

# Flood Risk Management Strategy

## Tweed 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 Tweed Local Plan District, river flooding is reported for the Tweed river catchment and surface water flooding is reported across the whole Local Plan District. There are no coastal areas in the Tweed Local Plan District and the Scottish Borders Council coastline is contained within the Forth Estuary Local Plan District.

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

	Total number of properties at risk <sup>1</sup>	Annual Average Damages	Local authority
<b>River catchments</b>			
River Tweed catchment	4,600	£10.5 million	Scottish Borders Council South Lanarkshire Council
<b>Surface water flooding</b>			
Tweed Local Plan District	1,300	£2.7 million	Scottish Borders Council South Lanarkshire Council

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

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

## 3.2 River flooding

### River Tweed catchment

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 River Tweed catchment is approximately 4,335km<sup>2</sup>. It rises from sea level at Berwick-upon-Tweed to its highest point of 850m at Broad Law. The headwaters in the west drain steep hills and flow through narrow valleys. The lower part of the catchment becomes less steep downstream of Melrose where the Tweed and its tributaries flow through wider valleys and floodplains.

The main-stem of the River Tweed has its source at Glenbreck and flows through Peebles, Innerleithen, Melrose, Kelso and Coldstream to meet the North Sea at Berwick-upon-Tweed in England. The main tributaries of the Tweed include the River Teviot, Whiteadder Water, Blackadder Water, Leader Water, Gala Water and Ettrick Water. The River Teviot includes part of the Bowmont Water that flows into England and is a tributary of the English River Till that meets the River Tweed north east of Coldstream.

Intensive agriculture dominates the low lying areas of the catchment where the land is used mainly for arable and horticulture production. Pasture dominates in the steep hills in the west of the catchment where grasslands are most prevalent.

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 1250-2000mm in the upper catchment.

#### Flood risk in the catchment

Within the River Tweed catchment approximately 3,000 residential and 1,600 non-residential properties are at risk of river flooding. It is estimated that 89% of these properties are located within Potentially Vulnerable Areas. There are 13 Potentially Vulnerable Areas at risk of river flooding in this catchment (Figure 1):

- West Linton (13/01)
- Preston (13/02)
- Lauder (13/03)
- Eddleston, Peebles, Innerleithen, Selkirk, Stow and Galashiels (13/04)
- Earlston (13/05)
- Coldstream (13/06)
- Biggar (13/07)
- Broughton (13/08)
- Kelso (13/09)
- Jedburgh (13/10)
- Denholm (13/11)

- Hawick (13/12)
- Bonchester Bridge (13/13)

### Main areas at risk

The main areas at risk of river flooding can be seen in Table 1. The table 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
Hawick	920	£1,700,000 <sup>1</sup>
Galashiels	860	£1,500,000 <sup>2</sup>
Selkirk	630	£760,000 <sup>1</sup>
Innerleithen	540	£880,000
Peebles	390	£890,000
Jedburgh	150	£430,000
Earlston	110	£610,000
Stow	50	£200,000
Broughton	50	£160,000
Biggar	50	£88,000
Walkerburn	40	£160,000
Greenlaw	40	£150,000
Bonchester Bridge	40	£120,000
Melrose	30	£72,000
Eddleston	30	£58,000
Preston	20	£110,000
Kelso	20	£24,000
Yarrowford	10	£110,000
Coldstream	10	£31,000
Abbey St Bathans	<10	£8,000
Denholm	<10	£8,000

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

<sup>1</sup> The damages presented in this report are derived from SEPA data that is assessed at a strategic level. Scottish Borders Council has carried out more detailed assessment of flood risk in Hawick and Selkirk that identifies higher economic damages from river flooding.

<sup>2</sup> The damages presented in this report are derived from SEPA data that is assessed at a strategic level. Scottish Borders Council has carried out more detailed assessment of flood risk in Galashiels that identifies lower economic damages from river flooding.



## Economic activity and infrastructure at risk

The Annual Average Damages caused by river flooding in the River Tweed catchment are approximately £10.5 million. The damages are distributed as follows:

- 45% residential properties (£4.8 million)
- 37% non-residential properties (£3.9 million)
- 7% emergency services (£710,000)
- 6% roads (£610,000)
- 3% agriculture (£300,000)
- 3% vehicles (£290,000).

Figure 2 show the Annual Average Damages throughout the catchment. The highest Annual Average Damages are in Hawick and Galashiels due to a combination of high economic damages and a large density of residential and non-residential properties.

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

	Number at risk	Further detail
<b>Community facilities</b>	20	Includes: educational buildings, healthcare services and emergency services
<b>Utility assets</b>	70	Includes: electricity substations, fuel extraction sites and telephone exchanges
<b>Roads (excluding minor roads)</b>	56	17 A roads at 335 locations 39 B roads at 274 locations
<b>Railway routes<sup>3</sup></b>	0	
<b>Agricultural land (km<sup>2</sup>)</b>	128.2	

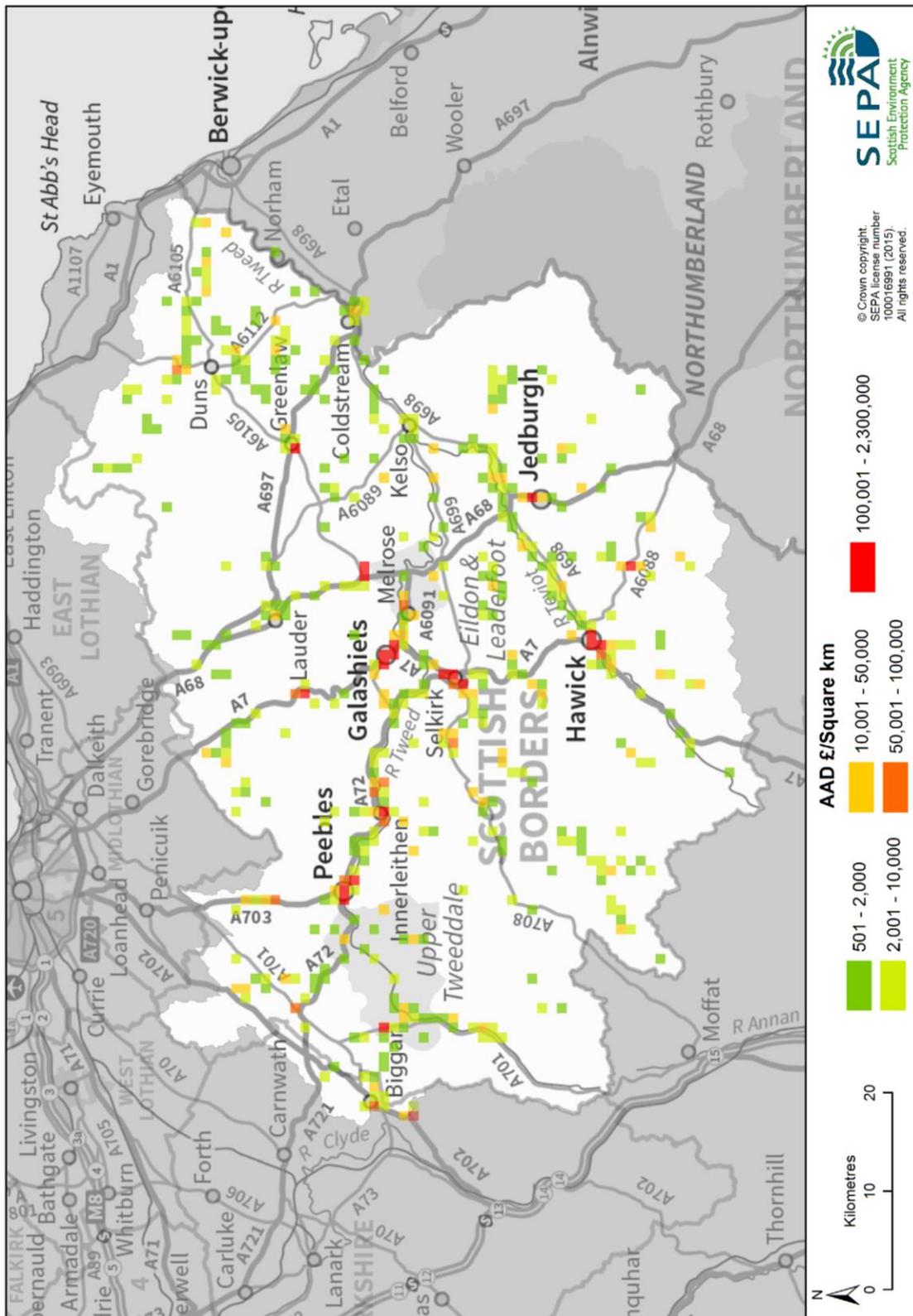
**Table 2:** Infrastructure and agricultural land at risk of flooding

## Designated environmental and cultural sites at risk

Within the catchment it is estimated that 104 cultural heritage sites are at risk of river flooding. These sites include scheduled monuments, gardens and designed landscapes, battlefield sites and listed buildings.

Approximately 42 protected environmental sites are at risk of river flooding. These include three Special Areas of Conservation, two Special Protection Areas and 37 Sites of Special Scientific Interest. Amongst these areas are the Borders Woods, River Tweed, St Mary's Loch and Dolphinton - West Linton Fens and Grassland.

<sup>3</sup> This assessment was carried out prior to the reconstruction of the Borders Railway; flood risk to this railway route will be assessed in the next FRM cycle.



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

## History of river flooding

The Tweed catchment has a long history of flooding with many floods recorded since 1831. Many towns have been affected including Jedburgh from the Skiprunning Burn, Peebles from the River Tweed, Selkirk from the Long Philip Burn, Hawick from the River Teviot, as well as Denholm and Keslo.

One of the most significant floods in this catchment is believed to have occurred in August 1948 when flooding from the River Tweed, Whiteadder Water and Gala Water affected numerous properties and businesses throughout the Scottish Borders. Multiple bridges were swept away during the flood, causing major disruption to local and national transport infrastructure. The flood is known to have affected a large part of the region. The most significant event on the Slitrig Water occurred in 1846. It is thought that flooding was exacerbated by upstream forests being ripped out and blocking bridges in Hawick.

The most recent flood occurred on 30 December 2013 when the Upper Tweed and the Ettrick Water flooded. Many areas were affected including Merlindale, Dawyck, Peebles, Ettrick Valley and Lindean. The Tweed Green area of Peebles was inundated and a nursing home had to be evacuated. No properties flooded internally as water ingress was stopped using property level protection.

The earliest flood was recorded in February 1831 when Kelso was affected by flooding from the River Tweed. There was significant damage to properties and agriculture as a result of this event.

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.

Existing actions to manage flood risk are detailed below and should be read alongside Section 2.

### Flood protection schemes

There are 11 flood protection schemes in the River Tweed catchment:

- Turfford Burn Flood Prevention Scheme
- Ettrick Water and Yarrow Water Flood Prevention Scheme
- Denholm – The Loaning Flood Prevention Scheme
- Jedburgh – Skiprunning Burn Culvert Flood Prevention Scheme
- Galashiels – Plumtree / Wilderhaugh Flood Prevention Scheme
- Galashiels – Netherdale Flood Prevention Scheme
- Jed Water Flood Prevention Scheme
- Peebles – Southpark Area Flood Prevention Scheme
- Innerleithen Hall Street Flood Prevention Scheme
- Lauder Station Yard Flood Prevention Scheme

- Galashiels Flood Protection Scheme.

Two further schemes are currently under construction. These are Selkirk Flood Protection Scheme, due for completion in December 2016, and Jedburgh (Skiprunning Burn) Flood Protection Scheme, due for completion in February 2016.

### River flood warning schemes

There are 27 river flood warning areas within this catchment as shown in Table 3 and Figure 3. Table 3 shows the total number of properties in the flood warning area and the percentage of those properties that have signed up to receive flood warnings. Note that this is not the number of properties at risk of flooding.

Flood warning area (FWA)	River	Number of properties within FWA	% of properties registered July 2014
Camptown to Jedburgh	Jed Water	23	35%
Coldstream Town	River Tweed	205	22%
Dawyck to Lyne Ford	River Tweed	16	75%
Drumelzier to Dawyck	River Tweed	9	89%
Earlston	Leader Water	82	41%
Ettrick Valley	Ettrick Water	45	36%
Galashiels (Netherdale)	Gala Water	92	36%
Galashiels including Bowland	Gala Water	945	14%
Greenlaw to Allanton	Blackadder Water	50	22%
Hawick (Slitrig)	Slitrig Water	139	39%
Hawick (Teviot)	River Teviot	937	36%
Hawick to Monteviot	River Teviot	42	98%
Jedburgh to Jedfoot Bridge	Jed Water	169	28%
Kelso to Coldstream	River Tweed	122	47%
Monteviot to Kelso	River Teviot	33	48%
Peebles (Eddleston Water)	Eddleston Water	748	15%
Preston to Paxton	Whiteadder Water	53	64%
Romannobridge to Lyne Station	Lyne Water	25	56%
Selkirk (Bannerfield and Riverside Industrial Estate)	Ettrick Water	478	29%
Selkirk to Lindean	Ettrick Water	93	92%
Shiplaw to Crossburn including Eddleston	Eddleston Water	70	39%
Stow	Gala Water	37	49%
The Leithen Water at Innerleithen	Leithen Water	338	28%
The Tweed from Peebles to Yair Bridge	River Tweed	270	30%
The Tweed in Peebles	River Tweed	119	58%
Tweedbank to Floors	River Tweed	62	32%
Yarrow Valley	Yarrow Water	76	30%

**Table 3:** Flood warning areas

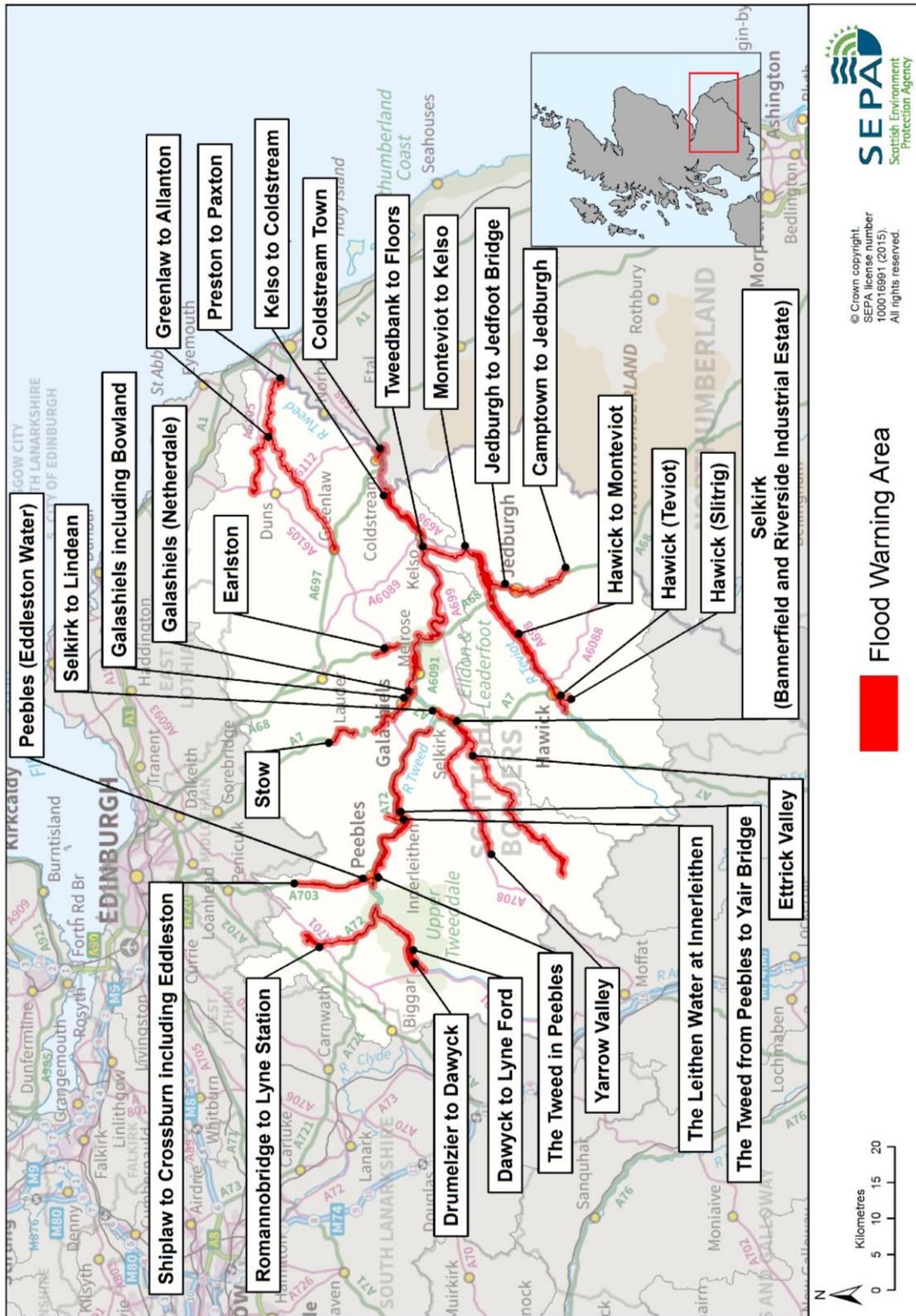


Figure 3: Flood warning areas

## Community groups

There are two flood action groups operating within this catchment located in Peebles and Hawick. There are also resilient communities groups based on some community councils which respond to flooding.

In addition, there are local flood warning groups operated by the local authorities. These are:

- Scottish Borders Council, Selkirk Long Philip Burn Flood Warning Group
- Scottish Borders Council, Galashiels (Bakehouse Burn) Flood Warning Group
- Scottish Borders Council, Jedburgh Skiprunning Burn Flood Warning Group
- South Lanarkshire Council owns and operates a flood warning and routing system at Biggar High School.

## Property level protection

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

- In the River Tweed catchment 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 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;
- South Lanarkshire Council provides assistance during emergency situations which can include the provision of sandbags and other actions where possible to reduce the risk of flooding to properties, businesses and infrastructure.

## 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 River Tweed catchment may increase by 33%<sup>4</sup>. This would potentially increase in the number of residential properties at risk of river flooding from approximately 3,000 to 4,100 and the number of non-residential properties from approximately 1,600 to 1,900.

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.

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<sup>4</sup> From the study 'An assessment of the vulnerability of Scotland's river catchments and coasts to the impacts of climate change' (CEH, 2011)

## 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.

A number of natural flood management projects and initiatives are underway in this catchment:

- Eddleston Water project is investigating whether changes in land use management and the restoration of natural habitats can help improve the river valley for wildlife and reduce the risk of flooding in Eddleston and Peebles.
- Gala Water habitat mitigation project due to windfarm development has created an opportunity for habitat enhancement and natural flood management on the upper Gala Water.
- Cheviot Futures aims to provide practical real-world solutions to the climate change challenges communities face. The project is a cooperative of agencies and organisations working with rural communities in north Northumberland.
- Ale Water Working Wetlands project is taking a catchment-scale approach to assessing largely undesignated, but regionally important, wetland sites and focusing on the attitudes of land managers towards the wetlands on their land holdings.
- Riparian improvements and woodland planting at Yarrow, Bowanhill and Teviothead.

### Runoff reduction

A number of areas have been identified as having potential for runoff reduction. In the River Tweed the most dominant area is situated in the south east of the catchment within the Ettrick Forest and surrounding St Mary's Loch. Furthermore, a number of areas to the south east of both Peebles and Lauder also show potential.

A number of locations on the River Teviot show potential in the upper reaches of the Borthwick Water and Slitrig Water, Allan Water and Rule Water. Both of these tributaries contribute flows to Hawick Potentially Vulnerable Area (13/12). Notably, the Allan Water has absence of woodland and may have potential for tree planting.

### Floodplain storage

The River Tweed includes a number of potential floodplain storage areas. The largest of these is the St Mary's Loch as well as the Talla, Fruid and Megget Reservoirs. Large sections upstream of the River Tweed at Broughton and Bellspool also indicate potential for floodplain storage.

River Teviot between Nisbet and Ancrum includes a floodplain with indicative storage potential. Within these locations are embankments that may contribute to floodplain disconnection. Sediment transport alternates markedly between high deposition and high erosion. This is unlikely to be a natural occurring process but may be a consequence of modifications to the river channel in this area. Reconnection and restoration of the floodplain could potentially reduce local flooding.

The Borthwick Water catchment, just above Burnfoot, includes a small area of floodplain with storage potential that is currently disconnected from its floodplain by embankments. There is also an area of high erosion on the Howpaisley Burn in the upper catchment just above its confluence with the Borthwick Water at Craik which may be associated with realignment at this location.

In the Slitrig Water catchment there are man-made embankments that could restrict the movement of water into floodplain. There is further evidence of realignment of the Langside Burn in the upper Slitrig catchment and on the main stem of the Slitrig just above Stobs Castle that may be linked with high sediment deposition in this area.

Potentially large areas of floodplain storage were also noted in the middle reaches of the Rule Water around Hallrule and Bonchester Bridge. A lack of vegetation in some locations may suggest that there is potential for tree planting to help reduce the flow of water.

### **Sediment management**

Erosion and sediment levels appear to be of an appropriate level across the majority of the catchment. There are some zones prone to high levels of erosion, including the Ettrick Water approaching Selkirk and in the upper reaches of the River Teviot, leading to increased deposition downstream. There are also higher levels of deposition on the River Tweed as it nears the coast, particularly between Coldstream and Berwick. While much of the erosion and deposition will be attributable to natural processes, further investigation of actions that reduce erosion rates may be merited, such as improvement of bankside vegetation or gully planting.

## 3.3 Surface water flooding

### Tweed 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 Tweed Local Plan District approximately 640 residential properties and 700 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.

	Residential and non-residential properties at risk of surface water flooding	Annual Average Damages
Galashiels	300	£660,000
Peebles	280	£340,000
Hawick	230	£430,000
Jedburgh	120	£180,000
Selkirk	110	£190,000
Kelso	90	£67,000

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

#### Economic activity and infrastructure at risk

The Annual Average Damages caused by surface water flooding in the Tweed Local Plan District are approximately £2.7 million. The damages are distributed as follows:

- 37% non-residential properties (£1.0 million)
- 33% roads (£890,000)
- 25% residential properties (£670,000)
- 4% emergency services (£94,000)
- 1% vehicles (£23,000).

Figure 1 shows the distribution of Annual Average Damages throughout the Local Plan District. Galashiels and Hawick show the highest economic damages with surface water flooding affecting the commercial and industrial properties in the towns.

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

	Number at risk	Further detail
<b>Community facilities</b>	10	Includes: educational buildings and emergency services
<b>Utility assets</b>	60	Includes: electricity substations, fuel extraction sites and telephone exchanges
<b>Roads (excluding minor roads)</b>	55	17 A roads at 300 locations 38 B roads at 200 locations
<b>Railway routes<sup>1</sup></b>	0	

**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 98 designated cultural heritage sites have a risk of surface water flooding. These sites include scheduled monuments, gardens and designed landscapes, battlefield 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

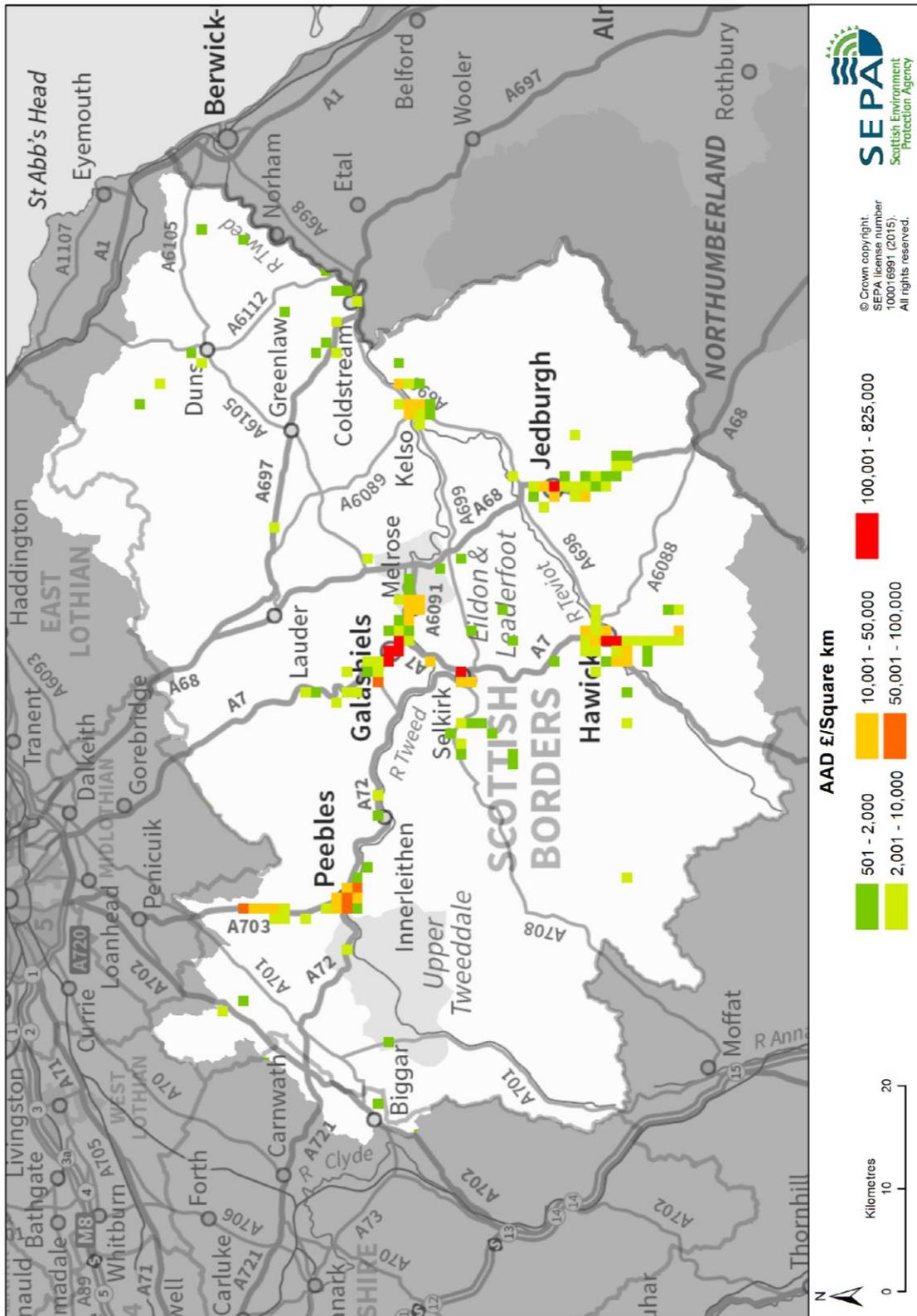
A number of areas in this Local Plan District have been affected by surface water flooding including Jedburgh, Galashiels and Selkirk.

Recent events include flooding in Jedburgh on 21 December 2013 when heavy rainfall led to flooding of Naggs Head Close, Exchange Street, Castlegate, Canongate and the High Street from the Skiprunning Burn. Jedburgh also flooded on 5 August 2012, 2 August 2002 and 4 January 1982.

Galashiels recently flooded on 22 November 2012 following heavy rainfall. Areas affected included Meigle View, Riddle Dumble Park and Bank Street. Flash flooding also affected Galashiels on 30 May 2003 with property flooding at Netherbank and Kimberley and Galashiels.

Selkirk was affected on 13 August 2004 when heavy rainfall led to flooding of Selkirk Rugby Club and Ettrickhaugh Road from the Long Philip Burn. Flash flooding affecting Yarrow Valley and Selkirk as well as the small settlement of Broadmeadows and Bannerfield housing estate in Selkirk also occurred on 30 May 2003.

<sup>1</sup> This assessment was carried out prior to the reconstruction of the Borders Railway; flood risk to this railway route will be assessed in the next FRM cycle.



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

### 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.

### Flood protection schemes

There are five formal flood protection schemes which aid the management of surface water flooding in the Tweed Local Plan District:

- Denholm - The Loaning Flood Protection Scheme designed to divert surface water runoff from fields away from properties at Ashloaning, The Loaning, Eastgate and Eastlea Drive.
- Jedburgh - Skiprunning Burn Culvert Flood Protection Scheme designed to mitigate the flooding of Exchange Street, High Street, Friars and Pleasance areas from the Skiprunning Burn.
- Peebles - South Park Flood Protection Scheme designed to mitigate flooding to Caledonian Road, Southpark Drive and Southpark West from fields and overflows from Ederston Burn.
- Lauder (Station Yard) - Flood Protection Scheme designed to mitigate the flooding of Station Yard area surface water runoff from fields.
- Innerleithen, Hall Street - Flood Protection Scheme designed to mitigate flooding to St Ronans Terrace and High Street from surface water runoff and overflows from Chapmans Burn.

### Community groups

There are three flood action groups operating in this Local Plan District, located in Hawick, Selkirk and Peebles. There are also resilient communities groups based on some community councils which respond to flooding.

In addition, there are three local flood warning groups operated by Scottish Borders Council:

- Selkirk Long Philip Burn Flood Warning Group
- Galashiels Bakehouse Burn Flood Warning Group
- Jedburgh Skiprunning Burn Flood Warning Group.

## Property level protection

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

- Scottish Borders Council operates a subsidised flood protection products scheme for residential and non-residential property owners in its flood risk areas. Scottish Borders Council also provides and maintains dedicated sandbag stores in areas of flood risk to ensure sandbags are available to the public in the event of a flood.
- South Lanarkshire Council provides assistance during emergency situations which can include the provision of sandbags and other actions where possible to reduce the risk of flooding to properties, businesses and infrastructure.

## 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 640 to 890 and the number of non-residential properties from approximately 700 to 820.

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.