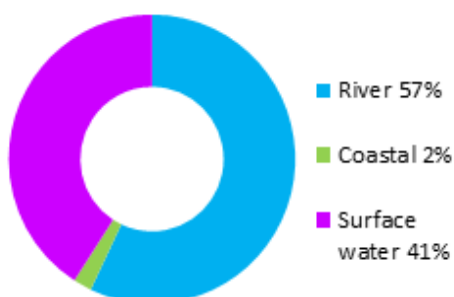


## Arbroath (Potentially Vulnerable Area 07/07)

Local Plan District	Local authority	Main catchment
Tay Estuary and Montrose Basin	Angus Council	Brothock Water

### Summary of flooding impacts



#### At risk of flooding

- 250 residential properties
- 140 non-residential properties
- £1.6 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	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

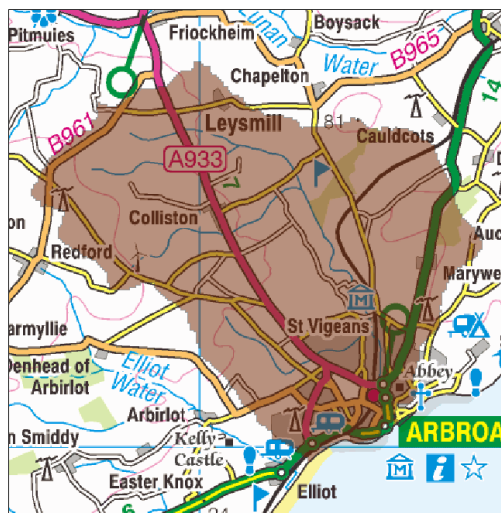
Actions

## Arbroath (Potentially Vulnerable Area 07/07)

Local Plan District	Local authority	Main catchment
Tay Estuary and Montrose Basin	Angus Council	Brothock Water

### Background

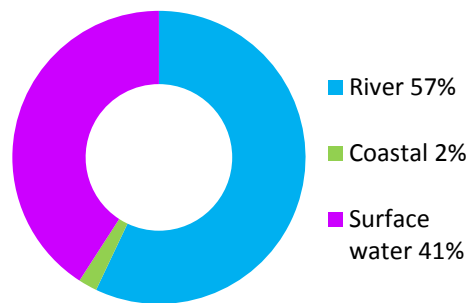
This Potentially Vulnerable Area is 50km<sup>2</sup> and includes the whole Brothock Water catchment. It contains Arbroath and the main watercourses are the Brothock Water and its tributaries including the Magungie Burn, Denside Burn, Coliston Burn and Hercules Den Burn.



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There are approximately 250 residential properties and 140 non-residential properties at risk of flooding. The Annual Average Damages from flooding are approximately £1.6 million.

The main sources of flood damages are river and surface water flooding.



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

### Summary of flooding impacts

The highest risk of flooding is in Arbroath from the Brothock Water. Arbroath is also notably impacted by surface water flooding.

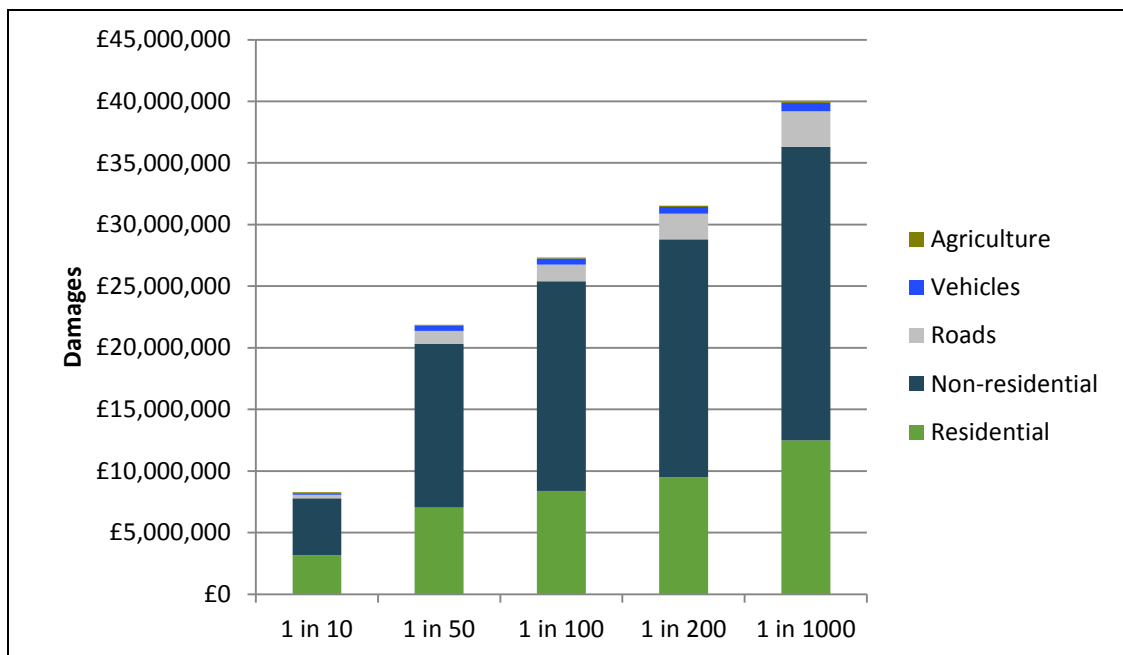
The risk of flooding to people and property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1.

The damages associated with floods of different likelihood are shown in Figure 2. For this Potentially Vulnerable Area the highest damages are to non-residential properties followed by damages to residential properties. The Dundee to Aberdeen railway line is also notably impacted. The location of the impacts of flooding is shown in Figure 3.

The figures presented for Annual Average Damages include damages to residential properties, non-residential properties, transport and agriculture.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 10,500)	130	250	330
Non-residential properties (total 1,000)	60	140	170
People	280	550	720
Community facilities	0	<10 Educational buildings	<10 Educational buildings
Utilities assets	<10	<10	<10
Transport links (excluding minor roads)	2 A roads, 3 B roads at 46 locations  1 Railway route at 16 locations: Dundee to Aberdeen	2 A roads, 4 B roads at 109 locations  1 Railway route at 30 locations: Dundee to Aberdeen	2 A roads, 5 B roads at 124 locations  1 Railway route at 32 locations: Dundee to Aberdeen
Environmental designated areas (km <sup>2</sup> )	0	0	0
Designated cultural heritage sites	3	4	4
Agricultural land (km <sup>2</sup> )	1.1	1.2	1.2

**Table 1:** Summary of flooding impacts



**Figure 2:** Damages by flood likelihood

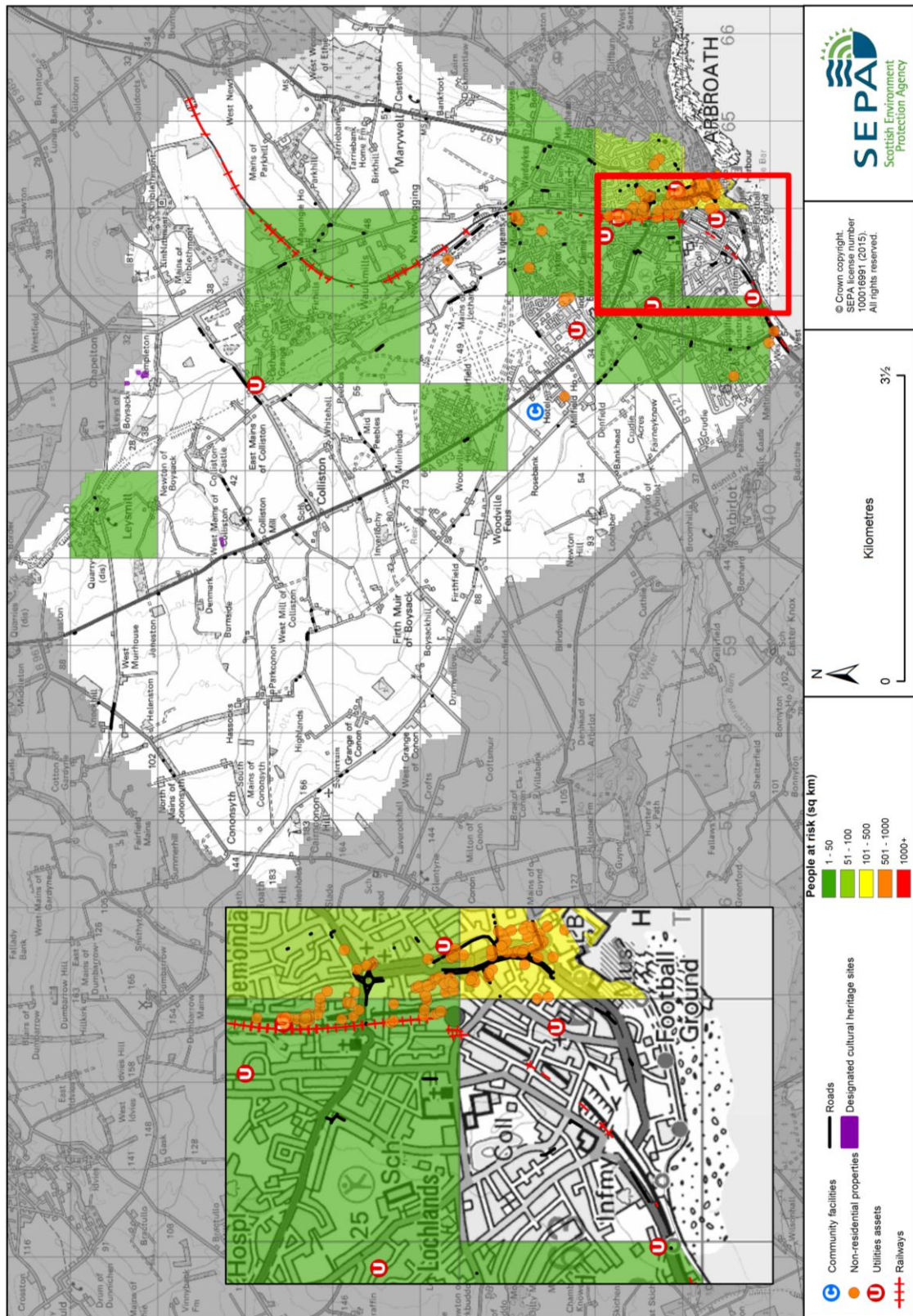


Figure 3: Impacts of flooding

## History of flooding

The following significant floods have been recorded in this Potentially Vulnerable Area:

- 1 December 2009: Arbroath Harbour and Victoria Park flooded from the sea.
- November 2009: The highest river level recorded at the SEPA gauging station on the Brothock Water at Arbroath was in November 2009, when the level reached 1.66m.
- October 1998: Heavy rainfall led to flooding of some properties on Lindsay Street.
- October 1976: Exceptional rainfall led to flooding to the area upstream of Guthrie Port with a number of industrial premises flooded.
- 10 February 1977: High tide and exceptional rainfall producing flows around  $24\text{m}^3/\text{s}$  causing widespread flooding from St Vigeans junction to the Harbour.

## Objectives to manage flooding in Potentially Vulnerable Area 07/07

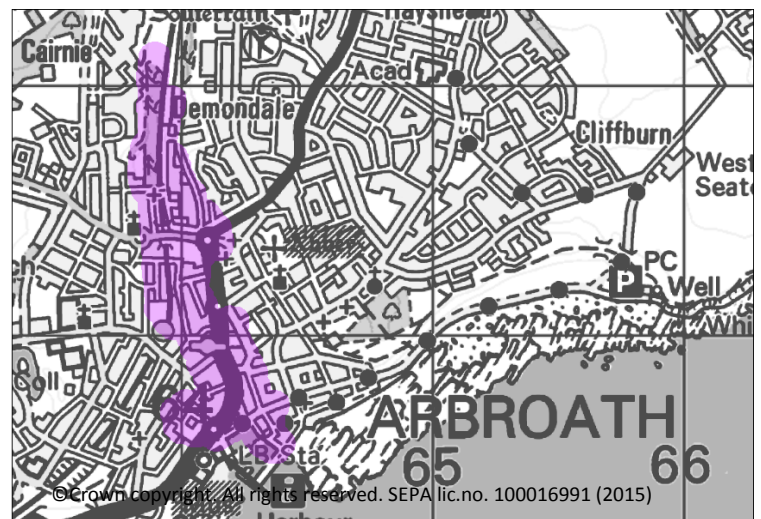
Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target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

### Reduce economic damages to residential and non-residential properties and risk to people in Arbroath caused by flooding from the Brothock Water

Indicators:

- 530 people
- £360,000 Annual Average Damages from residential properties
- £480,000 Annual Average Damages from non-residential properties

Target area:



Objective ID: 7016, 7017

Target area	Objective	ID	Indicators within PVA
Arbroath, Arbirlot, Auchmithie and Colliston	Reduce economic damages and number of residential properties at risk of surface water flooding in Arbroath, Arbirlot, Auchmithie and Colliston where practical	7014	* See note below
Applies across Tay Estuary and Montrose Basin Local Plan District	Avoid an overall increase in flood risk	7001	<ul style="list-style-type: none"> <li>• 250 residential properties</li> <li>• £1.6 million Annual Average Damages</li> </ul>
Applies across Tay Estuary and Montrose Basin Local Plan District	Reduce overall flood risk	7054	<ul style="list-style-type: none"> <li>• 250 residential properties</li> <li>• £1.6 million Annual Average Damages</li> </ul>
Applies across Tay Estuary and Montrose Basin 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 07/07 there are 120 residential properties at risk and Annual Average Damages of £640,000.

## Actions to manage flooding in Potentially Vulnerable Area 07/07

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

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

<b>Action (ID):</b>	<b>FLOOD PROTECTION SCHEME/WORKS (70160006)</b>				
<b>Objective (ID):</b>	Reduce economic damages to residential and non-residential properties and risk to people in Arbroath caused by flooding from the Brothock Water (7016, 7017)				
<b>Delivery lead:</b>	Angus Council				
<b>Priority:</b>	National:		Within local authority:		
	<b>17 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 strategy was developed for Arbroath and identified river and coastal actions to reduce flood risk. The proposed river flood protection scheme will address flood risk from the Brothock Water and include improvements to flood defences and the construction of two flood storage areas. The scheme has been put forward as a priority in the first flood risk management cycle. Coastal flood protection works will be phased in by Angus Council. The scheme will provide a 1 in 200 year standard of protection.				
<b>Potential impacts</b>					
<b>Economic:</b>	The proposed scheme has estimated damages avoided of £16 million and an estimated benefit cost ratio of 2.89.				
<b>Social:</b>	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community and socially vulnerable people located within the flood protection scheme area. In addition there are two utilities, three roads and one railway line which have been identified as potentially benefitting from this action. There may be negative impacts through disturbance to the local community during the construction phase.				



<b>Environmental:</b>	Flood protection schemes may have both positive and negative impacts on the ecological quality of the environment depending on how they are designed. Flood protection works are located on the Brothock Water (water body ID 5603) and the physical condition of this river is identified by SEPA to be at less than good status. Opportunities to improve the condition of the river should be considered by coordinating with river basin management planning. Furthermore, a number of nationally and locally designated sites are present in the study area and could be positively or negatively impacted. These include conservation areas, scheduled monuments, listed buildings and ancient woodlands.
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<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (70140018)</b>		
<b>Objective (ID):</b>	Reduce economic damages and number of residential properties at risk of surface water flooding in Arbroath, Arbirlot, Auchmithie and Colliston where practical (7014)		
<b>Delivery lead:</b>	Angus Council		
<b>Status:</b>	<b>Not started</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>SURFACE WATER PLAN/STUDY (70140019)</b>		
<b>Objective (ID):</b>	Reduce economic damages and number of residential properties at risk of surface water flooding in Arbroath, Arbirlot, Auchmithie and Colliston where practical (7014)		
<b>Delivery lead:</b>	Scottish Water in partnership with local authorities		
<b>Status:</b>	<b>Ongoing</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	An integrated catchment study will be carried out to support the surface water management plan process and improve knowledge and understanding of surface water flood risk and interactions with other sources of flooding e.g. with the sewer network, watercourses and the sea.		

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (70540016)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (7054)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	SEPA will seek to develop flood mapping in the Arbroath to Dundee area to improve understanding of coastal flood risk. The extent and timing of improvements will depend on detailed scoping and data availability. A detailed local authority led study has already been undertaken in this area and SEPA will work collaboratively to ensure consistent modelling approaches are applied.		

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (70540019)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (7054)		
<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>MAINTAIN FLOOD PROTECTION SCHEME (70160017)</b>		
<b>Objective (ID):</b>	Reduce economic damages to residential and non-residential properties and risk to people in Arbroath caused by flooding from the Brothock Water (7016, 7017)		
<b>Delivery lead:</b>	Angus Council		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	Continue to maintain existing Brothock Water Flood Protection Scheme that provides protection to Arbroath from river flooding. The scheme includes an increase in wall height along the Brothock Water through the town, the construction of two flood storage areas retaining flood water upstream and various alterations to culverts and bridges.		

<b>Action (ID):</b>	<b>MAINTAIN FLOOD WARNING (70540030)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (7054)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	Continue to maintain the Arbroath flood warning area which is part of the Brothock river flood warning scheme. Continue to maintain the Arbroath Coastal flood warning area which is part of the Firth of Forth and Tay coastal flood warning scheme.		

<b>Action (ID):</b>	<b>FLOOD FORECASTING (70540009)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (7054)		
<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 (70540011)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (7054)		
<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 (70540013)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (7054)		
<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 and promote Floodline. This will be achieved through SEPA led education events. 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 (70540007)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (7054)		
<b>Delivery lead:</b>	Angus 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 (70540014)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (7054)		
<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 (70010001)</b>		
<b>Objective (ID):</b>	Avoid an overall increase in flood risk (7001) Reduce overall flood risk (7054)		
<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.		