

Flood Risk Management (Scotland) Act 2009:

Delivering Sustainable Flood Risk Management



The Flood Risk Management (Scotland) Act 2009:

Delivering Sustainable Flood Risk Management

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Ministerial foreword



The impacts of flooding experienced by individuals, communities and businesses can be devastating and long lasting. It is vital that we continue to reduce the risk of any such future events and improve Scotland's ability to manage and recover from any events which do occur.

Taking the Flood Risk Management (Scotland) Act in 2009 through Parliament was a vital step towards better flood risk management, and real progress has already been made to translate this legislation into actions to reduce the damage and distress caused by flooding.

Important milestones over the past 4 years have included record levels of investment in flood protection by local authorities, creation of a new flood forecasting service for Scotland, and investment into research to improve our understanding of more natural approaches to tackling flooding. In addition, a new approach to providing advance flood warnings to the public was successfully launched earlier this year.

This guidance is another important milestone in implementing the Act and improving how we cope with and manage floods. *Delivering sustainable flood risk management* sets out statutory guidance to SEPA, local authorities and Scottish Water on fulfilling their responsibilities under the Act and, in particular, on the steps that should be taken to manage flooding in a sustainable manner.

This guidance should form the blueprint upon which SEPA, local authorities and Scottish Water and any other future responsible authorities will deliver their flood risk management responsibilities.

I would like to thank all those who contributed to the development of this guidance which will help shape the way in which floods and their impacts are managed across Scotland.

Stewart Stevenson MSP
Minister for Environment and Climate Change



Statutory context

The production of this guidance is one of the duties of the Scottish Ministers set out in the Flood Risk Management (Scotland) Act 2009 (the Act). This guidance is issued by the Scottish Ministers to the Scottish Environment Protection Agency (SEPA) and the responsible authorities under section 2 (5) and section 29 of the Act. The responsible authorities are local authorities and Scottish Water, and any other public bodies and office-holders designated as such by the Scottish Ministers.

Guidance is provided to SEPA and the responsible authorities on fulfilling their duties to:

- act in the way best calculated to manage flood risk in a sustainable way; and
- consider the social, environmental and economic impact of exercising flood risk management functions;

Initial guidance is also provided to SEPA on:

- Setting objectives and identifying measures for inclusion in flood risk management plans prepared under Sections 27 and 28 of the Act. As required by Section 29 (2), the guidance addresses how the alteration and restoration of natural features and characteristics of the landscape should be considered.

The guidance will be reviewed every six years or earlier to ensure continual improvement, and to reflect the experience and needs of those involved and assist further in delivering the main purpose of the Act, which is to reduce flood risk.

Consultation

A public consultation was carried out on draft guidance between 18 January 2011 and 18 March 2011. 49 responses were received and both the responses and the report on the analysis of the consultation response are available to view separately on the Scottish Government website. The many and varied comments made by consultees have been taken on board and taken into account where appropriate when drafting this guidance.



Summary

Climate change predictions suggest that the number and severity of storm events across Scotland is likely to increase. This could place pressure on our existing defences and reveal new areas at risk of flooding. To deal with these risks, we must continue to improve our understanding of the causes and consequences of flooding and deploy more sustainable approaches to tackling flood risk.

This guidance complements the flooding legislation that was introduced in 2009, the Flood Risk Management (Scotland) Act 2009 (the Act). It sets out statutory guidance to SEPA, local authorities and Scottish Water on fulfilling their responsibilities under the Act, and in particular on the steps that should be taken to manage flooding in a sustainable manner. The guidance is intended to ensure adoption of consistent principles and approaches based on good practice lessons in flood risk management.

In promoting a more sustainable approach to flood risk management, the guidance establishes the five following overarching outcomes for Scotland:

- A reduction in the number of people, homes and property at risk of flooding as a result of public funds being invested in actions that protect the most vulnerable and those areas at greatest risk of flooding.
- Rural and urban landscapes with space to store water and slow down the progress of floods.
- Integrated drainage that decreases burdens on our sewer systems while also delivering reduced flood risk and an improved water environment.
- A well informed public who understand flood risk and take actions to protect themselves, their property or their businesses.
- Flood management actions being undertaken that will stand the test of time and be adaptable to future changes in the climate.

Guidance to support delivery of these outcomes is provided through seven themed sections, which cover topics like understanding flood risk, catchment flood management and selecting and implementing sustainable actions. Technical guidance on appraising flood management options is provided separately.

The guidance was developed in close collaboration with SEPA, local authorities, Scottish Water and a wide range of stakeholders representing Scotland's public bodies, flood risk management professionals and other interested parties.



Introduction

Flooding can endanger lives and livelihoods, and disrupt the services that support our social and economic wellbeing. Although it will never be possible to eradicate flooding, a wide range of actions can be taken to reduce the likelihood and impacts of flooding (Figure 1).

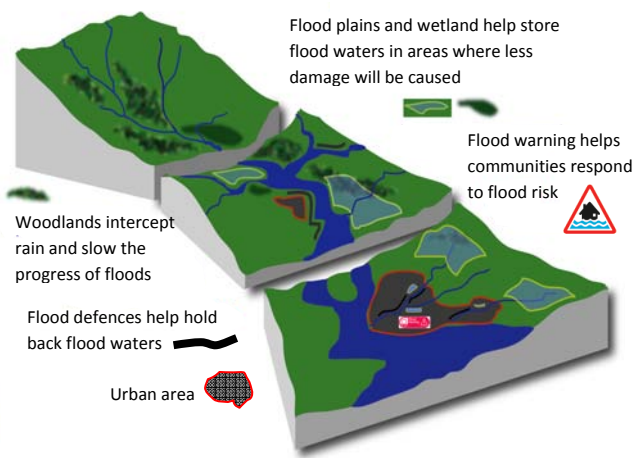


Figure 1 Examples of actions to tackle flood risk

The Flood Risk Management (Scotland) Act 2009 (the Act) has created a new framework for the assessment and management of flood risk, which is supported by new responsibilities on the Scottish Environment Protection Agency (SEPA), local authorities, Scottish Water and other designated responsible authorities.

Delivering sustainable flood risk management provides statutory guidance to these organisations on fulfilling their responsibilities under the Act. It also provides contextual information on how these responsibilities align with the Government's wider policy framework for reducing flood risk and improving how flood risk is managed.

Why we need a new approach

In the past, development on flood plains and along coasts took place with less knowledge of the risks associated with such development than we have available to us today. In places, this has left us with a complex and difficult legacy to manage.

Some past interventions also mean that we have lost features of our natural landscape that can help store and slow flood waters, including flood plains and wetlands. In urban settings, a similar trend has occurred as our towns have expanded and green spaces, gardens and other natural drainage features have been lost.

Climate change predictions suggest that although summers may be drier in Scotland in future, winters are likely to be much wetter and this in combination with continuing urban creep (the loss of permeable surfaces within urban areas leading to increased runoff), is placing increased pressure on our existing defences and potentially revealing new areas at risk of flooding.

To deal with current and future flood risk, we need to improve our understanding of flood risk and deploy more sustainable approaches to tackling these risks. This will mean managing whole flooding systems, be they catchments or coastlines, in a way that takes account of all interventions that can affect flood risk.

Delivering the Outcomes

This guidance is part of the Scottish Government's work to improve flood risk management across Scotland. The changes the Government wishes to bring about are set out in the following five long term key outcomes:



1. A reduction in the number of people, homes and property at risk of flooding as a result of public funds being invested in actions that protect the most vulnerable and those areas at greatest risk of flooding

The long-term aim must be to reduce the risk of flooding from all sources as far as is reasonable, taking full account of environmental, economic and social priorities. This means moving away from short-term reactive decisions and embracing proactive planning and investment decisions.

2. Rural and urban landscapes with space to store water and slow down the progress of floods

Our urban and rural landscape can play an important role in storing and slowing flood waters. Consideration has to be given to the competing demands on our finite land resources. Therefore, SEPA and the responsible authorities should work closely with land managers to consider how to maximise the reduction in flood risk that can be achieved through these processes. This will not only help to reduce flood risk, it will promote the healthy functioning of Scotland's environment and the wildlife it supports.

3. Integrated drainage that decreases burdens on our sewer systems while also delivering reduced flood risk and an improved water environment

In both rural and urban areas, surface water run-off should be managed before it enters sewers and receiving watercourses by allowing for increased capture and reuse of water; increased absorption through the ground; and

more above-ground storage and safe conveyance of flood waters.

4. A well informed public who understand flood risk and adopt actions to protect themselves, their property or their businesses

Individuals, business and communities can play a role in helping to reduce the risks they face. This must be supported through improved awareness and access to information on flood risk and on simple actions individuals and businesses can take to protect themselves and others from the impacts of flooding.

This will build on and enhance the benefits of actions taken by public bodies for example: - through provision of flood warning, development planning, improvement of infrastructure and the active management of "at risk" sites by undertaking and maintaining flood protection work.

5. Flood management actions undertaken that will stand the test of time and be adaptable to future changes in the climate

Decisions taken today will have a profound impact on the likely flood risks that future generations will need to manage. Our strategies and actions to manage flood risk must reflect the needs of future generations and be adaptable to a changing climate.

Purpose of the guidance

Delivering sustainable flood risk management is statutory guidance issued under the Act. It explains to SEPA, local authorities, Scottish Water, and any other responsible authority designated by the Scottish



Ministers, how they should fulfil their duty to:

Act in the way best calculated to manage flood risk in a sustainable way.

Guidance is provided separately on steps that should be taken to ensure full consideration of the social, environmental and economic impact of actions taken to manage flood risk. Initial guidance is also provided to SEPA on setting objectives and identifying measures for inclusion in flood risk management plans.

Delivering sustainable flood risk management

is not an operational manual and it is not intended to prescribe how SEPA and the responsible authorities should fulfil their duties. It is, however, intended to ensure the adoption of consistent principles and approaches based on good practice lessons in flood risk management. The guidance is divided into the following topics:

1. Understanding Flood Risk
2. Understanding catchments
3. Integrated Approach to Flood Risk Management
4. An Integrated Approach to Drainage
5. Selecting and Implementing Sustainable Actions
6. Engaging with the Public
7. Delivering responsibilities collectively

The guidance will be updated regularly to promote continuous improvement. Supplementary guidance notes may be published from time to time to further expand or update the guidance or related policy matters. These may address feedback on how the policy is

being implemented, or to reflect changes to wider policies, such as climate change adaptation or planning policy.

The guidance has been prepared for a professional audience with knowledge of the topics covered. Although its main users will be SEPA and the responsible authorities, aspects of the guidance will be relevant to other public, commercial and voluntary organisations, as well as the public.



1. Understanding flood risk

Introduction

Flood risk is a measure of the likelihood that a flood event will happen and of the potential consequences of that event. The long-term aim of the Scottish Government is to reduce these risks.

Robust and reliable information on the causes and consequences of flooding are needed to promote well informed decisions on how to tackle flood risk.

Sources of flooding

This guidance does not deal with floods caused solely by a failure in or blockage of a sewerage system although many of the same principles will apply. Scottish Water has statutory responsibilities for maintaining the sewerage network. Floods caused solely by a failure in or blockage of a sewerage system should be dealt with through this existing channel.

This guidance covers all other potential sources of flooding. In fulfilling their flood risk management responsibilities, SEPA and the responsible authorities should focus on the sources of greatest risk, which should include the following primary sources of flooding.

- *River (Fluvial) flooding* - this occurs when the water draining from the surrounding land exceeds the capacity of the watercourse.

- *Coastal flooding* – is caused by a combination of high tides and stormy conditions where wave overtopping can occur.

- *Surface water (pluvial) flooding* - is caused when rainfall water ponds or flows over the ground before it enters a natural or man-made drainage system or watercourse, or when it cannot enter the drainage system because the system is already full to capacity.

- *Sewer flooding* - this occurs when combined sewers are overwhelmed by heavy rainfall. Sewer flooding is often closely linked to surface water flooding, and may contain untreated foul water.

- *Groundwater flooding* - this occurs when water levels in the ground rise above surface levels.

- *Reservoir flooding and flooding from other infrastructure* - Although unlikely, failure of infrastructure such as dams, could result in a large volume of water being released very quickly.

Characteristics of a flood

The causes and consequences of flooding can only be fully understood when the characteristics of a flood are examined. The Act specifies particular flood hazard characteristics that must be assessed and mapped, which are described in more detail in Table 1. Flood hazard maps will show where flooding has the potential to do harm. Where necessary, additional factors should be considered to give a full picture of the likely impacts resulting from a flood.



Table 1 Flood Hazard characteristics

Characteristic	Significance
Extent	Helps show where flood waters will penetrate and what may be affected.
Depth	Helps understand the potential impacts of a flood. For instance, extensive shallow water flooding is likely to be less damaging than more localised areas of deeper water
Duration	The duration of a flood can have an impact on the damage caused, for long duration flooding can increase impacts to crops and services.
Velocity/ flow	High velocity flood waters can increase risk to health and safety and cause greater damage.
Water quality	Flood that carry pollutants, for instance where sewer flooding occurs often carry a greater risk to health and safety as well as the potential to cause greater economic damage.
Sediment content	Flood waters with a high sediment or debris content can create additional risks to health and safety, and may increase the risk of damage to infrastructure (e.g. bridges).

Likelihood of flooding

For flood mapping purposes, the Act requires three flood scenarios to be assessed: high, medium and low probability floods. The Scottish Government will issue regulations defining the flood probabilities that should be applied to each scenario.

A variety of methods can be used to estimate the probability of flooding. After considering existing methodology and work being undertaken in other Member States implementing the Floods Directive, SEPA should take a lead role in developing and disseminating guidance on the analysis of flood probabilities, including techniques to examine multiple or combined sources of flooding.

In many instances, different sources of flooding can combine to intensify a flood. For example, high tides in estuaries can occur simultaneously with high river levels. Understanding these interactions (including their likelihood) will be an important part of

understanding and managing flood risk.

Assessing the impacts of flooding

A wide range of impacts to society, the economy, the environment and cultural heritage should be assessed where appropriate, including those set out in Table 2.

To gain a fuller appreciation of the impacts of flooding, SEPA and the responsible authorities should also consider the following factors:

- **Exposure** - what will be exposed to the flood;
- **Vulnerability** - the vulnerability of those things that are exposed to the hazard; including the ability to recover, which may include the availability of insurance;
- **Value** - the value of things exposed to the hazard, which could include costs or how critical the item is.

Wherever possible, both aspects of vulnerability should be considered - *susceptibility* and *resilience*.

Susceptibility is a measure of how prone to impacts particular elements will be during a flood event. For example, the elderly, frail or sick can be more susceptible to injuries or loss of life. Resilience is a measure of the ability of something to recover from a flood. For instance, businesses can be more resilient to flooding through the use of insurance. Buildings can be made more resilient through the use of water resilient materials in construction.

In particular, measuring the impacts on the environment poses a significant challenge, and concepts like ecosystem services set out later in the



guidance should be explored to help assess these impacts.

The indirect impacts of flooding can also cause problems. For example, the costs of disruption to transport and power supplies or the costs to emergency services. It is important that these indirect impacts are included wherever practical to do so.

Table 2 Measuring the impacts of flooding

Impact	Categories and descriptions
Human Health (Social)	<i>Human Health:</i> includes immediate or consequential impacts
	<i>Community:</i> impacts to emergency response, education, health and social work facilities
Environment	<i>Water body Status:</i> permanent or long-term impacts to ecological or chemical status of surface water bodies including those caused by hydro morphological impacts of flooding.
	<i>Protected Areas:</i> adverse permanent or long-term impacts to protected areas or water bodies.
	<i>Pollution Sources:</i> sources of potential pollution in the event of a flood, such as IPPC and Seveso installations, or point or diffuse sources.
	<i>Wider environment:</i> Other potential permanent or long-term environmental impacts, such as those on soil, biodiversity, flora and fauna, etc.
Cultural Heritage	<i>Cultural Assets:</i> permanent or long-term impacts to cultural heritage, which could include archaeological sites / monuments, and architectural sites.
Economic	<i>Property:</i> impacts to property, which could include homes, insurance availability
	<i>Infrastructure:</i> impacts to infrastructural assets such as utilities, energy generation and transmission, transport, storage and communication.
	<i>Rural Land Use:</i> impacts to uses of the land, such as agricultural activity (livestock, arable and horticulture), forestry, mineral extraction and fishing.
	<i>Economic Activity:</i> impacts to other sectors of economic activity, such as manufacturing, construction, retail, services and other sources of employment.

Analysing flood risk

An integrated approach to assessing risk

Many of the assessments undertaken by SEPA will be strategic level assessments that will support the preparation of flood management plans. These assessments will also identify where more targeted or detailed assessment should be carried out, potentially by local authorities, Scottish Water or any other designated responsible authorities.

Ultimately this should form a cyclic process where information and knowledge is built up over planning cycles (Figure 2).

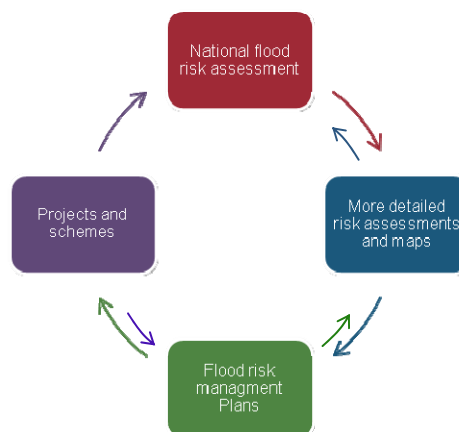



Figure 2 Cycle of information and knowledge growth

To support the delivery of this integrated approach to assessing and managing flood risk, SEPA should:

- Make use of available historic flood and gauging data;
- publish and maintain advice on assessing, modelling, mapping and sharing data. In doing so, SEPA should work alongside the responsible authorities and other



organisations to ensure that the information meets the needs of all relevant organisations;

- take all practicable steps to ensure that national assessments, including the national flood risk assessment and national flood maps, thoroughly consider and reflect local risks and issues;
- ensure that information generated on flood risk can be used in a consistent way at all stages of the flood risk management planning process, and in particular in the appraisal of options to manage flood risk;
- create and manage a repository of information on flooding and its impacts that can be shared with the responsible authorities and other interested parties. If possible this should include data on insurance claims.

The responsible authorities should provide active support and information to help SEPA in this work. Where necessary, the Act provides SEPA and local authorities with powers to request information and to seek assistance.

Residual risk and the effectiveness of actions

Residual risk is the risk that remains after management actions have been taken. Residual risks often have a low probability of occurrence, although the impacts can be severe. Residual risk should be considered in flood management decisions. Home and business owners should be encouraged to insure themselves against the residual risk where possible and all actions to manage

flooding should include arrangements to deal with residual risks.

Understanding the effectiveness of existing actions and residual risk is an important step in identifying management actions. For example:

- How well are flood defence structures performing against their initial design standard?
- What difference does flood warning make to public safety?
- What are the consequences of an event exceeding the design standard?
- Is insurance available to cover the residual risk?

It is important that existing actions to manage flooding and their effectiveness are taken into account wherever it is practical to do so, particularly when undertaking work that will influence investment decisions, e.g. assessing areas vulnerable to flooding or preparing flood risk management plans.

Source-pathway-receptor-impact model

Data on historical flood events and gauge data are essential to build up a picture of what contributes to flood events in a particular catchment. Additional information can be used to build a good understanding of the links between the sources and impacts of flooding. This will help identify the right combination of measures to tackle particular flooding problems. For instance, where high rates of run-off in upland areas is contributing to flooding problems, measures to store or slow run-off could be considered, including



re-vegetating a hill slope to increase the interception of rainfall and increase the roughness of the land surface, thereby slowing runoff.

The same principles apply in urban areas, where an understanding the sources and pathways of flood waters can help identify where features to store or divert flood waters, including detention ponds and other Sustainable Urban Drainage System should be located. Drainage is discussed in more detail in section 4.

To help understand the interaction of different actions across catchments and coastlines, SEPA and the responsible authorities should adopt what is commonly referred to as the source –pathway- receptor -impact approach.

The approach is a well-established framework in flood risk management. It provides a basis for understanding the causal links between the source of flooding, the route by which it is transmitted and the receptor, which suffers some impact:

- *Sources* are the weather events or conditions that result in flooding (e.g. heavy rainfall, rising sea level, waves, dam break, river flows etc);
- *Pathways* are routes between the source of flood waters and the receptor. These include surface and subsurface flow across the landscape, urban drainage systems. The hydrological cycle can provide valuable insights into the pathways of flood waters;
- *Receptors* are the people, industries and built and natural environments

that can be impacted upon by flooding;

- *Impacts* are the effects on receptors. The severity of any impact will vary depending on the vulnerability of the receptor.


Quantifying flood risk

Risks are evaluated by combining the likelihood and consequence of flooding. This can be achieved in a variety of ways, and the approach adopted should reflect the purpose of the assessment, the scale of the assessment and the data available.

There will be times where risk thresholds will need to be set, for instance, when undertaking the national flood risk assessment. Risk thresholds are highly subjective and can be influenced by societal preferences, values and opinions of acceptability. SEPA and the responsible authorities should present a consistent opinion of flood risk and its significance or acceptability. This must be done within the context of Government guidance and policy on these matters.

Climate change and other long term trends

Testing proposed flood management actions against long term trends is essential to selecting sustainable actions that will stand the test of time. SEPA and the responsible authorities should work to establish approaches to examining future scenarios that can be applied consistently across flood risk assessments and management decisions. Wherever possible, a range of future scenarios should be



examined, including a ‘worst case’ scenario.

Climate change is likely to have a substantial impact on flooding. SEPA in collaboration with the responsible authorities should work to improve information on the affects of climate change on flood risk. This should include using information gathered over implementation cycles to detect changes in flood patterns, and developing new methods to detect and assess trends.

Other long term trends that could have a measurable impact on flood risk should also be considered, including urban creep, changes in land-use and societal changes.

Dealing with uncertainty

Floods are infrequent phenomena for which it is difficult to predict future events. Uncertainties can be divided into four main areas:

- natural variability, which can be subdivided into natural variability in time and natural variability in space;
- knowledge uncertainties that come from a lack of knowledge, for example about the behaviour of defences or climate change;
- modelling and data uncertainties in the quality of models or data that supports assessments, design and appraisal.
- fundamental uncertainties about things we cannot know, for example the distant future.

Uncertainty should be clearly presented in flood risk assessments showing what approaches have been used to quantify them and how

decisions have been influenced by uncertainties. Any assumptions made should be clearly set out.

Communicating flood risk

It is important that the public understand the flood risk that they face. These can be complex concepts to explain. This means that special attention must be given to how information on flooding is conveyed to the public. Experience suggests that simply stating ‘return periods’ or probabilities for particular events can be very confusing, particularly to communities who have recently experienced flooding.

SEPA and the responsible authorities must investigate a range of options for expressing flood probabilities and risk to the public. Visual tools in particular can help with understanding such as figures, maps and diagrams to communicate the messages.

Options may include providing information on the chance that an individual or community could be affected by a flood, rather than information on the likelihood of particular flood occurring. Comparisons to other risks people face in daily life could also be used to help explain flooding issues. As no comparison is perfect, this approach should not be relied upon in isolation.

Where risk thresholds have be used, for instance when identifying areas potentially vulnerable to flooding, they must be accompanied by clear explanations of the criteria used, how risks were calculated or estimated, and how thresholds have been set.



2. Understanding and working with catchments

Introduction

Actions that affect one part of a river or coastline can have consequences elsewhere. This means that flood management measures are most effective when they are coordinated across catchments and along coastlines in a way that is uninhibited by administrative boundaries.

Adopting a catchment approach to flood risk management requires an appreciation of catchment and coastal processes, and an understanding of how best to manage the sources and pathways of flood water. This includes looking at how the timing, magnitude and duration of a flood event can be altered by creating, restoring and enhancing natural features and characteristics of the landscape, including wetlands, vegetation and functional flood plains.

This section provides guidance on:

- setting appropriate units of management;
- the application of a source-pathway-impact approach to flood risk management;
- the role of land use and positive management in managing flood risk including measures in urban areas;
- promoting and balancing the needs of those living and working in rural areas.

Catchment management units

SEPA and the responsible authorities must coordinate their actions to tackle flood risk across catchments. In most cases this will require coordination of actions at the scale of the river basin - i.e. a catchment that drains to the sea (Figure 3).

This is a move away from the traditional approach which has been undertaken within administrative boundaries. It is important that the issues arising as a result of working across administrative boundaries are addressed. SEPA and the responsible authorities need to work together to develop the catchment approach.

In some cases it may be appropriate to sub-divide river basins into smaller catchments (also referred to as sub-basins) to allow for more detailed assessment and analysis of management options. When assessing options to tackle urban surface water flooding, small urban drainage catchments can be defined to promote detailed analysis of the urban landscape as long as it is considered as part of the wider catchment.

Where river basins are separated into smaller catchments, all the interactions, physical and ecological, with the larger river basin in which they are located must be understood.

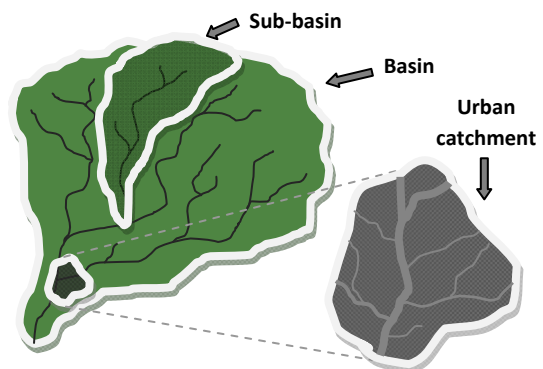


Figure 3 Basins, sub-basins and urban catchments



SEPA should work closely with the other responsible authorities to identify the appropriate spatial scales and catchments around which flood risk management efforts should be targeted.

Many of the principles that apply to catchments also apply to coastal areas, with actions in one place potentially affecting other areas of the coastline. In identifying appropriate management units for coastal areas, SEPA should give careful consideration to coastal and estuarine processes and interactions between coastal areas and catchments.

Understanding catchments

Our natural landscape can play an important role in managing flood risk. Over time, human activities have altered the character of our landscape and affected the timing, magnitude and duration of flood events. For example, urban creep, compacted soils, changes in land cover and increased field drainage can all increase run-off and peak flood flows.

Creation, restoration and enhancement of natural features of the landscape (e.g. flood plains, wetlands and forests etc) can help to restore more favourable run-off patterns and reduce flood risk;

These more natural techniques typically protect, emulate or restore the natural processes which regulate flooding and erosion, often by keeping water in areas where it will cause less damage. Examples include:

- improving water storage and capturing run-off by restoring,

protecting or enhancing soil condition and woodland areas;

- reconnecting floodplains, restoring wetlands or creating ponds and reservoirs to help store flood waters;
- planting vegetation and managing hill slopes to help slow run-off;
- restoring watercourses to a more natural channel form by removing culverts and other structures that constrain channels and contribute to flooding during high flows;
- reducing the pressure of sea level rise and coastal erosion through managed realignment or regulated tidal exchange.

In urban areas, green roofs, permeable paving, flood and surface water attenuation ponds, opening up and realigning watercourses, and establishing green spaces and blue corridors are equivalent examples.

To provide insights into the causes of flooding and the types of management options available, SEPA, in close collaboration with the responsible authorities and other organisations with an interest in catchment management, should work to develop an improved understanding of the hydrological, ecological and geomorphological condition and functioning of Scotland's catchments. This should include assessments of the effects of human interventions on flooding processes.

The condition of our soils, our water resources and the health of our ecosystems are all influenced by processes that occur within and across catchments and coastlines.



Understanding and managing these interactions will create opportunities to invest in actions that can simultaneously reduce the risk of flooding, while also improving the quality of our natural and urban environment. SEPA should ensure that information generated on catchment characteristics and natural features can be used to support other work areas, including River Basin Planning and the selection and design of environmentally sensitive engineered defences or other measures.

SEPA is also responsible for assessing how the restoration or enhancement of natural features and characteristics of catchments could contribute to managing flood risk. In preparing these assessments, SEPA should work to create information that can be used in the appraisal of flood management options. SEPA should also work to identify any additional costs or benefits that can be delivered from these actions, thus ensuring that the full value of these options can be considered.

State of knowledge and using reliable science

The state of knowledge on these natural techniques is still evolving. Robust and reliable science must be applied at all stages of flood risk management. SEPA should draw on its environmental and hydrological expertise so as to advise its partners and the wider stakeholder community on the benefits and role of these techniques. This should include supporting research and promoting demonstration projects.

The uncertainties associated with using more natural approaches have been greater than those for more traditional engineering. It is expected that these uncertainties will diminish as the evidence base expands, and these uncertainties should not be viewed or used as a barrier to adopting these techniques.

SEPA and the responsible authorities must ensure that these uncertainties are examined and communicated to those who may benefit or be affected by the use of these techniques.

Promoting and balancing the needs of rural areas

Rural land use is important to the Scottish economy. There are many and varied demands already placed on land managers, and rural land use contributes to delivering many wider economic, environmental and social benefits, with a large number of people directly employed in these sectors. A large proportion of Scotland's land is under agricultural production and the sector is responsible for much of Scotland's domestic food supplies and exports.

Some of the greatest opportunities to restore our landscapes natural capacity to cope with floods are in rural areas. However, compromising important areas of agricultural production or forestry could have serious impacts on rural economies and food production, particularly considering that Scotland is not self sufficient in food production. In preparing flood risk management plans, SEPA and local authorities should consider carefully the views



and needs of land owners and rural businesses so that the correct balance is struck between all competing demands on rural areas.

It is important that land management changes are focused at a scale/ distance that is relevant to the area at risk of flooding.

Some funds are available to support voluntary action, including the Scotland Rural Development Programme (SRDP) and SEPA's restoration fund. The SRDP supports sympathetic management of land by promoting actions that reduce the effects of pollution, deliver biodiversity benefit, flood management and other societal and environmental benefits. However, due to competition from other policy areas, their contribution to flood risk management is likely to be limited.

SEPA and the responsible authorities should consider carefully how the range of existing funding routes and instruments can be used to support flood management and wider restoration initiatives and, in particular, the new local authority powers under the Act can be used to deliver flood risk reductions through land management. For example, in allocating funding for environmental improvements SEPA should give consideration to promoting projects that deliver coincident flooding and environmental benefits.

Where land management and restoration forms part of a flood protection scheme, local authorities have a new wide range of powers to compensate land owners/managers.

Options include one off payments, service agreements and compulsory land purchase. In all cases voluntary action or voluntary agreements should be pursued. However, the voluntary agreements still need to be set down in a legal framework which gives both parties security.

The Scottish Government will continue to work with stakeholders and local authorities to ensure that local authorities have access to a toolkit of options for delivering improved flood risk management and a reduction in flood risk. Particular attention will be paid to any limitations of current instruments and to instruments that encourage land owners to participate through voluntary actions.



3. An integrated approach to flood risk management

Introduction

Flood risk management is the process of assessing, organising and implementing actions to deal with flood risk. The main outcome of the flood risk management planning process should be a set of sustainable actions being taken to reduce overall flood risk across Scotland.

Multiple organisations are involved in managing flood risk. It is therefore essential that an integrated approach, that balances national consistency and strategic decisions with local knowledge and accountability, is adopted.

This section provides guidance on:

- principles that should be adopted to deliver an integrated approach to flood risk management;
- the interaction of flood risk management with other land and water management decisions;
- involving stakeholders in flood risk management.

Flood risk management plans

The preparation and implementation of flood risk management plans will be at the heart of future efforts to tackle flooding. The Act sets out a flood risk management planning process that will ensure that long-term and nationally-focused objectives are balanced with local knowledge and priorities. Table 4 summarises the key steps in preparing these plans, and Annex 1 provides further information on key milestones. Once in place, the plans will be reviewed and updated every six years.

Table 4 Key steps in preparing flood risk management plans

(National) Flood risk assessment – by 22nd December 2011

The national flood risk assessment will create a broad-scale picture of the causes and impacts of flooding across Scotland. The assessment will lead to the identification of Potentially Vulnerable Areas that will be used to help target studies, actions and investment to reduce flood risk.

Flood hazard and flood risk strategies – by 22nd December 2015

Building on flood risk assessment and mapping exercises, plans will be prepared to coordinate measures across catchments. Flood risk management strategies will allow for targeted investments and better decisions to be made about measures to reduce flood risk.

Local Flood Risk Management Plans – by June 2016

Local plans will supplement the strategic objectives and measures identified by SEPA. They will translate the strategies into coordinated actions to reduce the impacts of flooding.

The principal output of the planning process should be a set of sustainable actions to manage flood risk across Scotland. These actions should deal with all identified flood risks and should be selected following the guidance set out in this document.

The Act establishes lead roles for all the key steps in preparing and implementing flood risk management plans, although cooperation between SEPA and the responsible authorities will be required at all stages.

Scottish Ministers have tasked SEPA with ensuring that the most sustainable measures are identified and included within flood risk management plans. SEPA's strategic plans are a key step in the flood risk management process. The flood risk management strategies, and the measures which follow, will drive national investment decisions in each 6 year cycle. These plans will be subject to approval by the Scottish Ministers.



Flood risk management actions

Once a lead local authority has been agreed, the lead local authority for each local plan will lead on agreeing the funding routes and timetables by which actions will be taken forward locally. The Scottish Ministers, SEPA and the responsible authorities are then responsible for implementing the agreed actions and reducing flood risk.

The strategies and local plans can not be developed in isolation, SEPA and the responsible authorities must ensure that systems are in place to manage all interdependencies, while also ensuring that the national exercises being undertaken, such as the national flood risk assessment, take account of local knowledge and priorities.

Although developed through an integrated process that will lead to a set of coordinated objectives, measures and actions for Scotland, information will need to be presented

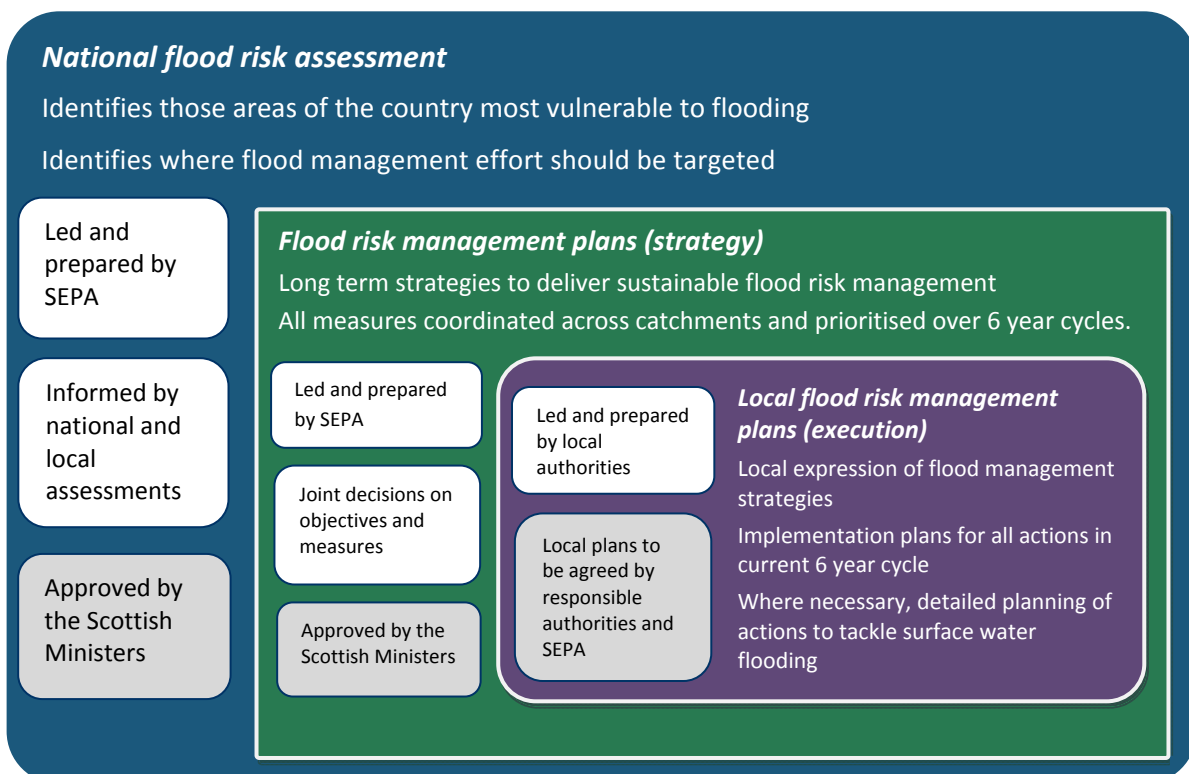
in the two closely related sets of plans prepared by SEPA and local authorities (Figure 4).

The first set of flood risk management plans will be prepared and published by SEPA. These strategic plans will set the overall direction of flood risk management across Scotland. They will also fulfil the reporting requirements of the EC Floods Directive.

To promote stakeholder engagement and coordination with local plans, it is expected that SEPA will prepare a flood risk management strategy for each local plan district. This will be done working closely with the lead local authority and other responsible authorities relevant for that district.

The second set of plans, known as local flood risk management plans, will be published by lead local authorities. In addition to providing a local expression of the strategic plans prepared by SEPA, these 'tactical' plans will include a summary of how

Figure 4 Roles and responsibilities in preparing flood risk management plans





actions will be implemented in each local plan district. Local flood risk management plans will support engagement with local communities and should also contain both surface water management plans and any additional actions and information that they believe is necessary to support local needs.

SEPA and local authorities should integrate as far as practical the presentation, publication and consultation of their respective plans.

In urban areas, the coordination of actions to tackle surface water flooding presents a unique set of challenges. Local authorities will be expected to lead on the coordination of actions to deal with surface water flooding. This work should be coordinated and presented within local flood risk management plans. Surface water management and drainage are examined further in Section 4.

Delivering integrated FRM planning

Multiple organisations are involved in managing flood risk. It is therefore essential that a fully integrated approach, that balances the need for national consistency with local knowledge and accountability, is adopted. A top down approach that disengages local authorities and local communities from decision making must be avoided.

National consistency

Adoption of consistent principles, approaches and methods at each step in the process of managing flood risk will ensure a nationally comparable

risk-based approach informs management and investment decisions. Areas where consistency will be particularly important include methods adopted to assess flood risk, approaches to considering climate change, and techniques adopted to appraise management options (Table 5). SEPA should lead on ensuring the appropriate level of national consistency is delivered.

Table 5 Areas where consistency should be promoted

Assessing and quantifying flood risk
Considering the full range of social, economic, environmental impacts of floods
Examining current and future risk based on climate change scenarios and other long term trends
Promoting and adopting a source, pathway impact approach to assessing and managing flood waters
Considering a full range of actions, paying particular attention to those that restore a catchments ability to slow or store flood water
Communicating flood risk and engaging with the public

Balancing local and national needs

A balance must be struck between national strategies and priorities and local decision making and accountability. This will require close collaboration and a structured planning process that creates the space and time needed to consider any competing needs and reach informed decisions.

The strategies set out in Flood risk management plans should establish the overall approach, for instance identify the need for particular combinations of measures or management response. Where these measures, for instance a flood protection scheme require significant



public expenditure, more detailed design and appraisal work will be required to ensure that the best option and design is selected and tailored to suit local needs.

Joint ownership of plans and actions

The identification and undertaking of sustainable flood management actions will require close collaboration between SEPA, local authorities, Scottish Water, and other stakeholders. Ultimately, there must be joint ownership of the plans and the actions set out therein.

Wherever necessary, SEPA should ensure that decisions on setting objectives and identifying measures are taken jointly with the responsible authorities, as well as with others who could contribute to delivering actions and could be affected by decisions. Where agreements on objectives and measures cannot be reached, SEPA will have to set out any difficulties in reaching agreement in their report to the Scottish Ministers, who can then approve the plan, or require SEPA to undergo further consultation before it is approved.

The same principles apply to local authorities when developing the implementation plans. Where agreements can not be reached on how actions will be implemented, the Scottish Ministers will determine the content of the implementation plans.

Creating efficiencies in the development of flood protection schemes and measures

The promotion of joint working and sharing of skills and expertise will be

challenging but should lead to efficiencies of time and resources between SEPA and the responsible authorities. Importantly, the process of preparing flood risk management plans should speed-up the process of taking forward and implementing a flood protection scheme or other measures. For example, the information generated by SEPA should fulfil, at least in part, early option appraisal stages of scheme development, while also supporting subsequent, more detailed assessments and appraisals.

Interactions with other issues

There will need to be close coordination of flood risk management planning work with other areas which affect or are affected by flood risk management, including the land use planning system, insurance provision and emergency response (Figure 5).

Land use planning decisions are one of the most powerful tools available to manage flood risk. This concept is set out in Scottish Planning Policy, which states that development which would have a significant probability of being affected by flooding or would increase the probability of flooding elsewhere should not be permitted. Where redevelopment occurs, the planning system can identify opportunities to build flood resilient structures, integrated urban drainage and flood management actions into the fabric of our urban landscapes.

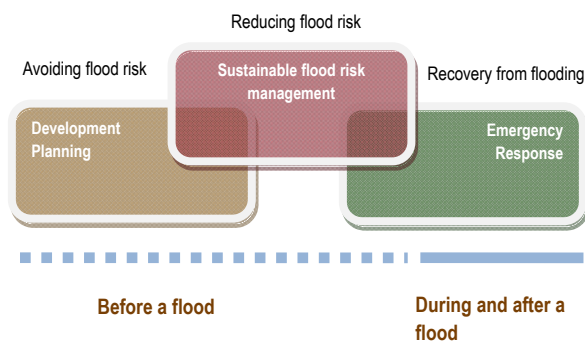


Figure 5 Three elements of flood risk management

Flood risk assessments and plans produced under the Act will provide additional information that will enable the planning authorities to plan and consider future development with a more complete picture of current and future flood risk and the insurance industry to offer premiums which reflect the risk of such provision.

Scottish emergency planning and response is founded on the concept of Integrated Emergency Management (IEM). Under IEM, preparation and response to emergencies focus on the effects of events rather than their causes. Close ties between Scottish emergency planning, the Scottish Flood Forum and flood risk management planning will need to be established so as to coordinate actions to reduce flood risk with existing work to manage the effects of flooding, including where restoration and repair of homes and properties is being undertaken once the flood waters have receded.

Integrated land and water management

As far as is practicable, an integrated approach to land and water management should be pursued. When developing flood risk

management plans, early links must be made with other relevant aspects of water and land management. In turn the findings from flood risk management plans should influence other planning initiatives in an interactive and iterative cycle. Making these links will help identify opportunities to deliver multiple benefits from flood risk management measures.

Examples of relevant policy areas include:

- National planning framework;
- Local and strategic development plan;
- River Basin Management Plans;
- Rural Development policy;
- Shoreline management plans;
- Marine spatial plans;
- Green Networks;
- Emergency response;
- Economic development plans;
- Asset management and investment plans;
- Protection of critical national infrastructure;
- Climate change adaptation and mitigation.

This is not an exhaustive list. The important point is that connections and dependencies should be considered early so as to allow links and synergies to be established and taken account of.

Ecosystem Services Approach

The ecosystem services approach (BOX 1) can be used to help create a common framework upon which flood



management decisions can be balanced with other decisions, for instance spatial planning, food security, environmental regulation and river basin management.

River Basin Management Planning, which is led by SEPA, takes a source-to-sea approach to integrating land and water management to improve the quality of Scotland's Waters. The FRM Act requires consistency and coordination between River Basin Planning and flood risk management. Examples of where SEPA should ensure consistency and coordination include:

- where possible, promoting land management measures that deliver coincident flooding and environmental benefits;
- where possible not undermining the objectives of one, when addressing the other;
- operating its monitoring regime so as to provide information about flooding;
- managing advisory groups and consultation activities to reduce consultation fatigue.

SEPA must strike the right balance between protecting and improving the environment and supporting the social and economic needs of those who depend upon or are affected by land and water. Areas of particular importance to flood risk management include the construction and operation of reservoirs, CAR licensing of flood protection schemes, land drainage and the maintenance of watercourses and flood defences.

BOX 1 Ecosystem services

Our natural environment contains natural capital that underpins our economic activity, our well being and the earth's life support systems. The food we eat, the water we drink and the air we breathe are only available to us because the natural environment cycles nutrients, purifies water and generates oxygen.

This natural capital is locked within a series of living, interacting systems - ecosystems. A river system and the land around it can be described as an ecosystem. In these systems, people, other living things and the environment all interact. These ecosystems provide the services (often called ecosystem services) that we need. Well-functioning ecosystems provide these services very cost-effectively compared with other alternatives.

The ecosystem approach offers a useful tool to understand value and account for the physical, biological and chemical interactions within and flowing from ecosystems.

The information, knowledge and structures created to support flood risk management should also be used to support continued improvements to River Basin Planning. The greatest opportunities are likely be in the areas of diffuse pollution, water resources and hydro morphology, all of which should benefit significantly from the information, tools and knowledge that will be generated through the



preparation of flood risk management plans.

SEPA should work towards an appropriate integration of River Basin Planning and Flood Risk Management Planning so as to develop a joined up approach to protecting and managing Scotland's water resources.

Involving stakeholders

SEPA and the responsible authorities will need to work in partnership with communities and land managers to help them understand flood risk, while encouraging them become involved in decision-making and flood management actions. This will include giving communities a bigger say in what action is taken and a more active role in decisions on local funding priorities. Ultimately, SEPA and the responsible authorities should be accountable for the decisions they take.

Opportunities for stakeholder participation should be incorporated at all stage of flood risk management, from the preparation of flood risk management plans through to schemes and projects. Engagement with interested parties should aim to gain a sound understanding of local issues and an appreciation of the concerns of individuals, communities and businesses potentially affected, as well as more strategic and national perspectives.

SEPA and the responsible authorities need to consider and utilise a range of different mechanisms for engagement including physical and online forums,

mobile texts as well as formal written consultation routes.

Information should be conveyed to stakeholders in a transparent way, using plain language to enable stakeholders to gain a better understanding of the decisions that affect them and what they can do to influence or get involved in the decision making process.

Information on flooding and its management should also be communicated through the advisory services that provide support to businesses and land managers.

To support the preparation of flood risk management plans, the Act provides for the creation of advisory groups. The groups, which must include representation from a wide range of interests, will provide an important forum for discussing flood management and engaging with the stakeholder community. SEPA and the responsible authorities will need to consider how best to engage with existing stakeholder forums and whether further fora will need to be established.



4. Integrated drainage

Introduction

Drainage is a complex interaction of piped systems, watercourses, and other features of the landscape, like roads and paths, that by design or otherwise perform a drainage function.

It is widely recognised that an integrated approach to drainage, ensures that above and below ground parts of the drainage system can work in concert to deliver benefits for flood risk management, the environment and water treatment.

This section provides guidance on:

- delivering an integrated approach to drainage with a focus on urban areas in particular;
- inclusion of surface water management within the preparation of flood risk management plans;
- interactions with River Basin Management.

Drainage and flooding

Drainage involves the interaction of many different components of above-ground and below-ground drainage. Following a rainfall event, surface water runoff will normally flow above-ground until it reaches a receiving body (storage pond, stream or low point in the catchment), or it enters the below-ground piped drainage system, typically through a series of gullies, eventually making its way to a

receiving body of water or a wastewater treatment works.

These systems are not designed to deal with severe storms and can never be built large enough to accommodate the most extreme rainfall events. This means heavy rainfall events can cause flooding when the capacity of part or all of the drainage system is exceeded, which can include when:

- capacity of the below-ground system is overwhelmed by the rate of flow;
- surface runoff cannot enter the below-ground drainage system due to limited capacity of drainage inlets (by design or through poor maintenance);
- systems cannot drain effectively because of they cannot discharge at their downstream outfall, possibly due to high levels in receiving waters.

Where run-off is conveyed through combined sewers, as is the case in older developments, a mixture of surface water and untreated discharges can spill out from the system if it becomes overwhelmed.

Potentially hazardous contaminants can also enter the system at several points and lead to pollution of land and receiving watercourses. Under the Controlled Activities Regulations, all new developments must drain surface water through Sustainable Urban Drainage systems (SUDs) before it enters receiving watercourses.

Where possible opportunities to retrofit sustainable urban drainage and surface water management systems in existing developments should be identified and encouraged to keep



water from entering the sewers in the first place.

A number of factors can, if uncontrolled, place additional pressure on urban drainage, potentially resulting in increased flood risk and pollution. For instance increases in the proportion of impermeable surfaces in existing developments as new roads and car parks are constructed and people pave over gardens. Likewise climate change is likely to place increasing pressure on existing drainage systems.

An integrated approach to urban drainage

The long term answer to urban water management cannot be continual upgrading of sewerage infrastructure, for instance by creating ever larger pipes and subsurface storage, as this would be impractical and prohibitively expensive.

Instead, an integrated approach to drainage that takes account of all aspects of the urban drainage systems and produces long term and sustainable actions must be deployed. This requires examination of the sources, pathways and receptors of flood waters to ensure that during any event the flows created can be managed in a way that will cause minimum harm to people, buildings, the environment and businesses.

A key component of this approach is to manage surface water before it enters the sewer system or receiving watercourse by allowing for the increased capture and reuse

of water; increased absorption through the ground; and more above-ground storage and routing of surface water separate from the foul sewer system.

This approach will not only help reduce surface water flooding, it will also help to reduce pollutant inputs to watercourses and reduce the reliance on infrastructure, e.g. culverts that can damage the water environment. It can also create other recreational, amenity and economic benefits through the creation of green spaces and opportunities for urban regeneration.

Good surface water management will involve increased use of SUDS and creation of surface water flow routes that divert floods to areas where impacts will be minimised. The best solutions will be achieved when the full drainage system, from source to receiving water, is designed from the outset. This allows the optimum balance between source, site and regional controls to be achieved.

To deliver these changes, integrated drainage must be a key consideration in planning decisions, so that sustainable drainage is embedded into the fabric of our urban and rural landscapes.

The principles set out in BOX 2 should be adopted by SEPA and the responsible authorities to support the delivery of integrated drainage.



BOX 2 Principles to support integrated drainage

- increase the percentage of new surfaces that are permeable;
- aim to deal with storm water runoff from impermeable surfaces as close to source as possible;
- replace existing impermeable surfaces with permeable surfaces where possible;
- minimise the amount of drainage going underground as this is often an inflexible solution that cannot deliver wider benefits or be easily adapted to future conditions;
- maximise opportunities to manage surface water before it enters the sewer system;
- design for exceedence by ensuring that existing and new developments have flood plains and safe flow paths.

Local flood risk management plans and integrated drainage

Local authorities will be expected to lead on the preparation of surface water management plans for inclusion in the local flood risk management plans, and to do so in a way that respects the principles of integrated drainage (BOX 2). This work should be taken forward within the context of wider flood risk management strategies prepared by SEPA in order to ensure that surface water management decisions are undertaken in consideration of other flood management actions and interactions with the wider catchment.

In taking this work forward, careful consideration will need to be given to responsibilities for delivering and maintaining all parts of the drainage

system, with particular attention given to responsibilities where the system, or parts of the system, performs more than one function. The aim should be to find a fair and practical way to share costs and responsibilities for the whole drainage system.

SEPA and Scottish Water will need to engage proactively in this work, offering support, expertise, data and models to local authorities. This should include drainage studies and, wherever possible, contributions to overland flow modelling and mapping. SEPA should also provide guidance to support the development of integrated modelling, both above and below ground and with the wider catchment. This could be delivered through the provision of advice or the establishment of guidance standards for modelling.

Prioritising effort

The level of effort invested in understanding and tackling surface water and drainage flooding problems must be proportionate to the risks they present. In complex urban settings where the risk of surface water flooding is significant, detailed urban studies and planning is likely to be required.

In determining the level on the effort needed to investigate and manage surface water flooding, consideration should be given to:

- future urbanisation/redevelopment – urban expansion or regeneration presents a challenge to existing drainage systems but can also become an opportunity to address long-standing problems;



- opportunities to retrofit sustainable drainage and surface water management systems;
- evidence of surface water and sewer flooding— past flooding is a reliable indicator of future flooding;
- asset knowledge- where there are complex drainage systems, solutions are more likely to require detailed studies and a partnership approach.

SEPA and the responsible authorities will need to decide early in the first planning cycle where surface water management plans will be necessary to tackle surface water flooding. The national flood risk assessment prepared by SEPA should provide information to help target effort in the first planning cycle. Longer term needs should then be coordinated through the strategic flood risk management plans, for instance by identifying where detailed drainage studies are required.

Interactions with River Basin Management

Water quality problems can occur where surface water and sewage are transported in the same pipes. The overflows that are designed to help protect properties during periods of heavy rainfall can significantly increase pollution to receiving watercourses. Contaminants can also enter the system at several points and lead to pollution of watercourses.

Man made changes to the morphology of watercourses can also cause widespread environmental damage. River straightening, culverting and alterations to bank side vegetation can damage habitats. These actions can also lower the natural resilience of watercourses to erosion which can cause sediments to accumulate leading to increased flood risk.

SEPA must work closely with Scottish Water and local authorities to ensure that opportunities to improve the quality of Scotland's water environment are exploited. This will require close coordination with River Basin Management Plans.



5. Selecting and implementing sustainable actions

Introduction

The main output of the flood risk management planning process should be a set of sustainable actions being taken to reduce overall flood risk across Scotland.

Flood risk management plans will incorporate a wide spectrum of actions, ranging from national policies to flood protection schemes to awareness raising activities. All options must be identified and considered within a structured appraisal process. This will ensure that options are considered in a consistent way, that alternative options are properly considered and that investment decisions are justified.

Where significant investment of public funds is being proposed, actions should be appraised in a manner that is consistent with the guidelines in HM Treasury's Green Book.

This section provides guidance on:

- principles to support the selection of sustainable actions;
- the hierarchy and interaction of different forms of appraisal;
- the key steps that should be followed in performing an appraisal.

Detailed guidance on the appraisal process is set out separately. The intention is to include this supplementary guidance in a policy statement to accompany this Ministerial Guidance. The Scottish Government will issue further guidance on the appraisal process as necessary.

A sustainable approach

In appraising options for inclusion in flood risk management plans, the Act requires that SEPA:

identify measures to achieve objectives in a way which it considers is most sustainable.

Flood management actions that don't respect the three pillars of sustainability- social, economic and environmental, and the need to protect our natural resources for future generations, will not accord with the principles of sustainable development. Guidance on selecting sustainable actions is set out below.

Risk-based decisions

The Act places a duty on SEPA and the responsible authorities to: *act with a view to reducing overall flood risk*

Actions should target those areas where flood risk can be reduced, while also taking steps to maintain existing levels of risk in locations where it would not be feasible or practicable to substantially reduce risk. The long-term aim must be to reduce the risk of flooding across Scotland as far as is reasonable, taking full account of environmental, economic and social priorities and needs.

These options should cover the three main ways in which risk can be reduced (Figure 6): avoiding risk, reducing the likelihood of flooding, reducing the impacts of flooding.

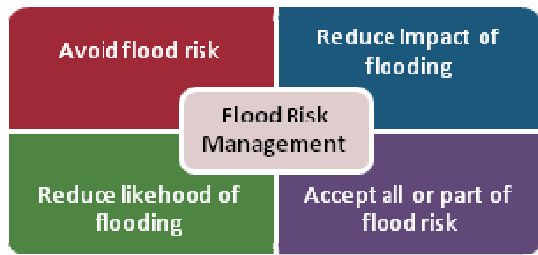


Figure 6 Approaches to reducing flood risk

Decisions on tackling risk should focus on addressing national priorities, however, flexibility must be maintained to allow local priorities to be addressed particularly where a relatively small amount of investment can address important local priorities and encourage communities to help protect themselves. For example subsidising flood protection products.

It is not realistic to expect all flood risk to be eliminated, and areas where it is not feasible to reduce risk or where current risks are believed to be acceptable should be clearly identified. In all cases, risk management measures should include arrangements to deal with residual risks (for example, if design limits are exceeded by flood events). This could include promoting actions by individuals, local communities or business and raising awareness of flooding issues and the availability of insurance for any residual risk.

Adopt a long term planning approach

Actions to tackle flood risk should be planned over a long time period (50-100 years) with a view to retaining sufficient flexibility to manage changing risks over that period.

Testing flood risk management actions against long term trends will be essential to selecting sustainable actions that will stand the test of time. SEPA and the responsible authorities should work to establish approaches to examining future scenarios that can be applied consistently across flood risk assessments and management decisions. Wherever possible, a range of future scenarios should be examined, including a 'worst case' scenario.

The impacts of the changing climate should be consistently taken into account in appraisals using up to date robust evidence and in accordance with the Scottish Government's guidance on '[Public Bodies Climate Change Duties](#)' and the objectives of the '[Climate Change Adaptation Framework](#)' and accompanying '[Water Environment and Resources Action Plan](#)'.

Consider a broad and adaptable range of actions

Consideration must be given to a broad range of structural and non structural options (Figure 7), both individually and in combination across a catchment. In identifying options, careful consideration should be given to:

- options that prevent sudden catastrophes and enhance recovery;
- actions that can cope with natural variability and unexpected events;
- temporary as well as permanent options should be considered, for instance demountable defences;
- Whether abandonment or relocation of property is a better alternative.



Structural	Non Structural
Restoration of natural features of catchment, including wetlands, forests and floodplains.	Flood warning
Clearance and repair works to rivers	Public awareness raising campaigns
Walls, embankments and other defences	Planning system and planning decisions
Barriers, barrages and other dams or storage structures	Emergency response
Drainage infrastructures,	Relocation
	Flood insurance
	Compensation
	Flood proofing buildings
	Temporary defences

Figure 7 Examples of structural and non structural actions to manage flood risk

SEPA and the responsible authorities should avoid making decisions that will make it more difficult to manage the effects of climate change. This will involve not locking in options that limit further adaptation in the future.

Wherever possible, SEPA and the responsible authorities should use flexible or adaptive management options. These are typically options that can be implemented incrementally or as small steps over time, responding to new information and adjusting management gradually, rather than acting in one step.

Being flexible may mean that actions are not implemented at a single time. Instead, implementation could be phased and accompanied by monitoring to provide evidence on when or whether further action is needed.

Working with and restoring catchments

As described in Section 2, all options should be developed in consideration

of catchment processes and characteristics, including consideration of how different interventions interact across a catchment.

In recognition of the range of potential benefits that can be obtained from working with our natural landscape, all reasonable and practical efforts should be made to enhance the (urban and rural) landscapes natural ability to slow and store flood waters. (Figure 8).

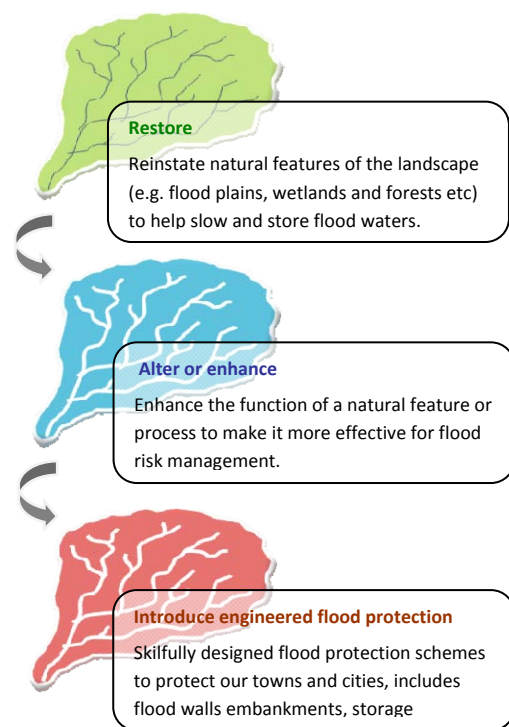


Figure 8 Managing the catchment

There is unlikely to be a simple line between natural flood management actions and more traditional engineering, and in many cases options will need to be considered in combination. However, the overriding principle should be to ensure the most sustainable approach is adopted and that all available actions are considered.



As the evidence base for some of these actions is still evolving, wherever possible, monitoring should be undertaken to promote growth of the evidence base. Monitoring will also allow actions to be adapted or refined as evidence on their effectiveness is obtained. Actions which benefit flood risk management to some degree and deliver other benefits, for instance environmental benefits or contributions to climate change adaptation, should be promoted wherever possible.

Moving beyond design standards

Simple consideration of design standards can limit consideration of how factors other than geometry affect the effectiveness of the defence—such as manually operated flood gates, which depend on accurate, timely flood warnings and operational response. More broadly, the design standard, for instance to contain a flood with a 100 year return period (an event that has a 1% probability of occurring in any given year), has become a default flood management objective over recent years, if this was to be adhered to in the future this could limit decisions on how to optimise investment and protect those at greatest risk.

Although there are some benefits to be gained from adopting a common standard of protection for all flood protection work, not least of which is simplicity of communication and simplification of investment planning; this approach would mean that all works would be constructed without due regard to the value or importance of the assets being protected, whether

they be people, critical infrastructure, property or the environment.

This guidance does not specify certain design standards. Instead, the approach adopted should be entirely risk based; linking benefits to costs, with the aim of maximising the reduction in overall risk. This approach requires management options to be compared on the basis of the effect that they are expected to have on the frequency and impact of flooding in a specified area. This requires information to predict where flooding will occur (now and in the future) for a range of event probabilities. Estimates of the impacts of this flooding and any mitigation options can then be tested to identify the most cost beneficial option(s).

In practice, it is recognised that design standards act as useful benchmarks. We expect a variety of protection levels to be considered during the design process including 0.5%, 1% and if appropriate a lesser level. As an option we expect actions that protect to a 1% exceedence probability plus allowances for climate change to be included in all appraisals. It is not expected that sewer pipes which are currently built for a 1 in 30 year flood event (3.33%) should be designed to this level. However we would expect SEPA and the responsible authorities to consider the feasibility of designing for protecting to a 1% exceedence through the use of a number of measures including above surface storage etc. Where other design standards are considered, a clear justification must be provided, for instance, where a scheme to protect to



a lesser standard is the only technically viable option.

In many cases, particularly when tackling surface water flooding, a combination of actions will need to be brought together (above and below ground) to reduce flood risk. In these cases, the emphasis should be on examining the benefits and costs of combinations of actions against a range of flooding scenarios. For instance, the costs and benefits of upsizing sewers alone compared to the costs of actions to create above ground storage and a small increase in sewer capacity.

An integrated approach to appraisal

Appraisal has an important role to play at all levels of flood risk management, from the preparation of flood risk management plans that set out the strategic direction of flood management, through to specific projects or schemes (Figure 9).

It is important that appraisal is viewed as part of the process of developing and implementing flood risk management plans and the actions set out therein: it should not be viewed or undertaken as a separate process or exercise.

The Act requires close interaction between the preparation of flood risk management plans and the implementation of actions. For instance, the power conferred on local authorities to undertake flood protection work, including schemes, can only be exercised where it will contribute to delivering the measures

in a flood management plan or not impair delivery of actions set out in plans. Similarly, investment by SEPA in flood warning schemes is expected to be based upon needs identified in flood risk management plans.

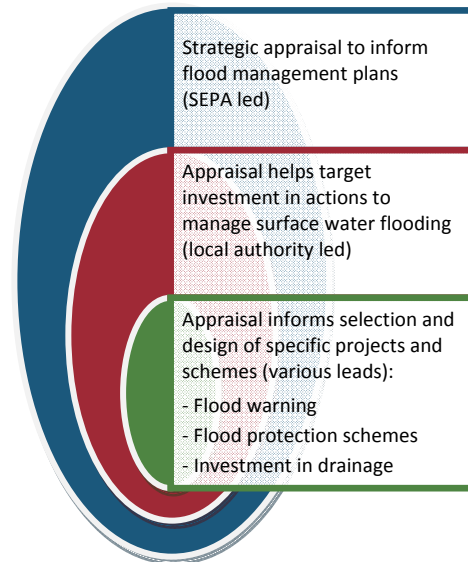


Figure 9 Roles of appraisal in flood risk management

It is therefore important that strategic appraisals underpinning flood risk management plans form the outline for appraisals made for the individual projects within the plans. This does not mean that the details of individual schemes will be set out in flood management plans. Instead, the appraisals carried out in flood risk management plans will set out catchment focused flood risk management strategies, which should identify the need for particular types of local actions or management response. Where these actions, for instance flood protection schemes or long term land management agreements, require significant public expenditure, more detailed appraisal work will be required to ensure that the



options and designs reflect local needs.

As discussed in Section 3, the process of preparing flood risk management plans should speed-up the process of taking forward and implementing a flood protection scheme. For example, the information generated by SEPA should fulfil, at least in part, early optioneering stages of scheme development, while also supporting subsequent, more detailed assessments and appraisals.

Local scale assessments will need to be consistent with those at a higher level, taking forward the assumptions and principles already agreed on. For example, ensuring that appraisal of shorter-term activity, such as the maintenance of defences, is undertaken in the context of wider strategic objectives as set out in flood risk management plans.

Throughout the appraisal process:

- the degree of detail considered should be proportionate to the complexity of the problem and the information required to reach and demonstrate a robust decision;
- the cost of the appraisal stage should be proportionate to the overall costs and factors associated with delivering the plan, policy or project;
- the sensitivity of options to changes in cost and benefit assumptions should be tested at different stages of appraisal, to fully understand the uncertainties that exist in the analysis of options.

The appraisal process

All appraisals should go through at least the following three stages. Additional stages may be added as necessary depending on the purpose of the appraisal and information available.

1. **Define** the purpose of the appraisal, the issue and the case for intervention and set clear objectives for the appraisal.
2. **Describe** the impacts (positive and negative) associated with a wide range of possible options. As necessary and appropriate, evaluate impacts in qualitative and quantitative terms and assigning monetary values to them where possible.
3. **Compare** different options and combinations of options and selecting those that are most appropriate, deliverable and prioritise between actions as necessary.

Guidance on the appraisal process is published separately.

Valuing impacts

To support selection of sustainable actions, SEPA and the responsible authorities will need to ensure that the full ranges of positive and negative impacts of actions are considered in an equitable manner.

Wherever possible, impacts (positive and negative) should be valued in monetary terms. Values should be based on market prices and derived estimates for non-market values where feasible. This is to provide a consistent basis for comparing impacts



of different options both at a plan and project level.

Impacts that cannot be valued in monetary terms should always be described, quantified and brought into the appraisal through appraisal summary tables. Understanding these impacts is critical to selecting sustainable actions, and they should not be ignored simply because they are difficult to quantify or value in monetary terms.

The effort invested in valuing impacts should be proportionate to the complexity of the problem and the information required to reach a robust decision. Wherever possible, standard approaches should be used for assessing impacts to ensure consistency within and across different appraisals.

Involving stakeholders

Stakeholder participation should be used to help identify and develop management options and to gain an understanding of local people's views and needs, in particular those affected by flooding and those that can assist in protecting against it. Involvement of individuals, businesses and communities in taking forward actions should be promoted wherever possible.

Formal and informal consultation should be undertaken in the development of plans and projects. This should enable stakeholders affected, including the community and statutory consultees to make a meaningful contribution to the appraisal processes. Consultation

should be coordinated and structured to enable interested parties to understand the decision making process. Statutory consultation requirements, to do with the EU Environmental Impact Assessment and Strategic Environment Assessment Directives and the Floods Directive, should be used to inform policy and projects appraisal.

From the outset, it should be explained to communities and other beneficiaries that the availability of public funds for delivering flood risk management may be dependent on national priorities for investment and how the project compares with the benefits achievable by investment in other parts of the country. However, it is equally important that people understand that constraints on public funds shouldn't prevent beneficial local projects being developed, partly or wholly funded or delivered by local beneficiaries. This is subject to the impacts being acceptable to the whole community and such projects complying with any relevant legislation.

As part of the consultation process, the potential benefits and the beneficiaries should be clearly identified. This should enable stakeholders to understand the relevance of costs and benefits. It may also encourage contributions towards projects which could enable measures to be promoted that otherwise might not be afforded or allowed to proceed sooner. Such contributions should allow public funding to go further and deliver improved flood risk management in areas that otherwise would not benefit. Section 6 provides further guidance on engaging with the public.



Scrutiny

SEPA and the responsible authorities should undertake in-house quality assurance checks of all proposals and post project evaluation, to create a cycle of continuous learning and to understand where policy and delivery can improve. The Scottish Government may review a sample of appraisals after they have been approved. This will help determine how the principles in this guidance are being applied and whether further guidance is necessary.

Implementing actions

Consideration of sustainability does not end when the best options have been selected. It is also important that actions are implemented in a sustainable manner. It is not the purpose of this guidance to set out how this can best be achieved, but the following principles should be applied.

- aim to minimise construction waste;
- maximise the reuse of materials;
- adopt low carbon construction strategies;
- ensure designs support the principle of adaptive management wherever possible.



6. Engaging with Stakeholders

Introduction

Public awareness, participation and community support are essential components of sustainable flood risk management. Public participation can not only raise awareness of flood risk, it can also inform decisions and contribute to the successful implementation of actions.

Individuals, businesses and communities can play an important local role in flood management by acting as their own first line of defence against flooding. These actions can play an important role in complementing and supporting the work undertaken by SEPA and the responsible authorities.



When the residents of Waulkmill near Langholm wanted advance warning of flooding and river heights, they built their own early warning system

This section provides guidance on:

- improving access to information on flood risk, including flood warning, flood maps and other resources;
- improving access to information on the steps that individuals can take to protect their families, homes and businesses from flooding;

- improving awareness of actions that can increase flood risk and alternative options, for instance using permeable paving;

- Raising awareness among land managers about the contribution they can make to flood risk management.

Improving access to information

Public engagement and participation needs to be ongoing and regularly refreshed, seeking to attract attention and changes in behaviour without causing undue alarm. At all times, it must be based on clear, accurate information, and presented in simple and engaging language.

In collaboration with the Scottish Flood Forum and the Insurance Industry, SEPA, and the responsible authorities should help local community groups take some responsibility for their own awareness campaigns and flood preparation.

Using flood maps

Flood maps are a powerful tool for communicating complex flooding information. For instance flood outlines can show predictions of where flood waters would go under different flooding scenarios.

The flood risk management planning process will generate an extensive resource of information on flooding and its impacts including new maps. It is important that the public are given appropriate access to relevant information. Care must be taken to ensure that the information available to the public is of value and suited to their needs.



As flood maps and other similar resources become more sophisticated, for example, through consideration of multiple sources of flooding and their impacts. SEPA and the responsible authorities will need to ensure that information is presented in a way which is clear and understandable for a non-technical user.

Flood warning

SEPA is Scotland's flood warning authority with responsibility for warning and informing the public and strategic partners on the threat of flooding through the Floodline service.

There should be continued emphasis on improving this flood warning service, and this should include maintaining and improving links to other awareness raising initiatives.

Perceptions and attitudes to flood risk

To help target awareness raising work, SEPA and the responsible authorities should work to develop a more comprehensive understanding of public perceptions and attitudes to flood risk. In undertaking this work, particular attention should be given to understanding how past experiences or the lack of them colour perceptions of flood risk.

Information on perceptions and attitudes to flood risk should be reviewed periodically to test the performance and success of awareness raising and other campaigns.

An active and planned approach to public participation

Public engagement and participation in flood risk management decisions will help reassure the public that sustainable actions are being selected. In taking forward public engagement and participation, SEPA and the responsible authorities should focus on:

- building understanding and trust locally, particularly through inclusive decision making;
- involving local residents, land managers and key community representatives in the planning process;
- clarifying the responsibilities on both public bodies and home and business owners and the important supportive role of voluntary organisations; and
- agreeing priorities and setting realistic expectations - to best achieve the needs of those with different interests.
- Raising long term awareness of flood risk and its sustainable management through schools and colleges including those that serve the land management sectors.

To support this work, SEPA and the responsible authorities, in liaison with the Scottish Government, the Scottish Flood Forum and other relevant organisations, should develop and begin application of a national engagement and communication strategy.



A meeting in Moffat gives local residents an opportunity to discuss flood management actions.

The strategy should support the adoption of clear and consistent messages at a national and local level, be pro-active and encourage greater public involvement. The strategy should not be viewed as a one off exercise; instead it is about creating an on-going process of engagement that can be applied in all areas of flood risk management.

The strategy should help ensure that the public:

- are provided with accessible and comprehensible information on flood risk and flood risk management;
- are aware of actions being taken by SEPA and the responsible authorities to manage flood risk
- have appropriate expectations for the level of flood protection that can be provided;
- have access to information on the consequences of key flood risk management decisions;
- have clear opportunities to communicate their views and priorities for flood risk management;
- have confidence that their views and priorities are fully considered in decision-making processes;
- understand the basis on which decisions have been made.

Promoting and supporting actions by individuals and communities

Investing in flood protection schemes and other actions to reduce flood risk is an important part of protecting Scotland's communities and businesses from the impacts of flooding. However, it will never be possible to eliminate flood risk. Actions by individuals, business and communities will play an important role in complementing and supporting the work undertaken by SEPA and the responsible authorities.

Individuals already take responsibility for managing many risks they face in their day to day lives, for example, to protect themselves from fire by using smoke detectors, fire blankets and fire extinguishers. A similar approach should be encouraged for flood risk, with individuals acting as their own first line of defence against flooding.

Simple steps include keeping abreast of flood warning information, checking flood maps to see whether homes are in flood risk areas, making a plan of actions that should be taken in the event of a flood. Steps can also be taken to reduce the damage caused by flood waters, for instance by installing flood proofing products to homes and businesses.

SEPA and the responsible authorities need to support actions by individuals by improving access to information on the steps that individuals can take to protect their family's homes and businesses from flooding. This could include showcasing best practise and promoting self help guides, particularly



amongst those who have not experienced a significant flood event.

SEPA and responsible authorities should encourage land managers to contribute to flood risk management through altering land management practices in areas identified as important for this purpose. This can be done in a number of ways, for instance through demonstration sites, representative bodies, advisory organisations and trusted intermediaries such as the Tweed forum. Appropriate financial and non monetary incentives should also be made available to encourage voluntary agreement.

In promoting these messages and actions, the aim should be to minimise the damage caused by flooding and while also improving the ability of individuals, businesses and communities to recover quickly and fully from an incident of flooding.

Improving awareness of actions that can increase flood risk

Small changes to how land within and around properties, and businesses is managed could, over time, make a substantial contribution to increase flood risk. In urban areas, simple actions like paving over gardens can have a major cumulative impact on flooding. Similarly, actions in rural areas, which include actions to maintain watercourses, can cause problems elsewhere.

SEPA and the responsible authorities should promote awareness of the cumulative impact that individuals and business can have on flooding and the positive actions that can be taken to prevent and reduce these effects.



7. Delivering responsibilities collectively

Introduction

Responsibilities for flood risk management are divided between different organisations. Strong partnerships, founded on common aspirations, will be needed to deliver coordinated or joint actions, aligned investment planning and efficient use of resources. Finding new ways to share skills, expertise and services will be important to delivering partnership working.

This section provides guidance on:

- the statutory framework for partnership working;
- what it means to adopt a partnership approach to flood risk management;
- building the right kind of partnerships;
- governance and resourcing arrangements.

General duties on the Scottish Ministers and public bodies

Section 1 of the Act places a set of general duties on the Scottish Ministers, SEPA, and the responsible authorities (Table 3). With the support of the Scottish ministers, SEPA and the responsible authorities must embrace and build on these statutory responsibilities to create a framework for partnership working that is underpinned by a common set of goals and responsibilities.

This will, at times, mean rethinking traditional responsibilities built around

individual organisations. This will involve promoting joint working practices and initiatives; ultimately leading to greater coherence in the way flooding is managed.

Table 6 General duties on SEPA and the responsible authorities (based on Section 1 of the Act)

Exercise functions to reduce overall flood risk
Exercise functions to secure compliance with the Floods Directive
Act with a view to achieving objectives set out in flood risk management plans
Have regard to the social, environmental and economic impact of exercising functions
Act in the way best calculated to manage flood risk in a sustainable way
Promote sustainable flood management
Act with a view to raising public awareness of flood risk
Act in the way best calculated to contribute to sustainable development
So far as practicable, adopt an integrated approach by cooperating with each other

A partnership approach to flood management

Many public bodies have already recognised the benefits of working in partnership, either on an informal or a more formal basis. If approached effectively and in a focussed way, joint working can yield a range of benefits:

- by identifying and removing duplication of effort and by sharing resources and information efficiencies can be found;
- sharing of expertise allowing each organisation to focus on its strengths and avoid the need to develop/maintain expertise where it exists elsewhere;
- building relationships to help deliver in one area of work can lead to benefits and improvements in other common areas;



- partners can often add value by tapping into a wider pool of resources and expertise.

SEPA and the responsible authorities must work across traditional institutional boundaries to deliver an integrated approach to flood risk management. This will require adoption of partnership working at all levels of flood management, from national strategic partnerships through to local/operational partnerships that deliver coordinated actions on the ground. This is not to say that everything must be delivered in partnership; and SEPA and responsible authorities should identify areas where it would not be realistic to deliver their responsibilities collectively, this should include areas where it is clear that they can achieve more working alone.

A wide range of powers exists in statute to support partnership work and joint delivery of projects and services. SEPA and the responsible authorities should draw on these powers and arrangements to support their work to manage flood risk.

Building the right type of partnership

When developing flood risk management plans, SEPA and the responsible authorities should work in partnerships founded on collaboration and co ownership of issues and actions (Table 6). These partnerships should be formed around the key units of management for preparing flood risk management plans, as described in Section 3.

To support operational work (which could include implementing changes to SEPA’s flood warning service,

implementing flood protection schemes, asset management, awareness raising campaigns, or integrated urban drainage projects) a wide range of partnership models will need to be adopted depending on particular circumstance and aims (Table 7).

In many cases a less formalised arrangement may be suitable, with the partnership consisting largely of a steering group whose aim is to improve co-ordination of day-to day service delivery. Conversely, integrated drainage projects may require a partnership based on full co-ownership of work and deliverables, supported by joint funding arrangements. Funding arrangements are discussed further later in this Section.

Table 7 Common types of partnership arrangements

Degree of Partnership	Characterised by...
<i>Co-existence</i>	<i>“You stay on your turf and I’ll stay on mine”</i> (May be a rational solution - where clarity is brought to who does what and with whom)
<i>Co-operation</i>	<i>“I’ll lend you a hand when my work is done”</i> (Often a pre-requisite of further degrees of partnership, where there is early recognition of mutual benefits and opportunities to work together)
<i>Co-ordination</i>	<i>“We need to adjust what we do to avoid overlap and confusion”</i> (Where the partners accept the need to make some changes to improve services/activities from a user/customer/community perspective and make better use of their own resources)
<i>Collaboration</i>	<i>“Let’s work on this together”</i> (Where the partners agree to work together on strategies or projects, where each contributes to achieve a shared goal)
<i>Co-ownership</i>	<i>“We feel totally responsible”</i> (Where the parties commit themselves wholly to achieving a common vision, making significant changes in what they do and how they do it)



Whatever partnership model is being adopted, careful consideration should be given to whether the partnership should be formed through informal working relationships or be bound by legal agreements.

Consideration will also need to be given to who should be represented. Partnerships typically encompass members with three distinct roles:

Decision makers – the organisations that need to be involved in decisions and investment;

Consultees – the organisations or individuals who should be consulted for their advice or views but do not necessarily need to be regularly involved in all decision-making;

Informed parties – the organisations or individuals which may be interested in the outcomes of the partnership and should be kept informed but who are unlikely to have strong views about the decisions being made.

Governance arrangements

It is important that the partnerships are underpinned by a clear governance and decision making forum. These arrangements should promote accountability among the partners, and with those affected by decisions: shared responsibility should not mean diminished accountability.

Local flood risk management plans cannot be completed until agreements over funding and implementation timetables are reached. Delays in reaching agreements could affect delivery and approval of the plans and result in failure to meet statutory deadlines. It is important therefore

that arrangements are in place within each organisation to secure agreements on flood management actions and their implementation.

To help ensure agreements can be reached, SEPA and the responsible authorities must establish the necessary forums, advisory groups and governance arrangements to support their flood management work. This could include, for more formal arrangements, the creation of boards to oversee the work of individual partnerships. To enable a Partnership to work well there has to be:

- Clear objectives that are agreed by all partners;
- A plan that sets out each partner's responsibilities, actions and timescales;
- Commitment from partners that they can invest effort and resource (time or finances);
- A lead co-ordinator who will be responsible for reviewing whether work towards the objectives is progressing;
- Clear communication, between partners and externally;
- Engagement of wider stakeholders. Consultation and buy-in from the local community can be essential.

Managing partnerships

It is unusual to find a successful partnership that does not have some dedicated administrative and programme/project support, or at least a firm commitment from members'



organisations to the significance of the partnership and to the importance of time devoted to it by members.

SEPA and the responsible authorities should examine the need for dedicated staff to support the management of any partnerships formed to develop and implement flood risk management plans.

More generally, each organisation will need to ensure that:

- they have the time to contribute effectively at meetings, operate on behalf of the partnership between meetings and implement appropriate actions within or on behalf of their organisation;
- partnership skills and behaviours are embedded throughout the organisation so 'partnership behaviour' is not limited to those who sit round partnership tables;
- key members of the partnership are given guidance on delegated authority and support to fast-track decisions that it is not possible to make round the partnership table;
- Mediation mechanisms are built in to help resolve any disputes quickly and effectively.

Sharing services

Shared services is the convergence and streamlining of similar functions within an organisation, or across organisations, to ensure that they are delivered more efficiently than working alone, for instance, through economies of scale, access to specialised skill-sets and expertise.

SEPA and the responsible authorities should challenge themselves to collaborate, and engage in sharing services as an integral part of the partnerships formed to deliver flood risk management where appropriate. This should include considering joint initiatives and consolidation of services that can be shared with others where it adds value to the flood risk management process and reduces the resources required to deliver a reduction in flood risk.

Examples of areas where there may be benefits to be gained from a shared service approach include:

- establishment and procurement of 3rd party projects;
- creation and sharing of flood risk management data, information and knowledge;
- awareness raising exercises, web tools to access to flooding information and other communications work;
- training and building of skills and expertise;
- programme and project management.

Formal agreements such as service level agreements or memoranda of understanding should be established to manage the interdependencies and resource implications of sharing services. In all cases, these arrangements should be used to promote innovation and improvement.

Resourcing

Delivering the actions set in flood risk management plans will require significant investment of public funds. In partnership with the Scottish Ministers, SEPA and the responsible



authorities should investigate and apply different forms of joint resourcing (Table 8).

As a minimum, all resource commitments must be aligned. However, in many instances, joint funding commitments or pooling of resources may be necessary. For instance, between local authorities working to deliver coordinated actions across a catchment, or between local authorities and Scottish Water when coordinating their respective work to deliver integrated urban drainage.

SEPA and all responsible authorities are funded separately for their duties under the Act. They will have to get together to identify how they can pull together those resources to deliver actions on the ground. One successful example of this is where SEPA, Scottish Water and the Society of Chief Officers of Transportation in Scotland (SCOTS) have together identified 6 priority areas for Quality & Standards 3b 2010-2015 where work will be done in cooperation between Scottish Water and the relevant local authorities to address surface water flooding issues.

Type	Examples
Aligning resources	<ul style="list-style-type: none"> - Co-ordination of planning across partner organisations - Targeting funding from different agencies in the same areas - Lead or joint commissioning of related services
Pooling non-financial resources	<ul style="list-style-type: none"> - Time spent on partnership or inter-agency groups - Information generation and sharing - Different partners providing different elements in combination to provide a service (e.g. awareness raising campaigns) - Secondment of staff with specialist skills to projects or multi-disciplinary teams - Shared use of facilities or equipment
Joint funding	<ul style="list-style-type: none"> - Joint funded posts - Jointly funded data, tools or models - Contributions to specific activities – with funds managed by one agency
Pooling budgets	<ul style="list-style-type: none"> - To deliver coordinate drainage works or other projects - Creating centres of excellence or expertise in flood management



Annex 1

Flood risk management milestones

Deadline	Lead authority	FRM Act requirement
May/June 2011	Scottish Government	Publish guidance on sustainable flood management.
January 2011	SEPA	Establish advisory groups.
December 2011	SEPA	Produce an assessment of flood risks across Scotland leading to identification of areas most vulnerable to flooding.
	SEPA	Identify local plan areas.
March 2012	SEPA	Establish local plan advisory groups.
No statutory deadline	Local authorities	Prepare a schedule of clearance and repair works.
Timescales to be set by Scottish Ministers	Local authorities	Prepare maps of water bodies and Sustainable Urban Drainage Systems (SUDS).
Timescales to be set by Scottish Ministers	SEPA	Prepare maps of artificial structures and natural features.
Timescales to be set by Scottish Ministers	Scottish Water	Publish an assessment of flood risk from sewerage systems.
December 2013	SEPA	Publish an assessment of opportunities for restoration of natural features and characteristics to reduce flood risk.
	SEPA	Publish flood hazard maps and flood risk maps.
	SEPA	Publish a statement of consultation actions.
December 2014	SEPA and lead local authorities	Publish draft national and local flood risk management plans for consultation.
December 2015	SEPA and lead local authorities	Publish flood risk management plans.
June 2016	Lead local authorities	Publish implementation parts of local flood risk management plans.
2016 onwards	SEPA and responsible authorities	Begin implementing the measures in local flood risk management plans

Cycle repeated every 6 years thereafter



Annex 2

Glossary of terms

Cost/Benefit Analysis

Comparison of present value scheme benefits and costs as part of an economic appraisal. The benefit-cost ratio is the total present value benefits divided by the total present value costs.

Catchment or Catchment Area

The specific land area that drains into a watercourse.

Civil Contingencies

The Civil Contingencies Act 2004 establishes a framework for emergency planning and response at both a local and a national level.

Climate Change

Long-term changes in climate, either through natural variability or human intervention.

Coastal Flooding

Flooding that results from a combination of high tides and stormy conditions.

Consequence

An impact such as economic, social or environmental damage/improvement. May be expressed quantitatively (e.g. monetary value), by category (e.g. High, Medium, Low) or descriptively.

Controlled Activities Regulations (CAR)

A reference to The Water Environment (Controlled Activities) (Scotland) Regulations 2005. All engineering works in or in the vicinity of rivers, lochs and wetlands now require authorisation under the CAR Regulations.

Culvert

A closed conduit used for the conveyance of surface drainage water under a roadway, railroad, canal, or other impediment.

DEFRA

DEFRA (Department for Environment, Food and Rural Affairs) is a UK Government Department.

Diffuse Pollution

Pollution which originates from various activities and which cannot be traced to a single source e.g. contaminated run off from built up areas.

Do-Nothing Scenario

An option used in benefit/cost analysis to act as a baseline against which all other options are tested. It assumes no active intervention.

EC Floods Directive

The EC Directive on the Assessment and Management of Flood Risks or *EC Floods Directive* builds on and is closely related to the Water Framework Directive.

Embankment

Artificial raising of the natural bank height of a waterway.

Environment

Where environmental issues are referred to in this document, this term is used to encompass landscape and visual, flora, fauna, geological or geomorphological features and buildings, air, water, sites and objects of archaeological, architectural or historical interest. (It is recognised that in other contexts the environment has much wider implications).

Environmental Impact Assessment (EIA)

Environmental Impact Assessment (EIA) is a process which identifies the potential environmental effects (both negative and positive) of a proposal.



Flood Risk Management Plans (FRMP)

High-level plans prepared by SEPA that set out the strategic direction of flood management, through to specific projects or schemes.

Floodplains

Floodplains are land areas adjacent to rivers and streams that are subject to recurring inundation.

Greenhouse Gases

Naturally occurring gases, such as carbon dioxide, nitrous oxide, methane and ozone, and man-made gases like chlorofluorocarbons, which absorb some of the sun's radiation and convert it into heat.

Groundwater Flooding

Flooding that occurs when water levels in the ground rise above surface levels. It is most likely to occur in areas underlain by permeable rocks, called aquifers.

Hazard

A situation with the potential to result in harm. A hazard does not necessarily lead to harm.

Impermeable Surface

A surface that does not permit the infiltration of water and, therefore, generates surface water runoff during periods of rainfall.

Local Flood Management Plans

Plan prepared by local authorities that provide a local expression of the strategic plans prepared by SEPA. Include a summary of how actions will be implemented in each local plan area.

Pluvial flooding

Flooding that results from overland flow which has been generated by rainfall before the runoff enters any watercourse or sewer. This is also referred to as surface water flooding.

Post project evaluation

A procedure to review the performance of a project with respect to its original objectives and the manner in which the project was carried out.

Preparedness

Informing the population about flood risks and what to do in the event of a flood.

Probability

The probability of an outcome is the relative proportion or frequency of events leading to that outcome, out of all possible events.

Qualitative Methods

Approaches which use descriptive rather than numerical values for assessment and decision making.

Residual risk

The risk which remains after risk management and mitigation. May include, for example, risk due to very severe (above design standard) storms, or risks from unforeseen hazards.

Resilience

Resilience is a measure of the ability of something to recover from a flood.

Restoration of natural flooding processes

This is the return of a landscape, ecosystem, or other ecological entity to a predefined historical state where the flooding processes are uninterrupted.

Return Period

The flood return period is a measure of the rarity of an event - the longer the return period, the rarer the event. It is the average length of time (usually in years) separating flood events of a similar magnitude.

Risk

A combination of the likelihood and consequences of an event.



River Basin District

Geographic areas over which River Basin Management plans area prepared. In Scotland there are 2 River Basin Districts identified under the 2003 Act - one for the Solway/Tweed area and one covering the rest of Scotland.

River Basin Management Planning

River basin planning is a strategic decision-making process introduced by the Water Framework Directive (WFD) which integrates the management of land and water within river basin districts (RBDs).

SCOTS

The Society of Chief Officers of Transportation in Scotland (SCOTS).

Scottish Water

Scottish Water is a publicly owned business, answerable to the Scottish Parliament and the people of Scotland. Its key duties are providing clean, safe drinking water and disposing of waste water from homes and businesses across Scotland.

Sensitivity testing

Method in which the impact on the output of an analysis is assessed by systematically changing the input values

SEPA

Scottish Environment Protection Agency. SEPA is the public body responsible for environmental protection in Scotland.

Sewer Flooding

Flooding caused by a blockage or overflowing in a sewer or urban drainage system.

Sustainability

Actions taken now to manage the risk of flooding that are robust enough to stand the test of time. There are three pillars of sustainability that must be considered - environmental, social and economic.

Sustainable Development

Sustainable development is an approach to resource use that aims to meet human needs, while preserving the environment so that these needs can be met not only in the present, but also for future generations. The delivery of sustainable development is generally recognised to require reconciliation of three pillars of sustainability – environmental, social and economic.

Sustainable Urban Drainage Systems (SUDS)

A set of techniques designed to slow the flow of water, can contribute to reducing flood risk by absorbing some of the initial rainfall, and then releasing it gradually, thereby reducing the flood peak and helping to mitigate downstream problems, and make a useful contribution to flood management.

Vulnerability

Vulnerability is defined as a combination of susceptibility and resilience.

Water Framework Directive (WFD)

The WFD establishes integrated river basin management for Europe. It requires all inland and coastal waters to reach "good status" by 2015, or an alternative or delayed objective.

Whole Life Costs

The total costs associated with a scheme for its full design and potential residual life span, taking proper account of all aspects of design, construction, maintenance and external impacts. A particularly useful approach in helping to determine economic sustainability when used to compare the relative costs of long- life schemes such as flood defences and where decisions between short-term capital costs and long-term maintenance costs need to be made.



Annex 3

Acknowledgements

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Aberdeenshire Council

Association of British Insurers

British Waterways

Cairngorms National Park Authority

City of Edinburgh Council

Clackmannanshire Council

Environment Link

Forestry Commission

Glasgow City Council

Tingle Consulting

Tweed Forum

University of Dundee

Halcrow

Jacobs

JBA Consulting

John Riddle

Met Office

Mike Donaghy Associates

Moray Council

MWH

RSPB

Perth & Kinross Council

SCOTS

Scottish Borders Council

Scottish Flood Forum

Scottish Rural Property and Business Association

Scottish Water

SEPA

SNH



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