

Natural Flood Management

Harnessing nature's power
in West Somerset



A practical guide

This guide has been produced to offer clear, simple advice to anyone interested in introducing natural flood management (**NFM**) measures onto their land or into their community.

You'll discover the different NFM interventions available and their benefits, as well as advice on how and where they might be best used. It outlines the rationale behind using NFM, as well as providing information on funding and financial incentives.

For advice on NFM proposals in your area, please contact:

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Storms Ciara and Dennis – and communities that have suffered repeated flooding events in recent years – have highlighted to me the importance of making nature's power part of the solutions we urgently need to tackle the challenge of flooding.

Environment Secretary, George Eustice, February 2020



Woody debris dams are one example of an effective NFM tool. They back up flood waters during high flows, slowing down the rate at which the water reaches higher risk areas downstream. Their leaky structure means that fish and other wildlife can still pass up and down the river in normal flows.

Introduction

Floods are nothing new. We've lived with them for thousands of years. They replenish the land with nutrients, boosting agriculture and providing food and water for people and livestock for the rest of the year.

However, their frequency and impact is becoming greater and increased flood risk is now predicted to be one of the UK's top climate change threats. Scientists predict that one of the impacts of our climate emergency will be heavier rainfall and greater frequency and strength of storms.

It's not just climate change that's to blame. For two hundred years we've followed the 'getting rid of water as quickly as possible' approach; cleaning out watercourses, straightening and sanitising them to make water flow away as quickly as possible. The problem with this is that those further downstream get flooded.

Somerset as a county has been particularly badly affected by flooding due to its mostly low-lying geography, 'flashy' streams on steeper, higher ground and heavy development of its fertile land for agriculture. The floods in 2013/2014 were particularly bad, leading the council to draw up a 20-year action plan to combat floods.

Physical flood barriers like concrete walls and dredging rivers can have an important part to play in protecting our homes and businesses against flooding. However, they're expensive, and building and maintaining vast flood defence schemes for every town, village and property that floods is prohibitive.

Natural flood management (NFM) is an alternative that's attracting increasing political and public interest. It's being recognised that in some cases NFM can complement traditional flood management techniques, offering a more natural, sustainable and cost-effective way to manage flood risk.



Particularly in rural areas like West Somerset, we've struggled with big conventional hard engineered projects. Which is why the role of NFM is so worth exploring to see if it can complement other techniques and fill the gaps where we can't do traditional hard engineering.

Niels McCartney, Environment Agency

Studies also suggest that NFM can bring other benefits including improved biodiversity, increased wellbeing, enhanced water quality and strengthened community cohesion*.



Met Office figures show that England had its fifth wettest autumn on record in 2019.

What is natural flood management (NFM)?

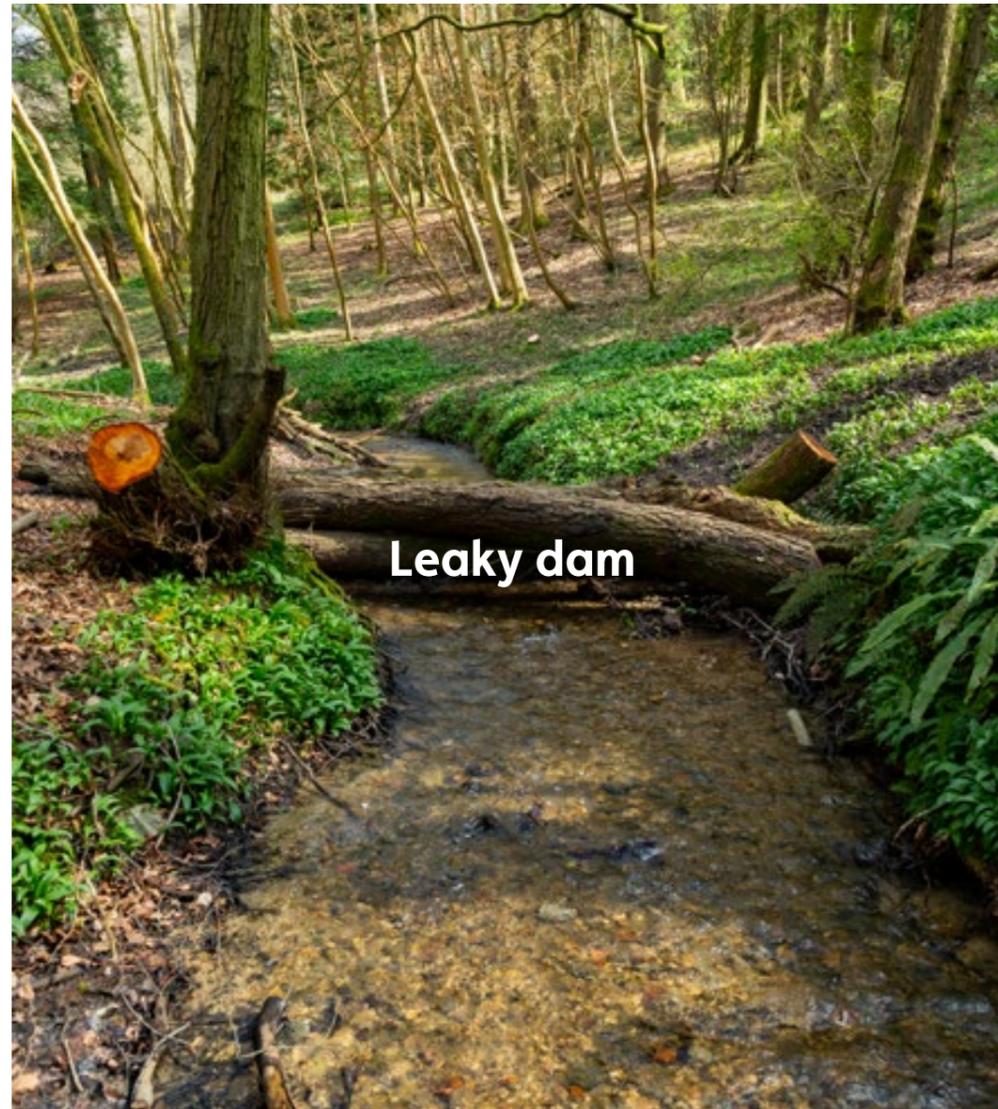
The premise of NFM is to hold water in the landscape for as long as possible using a range of simple measures, like ponds or leaky dams. These slow run off and allow water to pass slowly through the river catchment over a long period, so reducing flood risk downstream.

NFM manages the flow of water along the whole length of a river catchment. Each structure or technique performs a small amount of runoff storage or attenuation, gradually releasing flood water over 12 to 14 hours. It is this mosaic of features, rather than the individual interventions, that can have the effect of reducing flooding in the immediate vicinity and further downstream.



The idea of natural flood management is not an entirely new one. It's an umbrella term for a range of different techniques that mimic natural processes to use features in the landscape, like ponds, floodplains and wet woodlands to manage water, slowing it down and reducing flooding.

Tom Hayek, Senior Project Manager, WWT
(Nature-based solutions)



Leaky dam



Hedge bank



Hedgerow



Scrapes and bunds



Wet woodlands and ponds

How does natural flood management work?

NFM techniques work with the natural features of the catchment to slow down or store flood waters.

It works in three main ways. Firstly, features like ponds help create temporary storage which will fill up during a flood and then empty slowly. Secondly, NFM helps slow the flow by increasing the resistance to surface and in-channel water flow, for example by planting trees and hedgerows and creating woody dams.

Thirdly, NFM features work by increasing water losses, either by encouraging more water to drain into the ground or to be lost back into the atmosphere.

Many communities in West Somerset are prone to localised flooding due to water flowing off the land and down the streams too quickly, resulting in flooding at pinch points.

By using natural features such as ponds, wet woodland, swales, leaky woody dams and tree and hedgerow planting, water is slowed and stored which reduces the risk of flooding downstream.



Woody dams are a fairly simple thing that anyone can do.

Gary Holt, Farmer, Bicknoller, West Somerset

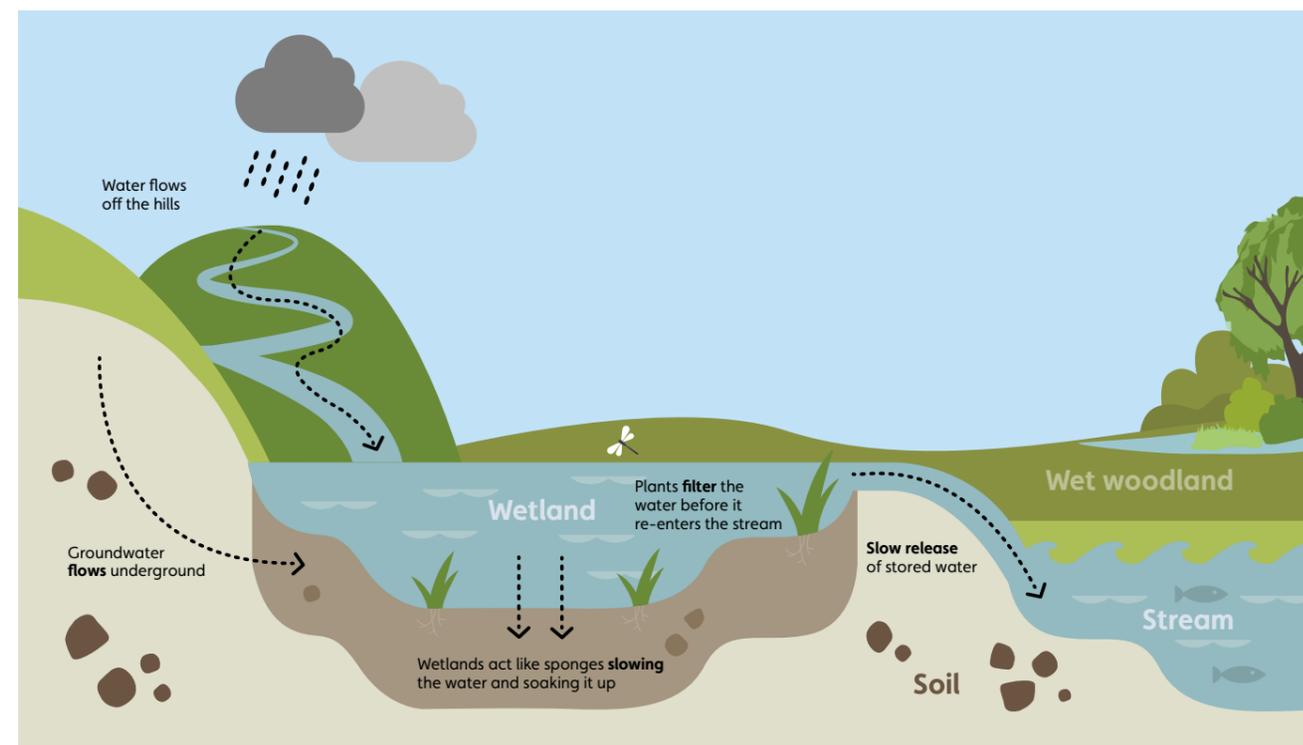


Illustration (a) By using natural features, such as wetlands, ponds and wet woodland to hold back and slow water flow this reduces the risk of flooding downstream.

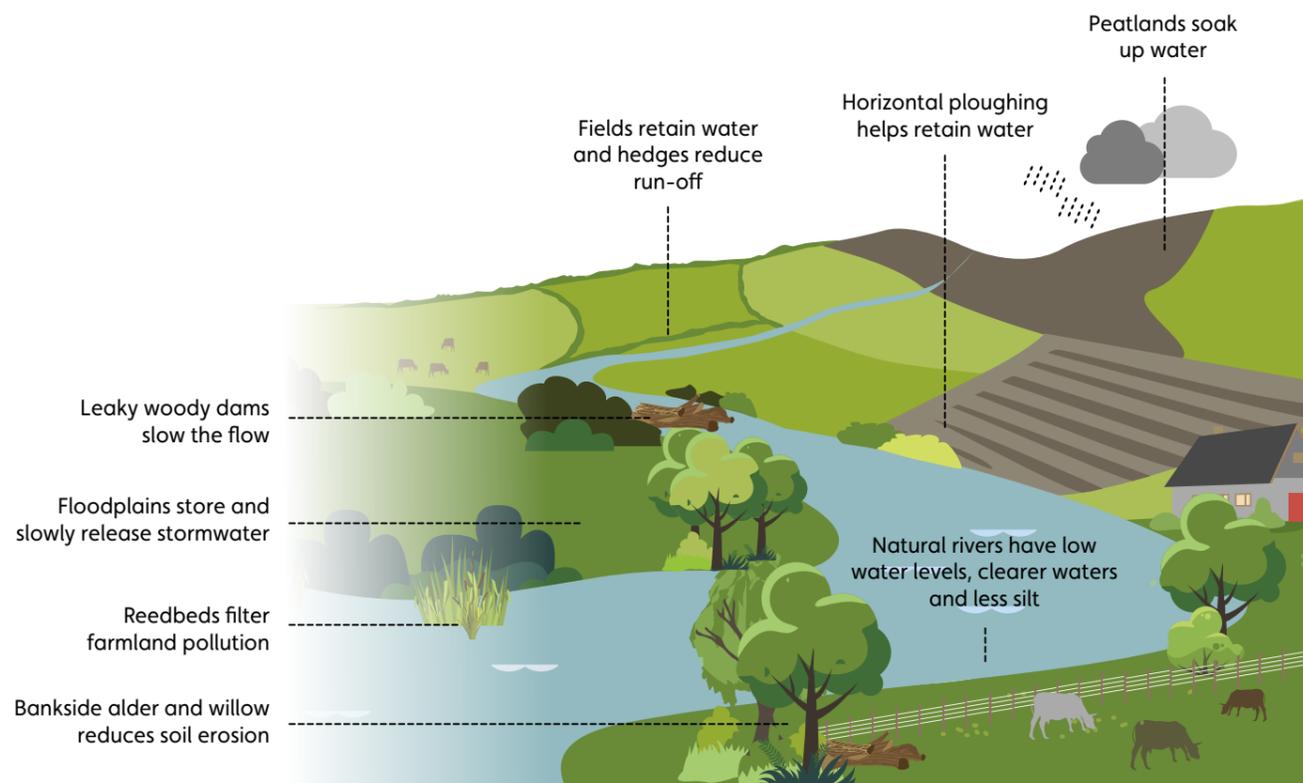


Illustration (b) Natural solutions in the landscape.

Additional benefits

Natural flood management techniques provide many benefits beyond just flood protection.



Natural flood management is good for the environment, good for controlling floods and water flow and to control the quality of water.

Ben Lintott, Arable Farmer, Watchet

Habitat creation to help restore biodiversity

NFM features like hedgerows and ponds provide ideal habitat for farmland birds, small mammals and invertebrates. In particular, increasing the number and quality of small wetlands in farmed landscapes can boost insect numbers which support farmland birds and bats.



I like to encourage more wildlife and it was interesting to see more diversity, frogs and newts and grass snakes as a result of our new NFM features and we've seen kingfishers which we never saw before.

Gary Holt, Farmer, Bicknoller, West Somerset

In addition, ponds help wetland species move around farmland habitats. Without them, many native species would struggle to survive. Research shows there are clear links between the management of farmland ponds and thriving populations of farm birds.

Early evidence from monitoring WWT's NFM work in West Somerset suggests an increase in aquatic insect abundance downstream from NFM interventions, especially leaky dams.

[Discover more](#) about our work restoring lost farmland ponds and how it benefits wetland wildlife.





Improved wellbeing

Research suggests higher occurrences of mental health issues (such as anxiety, depression and post-traumatic stress disorder) in communities that have experienced flooding. By working with flood-prone communities, WWT is building their resilience to a changing climate and helping to reduce the negative impacts damaging flooding has on homes, livelihoods and mental health and wellbeing.

WWT research also shows that being near water can increase people's reported levels of mental health and wellbeing. Our [Blue Prescriptions](#) pilot showed significant improvements in individuals across a range of indicators, including mental wellbeing, anxiety, stress and emotional wellbeing.



To walk in nature, the sounds, having wildlife around....it's key to our mental health and it's great to be able to promote that with these new natural flood management measures.

Sian Tennant, Landowner, West Somerset

In addition, because NFM involves creating and maintaining a large number of small-scale features, it lends itself to the participation of grass-roots groups in building, managing and monitoring. This form of volunteer engagement can in turn lead to improved wellbeing for individuals and cohesion for communities.



Water Quality

Evidence from other studies suggests that some types of NFM features like leaky dams can improve water quality by reducing the amount of sediment carried in the water by trapping it behind the barrier. Trapping and removing this sediment can also benefit wildlife by reducing phosphate and nitrate levels in the water.



Carbon Storage

NFM projects are typically low carbon as they don't involve the use of high carbon materials like concrete. In addition, research suggests that less-intensively managed grasslands store around 25% more carbon than intensively managed grassland and that floodplain restoration can increase the capacity of soil to store carbon. Wet woodland creation absorbs carbon from the atmosphere and stores it in the landscape, so contributing to climate regulation. [Blue Carbon Route Map](#)



I would really urge others to engage with this type of work and really think hard about the flooding, the quality of the water and talk to WWT as they're there with all the expertise.

Sian Tennant, Landowner, West Somerset

Who can use NFM?

Natural flood management structures have been designed so that they do not significantly impact on farming, are typically small in size, simple to install and can be considered an extension to the land's drainage system. From large landowners to those with smallholdings, these low-cost techniques are easily accessible to all. Every farm and community will have land with features that could play a role in natural flood management.

Sources of funding

There are a number of sources of funding to implement natural flood management on your land or in your community.

Agricultural holdings will be able to access funding through the new Environmental Land Management Schemes (ELMS) in due course, and those already in a Countryside Stewardship scheme may be able to add NFM works in. Speak to your local Natural England Advisor or Catchment Sensitive Farming Officer to find out what you can access now and to keep updated on future opportunities.

Westcountry Rivers Trust and Somerset Rivers Authority will often be aware of specific funding pots available for these works including for riverside fencing and tree planting. The Woodland Trust also often has funding available for tree and hedgerow planting and the Forestry Commission may fund larger schemes.

For larger individual NFM interventions or if considering works across a landscape-scale, it is worth speaking to the Environment Agency or the local authority to understand what grant support might be available at this level. These authorities will also be able to advise you on what consents might be needed for any NFM works.



Case study **The Two Valleys**



Over the last four years, WWT has delivered the Two Valleys – Slow the Flow Project, a natural flood management (NFM) scheme in West Somerset, to reduce flood risks within the Doniford Stream and Monksilver catchments near Williton.

Thanks to funding from the Environment Agency's national NFM fund and the Green Recovery Challenge Fund, the project has worked with natural processes to construct simple features within the local landscape that, combined with careful land management, enable water to be safely slowed and stored within the catchments. This has the effect of slowing water that drains into streams and rivers, especially during high rainfall events, reducing the potential to flood property and devastate communities.

The focus of the project was to explore the planning, delivery and monitoring of NFM measures as a means to help reduce flood risk and deliver wider environmental and social benefits as well as looking at ways to build support for these measures within the communities. The knowledge and data gathered have helped improve the understanding of the challenges and opportunities faced at all stages of NFM delivery. The lessons learned have enhanced the national evidence base for NFM practitioners and provided communities with this useful toolkit for considering such measures in the future.

Working with landowners, the project looked to test a variety of NFM measures, such as leaky woody dams, water storage areas and riparian planting across a range of sub-catchments. The measures focussed in the upper and mid-reaches of the catchments, working both within the channel and, importantly, in the wider landscape to reduce the degree of surface runoff reaching the channels. As well as helping to reduce flood risk, the project aimed to create additional woodland habitat, new water dependent habitat and wetland features, as well as restoring existing habitat and improving land management.

Monitoring the impacts of these NFM measures is ongoing, including assessing the impact on water quality, flow rate, biodiversity and turbidity. It is hoped that the evidence will be able to show improvements for nature and water quality alongside a reduction in flood risk.

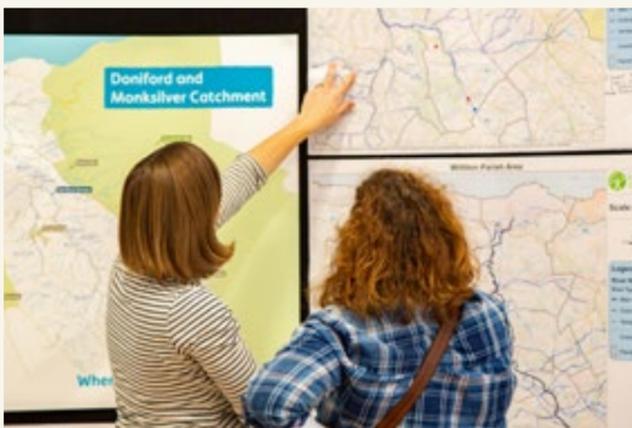
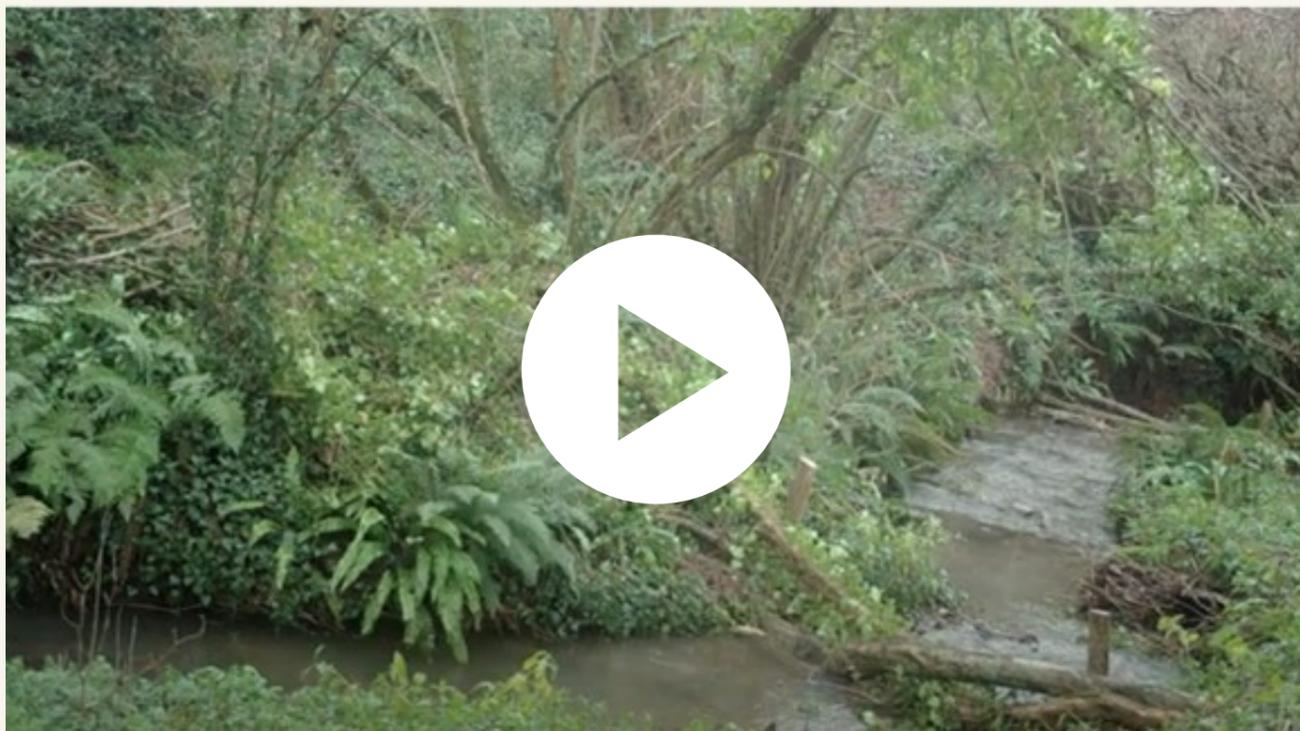


All these small measures that are being taken to reduce the flow and increase the holding capacity of the land should really help reduce the risk of surface water flooding.

Jan Swan, Parish Councillor, Sampford Brett, West Somerset

Harnessing nature's power

Watch **Harnessing Nature's Power**, a short video about our work in the Two Valleys.



Key achievements

Over the course of the project (2019-2022) we have been able to deliver:

35 farms

NFM solutions on **35 different farms** and other land holdings.

20 farmers

Land management advice via project partners The Farming & Wildlife Advisory Group SouthWest (FWAG SW) to **20 farmers** in the Monksilver and Doniford Stream catchment on a total of 90 fields.

80 meters

Creation of **80m of elevated hedge bank** at three sites.

3,778 trees

Planting of **3,778 native hardwood trees** at 17 sites.

1,624 meters

Erection of **1,624m of livestock fencing** at five sites.

20 cross drains

Construction of **20 cross drains** at five sites to reduce the runoff and pollution issues detected.

90 fields

Soil condition and flood hotspot surveys of **90 fields across 20 farms**, with soil husbandry advice and mitigation recommendations.

Partnership

WWT's work in the Two Valleys project area has been in partnership from the very beginning. Initially working with and funded by the Environment Agency, we have developed strong relationships with parish councils and other community-focussed groups.

As the project has developed, we have worked with a wider range of partners and stakeholders. Most notably this has been with The Farming & Wildlife Advisory Group SouthWest (FWAG SW) who provide independent advice and deliver a range of practical work with and for farmers and land managers. Their specialist advice and local knowledge is represented in the following table of possible NFM interventions that communities and landowners can take forward. We have signposted to FWAG SW's natural flood management advice sheets, and further sheets can be found [here](#).



Using the guide



This guide has been developed to provide the advice and key information needed to aid decision-making, should you wish to install flood management features on your land or in your community.

Each measure is described in terms of its flood management effectiveness, its benefit to agricultural production, and its overall cost. Set up and maintenance costs have been colour-coded, with the definition provided below.

Set up costs:

Requires significant raw materials, specialist equipment, or expert involvement.	High
Requires some raw materials, specialist equipment, and/or expert involvement.	Medium
Land manager can implement system with minimal advice, equipment, and specialist material.	Low

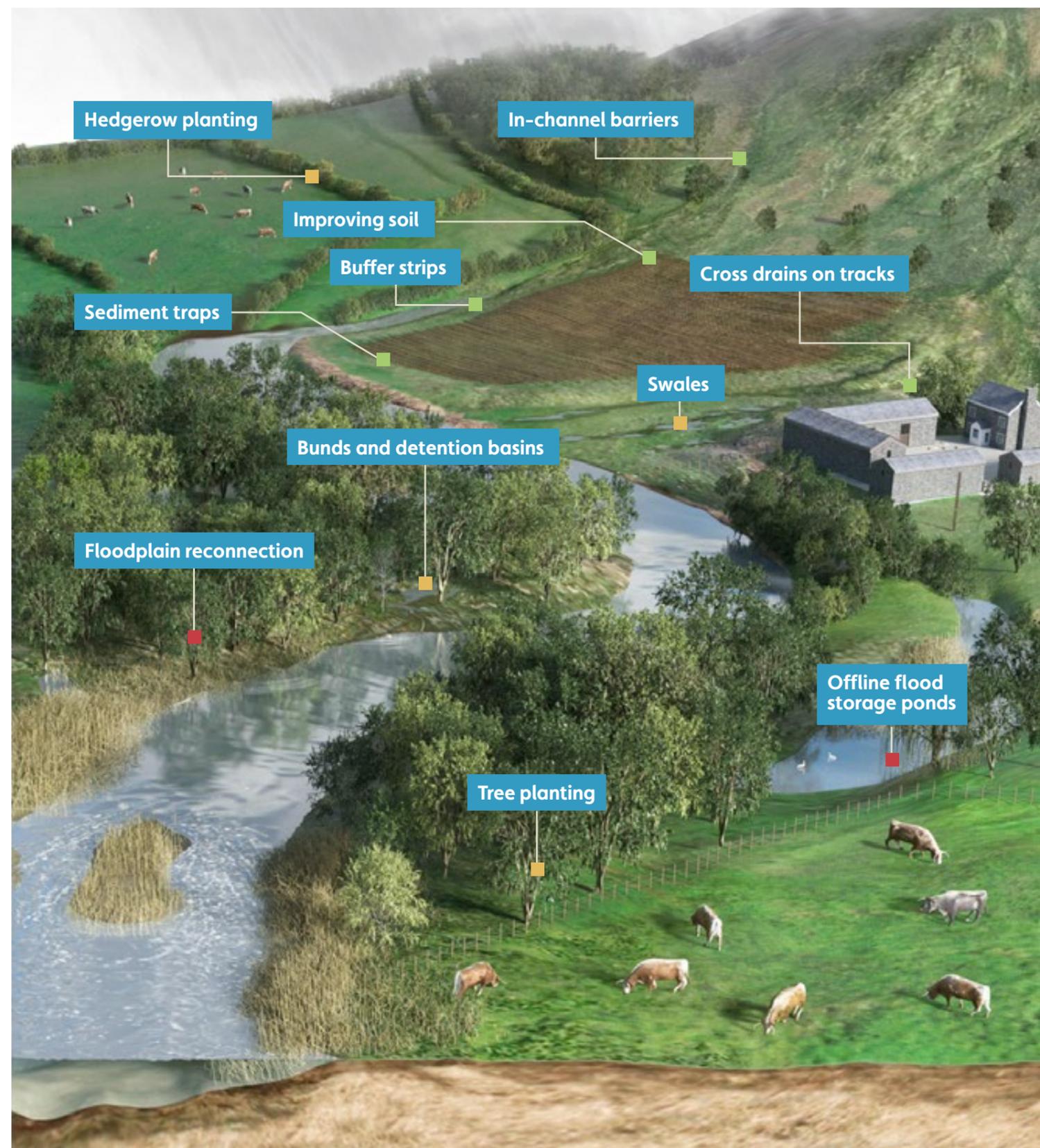
Maintenance costs:

Expert advice or equipment required to be brought in frequently (e.g. every 1-5 years).	High
Expert advice or equipment required to be brought in occasionally (e.g. every 5-10 years).	Medium
Mostly involves routine inspections and low-grade management, which can be undertaken by the land manager.	Low

Levels of maintenance

As maintenance can mean different things for each type of intervention, the colour coding for this part of the toolkit is intended to give a guide rather than providing a defined set of indicators as in the sections above.

Where measures go in the landscape





Ground churned up by livestock can cause soils to be washed in rivers and other wetlands, reducing their ability to cope with high flows.



Intervention measures

Improving soil management

Natural flood management purpose

- Reduce soil compaction
- Improve connectivity with groundwater

Main benefits

- Enhanced soil water uptake
- Improved fertiliser uptake
- Reduced water runoff and soil loss
- Stronger grass roots
- Enhanced heat and drought stress tolerance
- More earthworms
- More efficient crop growth

Costs

Set up:	Low
Maintenance:	Low
Level of maintenance:	Low

How and where to do it

- [FWAG SW soil husbandry advice sheet](#)



Allowing longer vegetation to grow between farm fields and watercourses can help protect them from the potential pollutants in run off.



Buffer strips

Natural flood management purpose

- Increase infiltration
- Reduce sediment flow into watercourses

Main benefits

- Prevent loss of fertilisers, sediment and pesticides
- Prevent erosion of top soil into watercourses
- Reduce nitrate leaching
- Create wildlife corridors and sites for ground-nesting birds, small mammals and beneficial insects
- They reduce effects of spray drift

Costs

Set up:	Low
Maintenance:	Low
Level of maintenance:	Low

How and where to do it

- [Sustainable Farming Incentive waterbody buffering standard](#)



Strategically planting hedgerows such as at the bottom of slopes can help to hold back water and remove soil.



Hedgerow planting

Natural flood management purpose

- Reduce volume of runoff by promoting rainfall infiltration
- Trap sediment, reducing its flow into watercourses

Main benefits

- Create areas of shelter and shade for livestock
- Trap and filter runoff, preventing loss of fertilisers, sediment and pesticides
- Provide habitat for farmland birds and beneficial insects

Costs

Set up:	Medium
Maintenance:	Low
Level of maintenance:	High

How and where to do it

- [FWAG SW cross-slope hedges advice sheet](#)



Targeted tree planting can slow the flow of water after high rainfall.



Tree planting

Natural flood management purpose

- Increases the roughness of vegetation, slowing the flow of water during a flood event
- Reduces the volume of runoff by promoting rainfall infiltration
- Can increase the capture and evaporation of rainfall
- Can reduce the amount of rainfall reaching the ground by as much as 45%, making a major contribution to flood control
- The roots of bankside trees help to bind and strengthen stream banks, reducing the risk of bank collapse, erosion and siltation

Main benefits

- Creates areas of shelter and shade for livestock
- Reduces floodwater damage on productive farm land
- Traps and filters runoff, preventing loss of fertilisers, sediment and pesticides

Costs

Set up:	Medium
Maintenance:	Low
Level of maintenance:	Low

How and where to do it

- [FWAG SW woodland planting advice sheet](#)



Cross drains on tracks

Natural flood management purpose

- Divert the main pathway of water, reducing flow volume, velocity and sediment load
- Can be used with a sediment trap to slow the flow of storm water

Main benefits

- Reduce erosion to farm tracks
- Sediment caught in traps can be re-used on the track, saving time and money

Costs

Set up:	Low
Maintenance:	Low
Level of maintenance:	Low

How and where to do it

- [FWAG SW cross drains advice sheet](#)

Installation of cross-drains can prevent hard surfaces from channeling rainfall and run off straight into rivers.



Creating earth bunds can store water during high rainfall meaning that it enters rivers much slower.



Bunds and detention basins

Natural flood management purpose

- Reduce runoff rates by retention and controlled flow release
- Reduce volume of runoff by increasing the opportunity for infiltration and evaporation
- Trap sediment which can reduce the function of neighbouring watercourses and drainage systems

Main benefits

- Bunds reduce soil loss and surface scour
- They provide opportunity for nutrient reclamation
- They provide pollutant treatment by allowing settlement

Costs

Set up:	Medium
Maintenance:	Medium
Level of maintenance:	Variable

How and where to do it

- [FWAG SW in-field bunds advice sheet](#)



Sediment traps allow soil to settle out of run off water, preventing it from entering rivers and streams.



Sediment traps

Natural flood management purpose

- Reduce siltation of watercourses, maintaining capacity
- Can be used as a pre-treatment for other natural flood management measures, such as retention ponds

Main benefits

- Improve water quality
- Retain washed-off top soil

Costs

Set up:	Low
Maintenance:	Low
Level of maintenance:	Variable

How and where to do it

- [FWAG SW silt traps advice sheet](#)



Swales can allow water to settle and be drawn back into the ground, preventing it from adding to high flows in rivers.



Swales

Natural flood management purpose

- Reduce runoff rates by slowing runoff flow
- Reduce volume of runoff by increasing the opportunity for infiltration and evaporation
- Trap sediment which can reduce the function of neighbouring watercourses and drainage systems

Main benefits

- Reduce soil loss and surface scour
- Provide pollutant treatment by allowing settlement

Costs

Set up:	Medium
Maintenance:	Low
Level of maintenance:	Low

How and where to do it

- [Catchment Sensitive Farming swale design](#)



In-channel barriers

Natural flood management purpose

- A network of in-channel barriers installed on a local scale can control channel flows
- Drain trapped water slowly once the flood period has passed
- Can be constructed so that floodwater spills onto the floodplain for additional temporary storage

Main benefits

- Can reduce localised flooding within the farm holding

Costs

Set up:	Low
Maintenance:	Low
Level of maintenance:	Medium

How and where to do it

- [FWAG SW leaky woody dams advice sheet](#)
- [FWAG SW woody flow spreaders advice sheet](#)
- [FWAG SW in-ditch features advice sheet](#)

In-channel barriers slow the flow of water meaning that it can reach downstream areas over a longer period, reducing the risk of flash flooding.



Offline storage ponds are dry or very low for much of the year giving them the ability to store water during periods of high rainfall.



Offline flood storage ponds

Natural flood management purpose

- Direct flood waters out of the channel into a pre-constructed storage area. The water then slowly infiltrates or is released back into the channel via an outlet point once the flood peak has passed
- Can be designed to hold some water all year, adding to the wildlife value of the farm

Main benefits

- Improves water quality by removing sediment which can be returned to fields
- Depth and speed of drainage can be manipulated according to the site and landowner requirements

Costs

Set up:	High
Maintenance:	Low
Level of maintenance:	Medium

How and where to do it

- [FWAG SW leaky runoff ponds advice sheet](#)



Reconnecting floodplains to rivers allows them to store water during high flows before gradually letting that water seep back in the watercourse.



Floodplain reconnection

Natural flood management purpose

- Storage of potentially large amounts of floodwater on the floodplain, with a controlled discharge back to the river once the flood event has passed

Main benefits

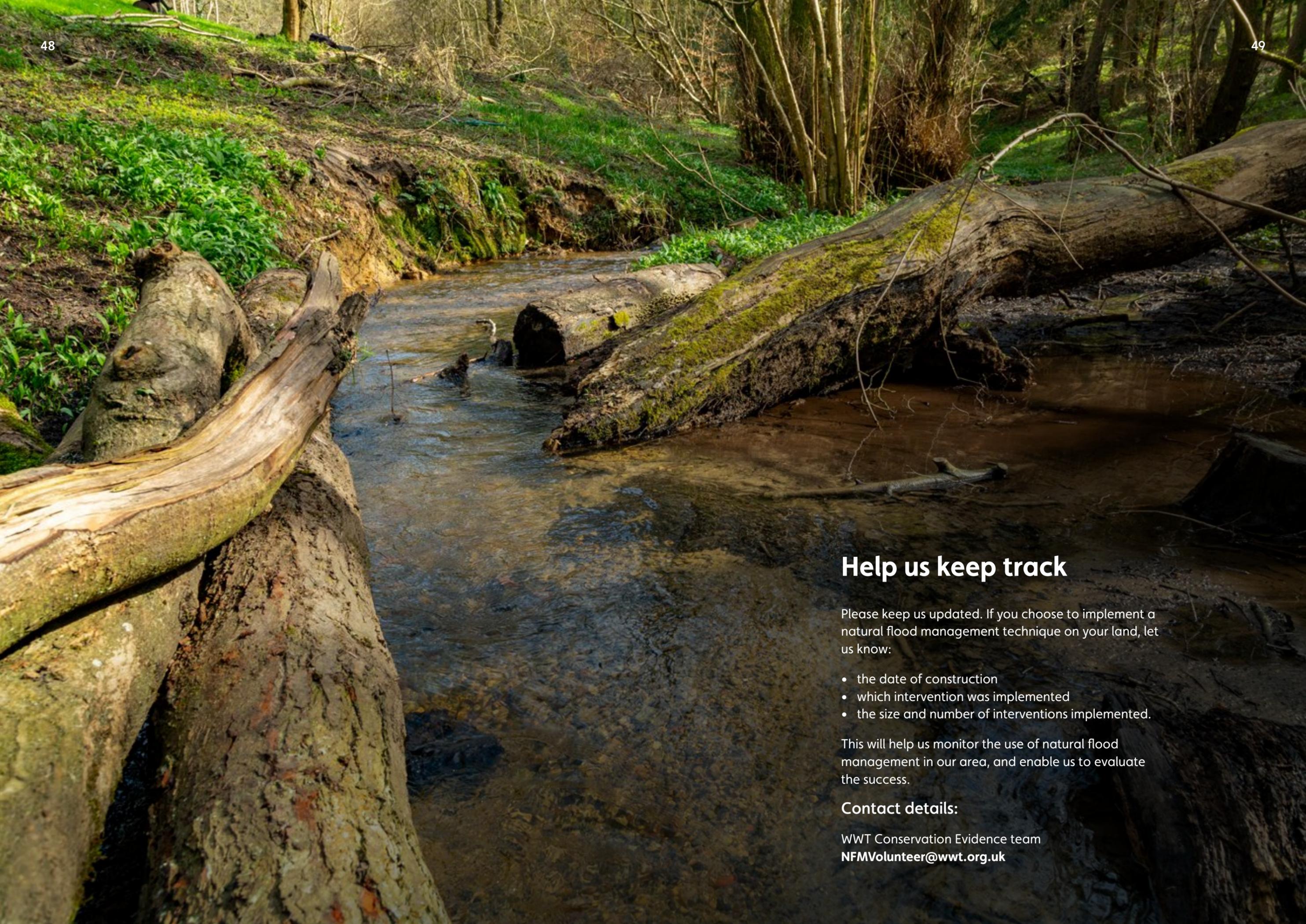
- Dependent on location

Costs

Set up:	High
Maintenance:	Low
Level of maintenance:	Medium

How and where to do it

- [FWAG SW floodplain reconnection advice sheet](#)



Help us keep track

Please keep us updated. If you choose to implement a natural flood management technique on your land, let us know:

- the date of construction
- which intervention was implemented
- the size and number of interventions implemented.

This will help us monitor the use of natural flood management in our area, and enable us to evaluate the success.

Contact details:

WWT Conservation Evidence team
NFMVolunteer@wwt.org.uk

The evidence

The evidence base around the wider biodiversity benefits that NFM can provide are building all the time. The Wetland Science team at WWT have been collecting data across the Two Valleys project to better understand the impact that natural flood management interventions can have.

Working together with volunteers from the community we have been collecting data to document the changes to water quality and flow rate and how this impacts the instream and emerging insects that depend upon the upstream freshwater locales. In turn the influence of NFM on the insect populations are likely to have an effect on wider biodiversity such as bird and bat activity. As some of the changes such as tree planting and woodland creation take time to become established we are continuing to monitor in the Two Valleys and you will likely still see us working in the catchment.

Acknowledgements

This guide has been put together to provide you with a comprehensive set of natural flood management (NFM) measures that are easy to implement on your land or in your local community. These measures can help manage flood risk, boost biodiversity and improve people's wellbeing.

This document is based on the publication 'Natural Flood Management Measures – a practical guide for farmers (2017),' which was specifically requested by the farmers and land managers of the Yorkshire Dales National Park, and compiled by the Yorkshire Dales National Park Authority, Yorkshire Dales Rivers Trust and North Yorkshire County Council, with support from Natural England and the Environment Agency.

All information contained in this publication, including links to websites and further reading, is believed to be correct at the time of going to press.

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WWT