Environment Agency

South Devon Catchment Flood Management Plan

Summary Report June 2012

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Introduction

I am pleased to introduce our summary of the South Devon Catchment Flood Management Plan (CFMP). This CFMP gives an overview of the flood risk in the South Devon catchment and sets out our preferred plan for sustainable flood risk management over the next 50 to 100 years.

The South Devon CFMP is one of 77 CFMPs for England and Wales. Through the CFMPs, we have assessed inland flood risk across all of England and Wales for the first time. The CFMP considers all types of inland flooding, from rivers, ground water, surface water and tidal flooding, but not flooding directly from the sea (coastal flooding), which is covered by Shoreline Management Plans (SMPs). Our coverage of surface and ground water is however limited due to a lack of available information.

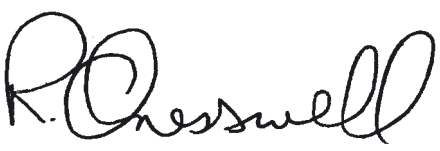
The role of CFMPs is to establish flood risk management policies which will deliver sustainable flood risk management for the long term. This is essential if we are to make the right investment decisions for the future and to help prepare ourselves effectively for the impact of climate change. We will use CFMPs to help us target our limited resources where the risks are greatest.

This CFMP identifies flood risk management policies to assist all key decision makers in the catchment. It was produced through a wide consultation and appraisal process, however it is only the first step towards an integrated approach to Flood Risk Management. As we all work together to achieve our objectives, we must monitor and listen to each others progress, discuss what has been achieved and consider where we may need to review parts of the CFMP.

There are many sources of flood risk within the South Devon catchment. The main risk of flooding is from rivers and is largely due to insufficient channel capacity and problems associated with culverts. Risks to people, property and infrastructure are concentrated mainly in Newton Abbot, Kingsteignton, Bovey Tracey, Buckfastleigh, Ashburton, Totnes, Ivybridge and Torbay. Surface water flooding is also a significant source of flood risk. There was widespread flooding across South Devon in 1979 and 2000.

We cannot reduce flood risk on our own, we will therefore work closely with all our partners to improve the co-ordination of flood risk activities and agree the most effective way to manage flood risk in the future. We have worked with others including: Devon County Council, Natural England, South West Water and the National Farmers Union to develop this plan.

This is a summary of the main CFMP document, if you need to see the full document an electronic version can be obtained by emailing enquiries@environment-agency.gov.uk or alternatively paper copies can be viewed at any of our offices in South West Region.



Richard Cresswell
South West Regional Director

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The purpose of a CFMP in managing flood risk

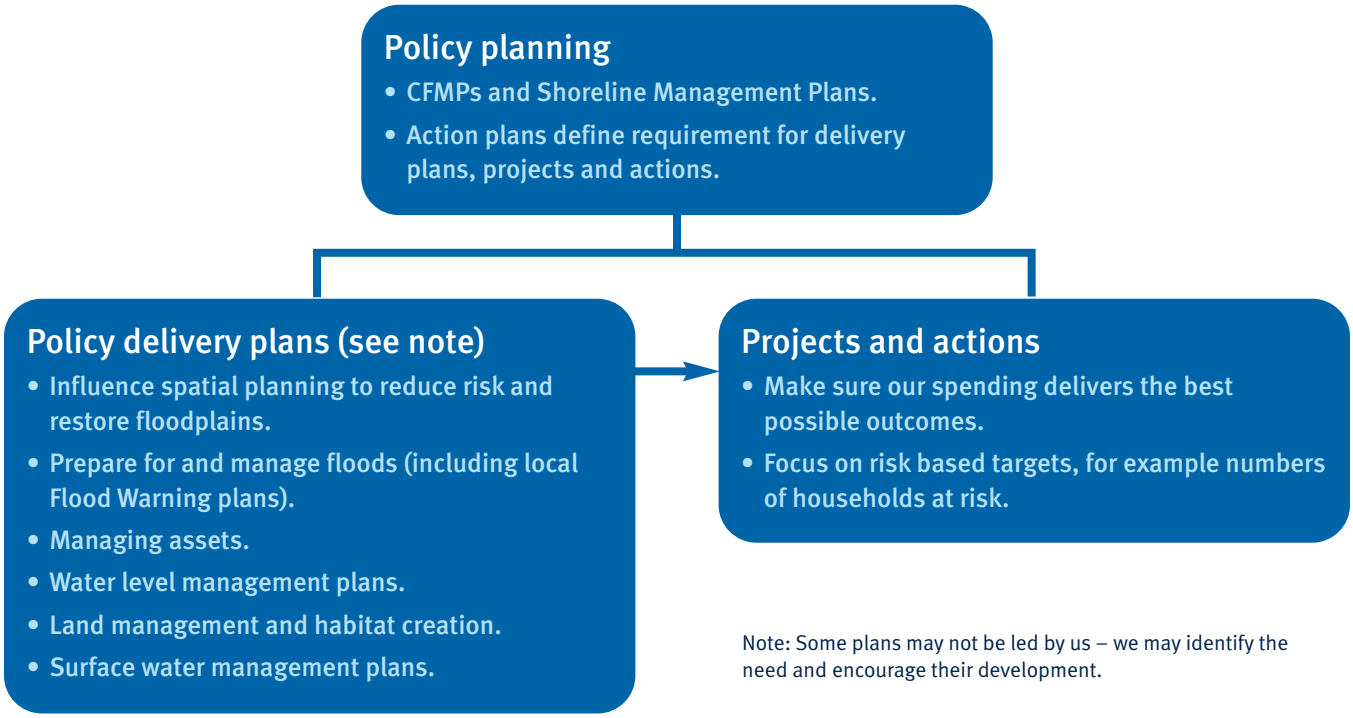
CFMPs help us to understand the scale and extent of flooding now and in the future, and set policies for managing flood risk within the catchment. CFMPs should be used to inform planning and decision making by key stakeholders such as:

- the Environment Agency, who will use the plan to guide decisions on investment in further plans, projects or actions;
- Regional Assemblies and local authorities who can use the plan to inform spatial planning activities and emergency planning;
- Internal Drainage Boards (IDB), water companies and other utilities to help plan their activities in the wider context of the catchment;
- transportation planners;
- land owners, farmers and land managers that manage and operate land for agriculture, conservation and amenity purposes;
- the public and businesses to enhance their understanding of flood risk and how it will be managed.

CFMPs aim to promote more sustainable approaches to managing flood risk. The policies identified in the CFMP will be delivered through a combination of different approaches. Together with our partners, we will implement these approaches through a range of delivery plans, projects and actions.

The relationship between the CFMP, delivery plans, strategies, projects and actions is shown in Figure 1.

Figure 1. The relationship between CFMPs, delivery plans, projects and actions



Note: Some plans may not be led by us – we may identify the need and encourage their development.

Catchment overview

The South Devon CFMP covers the catchments of the Rivers Teign, Dart, Erme and Avon, which flow east and south from Dartmoor into the estuaries and sea. It also includes several small watercourses draining the Torbay area. The area is environmentally rich, containing several important environmental sites and a very high quality river system.

The South Devon CFMP covers an areas of some 1,500 square kilometres (580 square miles).

The main physical characteristics of the catchments are steeply sloping watercourses rising in the Dartmoor National Park, that then flow into wider, more permeable valleys in the lower reaches. Annual rainfall ranges from more than 2,300mm (90in) in upland areas to less than 1,000mm (39in) on the coast. The England and Wales average is 920mm (36in).

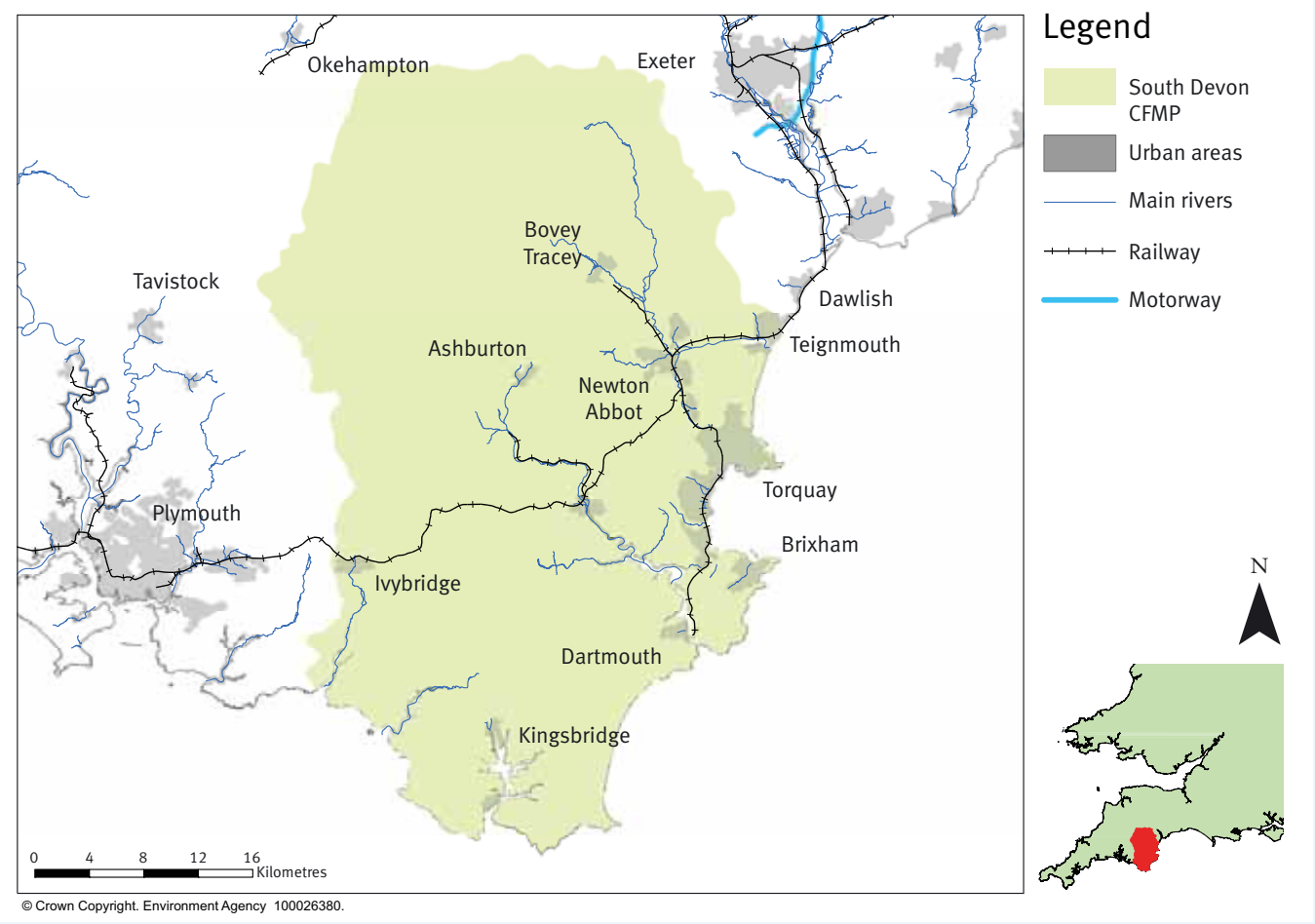
Geology is divided between Dartmoor's impermeable granite to the north and the mainly Devonian and Carboniferous deposits to the south. Impermeable rocks respond faster to rainfall and generate higher flood peaks than more permeable rocks. Water levels in the largely impermeable upper catchment rise fairly rapidly after rainfall. They reach their peak in a relatively short time – typically less than 12 hours – and fall quickly after the rain has stopped. Less severe gradients in the lower catchment mean that rivers there reach their flood peak in typically 12 to 24 hours.

There is a varied landscape across the area, including the uplands of Dartmoor National Park and extensive estuaries to the south. Much of the countryside is recognised for its environmental and cultural value including an Area of Outstanding Natural Beauty (AONB) and 470 Scheduled Monuments. There are many other ecologically, socially and historically important sites in the catchment and a network of good quality river courses, with four Special Areas of Conservation (SAC) and 74 Sites of Special Scientific Interest (SSSI).

Urban development (about 7% of the catchment) is mainly concentrated in the lower reaches of the River Teign (at Newton Abbot and Kingsteignton) and in the Torbay area. Around 90% of the catchment is agricultural.

Water levels in the largely impermeable upper catchment rise fairly rapidly after rainfall.

Map 1. Location and extent of the South Devon CFMP area



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↑ A family wade through floods at Teigngrace in November 2000 *Photo: Gareth Williams/Express and Echo*

Current and future flood risk

Overview of the current flood risk

There are many sources of flood risk within the South Devon catchment. The main risk of flooding is from rivers and is largely due to insufficient channel capacity and problems associated with culverts.

Several SSSIs, SACs, Scheduled Monuments and National Nature Reserves (NNRs) are at risk.

We spend more than £250,000 a year on flood risk management in South Devon and local authorities carry out further management. A warning system is in place for most urban areas, with the exception of Torbay, although there is sometimes less than two hours warning of an impending flood. There is no flood warning for many locations next to smaller watercourses.

What is at risk?

Some 8,200 properties are estimated to be at risk from the 1% annual probability flood, ignoring the effect of defences. This represents 5% of all property across the area.

Also at risk are Torre Abbey, the four conservation areas of Torbay, and the main rail line to Plymouth and Penzance. Other community assets at risk include various schools, health centres, a hospital and a waste water treatment works.

Environmental assets that are within the floodplain and could be affected by management activities include the River Lowman Valley Woods SSSI, Buckfastleigh Caves SSSI, the River Erme and the Salcombe and Kingsbridge Estuary SSSIs.

‘The River Dart rose higher on Monday night than ever known during summer months. A flood came down from the Dartmoor hills with unusual rapidity. Water rose above 12 feet on the banks within a few minutes.’ 1848

Map 2. Flood risk to property in a 1% annual probability river flood, ignoring current flood defences

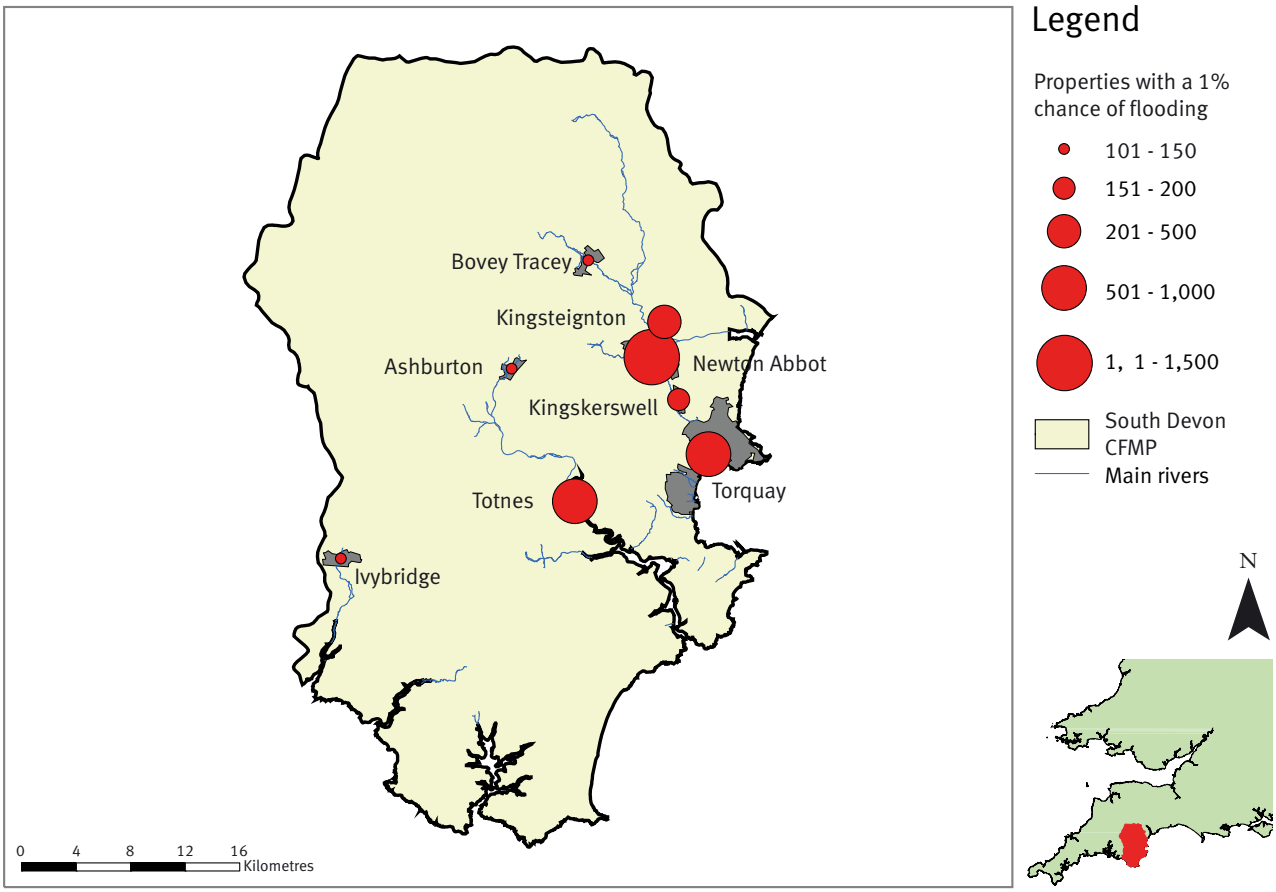

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Table 1. Locations of towns and villages with 100 or more properties at risk in a 1% annual probability river flood

Number of properties at risk	Locations
1,000 to 2,000	Newton Abbot
500 to 1,000	Torbay, Totnes
250 to 500	Kingsteignton
100 to 250	Kingskerswell, Ivybridge, Ashburton, Bovey Tracey

Table 2. Critical infrastructure at risk:

25 electricity substations, 6 railway lines, 6 A roads, 1 hospital, 5 emergency services, 2 water treatment works

Where is the risk?

The distribution of potential flood risk from rivers and tides is illustrated in Map 2 for a flood with a 1% annual probability (0.5% for tides) of occurring or being exceeded.

The greatest concentration of properties at risk of flooding is at Newton Abbot and Kingsteignton. Here some 1,650 properties are at risk from river and tidal flooding. This is set to increase due to rising sea levels.

Torbay and Totnes then have the next highest concentrations in property at risk with some 670 and 610 properties at risk respectively.

In addition to these locations, there are risks of surface water flooding, which can be deep and fast flowing, across much of the catchment. However, further studies following on from the CFMP are needed by us and our partners to quantify this potential risk.

How we currently manage the risk

- Flood risk mapping – A major part of the programme is Flood Zone Improvements and Hazard Mapping. This is focused on improving the mapping at high-risk locations.
- Managing development – Our development control team supports the planning process by ensuring that new developments have the appropriate flood risk assessments and follow PPS25 (Government Planning Policy Statement on Development and Flood Risk).
- Flood warning – In some areas there is currently no service provided, in other areas such as Buckfastleigh and Harbertonford there is less than two hours warning provided. Elsewhere in the catchment, registered properties receive a direct message via phone, email or fax. Major Incident Plans have been developed for Newton Abbot, Kingsteignton, Totnes, Teignmouth, Shaldon and Dartmouth.
- Flood defence schemes – We have flood defence schemes to alleviate river flooding at Ashburton, Bovey Tracey, Buckfastleigh, Harbertonford, Kingsteignton and Newton Abbot, and tidal defences at Teignmouth and combined tidal and river defences at Totnes. In addition there are a range of local authority defences in the catchment.
- Maintenance – We maintain channels and defences, with local authorities carrying out a large amount of further work.

← Cars in Newton Abbot are winched from the River Lemon's floodwaters in December 1979

The impact of climate change and future flood risk

It is widely accepted that our climate is changing and increasing peak river flows and sea levels will have a significant effect on flood risk. Land use and management changes in the catchment will also affect the frequency and magnitude of flooding. We have combined these factors with different levels of flood risk management to forecast flood risk over the next 100 years.

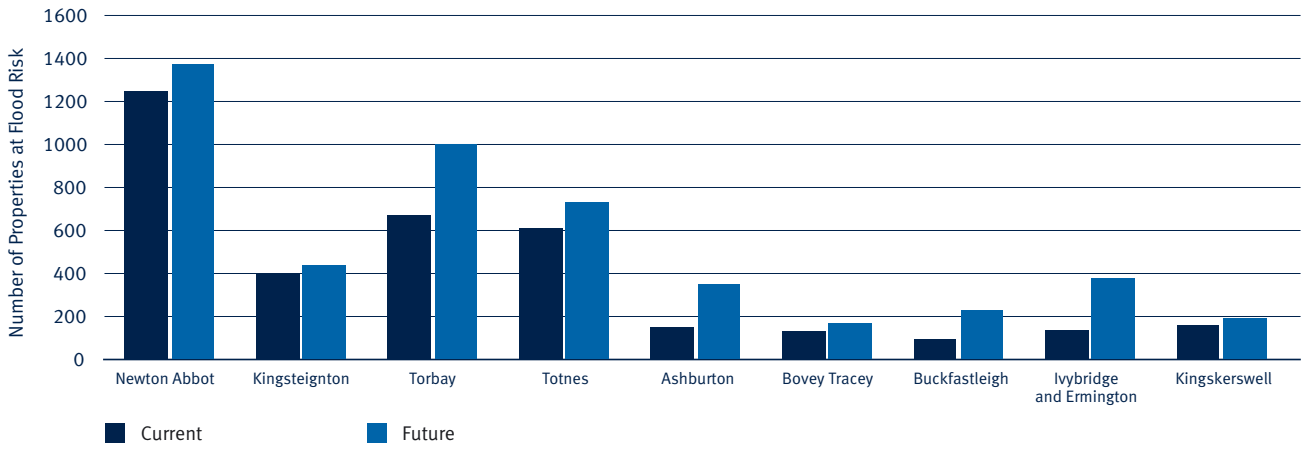
Climate change is likely to be the main factor influencing future increases in flood risk in most places. For the South Devon CFMP the future scenario use was as follows:

- 30% increase in peak flows and 500mm sea level rise due to climate change.
- additional 20 square kilometres of development in urban areas.
- additional 5 square kilometres of development in rural areas.
- 5% increase in peak flows due to land use and land management.

The sensitivity testing undertaken for the catchment has shown that, in addition to climate change, changes in agricultural land use and land management will have a significant impact on peak flows. Urban development is unlikely to have a large impact.

Newton Abbot and Torbay would see most properties affected in the future (see Figure 2).

Figure 2. Current and future (2100) flood risk to property from a 1% annual probability river flood, ignoring current flood defences



Future direction for flood risk management

Approaches in each sub-area

We have divided the South Devon catchment into nine distinct sub-areas which have similar physical characteristics, sources of flooding and level of risk. We have identified the most appropriate approach to managing flood risk for each of the sub-areas and allocated one of six generic flood risk management policies, shown in Table 2.

To select the most appropriate policy, the plan has considered how social, economic and environmental objectives are affected by flood risk management activities under each policy option.

↑ A flooded quay at Dartmouth in April 1985

Map 3. South Devon sub-areas

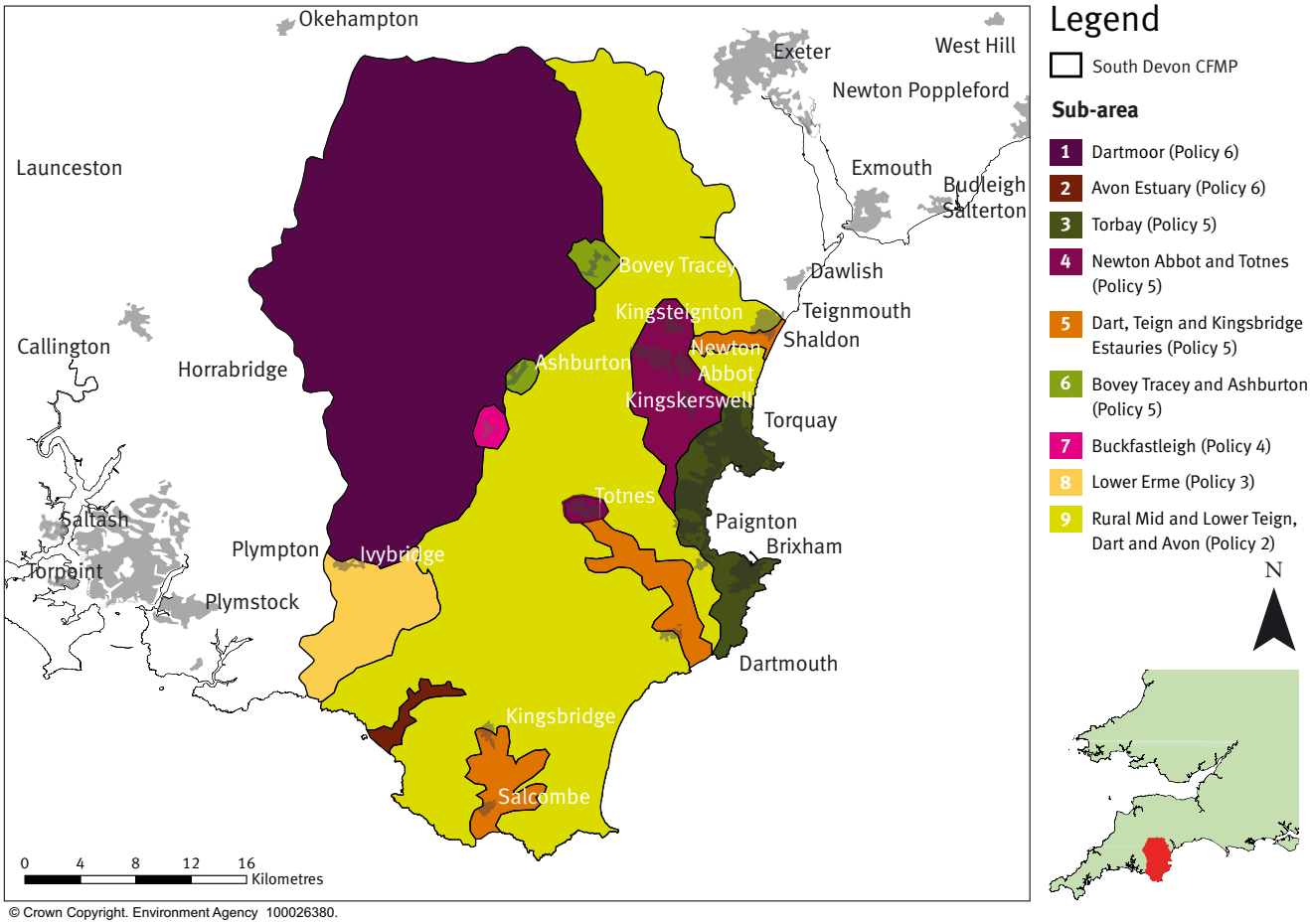


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Table 3. Policy options

Policy 1

Areas of little or no flood risk where we will continue to monitor and advise

This policy will tend to be applied in those areas where there are very few properties at risk of flooding. It reflects a commitment to work with the natural flood processes as far as possible.

Policy 2

Areas of low to moderate flood risk where we can generally reduce existing flood risk management actions

This policy will tend to be applied where the overall level of risk to people and property is low to moderate. It may no longer be value for money to focus on continuing current levels of maintenance of existing defences if we can use resources to reduce risk where there are more people at higher risk. We would therefore review the flood risk management actions being taken so that they are proportionate to the level of risk.

Policy 3

Areas of low to moderate flood risk where we are generally managing existing flood risk effectively

This policy will tend to be applied where the risks are currently appropriately managed and where the risk of flooding is not expected to increase significantly in the future. However, we keep our approach under review, looking for improvements and responding to new challenges or information as they emerge. We may review our approach to managing flood defences and other flood risk management actions, to ensure that we are managing efficiently and taking the best approach to managing flood risk in the longer term.

Policy 4

Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change

This policy will tend to be applied where the risks are currently deemed to be appropriately-managed, but where the risk of flooding is expected to significantly rise in the future. In this case we would need to do more in the future to contain what would otherwise be increasing risk. Taking further action to reduce risk will require further appraisal to assess whether there are socially and environmentally sustainable, technically viable and economically justified options.

Policy 5

Areas of moderate to high flood risk where we can generally take further action to reduce flood risk

This policy will tend to be applied to those areas where the case for further action to reduce flood risk is most compelling, for example where there are many people at high risk, or where changes in the environment have already increased risk. Taking further action to reduce risk will require additional appraisal to assess whether there are socially and environmentally sustainable, technically viable and economically justified options.

Policy 6

Areas of low to moderate flood risk where we will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits

This policy will tend to be applied where there may be opportunities in some locations to reduce flood risk locally or more widely in a catchment by storing water or managing run-off. The policy has been applied to an area (where the potential to apply the policy exists), but would only be implemented in specific locations within the area, after more detailed appraisal and consultation.

Dartmoor

Our key partners are:

- Dartmoor National Park
- Natural England
- National Farmers Union (NFU)
- Country Landowners Association
- Land owners and farmers

The issues in this sub-area

The area of the Dartmoor National Park located within the CFMP includes the sources of the Teign, Dart, Avon and Erme rivers. There are no major towns in this area, infrastructure is limited (with no defence structures) and there are negligible economic losses from flooding.

There are approximately 60 properties at risk from a 1% annual probability flood event and this may increase to approximately 150 properties in the future 1% annual probability flood event.

The study's assessment shows that a reduction in flows from upper catchments could result in a reduction in flood risk at downstream urban areas where risks to people and the economy are currently high (and expected to increase in the future).

A number of designated environmental sites experience flooding, but natural river processes and sensitive flood risk management generally benefit these sites. These sites include Dartmoor SAC and South Dartmoor Woods SAC. There are opportunities to maximise the natural hydrological processes for the benefit of Biodiversity Action Plan habitats and species. This presents an opportunity to create and manage ecologically functional wetlands in which the natural processes of peatland erosion/accretion, soil conservation, and water storage/dissipation are optimised. Consultation with local farmers and the NFU will be of key importance, with agreement needed to be reached with all interested parties before any land can be used for additional flooding.

The vision and preferred policy

Policy Option 6 - we will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits.

This supports all the environmental objectives apart from possibly the historic environment objective. However, without a more detailed assessment of the impacts on the historic environment it is not possible to determine the impacts on these features. Consultation with the Dartmoor National Park Authority, English Heritage and Natural England will therefore be essential to the progression of this policy.

Whilst the policy involves a strategic increase in flooding in allocated areas, it is not intended to adversely affect the risk to individual communities and we will not put these communities at increased risk. Depending on actions taken, the risk to these communities may in fact reduce.

We will continue with our current maintenance activities where there are significant numbers of people and properties at risk. Any new developments in the area will still be expected to comply with PPS25 and take into account this plan's policy for the area.

Proposed actions to implement the preferred policy

- We will develop a land management plan that identifies locations that would benefit from increased flooding, increased water levels. This will support existing studies such as the Mire restoration project, culm restoration, Action for Wildlife, and Dartmoor High Moorland Vision 2030.
- We will work with the agricultural industry to seek opportunities where a change in land management practices could reduce flood risk and improve water quality and habitats.
- We will work with partners to identify and reduce the impact of flood risk management practices on the historic environment including areas of palaeoenvironmental potential.

To support the policy, land use planners should designate all floodplain and wetland areas as functional floodplain to support their role in attenuating floodwaters and reducing risks downstream.

Avon Estuary

Our key partners are:

- South Hams District Council
- Department for Environment, Food and Rural Affairs (Defra)
- Natural England
- Landowners
- Local farmers
- National Farmers Union (NFU)

The issues in this sub-area

The Avon Estuary sub-area extends from the coast inland to Aveton Gifford, which is situated at the upper tidal limit of the Avon Estuary.

A small private tidal defence scheme protects one property and fields from a 1% annual probability flood. However, approximately 10 properties are still at risk from a 1% flood. There is only about one hours flood warning to Aveton Gifford for flooding from the River Avon.

Future flood risk will mainly be caused by climate change (increased rainfall, peak flows and sea level rise). Approximately 20 properties may be at risk by 2100.

The vision and preferred policy

Policy Option 6 - we will take action with others to store water manage run-off in locations that provide overall flood risk reduction or environmental benefits.

As only a small number of properties are at risk and the associated economic damages in this rural area are minor, we consider policies to maintain or increase flood risk management actions are inappropriate.

This supports environmental objectives and does not have significant negative implications for economic and social objectives. The policy will support intertidal Biodiversity Action Plan habitats to be created and help restore links with the floodplain.

The policy will involve identifying specific areas where additional flooding may be appropriate, and agreement will need to be reached with all interested parties (such as local farmers). This is likely to involve looking at any impact on farming business and possible mechanisms for compensation.

As the area is rural there are few people and properties at risk, an overall increase in flooding in this area is acceptable, assuming the risk to individual properties in Aveton Gifford is not increased. A more detailed study may be needed to make sure that the chosen policy does not significantly increase risk in the village.

Proposed actions to implement the preferred policy

- We will look at ways of reconnecting the river/estuary to its natural floodplain to utilise flood storage, reduce risk to people and enhance habitats.
- We will look at ways of improving the flood warning service in Aveton Gifford.

To support the policy, land use planners should designate all floodplain and wetland areas as functional floodplain to support their role in attenuating floodwaters and providing Biodiversity Action Plan habitat.

↑ The tidal road to the south of Aveton Gifford

Torbay

Our key partners are:

Torbay Council

South West Water

The issues in this sub-area

Torbay has small watercourses that flow eastwards through the urban area directly into the sea. Flood risk is from fluvial, tidal, sewer and surface water.

Approximately 700 properties in Torquay, Paignton and Brixham (and 1,000 across the whole area) are at risk from flooding in 1% fluvial and 0.5% tidal annual probability floods. Our review suggests that 120 properties are at risk from sewer flooding and at least 400 properties are affected by surface water run-off. Only 2% of our flooding records relate to groundwater flooding.

No modelling was carried out for Torbay so the assessment of flood risk to properties is based on our Flood Map. We have assumed that the current 0.1% flood outline will approximately represent the 1% flood outline by 2100. The number of properties at risk is expected to increase to well in excess of 1,000.

Schools and health centres are at risk of flooding. Main roads experience frequent flooding. Landfill sites at Clennon Valley and Paignton Zoo are at risk from flooding in extreme floods from minor watercourses. The Barton Tip leachate lagoon is prone to flooding from surface water into the headwaters of the Aller Brook.

There are numerous small schemes for fluvial, tidal, surface water and sewer flooding in Torquay, Paignton and Brixham, providing a range of protection.

Future flood risk will mainly be due to climate change and urban development. Torquay is identified as a likely site for future development in South Devon which would lead to increased surface run-off and pressure on sewerage systems. The number of properties at risk could increase due to these factors.

The vision and preferred policy

Policy Option 5 - we can generally take further action to reduce flood risk.

This is the only policy to meet all of the social and economic objectives. It will reduce the number of people and properties at risk and minimise disruption to transport links in all but the most extreme events. It supports the environmental objectives by increasing the standard of protection for Torre Abbey, four conservation areas, as well as improving water quality.

Proposed actions to implement the preferred policy

- System Asset Management plans and performance specifications will be produced for all our flood risk systems and major assets. These will assess flood risk maintenance with the aim to reduce flood risk in Torbay and will include environmental constraints and targets.
- Investigate causes of flooding, identify measures such as flood storage areas and implement recommendations to reduce current risks including from combined fluvial and tidal conditions.
- We will examine possible options for providing a flood warning service in Torbay.
- We will examine ways to work with the local planning authority to improve flood risk in the future and ensure that all development complies with PPS25.
- We will look at different options for opening up the floodplain through relocation strategies. We will also aim to secure, restore and keep an area free from development next to all watercourses in and around urban areas.
- Develop an Integrated Urban Drainage Strategy, with a review of watercourses and catchments, foul and surface water sewerage, and the impact of climate change.
- Improve the way that flooding records are collated from different sources.

↑ Flooding at the lower end of Union Street, Torquay

Newton Abbot and Totnes

Our key partners are:

- Devon County Council
- South Hams District Council
- Teignbridge District Council
- Natural England
- Teign Estuary Partnership

The issues in this sub-area

The urban area of Newton Abbot, including the town of Kingsteignton, is located at the confluence of the rivers Teign and Lemon and at the head of the Teign Estuary. It encompasses the Aller Brook catchment.

Development at Newton Abbot and Kingsteignton has extended into the floodplains and, without defences in place, approximately 1,800 properties would be at risk from a 1% annual probability flood. The River Lemon flood defence scheme gives some protection to 1,000 properties; the Kingsteignton flood defence scheme to a further 300 properties. A retention dam at Holbeam is designed to hold excess floodwaters in events up to the 1% flood.

There may be risks to health centres and schools. Although flows are not fast, they can be deep, causing a risk to public safety. The Paddington-Penzance railway line is at risk of flooding from the Aller Brook.

Totnes is located at the head of the Dart Estuary. Previous development in the town has taken place within the floodplain. A flood alleviation scheme constructed in 1982 was designed to protect approximately 500 properties from a 3.3% annual probability combined fluvial and tidal flood and from a 0.5% tidal flood. However, a more recent study has found that the standard of protection varies between 1.3% and 10%.

There is still a risk of flooding from more severe flood events. Approximately 600 properties are at risk from a 1% flood and over 700 properties from a 0.1% flood. A hospital, four health centres and a waste water treatment works immediately upstream of the town are also at risk from combined fluvial and tidal flooding. In addition to fluvial/tidal flood risks, there are also surface water flooding problems in Totnes.

Future flood risk will be caused mainly by climate change (increased rainfall, peak flows and sea level rise). Economic damages, disruption to communications and the threat to public health and safety are expected to increase significantly with climate change, especially in Totnes. Flows in the Aller Brook are particularly sensitive to urbanisation and the whole area may be the focus for future development in South Devon. Future flood risk changes in the Teign catchment will be caused, to a lesser extent, by land use and management.

In the future 1% annual probability flood 1,375 properties in Newton Abbot are expected to be at risk, while 730 properties in Totnes are expected to be at risk.

The vision and preferred policy

Policy Option 5 - we can generally take further action to reduce flood risk.

The policy and actions would reduce the number of properties in Newton Abbot that are at risk. The risk to infrastructure would be reduced, and a significant number of vulnerable people would be protected.

In Totnes, reducing educing the flood risk would benefit a scheduled monument and Totnes' conservation area and would reduce the number of properties in Newton Abbot that are at risk. It would also help to improve water quality within the River Dart. In particular the risk of flooding to the waste water treatment works upstream of Totnes could be reduced thus avoiding impacts on water quality and environmental and public health implications.

We believe the policy is an environmentally acceptable option. However, the existing debris clearance within the River Lemon Valley Woods SSSI is considered to be adversely affecting the site. This should not affect the policy and we will work with Natural England to find a solution.

Proposed actions to implement the preferred policy

- System Asset Management plans and performance specifications produced for all our flood risk systems and major assets. These will assess flood risk maintenance to reduce flood risk in the urban areas and include environmental constraints and targets. These will assess the standard of protection and structural integrity of defences in Newton Abbot.
- Continue to improve flood mapping of areas benefiting from defences for the River Lemon in the Newton Abbot area. Carry out modelling to identify locations at risk of flooding in Totnes; in particular any culverts and channels causing problems need to be identified. These assessments should include combined tidal and fluvial or surface water flooding.
- Look at options for reducing flooding including surface water flooding problems and options for flood routing away from properties and important infrastructure in Newton Abbot and relocating existing commercial properties in Totnes.
- Apply new flood risk mapping to the multi-agency flood warning response plan for Newton Abbot and Totnes. Review the flood warning service for the River Teign at Kingsteignton and encourage the production of community flood action plans. Develop a new flood warning area for the Aller Brook to provide flood warnings for Kingskerswell and Newton Abbot. Consider ways of improving the flood warning service for Totnes.
- Consider ways to compensate for 'coastal squeeze' throughout the South Devon CFMP area, and in particular in the Newton Abbot and Totnes areas. This should identify locations for habitat creation.

Dart, Teign and Kingsbridge Estuaries

Our key partners are:

South Hams District Council

Teignbridge District Council

Natural England

The issues in this sub-area

Risks to people and the economy from tidal and fluvial flooding are currently high and are sensitive to rising sea levels in the future. Numerous scattered settlements adjacent to the estuaries are at risk from flooding.

For the Teign Estuary there are approximately 850 properties within the current 1% annual probability flood extent (1% fluvial and 0.5% tidal). Approximately 1,300 properties in the Teign estuary are estimated to be within the future 1% annual probability flood extent. Also at risk are numerous health centres in Teignmouth and Shaldon, several schools in Shaldon, and the mainline railway between Newton Abbot and Teignmouth at several locations. There are combined fluvial/ tidal defences at Shaldon as well as tidal defences at Teignmouth (constructed in 1991). Teignmouth is also affected by wave action.

For the Kingsbridge Estuary approximately 350 properties and several health centres are within the current 1% annual probability flood extent, and 450 properties are within the current 0.1% flood extent. 450 properties are expected to be at risk within the future 1% annual probability flood event.

For the Dart Estuary approximately 350 properties are within the current 1% annual probability flood extent (1% fluvial and 0.5% tidal). Several health centres in Dartmouth are also at risk. Approximately 400 properties in the Dart Estuary are estimated to be within the future 1% annual probability flood extent. Dartmouth is also affected by wave action.

The vision and preferred policy

Policy Option 5 - we can generally take further action to reduce flood risk.

Future flood risk will mainly be caused by climate change, with possible sea level rises increasing the frequency and depth of future flooding. The chosen policy is considered to be the only policy to meet social and economic needs as a result of the large number of properties at risk and the potential for this to significantly increase in the future.

Reducing flood risk overall will depend on working with Shoreline Management Plan policies and actions to reduce wave overtopping as well as flooding from fluvial and tidal sources.

Proposed actions to implement the preferred policy

- System Asset Management plans and performance specifications will be produced for all our flood risk systems and major assets. These will assess flood risk maintenance with the aim to reduce flood risk in the policy unit and will include environmental constraints and targets.
- We will investigate options to reduce flood risk to settlements around the estuaries. This should include habitat creation or enhancement to contribute to Devon's Biodiversity Action Plan targets.
- We will identify locations where tidelocking of tributaries is causing problems. We will investigate, and where appropriate implement solutions (for example at Bitton and Brimley Brooks in Teignmouth).
- Produce community flood action plans in Dartmouth and Kingsbridge to reduce flood risk through engagement of the local community.

↑ Flooding from the River Teign at Teigngrace

Sub-area 6

Bovey Tracey and Ashburton

Our key partners are:

Teignbridge District Council

Devon County Council

Dartmoor National Park Authority

South West Water

The issues in this sub-area

Bovey Tracey is situated on the River Bovey, approximately 5 km upstream of the confluence with the River Teign. Part of the town, built in the 19th and 20th centuries, is within the floodplain, with flooding from the River Bovey, smaller watercourses and surface water. Some 130 properties are at risk from a 1% annual probability flood.

A flood alleviation scheme was constructed in 1986 on the River Bovey that protects approximately 50 properties to a 1.7% annual probability standard. There are other defences on the smaller watercourses flowing into the River Bovey. However, the flood warning service provides less than one hour warning due to the size of catchment and speed of response to rain.

Development within the Ashburton area has led to increased flood risk, and a flood alleviation scheme was constructed in 1989 to provide protection to properties in floods up to a 2% flood annual probability. However, the scheme only covers the River Ashburn and not the Balland Stream that flows just north of the A38. There is also still a risk from more severe events; approximately 150 properties and two health centres are at risk from a 1% flood, increasing to approximately 350 properties by 2100.

There is no flood warning for Ashburton and water levels can rise quickly, with deep and fast flows. The present risk to people and properties from flooding is high, and social vulnerability is also high.

Future flood risk will mainly be caused by climate change (increased rainfall and peak flows) but also, to a lesser extent, by land use and management changes in the upper Bovey catchment.

The vision and preferred policy

Policy Option 5 - we can generally take further action to reduce flood risk.

Bovey Tracey has been identified within a Strategic Development Zone. This may enable large numbers of extra houses and commercial properties to be built. Additional flood risk management action may need to be secured, principally through the land use planning system, to avoid the effects of this urban development.

The chosen policy has been proposed to take further action to reduce flood risk to existing residential and commercial property in the future. This is not to enable new development to take place in areas at risk.

Proposed actions to implement the preferred policy

- System Asset Management plans and performance specifications will be produced for all our Flood risk systems and major assets. These will assess flood risk maintenance with the aim to reduce flood risk and will include environmental constraints and targets.
- We will take action to reduce the flood risk in Ashburton including the Balland Stream as well as the River Ashburn. We will assess and improve where necessary the defences on the River Bovey and surrounding watercourses.
- We will influence partners to improve highways drainage in Ashburton.
- Investigate a flood warning for the river Ashburn at Ashburton, and encourage the production of community action plans to reduce flood risk through engagement of the local community.
- Consider ways of improving the flood warning service to Bovey Tracey and encourage the production of community flood action plans to reduce flood risk through engagement of the local community.
- Produce a study to look at ways of creating flood storage areas. This should aim to reduce flood risks to property in Bovey Tracey and further downstream, but should also provide Biodiversity Action Plan habitat enhancement or creation opportunities.

↑ Flooding in Bovey Tracey

Buckfastleigh

Our key partners are:

Dartmoor National Park

The issues in this sub-area

The area covers the towns of Buckfastleigh and Buckfast. Buckfastleigh is located at the confluence of the River Ashburn, River Dart and River Mardle, with Buckfast lying just upstream on the River Dart.

There is a less than one hour flood warning for Buckfastleigh as water levels can rise rapidly.

A flood alleviation scheme was constructed in Buckfastleigh in 1988 and protects properties with a design standard of protection of 2% annual probability. However, it is possible that the standard of protection provided has subsequently reduced. In addition, there is a risk from more severe events, with 95 properties at risk from a 1% flood that is anticipated to increase to over 200 properties by 2100. This includes properties at risk from the River Dart, the River Mardle and the Dean Burn which flow into Buckfastleigh from the south east.

Greater horseshoe bat hibernation and maternity roost sites are located within the floodplain. There is a risk of potential flooding of the Buckfastleigh Caves SSSI (part of South Hams SAC).

Future flood risk will mainly be caused by climate change (increased rainfall and peak flows) and, to a lesser extent, by land use and management changes in the upper Dart.

The vision and preferred policy

Policy Option 4 - we are already managing the flood risk effectively, but we may need to take further actions to keep pace with climate change.

We believe the 2% standard of protection given by the defence scheme and maintenance is sufficient at the moment. As such the policy to take further action to sustain the current scale of flood risk into the future is appropriate for the 200 properties at risk.

If land management changes on Dartmoor identified in this CFMP have a significant effect on reducing peak flows, it may be possible in the future to 'downgrade' future requirements at Buckfastleigh and Buckfast without increasing risks to property and life. Similarly, any future alterations in flow regime for the River Ashburn as a result of implementing the proposed policy in Ashburton will also need to be taken into account.

Proposed actions to implement the preferred policy

- System Asset Management plans and performance specifications will be produced for all our flood risk systems and major assets. These will assess flood risk maintenance with the aim of sustaining the current scale of flood risk in Buckfastleigh and will include environmental constraints and targets.
- Consider ways of improving the flood warning service. This will include targeting communities at risk in Buckfast and Buckfastleigh and investigating improvements to the River Mardle and Dean Burn at Buckfastleigh.

Lower Erme

Our key partners are:

South Hams District Council

Natural England

Local Farmers

National Farmers Union

Department for Environment, Food and Rural Affairs (Defra)

The issues in this sub-area

The sub-area covers the River Erme from Ivybridge to the coast. It is predominantly rural but does include the towns of Ivybridge and Ermington.

Ivybridge is situated on the River Erme where the river leaves Dartmoor and enters the lower lying South Hams area. Ermington is located to the south, on the lower reaches of the Erme.

There are no flood alleviation schemes and there is less than half an hour flood warning for the towns. Approximately 160 properties in Ivybridge and Ermington are at risk of flooding from a 1% annual probability flood (the majority of these being in Ivybridge), increasing to approximately 250 properties by 2100. Approximately 190 properties are currently at risk from a 0.1% flood (again, the majority of these in Ivybridge).

25% of the Erme Estuary SSSI is within the 1% flood extent. Silt levels are high in the lower catchment of the River Erme, caused by soil erosion as a result of the steep-sided agricultural fields adjacent to the river.

The vision and preferred policy

Policy Option 3 - we are generally managing existing flood risk effectively.

As this is a predominantly rural area, with the two urban areas being fairly small, increasing the level of flood risk management is not considered significant enough to be justified. The chosen policy is considered most sustainable over the next 100 years. Any increase in risk is not significant and it meets our social and economic objectives.

Proposed actions to implement the preferred policy

- System Asset Management plans and performance specifications will be produced for all our flood risk systems and major assets. These will include a review to determine the appropriate level of maintenance consistent with this policy option and will include environmental constraints and targets. This action should include the production of a System Asset Management Plan for the Erme Estuary which must support the favourable condition of the SSSI.
- Investigate the flood risk in Ivybridge, and review opportunities for reducing current maintenance activities if appropriate.
- Consider ways of reconnecting the river to its natural floodplain to utilise flood storage and enhance habitats, in particular within and around the Erme Estuary SSSI. Include a review of the likely change in flood risk associated with this action.
- Encourage the production of community flood action plans in the Lower Erme and Ivybridge to increase the local community awareness and engagement of flooding issues.
- With the agricultural industry, seek opportunities where a change in land management practices could reduce flood risk and improve water quality and habitats.

We will look to land use planners to ensure that no further development is allocated in areas at risk of flooding. Planners should aim to reduce flood risks to existing developed areas by incorporating resilience and resistance measures and by changing uses to less vulnerable types where possible. Furthermore, due to the short warning times, it is essential that vulnerable development includes suitable warning and evacuation procedures.

Sub-area 9

Rural Mid and Lower Teign, Dart and Avon

Our key partners are:

South Hams District Council

Teignbridge District Council

Dartmoor National Park

Natural England

Landowners

National Farmers Union (NFU)

Department for Environment, Food and Rural Affairs (Defra)

The issues in this sub-area

This mainly rural area covers the mid and lower extents of the three major watercourses in the South Devon CFMP: the Teign, Dart and Avon. The area extends from the Dartmoor boundary to the estuaries, but excludes the urban areas of Bovey Tracey, Buckfastleigh, Buckfast, Ashburton, Newton Abbot and Totnes.

It is a large and varied area that contains a number of smaller villages but no major towns.

Scattered across the whole area, 500 properties are at risk from a 1% annual probability flood, with 700 properties, agricultural land and the preserved railway at Staverton being at risk from an extreme flood (with 0.1% annual probability). Part of the A383 between Bovey Tracey and Newton Abbot is at risk from the River Lemon in a 0.1% flood. The edge of the Heathfield South Landfill site is also at risk from flooding with implications for water quality in the River Teign.

Future flood risk will mainly be caused by climate change, but land use and management changes will also have an impact. Approximately 700 properties may be at risk from a 1% flood by 2100.

Harbertonford flood defence scheme on the River Harbourne was built in 2002 and protects 50 properties from events up to the 2.5% flood.

The vision and preferred policy

Policy Option 2 - we can generally reduce existing flood risk management actions.

Due to the scattered nature of properties, the most appropriate policy is to generally reduce our existing flood risk management actions but to continue our activities in certain key locations.

For instance, the risk to people and the economy at Harbertonford (where social vulnerability is high) could increase significantly in the future if defences become ineffective so we shall continue to maintain these.

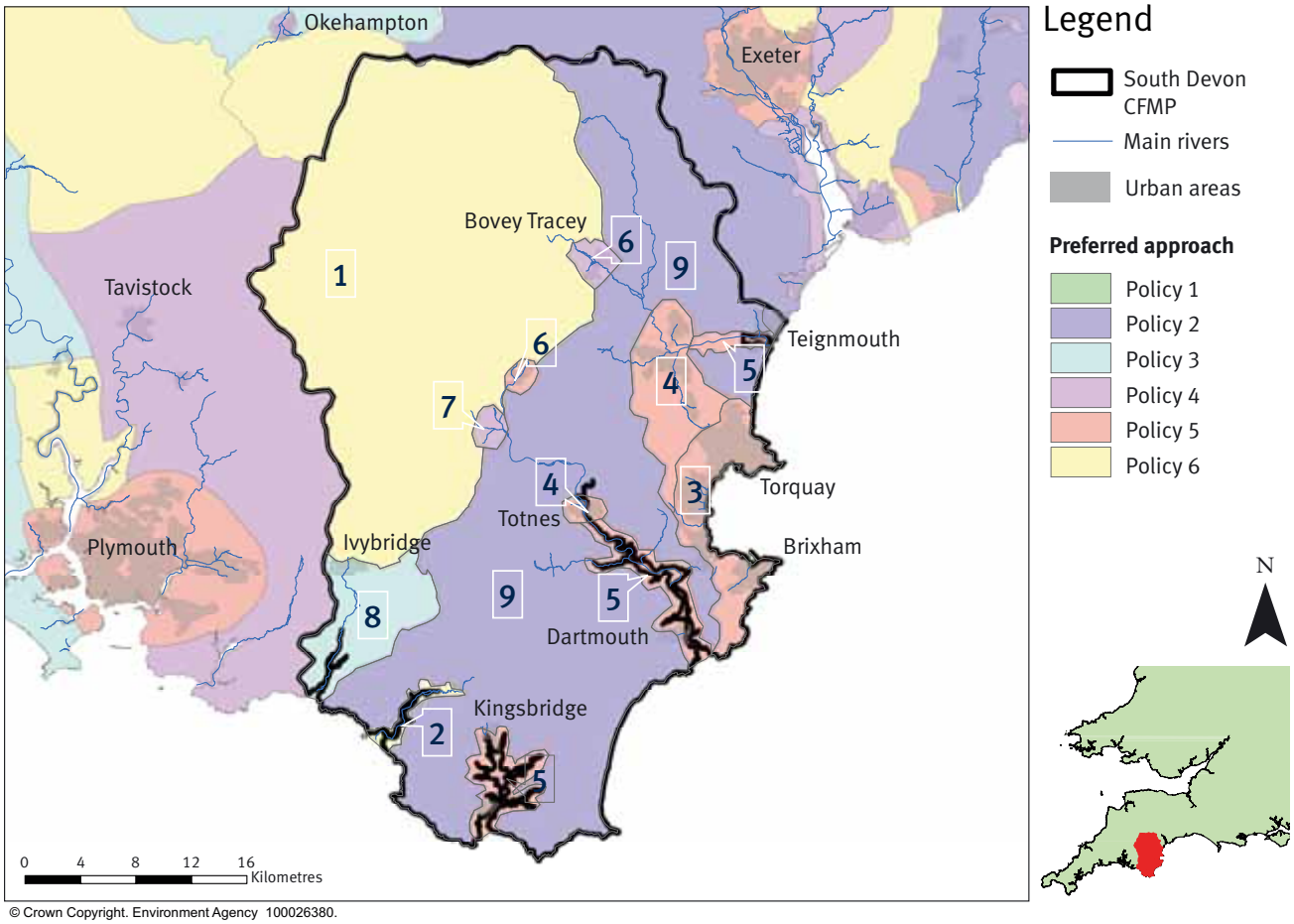
Proposed actions to implement the preferred policy

- Produce System Asset Management plans and performance specifications for our flood risk systems and major assets. These will aim to reduce actions where appropriate and include environmental constraints and targets. We will continue with our current activities in certain key locations.
- With the agricultural industry seek opportunities where a change in land management practices could reduce flood risk and improve water quality and habitats. Influence local, regional and national agricultural policies, and assess how they can be integrated into flood risk management practices.
- Consider ways of reconnecting the river to its natural floodplain to utilise flood storage, reduce risk to people and enhance habitats. This should provide opportunities to enhance or create Biodiversity Action Plan habitats.
- Develop a community flood warning area to provide a more targeted warning for Staverton. Consider ways of improving the flood warning service in Harbertonford.
- Encourage production of community flood action plans through engagement of the local community. This should include at least the significant flood risk locations of Harberton, Harbertonford.

↑ Flooding from the River Harbourne at Harbertonford in December 1999. Fifty homes were affected and water swept into the bar at the Maltsters Arms, where staff provided customers with rubber boots

Map of CFMP policies

Map of the policies in the South Devon catchment



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The sub-areas

1 Dartmoor
2 Avon Estuary
3 Torbay
4 Newton Abbot and Totnes
5 Dart, Teign and Kingsbridge Estuaries
6 Bovey Tracey and Ashburton
7 Buckfastleigh
8 Lower Erme
9 Rural Mid and Lower Teign, Dart and Avon

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