

Flood Risk Management Strategy

Forth Estuary 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.

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3.1 Introduction

In the Forth Estuary Local Plan District, river flooding is reported across two distinct river catchments. Coastal flooding and surface water flooding are reported across the whole Local Plan District.

A summary of the number of properties and Annual Average Damages from river, coastal and surface water flooding is outlined in Table 1.

	Total number of properties at risk ¹	Annual Average Damages	Local authority
River catchments			
East Lothian and Berwickshire catchment group	640	£1.7 million	East Lothian Council Midlothian Council Scottish Borders Council
Almond and Edinburgh Group catchment group	6,100	£10 million	The City of Edinburgh Council East Lothian Council Midlothian Council West Lothian Council
Firth of Forth catchment group	2,200	£6.7 million	The City of Edinburgh Council Clackmannanshire Council Falkirk Council Fife Council North Lanarkshire Council Perth and Kinross Council Stirling Council West Lothian Council
Coastal flooding			
Forth Estuary coastal area	2,000	£5.5 million	The City of Edinburgh Council East Lothian Council Falkirk Council Fife Council Scottish Borders Council Stirling Council
Surface water flooding			
Forth Estuary Local Plan District	7,800	£12.5 million	The City of Edinburgh Council Clackmannanshire Council East Lothian Council Falkirk Council Fife Council Midlothian Council North Lanarkshire Council Perth and Kinross Council Scottish Borders Council Stirling Council West Lothian Council

Table 1: Summary of flood risk from various sources within the Forth Estuary Local Plan District

¹ Total number of residential and non-residential properties at risk of flooding.

River flooding

East Lothian and Berwickshire catchment group

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

The East Lothian and Berwickshire catchment group covers an area of 860km² and contains a number of catchments which are predominantly small and rural. The main watercourses include the River Tyne, Eye Water, Horn Burn, Ale Water, Pease Burn, Dunglass Burn, Tower Burn, Mill Burn, Biel Water and East Peffer Water.

The catchments in this group characteristically have steep headwaters in the Lammermuir Hills and gently rolling topography. The Eye Water catchment is recognised as a flashy watercourse due to steep valley sides and limited tree cover. On average the soils for this catchment group are generally dry due to a sheltered location on the east coast.

The average annual rainfall for this catchment is low for Scotland, with 600-700mm falling in the lower part of the catchment, rising to 700-900mm in the upper catchment.

Flood risk in the catchment

Within the East Lothian and Berwickshire catchment group approximately 460 residential properties and 180 non-residential properties are at risk of river flooding. It is estimated that 76% of these properties are located within Potentially Vulnerable Areas. There are four Potentially Vulnerable Areas at risk of river flooding in this catchment group (Figure 1):

- Cockenzie, Port Seton, Longniddry and Prestonpans (10/23)
- Haddington (10/24)
- Dunbar and West Barns (10/25)
- Berwickshire Coast (10/26).

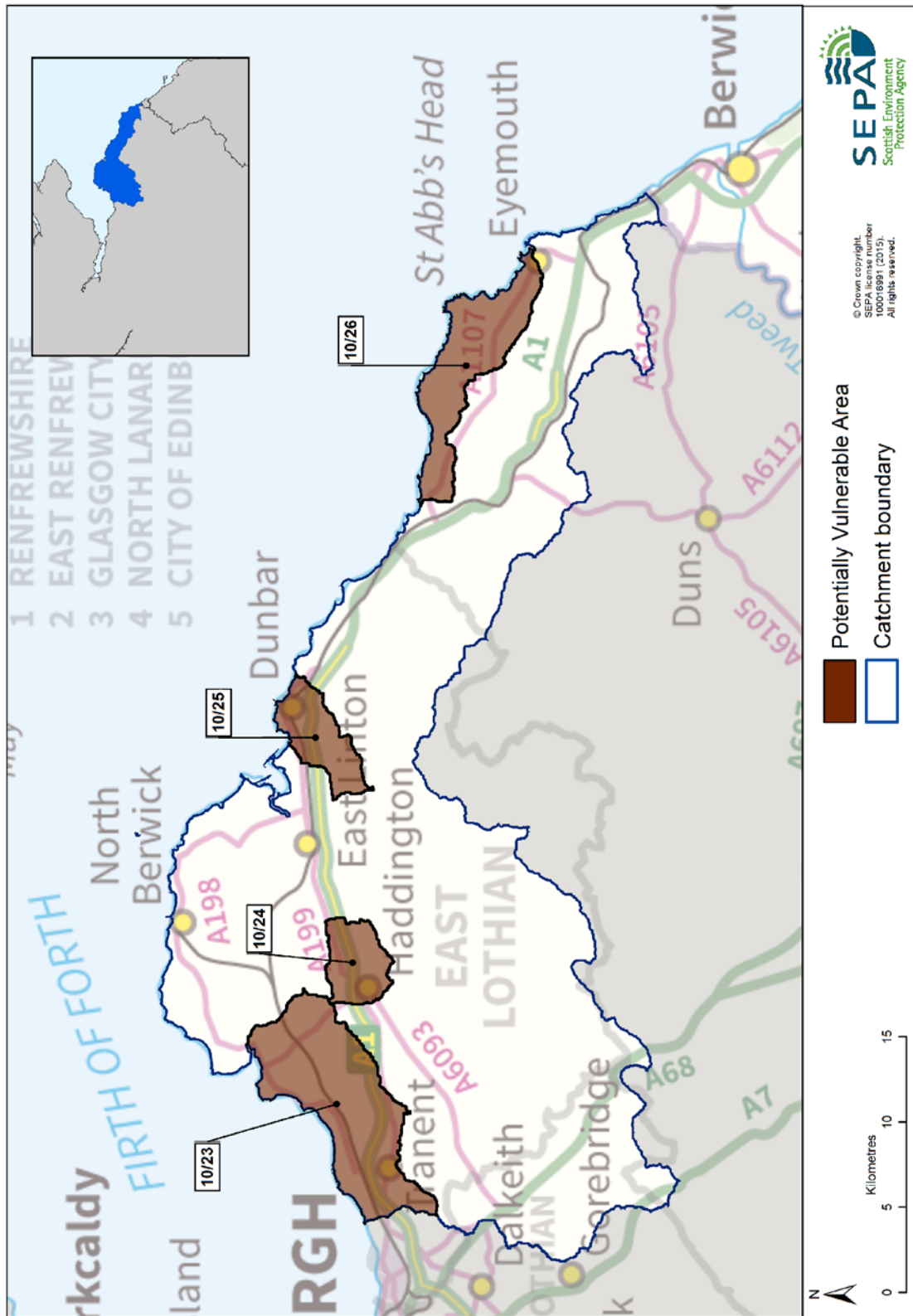


Figure 1: The East Lothian and Berwickshire catchment group

Main areas at risk

The main areas with a risk of river flooding can be seen in Table 1 which shows the number of properties at risk and the Annual Average Damages caused by river flooding. This includes damages to residential and non-residential properties, transport and agriculture.

	Residential and non-residential properties at risk of river flooding	Annual Average Damages
Haddington	320	£560,000
Longniddry	40	£97,000
Eyemouth	40	£85,000
Tranent	30	£76,000
Dunbar and West Barns	30	£50,000
Gifford	10	£55,000
Garvald	<10	£44,000
East Linton	<10	£18,000
Ayton	<10	£12,000
North Berwick	<10	£9,000
Cockenzie and Port Seton	<10	<£1,000

Table 1: Main areas at risk of river flooding

Economic activity and infrastructure at risk

The Annual Average Damages caused by river flooding in the East Lothian and Berwickshire catchment group are approximately £1.7 million. The damages are distributed as follows:

- 59% residential properties (£1.1 million)
- 18% non-residential properties (£300,000)
- 8% agriculture (£150,000)
- 7% emergency services (£120,000)
- 4% roads (£60,000)
- 4% vehicles (£60,000).

Figure 2 shows the Annual Average Damages throughout the catchment group. The highest damages can be seen around Haddington due to the high density of residential and non-residential properties in the area being affected by flooding from the River Tyne.

Table 2 shows further information about infrastructure and agricultural land at risk of flooding within this catchment group.

	Number at risk	Further detail
Community facilities	0	
Utility assets	<10	Electricity substations
Roads (excluding minor roads)	24	9 A roads at 65 locations 15 B roads at 58 locations
Railway routes	2	Berwick-upon-Tweed to Edinburgh (33 locations at risk) North Berwick to Drem Junction (1 location at risk)
Agricultural land (km ²)	42.1	

Table 2: Infrastructure and agricultural land at risk of river flooding

Designated environmental and cultural heritage sites at risk

Within the catchment group there are approximately 52 designated cultural heritage sites at risk of river flooding. These sites include scheduled monuments, gardens and designed landscapes, battlefield site and listed buildings.

It is estimated that 17 environmental designated areas are at risk of river flooding. These include two Special Areas of Conservation, two Special Protection Areas and 13 Sites of Special Scientific Interest, notably the Berwickshire and North Northumberland Coast and St Abb's Head to Fast Castle.

History of river flooding

The most significant river flooding in the East Lothian and Berwickshire catchment group is believed to have occurred in August 1948 with reports of Haddington High Street being flooded up to a depth of 57 inches from the River Tyne. The Eye Water and Whiteadder Water also caused significant flooding, with widespread impacts. Eyemouth saw evacuation at the harbour, with some buildings flooded up to the second floor. Residents from Biel Mill Lodge, West Barns also had to be rescued and transport infrastructure was damaged over a wide area.

Recent floods occurred on 7 July and 25 September 2012 with property flooding in Haddington due to drains and watercourses backing up and unable to discharge into the River Tyne. However, widespread property flooding was avoided as a result of actions taken by East Lothian Council.

The earliest record of flooding dates back to 1775 when a large flood event in Haddington inundated most of the town.

Further detail about the history of flooding in this area is available in the relevant Potentially Vulnerable Area chapters.

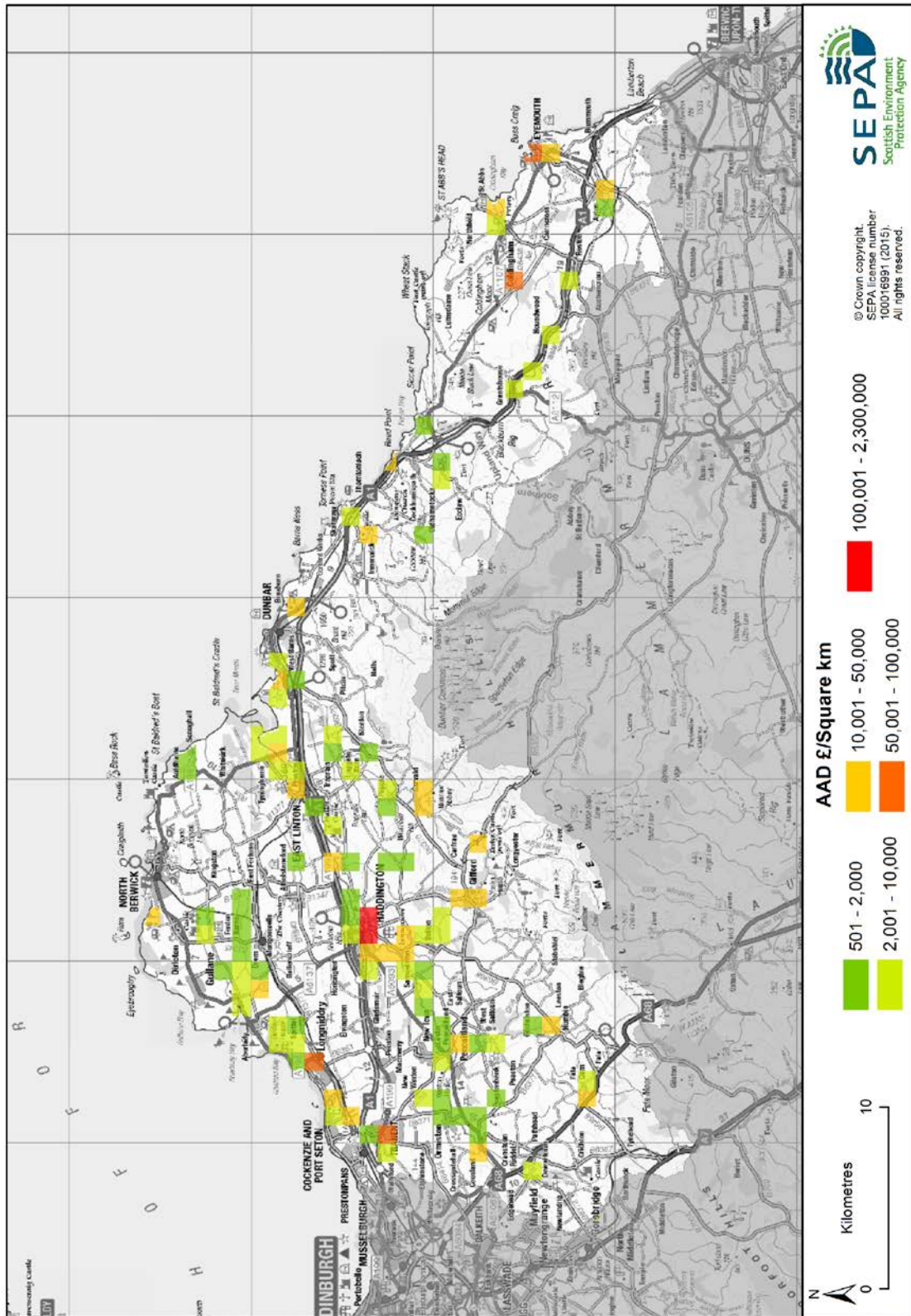


Figure 2: Annual Average Damages from river flooding

Managing flood risk

A range of public bodies have responsibility for managing flood risk in Scotland and they are working closer than ever before to target action in the areas where the greatest benefit can be gained. Members of the public also have a role to play and are the first line of defence against flooding by taking action to protect themselves and their property from flooding. Further information about roles and responsibilities is provided in Section 1.

This section describes the existing actions that are in place to manage flood risk and are in addition to the information presented in the relevant Potentially Vulnerable Area chapters.

River flood warning schemes

There are four river flood warning areas within this catchment group as shown in Table 3 and Figure 3. Table 3 shows the total number of properties in the flood warning area and the percentage of those properties that have signed up to receive flood warnings. Please note that this is not the number of properties at risk of flooding.

Flood warning area (FWA)	River	Number of properties within FWA	% of properties registered July 2014
Grantshouse to Eyemouth	Eye Water	13	100%
Haddington (Green) ¹	River Tyne	212	68%
Haddington (Orange)	River Tyne	179	40%
Haddington (Red)	River Tyne	549	33%

Table 3: Flood warning areas

Community groups

The following community groups are known to operate within this catchment:

- Friends of the River Tyne
- North Berwick Environment Group
- John Muir Trust
- East Lothian Tenants and Residential Panel.

There are also various local community councils that operate throughout the East Lothian council area.

¹ These “coloured” flood warning areas for Haddington reflect East Lothian Council’s emergency plan

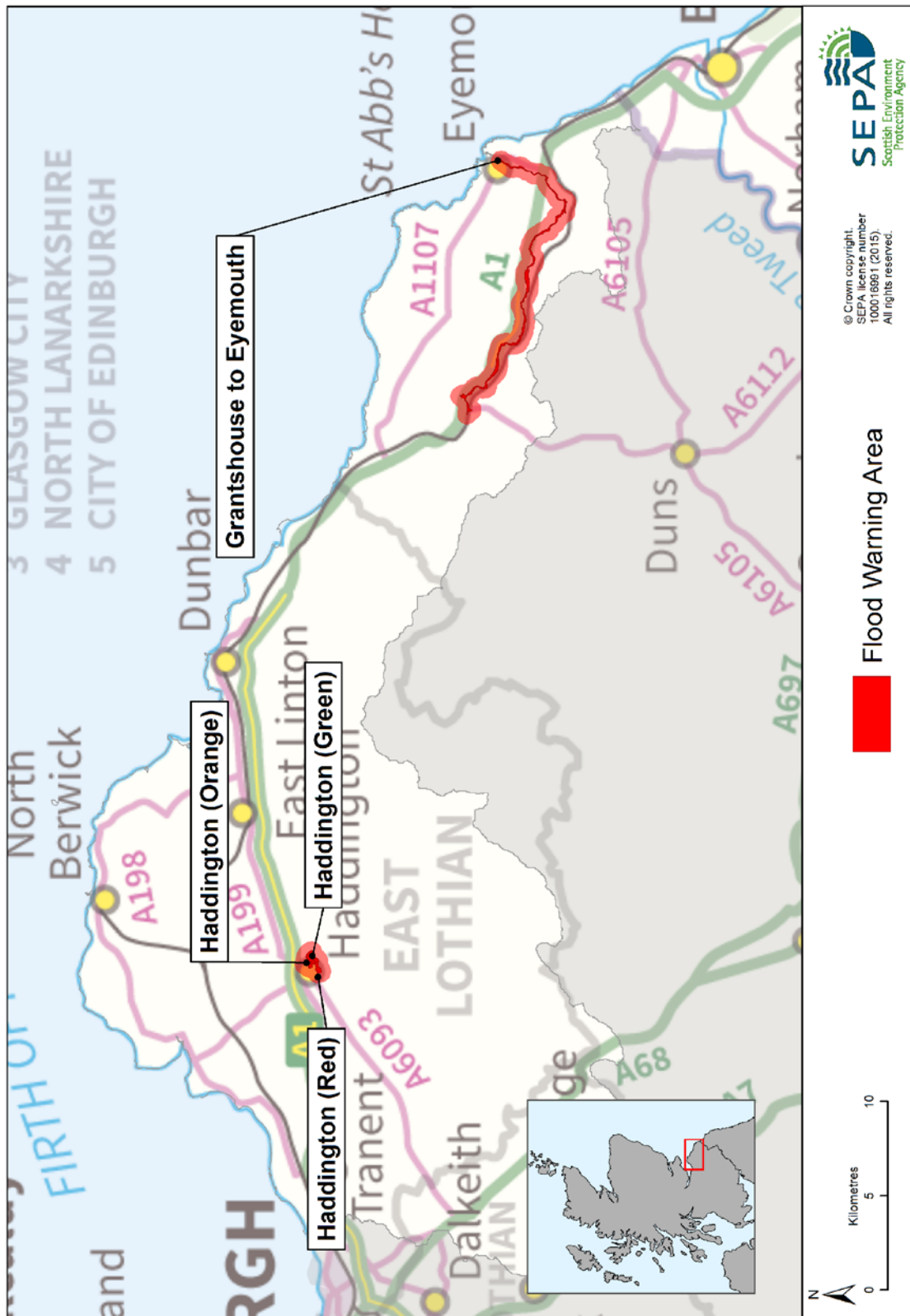


Figure 3: Flood warning areas

Property level protection

Each local authority has its own incentives or subsidies to help property owners with property level protection:

- East Lothian Council strategically deploys temporary flood barriers and sand bags when properties are threatened by flooding
- Scottish Borders Council offers discounted flood protection products to homes and businesses at risk in the Scottish Borders. Several properties in Eyemouth have taken up the scheme and have been protected from flooding as a result
- Scottish Borders Council provides and maintains dedicated sandbag stores in areas of flood risk to ensure sandbags are readily available to the public in the event of a flood. These are mainly located at fire stations.

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 East Lothian and Berwickshire catchment may increase by 39%². This would potentially increase in the number of residential properties at risk of river flooding from approximately 460 to 760 and the number of non-residential properties from approximately 180 to 230.

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

In the East Lothian and Berwick catchment group, potential for runoff reduction is confined mainly to areas upstream of the Biel Water/ Luggate Burn. Actions on these potential runoff reduction sites may benefit Dunbar and West Barns Potentially Vulnerable Area (10/25).

² From the study 'An assessment of the vulnerability of Scotland's river catchments and coasts to the impacts of climate change' (CEH, 2011)

Floodplain storage

Floodplain storage potential within the catchment group is limited. There is some potential for floodplain storage on the River Tyne upstream of Haddington Potentially Vulnerable Area (10/24). Further local assessment would be required in order to determine the suitability of these areas and to quantify any benefits.

Sediment management

Areas of high deposition and high erosion have been identified across the East Lothian and Berwickshire catchment. These may be the result of natural processes or other factors including channel modification. There are a number of watercourses across the catchment which have been modified. Deposition may also result from sediment transfer from land surrounding the watercourse, particularly if this is agricultural land or woodland areas.

River flooding

Almond and Edinburgh catchment group

Catchment overview

The Almond and Edinburgh catchment group covers an area of 930km² and comprises of a number of smaller watercourses. The main watercourses include Water of Leith, Braid Burn, River Esk, Niddrie Burn, River Almond, Brox Burn and Gogar Burn. A substantial portion of the catchment is urban, covering Edinburgh city and its wider area.

The topography of the catchment group varies, with some watercourses such as those draining the Pentland Hills being relatively steep and the remainder draining gently rolling areas. River levels will rise quickly within steep, urbanised watercourses but more slowly in those covering rural areas with shallow gradients. On average the soils are generally dry due to the sheltered location on the east coast.

The average annual rainfall for this catchment is low to average for Scotland, with 600-700mm falling in the lower part of the catchment, rising to 900-1100mm in the upper catchment.

Flood risk in the catchment

Within the Almond and Edinburgh catchment group approximately 5,400 residential properties and 720 non-residential properties are at risk of river flooding. It is estimated that 97% of these properties are located within Potentially Vulnerable Areas. There are eight Potentially Vulnerable Areas and one candidate Potentially Vulnerable Area at risk of river flooding in this catchment group (10/29c) (Figure 1):

- Cramond Bridge (10/16)
- Granton (10/17)
- Water of Leith catchment (10/18)
- Braid Burn catchment (10/19)
- Niddrie and Burdiehouse Burn catchment (10/20)
- Musselburgh (10/21)
- Lasswade, Penicuik, Dalkeith and Musselburgh (10/22)
- South Gyle, Broxburn and Bathgate (10/27)
- Whitburn (10/29c).

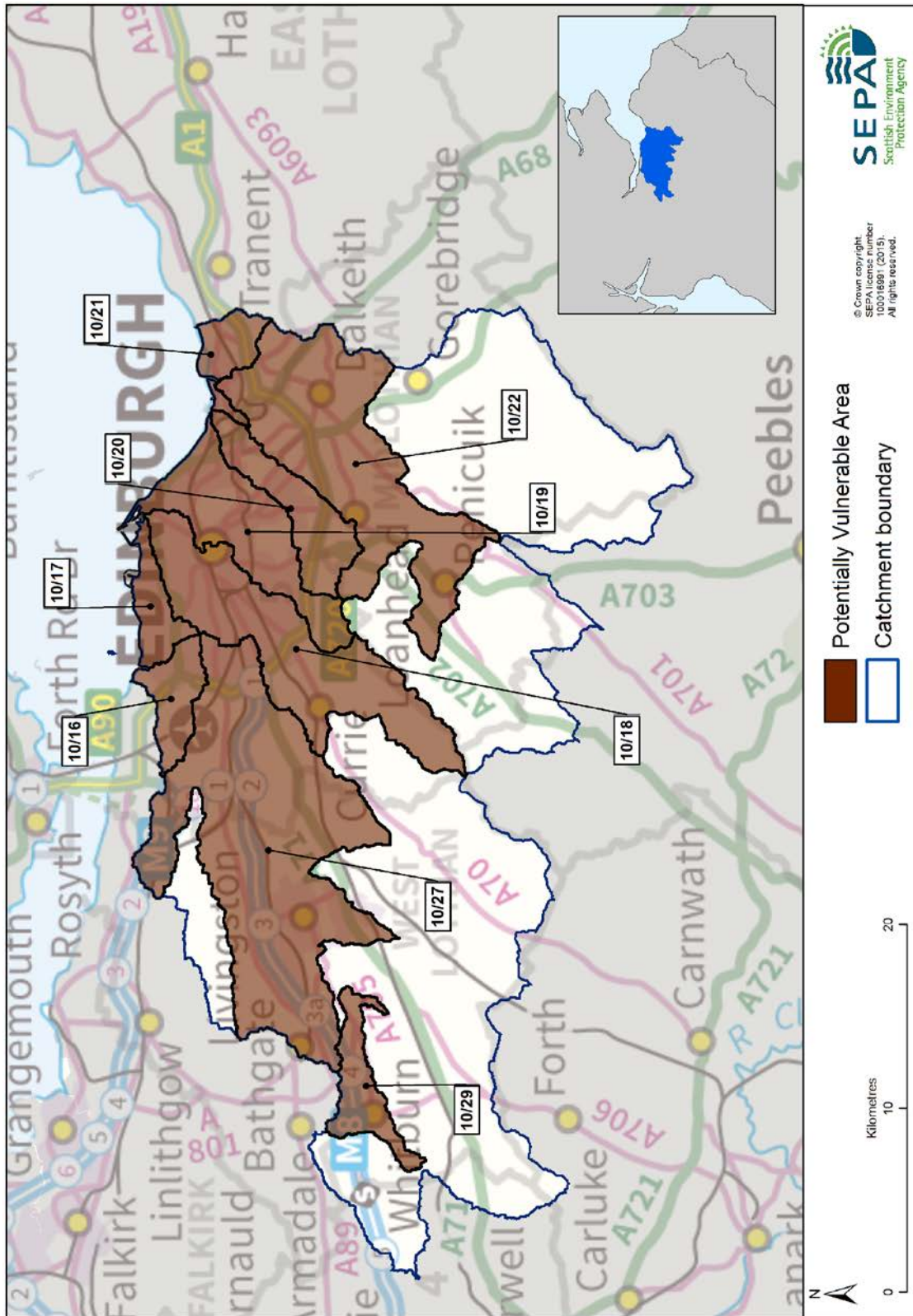


Figure 1: The Almond and Edinburgh catchment group

Main areas at risk

The main areas at risk of river flooding can be seen in Table 1 which shows the number of properties at risk and the Annual Average Damages caused by river flooding. This includes damages to residential and non-residential properties, transport and agriculture.

	Residential and non-residential properties at risk of river flooding	Annual Average Damages
Edinburgh	3,700	£5.9 million
Musselburgh	1,700	£3 million
Whitburn	140	£180,000
Broxburn	130	£210,000
Harthill	20	£63,000
Dalkeith and Newbattle	20	£21,000
Bathgate and Blackburn	<10	£19,000
West Calder	<10	£12,000
East Calder	<10	£11,000
Lasswade and Bonnyrigg	<10	£9,000
Penicuik	<10	£2,000
Kirkliston	<10	£1,000
Livingston	<10	<£1,000

Table 1: Main areas at risk of river flooding

Economic activity and infrastructure at risk

The Annual Average Damages caused by river flooding in the Almond and Edinburgh catchment group are approximately £10 million. The damages are distributed as follows:

- 63% residential properties (£6.3 million)
- 26% non-residential properties (£2.6 million)
- 5% emergency services (£500,000)
- 4% vehicles (£450,000)
- 1% roads (£80,000)
- 1% agriculture (£70,000).

Figure 2 shows the Annual Average Damages throughout the catchment group. The highest damages can be seen around the Musselburgh area. This is due to a combination of high density areas of non-residential and residential properties which are at risk of flooding from the River Esk. High damage figures can also be seen in the Murrayfield area of Edinburgh due to a combination of scattered non-residential properties and a high number of residential properties.

Table 2 shows further information about infrastructure and agricultural land at risk of flooding within this catchment group.

	Number at risk	Further detail
Community facilities	<10	Includes: educational buildings, healthcare facilities and emergency services
Utility assets	40	Includes electricity substations and fuel extraction sites
Roads (excluding minor roads)	53	2 M roads (M8, M9) at 25 locations 26 A roads at 186 locations 25 B roads at 84 locations
Railway routes	7	Berwick-upon-Tweed to Edinburgh (4 locations at risk), Carstairs to Edinburgh (10 locations at risk) Drumgelloch to Newbridge Junction (2 locations at risk) Edinburgh Waverly to Glasgow Queen Street (8 locations at risk) Dalmeny to Winchburgh and Dalmeny to Haymarket West Junctions (7 locations at risk) Mid-calder Junction to Holytown Junction (8 locations at risk)
Airports	1	Edinburgh airport
Agricultural land (km²)	19.7	

Table 2: Infrastructure and agricultural land at risk of river flooding

Designated environmental and cultural heritage sites at risk

Within the catchment it is estimated that approximately 124 designated cultural heritage sites are at risk of river flooding. These sites include scheduled monuments, gardens and designed landscapes, battlefield sites, listed buildings and World Heritage sites.

Approximately 21 environmental designated areas are at risk of river flooding. These include three Special Protection Areas and 18 Sites of Special Scientific Interest, notably the Imperial Dock Lock at Leith, Balerno Common and Roslin Glen.

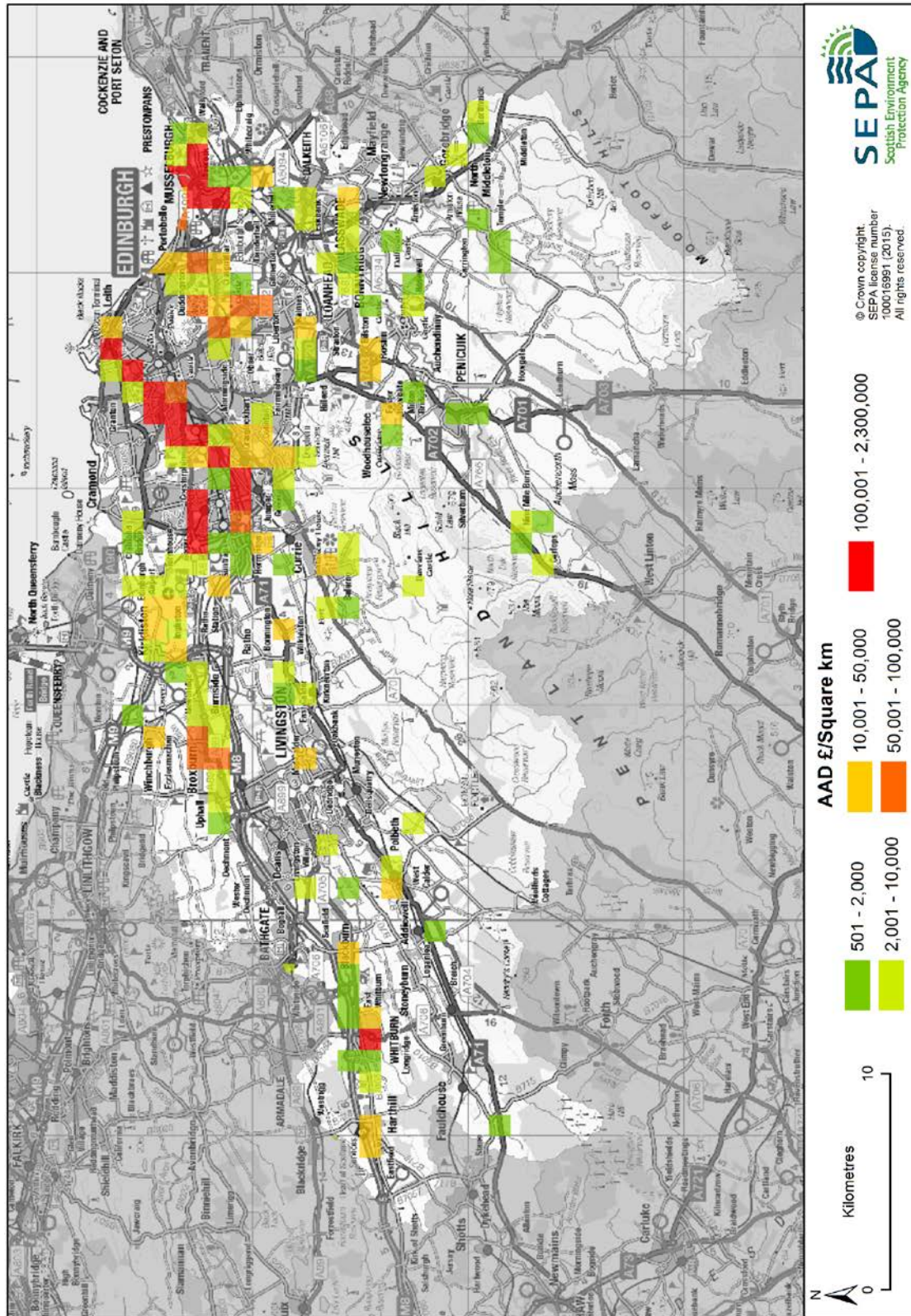


Figure 2: Annual Average Damages from river flooding

History of river flooding

The most significant flood event on the Water of Leith, River Almond, Braid Burn and Gogar Burn occurred on 8 November 2000. Over 500 properties were inundated, including Murrayfield Stadium, Murrayfield Ice Rink and two residential care homes. High water levels also caused flooding at Edinburgh Airport and Kirkliston. Probably the most significant flooding from the River Esk is believed to have occurred in August 1948 with severe flooding to Musselburgh causing evacuation of many areas of the town. The highest river level recorded at SEPA's gauging station on the River Almond at Whitburn was in December 1994, where the river levels reached 2.25m above normal levels.

The earliest flood recorded in this catchment group occurred in October 1832, when heavy rains and overtopping of the Water of Leith results in areas of Slateford, Canonmills and Warriston being inundated for 3 days. In February 1884 overtopping on the River Almond also resulted in large areas of flooding in Whitburn.

The most recent flood recorded in the catchment occurred on 20 August 2008. Over 100 properties and five businesses flooded in Broxburn following overtopping of the Brox Burn.

Further detail about the history of flooding in this area is available in the relevant Potentially Vulnerable Area chapters.

Managing flood risk

A range of public bodies have responsibility for managing flood risk in Scotland and they are working closer than ever before to target action in the areas where the greatest benefit can be gained. Members of the public also have a role to play and are the first line of defence against flooding by taking action to protect themselves and their property from flooding. Further information about roles and responsibilities is provided in Section 1.

This section describes the existing actions that are in place to manage flood risk and are in addition to the information presented in the relevant Potentially Vulnerable Area chapters.

Flood protection schemes

There are six formal flood protection schemes in this catchment group:

- Polton Road Bridge Relief Culvert Flood Protection Scheme (Bilston Burn) which has a design standard of protection of 1 in 100 years
- Braid Burn Flood Protection Scheme in Edinburgh which was completed in 2010 and has a design standard of protection of 1 in 200 years plus 12% climate change
- Water of Leith Flood Protection Scheme (1984) protects the Roseburn area of Murrayfield in Edinburgh. The scheme's design standard is now estimated at 1 in 50 years to 1 in 100 years
- Water of Leith Flood Prevention Scheme (2003) in Edinburgh protects areas of Stockbridge, Bonnington, Veitch's Square and Warriston. The scheme has a design standard of protection of 1 in 200 years plus 12% climate change

- Water of Leith advanced works comprises reservoir works to Harperrig and Treipmuir/ Harlaw reservoirs
- Broxburn Flood Prevention Scheme was substantially completed in January 2014 and has a design standard of protection of 1 in 75 years plus 20% climate change.

Further work is currently ongoing on the Water of Leith by The City of Edinburgh Council. Further detail will be set out in the Local Flood Risk Management Plan.

River flood warning schemes

There are 11 river flood warning areas within this catchment group as shown in Table 3 and Figure 3. Table 3 shows the total number of properties in the flood warning area and the percentage of those properties that have signed up to receive flood warnings. Please note that this is not the number of properties at risk of flooding.

Flood warning area (FWA)	River	Number of properties within FWA	% of properties registered July 2014
Colinton Mains	Braid Burn	574	12%
Cramond	River Almond	33	64%
Dean Village	Water of Leith	150	25%
Inch Park and Peffermill	Braid Burn	282	14%
Longstone/Stenhouse	Water of Leith	402	20%
Mid Liberton and Cameron Toll	Braid Burn	105	10%
Musselburgh	River Esk	339	78%
Portobello	Braid Burn	230	14%
Roseburn	Water of Leith	871	35%
Stockbridge	Water of Leith	636	41%
Warriston and Bonnington	Water of Leith	1,345	25%

Table 3: Flood warning areas

Awareness raising campaigns and community groups

The following community groups are known to operate within this catchment:

- Musselburgh and Inveresk Community Council
- East Lothian Tenants and Residents Panel
- East Burnside Village Community Flood Action Group, Broxburn.

There are also various local community councils that operate throughout the East Lothian Council area.

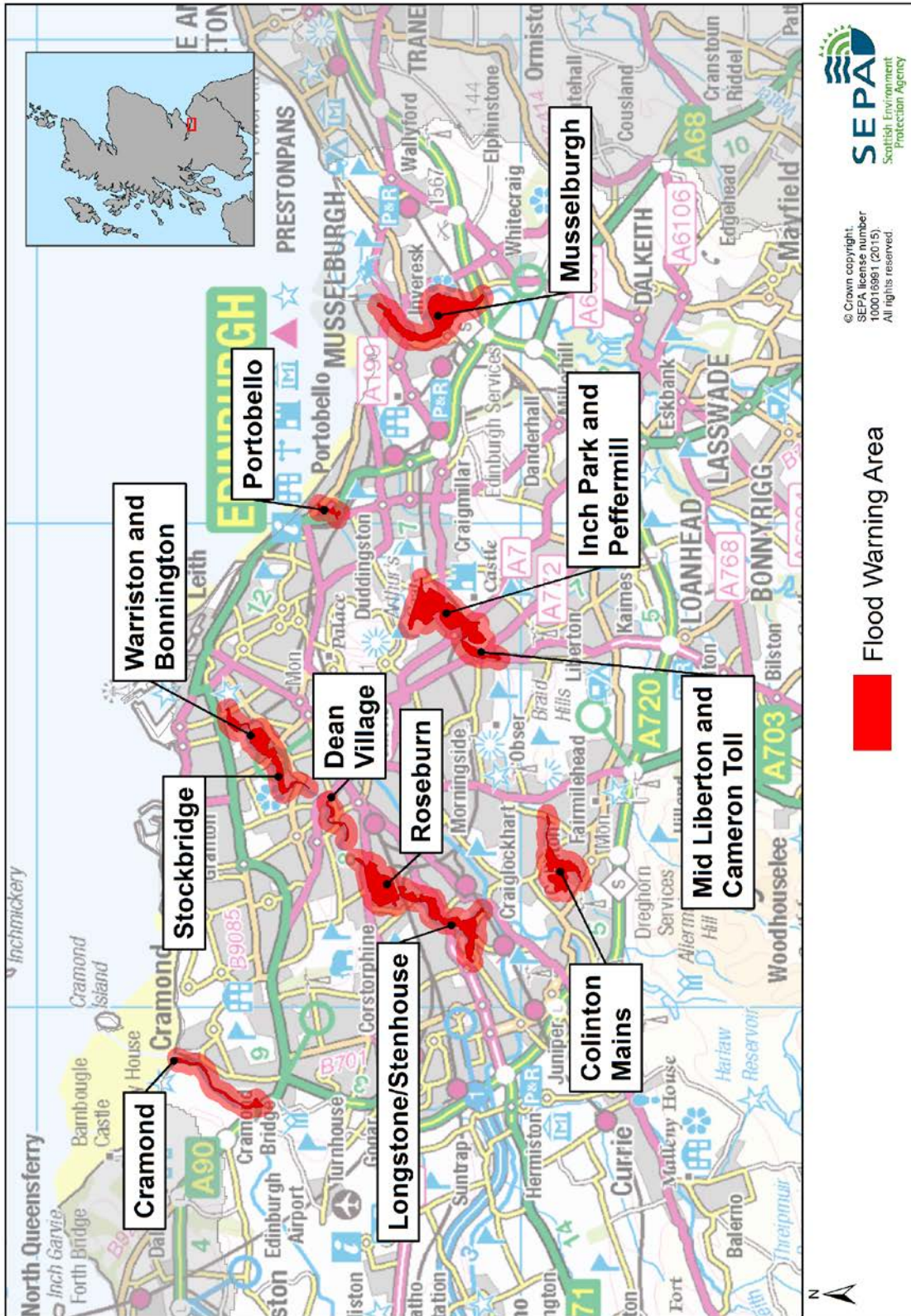


Figure 3: Flood warning areas

Property level protection

Each local authority has its own incentives or subsidies to help property owners with property level protection:

- The City of Edinburgh Council owns temporary pallet barriers that can be used to protect properties from river flooding and sandbags for public use during flood events
- The City of Edinburgh Council operates emergency action packs that are used to determine where people should be deployed during flood events.
- East Lothian Council strategically deploys temporary flood barriers and sand bags when properties are threatened by flooding
- West Lothian Council provides sandbags and 'Aguasacs' for public use during an emergency situation.

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 Almond and Edinburgh catchment may increase by 39%¹. This would potentially increase in the number of residential properties at risk of river flooding from approximately 5,400 to 8,400 and the number of non-residential properties from approximately 720 to 1,100.

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.

Runoff reduction

There are some areas with medium potential for runoff reduction, which are mainly located to the south and south east of this catchment group. The largest of these areas surrounds Portmore Loch and Gladhouse Reservoir, with other sites including Crosswood Reservoir and the areas surrounding West Calder.

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

Floodplain storage

Areas with floodplain storage are extremely limited within this catchment group. There are two possible locations: near Edinburgh Airport and Gladhouse Reservoir, which have medium to high potential.

Sediment management

Channel erosion appears to be widespread throughout the catchment group, with all water bodies experiencing moderate levels of erosion. Zones of high erosion occur on the River South Esk downstream of the Gladhouse and Roseberry reservoirs, on the Niddry Burn at the confluence with the River Almond and on the upper reach of the Lead Burn.

Sediment deposition is also widespread throughout the catchment group. High sediment deposition occurs on the River Almond northwest of Edinburgh Airport, the Bickerton Burn and How Burn at Whitburn and in Threipmuir and Harperig reservoirs southwest of Balerno.

River flooding Firth of Forth catchment group

Catchment overview

The Firth of Forth catchment group covers an area of 1,463km² and comprises of a number of smaller watercourses. The watercourses in this group include the River Leven, River Ore, Keithing Burn, Bluther Burn, River Avon, River Carron, Bonny Water and Grange Burn. The catchment group includes several large lochs and reservoirs including Loch Leven and the Carron Valley Reservoir.

The topography is generally gently sloping although there are steep areas particularly in the headwaters of the larger catchments. On average its soils are generally dry due to its sheltered location on the east coast. The average annual rainfall for this catchment is low to average for Scotland, with 600-700mm falling in the lower part of the catchment, rising to 1500-2000mm in the upper catchment.

Flood risk in the catchment

Within the Firth of Forth catchment group approximately 1,700 residential properties and 450 non-residential properties are at risk of river flooding. It is estimated that 87% of these properties are located within Potentially Vulnerable Areas. There are 15 Potentially Vulnerable Areas and one candidate Potentially Vulnerable Area (10/28c) at risk of river flooding in this catchment group (Figure 1):

- Crail (10/01)
- Pittenweem (10/02)
- Leven (10/03)
- Kinross, Milnathort, Glenrothes and Kinglassie (10/04)
- Kirkcaldy, East Wemyss and Methil (10/05)
- Inverkeithing, Rosyth, Dunfermline and Wellwood (10/06)
- Cairneyhill (10/07)
- Hawkhill, Kincardine, Kennet Pans and Culross (10/08)
- Airth (10/09)
- North Queensferry and Inverkeithing (10/10)
- Falkirk, Grangemouth, Lauriston, Denny, Redding, Dunipace, Cumbernauld, Carron and Stenhousemuir (10/11)
- Bo'ness (10/12)
- Linlithgow Bridge, Bathgate, Whiteside and Slammanan (10/13)
- Philipstoun (10/14)
- South Queensferry (10/15)
- Cowdenbeath (10/28c).

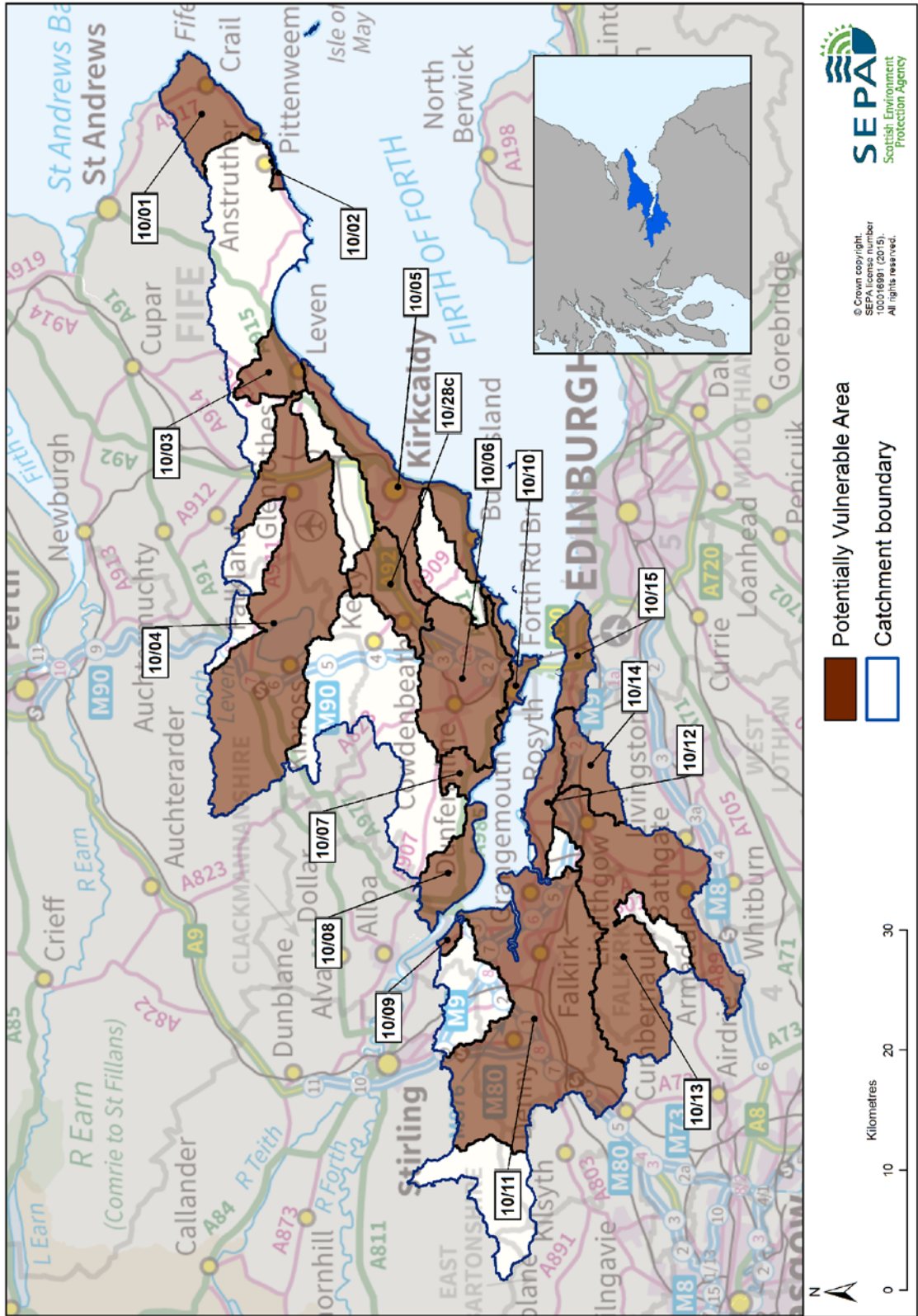


Figure 1: The Firth of Forth catchment group

Main areas at risk

The main areas at risk of river flooding can be seen in Table 1 which shows the number of properties at risk and the Annual Average Damages caused by river flooding. This includes damages to residential and non-residential properties, transport and agriculture.

	Residential and non-residential properties at risk of river flooding	Annual Average Damages
Carron-Carronshore-Bainsford	580	£760,000
Denny-Dunipace	160	£310,000
Dunfermline	140	£600,000
Crail	140	£280,000
Leven-Methil	90	£610,000
Kirkcaldy	80	£430,000
Linlithgow	80	£210,000
Falkirk Westquarter	70	£120,000
Cardenden-Auchterderran-Bowhill	70	£160,000
Bonnybridge-Banknock	60	£120,000
Falkirk	50	£90,000
Glenrothes-Markinch-Leslie	40	£260,000
Rosyth	40	£110,000
Lochore	40	£100,000
Cowdenbeath	40	£90,000
Inverkeithing-North Queensferry	30	£250,000
Cairneyhill	20	£80,000
Slamannan	20	£71,000
Oakley	20	£55,000
Kinross ¹	20	£20,000
Milnathort ¹	20	£19,000
Larbert-Stenhousemuir and Carmuir	10	£230,000
Torryburn	10	£34,000
Bathgate-Blackburn	10	£33,000
Anstruther-Pittenweem	10	£5,000
Grangemouth	<10	£200,000
Kennoway	<10	£38,000
Kelty	<10	£12,000

Table 1: Main areas with a risk of river flooding

¹ The numbers presented in this report are derived from SEPA data that is assessed at a strategic level. Perth and Kinross Council has identified that there may be higher numbers of properties at risk from river flooding in Kinross and Milnathort.

Economic activity and infrastructure at risk

The Annual Average Damages caused by river flooding in the Firth of Forth catchment group are estimated to be approximately £6.7 million. The damages are distributed as follows:

:

- 47% Residential properties (£3.1 million)
- 42% Non-residential properties (£2.8 million)
- 6% Emergency services (£380,000)
- 2% Roads (£150,000)
- 2% Agriculture (£110,000)
- 1% Vehicles (£100,000).

Figure 2 shows the Annual Average Damages throughout the catchment group. The highest damages can be seen around the Methil/ Leven area due mainly to non-residential property at risk of flooding from the River Leven. High damages can also be seen in the Carron area of Falkirk due to dense areas of residential properties being affected by flooding from the River Carron.

Table 2 shows further information about infrastructure and agricultural land at risk of flooding within this catchment group.

	Number at risk	Further detail
Community facilities	<10	Includes: educational buildings and emergency services.
Utility assets	60	Includes: electricity substations, fuel extraction sites and telecommunication sites.
Roads (excluding minor roads)	78	4 M roads (M8, M9, M80, M90) at 62 locations 29 A roads at 187 locations 45 B roads at 186 locations
Railway routes	7	Carmuir Junction to Polmont Junction (1 location at risk) Dunblane to Stirling/Larbert (8 locations at risk) Edinburgh Waverly to Glasgow Queen Street (11 locations at risk) Fife Circle, Dalmeny to Winchburgh and Dalmeny to Haymarket West Junctions (32 locations at risk) Perth to Ladybank (3 locations at risk)
Agricultural land (km²)	16.9	

Table 2: Infrastructure and agricultural land at risk of river flooding

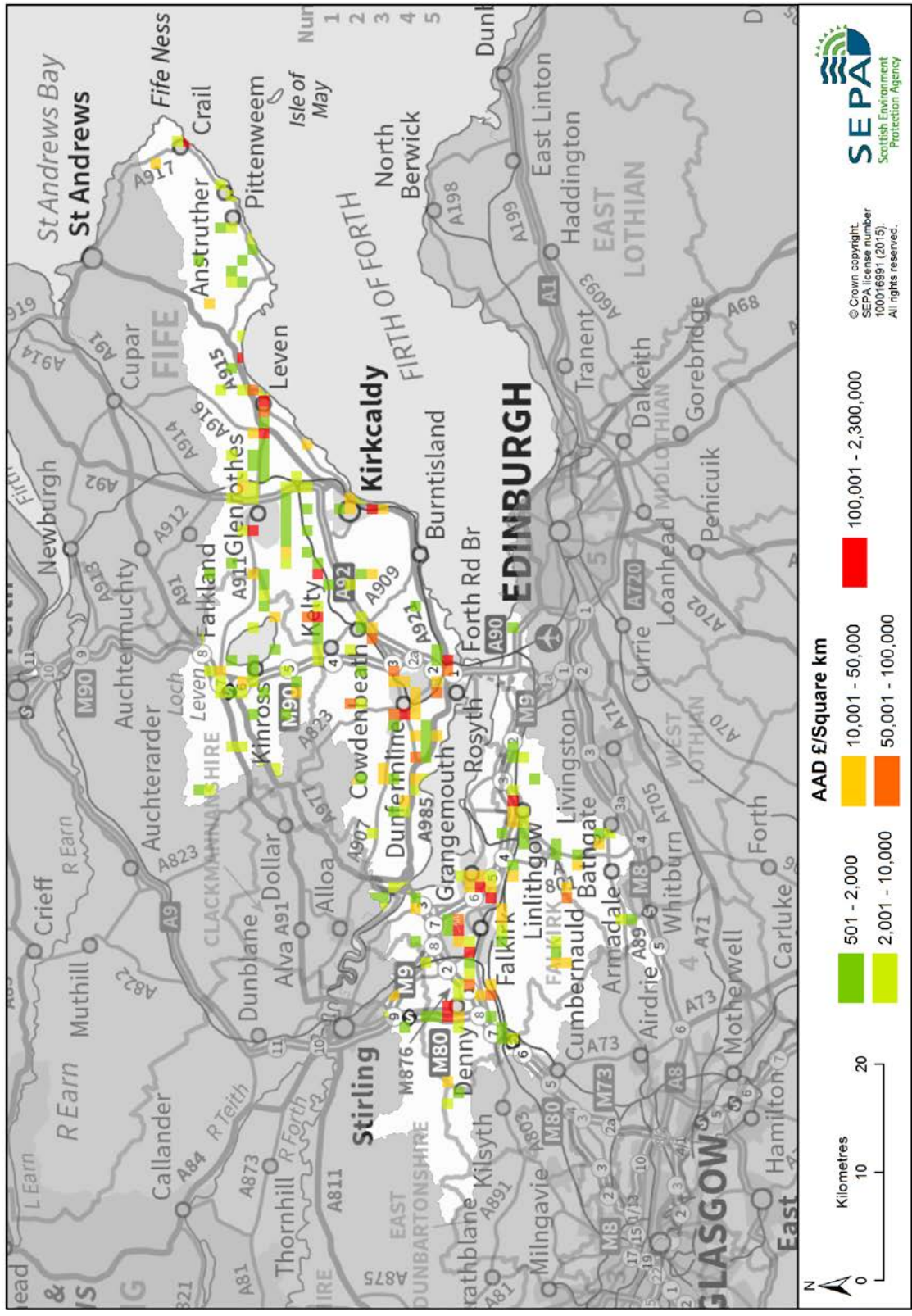


Figure 2: Annual Average Damages from river flooding

Designated environmental and cultural heritage sites at risk

Within the catchment group it is estimated that approximately 60 designated cultural heritage sites are at risk of river flooding. These sites include scheduled monuments, gardens and designed landscapes, battlefield sites, listed buildings and World Heritage sites.

It is estimated that 24 environmental designated areas are at risk of river flooding. These include a Special Area of Conservation, three Special Protection Areas and 20 Sites of Special Scientific Interest. Amongst these areas are West Fannyside Moss, Loch Leven and Carron Glen.

History of river flooding

The most significant river flooding in this catchment group is believed to have occurred in February 1903 when many urban areas were affected by flooding from watercourses, including the River Leven, the River Carron, the River Lochty and the River Ore.

Also of note is a flood on 13 December 2006 causing widespread damage including inundation of properties and disruption of transport links throughout the Falkirk area from the River Carron, in Milnathort from the Back Burn and in Kinross on the banks of the South Queich.

The earliest records of river flooding in the Firth of Forth catchment group include October 1864 when it was recorded that 49mm of rain fell in a single day and February 1872 when the River Leven burst its banks and many houses were flooded with furniture seen floating down the streets.

More recently, in 2012, a number of small burns and watercourses caused flooding in Dunfermline, Rosyth and Oakley.

Further detail about the history of flooding in this area is available in the relevant Potentially Vulnerable Area chapters.

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 2.

This section describes the existing actions that are in place to manage flood risk and are in addition to the information presented in the relevant Potentially Vulnerable Area chapters.

Flood protection schemes

There are seven formal flood protection schemes to reduce the risk of river flooding in the catchment group:

- Grange Burn Flood Prevention Scheme
- Cairneyhill Flood Prevention Scheme

- Parkneuk Flood Prevention Scheme
- Kincardine-on-Forth Flood Prevention Scheme
- Linlithgow Flood Prevention Scheme
- Milnathort Flood Prevention Scheme
- Dunfermline Flood Prevention Scheme.

Community groups

The following community groups are known to operate within this catchment group:

- Carronvale Residents and Tenants Association
- Perth and Kinross Council is part of a wider community resilience group which works with various communities including Milnathort to develop community resilience plans.

Property level protection

Each local authority has its own incentives or subsidies to help property owners with property level protection:

- Fife Council has installed flood pods containing flood sacks and flood snakes close to areas containing potential flood affected properties.

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 Firth of Forth catchment may increase by 39%². This would potentially increase in the number of residential properties at risk of river flooding from approximately 1,700 to 5,000 and the number of non-residential properties from approximately 450 to 660.

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.

² From the study 'An assessment of the vulnerability of Scotland's river catchments and coasts to the impacts of climate change' (CEH, 2011)

Runoff reduction

The catchment group contains several areas of potential for runoff reduction, including large areas within the Carron Valley Forest, at Cairnoch Hill and Earl's Hill and surrounding the Earls Burn Reservoirs. These sites would require further investigation to determine whether they can contribute to reducing flood risk.

Floodplain storage

There is high floodplain storage potential at the Carron Valley Reservoir and Loch Leven. A number of other areas of medium/ high potential are located within the Potentially Vulnerable Area boundaries and therefore merit further investigation.

Sediment management

High levels of channel erosion are experienced at various locations throughout the catchment, including the Earls Burn southwest of Stirling, the Westquarter Burn southeast of Falkirk and the River Leven. Sediment deposition is also widespread throughout the catchment. While much of this will be attributable to natural processes there may be reaches which would benefit from actions that reduce erosion such as improvement of bankside vegetation. Further investigation of sediment management options may be beneficial at Ball and Harperleas Reservoirs in the Lomond Hills, Loch Ore and the River Ore, particularly north of Lochgelly and north of Kirkcaldy.

3.3 Coastal flooding

Forth Estuary Local Plan District

This chapter provides supplementary information on flooding for coastal areas. It provides an overview of the natural characteristics of the coast, a summary of flood risk within the coastal area and a brief history of flooding. It also outlines the likely impact of climate change and the potential for natural flood management.

Information about the objectives and actions to manage flood risk are provided in in Section 2.

Coastal overview

The Forth Estuary Local Plan District has 375km of coastline, stretching from Fife Ness in the north to the Scottish Borders in the south. The coastline includes the Firth of Forth and areas of coast exposed to the North Sea. Several urban areas are situated along the coastline including Grangemouth, Bo'ness, Edinburgh, Musselburgh, North Berwick and Eyemouth.

Due to the sheltering effects of the estuary, the main influences of coastal flooding in the Firth of Forth are storm surges. The coast itself, from around North Berwick to the Scottish border, is exposed to the North Sea. Coastal flooding here is influenced by storm surges, swell waves and locally generated wind waves.

Finer sediments in the inner Firth of Forth create habitats such as mudflats, salt marshes and reed beds, such as those at Skinflats and the Alloa Inches. Toward the outer Firth of Forth the sediments in the estuary become coarser, creating habitats such as sandy beaches and dunes, such as those at Gullane Bay and Aberlady Bay.

Flood risk

Within the Forth Estuary Local Plan District approximately 1,700 residential properties and 340 non-residential properties are at risk of coastal flooding. It is estimated that 92% of these properties are location within Potentially Vulnerable Areas. There are 22 Potentially Vulnerable Areas in this Local Plan District that have a risk of coastal flooding (Figure 1):

- Crail (10/01)
- Leven (10/03)
- Kirkcaldy, East Wemyss and Methil (10/05)
- Inverkeithing, Rosyth, Dunfermline and Wellwood (10/06)
- Cairneyhill (10/07)
- Hawkhill, Kincardine, Kennet Pans and Culross (10/08)
- Airth (10/09)
- North Queensferry, Inverkeithing and Rosyth (10/10)
- Falkirk, Grangemouth, Lauriston, Denny, Redding, Dunipace, Cumbernauld, Carron and Stenhousemuir (10/11)
- Bo'ness (10/12)
- Philipstoun (10/14)
- South Queensferry (10/15)
- Cramond Bridge (10/16)
- Port of Leith, Granton and Cramond (10/17)
- Water of Leith Catchment (10/18)

- Braid Burn Catchment (10/19)
- Niddrie and Burdiehouse Burn Catchment (10/20)
- Musselburgh (10/21)
- Penicuik, Bonnyrigg, Lasswade, Dalkeith and Musselburgh (10/22)
- Cockenzie, Port Seton, Longniddry and Prestonpans (10/23)
- Dunbar and West Barns (10/25)
- Berwickshire Coast (10/26).

Main areas at risk

The main areas at risk of coastal flooding, the number of properties at risk and the total Annual Average Damages caused by coastal flooding are shown in Table 1. The Annual Average Damages include damages to residential and non-residential properties, transport, emergency services and agriculture.

	Residential and non-residential properties at risk of coastal flooding	Annual Average Damages
Grangemouth	730	£650,000
Musselburgh	450	£750,000
Kincardine	160	£870,000
Culross	140	£360,000
Airth	110	£680,000
Eyemouth	100	£290,000
Edinburgh	60	£160,000
Newmills and Torryburn	40	£190,000
Inverkeithing-North	20	£42,000
Dunbar and West Barns	20	£30,000
South Queensferry	20	£20,000
North Berwick	20	£13,000
Rosyth	10	£460,000
Carron-Carronshore-Bainsford	10	£110,000
Leven-Methil	10	£78,000
Anstruther-Pittenweem	10	£22,000

Table 1: Main areas with a risk of coastal flooding¹

¹ Table 1 does not show properties at risk if they are protected by a flood protection scheme with a standard of protection of 1 in 200 years.

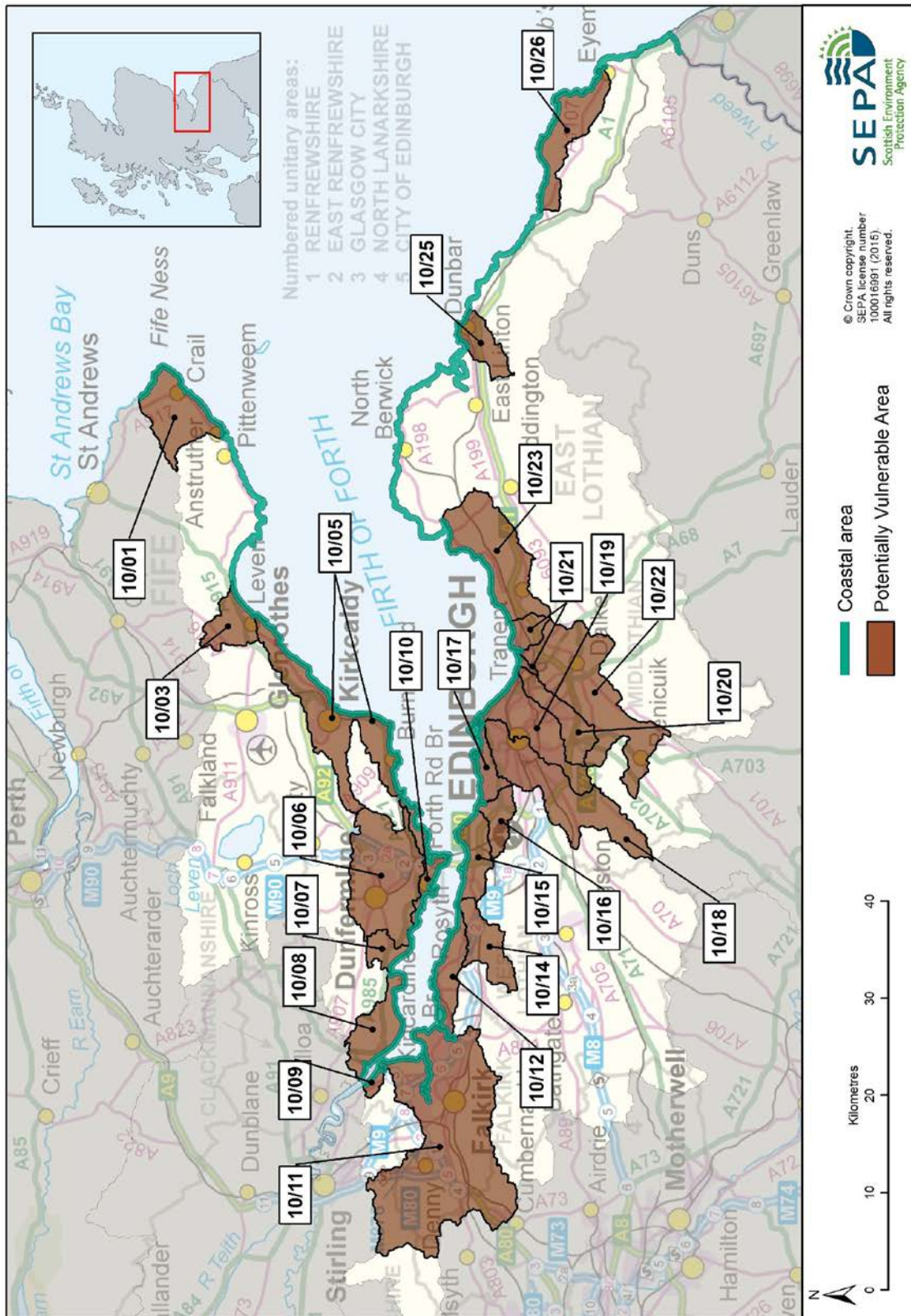


Figure 1: Forth Estuary Local Plan District coastal area and Potentially Vulnerable Areas with a risk of coastal flooding

Economic activity and infrastructure at risk

The Annual Average Damages caused by coastal flooding in the Forth Estuary Local Plan District are approximately £5.5 million. The damages are distributed as follows:

- 40% residential properties (£2.2 million)
- 32% roads (£1.8 million)
- 22% non-residential properties (£1.2 million)
- 4% emergency services (£240,000)
- 2% vehicles (£100,000)
- <1% agriculture (£22,000).

Figure 2 shows the Annual Average Damages throughout the coastal area. High damages can be seen around the Musselburgh and Airth due to the large number of residential and non-residential properties along the coastline. The greatest number of properties at risk is in Grangemouth. Industrial areas around Grangemouth, Rosyth, Kincardine and Culross also contribute to high damage values.

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

	Number at risk	Further detail
Community facilities	<10	Educational buildings
Utility assets	40	Includes: electricity substations and energy production sites
Roads (excluding minor roads)	18	13 A roads at 69 locations 5 B roads at 30 locations
Railway routes	1	Fife circle: Dalmeny to Winchburgh and Haymarket West Junctions (3 locations at risk)
Agricultural land (km²)	10.5	

Table 2: Infrastructure and agricultural land at risk of flooding

Designated environmental and cultural heritage sites at risk

Within the catchment it is estimated that approximately 69 designated cultural heritage sites have a risk of coastal flooding. These sites include scheduled monuments, gardens and designed landscapes, battlefield sites, World Heritage Sites and listed buildings.

Approximately 12 environmental designated areas are at risk of coastal flooding. These include a Special Area of Conservation, five Special Protection Areas and six Sites of Special Scientific Interest, notably Bass Rock, St Abb's Head to Fast Castle and the Isle of May.

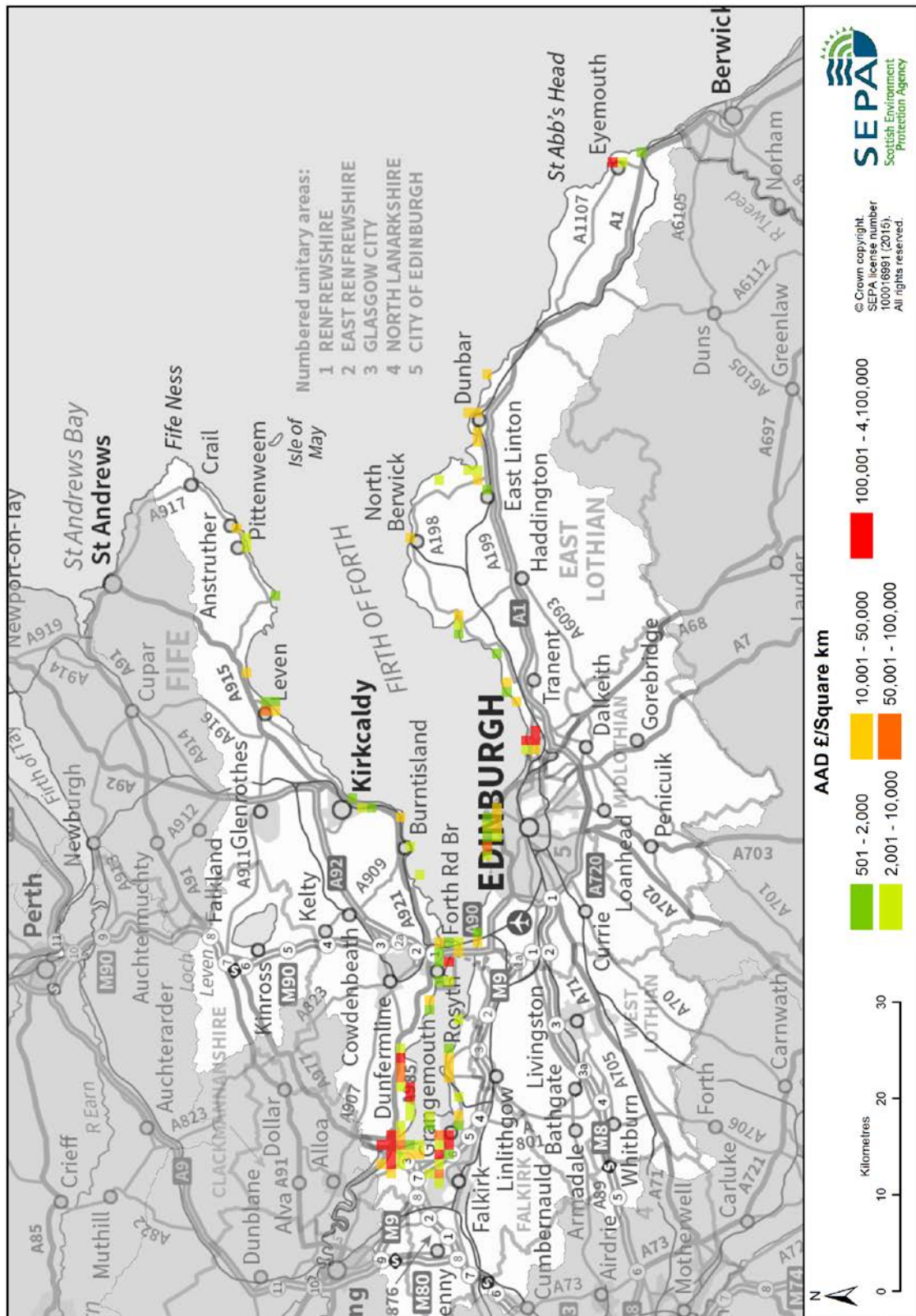


Figure 2: Annual Average Damages from coastal flooding

History of coastal flooding

The Forth Estuary has a long history of coastal flooding. The highest tide on record occurred in 1959 when a level of 4.47m was recorded at Grangemouth Docks.

A recent flood was recorded on 4 January 2014 when a tidal surge combined with a storm surge affected coastal areas across the east of Scotland.

Probably the most significant flood on record occurred in March 2010 when a tidal surge coincided with the highest mean tides of the year. The Firth of Forth was one of the worst affected areas, with Leith, Musselburgh, Prestonpans, Port Seton, Kirkcaldy, Dunbar, Eyemouth and North Berwick affected. Impacts included flooding of properties, damage to harbours, seawalls and roads. Edinburgh City Council estimated the cost to repair damages in the region of £650,000.

Another significant flood occurred in April 1958 when 40 families had to be evacuated in Kirkcaldy, homes and businesses flooded, cars were washed away and civil infrastructure was damaged. Portobello promenade and nearby houses were also inundated.

Examples of some of the earliest floods on record includes event in 1877 when the sea wall was washed away between Portobello and Joppa, and the 'Eyemouth Disaster' of 1881 when 191 fishermen died.

Further detail about the history of flooding in this area is available in the relevant Potentially Vulnerable Area chapters in Section 2.

Managing flood risk

A range of public bodies have responsibility for managing flood risk in Scotland and they are working closer than ever before to target action in the areas where the greatest benefit can be gained. Members of the public also have a role to play and are the first line of defence against flooding by taking action to protect themselves and their property from flooding. Further information about roles and responsibilities is provided in Section 1.

This section describes the existing actions that are in place to manage flood risk and are in addition to the information presented in the relevant Potentially Vulnerable Area chapters.

Flood protection schemes

There are three formal flood protection schemes that reduce the risk of coastal flooding:

- Bo'ness coastal flood protection scheme with a standard of protection of 1 in 200 years
- Grangemouth Grange Burn flood protection scheme that has some coastal protection benefits
- Prestonpans coastal flood protection scheme has a standard of protection of 1 in 200 years.

Coastal flood warning schemes

There are 19 coastal flood warning areas within the Forth Estuary Local Plan District as shown in Table 3 and Figure 3. Table 3 shows the total number of properties within a flood warning area and the percentage of properties that have registered to receive flood warnings directly from SEPA. Please note that this is not the number of properties at risk of flooding.

Flood warning area (FWA)	Number of properties within FWA	% of properties registered January 2014
Anstruther to Elie	124	15%
Blackness	24	8%
Burntisland to Aberdour	26	15%
Culross, Longannet and Kincardine	615	11%
Dunbar including West Barns	198	34%
Eyemouth Coastal	88	22%
Grangemouth	1,340	14%
Granton and Leith	3,545	7%
Kinghorn	50	12%
Kirkcaldy	156	7%
Leven and Methil	285	9%
Lower Largo	38	39%
Musselburgh Coastal	2,085	15%
North Berwick	48	65%
North Queensferry and Inverkeithing Bay	184	16%
Portobello Esplanade	162	12%
Prestonpans, Cockenzie and Port Seton	297	12%
Rosyth, Limekilns and Charlestown	106	17%
Torryburn and Newmills	29	10%

Table 3: Flood warning areas

Community groups

The following community groups are known to operate within this coastal area:

- Burnmouth Resilient Community Group
- Coastal Regeneration Group for Port Seton and Cockenzie
- Cockburnpath Resilient Community Group
- Dunbar Shore and Harbour Neighbourhood Group
- East Lothian Biodiversity Group and Local Community Councils
- Eyemouth Resilient Community Group
- Friends of the River Tyne
- Musselburgh Waterfront Group
- North Berwick Environment Group
- St Abbs Resilient Community Group.

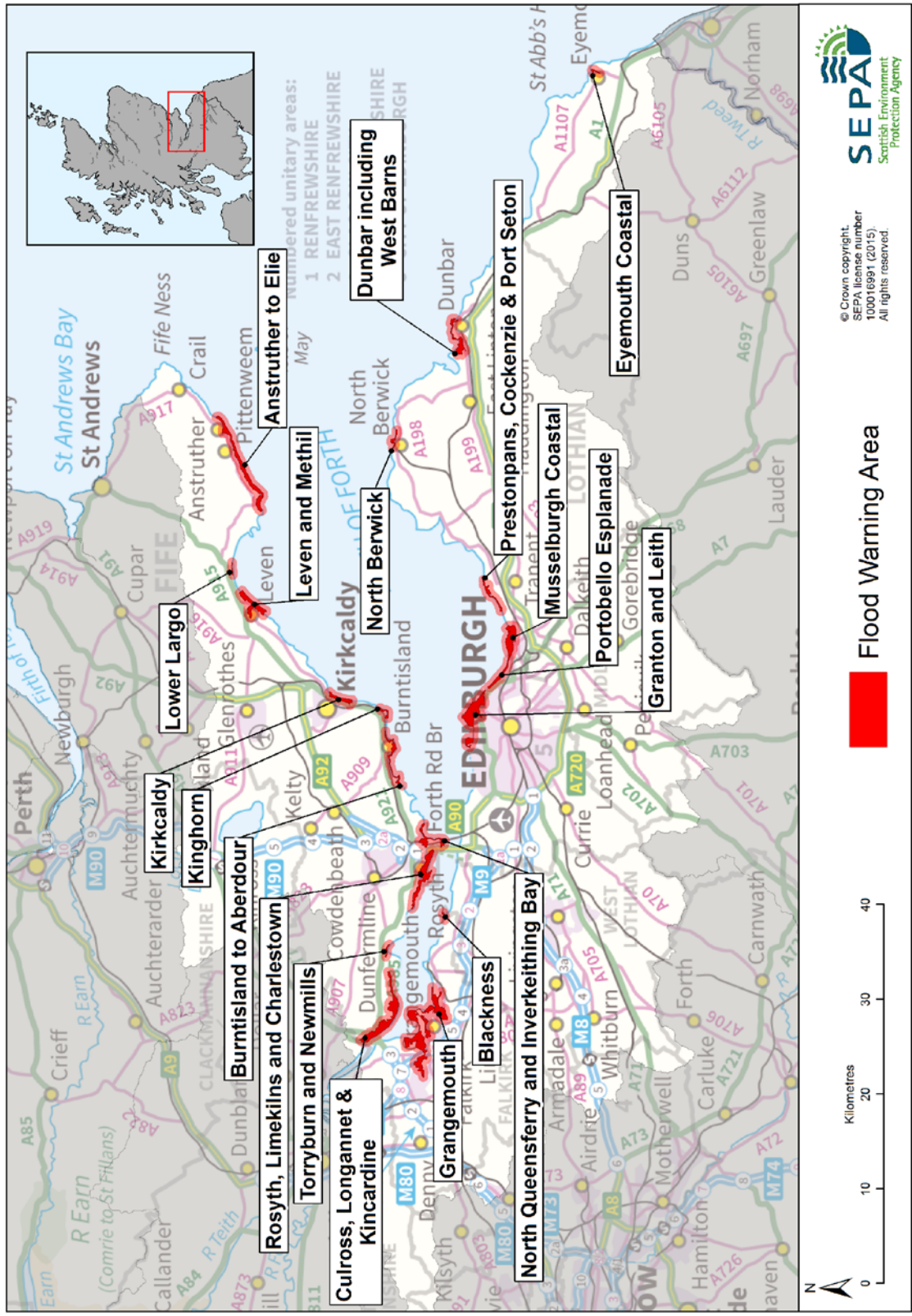


Figure 3: Flood warning areas

Property level protection

Each local authority has its own incentives or subsidies to help property owners with property level protection. In this coastal area:

- East Lothian Council strategically deploys temporary flood barriers and sandbags when properties are threatened by flooding
- Fife Council provides Aquasacs for use in emergencies
- Scottish Borders Council operates a subsidised flood protection products scheme for residential and non-residential property owners in flood risk areas
- Scottish Borders Council also maintains dedicated sandbag stores in areas of flood risk to ensure they are available to the public in the event of a flood
- The City of Edinburgh Council owns sandbags to be used in the event of flooding.

Climate change and future flood risk

UK Climate Projections (UKCP09) predicts that climate change may increase sea levels. The magnitude of sea level rise varies around the coastline.

Under the UKCP09 high emissions scenario, the predicted average sea level increase around the Forth Estuary Local Plan District ranges from 0.47-0.5m by 2080. This may increase the number of residential properties at risk of coastal flooding from approximately 1,700 to 3,800 and the number of non-residential properties from approximately 340 to 970. 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.

Wave energy

The assessment shows that there is potential for estuarine surge attenuation to reduce flood risk in and around Kincardine and Rosyth, and at Grangemouth, Bo'ness, North Queensferry, South Queensferry and Inverkeithing. There is potential for wave dissipation to provide flood risk benefits along the coastline from North

Queensferry to Fife Ness, around Grangemouth, along most of the coast from South Queensferry to North Berwick, around Dunbar and within the Berwickshire Coast.

The feasibility of implementing natural flood management actions may be limited in some locations due to the large amount of industrial sites located along this coastline.

3.4 Surface water flooding

Forth Estuary Local Plan District

This chapter provides supplementary information on surface water flooding across the Local Plan District. It provides an overview of the main areas at risk and the history of surface water flooding. The predicted impacts on infrastructure are also identified. The impacts on environmental sites and agricultural land have not been assessed.

Information about the objectives and actions to manage flood risk are provided in Section 2.

Flood risk

Within the Forth Estuary Local Plan District approximately 5,400 residential properties and 2,400 non-residential properties are at risk of surface water flooding. It is estimated that 96% of these properties are located within Potentially Vulnerable Areas.

Main areas at risk

The main areas at risk of surface water flooding can be seen in Table 1, which shows the number of properties at risk and the Annual Average Damages caused by surface water flooding. The damages include impacts to residential and non-residential properties, vehicles, emergency services and roads.

Economic activity and infrastructure at risk

The Annual Average Damages caused by surface water flooding in the Forth Estuary Local Plan District are approximately £12.5 million. The damages are distributed as follows:

- 39% roads (£4.8 million)
- 32% residential properties (£3.9 million)
- 26% non-residential properties (£3.2 million)
- 3% emergency services (£400,000)
- <1% vehicles (£120,000).

Economic damages to airports and the rail network were not assessed as information on damages at a strategic scale is not available. Of the economic damages assessed, the highest damages in the Local Plan District are to roads, of which the M9 and the Edinburgh City Bypass are significantly affected. Figure 1 shows the distribution of Annual Average Damages throughout the Local Plan District. High damages can be seen in Edinburgh due to the number of residential and non-residential properties. High damages can also be seen in Dunfermline due to the high number of non-residential properties affected.

	Residential and non-residential properties at risk of surface water flooding	Annual Average Damages
Edinburgh	3,100	£2.5 million
Dunfermline	300	£610,000
Livingston	290	£380,000
Linlithgow	280	£650,000
Bo'ness	260	£440,000
Leven-Methil	220	£160,000
Falkirk	200	£190,000
Kirkcaldy	190	£230,000
Glenrothes-Markinch-Leslie	170	£340,000
Bathgate-Blackburn	170	£140,000
Broxburn	130	£130,000
Cowdenbeath	100	£150,000
Musselburgh	90	£100,000
Carron-Carronshore-Bainsford	90	£64,000
Armadale	90	£60,000
Lasswade-Bonnyrigg	80	£64,000
Haddington	70	£140,000
Penicuik	70	£110,000
Rosyth	70	£100,000
Grangemouth	70	£62,000
Dalkeith	60	£320,000
Newtongrange	60	£140,000
Culross	50	£70,000
Cumbernauld (East)	50	£60,000
Cairneyhill	50	£51,000
Polmont	40	£60,000
Whitburn	40	£40,000
Burntisland	30	£40,000
Tranent	30	£34,000
Cardenden-Auchterderran-Bowhill	30	£24,000
Bonnybridge-Banknock	30	£20,000
Milnathort	30	£15,000
Loanhead	20	£40,000
Kinross	20	£28,000
Lochore	20	£27,000
Larbert-Stenhousemuir	20	£24,000
Denny-Dunipace	10	£46,000

Table 1: Main areas at risk of surface water flooding

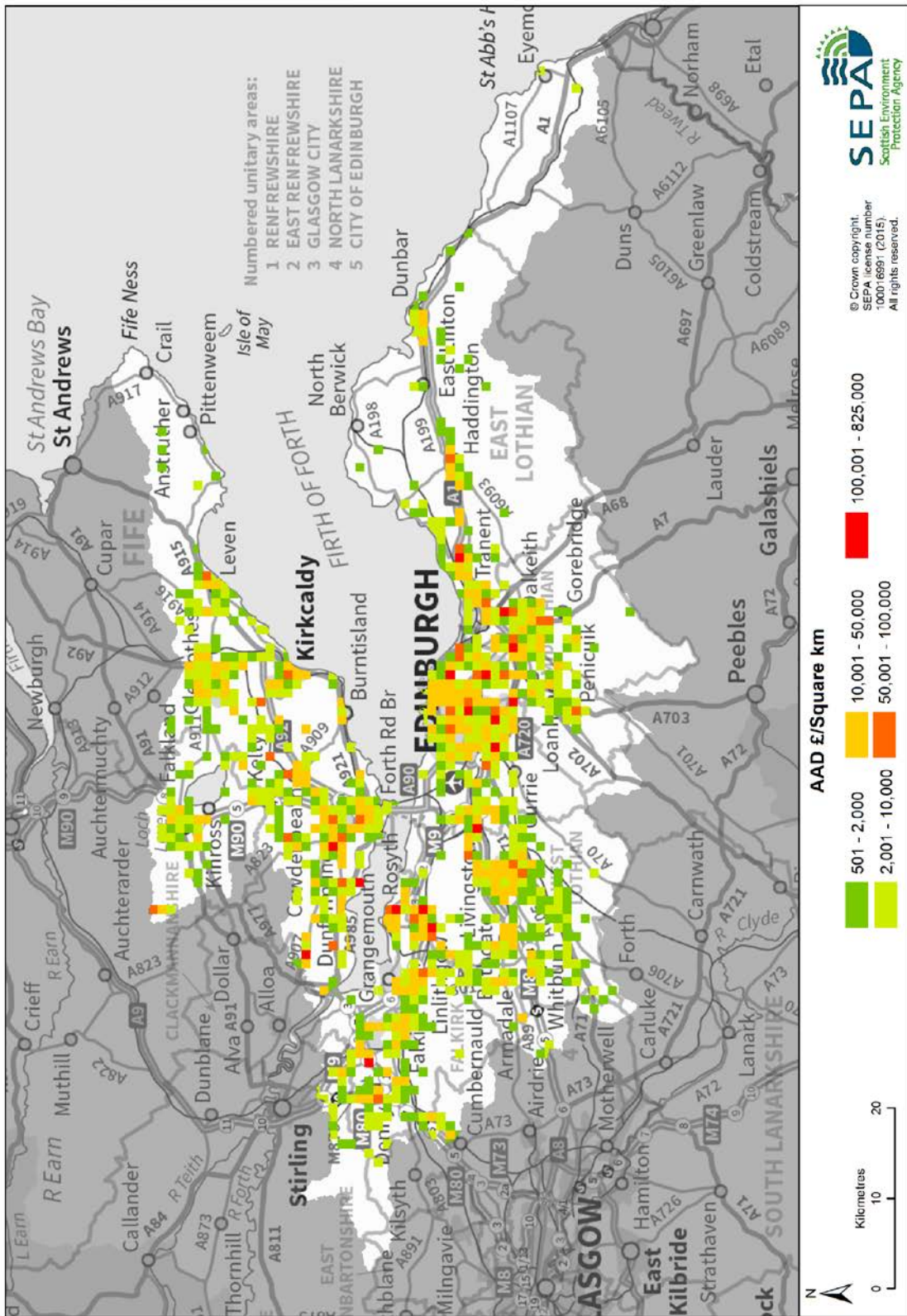


Figure 1: Annual Average Damages from surface water flooding

Table 2 shows the approximate numbers of further infrastructure assets which are at risk of flooding within this catchment.

	Number at risk	Further detail
Community facilities	30	Includes: educational buildings and healthcare service
Utility assets	410	Includes: electricity substations fuel extraction sites and telephone exchanges
Roads (excluding minor roads)	181	5 M roads (M90) at 280 locations 68 A roads at 2,000 locations 108 B roads at 1,200 locations
Railway routes	9	Berwick-upon-Tweed to Edinburgh (80 locations at risk) Carmuir Junction to Polmont Junction (15 locations at risk) Carstairs to Edinburgh (60 locations at risk) Drumgelloch to Newbridge Junction (45 locations at risk) Dunblane to Larbert / Stirling (15 locations at risk) Edinburgh to Glasgow Queen Street (90 locations at risk) Fife Circle, Dalmeny to Winchburgh and Haymarket West Junctions (110 locations at risk) Mid Calder Junction to Holytown Junction (50 locations at risk) Perth to Ladybank (10 locations at risk)
Airports	2	Edinburgh airport Fife airport

Table 2: Infrastructure at risk of surface water flooding

Designated environmental and cultural heritage sites at risk

Within the Local Plan District it is estimated that approximately 519 designated cultural heritage sites have a risk of surface water flooding. These sites include scheduled monuments, gardens and designed landscapes, battlefield sites, World Heritage sites and listed buildings.

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

History of surface water flooding

A number of surface water flood events have been recorded in this Local Plan District.

Recently, on 25 July 2013 there was flooding in Albert Road, Church Street and Harbour Road in Eyemouth to both residential and commercial property. The same area also flooded on 28 June 2012.

On 8 July 2011 there was surface water flooding of homes and businesses in Edinburgh. Balcarres Street in Morningside was identified as the area worst affected area with around 20 residential and three commercial properties flooding. Four properties were also affected from this flooding event at Greenbank Road.

In July 2009 heavy rain caused surface water flooding in areas of Fife and Perth and Kinross, including Milnathort.

The earliest flood on record occurred in August 1948 in Eyemouth when low-lying areas flooded by surface water flowing down Northburn Road.

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.

Surface water management priority areas

The areas at highest risk from surface water flooding have been prioritised. These priority areas were identified using SEPA flood models, supplemented with historical flood information and, where available, more detailed modelling from local authorities. These priority areas require the preparation of surface water management plans, the details of which can be found in Section 2.

Community groups

The following community groups are known to operate within the Forth Estuary Local Plan District:

- East Lothian Tenants and Residents Panel
- Eyemouth Community Resilience Group
- Friends of the River Tyne
- Musselburgh and Inveresk Community Council
- St Abbs Community Resilience Group
- Various local community councils operate throughout the East Lothian Council area
- Perth and Kinross Council is part of a wider community resilience group which works with various communities including Milnathort to develop community resilience plans.

Property level protection

Each local authority has its own incentives or subsidies to help property owners with property level protection:

- The City of Edinburgh Council has issued properties on Balcarres Street with door and vent flood guards. The City of Edinburgh Council also stores sandbags at key fire stations
- East Lothian Council strategically deploys temporary flood barriers and sand bags when properties are threatened by flooding
- Fife Council has installed flood pods containing flood protection products

- close to flood affected properties
- Scottish Borders Council operates a subsidised flood protection products scheme for residential and non-residential property owners in flood risk areas. Scottish Borders Council has provided and maintains dedicated sandbag stores in areas of flood risk to ensure sandbags are available to the public in the event of a flood
 - West Lothian Council provides 'Aquasacs' which are stored at key fire stations through the council area.

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 5,400 to 9,900 and the number of non-residential properties from approximately 2,400 to 4,400. With future impacts of climate change considered, new surface water flood risk may arise in Gorebridge where currently there is estimated to be a very low risk of surface water 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.