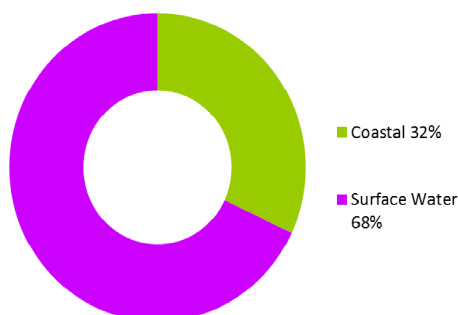


Glasgow City centre (Potentially Vulnerable Area 11/16)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	Glasgow City Council	River Clyde

Summary of flooding impacts



At risk of flooding

- 420 residential properties
- 460 non-residential properties
- £550,000 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


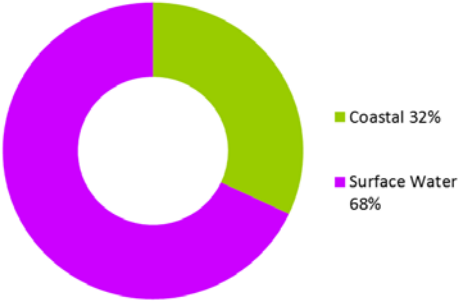
The actions below have been selected to manage flood risk.

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

Actions

Glasgow City centre (Potentially Vulnerable Area 11/16)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	Glasgow City Council	River Clyde

Background							
<p>This Potentially Vulnerable Area is located in Glasgow City centre along the north of the River Clyde between Glasgow Bridge in the east and the riverside museum to the west (shown below). The area incorporates Yorkhill, Glasgow Central railway station, Townhead and is approximately 4km².</p>  <p><small>© Crown copyright. SEPA licence number 100016991 (2015). All rights reserved.</small></p>	<p>The area has a risk of river, surface water and coastal flooding. The majority of damages are caused by surface water flooding.</p> <p>There are approximately 420 residential properties and 460 non-residential properties at risk of flooding. The Annual Average Damages are approximately £550,000.</p>  <table border="1"> <caption>Data for Figure 1: Annual Average Damages by flood source</caption> <thead> <tr> <th>Flood Source</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Coastal</td> <td>32%</td> </tr> <tr> <td>Surface Water</td> <td>68%</td> </tr> </tbody> </table> <p>Figure 1: Annual Average Damages by flood source</p>	Flood Source	Percentage	Coastal	32%	Surface Water	68%
Flood Source	Percentage						
Coastal	32%						
Surface Water	68%						

Summary of flooding impacts

Surface water flooding in the area impacts residential properties and there is also the potential for flooding to restrict access to many others. The areas at highest risk from surface water flooding will require the preparation of surface water management plans.

Scottish Water and local authorities have completed a number of studies in the area. These have included strategic and detailed assessments of surface water risk and its interaction with river flooding, as well as considering mitigation actions. Many of these studies have been helped by the partnership working developed within the Metropolitan Glasgow Strategic Drainage Partnership. This has led to the implementation of schemes and works to protect properties from river and surface water flooding.

The southern boundary of the Potentially Vulnerable Area fronts onto the River Clyde which is tidal over this entire reach. Coastal flooding is predicted to affect approximately 170 residential and 20 non-residential properties as well as sections of the road and rail network. Coastal flood risk is centred on the mouth of the River

Kelvin, in the vicinity of the Scottish Exhibition and Conference Centre, and sections of Lancefield and Anderston Quay as far as the Kingston (M8) Bridge.

The assessment of coastal flooding does not include local surge and wave impacts which have the potential to increase coastal flood risk. Severe weather conditions to the south and west of the Firth of Clyde can cause a surge that will run up the Firth as far as Glasgow. If a surge coincided with a high tide, the water level could rise above the quay walls in the city centre, increasing the identified risk.

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

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 420 to 680 and the number of non-residential properties from approximately 460 to 830.

The location of the impacts of flooding is shown in Figure 3. The M8 and M74 are at risk of flooding within this Potentially Vulnerable Area.

History of flooding

There is a long history of flooding within this area. Many of the river floods which caused damages to properties and people occurred prior to the Clyde being canalised and widened to the south (1700's and 1800's), however the city was very different at this time.

Between 10- 12 December 1994 major flooding occurred in rivers and urban watercourses across Glasgow and surrounding areas. A slow-moving weather system delivered persistent rain over a 48 hour period across a wide geographical area. Previously recorded peak river flows were exceeded in all major catchments in the region. The River Clyde is thought to have reached its highest level in 150 years, and the total cost of the damage reached in the region of £100 million. This flood had a magnitude of 50-100 year return period. There were 700 homes and many businesses affected in Strathclyde. This flood severely affected Glasgow City and completely inundated the grounds of the Scottish Exhibition and Conference Centre.

On 8 of August 1948 surface water flooding resulted in two deaths and transport disruption. Some homes were isolated by the flood waters and a telephone communication was affected.

There have been no coastal floods recorded within this Potentially Vulnerable Area; however, it is likely that many of the early river flood events could be attributed to tidal surges from the Clyde.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 10,000)	<10	420	720
Non-residential properties (total 10,000)	40	460	820
People	<10	920	1,600
Community facilities	0	<10 Includes: educational buildings and healthcare facilities	10 Includes: educational buildings, emergency services and healthcare facilities
Utilities assets	<10	<10	<10
Transport links-roads (km)	0.7 (of which 0.3 is motorway)	2.4 (of which 0.6 is motorway)	3.7 (of which 0.6 is motorway)
Transport links-rail (km)	0.4	1.2	1.7
Designated cultural heritage sites	0	20	39

Table 1: Summary of flooding impacts¹

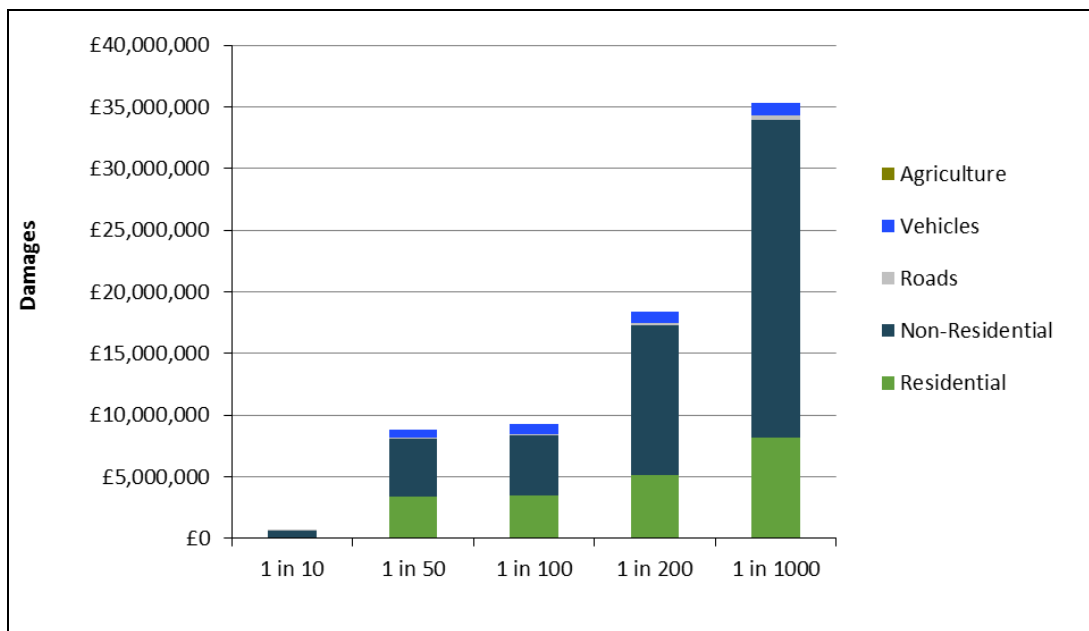


Figure 2: Damages by flood likelihood

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

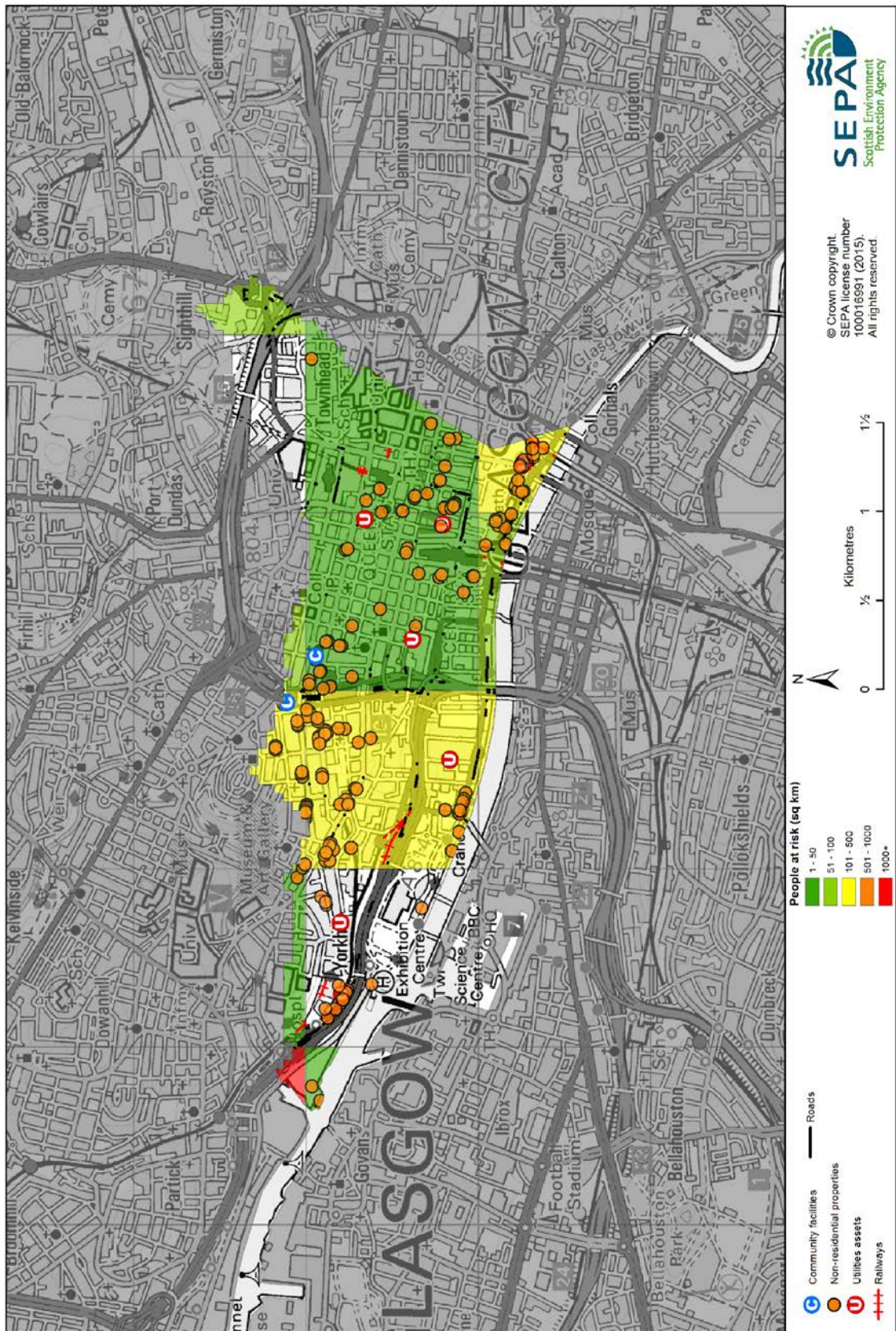


Figure 3: Impacts of flooding

Objectives to manage flooding in Potentially Vulnerable Area 11/16

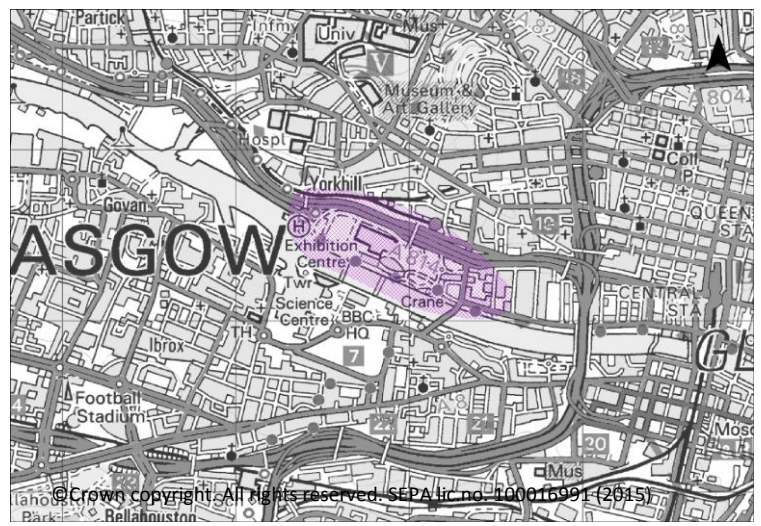
Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target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

Reduce the risk of coastal flooding to non-residential properties in the Exhibition Centre Quarter

Indicators:

- 10 non-residential properties
- £18,000 Annual Average Damages

Target area:



Objective ID: 11023

Target area	Objective	ID	Indicators within PVA
Glasgow	Reduce the economic damages and number of people at risk of surface water flooding in Glasgow City	11007	* See note below
Applies across Clyde and Loch Lomond Local Plan District	Avoid an overall increase in flood risk	11127	<ul style="list-style-type: none"> • 420 residential properties • £550,000 Annual Average Damages
Applies across Clyde and Loch Lomond Local Plan District	Reduce overall flood risk	11132	<ul style="list-style-type: none"> • 420 residential properties • £550,000 Annual Average Damages
Applies across Clyde and Loch Lomond 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 11/16 there are 240 residential properties at risk and Annual Average Damages of £370,000.

Actions to manage flooding in Potentially Vulnerable Area 11/16

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

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

Action (ID):	FLOOD PROTECTION SCHEME/WORKS (110230006)		
Objective (ID):	Reduce the economic damages and number of people at risk of surface water flooding in Glasgow City (11007)		
Delivery lead:	Scottish Water		
Status:	Under development	Indicative delivery:	2016-2021
Description:	Scottish Water have proposed a large combined sewer overflow interceptor for Yorkhill adjacent to the Heliport which will remove combined sewer spills from the River Kelvin. This will not reduce the risk of coastal flooding to the Exhibition Quarter.		
Potential impacts			
Economic:	This project is not principally designed to protect against flooding however it may help to reduce the impact of flooding in the local areas. As a consequence the flooding benefits have not been assessed.		
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community.		
Environmental:	Flood protection works can have both positive and negative impacts on the ecological quality of the environment depending on how they are designed.		

Action (ID):	SURFACE WATER PLAN/STUDY (110070018)
Objective (ID):	Reduce the economic damages and number of people at risk of surface water flooding in Glasgow City (11007)
Delivery lead:	Glasgow City Council

Status:	Not started	Indicative delivery:	2028-2033
Description:	The area must be covered by a strategy to manage and reduce surface water flood risk and identify the most sustainable actions to achieve the objectives. This strategy has been developed by the Metropolitan Glasgow Strategic Drainage Partnership. The detailed objectives and actions to manage and reduce surface water flood risk will be set out in the area specific surface water management plans described below.		

Action (ID):	STRATEGIC MAPPING AND MODELLING (111320019)		
Objective (ID):	Reduce overall flood risk (11132)		
Delivery lead:	Scottish Water		
Status:	Not started	Indicative delivery:	2016-2021
Description:	Scottish Water will review the assessment of flood risk within the highest risk sewer catchments to improve knowledge and understanding of surface water flood risk.		

Action (ID):	MAINTAIN FLOOD PROTECTION SCHEME (110230017)		
Objective (ID):	Reduce the risk of coastal flooding to non-residential properties in the Exhibition Centre Quarter (11023)		
Delivery lead:	Glasgow City Council		
Status:	Existing	Indicative delivery:	Ongoing
Description:	There are a number of sections of flood defence along the River Clyde which offer protection to properties in the area. These defences will be maintained, and will continue to manage flooding according to the design standard at the time of construction. Levels of flood risk are likely to increase over time as a consequence of climate change.		

Action (ID):	MAINTAIN FLOOD WARNING (111320030)		
Objective (ID):	Reduce overall flood risk (11132)		
Delivery lead:	SEPA		
Status:	Existing	Indicative delivery:	Ongoing
Description:	Continue to maintain the Glasgow Quay Walls flood warning area which is part of the Firth of Clyde coastal flood warning scheme.		

Action (ID):	FLOOD FORECASTING (111320009)		
Objective (ID):	Reduce overall flood risk (11132)		
Delivery lead:	SEPA		
Status:	Existing	Indicative delivery:	Ongoing
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 Responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	SELF HELP (111320011)		
Objective (ID):	Reduce overall flood risk (11132)		
Delivery lead:	—		
Status:	Existing	Indicative delivery:	Ongoing
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and Resilient Communities initiatives, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	AWARENESS RAISING (111320013)		
Objective (ID):	Reduce overall flood risk (11132)		
Delivery lead:	Responsible authorities		
Status:	Existing	Indicative delivery:	Ongoing
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. From 2016 SEPA will engage with the community through local participation in national initiatives, including partnership working with Neighbourhood Watch Scotland. In addition, SEPA will engage with local authorities and community resilience groups where possible. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

Action (ID):	MAINTENANCE (111320007)		
Objective (ID):	Reduce overall flood risk (11132)		
Delivery lead:	Glasgow City Council, asset / land managers		
Status:	Existing	Indicative delivery:	Ongoing
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. They produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk.		

Action (ID):	SITE PROTECTION PLANS (110230015)		
Objective (ID):	Reduce the risk of coastal flooding to non-residential properties in the Exhibition Centre Quarter (11023)		
Delivery lead:	Glasgow City Council		
Status:	Not started	Indicative delivery:	2016-2021
Description:	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. A site protection plan for the Exhibition Centre should be developed; the multiple operators in the Centre should be involved in the process.		

Action (ID):	EMERGENCY PLANS/RESPONSE (111320014)		
Objective (ID):	Reduce overall flood risk (11132)		
Delivery lead:	Category 1 and 2 Responders		
Status:	Existing	Indicative delivery:	Ongoing
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	PLANNING POLICIES (111270001)		
Objective (ID):	Avoid an overall increase in flood risk (11127) Reduce overall flood risk (11132)		
Delivery lead:	Planning authority		
Status:	Existing	Indicative delivery:	Ongoing
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		