

Flood Risk Management Strategy

Shetland Local Plan District

This section provides supplementary information on the characteristics and impacts of river, coastal and surface water flooding. Future impacts due to climate change, the potential for natural flood management and links to river basin management are also described within these chapters.

Detailed information about the objectives and actions to manage flooding are provided in Section 2.

Section 3: Supporting information

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3.1 Introduction

In the Shetland Local Plan District, river, coastal and surface water flooding are all reported at the scale of 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			
Shetland Islands river catchment	10	£55,000	Shetland Islands Council
Coastal flooding			
Shetland Islands coastal area	50	£350,000	Shetland Islands Council
Surface water flooding			
Shetland Islands Local Plan District	20	£30,000	Shetland Islands Council

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

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

3.2 River flooding

Shetland Local Plan District

This chapter provides supplementary information on river flooding at the catchment level. It provides an overview of the catchment's natural characteristics, flood risk and the existing actions to manage flooding. It outlines the likely impact of climate change and the potential for natural flood management.

Detailed information about the objectives and actions to manage flooding are provided in Section 2.

Catchment overview

Much of the Shetland Islands (Figure 1) comprise low rolling hills typically with grass slopes coupled with flatter low lying often boggy land. The soils on the Shetland Islands tend to be shallow and stony, low in fertility and with thick organic surfaces. Woodland is rare, with approximately 90% of the agricultural land being used for rough grazing.

The Shetland Islands have a moderate marine climate with long mild winters and short cool summers. The annual average rainfall for the Shetland Islands is around 1,000mm with November and December tending to be the wettest months.

There are no major rivers on the Shetland Islands. However, there are numerous small burns and lochs scattered throughout the catchment area. Generally, the burns are relatively small and short and drain the higher ground into lochs or the sea. Their catchments tend to be small and flashy in nature. The majority of the burns and lochs have not been heavily modified and are natural. In the agricultural areas some burns have been straightened to act as field drainage.

There is a tendency for periods of heavy rainfall to mobilise landslides on steep slopes particularly where bog and peat are located. This can block roads, and river channels leading to localised flooding.

There are three Potentially Vulnerable Areas:

- Shetland Mainland North (04/01)
- Shetland Mainland West (04/02)
- Shetland Mainland Central and Southern (04/03).

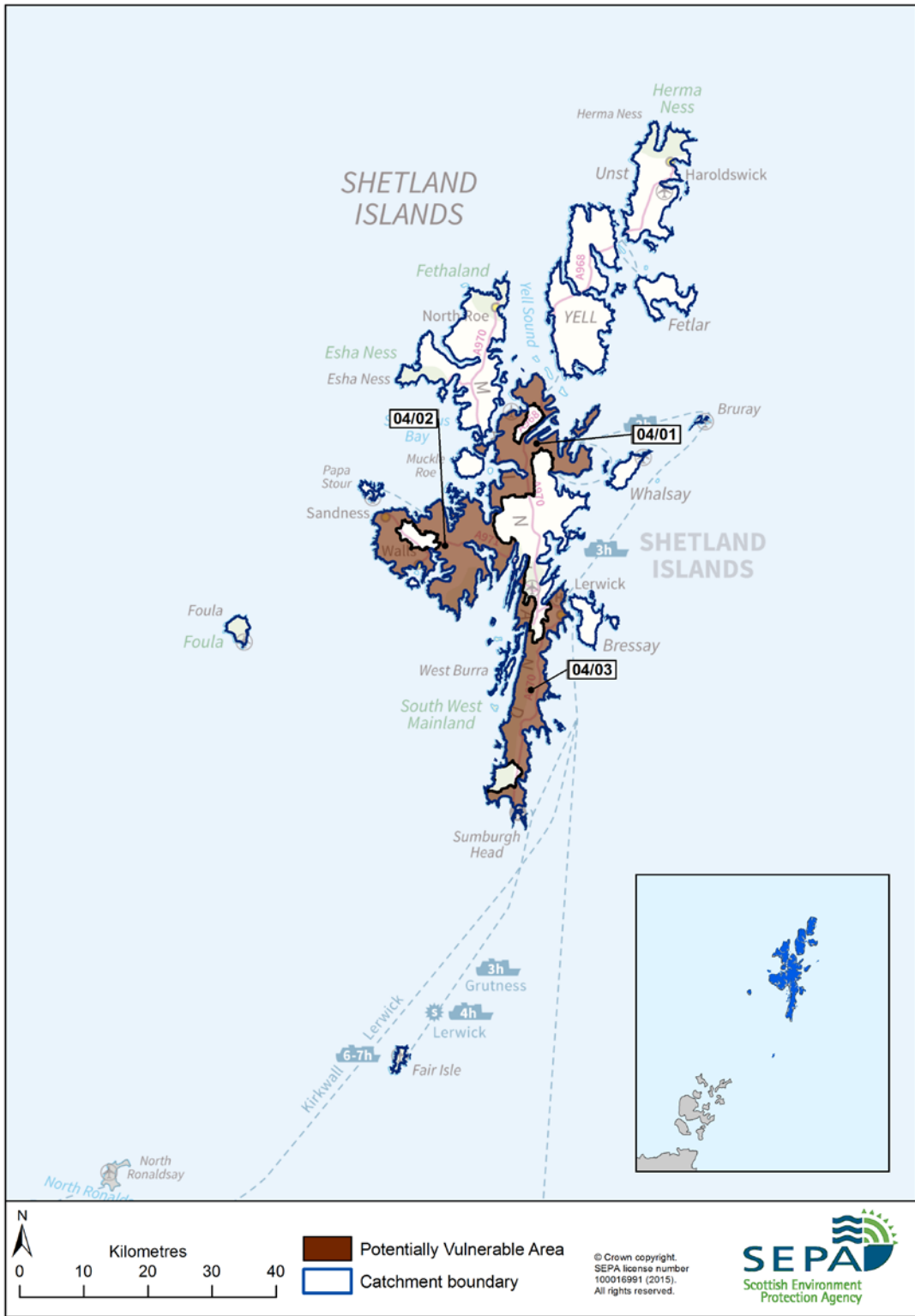


Figure 1: Shetland Islands river catchments area and Potentially Vulnerable Areas

Flood risk in the catchment

Main areas at risk

There are fewer than 10 residential properties and fewer than 10 non-residential properties at risk of river flooding. All of the residential properties and half of the non-residential properties at risk are located within the Potentially Vulnerable Areas.

The residential properties at risk of river flooding are located in Lerwick and Walls on Shetland Mainland. There is also a history of river flooding from the Burn of Laxdale and Burn of Mail at Cunningsburgh which is not fully represented in the national flood maps due to their small catchment sizes.

Economic activity and infrastructure at risk

The Annual Average Damages from river flooding are approximately £55,000. This accounts for approximately 13% of the total damages from flooding for the Local Plan District. The damages are distributed as follows:

- 37% roads (£20,000)
- 29% residential properties (£16,000)
- 25% agriculture (£14,000)
- 5% non-residential properties (£2,800)
- 3% emergency services (£1,800)
- <1% vehicles (£170).

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

There are approximately 110 road locations at risk of river flooding. The main routes affected include the A968, A970 and the A971.

Designated environmental and cultural heritage sites at risk

There are an estimated 10 cultural heritage sites at risk of river flooding. All of these sites are scheduled monuments.

Approximately 9km² of designated environmental area is at risk of river flooding across the islands. The sites affected include Special Areas of Conservation, Special Protection Areas and Sites of Special Scientific Interest. Examples include sites at Fetlar, Sullom Voe, Hermaness and the Lochs of Spiggie and Brow.

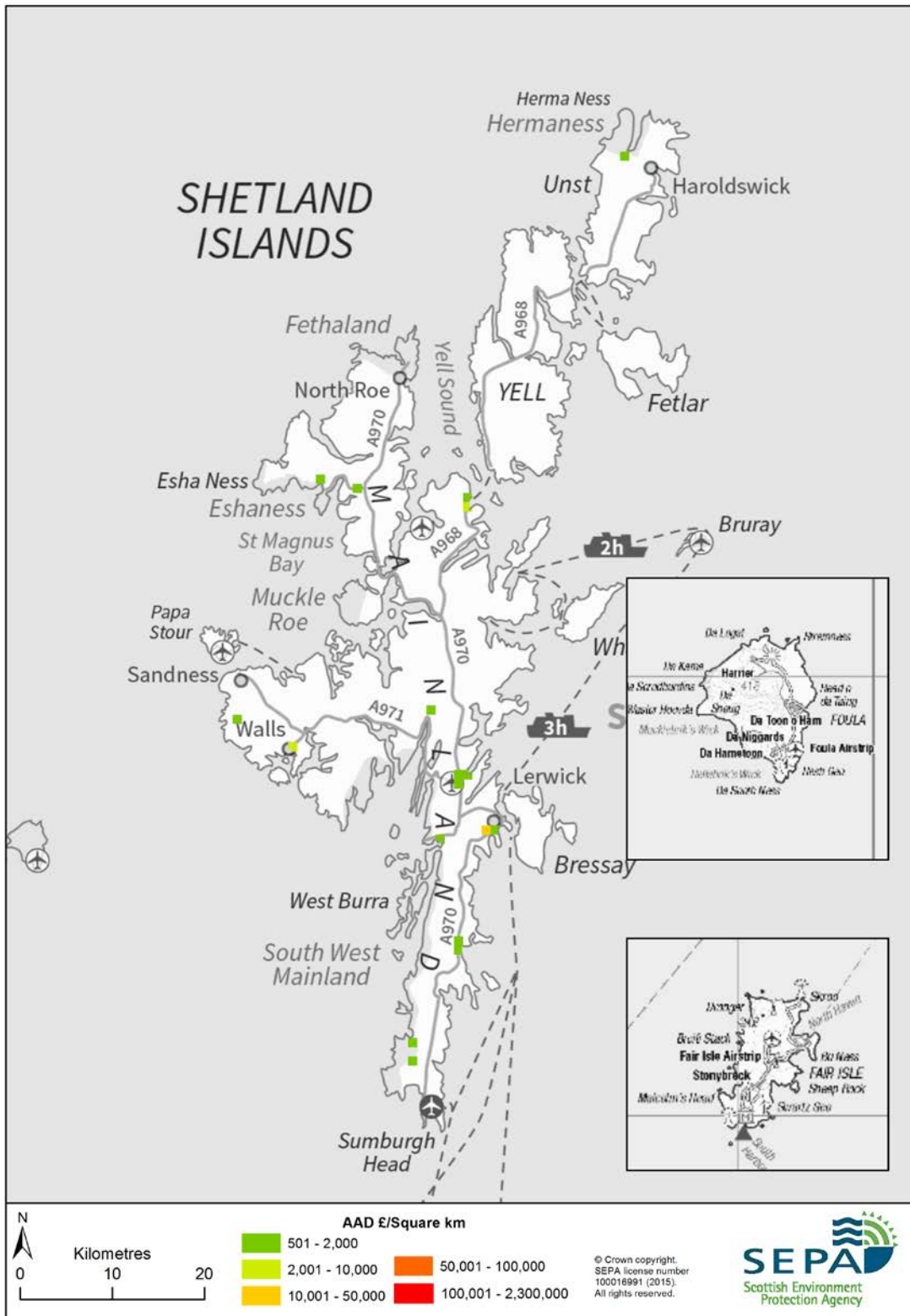


Figure 2: Annual Average Damages from river flooding

History of river flooding

There have been a number of localised floods from burns, including flooding from the Burn of Laxdale and the Burn of Mail at Cunningsburgh, and the Gallow Burn at Muirfield, Brae.

Managing flood risk

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

Existing actions that are in place to manage flood risk in this coastal area are described in Section 2.

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 Shetland may increase by 41%¹. Under these conditions it is estimated that the number of residential and non-residential properties at risk of river flooding does not change significantly.

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

Whilst the majority of the islands show potential for runoff reduction, no locations were identified where runoff reduction could practically contribute to significantly reduce river flooding in the Potentially Vulnerable Areas. Opportunities may exist however to make use of natural flood management techniques to assist with localise flooding issues. In particular, measures for reducing runoff may assist in reducing the occurrence of rainfall induced landslips.

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

As river catchments in the Shetland Islands tend to be small and steep, no areas have been identified where improved floodplain storage measures can have a direct impact on flood risk in the Potentially Vulnerable Areas.

Sediment management

There is no analysis of the potential for sediment management in Shetland due to the small size of the catchments.

3.3 Coastal flooding

Shetland 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 Section 2.

Coastal overview

The Shetland coastline has a length of around 2,700km and is predominantly rocky in nature with many inlets, voes, and bays. The sea is a dominant feature in Shetland and the majority of the towns and villages are located close to the coastline.

Beaches in Shetland tend to be pocket type beaches constrained by hard coastlines at either end. For the majority of beaches sediment losses exceed sediment supply, which coupled with the impacts of storms, results in the long term erosion of the beach. On the exposed coastlines, wave heights can be extreme due to the deep water close to shore.

High sea water levels can also contribute to flooding from coastal burns, culverts and drainage pipes due to water being unable to discharge to the sea efficiently. This problem is expected to become more common in future due to the rise in sea level relative to the land. Wave action can also lead to blocking of culverts and the outlets of burns with beach sediment causing localised flooding.

There are three Potentially Vulnerable Areas (Figure 1):

- Shetland Mainland North (04/01)
- Shetland Mainland West (04/02)
- Shetland Mainland Central and South (04/03).

Flood risk

Within the Shetland coastal area there are approximately 30 residential properties and 30 non-residential properties at risk of coastal flooding. Approximately 45% of these properties are located within Potentially Vulnerable Areas.

Main areas at risk of coastal flooding

There is coastal flood risk at Papil Aith and Boustaq on the Mainland, Cullivoe, Sellafirth and Fluke's Hole on Yell, Uyeasound and Ordale on Unst, and Creadyknowe on Whalsay. Coastal flooding is also reported to affect other locations including Scalloway.

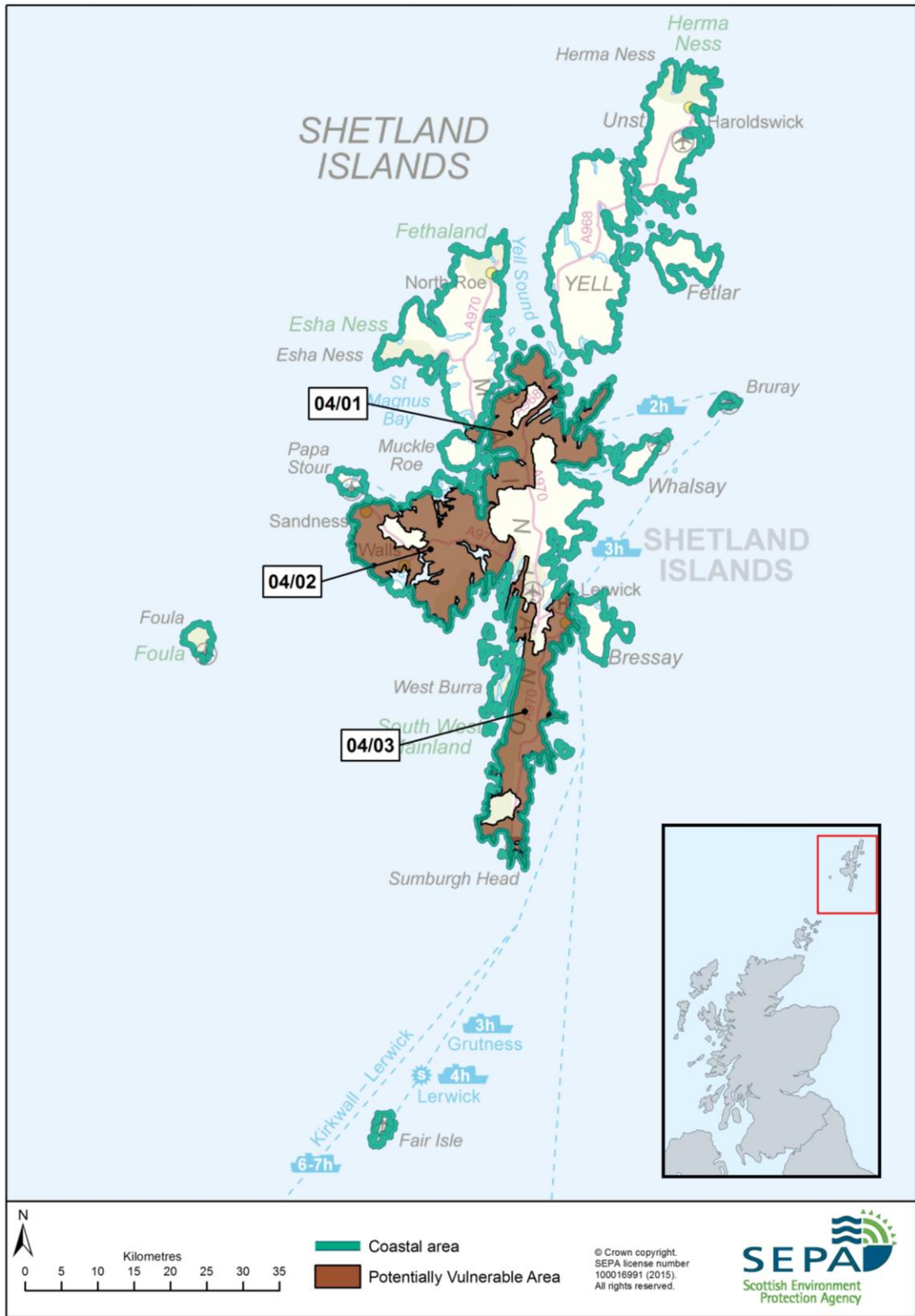


Figure 1: The Shetland Islands coastal area and Potentially Vulnerable Areas

Economic activity and infrastructure at risk

The Annual Average Damages from coastal flooding are estimated to be approximately £350,000. This accounts for 80% of flooding damages, from all sources, across the whole of the Shetland Islands. The damages are distributed as follows:

- 32% roads (£110,000)
- 29% residential properties (£100,000)
- 28% non-residential properties (£98,000)
- 6% emergency services (£21,000)
- 2% agriculture (£8,000)
- 2% vehicles (£7,600).

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

There are 92 road locations and approximately 5km² of agricultural land at risk of coastal flooding.

Designated environmental and cultural heritage sites at risk

There are 66 designated cultural heritage sites at risk of coastal flooding in the Shetland coastal area. These sites include scheduled monuments, gardens and designed landscapes and listed buildings.

Approximately 7km² of environmental designated area is at risk of coastal flooding. The areas affected include those at Fetlar, Mousa, Sullom Voe, Lochs of Spiggie and Brow, and Papa Stour.

History of flooding

As an island with much of its development around the coastline, Shetland regularly experiences coastal flooding from high tides, storm surges and wave action. The earliest recorded coastal flood of note was in 1900 when the harbour and Clickimin areas of Lerwick flooded. Extensive coastal flooding was noted during the North Sea storm surge of 1953 and there are recorded flood events through each of the more recent decades, with flooding in 2003 and 2004 affecting some coastal properties.

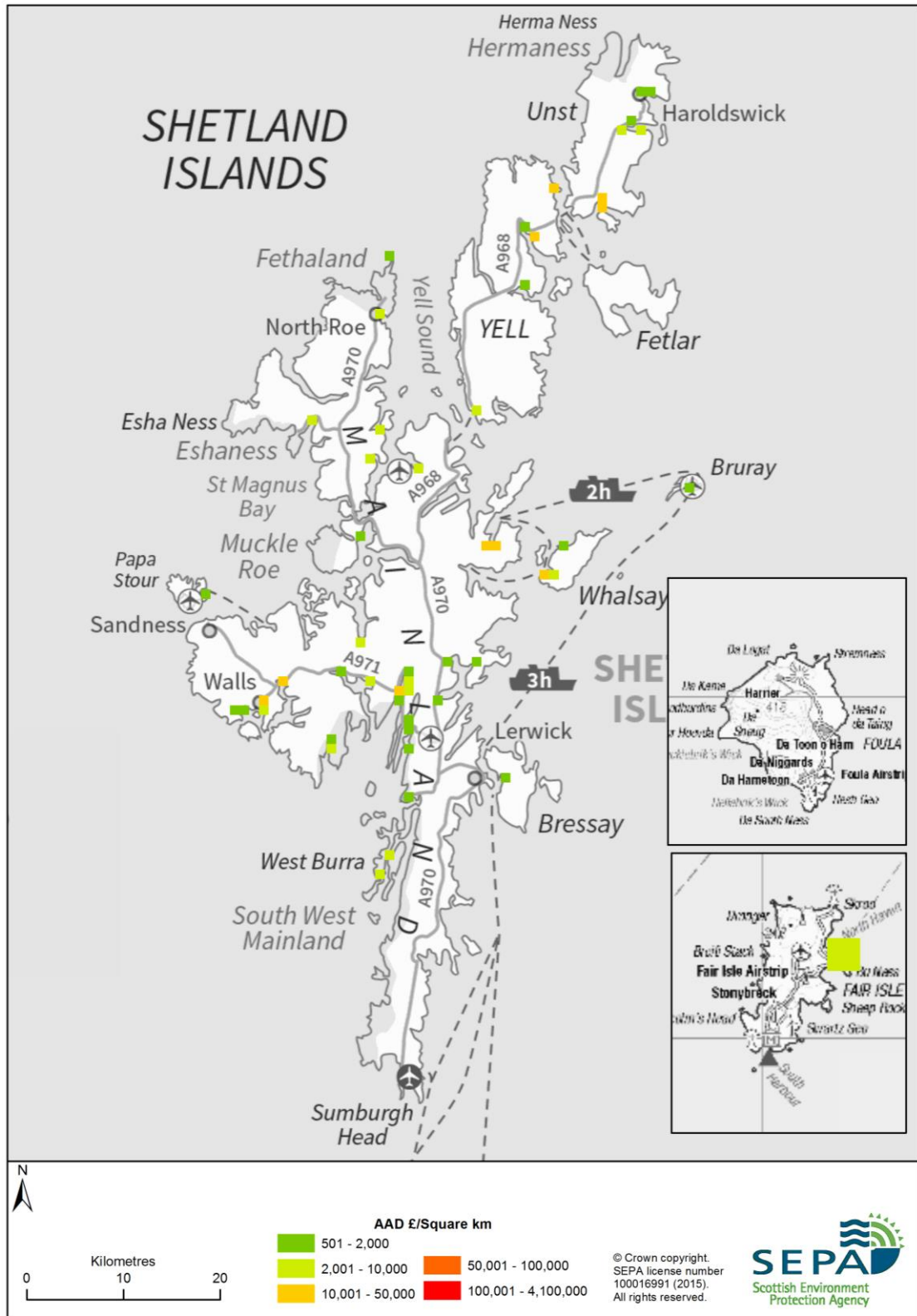


Figure 2: Annual Average Damages from coastal flooding

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.

Existing actions that are in place to manage flood risk in this coastal area are described in Section 2.

Climate change and future flood risk

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

For the UKCP09 high emissions scenario, the predicted average sea level increase for Shetland is 0.6m by 2080. This may increase the number of residential properties at risk of coastal flooding from approximately 30 to 50 and the number of non-residential from approximately 30 to 50. Coastal flood modelling by SEPA has not taken into account the impacts of a future climate on wave overtopping or storminess, which could increase the number of people affected by coastal flooding.

The predicted increases in flood risk are solely based on the impact of a changing climate on the magnitude of flooding; they do not take into account any potential increase due to population change, development pressures or urban creep, nor do they take into account any mitigation as a result of actions contained in this or future Flood Risk Management Strategies.

Potential for natural flood management

The assessment of the potential for natural flood management is shown on SEPA's flood maps (<http://www.sepa.org.uk/environment/water/flooding/flood-maps/>). The maps indicate the potential for wave attenuation and estuarine surge attenuation. They show areas where natural flood management could be effective and where further detailed assessment should take place.

This information was used to identify where local authorities could include natural flood management as part of flood risk management schemes and studies. The proposed schemes and studies are listed in the relevant Potentially Vulnerable Area chapters of this document.

Estuarine surge

No assessment of estuarine surge attenuation was undertaken for Shetland.

Wave energy

There are a number of short sections of coastline where there is potential for wave energy dissipation to reduce flood risk.

3.4 Surface water flooding

Shetland Local Plan District

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

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

Flood risk

Main areas at risk

Within the Shetland Local Plan District, there are estimated to be fewer than ten residential properties and approximately 20 non-residential properties at risk of surface water flooding. The main areas of surface water flood risk are in Lerwick and Levenwick. All of the residential properties and two-thirds of non-residential properties at risk are located within the Central and South Mainland Potentially Vulnerable Area (04/03).

Economic activity and infrastructure at risk

Annual Average Damages from surface water flooding are approximately £30,000. This accounts for around 7% of the total damages from flooding for the Local Plan District. The damages are distributed as follows:

- 89% non-residential properties (£27,000)
- 11% residential properties (£3,300)

Figure 1 shows the location of Annual Average Damages from surface water flooding across the Local Plan District.

An estimated 110 road locations and a small area of Sumburgh airport's runway are at risk of surface water flooding.

Designated environmental and cultural heritage sites at risk

Approximately 40 cultural heritage sites are at risk of surface water flooding. These include scheduled monuments and gardens and designed landscapes.

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

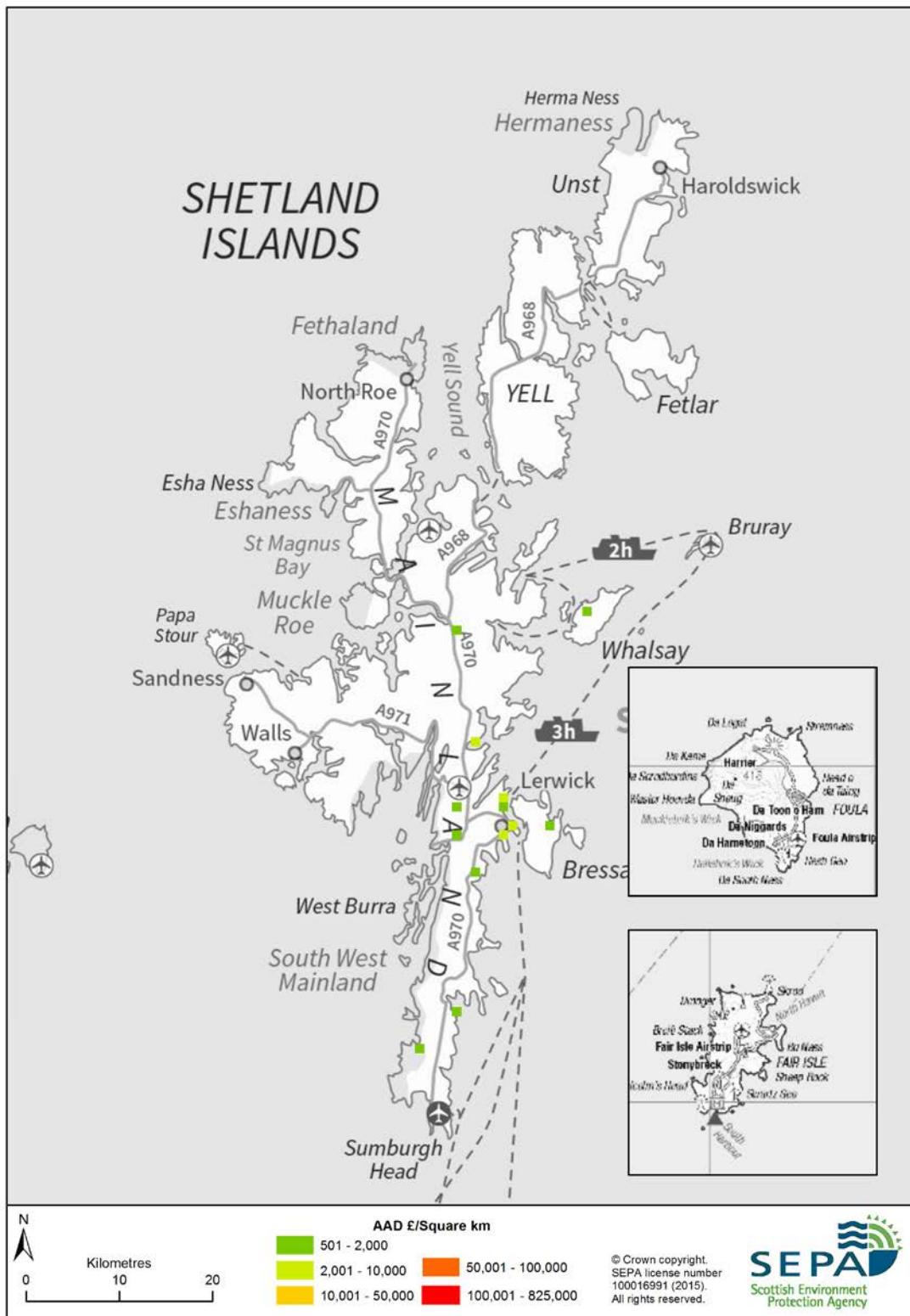


Figure 1: Annual Average Damages from surface water flooding

History of flooding

There have been a number of localised floods, including in Scalloway and Mossbank, where residential and non-residential properties have been affected.

There is a tendency for periods of heavy rainfall to cause landslides on steep slopes, particularly where bog and peat are located. The road between Lerwick and the airport at Sumburgh has been affected in the past by peat slides during periods of very intense rainfall. Residential and non-residential property has also been affected by flooding where material from peat slides has obstructed the flow in burns.

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

Climate change and future flood risk

UK Climate Projections (UKCP09) predicts that climate change may lead to warmer and drier summers, warmer and wetter winters with less snow, and more extreme temperature and rainfall. The surface water modelling undertaken considered climate change scenarios with a 20% increase in rainfall intensity.

Under these conditions it is estimated that the number of residential and non-residential properties at risk of surface water flooding does not change significantly.