Dartmoor Headwaters
Natural Flood Management (NFM) Project

A partnership between Dartmoor National Park and the Environment Agency

June 2020 Newsletter

The Dartmoor Headwaters NFM pilot project (2018-2021) is hosted by Dartmoor National Park Authority, funded by the Environment Agency and operates in five Dartmoor catchments: Mardle, Dean Burn, Colly Brook, Black Brook and Erme (Hanger Down only). The pilot is looking at the effectiveness of using natural river processes, land management techniques and soft engineering approaches to reduce the risk of flooding to downstream communities. The broad objectives are to demonstrate a reduction in flood risk to properties currently adversely affected by flooding and also to demonstrate that NFM can make a difference in reducing flood peaks and to sedimentation.

Some of the wider benefits of the pilot include improved water quality, better carbon storage and the enhanced biodiversity of the upper moor. Working on the commons

however is not without challenge, a complex landscape of designations for archaeology and biodiversity and the Dartmoor Commons Act 1985, which regulates all activity on the commons. Much work goes on behind the scenes obtaining consents and permissions, taking legal advice and liaising with landowners and commoners, all of which is not necessarily obvious on the ground.

Covid-19

Work has continued during the Covid-19 restrictions with staff working from home but unable to make site visits and contractors unable to continue work on site. We are now beginning to resume site work and hope to get contractors back out working very soon, both for the benefit of project delivery and to support the local economy.

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Water, Water Everywhere!

The winter was challenging with relentless wet weather, several named storms and abundant local flooding Dartmoor wide. There were unprecedented levels of run-off from moorland and from enclosed fields causing damage with many tracks and rights of way washed out badly.

Run-off from Dean Moor

Run-off Peter Tavy Common

Whilst all of this rain kept the Environment Agency Flood Risk team very busy it was also useful for gathering flow data, observing run-off pathways on the ground and for identifying where interventions are needed to reduce flood risk. It also put project staff and their waterproof clothing through continuous rigorous testing!

As well as high volumes of water descending from moorland at the head of the catchments, much soil is lost as water runs off enclosed land during these high rainfall events. This is especially true where agricultural or forestry activity is ill-timed or inappropriate for the location or the gradient of the land. Run-off and sediment descends onto roads, trackways and yards causing erosion, the potential for pollution and eventually ending up in our rivers and streams.


Run-off from Agriculture or Forestry operations

One of the keys to reducing flood risk is to address soil health. This will help to keep moorland habitat in good condition at the head of the catchments, help to achieve maximum water infiltration as well as promoting better grass and crop growth lower down. Soils are easily damaged by agricultural operations, especially in Dartmoor's wet climate but preventing damage is possible with planning and care.

Soil Surveys

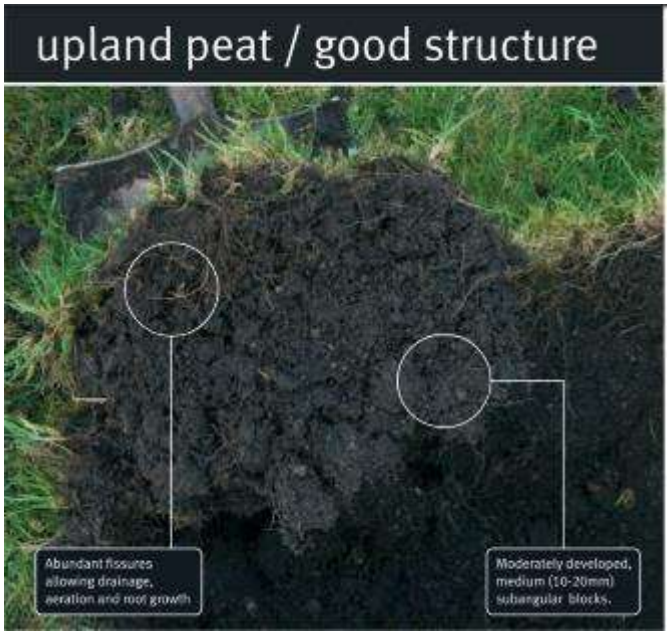
In recognition that good soil health underpins everything we are trying to achieve in Natural Flood Management, the project has commissioned professional soil surveys in all of the catchments on both common land and enclosed land. The surveys will determine soil type and soil hydrology, enabling detailed soil maps of the catchments to be compiled. Information gathered on soil condition and compaction will inform any remediation advice offered to commoners and landowners. Surveys will be ongoing until the end of the year, the results of which can be made available to anyone interested.

Please see the following informative article on NFM and soils.

Soils by Martin Harmer- West Country Rivers Trust

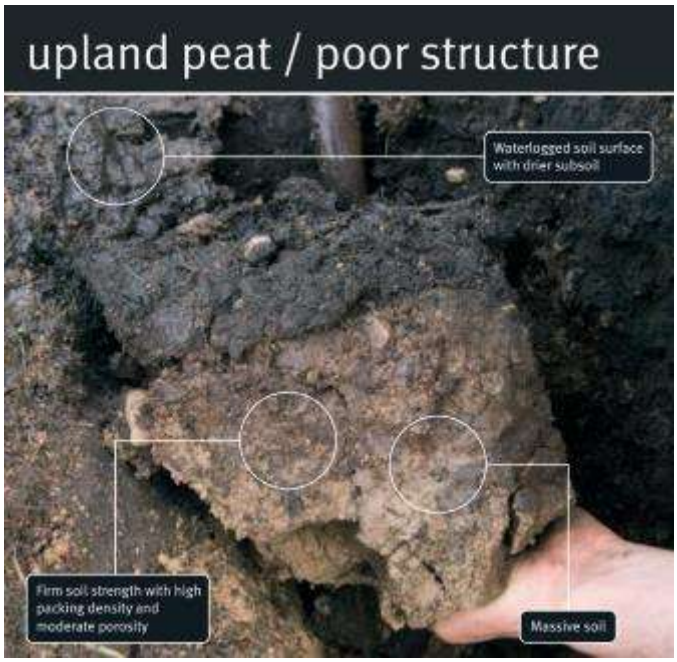
Natural flood management and (moorland) soils

Natural flood management, a term that describes bringing about changes in the landscape to limit or slow the flow of water. This can mean soft engineering remedies such as the creation of leaky dams, temporary storage ponds and tree planting. However, it can also include changes to land management practices, including soil management. There is great natural potential of the soil to temporarily store rainwater and naturally (slow) soil water movement.



Soil Compaction and Unnatural Soil Water Movement

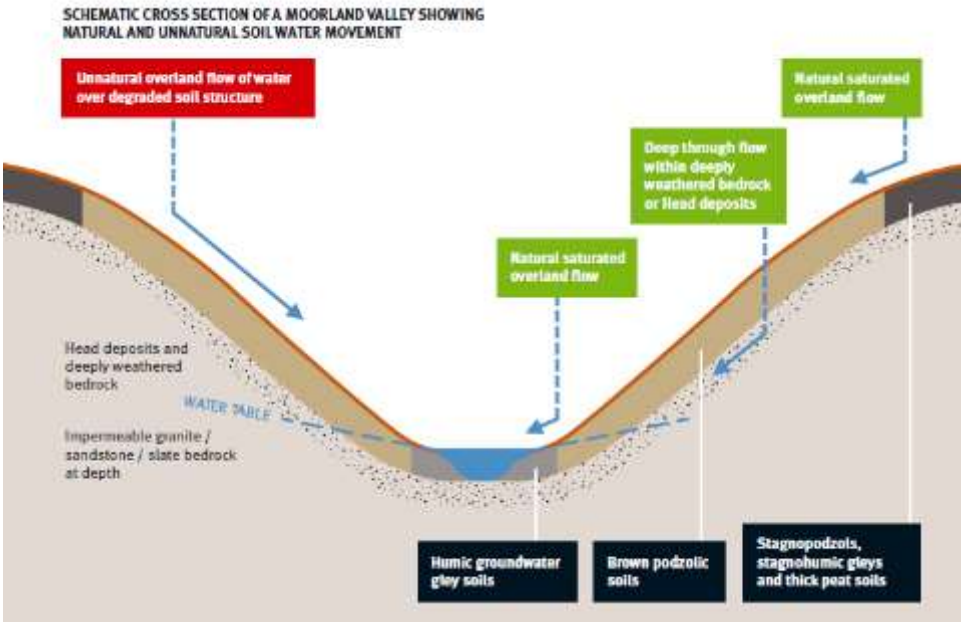
Degraded soil structure and evidence of topsoil compaction is widespread in moorland landscapes leading to enhanced overland flow. Top-soils are invariably organic-rich, if not peaty, and therefore, very easily degraded by stock trampling and vehicle movement on very moist or wet soils.



Soil compaction occurs when soil particles are compressed, reducing the spaces (pores) between them, which carry vital air and water through the soil. Degradation of soil structure where the soil becomes compacted and impermeable can lead to unnatural or enhanced runoff. Upper soil layers above the zone of compaction readily become saturated after rainfall. However, the deeper soil profile below the compaction remains relatively dry, so the full potential of the soil to accept rainfall is lost.

Soil compaction can be subtle. It is not necessarily restricted to the obvious impact that is seen for example concentrated around areas of traffic and overgrazing. Less severe compaction occurs within fields and can be found at various levels in the soil profile. All compaction restricts downward water movement and can lead to surface saturation and the potential for the generation of surface runoff. This may not necessarily radically affect forage yield so may not be a high priority for the farmer, but it can have major consequences off the farm and moor where flows accumulate and potentially cause erosion and flooding downstream.

Saturated root mat with compacted soil layer below



Natural Soil Water Movement

• Well drained podzolic soils (soils prone to leaching and have brightly coloured iron-enriched subsoils) predominate on the moors and have a high potential to accept rainfall
• Water movement is vertical through these permeable soils into shattered bedrock subsoils and substrates.
• The runoff response in these areas is naturally attenuated
• The moors also have large areas of saturated peat soils (stagnopodzols, stagnohumic gley and humic groundwater gley soils)
• These have limited ability to accept rainfall and excess rainwater moves as saturated overland flow producing a rapid flow response in local streams
• Mire vegetation, such as *Sphagnum* moss helps to slow the speed of runoff

Unnatural Soil Water Movement

• Soil compaction that has built up over many years is widespread on Common Land. This causes enhanced overland flow even on freely drained soils.
• Bare peat soils and drainage ditches can also cause very rapid runoff and erosion
• Degraded soils further exacerbate the runoff response

What can be done to get soil water movement back into natural balance?

Moorland landscapes have substantial landscape, conservation and amenity value. However, much of this soil landscape is degraded but still has a high potential for habitat creation that could reduce the risk of runoff and alleviate flooding downstream. Habitat and soil restoration will also improve water quality to the benefit of salmon and trout fisheries and drinking water quality. Upland wetland habitats can be improved or created by blocking drainage ditches on peat and stagnohumic gley soils*, which slows the rate of runoff and captures carbon in the soil. On freely draining ground there are opportunities for woodland planting and heather moorland can be encouraged by reducing grazing densities. Both these will help to remediate damaged soils and deal with enhanced runoff from moorland and localised soil erosion.

1 | WOODLAND CREATION

Steep slopes on freely draining soils are well suited to appropriate tree planting.

Compacted soils should be loosened when planting to aid tree growth. Planted areas should be fenced to prevent tree damage by grazing stock.

2 | GRASSLAND MANAGEMENT

Grazing densities should be matched to the capability of the land. Supplementary feeding should not be carried out on wet soils and semi-natural habitats.

Slit aeration of grassland in early summer can help soils to naturally restructure after shallow compaction damage.

Winter housing can be used for stock to prevent damage to soils.

3 | HEATHER MOORLAND RESTORATION

Heather moorland can be restored by reduced grazing, reseeding and by controlling bracken and gorse. Soils should be allowed to restructure over time.

Heather moorland can be restored on more freely draining soils.

4 | ARABLE CROPS

Fields used to grow early potatoes and vegetables should be relatively level and have a low risk of runoff.

Soils should be loosened after harvest to remove the inevitable compaction and to reduce the risk of enhanced runoff during winter.

5 | WETLAND CREATION

Drainage ditches can be blocked with dams to slow down runoff and create wetland habitats.

Wetlands store carbon and increase biodiversity.

Text, graphics and images courtesy of:

Think Soils – Environment Agency

Soils and Natural flood Management – East Devon Catchment Based approach

Exmoor Mires Partnership

Updates from the Catchments

This phase of the project is a pilot project covering all 5 catchments, so the aim has been to trial a series of different measures, rather than to attempt to solve all problems in all catchments.

Mardle

The River Mardle flows down to Buckfastleigh where it joins the Dean Burn River, before eventually joining the River Dart. The confluence of the two rivers in Buckfastleigh makes the town particularly vulnerable to flooding in high flows, showing the importance of slowing water to de-synchronise the peak flows of the two rivers.

In the Mardle catchment we are focusing mainly on the common with work planned for the autumn on Holne and hopefully also Buckfastleigh common. This will address run-off issues in the vicinity of Mardle head and around Snowdon Brook, focused largely around “blocking” former tin streaming gullies, which are acting as flow pathways channelling water from the high moor.

These gullies are important historic features. Such remains of tin exploitation are rare on a global scale, elevating the abundant remains that survive on Dartmoor to an international level of significance. A highly detailed survey of the tin streamed areas has been undertaken, with any mitigation incorporated into work plans. The gullies will be blocked with leaky dams made from a combination of either wooden boards, willow faggots, stone or where appropriate peat. The idea is that in normal conditions the dams won’t interrupt flow, but in high flows they will slow down the speed that water descends from the high moor.

View of the tin streaming from below Mardle Head

In our discussions with commoners about this work, we have a small group of commoners from Holne moor who are keen to do this work themselves. This makes great sense as they have the best local knowledge of the area, know the best access routes and have many years’ experience of the relevant issues locally.

Commoners visit Exmoor

In January 2019 we took a group of enthusiastic Holne and Buckfastleigh commoners to see work done by the Mires Project team on Exmoor, to learn from their experience in a similar upland setting. It was a horribly wet day but despite this it was really useful to share experience of the pitfalls and challenges faced. These include getting materials to remote sites, which machinery works best for which job, how the different types of leaky dams are performing and how to source willow faggots, a valuable insight into the practicalities of this work.

The work we looked at was mostly using willow faggot and wooden leaky dams in different situations, which inspired plenty of questions, discussion and thinking around how work might be tackled on their own home commons. There was no doubt a well-earned pub lunch on the way home to warm up and dry out!

Willow faggots used to slow the flow

To plant or not to plant?

We are looking into the feasibility of increasing the cover of small trees such as Hawthorn and Rowan along the river Mardle valley and possibly spreading out gently up the bracken dominated slopes either side in places. We are in consultation with Natural England in respect of the SSSI and the SAC designations on Holne and Buckfastleigh commons as well as consulting with commoners and other interest groups such as the Ramblers and the RSPB.

Natural regeneration of Rowan amongst the gorse

Ideally we would like to achieve this by allowing natural regeneration, which would increase the vegetation cover to intercept water better. However with the current levels of grazing and rotational burning this would not be achievable. We are therefore liaising with Dartmoor National Park Authority and the commoners over general views on the use of temporary fencing.

Peatland restoration

We are currently in negotiation with the Peatland Project regarding the possibility of partnership working to restore areas of degraded peat on both Holne and Buckfastleigh commons.

Why restore peat? Research carried out by the University of Exeter found that only 1% of Dartmoor's peatland area is still intact, functioning as a healthy peat-forming bog. Much of the remainder has been severely damaged by drainage, cutting, drying and erosion. Water is draining off the damaged peatlands more quickly, contributing to flood risk downstream. The damaged peat is also releasing greenhouse gases into the atmosphere and dissolved carbon and silt into our rivers and drinking water. As a result the wider moorland landscape is changing, as peat dries out and gradually we are losing the wildlife that relies on peat bogs. If peatland is not restored the decay of Dartmoor's drying peat is likely to accelerate.

Eroded peat

We have recently carried out surveys of potential restoration areas on both Holne and Buckfastleigh commons and will be consulting with commoners and others in the near future. If approval is gained work would start in the autumn.

Dean Burn

Despite being located adjacent to the Mardle catchment the Dean Burn is somewhat different in character, with the lower end being farmland largely given over to crops, with significant links to flooding issues in Buckfastleigh in recent years.

The area we have been focusing on is largely around the moorland edge near the top of the catchment. We have installed a series of different of leaky dams in gullies originating on Dean common and descending across Lambsdown, to eventually flow into the Dean Burn. These gullies are largely dry in the summer but carry a significant volume of water in the winter during high rainfall.

Live willow faggots have been used as a trial on the enclosed land and so far have been working well. These will improve over time as sediment backs up against them and the willow starts to grow. There is the option to add more faggots on top when needed and hence the stakes have been left long. The wooden dams have worked very well and during the winter storms held back a significant amount of water. Ideally we need to install a few more on the edge of the common before next winter.

Trial leaky dams installed winter 2019/2020

To monitor the flows both before and after the installation of dams, trail cameras were fixed up on two of the gullies.

We are yet to analyse the data taken after installation due to restricted access during Covid 19.

The cameras take photographs at approximately ten minute intervals so looking at the footage from several months will be a lengthy job!

Tree planting

An area of mixed woodland has been planted at the top of Dean Wood, adjacent to Lambsdown, where the land was dominated by dense bracken. The bracken has been cleared and a mixture of species, some chosen for biodiversity, some for timber value, have been planted. The new planting will help to intercept water running down this steep slope towards the river. The roots will in time increase water infiltration capacity, the canopy will intercept more rain water and the planting will complement the already very diverse Dean Wood.

The trees are protected by biodegradable guards, which will begin to break down after five years or so, avoiding the need to collect unsightly guards in future. There are several different biodegradable tree guards on the market now, the project can provide information and show samples of some of them if anyone is interested.

Collybook (Peter Tavy)

Peter Tavy sits in a 6kmsq sub catchment of the larger River Tavy catchment, the bulk of the catchment being steep and rocky. There are known issues with soil compaction and significant levels of run-off in the southern part of the catchment.

Soil surveys have been completed for the common land to better understand the soil hydrology and how degraded soils work in catchments such as this. These surveys will help to inform EA flood risk assessments in future as well as helping to site NFM measures in the most appropriate locations. The soil survey of the commons is available to anyone interested.

Surveys of the in-bye land in the catchments have also been completed by permission of individual landowners, and any advice on remediation measures delivered as necessary.

Positive discussions were held with commoners last year to get their views on some of our ideas to help reduce run-off from the common. These proposals have yet to be progressed owing to limited staff resource, we hope however to revisit discussions in the very near future.

Ditch and gully blocking would be beneficial in the upper areas of the main channel, high up beyond the tip of the enclosed land, where there is also potential to restore areas of mire to retain the water better. Slightly lower down the many gullies created by tin mining also have potential for blocking with leaky dams to slow down water.

Eroded channels worthy of “blocking”

Tin mining gullies at the head of enclosed land

Water storage: an area of tin mining on the common between Higher Godsworthy and Wedlake provides an ideal opportunity to create a water storage area for large volumes of surface run-off. Water would be held temporarily during peak flows and would disperse again after hours or days when rainfall eases.

Water gathering in the proposed storage area

We have consulted DNPA archaeologists and due to the low key nature of the work, this would not pose a problem. The water would be held up using leaky dams placed in strategic locations, to delay the rapid escape of water into a short channel before it joins the Colly Brook.

We are working with a private landowner at the head of the catchment with a view to using the area of tin works adjacent to the common to slow and store water. We have had trail cameras in place throughout winter to record the flows and try to capture levels during flood events. We will return to analyse the data very soon, delayed unfortunately due to Covid-19 restrictions.

Installing trail cameras

Plotting points in channel of tin mining works

Monitoring will also be taking place via the “Locate” project (Land ocean carbon transfer) with Plymouth Marine Laboratory (see link below). The project is looking at the current status of our soil carbon in terms of the amounts leaching into rivers and

streams, and what happens to it when it reaches our estuaries. They will be taking water samples from the Colly Brook to feed into their wider project work on the Tavy (sampling point at Hill Bridge). Samples will be taken monthly from 29th May onwards, for the next 12 months.

https://www.pml.ac.uk/Research/Projects/Land_ocean_carbon_transfer_(LOCATE)

Surface Run-off is a particular problem between Cox Tor and Roos Tor during high rainfall. The idea has been put forward to create a series of earth and stone bunds to intercept water as it descends the steep hillside. This area is directly in between the boundary of the geological SSSI on one side and important areas of archaeology on the other side, we are currently in negotiation with DNPA archaeologists over this.

Blackbrook (Walkhampton)

The work in the Blackbrook catchment is being delivered by West Country Rivers Trust on behalf of the project and by kind permission of the Maristow Estate, tenant farmers and other landowners. Soil surveys have been completed both on the common and on the in-bye land, which have helped to inform a package of measures to be undertaken to help mitigate flood risk.

The measures planned for **the common** are all designed to slow down surface run-off, prevent further erosion near the pinch point at the old railway bridge and to aid water infiltration. These include:

- Trial manual aeration of compacted soils using a team of volunteers, which would cause no disturbance to archaeological features, flora or fauna.
- Using a granite boulder /cobble mix to armour vulnerable eroded areas, preventing channel formation, further erosion and ongoing degradation of historic features.
- Repair of corn ditches that demarcate the moorland boundary and channel surface flows down towards Horseyeatt. Repair to incorporate stone constructed spurs built at right angles to the boundaries to act as “leaky dams.”
- Installation of an instream granite “throttle” under the disused railway bridge to hold back flood water.

Erosion down to stone substrate

Water channelled by the stone corn ditch

Erosion from flood water heading downstream

The disused railway bridge

On the In-bye land downstream of the common planned interventions include:

- Mechanical soil aeration of identified fields following soil pit testing, which has confirmed localised compaction issues.
- Relocation of field gateways identified as causing a run-off issue together with flow interceptors to further reduce run-off.
- Enhancement of the Welltown wetland area involving increased wetting, additional planting and enhancement of the wet woodland area around Welltown to increase water storage capacity.

Work on all of these measures has been delayed by Covid 19 but will hopefully begin in July if not sooner. Monitoring is already in place to gather flow data and full consultation has taken place.

Hanger Down

This area of the Erme catchment was chosen due to rapid surface flows descending from Hanger Down, posing a risk of flooding to properties in Ivybridge. Properties flooded several times during 2012 and 2013, run-off from Hanger Down was identified as the main cause.

Work here is being delivered by Devon County Council on behalf of the project, by kind permission of Maristow Estate.

Flow monitoring telemetry has been in place for over a year now with the dams due to be installed this summer.

Monitoring in place- V notch weir

Run-off flowing south towards Ivybridge

The monitoring picked up the highest flow recorded so far during a very wet January this year, peaking at just over 250l/s at 13:15 on 16th January. This highlights the volume of water we are dealing with in flood conditions and the importance of trying to slow it down.

A comprehensive soil survey of Hanger Down has been undertaken, revealing only very localised compaction. The soils are generally in good condition and can cope with heavy rain but reach a saturation point after prolonged wet spells, greatly increasing the risk of rapid surface run-off. It is hoped that measures to slow down the water on the Down, in conjunction with hard engineering solutions near the affected properties, will greatly reduce the risk of flooding from this source.

Local Community Involvement

We engaged with the communities downstream in the project catchments last year, via a series of meetings and screenings of the NFM film “High Water Common Ground”.

There was lots of interest locally and we have maintained good communications with local flood groups etc. There has been a healthy interest in volunteering, however so far there have been few opportunities to involve volunteers.

Subject to the easing of Covid-19 restrictions we hope to improve on this during the summer and autumn this year, with plans for volunteer days in conjunction with the Ranger service in the Dean Burn catchment. We hope to involve volunteers in tree planting, removing tree guards from well-established trees and a chance to see some of the work done to date on leaky dams etc.

In other catchments there may be similar opportunities, or to help gather data or photographic evidence for anyone who is keen to get involved.

What's on offer?

We are keen to talk to landowners and commoners about water related issues, which lead to localised flooding and erosion. Capital grants are available to implement practical solutions and where possible we try to use local contractors. The type of solutions we are looking at include:

- Soil remedies (soil health advice, soil aeration)
- Infiltration pits
- Reconnecting the river with its floodplain
- Tree planting or regeneration areas
- Peatland restoration (blanket bog and valley mire)
- Relocation of 'swaling' areas away from flow routes
- Gully blocking in old tin mining gullies
- Stone attenuation dams
- Planting of new hedges and Devon banks to divert water
- Wetland creation
- River restoration and buffering
- Vegetated swales

N.B. The project team will deal with obtaining all of the necessary consents and permissions for capital projects.

Although there is currently not yet long term project funding available for this kind of work, participation now can help landowners to understand the concept of "payment for public goods." This is good preparation for the introduction of ELMS (the new Environmental Land Management Scheme) in a few years, which is highly unlikely to

be offering payments for capital projects, but annual payments for the delivery of desired management objectives such as the reduction of flood risk.
For an insight into other NFM projects around the country- follow this link to a short six minute film “High Water Common Ground”

High Water Common Ground - 6 Minutes

Contacts

Anyone interested in discussing a proposal to help deal with a flood risk issue, or for more information about any aspect of the project please contact:

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