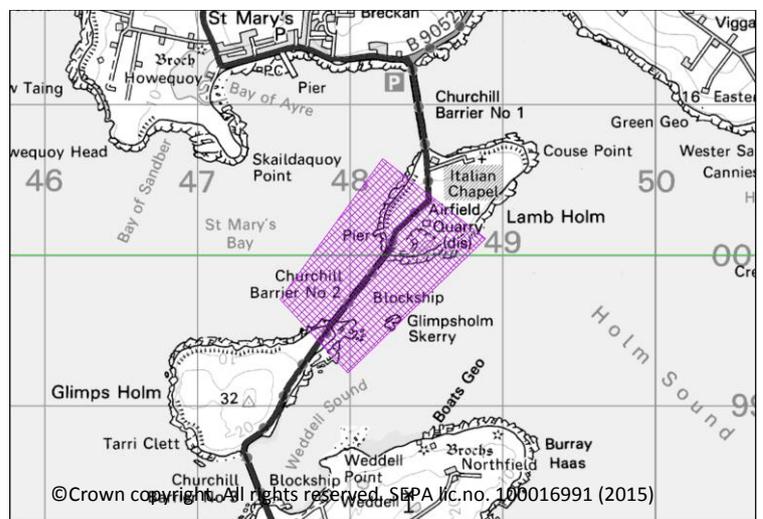
Objective ID: 300701

### Reduce coastal flood risk to Churchill Barrier number 2

Indicators:

- Churchill Barrier number 2

Target area:



Objective ID: 300702

Target area	Objective	ID	Indicators within PVA
Applies across Orkney Local Plan District	Avoid an overall increase in flood risk	300001	<ul style="list-style-type: none"> <li>• 50 residential properties</li> <li>• £85,000 Annual Average Damages</li> </ul>
Applies across Orkney Local Plan District	Reduce overall flood risk	300002	<ul style="list-style-type: none"> <li>• 50 residential properties</li> <li>• £85,000 Annual Average Damages</li> </ul>
Applies across Orkney 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 Candidate Potentially Vulnerable Area 03/07c

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 South Ronaldsay Candidate Potentially Vulnerable Area.

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

<b>Action (ID):</b>	<b>NEW FLOOD WARNING (3000020010)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	The area under consideration covers the coastline of the Orkney Islands. Forecasting capability is currently under development.		

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (3007010005)</b>		
<b>Objective (ID):</b>	Reduce coastal flood risk in St Margaret's Hope, including the access road to Hope school (300701)		
<b>Delivery lead:</b>	Orkney Islands Council		
<b>Priority:</b>	National:	Within local authority:	
	<b>110 of 168</b>	<b>2 of 6</b>	
<b>Status:</b>	<b>Ongoing</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	A flood protection study is required to consider flood protection works for St Margaret's Hope. The study should primarily focus on coastal management actions, direct defences and property level protection, but other actions may also be considered in order to develop the most sustainable range of options. The investigation will assess the impact from wave overtopping to confirm the existing risk and define the height and extent of flood protection works required.		

Potential impacts	
<b>Economic:</b>	The study could benefit 50 residential and 10 non-residential properties at risk of flooding in this location, with potential damages avoided of up to £2.9 million.
<b>Social:</b>	The development of flood protection works following the proposed study would potentially reduce risk to 110 people. The action could also reduce the impact of flooding on access to Hope school. A reduction in flood risk would have a positive benefit to the health and wellbeing of the community and socially vulnerable people. Negative impacts through disturbance to the local community during the construction phase should be considered.
<b>Environmental:</b>	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. Opportunities to mitigate any environmental impacts may include design and timing of works. There may be impacts on coastal habitats through any potential increased disruption of natural processes, coastal squeeze and possible increase to coastal erosion risk. The study should also minimise the visual impacts of the actions for the local community.

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (3007020005)</b>		
<b>Objective (ID):</b>	Reduce coastal flood risk to Churchill Barrier number 2 (300702)		
<b>Delivery lead:</b>	Orkney Islands Council		
<b>Priority:</b>	National:		Within local authority:
	<b>162 of 168</b>		<b>5 of 6</b>
<b>Status:</b>	<b>Ongoing</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	A flood protection study is progressing to reduce flooding to Churchill Barrier number 2 from high likelihood floods. The study is primarily focusing on coastal management actions and natural flood management through wave attenuation to minimise the impact of waves, but other actions may also be considered in order to develop the most sustainable range of options.		
Potential impacts			
<b>Economic:</b>	Reducing the impacts of flooding for Churchill Barrier number 2 during high likelihood floods would result in damages avoided of £37,000 due to reduced flood damages to the road. There are wider benefits that have not yet been quantified and should be considered within the ongoing study.		
<b>Social:</b>	The recommended actions from the ongoing flood protection study would improve access from South Ronaldsay to Mainland Orkney and reduce risk to life from using the access road in stormy weather. A reduction in flood risk would have a positive benefit to the health and wellbeing of the community and socially vulnerable people. Natural flood management actions can restore and enhance natural environments and create opportunities for recreation and tourism. Negative impacts through disturbance to the local community during the construction phase should be considered.		

<b>Environmental:</b>	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. Opportunities to mitigate any environmental impacts may include design and timing of works. The ongoing study should consider the effects on coastal habitats through any potential increased disruption of natural processes, coastal squeeze and possible increase to coastal erosion risk.
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<b>Action (ID):</b>	<b>FLOOD FORECASTING (3000020009)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p> <p>The Potentially Vulnerable Area is within the 'Orkney' flood alert area.</p>		

<b>Action (ID):</b>	<b>SELF HELP (3000020011)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	—		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

<b>Action (ID):</b>	<b>AWARENESS RAISING (3000020013)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	Responsible authorities		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p> <p>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.</p>		

<b>Action (ID):</b>	<b>MAINTENANCE (3000020007)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	Orkney Islands Council, asset / land managers		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

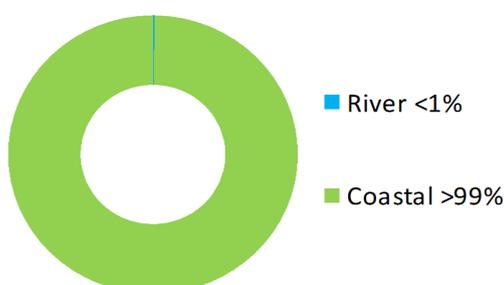
<b>Action (ID):</b>	<b>EMERGENCY PLANS/RESPONSE (3000020014)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	Category 1 and 2 Responders		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>Providing an emergency response 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.</p> <p>Orkney Islands Council monitors the flood risk daily by comparing forecast tide and surge levels with land levels. This enables advanced warning of coastal flood events to be provided. If the predicted tide level and surge combined are predicted to threaten the known flood defence level threshold in St Margaret's Hope, warnings are issued and mobile modular barriers are deployed along with sandbags.</p>		

<b>Action (ID):</b>	<b>PLANNING POLICIES (3000010001)</b>		
<b>Objective (ID):</b>	Avoid an overall increase in flood risk (300001) Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	Planning authority		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

## Westray (Candidate Potentially Vulnerable Area 03/08c)

Local Plan District	Local authority	Main catchment
Orkney	Orkney Islands Council	Orkney Islands coastal

### Summary of flooding impacts



#### At risk of flooding

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

(damages by flood source shown left)

Summary of flooding impacts

### 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.

Objectives

### Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

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

Actions

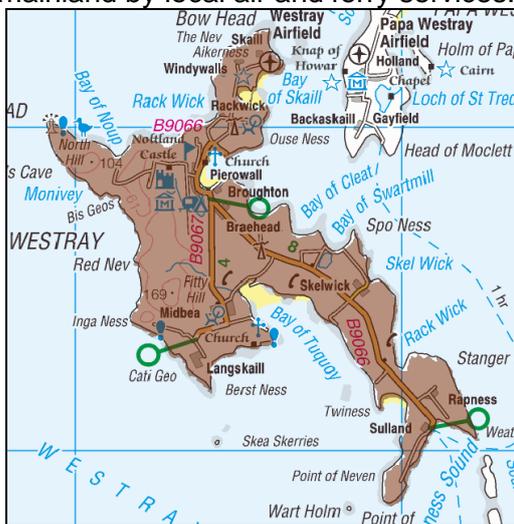
## Westray (Candidate Potentially Vulnerable Area 03/08c)

Local Plan District	Local authority	Main catchment
Orkney	Orkney Islands Council	Orkney Islands coastal

### Background

This candidate Potentially Vulnerable Area covers the island of Westray (shown below). It is approximately 47km<sup>2</sup>.

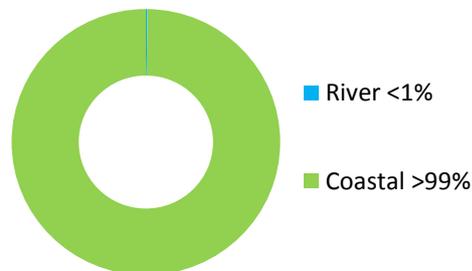
Westray is the most densely populated of all the outlying Northern Isles in Orkney and is connected to the mainland by local air and ferry services.



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Pierowall is the hub of the island, with a vibrant community comprising several businesses, community facilities and homes. The village has a history of flooding due to the combined affects of high sea levels and wave action.

There are approximately 40 residential and 20 non-residential properties at risk of flooding. The Annual Average Damages are £90,000 with the majority caused by coastal flooding (Figure 1).



**Figure 1: Annual Average Damages by flood source**

### Summary of flooding impacts

Coastal flood risk in this area is focused around Pierowall and on the access routes to and from the town and the airport.

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.

A number of roads are at risk of flooding, particularly at Pierowall, Skelwick and at the Bay of Tuquoy. The major access roads to the ferry port and airport are affected by flooding and there are no alternative access routes.

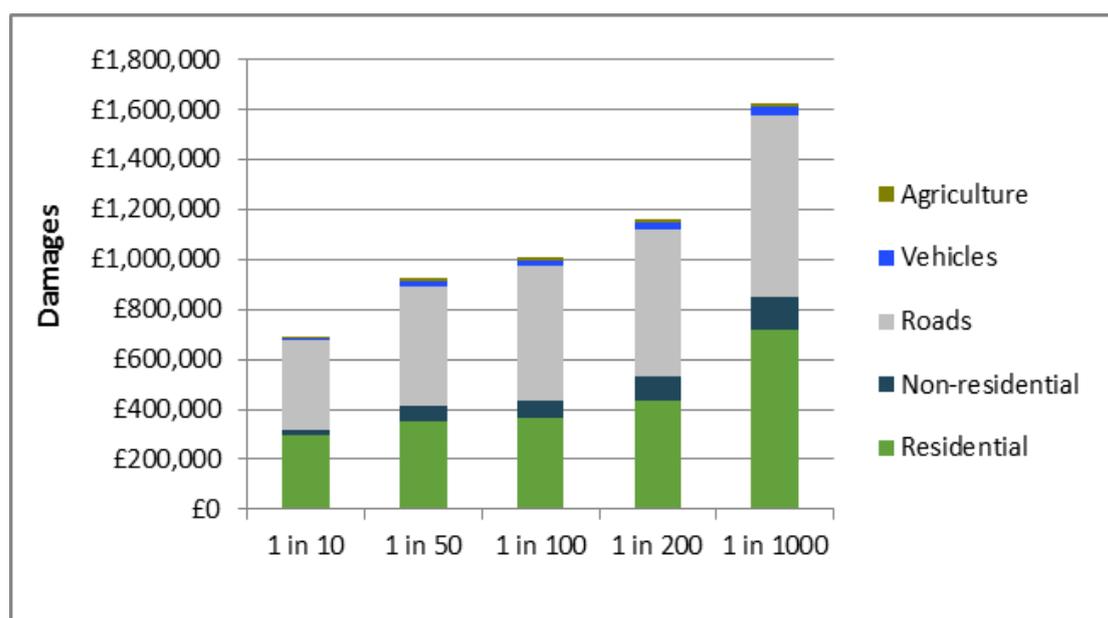
Four designated cultural heritage sites and a small area of the West Westray Special Protection Area and Site of Special Scientific Interest are also at risk.

The damages associated with floods of different likelihood are shown in Figure 2. Roads and residential properties experience the greatest economic impact. Note that cultural heritage and environmental sites are not included in the estimation of the economic impact of flooding due to the difficulty in placing an economic value on these impacts.

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 300)	10	40	40
Non-residential properties (total 110)	<10	20	20
People	10	90	90
Community facilities	0	0	0
Utilities assets	0	0	0
Transport links (excluding minor roads)	Roads at 20 locations	Roads at 30 locations	Roads at 30 locations
Environmental designated areas (km <sup>2</sup> )	0	<0.1	<0.1
Designated cultural heritage sites	4	4	5
Agricultural land (km <sup>2</sup> )	<0.1	0.5	0.6

**Table 1:** Summary of flooding impacts<sup>1</sup>



**Figure 2:** Damages by flood likelihood

<sup>1</sup> Some receptors are counted more than once if flooded from multiple sources



**Figure 3: Impacts of flooding**

## **History of flooding**

Westray has a history of coastal and surface water flooding. Between 1997 and 2009 Pierowall was affected by several coastal floods, as well as flooding due to seaweed blocking culverts and causing surface water to back up. In particular, flooding of the B9066, the major road across the island, affected the majority of residents.

During January 2005, Pierowall was subject to high tides and as a result flooding affected areas of the village. The worst affected area was in the vicinity of Ulva Cottage, where the sea flooded up through the burn and inundated low lying land. The coastal embankments were close to being exceeded at this time.

## **Further information on flood hazard and risk**

The national flood maps do not take account of wave overtopping and as a result the damages attributed to this candidate Potentially Vulnerable Area are considered to be significantly underestimated. The number of properties and people at risk has been updated based on evidence provided by Orkney Islands Council. There is however no suitable information available to update the estimated economic damages at this stage.

## Objectives to manage flooding in Candidate Potentially Vulnerable Area 03/08c

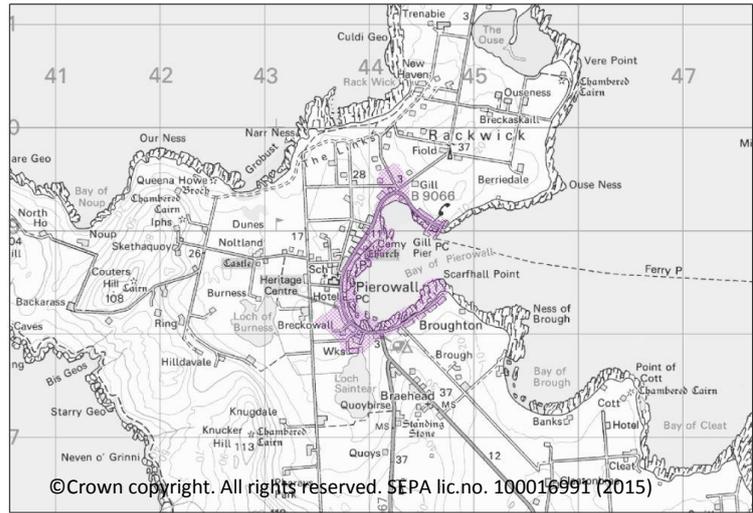
Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target 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 Westray Candidate Potentially Vulnerable Area.

### Reduce risk in Pierowall from coastal flooding

Indicators:

Target area:

- 90 people
- £49,000 Annual Average Damages from residential properties
- B9066 Gill to Scarfhall Point



Objective ID: 300801

Target area	Objective	ID	Indicators within PVA
Applies across Orkney Local Plan District	Avoid an overall increase in flood risk	300001	<ul style="list-style-type: none"> <li>• 40 residential properties</li> <li>• £90,000 Annual Average Damages</li> </ul>
Applies across Orkney Local Plan District	Reduce overall flood risk	300002	<ul style="list-style-type: none"> <li>• 40 residential properties</li> <li>• £90,000 Annual Average Damages</li> </ul>
Applies across Orkney 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 Candidate Potentially Vulnerable Area 03/08c

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 Westray Candidate Potentially Vulnerable Area.

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

<b>Action (ID):</b>	<b>NEW FLOOD WARNING (3000020010)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	The area under consideration covers the coastline of the Orkney Islands. Forecasting capability is currently under development.		

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (3008010005)</b>		
<b>Objective (ID):</b>	Reduce risk in Pierowall from coastal flooding (300801)		
<b>Delivery lead:</b>	Orkney Islands Council		
<b>Priority:</b>	National:	Within local authority:	
	<b>110 of 168</b>	<b>2 of 6</b>	
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	A flood protection study is required to consider flood protection works for Pierowall. The study should primarily focus on coastal management actions, direct defences and property level protection, but other actions may also be considered in order to develop the most sustainable range of options. The investigation will assess the impact from wave overtopping to confirm the existing risk and define the height and extent of flood protection works.		

Potential impacts	
<b>Economic:</b>	The study could benefit 40 residential and 20 non-residential properties at risk of flooding in this location, with potential damages avoided of up to £1.5 million.
<b>Social:</b>	The development of flood protection works following the study would potentially reduce risk to 88 people. A reduction in flood risk would have a positive benefit to the health and wellbeing of the community and socially vulnerable people. The B9066 could also benefit from reduced flooding, improving access across Pierowall during floods. Negative impacts through disturbance to the local community during the construction phase should be considered.
<b>Environmental:</b>	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. Opportunities to mitigate any environmental impacts may include design and timing of works. The study should consider the effects on coastal habitats through any potential increased disruption of natural processes, coastal squeeze and possible increase to coastal erosion risk. The study should also minimise the visual impacts of the actions for the local community. The scheduled monument may benefit depending on the extent of any works.

<b>Action (ID):</b>	<b>FLOOD FORECASTING</b> (3000020009)		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p> <p>The Potentially Vulnerable Area is within the 'Orkney' flood alert area.</p>		

<b>Action (ID):</b>	<b>SELF HELP (3000020011)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	—		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>AWARENESS RAISING (3000020013)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	Responsible authorities		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>MAINTENANCE (3000020007)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	Orkney Islands Council, asset / land managers		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>EMERGENCY PLANS/RESPONSE (3000020014)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (300002)		
<b>Delivery lead:</b>	Category 1 and 2 Responders		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p> <p>Orkney Islands Council monitors the flood risk daily by comparing forecast tide and surge levels with land levels. This enables advanced warning of coastal flood events to be provided.</p>		

<b>Action (ID):</b>	<b>PLANNING POLICIES (3000010001)</b>		
<b>Objective (ID):</b>	Avoid an overall increase in flood risk (300001)		
<b>Delivery lead:</b>	Planning authority		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

# Flood Risk Management Strategy

## Orkney 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

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## 3.1 Introduction

In the Orkney Local Plan District, coastal flooding is reported across two distinct coastal areas. River 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 <sup>1</sup>	Annual Average Damages	Local authority
<b>River Catchments</b>			
Orkney Islands river catchment	40	£150,000	Orkney Islands Council
<b>Coastal flooding</b>			
Orkney South Isles and Mainland coastal area	950	£2.7 million	Orkney Islands Council
Orkney North Isles coastal area	170	£1.2 million	Orkney Islands Council
<b>Surface water flooding</b>			
Orkney Local Plan District	190	£170,000	Orkney Islands Council

**Table 1:** Summary of flood risk from various sources within the Orkney Local Plan District

<sup>1</sup> Total number of residential and non-residential properties at risk of flooding

## 3.2 River flooding

### Orkney Local Plan District

This chapter 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.

#### Catchment overview

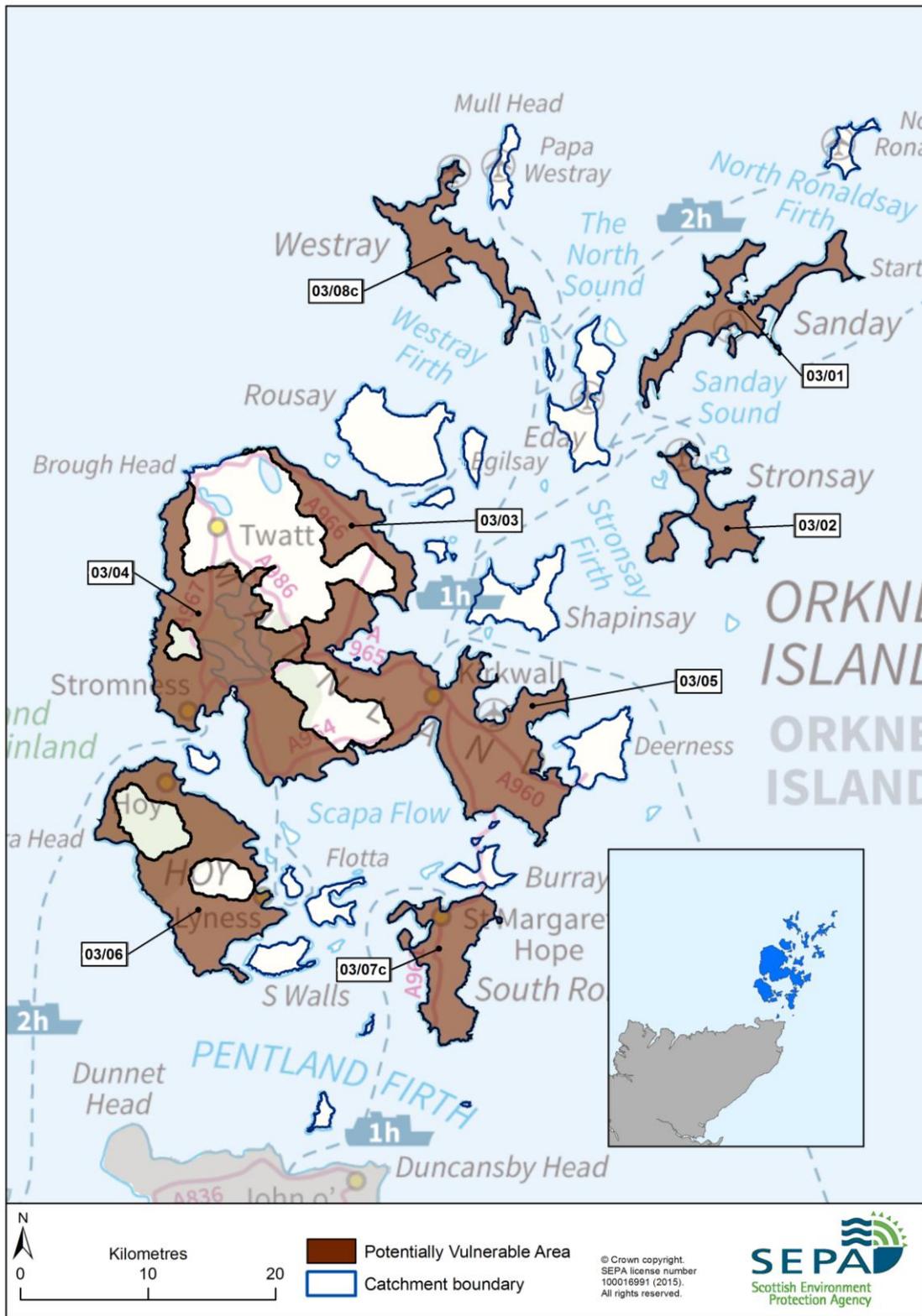
Much of the land in Orkney consists of improved or rough grassland and the fertile soils are also well suited to arable farming. The islands have a cool, temperate climate with an average annual rainfall of between 500mm and 1200mm.

There are no major rivers in the Orkney Islands (Figure 1). River catchments are generally small and respond rapidly to rainfall. In agricultural areas some burns have been straightened to act as additional field drainage.

There are eight Potentially Vulnerable Areas:

- Sanday (03/01)
- Stronsay (03/02)
- Orkney Mainland North (03/03)
- Stromness (03/04)
- Kirkwall (03/05)
- Hoy (03/06)
- South Ronaldsay (03/07c)
- Westray (03/08c).

These are spread across the islands with three located on Orkney Mainland, three on the North Isles, and two on the remaining South Isles.



**Figure 1:** Orkney Islands river catchment group and Potentially Vulnerable Areas

## Flood risk in the catchment

### Main areas at risk

There are approximately 30 residential properties and 10 non-residential properties at risk of river flooding in the Orkney Islands. Approximately 25% of the residential and 50% of the non-residential properties at risk of river flooding are located within the Potentially Vulnerable Areas. The properties at risk are spread across the island with no particular location where river flood risk is concentrated.

### Economic activity and infrastructure at risk

The Annual Average Damages from river flooding are approximately £150,000. This is estimated to be 4% of the total damages for the Orkney Local Plan District. The damages are distributed as follows:

- 59% residential properties (£87,000)
- 12% agriculture (£18,000)
- 11% non-residential properties (£17,000)
- 9% roads (£13,000)
- 6% emergency services (£10,000)
- 2% vehicles (£2,700)

Figure 2 shows the location of Annual Average Damages from river flooding across the area.

Table 1 shows the approximate numbers of further infrastructure assets which are at risk of flooding within this catchment.

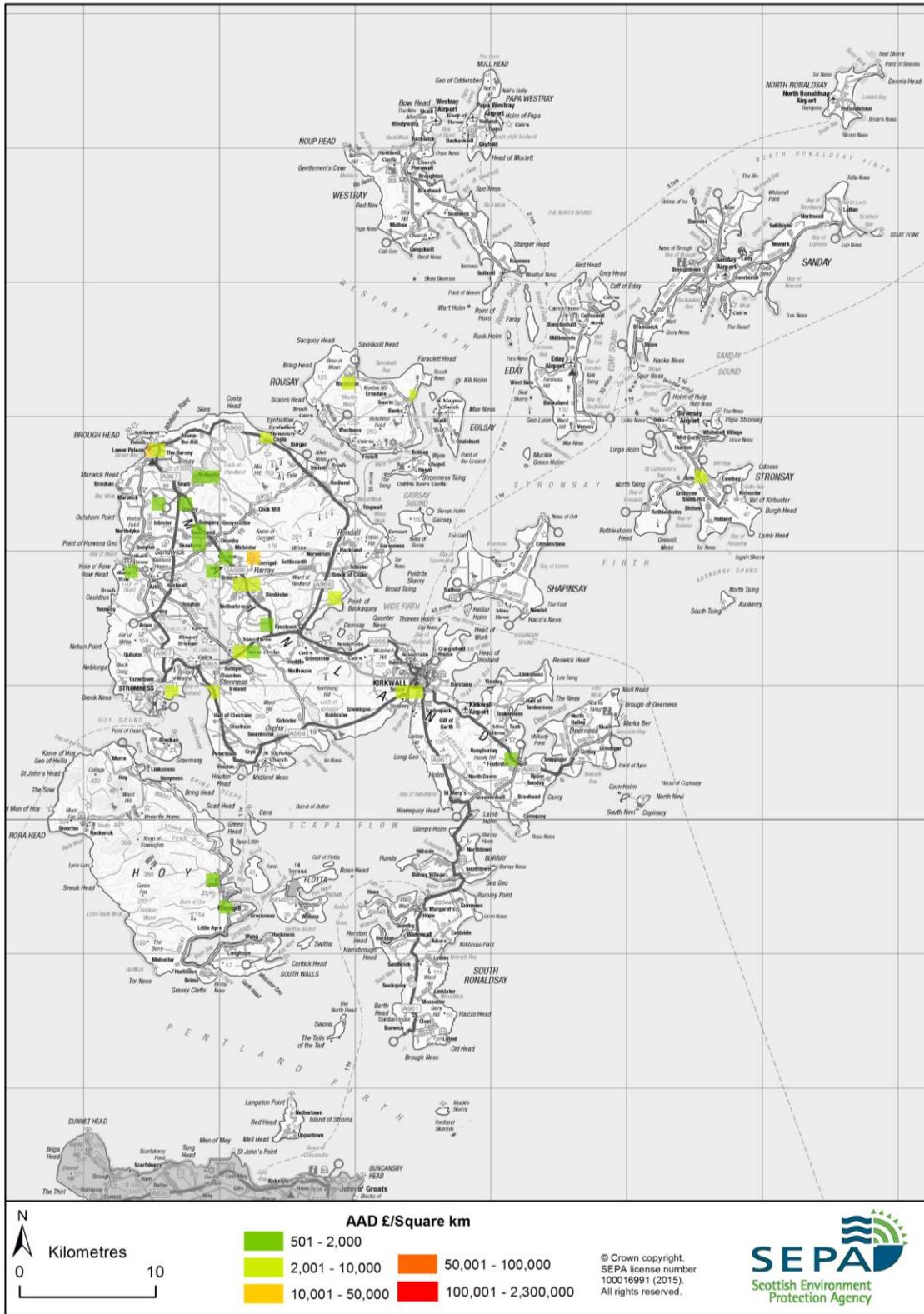
	Number at risk	Further detail
<b>Community facilities</b>	0	n/a
<b>Utility assets</b>	<10	Electricity substations
<b>Roads (excluding minor roads)</b>	110 locations	Notably the A986 and A966
<b>Railway routes</b>	n/a	n/a
<b>Agricultural land (km<sup>2</sup>)</b>	12	n/a

**Table 1:** Infrastructure and agricultural land at risk of river flooding

### Designated environmental and cultural heritage sites at risk

There are approximately 30 cultural heritage sites with a risk of river flooding. These include scheduled monuments, gardens and designed landscapes, conservation areas and World Heritage Sites.

Approximately 31km<sup>2</sup> of designated environmental area is at risk of being impacted by river flooding across the Orkney Islands. The areas affected include Special Areas of Conservation, Special Protection Areas, and Sites of Special Scientific Interest. Some of the sites affected include those at Lochs of Harray and Stenness, Orkney Mainland and Hoy.



**Figure 2: Annual Average Damages from river flooding**

## History of river flooding

There have been a number of localised floods from small burns. During a severe storm event in October 2006, roads and adjacent properties were flooded due to burns bursting their banks at the following locations:

- Willowburn, Kirkwall
- Muddisdale Burn, Kirkwall
- Otterswick, Papdale East, Kirkwall
- A960 at Wideford Brae (Wideford Burn) near Kirkwall Airport
- Millburn, Hoy
- Millburn, Garson, Stromness
- Millburn on A965 at Tormiston
- Kirkhouse Mill, South Ronaldsay
- Maitlands Burn, Finstown
- Cromarty Square, St Margaret's Hope
- Crantit Burn, St Ola
- A964 at Kirbister Mill, Orphir

Other instances of river flooding occurred between 2001 and 2014 when there was flooding from burns recorded at the following locations:

- Mill Bay, Stronsay
- Millburn, Stromness
- A965 at Saverock Junction, Hatston
- Cromarty Square, St Margaret's Hope
- A960 at Wideford Brae (Wideford Burn), near Kirkwall Airport
- Muddisdale Burn, Kirkwall
- Crantit Burn, St Ola

## 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.

Existing actions that are in place to manage flood risk and that are in addition to the information presented in Section 2 are described below.

Orkney Islands Council has an inspection and maintenance regime in place to help manage flood risk. Identified watercourses are inspected annually for potential future problems which may cause flooding. This includes checking inlet pipes and grills for debris, checking overgrown vegetation and examining the geometry of the burn for potential blockages. There is a schedule for checking and clearing 23 culverts throughout Orkney once a week in the summer and twice a week in the winter (October to April). Over the last decade investment has been made into upgrading headwalls and gratings into culverted watercourses.

Bags are made available for filling with sand locally in advance of flooding to the communities that may be affected.

## 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 Orkney Islands may increase by 41%<sup>1</sup>. This would potentially increase the number of residential properties at risk of river flooding from approximately 30 to 50. The number of non-residential properties at risk is not likely to increase significantly.

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 runoff reduction, floodplain storage and sediment management. 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

There are areas of potential for runoff reduction identified, many of which overlap with moorlands. These represent significant areas of generally high quality peatland, which has high biodiversity and carbon storage value. These areas already have value for runoff reduction and generally will not require or benefit from peatland restoration measures. Other potential runoff reduction measures, such as tree planting, would be inappropriate in such areas. There may be scope along the margins of the moorlands to reduce the speed of drainage into adjacent agricultural land through small scale tree planting or restoring / blocking canalised ditches.

### Floodplain storage

Only Mainland has significant areas of potential for floodplain storage, particularly in the west of the island. The only Potentially Vulnerable Area that has significant areas of potential, either within it or upstream is Stromness (03/04).

The most appropriate opportunities for enhanced floodplain storage for Orkney would be through retention of existing wetlands; restoration of the linkages between fragmented wetlands; restoration of canalised burns flowing into or out of existing lochs and wetlands, and restoration of more natural wetland vegetation along the margins of the larger lochs. This could not only have flood risk management benefits but would also have additional biodiversity benefits through the recreation of habitat linkages.

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<sup>1</sup> From the study 'An assessment of the vulnerability of Scotland's river catchments and coasts to the impacts of climate change' (CEH, 2011)

## **Sediment management**

The only river system in the Orkney catchment which has data on sediment management is Loch of Harray. It is unlikely that there will be significant flood risk improvements through sediment management measures in this catchment.

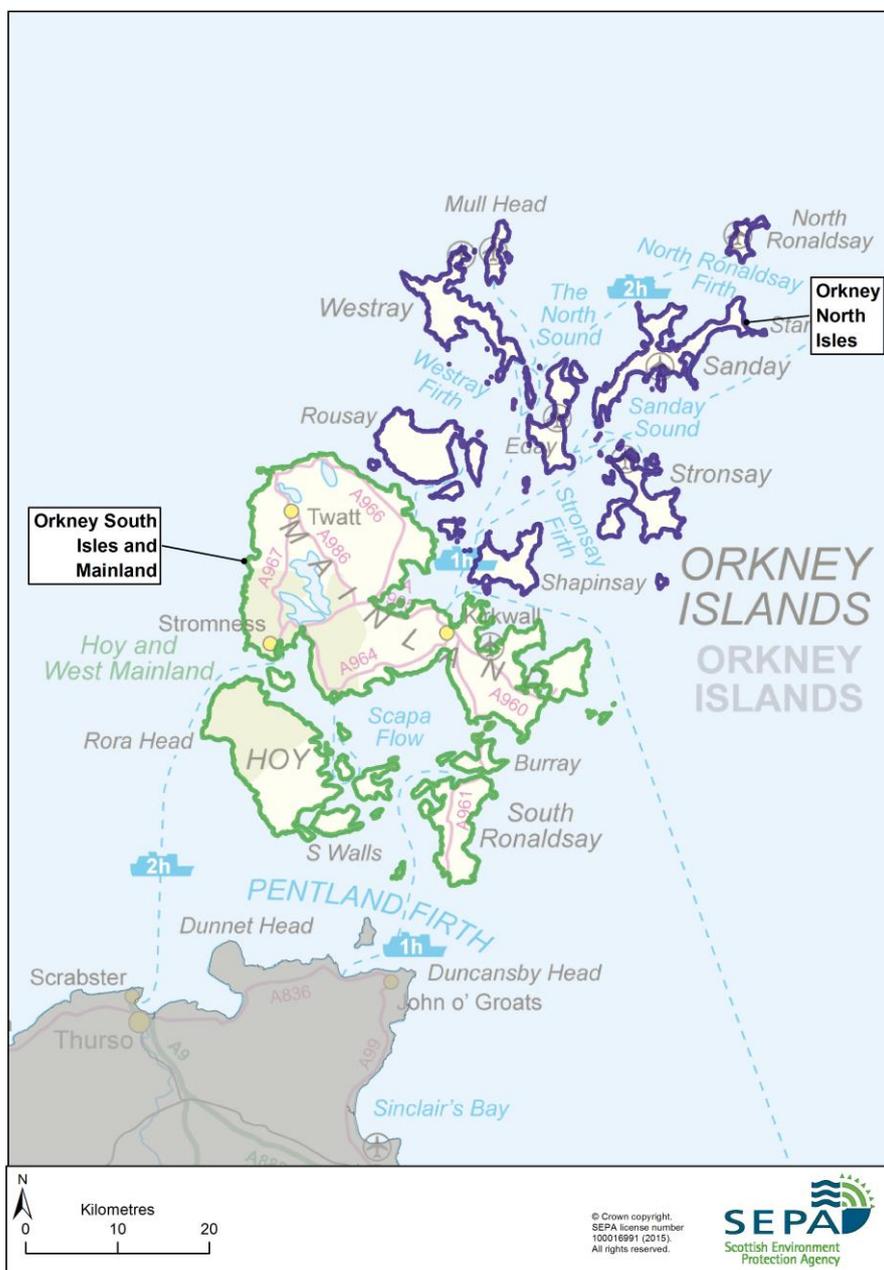
## 3.3 Coastal flooding

### Orkney Local Plan District

This section 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 Section 2.

In the Orkney Local Plan District, coastal flooding is reported across two coastal areas (Figure 1).



**Figure 1:** Coastal areas within the Orkney Local Plan District

## Coastal flooding Orkney South Isles and Mainland

### Coastal overview

The Orkney South Isles and Mainland coastal area includes Mainland, Hoy, South Walls, South Ronaldsay, Burray, Flotta, Graemsay, Cava, and other isles (Figure 1). It has a coastline with a length of approximately 430km. The majority of towns and villages are located close to the coast.

The western coastlines of Mainland Orkney and of Hoy are characterised by high sea cliffs, with lower more variable cliffs along the eastern coastline. There is very little dissipation of wave energy due to the deep water being close to the coastline. There are few beach areas which are mainly restricted to pocket beaches that are constrained between cliffs or rock platforms.

The northern coastline of Mainland Orkney is characterised by a low rock platform which is near continuous in the west and intermittent to the east where outcrops act as hinge points for the formation of beach areas, for example within Inganess Bay and Deer Sound. Wave conditions are less severe here due to the presence of numerous islands to the north and shallow water which provide shelter and dissipate much of the offshore wave energy.

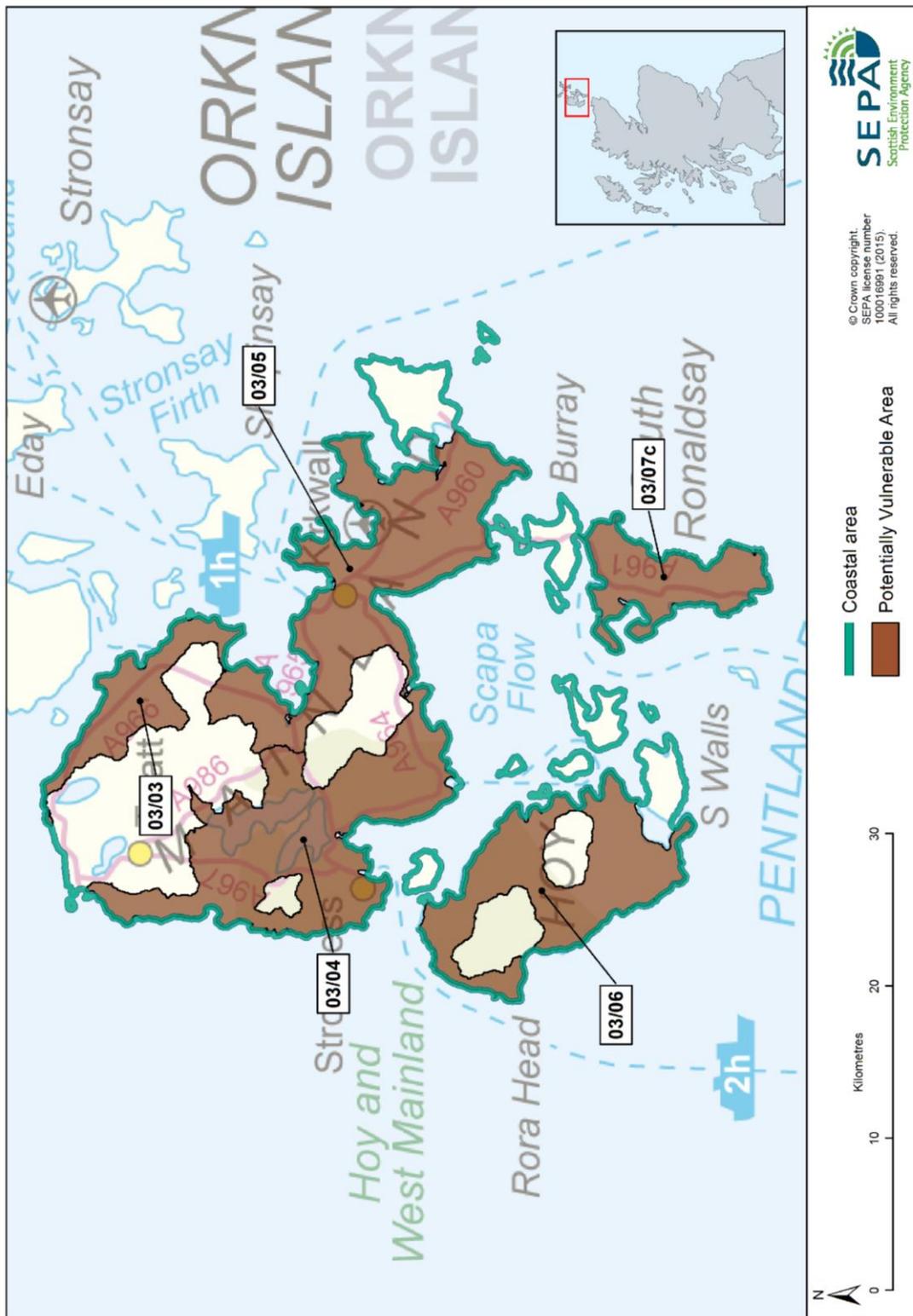
The inner coastline around Scapa Flow is typified by low rock platforms capped with thick boulder clay or peat deposits. Shingle and cobble fringe beaches are common. The entrances to Scapa Flow dissipate most of the offshore wave energy and as a result locally generated waves dominate.

There are five Potentially Vulnerable Areas:

- Orkney Mainland North (03/03)
- Stromness (03/04)
- Kirkwall (03/05)
- Hoy (03/06)
- South Ronaldsay<sup>1</sup> (03/07c).

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<sup>1</sup> Note that South Ronaldsay was not designated as a Potentially Vulnerable Area in the National Flood Risk Assessment (NFRA), which was completed in 2011. Information provided by Orkney Islands Council confirmed a level of flood risk which has led to South Ronaldsay's designation as a candidate Potentially Vulnerable Area.



**Figure 1:** Location of Orkney South Isles and Mainland coastal area

## Flood risk

Within the Orkney South Isles and Mainland coastal area, there are approximately 570 residential properties and 380 non-residential properties at risk of coastal flooding. Approximately 96% of properties at risk of flooding are located within Potentially Vulnerable Areas, of which the majority are located in Kirkwall (03/05).

### Main areas at risk

The main area of coastal flood risk is in Kirkwall. However, there are pockets of coastal flood risk to residential properties across the South Isles. St. Margaret's Hope tends to be the first settlement to flood during a coastal storm.

The Potentially Vulnerable Areas that have more than 20 residential properties at risk of coastal flooding are shown in Table 1.

	Residential and non-residential properties at risk of coastal flooding	Annual Average Damages
Kirkwall	720	£2.0 million
Stromness	70	£140,000
South Ronaldsay	50	£83,000

**Table 1:** Main areas at risk of coastal flooding

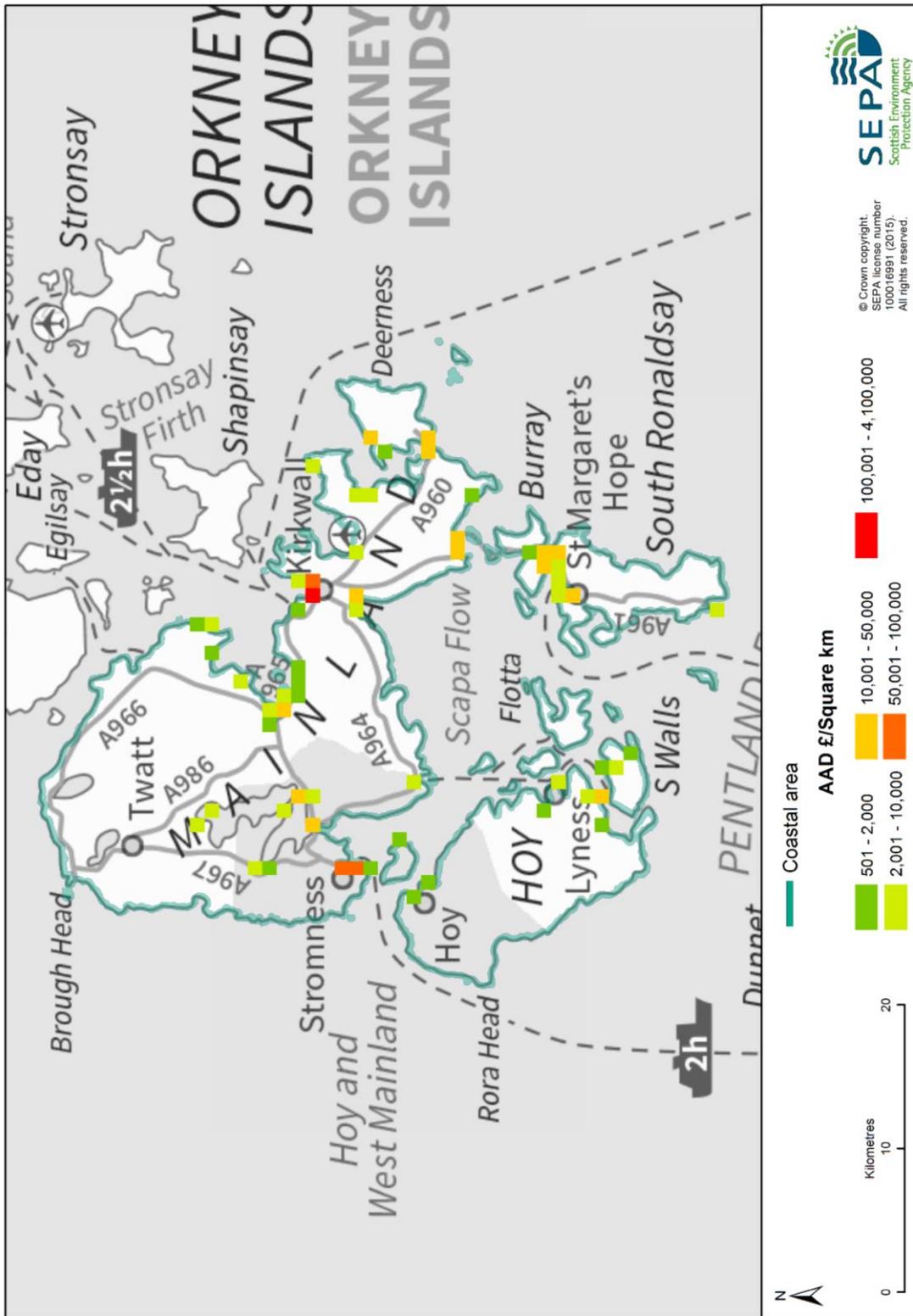
Orkney Islands Council provided updated numbers of properties at risk of coastal flooding to reflect the impact of wave action on flood risk in some Potentially Vulnerable Areas. Where updated figures were verified by photographic or historical evidence they have been used. Wave action is otherwise not accounted for in the figures presented. It was not possible to update economic impact data, due to the lack of information on the scale of flooding or depth of flooding which are required to calculate the Annual Average Damages.

### Economic activity and infrastructure at risk

The Annual Average Damages from coastal flooding in the South Isles and mainland coastal area are approximately £2.7 million. This accounts for 64% of the damages for the Local Plan District from all sources of flooding. The damages are distributed as follows:

- 38% non-residential properties (£1.0 million)
- 36% residential properties (£960,000)
- 13% roads (£340,000)
- 7% emergency services (£200,000)
- 5% vehicles (£130,000)
- <1% agriculture (£10,000).

Figure 2 shows the location of Annual Average Damages from coastal flooding across the area.



**Figure 2:** Annual Average Damages from coastal flooding

Table 2 shows further information about infrastructure and agricultural land at risk of coastal flooding.

	Number at risk	Further detail
<b>Community facilities</b>	<10	Includes; educational buildings and emergency services
<b>Utility assets</b>	10	Includes; electricity substations and telephone exchanges
<b>Roads (excluding minor roads)</b>	170	Notably; A965, A961 and A966 Causeway Hoy to South Walls
<b>Railway routes</b>	n/a	n/a
<b>Agricultural land (km<sup>2</sup>)</b>	2	n/a

**Table 2:** Main areas at risk of coastal flooding

### Designated environmental and cultural heritage sites at risk

There are approximately 41 designated cultural heritage sites at risk of coastal flooding. These sites include scheduled monuments, World Heritage Sites and listed buildings.

The main concern with cultural heritage sites in Orkney is their damage from or loss to coastal erosion. Impacts of coastal erosion are not considered as part of the work carried out under the Flood Risk Management (Scotland) Act 2009. However, it is recognised that there is a need to develop an integrated understanding of coastal erosion and flooding in future planning.

Approximately 2km<sup>2</sup> of environmentally designated site is at risk of flooding. This includes sites at Hoy, Selwick, Lochs of Stenness and Harray, Waulkmill, and the Bay of Skail.

### History of coastal flooding

The Orkney Isles have suffered frequent and sometimes significant coastal flooding. The most damaging coastal flood recorded to date was in 1953 with damages caused to residential and business properties, shops and water pipelines. Another significant flood was recorded in 2005, when extreme weather conditions caused a tidal surge coinciding with a high tide. Numerous properties were flooded throughout Orkney with several low lying coastal communities affected.

Orkney was affected by flooding in 2013 with various roads flooded. The Ayre Road on Hoy was damaged in this event.

### 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.

Existing actions that are in place to manage flood risk and that are in addition to the information presented in Section 2 are described below.

Orkney Islands Council monitors the predicted tide and surge levels against the lowest defences of all the local coastal communities, issues warnings and deploys mobile defences when and where appropriate.

Bags are made available for filling with sand locally in advance of flooding to the communities that may be affected.

### **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 Orkney South Isles and Mainland coastal area is 0.5m to 0.6m by 2080. This may increase the number of residential properties at risk of coastal flooding by approximately 24% and non-residential properties will increase by 28%. Coastal flood modelling by SEPA has not taken into account the impacts of a future climate 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.

#### **Estuarine surge**

No assessment of estuarine surge attenuation potential was carried out for Orkney.

#### **Wave energy**

There is potential for wave energy dissipation, and associated benefits to flood risk management, along much of the coastline. Along the northern coast of Orkney Mainland the potential areas are more continuous. There is potential for wave energy dissipation around the island of Hoy particularly in the south and west. Offshore features, particularly kelp beds, help to attenuate wave energy and the retention of these features is important in the sustainable management of flood risk in Orkney.

## Coastal flooding Orkney North Isles

### Coastal overview

The Orkney North Isles coastal area includes Stronsay, North Ronaldsay, Westray, Mull Head, Eday, Shapinsay, Rousay, Sanday and other islands (Figure 1). It has a coastline with a length of approximately 425km. The majority of towns and villages are located close to the coastline.

The coastline varies greatly between the islands. It is generally characterised by sandstone cliffs of varying heights fronted by a low rock platform. The low rock platform tends to act as hinge points upon which bay type beaches develop.

There are many beach areas and some extensive dune systems. These are mainly composed of fine shell sand and found predominantly on Sanday. There are several beaches along the south west coasts of Shapinsay, Westray, and Stronsay that are derived from erosion of soft glacial till deposits and are primarily shingle. Most of the beach areas are relatively stable but are dependent on the existence of the shingle storm ridges either at the back of or underlying the sand. These ridges are very efficient in dissipating wave energy.

There are three Potentially Vulnerable Areas:

- Sanday (03/01),
- Stronsay (03/02),
- Westray (03/08c)<sup>1</sup>.

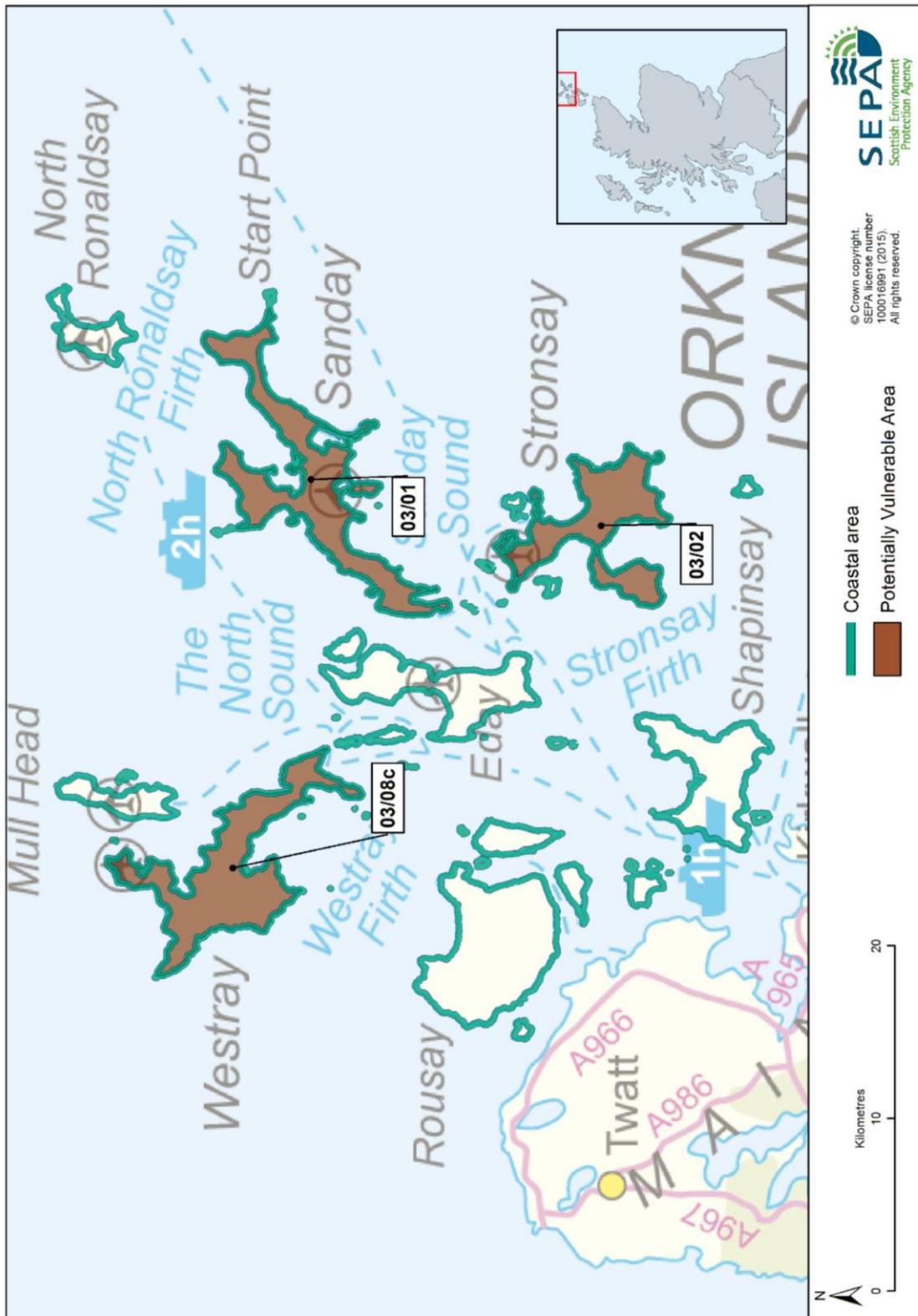
### Flood risk

#### Main areas at risk of coastal flooding

Within the Orkney North Isles coastal area, there are approximately 120 residential properties and 50 non-residential properties at risk of coastal flooding. Approximately 76% of residential and 62% of non-residential properties are located within Potentially Vulnerable Areas. The main areas of coastal flood risk to residential properties are in Kettletoft on Sanday and Whitehall on Stronsay.

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<sup>1</sup> Note that Westray was not designated as a Potentially Vulnerable Area in the National Flood Risk Assessment (NFRA), which was completed in 2011. Information provided by Orkney Islands Council confirmed a level of flood risk which has led to South Westray's designation as a candidate Potentially Vulnerable Area



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- Coastal area
- Potentially Vulnerable Area

Kilometres  
0 10 20

**Figure 1: Orkney North Isles Coastal Area and Potentially Vulnerable Areas**

## Economic activity and infrastructure at risk

The Annual Average Damages from coastal flooding in the North Isles are approximately £1.2 million. This accounts for 28% of the damages for the Orkney Local Plan District from all sources of flooding. The areas that have the highest damages are around Whitehall village and the western areas of Stronsay, Kettletoft, across the north, central, and north-east of Sanday, and in the north of Westray at Pierowall. The damages are distributed as follows:

- 43% residential properties (£520,000)
- 33% roads (£390,000)
- 12% non-residential properties (£150,000)
- 6% emergency services (£70,000)
- 3% agriculture (£33,000)
- 3% vehicles (£33,000)

Figure 2 shows the location of Annual Average Damages from coastal flooding across the area.

There are approximately 90 road locations with a risk of coastal flooding. The main routes affected include the B9068, B9069, B9060, and B9066 and minor roads. Road access to community facilities, airports and ferry ports is critically important on the North Isles.

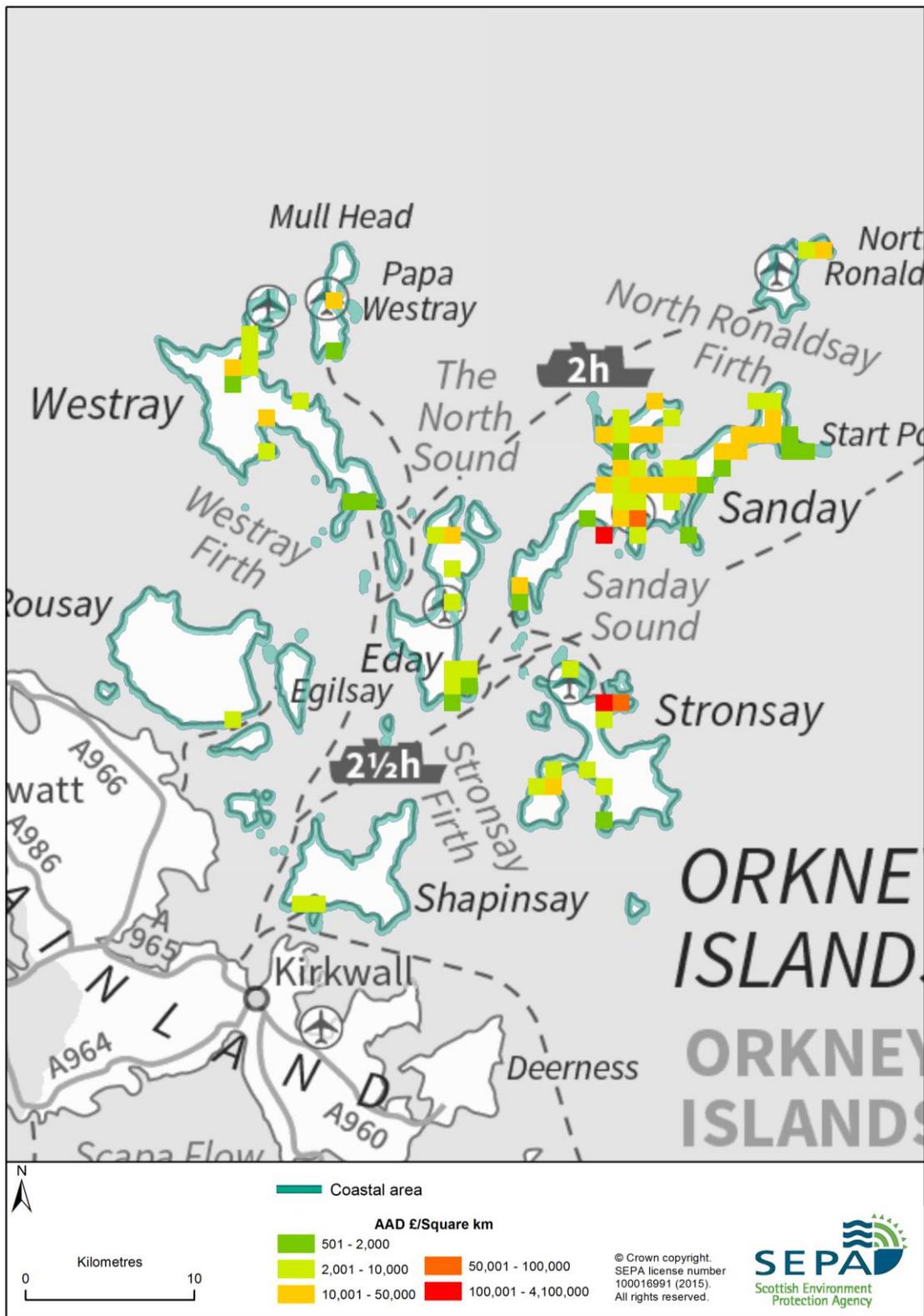
## Designated environmental and cultural heritage sites at risk

There are approximately 43 cultural heritage sites at risk of coastal flooding. The majority are scheduled monuments, including prehistoric domestic and defensive sites, listed buildings and funerary sites.

The main concern with cultural heritage sites is their damage from or loss to coastal erosion. Impacts of coastal erosion are not considered as part of the work carried out under the Flood Risk Management (Scotland) Act 2009. However, it is recognised that there is a need to develop an integrated understanding of coastal erosion and flooding in future planning.

Approximately 8km<sup>2</sup> of environmentally designated site is at risk of flooding, including special areas of conservation, Special Protection Areas, and Sites of Special Scientific Interest. The sites at risk include those at Mill Bay, Rousay, Faray and Holm of Faray, East and Central Sanday, Northwall and Westray.

The main area in Orkney with respect to potential interaction of measures intended to reduce flood risk and designated natural heritage sites is Sanday. The Orkney Islands Local Advisory Group provided comments on the natural flood management screening outputs for Sanday, noting that, *'On Sanday considerable natural protection is already provided by extensive dune systems, sand and mud flats, salt marsh and shingle banks, which are generally in good condition such that we were not able readily to identify potential for enhancement.* Further it was also noted that for the Orkney Islands as a whole, *'We highlight the value of offshore features, particularly kelp beds, to attenuate wave energy and suggest that retention of these features be identified as having high potential'.*



**Figure 2:** Annual Average Damages from coastal flooding

## History of coastal flooding

Whitehall in Stronsay suffers from coastal flooding to the roads and properties on a regular basis. In 1953 seafront roads and properties were flooded. There was significant damage to communities and flooding to properties in Whitehall, Kettletoft and Pierowall in January 2005. Whitehall in particular suffered coastal flooding in 2011, 2013 and 2014.

## 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.

Existing actions that are in place to manage flood risk and that are in addition to the information presented in Section 2 are described below.

Orkney Islands Council monitors the predicted tide and surge levels against the lowest defences of all the local coastal communities, issues warnings and deploys mobile defences when and where appropriate.

## 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 Orkney North Isles coastal area is 0.5m by 2080. This may increase the number of residential properties at risk of coastal flooding by approximately 63%, and non-residential properties will increase by 35%. Coastal flood modelling by SEPA has not taken into account the impacts of a future climate 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.

## **Estuarine surge**

No assessment of estuarine surge attenuation potential was carried out for Orkney.

## **Wave energy**

There is potential for wave energy dissipation along much of the coastline around the North Isles. It is understood that offshore kelp beds play an important role in reducing wave energy in Orkney. Offshore features, particularly kelp beds, help to attenuate wave energy and the retention of these features is important in the sustainable management of flood risk in Orkney.

On Sanday, considerable natural protection is already provided by extensive dune systems, sand and mud flats, salt marsh and shingle banks, which are generally in good condition. There are multiple natural heritage designations (SSSI, SPA, SAC and Ramsar) for marine and coastal features on and around Sanday and consequently development of any natural flood management projects would require careful consideration, in particular to assess impacts of projects at any one location on features in other locations.

## 3.4 Surface water flooding

### Orkney 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

##### Main areas at risk

There are approximately 60 residential properties and 130 non-residential properties at risk of surface water flooding in the Orkney Islands. 78% of the residential properties and 92% of the non-residential properties at risk are located in Kirkwall.

Orkney Islands Council considers that surface water flood risk is underestimated for Kirkwall. However, whilst there are good records of the extent of actual flooding there is no accurate record of the properties that have suffered from internal flooding. Orkney Islands Council is working with Scottish Water and SEPA to improve understanding of surface water flood risk in Kirkwall.

##### Economic activity and infrastructure at risk

Annual Average Damages in the Orkney Local Plan District from surface water flooding are estimated to be around £170,000 with the bulk of this (87%) attributed to Kirkwall. This accounts for 4% of the total flood damages for the Local Plan District. The damages are distributed as follows:

- 65% non-residential properties (£110,000)
- 21% residential properties (£38,000)
- 6% roads (£11,000)
- 8% emergency services (£13,000)
- <1% vehicles (£50).

Figure 1 shows the location of Annual Average Damages from surface water flooding across the Local Plan District. The most significant contributing area to the damages is Kirkwall.



**Figure 1:** Annual Average Damages from surface water flooding

Table 2 shows further information about infrastructure and agricultural land at risk of coastal flooding.

	Number at risk	Further detail
<b>Community facilities</b>	0	n/a
<b>Utility assets</b>	20	Includes; electricity substations and mineral/fuel extraction sites
<b>Roads (excluding minor roads)</b>	210 locations	Notably A960, A965, A964
<b>Railway routes</b>	n/a	n/a

**Table 2:** Main areas at risk of coastal flooding

### Designated environmental and cultural heritage sites at risk

There are an estimated 30 cultural heritage sites at risk of surface water flooding in the Orkney Islands. All of these are scheduled monuments. It should be noted that cultural heritage, and in particular prehistoric sites in Orkney, are a major driver for the tourist industry, which is important to the economy of Orkney. Flood damages or disruption to access to historic sites will have a significant negative impact on the local economy.

The impact of surface water flooding on environmental sites has not been assessed and is assumed to be relatively low.

### History of flooding

There have been a number of localised surface water floods. The most severe flood was in October 2006, which affected major roads in and around Kirkwall together with internal flooding to a large number of properties - including three schools. Orkney Islands Council considers that many cases of flooding were not reported. There have been a number of other localised floods, the most recent occurring in November 2013.

### 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.

Existing actions that are in place to manage flood risk and that are in addition to the information presented in Section 2 are described below.

In Kirkwall there is a system in place to divert the majority of storm water flows into the Peedie Sea. This acts to reduce the flood risk to low lying areas of Kirkwall which have historically been vulnerable to flooding. The Peedie Sea provides a balancing reservoir to store storm water during high tides, with the level in the Peedie Sea controlled by a series of automatic operating flap and stop valves.

Scottish Water has also invested in Kirkwall to reduce surface water flooding. In the early 1990s a new pumped system was installed adjacent to the west pier which eliminated the need to discharge the combined storm water and wastewater system

directly into Kirkwall Bay. In 2008, Scottish Water also refurbished the main combined sewer along Junction Road to remove issues associated with infiltration originating from the sea.

### **Surface water management priority areas**

The areas at highest risk from surface water flooding nationally have been identified as priority areas. These priority areas were identified using SEPA flood models, supplemented with evidence from historic surface water floods and, where available, more detailed modelling carried out by local authorities. These priority areas require surface water management plans to be prepared, the details of which can be found within the Potentially Vulnerable Area chapters in Section 2.

### **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 surface water 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 60 to 80 and the number of non-residential properties from approximately 130 to 160.

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. <sup>i</sup>
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 <sup>ii</sup> ), wetlands, rivers, canals (and their banks) and other watercourses <sup>iii</sup>
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 <sup>iv</sup> .
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
	<p>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.</p> <p>See also 'Annual Average Damages'</p>
Demountable defences	<p>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.<sup>v</sup></p>
Deposition	<p>A natural process leading to an accumulation of sediment on a river bed, floodplain or coastline.</p>
Economic impact	<p>An assessment of the economic value of the positive and negative effects of flooding and / or the actions taken to manage floods.</p>
Embankment	<p>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.</p>
Emergency plans / response	<p>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.</p>
Environmental impact	<p>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.</p>
Environmental Impact Assessment (EIA)	<p>Environmental Impact Assessment (EIA) is a process which identifies the potential environmental impacts, both negative and positive, of a proposal.</p>
Environmental sites / environmental designated areas/ environmentally designated sites	<p>Areas formally designated for environmental importance, such as Sites of Special Scientific Interest (SSSI), Special Protection Area (SPA) or Special Areas of Conservation (SAC).</p>
Episodic erosion	<p>Erosion induced by a single event, such as a storm.</p>
Erosion	<p>A natural process leading to the removal of sediment from a river bed, bank or floodplain or coastline.</p>
Estuarine surge attenuation	<p>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.</p>
Estuary	<p>A coastal body of water usually found where a river meets the sea; the part of the river that is affected by tides.</p>
Fault (fault line)	<p>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.</p>
Flash flood	<p>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.</p>
Flashy watercourse	<p>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</p>

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 from 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. <sup>vi</sup>
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 <sup>vii</sup> .
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’ <sup>viii</sup>

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. <b>High likelihood:</b> 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. <b>Medium likelihood:</b> 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. <b>Low likelihood:</b> 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 <sup>ix</sup> .
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.

<b>Term</b>	<b>Definition</b>
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 <sup>x</sup> .
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 <sup>xi</sup> .
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 <sup>xii</sup> .
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 <sup>xiii</sup>
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. <sup>xiv</sup>
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.

<sup>i</sup> <http://apps.sepa.org.uk/bathingwaters/> accessed 14/10/2015 last updated 2015

<sup>ii</sup> <http://www.susdrain.org/delivering-suds/using-suds/suds-components/swales-and-conveyance-channels/swales.html> accessed 12/10/2015 last updated 2012

<sup>iii</sup> <http://www.gov.scot/Resource/Doc/362219/0122541.pdf> accessed 12/10/2015 last updated 2011

<sup>iv</sup> <http://www.legislation.gov.uk/ukpga/2004/36/schedule/1> accessed 12/10/2015 last updated 2004

<sup>v</sup> <http://evidence.environment-agency.gov.uk/FCERM/en/FluvialDesignGuide/Chapter9.aspx?pagenum=10> accessed 12/10/2015 last update 07/03/2012

<sup>vii</sup> [http://ec.europa.eu/environment/water/flood\\_risk/](http://ec.europa.eu/environment/water/flood_risk/) accessed 12/10/2015 last updated 17/09/2015

<sup>viii</sup> <http://www.gov.scot/Resource/Doc/362219/0122541.pdf> accessed 12/10/2015 last updated 2011

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- <sup>ix</sup> <http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/local-designations/lnr/> accessed 12/10/2015 last updated 12/07/2015
- <sup>x</sup> <http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/national-designations/sssisi/> accessed 12/10/2015 last updated 21/01/2015
- <sup>xi</sup> <http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/international-designations/sac/> accessed 12/10/2015 last updated 01/03/2013
- <sup>xii</sup> <http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/international-designations/spa/> accessed 12/10/2015 last updated 01/03/2013
- <sup>xiii</sup> <http://watermaps.environment-agency.gov.uk/wiyby/wiyby.aspx?topic=ufmfs#w=x=357683&y=355134&scale=2> accessed 12/10/2015 last updated 12/10/2015
- <sup>xiv</sup> <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:

### **Ordnance Survey**

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### **Local authorities**

SEPA acknowledges the provision of flood models and other supporting data and information from local authorities in Scotland and their collaboration in the production of flood risk management information.

### **Scottish Water**

SEPA acknowledges the inclusion of surface water flooding data generated by Scottish Water in preparation of flood risk information.

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.

