

River Wye and Lugg Natural Flood Management Project



Short Form Business Case

Version No: V0.2

Date: 22/12/2017

FINANCIAL SCHEME OF DELEGATION (FSoD) APPROVALS

1.	Project name	River Wye and Lugg Natural Flood Management Project				
	Project ref.	Project Code	SNC500E/000A/053A	Start date	01/04/2017	
	Programme	FCRM GiA		End date	31/03/2021	
	Head Office dept. / team			For FSOD use only		
	Area name	West Midlands	FSoD reference			
	Function	FCERM	FSoD Date			

2.	Role	Name	Post Title	% time allocated to project
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	Project Manager	TBC, Herefordshire Council	NFM Project Officer	100

Risk Potential Assessment (RPA) Category	Low	<input checked="" type="checkbox"/>	Medium	<input type="checkbox"/>	High	<input type="checkbox"/>
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4.	FSoD schedule		Description	Delegation	
				National – up to	Area – up to
	A1	<input type="checkbox"/>	Projects (includes FCRM revenue)	£5m	£5m
	A2	<input type="checkbox"/>	FCRM capital project within approved strategy	£100m WLC Defra	£10m
	A3	<input checked="" type="checkbox"/>	FCRM capital project outside of approved strategy	£100m WLC Defra	£5m
	A5	<input type="checkbox"/>	Consultancy project	£500k	£500k
	T2	<input type="checkbox"/>	Corporate Property Projects /acquisitions	£5m	£5m

5.	FSoD value	Values - £k
	Strategic Outline Case	Amount for approval
		750
	FSoD reference	Estimate (at SOC) of full project cost
	Outline Business Case (OBC)	Costs to FBC £k
	Date assured or <i>N/a</i>	Estimate (at OBC) of full project cost or <i>N/a</i>
	Full Business Case (FBC)	Amount for approval
		750
	Total project cost assured and approved (SOC and FBC)	
		626
	Project Whole life costs (if applicable) £k	

Required level of Environmental Impact Assessment (EIA)	N/A	<input checked="" type="checkbox"/>	Low	<input type="checkbox"/>	Medium	<input type="checkbox"/>	High	<input type="checkbox"/>
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7.	NPAS/LPRG chair	Post title	Assurance confirmation			Date
			RED <input type="checkbox"/>	AMBER <input type="checkbox"/>	GREEN <input type="checkbox"/>	

8.	FSoD approver(s) name	Post title	Emailed approval	Date

<p>9. By default, all approved business cases are made accessible to the project community through the NPAS SharePoint site. This is to help with learning and providing example cases to others involved in similar work.</p> <p>If the business case contains sensitive/ commercial information or any other information/data which should not be viewed widely, please tick the box and we will not share your documentation.</p>	
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10. For FSoD Coordinator use only:
<p style="text-align: center; opacity: 0.5; font-size: 48px; font-weight: bold;">DRAFT</p>

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Executive Summary

In November 2016, the Secretary of State announced £15m for Natural Flood Management, £14m of which would be for projects included as part of the indicative allocation and this would be led by the Environment Agency, Natural England and the Forestry Commission, as well as numerous other partners.

Natural Flood Management (NFM) utilises land management measures to store water and slow the flow in upland areas to reduce flood risk downstream. This approach manages risk in an integrated and holistic way, to proactively tackle the causes of flooding. NFM measures typically include wetland and bog creation or restoration, improvement and maintenance of buffer strips, contour ploughing and afforestation, and the installation of leaky woody structures in water courses.

The four year River Wye and Lugg Natural Flood Management project will utilise experience gained on nationally recognised projects such as the Stroud Rural Sustainable Drainage (RSuDS) Project and the Shropshire Slow the Flow Project, both of which have been contributed to by members within our team, and involve partners that we are already working closely with such as the Regional Flood and Coastal Committee (RFCC), Natural England and the Forestry Commission. With a budget allocation of £750,000, we propose to allocate part of the funding to implement NFM measures, working on both new and existing community flood alleviation projects within the River Wye and Lugg catchments, and part to furthering our works on land and soil management practices within Herefordshire. The funding will also contribute to additional monitoring and research and redevelopment, to better inform where there are currently knowledge gaps and provide evidence of the effectiveness of the NFM measures being implemented.

1. Introduction

This business case is seeking approval for the allocation of £750,000 over a four year period, 2017/18 to 2020/21, for the delivery of Natural Flood Management (NFM) measures across seven sub-catchments in Herefordshire (please refer to Figure 1).

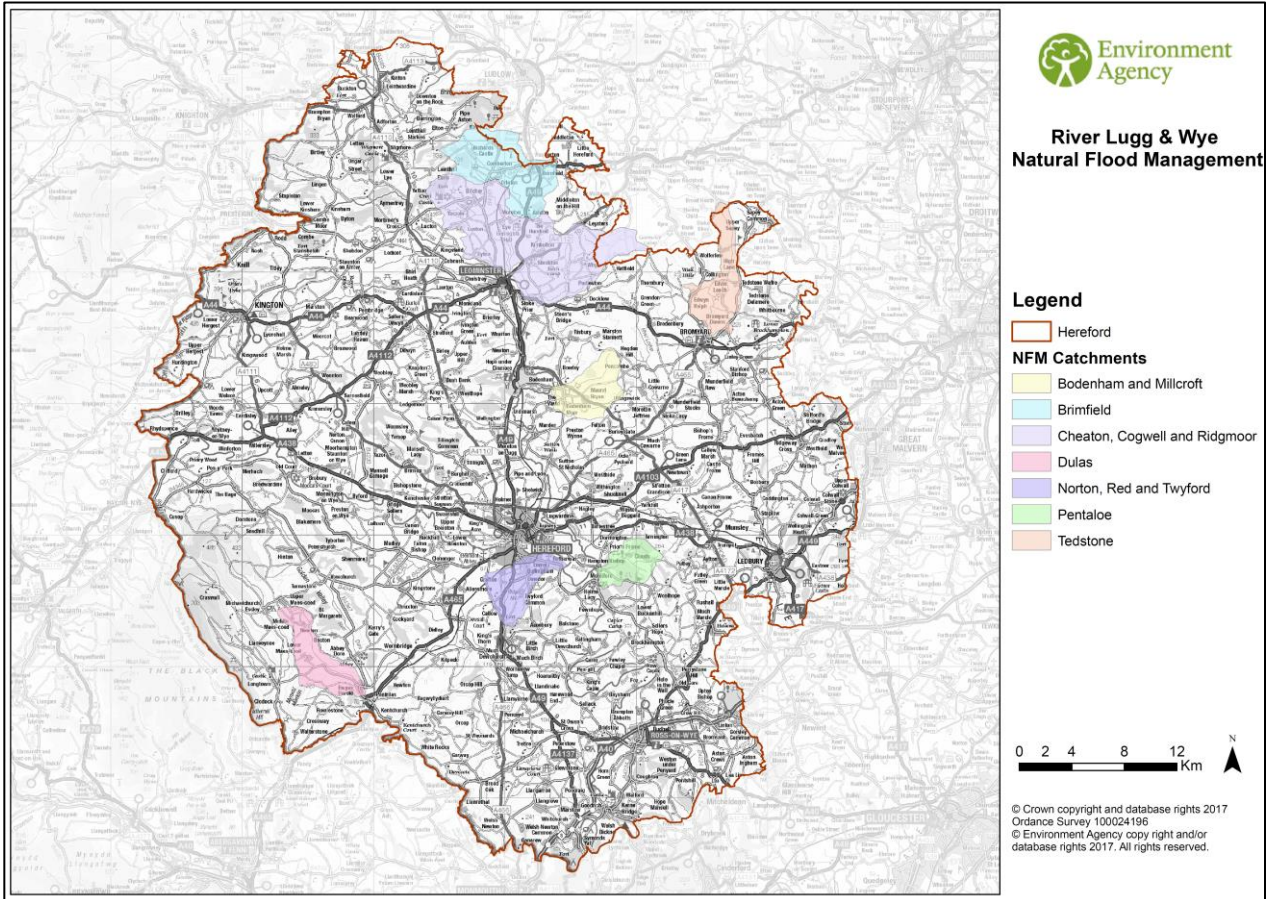


Figure 1: Map depicting the seven NFM catchment areas within Herefordshire (refer to Appendix A for a larger version of this map).

The project will focus on reducing flood risk to up to 902 properties in seven distinct catchments in Herefordshire, where communities have been badly affected by both fluvial and pluvial flooding. All the catchments have common flood risk characteristics with dispersed, small, rural communities with steep upper catchments and extensive land use change. The project aims to demonstrate how Natural Flood Management (NFM) can be tailored to a range of unique landscapes in Herefordshire and test several very different and innovative approaches and delivery mechanisms.

Under Defra rules, funding for capital projects is limited and hence there are fewer potential flood risk management options. We are looking to introduce NFM measures both as a standalone approach to Flood and Coastal Risk Management (FCRM) and in partnership with built FCRM measures where they would complement each other, sometimes being the only solution for a scheme to go ahead due to these funding restrictions. In taking forward NFM measures to reduce flood risk in these catchments, there is also considerable scope to deliver both environmental and socio-economic benefits whilst supporting the outcomes of the 25 year environment plan.

Some of the areas have strong community flood action groups who are actively promoting the NFM approach within their respective catchments; for example the Bodenham Flood Protection Group (BFPG) which was formed in 2008 to take 'self-help' action to reduce the risks of flooding to properties in the Parish. BFPG was awarded the 'Environmental Champions' category of the 2011 Pride of Herefordshire Awards for their efforts. Active Flood Action Groups (FAGs) will be imperative in delivering and maintaining the new NFM measures. In areas where a community led FAG has not been established, we will support communities in partnership with the National Flood Forum (NFF) and the Flood Resilience team within the Environment Agency to build these relationships.

We will also build upon our well-established relationships with organisations which already invest in countryside stewardship and conservation within Herefordshire, such as the Herefordshire Wildlife Trust, Brightspace Foundation and the Hereford Nutrient Management Group (amongst others). We will work with local community flood groups, land owners, farmers and partner organisations to implement a range of measures along the upper-reaches of the catchments to implement natural flood management techniques and restore natural drainage where it is safe and feasible to do so. The measures put in place in the upper-reaches will significantly enhance the opportunities and benefits of flood risk, water quality, biodiversity and amenity enhancements in the lower catchments.

This package of individual projects will be led by a Project Officer who will sit within Herefordshire Council, with direct support from Environment Agency staff who already lead on work within these catchments. The overarching goal is to imbed NFM principles into 'day-to-day' working practises so it is incorporated into all flood resilience projects (wherever suitable) long into the future.

2. Strategic Case

2.1. Strategic Context

In November 2016, the Environment Food and Rural Affairs Committee (EFRA) published a report on 'Future Flood Prevention'. This stated that, 'The Department for Environment, Food and Rural Affairs (Defra) should commission by July 2017 a large-catchment trial of the effectiveness of natural flood risk management approaches such as installation of leaky wooden structures, tree planting and improved soil management, alongside other measures'.

In response to this report, the Secretary of State for Defra asked the Environment Agency to initiate a pilot programme worth £15m to invest in flood risk reduction projects employing natural flood management techniques, slowing the flow and looking at ways to work with the contours of our environment to improve protection. In addition to reducing flood risk, we want to better understand the techniques and benefits by working with communities to trial a range of solutions to manage the risk they face. We also aim to support the outcomes of the 25 year environment plan by considering integrated outcomes to be delivered by projects in the natural environment.

We will collect data and evidence before and after implementation to quantify the benefits, improve our understanding of the design, construction and maintenance aspects and measure the value of the investment. We will soon be publishing a library

of natural flood management techniques to be appraised alongside a range of options for every project in the future capital programme promoted by Risk Management Authorities.

This investment demonstrates the current desire of Government to better understand NFM and work with communities to better understand their flood risk and trial a wider range of solutions to manage that risk.

Working with Natural Processes Position Statement (682-15, 16/11/2015): We will work with natural processes and use natural flood management measures wherever possible to slow, store and filter floodwater. This will achieve more sustainable flood risk management schemes, often with significant additional environmental and social benefits. We will use the approach in conjunction with traditionally constructed hard defences to increase the resilience of communities to extreme flooding.

West Midlands Area Strategic Context: The project meets the objectives set out in the Severn and Severn Tributaries Catchment Flood Management Plans (CFMP): Work with Natural England and other partners to identify opportunities for floodplain restoration (in line with the River Basin Management Plan) and increase storage in the upper catchment through retention basins/wetland/attenuation that benefits the environment; Encourage activities that may have potential to reduce run-off rates to downstream areas, whilst contributing wider benefits (biodiversity, soil conservation and water quality improvements).

In the Severn CFMP, the following objectives apply to all elements of the Herefordshire NFM Project:

- Reduce the number of properties affected by flooding;
- Reduce the cost of flood damage for residential and commercial properties;
- Protect and enhance catchment landscape character;
- Contribute towards realisation of UK and county biodiversity action plans;
- Take the lead in promoting more natural management of the river and its floodplain to help deliver WFD target of good ecological status;
- Support the agricultural sector to manage catchment flood risk and ongoing improvements in sustainable agriculture.

2.2. The Case for Change

2.2.1. Overview and FCRM Benefits

This business case is seeking approval for the allocation of £750,000 to the River Wye and Lugg Natural Flood Management Project to be allocated over a four year period.

The initial focus of this project will be around bringing NFM into key FCRM schemes as well as working in seven priority sub-catchments (for which we hold strong data sets) which experience both local flooding and water quality issues. These sub-catchments are as follows:

- Cheaton/ Cogwell/ Ridgemoor Brook system (above Leominster and Frome)
- Tedstone Brook (above Bromyard)
- Dulas Brook (above Ewyas Harold)
- Pentaloe Brook (above Mordiford)
- The Red, Norton and Twyford Brook system (above Rotherwas, Hereford)

- The Bodenham and Millcroft Brooks (above Bodenham)
- Brimfield Brook (above Brimfield and Orleton)

Herefordshire has encountered significant flood hazards in recent years and its sparse and scattered population presents many challenges for flood alleviation options. The area typically has low permeability, allowing limited drainage however, there are significant local variations influenced by a range of soil types. Of the 10 most major floods since 1795, five of these have occurred within the last 20 years (1990, 1998, 2000, 2004 and 2007). Table 1 shows the numbers of properties which are in each flood risk band within the NFM catchment locations.

Whilst each of the project catchments is unique and has distinct justifications for intervention and project development, all the catchments have common flood risk characteristics in that they are small, dispersed rural communities with steep upper catchments and are located in predominantly agricultural communities. More detail pertaining to each individual location can be found within 'Case Studies', as presented in Appendix B.

We will look to later introduce a number of Herefordshire Council led projects to this work stream to encourage collaborative working practices whilst packaging works where possible to ensure a joined-up approach to NFM across the catchment. There is also the potential to then extend this approach to benefit a city wide strategy which is being proposed for Hereford City centre.

Communities within the priority catchments live with an on-going and, in line with climate change predictions, an increasing level of flood risk. The NFM Pilot Project offers an opportunity to investigate and develop techniques and approaches that will reduce flood risk and mitigate for predicted impacts of climate change on dispersed communities throughout the catchments. It enables communities to engage in and take ownership of their local flood risk management and an effective means of integrating environmental enhancements in catchments of high ecological and amenity value, especially in those areas which are currently failing WFD targets (refer to Table 2).

It is recognised in the Herefordshire Strategic Flood Risk Assessment that flooding arises from excessive runoff within catchments therefore the runoff speed, quantity and peak is determined by the catchment characteristics. For a true understanding of flood risk we must consider catchments as the fundamental 'management unit', not rivers. It is for these reasons (as well as the presence of reduced impermeable soils) which dictate the need for NFM to be an integral part of the sustainable management and reduction of flood risk within Herefordshire.

Using the right combination of measures in the right places can help to slow flood peaks and reduce the depth and duration of flooding. It also achieves other benefits at the same time, for example, we can reduce soil erosion and sedimentation of lakes and rivers; increase carbon capture and storage; improve water quality; re-connect rivers with species-rich floodplain wetlands; enhance recreation opportunities; and create new habitat to help restore biological diversity. A better environment can improve human health and well-being, and make a significant contribution to the local economy, as recognised in the Well-being of Future Generations (Wales) Act 2015, which places a well-being duty on public bodies.

2.2.2 Current Flood Risk:

Table 1: Communities at risk data for the seven sub-catchment within the Herefordshire NFM proposal.

Location (refer to map, Appendix A)	Description	Community @ Risk	No. of properties @ Very Significant Risk. (>=5%)	No. of properties @ Significant Risk. (<5% but >1.33%)	No. of properties @ Moderate Risk. (<=1.33% but >0.5%)	No. of properties @ Low Risk: (<=0.5%)	Total	No of properties with the potential to improve flood risk (V. sig to sig)
Location 1: (Bright pink area)	Bodenham and Millcroft Brook	Bodenham	*29	0	0	18	47	47 properties are likely to see benefits from NFM, 29 of which may move from very significant risk of flooding to significant risk
Location 2: (Light pink area)	Brimfield	Brimfield/ Orleton	29	8	2	107	146	146 properties are likely to see benefits from NFM, 29 of which may move from very significant risk of flooding to significant risk
Location 3: (Green area)	Cheaton, Cogwell and Ridgemoor Brooks	Yarpole / catchment dispersed	7	2	0	118	127	127 properties are likely to see benefits from NFM, 7 of which may move from very significant risk of flooding to significant risk
Location 4: (Light blue)	Dulas Brook	Ewyas Harold	3	7	7	77	94	94 properties are likely to see benefits from NFM, 3 of which may move from very significant risk of flooding to significant risk
Location 5: (Turquoise area)	Norton, Twyford & Red Brooks	Lower Bullingham / Rotherwas	15	32	42	376	465	465 properties are likely to see benefits from NFM, 15 of which may move from very significant risk of flooding to significant risk
Location 6: (Orange area)	Pentaloe Brook	Mordiford	*14	0	0	5	19	19 properties are likely to see benefits from NFM, 14 of which may move from very significant risk of flooding to significant risk
Location 7: (Light green area)	Tedstone Brook	Bromyard / catchment dispersed	1	1	1	1	4	4 properties are likely to see benefits from NFM, 1 of which may move from very significant risk of flooding to significant risk
Catchments combined	All of the above	All of the above	98	50	52	702	902	902 properties are likely to see benefits from NFM, 98 of which may move from very significant risk of flooding to significant risk

*Surface water – showing at 1 in 30

2.2.3. Why make this investment now?

Community Engagement

The national NFM Pilot Project funding offers a unique opportunity to capitalise on the community momentum for NFM, which is already established in some of these catchments. Some of the catchments have strong community flood action groups who are actively promoting the NFM approach within their respective catchments; for example the Bodenham Flood Protection group who was awarded the 'Environmental Champions' category of the 2011 Pride of Herefordshire Awards for their efforts. The momentum generated by the local communities is a major impetus to the development of the NFM projects incorporated into this proposal.

Since 2010, the West Midlands Area PSO and Environment Programme teams have worked closely with the local communities and local councils and our partners are fully committed to ensuring that these projects deliver effective flood risk benefits. Working in partnership with landowners, local communities and key partners, will enable us to address many of these impacts, deliver catchment wide flood, environmental and socio-economic benefits and ensure sustainability, through local community ownership, of the flood risk solutions and NFM.

Funding opportunity:

The initial NFM Pilot Project funding will enable us to positively engage with communities and partners to develop and deliver the seven catchment pilots in Herefordshire. Experience in the Stroud Rural SuDS Project has shown that additional funding and contributions in kind, from communities, landowners and partners, which cannot be reliably estimated at this stage, will quickly contribute significant support to the project development and delivery.

Land and Soil Management

The funding allocated to this project will also contribute towards the development of sustainable land management practices within Herefordshire where such a large proportion of the county is agricultural. The Environment Agency currently funds work to help improve the reduction of nutrients (phosphate) in Herefordshire from agricultural diffuse pollution. Approximately 50% of the phosphate enters the Wye Catchment as a result of overland and subsurface flows where phosphate, attached to soil, washes into the drainage and river systems. By increasing infiltration rates on agricultural land, overland flows and soil loss will be reduced with improved water quality and reduced flood risk.

Some of the main funding in the Wye aimed at reducing soil and nutrient loss currently focuses on:

- The provision of consistent advice and guidance to farmers and land managers
- Farm visits and Capital Improvements
- Development of a Soil Erosion and Risk Assessment Decision Support Tool.
- Achieving the Wye and Lugg SSSI River Restoration Strategy objectives.

For more detail of how these points are being achieved please refer to Appendix B: Case Studies.

Environmental enhancement opportunities

Herefordshire forms a significant proportion of the River Wye catchment area, which is itself a significant part of the Severn River Basin District. The River Wye Catchment is a European designated Special Area of Conservation (SAC) and is failing to meet conservation objectives under the Habitats Directive as a result of excessive nutrients (phosphates) within many of its watercourses. Much of this phosphate originates from the Agricultural sector, being linked to soil erosion from both arable and livestock farming. The Wye and Lugg NFM project will link closely with the existing Wye Nutrient Management Plan to help reduce overland and subsurface flows and subsequent soil loss from the catchments identified.

Water Framework Directive:

In the 2016 WFD assessment, the majority of waterbodies in the WFD catchments identified failed to achieve Good Ecological Status. These waterbodies were rated as 'moderate' to 'bad', bringing the overall catchment classification down to 'bad'. Delivering NFM measures, especially in the upper catchments should help deliver significant environmental and habitat enhancement and increase the likelihood of reaching Good Ecological Status by 2021.

All the watercourses within these catchments are recognised as low, small (or extra small) and calcareous and none are designated as being Heavily Modified (HMWB).

Table 2: WFD status of the project catchments

Waterbody/system	Area (Km ²) (approx.)	Physio-Chemical Status (2016)	Ecological Status (2016)	Overall WFD Status (2016)
Bodenham Brook	10	Moderate	Bad	Bad
Cheaton System	39	Good	Poor	Poor
Norton System	13	Good	Moderate	Moderate
Tedstone Brook	20	Moderate	Bad	Bad
Pentaloe Brook	12	Good	Poor	Poor
Dulas Brook	19	Moderate	Moderate	Moderate
Brimfield Brook	33	Good	Poor	Poor

The Herefordshire Core strategy for growth relies on the EA fulfilling its commitments in the Wye Nutrient Management Plan. This project seeks to address these issues through an innovative approach to Farm Regulations, working with Stakeholders within the Wye Catchment Partnership. The EA will provide data and evidence to help target effective use of resources which is key to effective partner working.

In all aspects of delivering this project we will account for the importance of the local, natural environment and look to restore and enhance it wherever possible. By working on a catchment based approach, we will consider the effects and potential opportunities at both a landscape scale and along the lengths of watercourses. This will allow us to maximise the benefits which could be implemented as part of NFM. These will include the following techniques (where appropriate):

- Identify high risk areas of the catchment where both overland and sub surface flows are exacerbated as a result of degraded soils and poor land management. Ensure that suitable interventions are put in place to mitigate this.
- Identify where banks could be re-profiled to improve channel diversity, channel capacity and/or re-connect rivers with their floodplains.

- Introduce woody debris and leaky dams to slow the flow and create in-channel habitat, morphological and hydrological variability.
- Introduction of wetlands, ponds and scrapes as design features in the floodplain to provide for a range of habitats (both permanent and semi-permanent) as well as providing water storage on the floodplain.
- Introduction of reed-bed features at outfalls to achieve a benefit in terms of improving water quality.
- Re-meandering and planting of marginal vegetation drainage ditches to trap silt as well as providing new improved stream habitat.

For future information on Environmental Enhancements please refer to the Case Study in Appendix C.

2.3. Evidence and Monitoring

The project aims to demonstrate how Natural Flood Management (NFM) can be tailored to a range of unique landscapes in Herefordshire and test several very different and innovative approaches and delivery mechanisms.

All the main river catchments have baseline monitoring through Environment Agency managed flood warning gauges which will be utilised to provide historical data and quality assurance on supplementary monitoring. The smaller watercourses where we are proposing to implement NFM measures do not have gauging systems in place. It is therefore our intention to install a series of river level flow monitoring devices in specific locations as part of an agreed monitoring programme.

Monitoring of flow, sediment and water quality will be undertaken on individual brooks to provide sub-catchment specific data and will include community flood warning support. Monitoring across catchments where NFM is to be implemented will demonstrate the cumulative benefits of sub-catchment NFM on the catchment as a whole. One tributary in each area will be maintained as a control catchment with no interventions as a comparison. The monitoring equipment will remain in place post implementation of NFM measures within each catchment to gather evidence and best practice information to support future works involving NFM.

Community engagement in both the flood risk and environmental outcome monitoring is key to sustaining long term evidence and ensuring delivery and maintenance of NFM beyond the current funding period to 2020. All data will be accessible to the local community to enable them to engage with the project, understand the benefits being delivered and as a basis for long-term monitoring beyond the anticipated lifespan of current funding.

There is already a wealth of information available for the county of Herefordshire and this will be reviewed and utilised in the proposed projects. For example, Herefordshire Council has already started to focus on catchment dynamics as they influence general flood risk, and the importance of catchment hydrology. Work that has already been completed to collect hydrology and runoff dynamics for 47 separate sub-catchments within the study area, most notably in terms of rainfall, wetness conditions, percentage runoff and time to peak. Each area has been mapped in terms of their suitability for infiltration and source control measures and this will be invaluable in furthering our work.

The use of such measures will help us to integrate our flood risk objectives across our functions and with those of other organisations. For example, many natural flood management measures will require us to better align our programmes with those of

Natural England and the Forestry Commission. Better integration will help flood risk management contribute to the Water Framework Directive, Habitats Directive, and England's Biodiversity Strategy Biodiversity 2020.

3. The impact of not doing the project

The Environment Agency has worked closely with local communities, landowners and partners, in some instances since 2007, to develop the awareness and support for NFM, as part of a holistic approach to flood risk management in the catchment. There is a very strong commitment to the NFM partnership, to withdraw from funding a pilot project at this stage would have substantial negative impacts:

- Damaged partnerships with the local communities and local farmers/landowners. We have worked closely with the local communities to develop NFM and have built up positive engagement and mutual understanding; establishing the strong partnerships and positive communications which are essential to successful delivery of NFM. Withdrawing from the project at this stage will inevitably impact on the trust and confidence the communities we now have in the Environment Agency.
- Continuing and increasing current levels of flood risk impact on home and business owners involving costs, stress, insurance issues, loss of income, poor health and poor quality of life. The ongoing flooding risk causes stress to many families and numerous elderly residents every time there is severe inclement weather forecast for the area. Some properties are unsellable or their value is dramatically reduced. Even with the assistance of Flood Resilience, many residents are not able to obtain insurance or are paying increasing premiums.
- Lost opportunities to install NFM features. In developing the NFM projects we and the communities have had extensive discussions with landowners which has led to potential NFM sites and features being volunteered. Whilst all these opportunities require further investigation and planning, they represent a major opportunity for rapid delivery of initial projects. Losing the momentum would seriously impact on potential project success.
- Lost evidence of the benefits of NFM. A key aim of the NFM Pilot is to generate evidence to improve understanding of best practice and potential benefits of NFM. Loss of investment and research into the Herefordshire NFM Projects will substantially reduce the range of data and evidence that can be acquired by the national R&D WwNP Programme.
- Catchments continue to fail WFD Objectives. NFM has clear potential to improve water quality through slowing surface flows, removing sediment and nutrients before they reach the watercourses and encouraging morphological and restoration of natural function within watercourses and between river channel and floodplain. Without investment in NFM the catchments in this project will continue to fail WFD water quality and ecological good status, partly due to soil erosion and phosphate pollution from agricultural land. Environment Agency targets for WFD improvements by 2021 will not be met.

4. Objectives

We will use the approach in conjunction with traditionally constructed hard defences where necessary to increase the resilience of communities to extreme flooding however, natural flood management may be the only or most suitable option for small communities where a more traditional scheme would not be financially viable. Small, rural communities in Herefordshire particularly suffer from the effects of road closures during times of flood. Whereas Flood and Coastal Risk Management Grant in Aid funding is generally restricted to reducing the flood risk to properties, the proposed NFM work aims to slow the flow to these areas to alleviate further socio-economic issues in the areas as well as reducing the risk of flooding to properties.

By utilising the extensive local knowledge and experience of our team, it will be possible to introduce natural flood management schemes in appropriate locations which will offer flood resilience to both residential and commercial properties. In addition, there will be opportunities to create additional habitat, reduce nutrient inputs and to work towards achieving WFD phosphate targets of the River Wye's Special Area of Conservation. This will enable greater opportunities for growth and development in an area which requires additional housing to meet with a fast-expanding population.

Table 3: Objectives of the NFM River Lugg and Wye NFM project

	Objective	Measurable outcome	Evidence	Time Frame
1	Contribute towards alleviating flood risk in seven distinct catchments in Herefordshire	Reduced flood risk to up to 902 properties	Gauged river data and evidence of homes and business not being so impacted as before interventions are installed	2021
2	Contribute towards improvements to WFD Status in all the catchments.	WFD Status improved	WFD Monitoring	2021
3	Establish and sustain effective community partnerships and engagement, which enable communities to lead and manage on going NFM management and monitoring beyond the lifespan of project funding.	Self-managing and active community partnerships	On-going partnership engagement	2021
4	Enhance the evidence base of natural flood management schemes through effective monitoring and evaluation	Flood Risk and WFD change of status	Effective, long term, community based, monitoring and assessment of the NFM measures implemented and the hydrological and geomorphological changes that occur.	2021
5	The project will build on investments from within the Defra group and draw in investment from external partners in each area to deliver value for money for the spend across Defra's objectives;	Additional funding contributions from local sources and partnership initiatives including HLF and ESIF.	Periodic feedback to the project partners of additional funding, and contributions in kind, received or bid for.	2021
6	The authority or partners promoting the scheme can secure the measures for which they are requesting funding. (This is likely to involve gaining the agreement and cooperation of landowners and the consent of any relevant authorities);	Number of agreements reached and projects undertaken on private land.	Annual Project and Data Reports	2021
7	To collect and openly publish data, monitor and report on the impact of the work undertaken on reducing flood risk and any other benefits.	Annual Project and Data Reports. Website data access provision for all projects	Annual Project and Data Reports. Website data access provision for all projects	2021

4.1. Critical success factors

Table 4: Critical success factors

No	Critical Success Factor	Measurement Criteria	Importance (1-5) 1 being the highest
1	Strong partnership agreements in place with relevant LLFAs and RMAs.	Partnership agreements in place with relevant parties before commencement of project.	1
2	Strong levels of Community and Stakeholder engagement.	Communities and Stakeholders feel they are fully engaged and have shared ownership in the process and delivery, that the EA and other RMA partners are influenced and working collaboratively to deliver shared outcomes	1
3	Reliable and comprehensive baseline data to enable monitoring and assessment of impacts and change.	Gauged river and water quality/WFD data and evidence of homes and business not being so impacted as before interventions are installed Via community led and maintained surveys	1
4	A comprehensive programme of flood risk and environmental monitoring, during and post NFM implementation.	A demonstrable improvement in flood risk and water quality, habitat and biodiversity in the area of interventions.	1
5	Structured programme of strategic and delivery reviews.	Periodic project reviews with all partners to add to the lessons learnt and enable continuous improvement in NFM project delivery	1

5. Economic case

5.1 Long list of options considered:

Defra established the National NFM Pilot Project Programme, of which this project is one element, with the principle objective of developing, testing and evaluating the opportunities for, and benefits of, a wide range of NFM measures in a diverse array of catchments. Defra considers that this experimental approach is essential to enabling the Environment Agency and our partners to understand the potential benefits and limitations of NFM.

The Herefordshire NFM Project is engaging with recent, current and proposed Flood Risk Management schemes in many of the catchments throughout Herefordshire (Case for Change, section 1.2), to improve flood risk sustainability for communities where engineered solutions or PLR cannot deliver the full benefits desired alone.

NFM has a fixed budget of £0.75million and will deliver flood risk improvement to circa 200 properties (between 'Very Significant' and 'Moderate' flood risk), of which an estimated 98 could be moved from the 'Very Significant' to 'Significant' flood risk

categories. The Benefit to Cost Ratio (BCR), including 98 OM2s, is 1.61, with a Partnership Funding (PF) score of 101%. BCR and PF scores have also been calculated for the individual catchments (please see Table 5 below and Appendix D for the individual PF Calculators).

Table 5: Communities at Risk data

Location (refer to map, Appendix A)	Description	Community @ Risk	No. of properties @ Very Significant Risk. (>=5%)	No. of properties @ Significant Risk. (<5% but >1.33%)	No. of properties @ Moderate Risk. (<=1.33% but >0.5%)	No. of properties @ Low Risk: (<=0.5%)	Total
Location 1 (light yellow)	Bodenham and Millcroft Brooks	Bodenham	*29	0	0	18	47
Location 2 (light blue)	Brimfield Brooks	Brimfield / Orleton	29	8	2	107	146
Location 3 (light purple)	Cheaton, Cogwell & Ridgemoor Brooks	Yarpole / dispersed catchment	7	2	0	118	127
Location 4 (light pink)	Dulas Brook	Ewyas Harold	3	7	7	77	94
Location 5 (Purple area)	Norton, Twyford & Red Brooks	Lower Bullingham / Rotherwas	15	32	42	376	465
Location 6 (Light green)	Pentaloe Brook	Mordiford	*14	0	0	5	19
Location 7 (light peach area)	Tedstone Brook	Bromyard / catchment dispersed	1	1	1	1	4
Catchments combined	All of the above	All of the above	98	50	52	702	902

Additional OM4 benefits have been included in the PF calculators as indicated in Table 6 below.

Table 6: Additional OM4 habitat benefits.

Catchment	OM4a (Ha of water- dependent wetland creation)	OM4c (km protected river improved)	BCR	PF Score
Cheaton, Cogwell & Ridgemoor	1.0	1.0	1.89	114%
Brimfield	1.0	1.0	3.00	108%
Dulas Brook	1.0	1.0	1.5	149%
Red, Norton & Twyford	1.0	0.5	3.42	102%

Tedstone	1.0	1.0	2.06	179%
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Five option approaches have been considered as part of the short list of options. A full summary is attached in Appendix B.

Option 1 – Do nothing (baseline)

If we were to go forward with 'Option 1 – Do nothing', all current services (including maintenance) would cease to continue. Flood risk to these areas would increase due to the risk of blockages to channels, culverts and bridge locations and properties would either remain at their current level of flood risk or increase to a higher level of flood risk. This option would result in reduced maintenance costs however, the financial implications of increasing the flood risk to properties and services would greatly outweigh these savings.

Option 2 – Do minimum

The Environment Agency undertakes routine vegetation clearance, asset inspections and limited de-silting works on main river sections in Herefordshire, as well as reactive debris removal works. These works help to maintain the existing level of flood risk in these areas.

To maintain this level of works would not see a reduction in flood risk to property and no additional benefits to ecology, biodiversity or water quality would be realised. With fluctuations in funding available for these routine practices in the Environment Agency and via other partners (Highways England, Welsh Water etc), the frequency of these measures may be subject to change.

Option 3 - Deliver PLR to all properties at risk

Where communities are not eligible for a FCRM Capital Scheme, Property Level Protection (PLR) would be delivered to all suitable properties. PLR is an affordable and effective first line of defence in mitigating against internal flooding of a property but there is always residual risk in that the defences may be overtopped or they may not be deployed in time or correctly. PLR measures puts pressure on communities to make sure the defences (when not permanent) are deployed in time and for those who may not be able to deploy them themselves. It is expected that once PLR measures are deployed on a property, the residents should evacuate the property and this makes it unattractive to some homeowners in comparison to a capital scheme.

Table 7: Long list of options considered for this Business Case.

Option	Description	Benefits delivered / Risks involved	Reason for short list or rejection
1	Do nothing	Increase in flood risk as existing maintenance activities are halted	Reject Does not reduce flood risk to properties which are at risk
2	Do minimum	Existing level of flood risk maintained	Reject Does not reduce flood risk to properties which are at risk with the existing level of flood risk
3	Engineering options	Deliver Property Level Resilience	Reject

Option	Description	Benefits delivered / Risks involved	Reason for short list or rejection
	(Deliver Property Level Resilience measures or alternative to 98 properties)	measures or alternative to 98 properties at 'Very Significant' flood risk. Reduced flood risk to 98 properties. Ability to claim formal outcome measures	Does not deliver measures which demonstrate the benefits of the NFM approach. Not suitable in all areas.
4	Installation of NFM measures and data collection equipment across catchments within Herefordshire. Incorporate NFM measures into existing land management practices to improve flood attenuation in agricultural areas and reduce the impacts of soil run-off.	Potentially reduce flood risk to 902 properties across 7 catchments within Herefordshire. Improve water quality in line with the NMP Ecological improvements Crop productivity improvements Increases soil security Builds relationships with local landowners and the farming community	Preferred option along with Option 5. This option will demonstrate the appropriateness of the NFM approach in delivering a variety of outcomes and show case how it can be used elsewhere. Incorporates improved land management practices with flood management to achieve multiple socioeconomic and environmental benefits. Considers and reduces the long-term effects on soil fertility. Will educate and help to imbed NFM practices into general working practices for landowners within the area
5	Installation of NFM measures to support existing FCRM Capital Schemes which are currently not financially viable or those where NFM could complement (i.e. due to the restrictions and costs imposed by formal flood attenuation ponds upstream or in parallel with PLR)	Offers multiple benefits of reducing the flow in the upstream catchment to reduce frequent flooding while offering a built structure or PLR in the lower catchment for larger storm events	Preferred option along with Option 4 This option will demonstrate the appropriateness of the NFM approach in delivering a variety of outcomes and show case how it can be used elsewhere. Incorporates the benefits of NFM and the requirement of a capital scheme to offer multiple flood risk management benefits Encourages positive relationships with communities who feel that PLR is the only option for those who are not eligible for a capital scheme

5.2 Preferred option

The preferred option has been identified as a combination of both Options 4 and 5

Option 4: Implement NFM Measures.

- **Partnership Funding Calculator:**

The overall PF Score for all the catchments combined is 101% with a cost benefit ratio of 1.61, based on delivering improved flood risk which could move 98 properties from the 'Very Significant' to the 'Significant' flood risk category and potentially benefitting 902 properties overall. All these figures are estimated and are conservative. Actual level of delivery will be understood as the projects develop, and is expected to exceed these estimates.

NFM fulfils all the objectives (1-7) identified above, the key benefits are:

- **Contribute towards alleviating flood risk.**

The level of actual flood risk benefit that will be gained in each catchment, or for each individual community, cannot be confidently predicted at this stage. Monitoring and evaluation during the pilot project will give greater confidence to the actual outcomes.

Communities at Risk Flood data indicates that at least 98 properties are at very significant flood risk in the key catchments within the study areas and will potentially benefit from reduced flood risk, longer warning times and improved resilience. 98 properties, based on Lidar and threshold data have the potential to move from the 'Very Significant' to the 'Significant' flood risk level. In association with proposed or existing engineering and PLR schemes properties, NFM will significantly improve flood resilience.

Evidence from the Stroud Rural SuDS Project has shown that NFM can have substantial flood risk benefits: In the Slad Valley, comparing a 36mm in 12hr rain event on 9 March 2016 to a similar event on 22 November 2012, taking into account many variables including antecedent conditions, intensity, duration and distribution of rain over the 24 hour period and seasonality, gives a clear indication that NFM has reduced the peak level by up to 1m. 53 properties in the Slad Valley are in the 'Very Significant' Flood Risk category and would potentially have flooded in this event, local information confirms no properties reported flooding. The FCRM Partnership Calculator, estimates the economic benefits of protecting these 53 properties at £605k, the PLR estimate of damages avoided is £1.59 million.

- **Contribute towards improvements to WFD Status:**

All the watercourses in the project areas are failing WFD Good Status. Slowing flows, reducing sediment and encouraging morphological change will contribute toward the achievement of Good Ecological Status by 2020.

- **Community led NFM partnerships.**

Some local communities have been actively promoting the self-help approach and have undertaken considerable research, for example the Bodenham Flood Protection Group. We have worked closely with the local communities to discuss flood risk opportunities and have established the strong partnerships and positive

communications which are essential to successful delivery of NFM. NFM offers the communities in these locations the opportunity to reduce and manage their flood risk.

The majority of the communities engaged in the NFM project are situated in the lower catchment on “Main River” reaches, but are impacted by flooding which is generated on steep, fast response, upper catchments (e.g. Lower Bullingham, Tedstone and Mordiford) where the watercourses are Ordinary Watercourses. A catchment wide, partnership with the LLFAs and RMAs and local communities to deliver NFM is therefore essential to delivering sustainable flood risk management.

- **Enhance the evidence base of natural flood management.**

Existing partnerships including Cranfield University and other potential partners (Cardiff and Worcester University) will provide a basis for effective monitoring and evaluation of the benefits of NFM in the Lugg and Wye catchments. Catchment specific monitoring action plans will be a key output from the project partnerships in all catchments, with data being readily available to communities, partners, EA national WwNP R&D Team and external organisations for evaluation. An example of a community monitoring plan, developed by the Shipston on Stour Area Flood Action Group is attached in Appendix E.

- **Additional funding contributions from local sources and partnership initiatives.**

Specific contributions have not been included in the Business Case at this stage as these will be agreed on a case-by-case basis. Experience at Stroud Rural SuDS and Shropshire Slow the Flow has shown that as the project develops, additional funding streams, and most importantly landowner contributions in kind, increase substantially.

Option 5: Installation of NFM measures to support existing FCRM Capital Schemes

Installation of NFM measures and data collection equipment across several catchments within the River Wye and Lugg catchments to support existing flood resilience schemes including built defences and PLR as part of the Capital Six Year Programme; such as Brimfield and Orleton and Ewyas Harold. NFM measures will also be incorporated into land management practices as part of current work which is occurring with existing partnerships such as Farm Herefordshire. The Project Officer will work with local communities to ensure that these measures are community led wherever possible and that delivery partners are involved to ensure that these practices are carried forward after the NFM project has been completed.

This work will be incorporated into existing projects whereby PLR or small built schemes have been proposed but where NFM would offer additional benefits. Alongside reducing the risk of flooding to properties within the area, we will dedicate funding to working with partners and rural communities to improve land and soil management practices within Herefordshire to increase water quality within the area in line with the Herefordshire Nutrient Management Plan objectives.

6. Commercial case

6.1. Procurement strategy

It is proposed to deliver the project through a partnership with LLFA and RMA partners. The lead partner in this instance is Herefordshire County Council, who will provide the employment of the Project Officer, procurement and budget management. This approach is based on the highly successful Stroud Rural SuDS project, and enables the project to maximise community engagement, delivery cost efficiencies and flexibility. The contribution would be claimed by the RMA through the FCRM3 LAIDB Grant Claim process.

This approach places responsibility for procurement of services and materials in the employing authority's procedures and enables greater use of local contractors, with consequent efficiencies and savings to the project. The Stroud Project adopts a procurement approach of: first offers the work to the landowner at contract rates; secondly offer to landowners preferred contractor; thirdly competitively tender amongst local contractors. This has led to very cost effective delivery and development of an extensive network of appropriately skilled practitioners and so this approach will be taken forward as the approach within Herefordshire also.

6.2 Key contractual terms and risk allocation

The Project Lead Partner, Herefordshire County Council, will hold responsibility for ensuring project delivery and monitoring progress, budget and strategic management. The project will be managed through Strategic Steering Group, comprising the Environment Agency, LLFAs and RMAs, Local Community Groups, Natural England and Wildlife Trusts. A wider partnership forum will be established to engage with stakeholders and partners and ensure that the strategic direction and delivery is meeting community expectations.

DEFRA have made funding available to undertake NFM schemes with the aim to collect data and research to support future FCRM funding to support NFM schemes. A key criteria is that the funding is spent and evidence collected and disseminated before the end of the 6 year programme. Primary responsibility for this is with the Environment Agency, but will depend on building strong partnerships with clearly defined and shared objectives.

6.3 Efficiencies and Commercial arrangements

We aim to create efficiencies by learning from established NFM schemes such as Stroud Rural SuDS and Shropshire Slow the Flow to ensure that any features are constructed in the most cost effective manner. Experience in Stroud has highlighted the efficiencies that can be achieved through working with local contractors on small scale works. Shropshire Slow the Flow has highlighted efficiencies of working through partnership as opposed to delivery through a managing contractor (e.g County Highways managing consultants Mouchel).

This project will look to deliver efficiencies where is can. However, one of its objectives is about collecting evidence and supporting research and therefore this will enable subsequent projects to build on its learning and deliver efficiencies.

7. Financial case

7.1. Funding sources

The FCRM GiA Capital for this project is not subject to Partnership Funding rules. However, the project will seek contributions (financial or in-kind) to support achieving the objectives. It is suggested that contributions follow the existing processes and the EA

FCRM standard form is used. The funding for the project is summarised in the table below (refer to Table 8).

(Figures in brackets represent additional opportunity funding to support business case of £750 k compared to an agreed allocation of £626)

Where the NFM money will be supporting an existing FCERM project within the 6 year programme, a separate Business Case will be produced and any need for NFM funding will be highlighted.

Table 8: Sources of funding

Annualised funding profile (£k)	Yr 0	Yr 1	Yr 2	Yr 3	Yr 4+	Total
Grant in Aid FCRM FD GiA						
- National NFM Pilot Project		46	250 (62)	250 (62)	80	626 (750)
- Partnership FCRM schemes		tbc	tbc	tbc	tbc	tbc
Partnership funding						
- Herefordshire Council		tbc	tbc	tbc	tbc	tbc
Contributions:						
Herefordshire Wildlife Trust (in kind)		tbc	tbc	tbc	tbc	tbc
Other:						
- Landowner (in kind)		tbc	tbc	tbc	tbc	tbc
Project Total		40	250	250 (62)	80	626 (750)

Additional funding sources will be explored through partnership working, both on an individual project basis, as well as on a catchment based approach. Our work will complement work being undertaken by Cranfield University and other delivery partners to gain supportive evidence around infiltration rates in soil and grasslands, currently affected by degraded and compact soils. Throughout the project we will also be looking to generate further investment to continue this work in to the future.

7.2. Overall affordability

Table 9: Project cost detail

Annualised spend profile (£k)	Yr 0	Yr 1	Yr 2	Yr 3	Yr 4+	Total
Internal staff costs						
External Consultant fees						
- List by name and role						
Project implementation costs (construction/services/goods)		46	250 (62)	250 (62)	80	626 (750)
- List by name						
Environmental/Technical						
- List by name						
Other						
- List by name						
Risk contingency*		0	0	0	0	0
Inflation						
(%)						
Initial Project costs		46	250 (62)	250 (62)	80	626 (750)
Future costs (if applicable):						

Annualised spend profile (£k)	Yr 0	Yr 1	Yr 2	Yr 3	Yr 4+	Total
- revenue						
- capital						
- future risk/optimism bias						
Project whole life costs		46	250 (62)	250 (62)	80	626 (750)

8. Management case

8.1. Project management

As an area our ambition is to be the national go-to Area on all things associated with Natural Flood Management. We have had fantastic support from our RFCC and LLFA partners and have had recent success with Stroud NFM project.

The West Midlands area has been working to secure funding for 4 natural flood risk management schemes. The funding for these 4 schemes is allocated directly from FCRM GIA capital and sits within the FCRM Programme, benefitting from the same robust governance as other projects within this funding stream.

Within the Herefordshire Wye and Lugg NFM Project it is proposed to deliver the project through a partnership with LLFA and RMA partners, through a Collaborative Agreement. The lead partner in this instance is Herefordshire Council, who will provide the employment of the Project Officer, procurement and budget management. Project Executive and Project Manager would be with Herefordshire Council (TBC). This approach is based on the highly successful Stroud Rural SuDS project, and enables the project to maximise community engagement, delivery cost efficiencies and flexibility. The contribution would be claimed by Herefordshire Council through the FCRM3 LAIDB Grant claim process.

The Project Officer based within HC will be appointed to oversee on the ground delivery and evidence gathering for each of the projects in Herefordshire. This shared management approach will reduce project costs and project risks allowing more money to be spent on NFM features while facilitating networking and sharing of experience and resources across the West Midlands. The projects will also work together to identify any cross linking opportunities to improve ecology, geomorphology, heritage, landscape and amenity in the West Midlands Area.

Efficiencies will be created throughout all projects within the West Midlands area due to having project management services delivered through partners and will offer opportunities to use same contractors and service providers.

There will be three key overarching themes which will run through all projects;

- Evidence and Data
- Delivery
- Communications and Engagement

Each of these are fundamental to achieving both our area and national ambition to put NFM at the heart of FCRM and EPE/ E+B working.

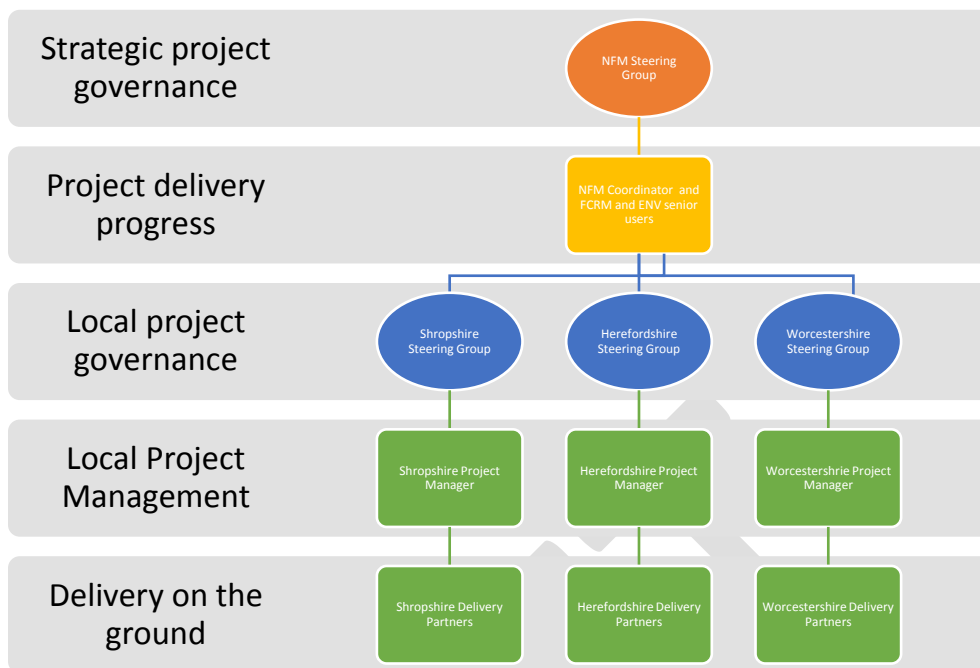


Figure 2: Outlining project governance across the West Midlands

Table 10: Milestone descriptions

Milestone Description	Estimated Start date	Estimated End date	Asset to be created?	Budget Required (£k)	Staff Required (FTE)
Establishment of partnership and strategic steering group	March 2018	2021 ¹	N/A		
Recruit & Employ Project Officer	March / April 2018	2021 ¹	N/A	150	1.0
Landowner Engagement	Ongoing	2021 ¹	N/A	50	0.2 (PO), 0.1 EA
Installation of gauge system/ monitoring	March 2018	2021	Monitoring equipment ²	76	0.2 (PO) + 0.1 EA
Implementation of in channel features, attenuation	March 2018	2021 ¹	Various NFM features ²	320 (124)	0.5 (PO) + 0.2 EA
Completion of Monitoring within project funding cycle	March 2021	2021 ¹	Monitoring equipment ²	30	0.1 (PO)
TOTAL				626 (750)	

¹: Aim to extend beyond March 2021
²: Owned by Community or LLFA/RMA

8.2. Engagement Plan

This NFM project will need significant engagement with a variety of stakeholders. An engagement plan is to be drafted with how and when each stakeholder will be engaged with and this will remain a living document to be added to as the project progresses. The 'engage, deliberate, decide' engagement method will be implemented as a guideline and this will be amended to suit each individual area.

The use of such measures will help us to integrate our flood risk objectives across our functions and with those of other organisations. For example, many natural flood management measures will require us to better align our programmes with those of Natural England and the Forestry Commission. Better integration will help flood risk management contribute to the Water Framework Directive, Habitats Directive, and England's Biodiversity Strategy Biodiversity 2020.

Stakeholders include (but are not limited to) the following:

- Herefordshire Council (lead partner and project host);
- Natural Resources Wales (NRW);
- Internal Drainage Boards (IDBs) (River Lugg IDB, Lower Severn IDB);
- The National Farmers Union (NFU);
- National Flood Forum (NFF); community engagement facilitation and support;
- Severn and Wye Regional Flood and Coastal Committee (RFCC);
- The Wye and Usk Foundation (WUF) registered charity;
- Natural England (NE);
- Welsh Water and Severn Trent Water;
- The Herefordshire Nutrient Management Group;
- The Brightspace Foundation
- Farm Herefordshire
- Wye Sanctions and Actions Safeguarding Soil (Wye SASS Group)
- Wye Catchment Partnership (WCP)
- Cranfield University
- Highways England and Network Rail
- Herefordshire and Gloucestershire Canal Trust
- Herefordshire Wildlife Trust

8.3. Benefits realisation

Table 11: Benefits realisation table

Type of benefit	Description	How measured and with what frequency?	Measure baseline and target	Benefit Owner (named individual) & role	When will benefit start and when will it be fully realised
Financial – cashable (cash releasing)					
	Delivery through partners/landowner	All contributions will be captured throughout the project	Measured by any reduction of cost to the scheme via contributions report.	Project Officer Project Partners	1-4 years
	Scheme raises awareness and cause review land management processes	Measured by talking to Local Farmers about how they have changed practices/ saved money. Workshops will also be carried out with land owners as well as 1-2-1 visits.	Target to install all NFM features as identified and changed practise.	Project Officer Project Partners	1-4 years
	Ecosystems services benefit of between £200-4300/ha/yr (depending on number of features installed)	Comparison between level 1 ecosystem services assessment and phase 2 assessment carried out as part of this project	Improvement to Level 1 ecosystem services assessment	Project Officer Environment Agency	1-4 years
Financial – non cashable (cost avoidance)					
	Reduction in flood risk to property	Measured by monitoring equipment in reduction/ delay in peak flow	Current baseline identified by modelling with monitoring equipment results.	Environment Agency Project Officer	1-4 years
	Reduction in maintenance costs	Reduced clearance of culverts/trash screens and other assets	Current EA & LLFA maintenance schedules. NFM structures will reduce silt and debris in stream.	Environment Agency and LLFA/RMA	1-4 years
Non-financial					
Community Benefit	Increase community knowledge and awareness of their water environment	Improved awareness of local water courses and understanding of natural flood risk management	Measured by community engagement before, after and during construction of features.	Project Officer	1-4 years
	Improved quality of life and reduced stress amongst community	Measured by community feedback.	Participating in NFM will generate better understand and confidence in the management of the local flood risk.	Community Partners. Project Officer	1 – 4 years
WFD elemental change	Reduction in sediment	Measured by improved or contribution towards WFD status via surveys	Measured against current WFD status and observations before and after installation of features	Environment Agency Project Officer	1-4 years
Ecology	Habitat corridors & increase in biodiversity	Habitat surveys undertaken before and after installation of features.	Target to have greater habitat diversity than present resulting from NFM features. Comparison of ecosystem services benefit before and after.	Environment Agency Project Officer	1-4 years
	Reduction in diffuse pollution runoff	Measured by improved WFD status via surveys and static cameras to observe fields which have changed land management practices	Measured against current WFD status and observations before and after installation of features	Environment Agency Project Officer	1-4 years
	Betterment in WFD status & improved water quality	Measured by improved WFD status via surveys	Measured against current WFD status and observations before and after installation of features	Environment Agency Project Officer	1-4 years

8.4. Risk management

Research conducted by Holstead and Kenyon (2011) highlights that a number of factors are likely to be influential in farmers' views of NFM and whether they might consider implementing it on their land. The key barriers are highlighted as the following:

- Economic factors such as maintaining a viable farm business.
- Funding and organisations such as the amount of funding and the relationship farmers have with key organisations.
- Availability of support such as appropriate information trusted advice, help if things go wrong.
- Policy landscape such as the volume of regulations and complementarity of NFM with other policies
- Social factors such as tradition and what other farmers and the public think of farmers and NFM
- Pests and parasites such as fluke, geese, spreading wetlands as a result of NFM

We aim to counter these risks by acknowledging and implementing the following:

- We have to understand that farmers are businessmen and their key concern is that their businesses remain viable.
- The amount of available funding must encourage farmers to implement NFM on their land. They are also concerned with how difficult and time-consuming the application process is. We will work closely with partners who already have good working relationships with local landowners to ensure they are approached in a positive manner and that their needs are considered throughout every step of the process.
- We will utilise well-informed and experienced farm advisors to introduce NFM concepts to the landowners and advise them about the options specific to their land and what funding could be available to them to implement changes.
- Any funding pertaining to NFM must be considered alongside any other funding each individual receives and must not result in funding being removed in other areas.
- Many farmers think NFM features are or will be 'unsightly'. They want their land to look well maintained and not merely abandoned to wetland. We also need to consider traditional processes that have been occurring on their land for generations before and work with these traditions and not against them.
- A common perception amongst farmers is that NFM measures will encourage pests and parasites onto the farm and increase farm costs to deal with these.
- Farmers are keen to see NFM introduced on a catchment-wide basis to counter the effects of urban communities expanding into floodplains. They also want to ensure that flood risk management plans consider other farms in the catchment too.

We propose to provide clear concise and targeted information about NFM to farmers. We aim to work with their advisors to develop, promote and relay viable funding schemes that are relatively simple to access and to identify locations for NFM on a case-by-case basis that would not negatively affect an individual farm's business, whilst ensuring a catchment wide approach is adopted.

Table 12: Key risks identified as part of this project

	Key Risks	Owner & role	Mitigation	Post mitigation Likelihood / impact (H/M/L)	Value
1	Reluctance of partners to sign up to common objectives	EA & Partnership	Maintain open dialogue and use established projects (Stroud / Shropshire) to generate confidence and understanding	L	
2	Reluctance of landowners to support project activity	EA & Partnership	Project Officer to ensure open dialogue with landowners and use established projects (Stroud / Shropshire) to generate confidence and understanding	L	
3	Monitoring demonstrates that the anticipated FRM / WFD benefits are not being achieved.	EA & Partnership	The project is a pilot to learn more about potential of NFM – this is a valid outcome. Will enable project to review monitoring methods and project implementation to improve benefits during life of project (and beyond)	L	
4	NFM features are incorrectly installed or lack adequate maintenance/.	EA & Partnership	Project Officer to engage with local land owners to ensure that they understand how the natural flood risk management project works and that maintenance plays a key role. Build skills and understand capacity in local contractors to ensure high quality of build and maintenance. Use established projects (Stroud / Shropshire) to generate confidence and understanding.	L	
5	Project partner contributions are not sufficient to support full project delivery.	EA & Partnership	The project is a pilot to learn more about potential of NFM – this is a valid outcome. Will enable project to review methods and objectives to improve understanding of project costs and best utilisation of funding.	L	

8.5. Assurance, approval & post project evaluation

As part of the project's governance, periodic review meetings will be undertaken with all major partners to ensure that efficiencies are identified and to ensure the aims of the project are clear throughout. Project review groups will also be held regularly with key project partners to ensure that all partners, including the community partners, remain engaged.

Local steering groups for each project will also share best practice across the West Midlands to ensure that each project is working as efficiently as possible and identifying savings where it can. The project officer will have regular communication with the project board and ensure that monthly updates are disseminated such that the project stays on track and any issues are dealt with efficiently.

Reporting, using a baseline of existing gauge information & anecdotal evidence from local land owners, will ensure that project evaluation can be carried out throughout the project to assess the success of NFM features within project timescales and then into the future by local community partnerships. This will ensure that the benefits of the NFM features on a local scale and a wider catchment scale are captured both from an ecosystem services and flood risk point of view. The small number of features already in place have been successfully holding water already, and will become the initial stages of the project to be built upon.

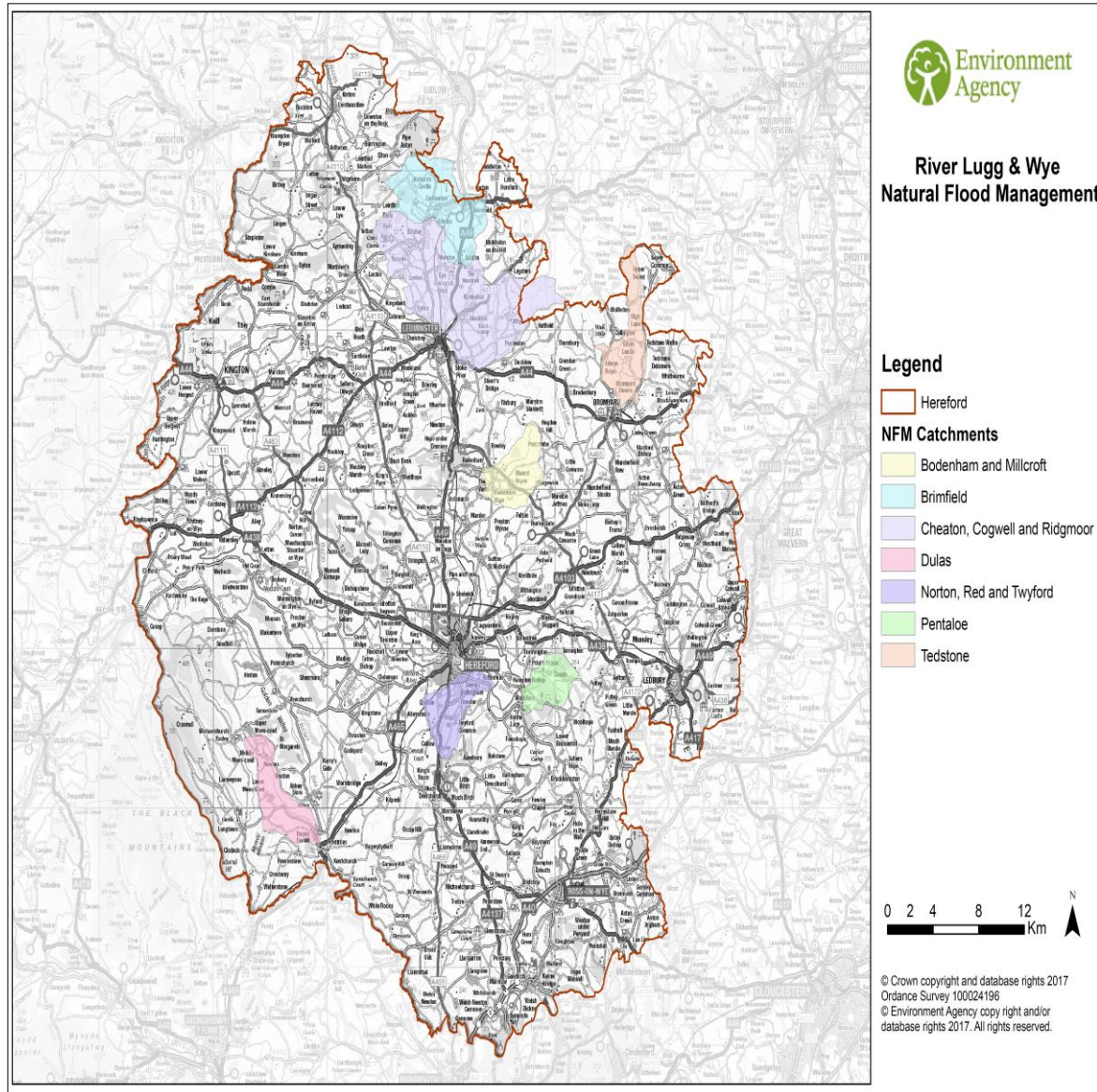
9. Recommendations

It is recommended that this request for the allocation of funding to the Herefordshire NFM scheme should be approved. It will reduce flood risk to communities across several catchments within Herefordshire as well as creating habitats, improving water quality and providing valuable evidence for future NFM schemes elsewhere. The scheme will be delivered through partnership working; bringing together organisations, businesses and communities, which will greatly assist in its long term sustainability. NFM offers a unique opportunity to locations in Herefordshire where a conventional built Flood Resilience scheme would not be suitable or cost-beneficial.

Table 13: List of key consultees

List of key consultees e.g. Finance Business Partner, NEAS, NE, Procurement, Legal and engagement (FRT engagement adviser and/ or C&E) etc.		
Name	Date	Key outcomes from consultation
Environment Manager, Herefordshire Dave Throup	21/12/2017	Has been actively engaged in the project planning and identifying potential opportunities to link with Local Enterprise and Nature Partnerships to generate socio - economic benefits. And developing an R&D work programme with Worcestershire University.
A&R Lucy Morris / Ros Challis	21/12/2017	The local team has provided advice and data on WFD, and opportunities to link monitoring programmes to deliver evidence of multiple benefits delivered through NFM.
FCRM - PSO Dan Trewin	21/12//2017	The PSO team initiated the original project bid and the draft BC. And have been actively engaged, providing community at risk data and linkages to existing and planned FCRM schemes.
FCRM Flood Resilience Jason Walker	21/12//2017	Has been actively engaged in the project planning and identifying potential benefits to communities through the flood warning scheme. Has a good relationship with existing Flood Action Groups within the county.
FRB Brecht Morris / Ed Noyes	21/12//2017	FRB has been actively involved in developing the NFM project, identifying opportunities for habitat enhancement where pressures eg sediment, livestock /bank erosion issues, barriers, NN invasive species etc have been identified.
H&T Rob Etheridge / Ash Woodman	21/12//2017	H&T have been involved in advising on initial monitoring options and are fully supportive of the project.
Finance Business Partner Adrian Martyn	21/12/2017	Awaiting Comments
Procurement Mandy Hadgkiss	21/12/2017	Awaiting Comments
Legal Kay Gill	21/12/2017	Awaiting Comments
C&E Jess Jaques	21/12//2017	Awaiting comments, but has been consulted at various stages of preparing draft BC.
NEAS Amanda McDonnell	21/12//2017	Awaiting comments, but has been consulted at various stages of preparing draft BC.
Natural England Liz Harris	21/12/2017	NE are key partners in the Lugg and Wye catchment due to protected area designations and Countryside Stewardship in all catchments. A number of integrated projects are ongoing in these catchments.
Herefordshire County Council Steve Hodges (Directorate Services Team)	21/12//2017	Steve has been informed during the drafting stages of the BC and has been provided with a final draft. He has also been closely involved obtaining HC approval to recruit and appoint Project Officer.
Herefordshire Wildlife Trust	21/12/2017	HWT will be key delivery partner with this project. HWT regularly updated with a number of integrated projects in the Wye catchment through the Wye Catchment Partnership
Wye and Usk Foundation (WUF)	21/12/2017	WUF will be key delivery partner with this project. WUF regularly updated with a number of integrated projects in the Wye catchment through the Wye Catchment Partnership
I confirm that the documentation is ready for submission to LPRG.		
I, as Project Executive, have ensured that relevant parties have been consulted in the development of this project and the production of this submission in particular the Project Sponsor and Senior User.		
Name	Andrew Osbaldiston	
Job Title	NFM Coordinator, EA FCRM Programming	
Emailed approval		
Date	22 January 2018	

Appendix A: River Lugg and Wye Natural Flood Management Catchments Map



Appendix B: Extended options summary

Option	Description	Benefits for EA and LLFA/RMA	Risks	Conclusion
<p>The majority of the communities (e.g. Bullingham / Rotherwas, Leominster, Bodenham, Mordiford, Ewyas Harold) engaged in the NFM project are situated in the lower catchment on “Main River” reaches, but are impacted by flooding which is generated on steep, fast response, upper catchments (e.g. Redbrook, Pentaloe, Dulas), where the watercourses are Ordinary Watercourses.</p>				
<p>Option 1: Do Nothing</p>	<p>Cease all maintenance programmes and flood warning services.</p>	<p>Reduced maintenance commitments and costs</p>	<p>Do nothing will leave communities at increasing levels of flood risk through the impacts of reduced management and climate change.</p> <p>This option will have reputational impacts for the Environment Agency and damage relationships within the catchment as highlighted in the impact of not doing the project section of the case for change.</p> <p>Opportunities to achieve the projected environmental improvements and WFD Good Status will be lost.</p>	<p>Rejected: Fails to meet objectives 1-4: Deliver FRM or WFD benefits. Communities remain at risk.</p> <p>Reputational damage to EA.</p>
<p>Option 2: Do Minimum</p>	<p>EA maintain current main river maintenance schedules and Flood Warning services. LLFA/RMA maintain ordinary watercourse maintenance schedule.</p>	<p>No change in current commitments and costs.</p>	<p>Will leave communities at increasing levels of flood risk through the impacts of climate change.</p> <p>This option will have reputational impacts for the Environment Agency and damage relationships within the catchment as highlighted in the impact of not doing the project section of the case for change.</p> <p>Opportunities to achieve the projected environmental improvements and WFD Good Status will be lost.</p>	<p>Rejected: Fails to meet objectives 1-4: Deliver FRM or WFD benefits. Communities remain at risk.</p> <p>Reputational damage to EA.</p>
<p>Option 3: Engineering options:</p>	<p>There are four NFM locations identified in this project that link with existing or proposed FCRM Schemes. These are at Leominster (SNC001E/000A/054A), Brimfield (SNC001F/000A/014A), Orleton (SNC001F/000A/072A) and Ewyas Harold (SNC001E/000A/143A).</p> <p>Due to the rural nature of the Wye and Lugg catchments, population densities are dispersed (high number of low population communities over a wide area). As a result, engineered schemes do not tend to be cost effective due to the reduced number of properties benefiting and requirement for a higher percentage £ contribution from the local community to make the scheme viable.</p>			<p>Rejected: Engineering options rejected where there are a high number of small communities due to insufficient cost:benefit ratio.</p>

Option 3a: Flood Storage Areas	Construction of Flood Storage areas to attenuate and store large volumes of water.	Where cost/benefit score permits delivery, would enable specific level of flood risk improvement to be defined.	<p>Very dispersed nature and small scale of affected communities would not support cost of Engineered FAS schemes.</p> <p>Topography of catchments does not allow Engineered FAS options.</p> <p>Most of the catchments are in areas of high landscape and ecological importance.</p> <p>The costs and complexity of mitigation of impacts of hard engineering schemes would become a major constraint</p>	Rejected: Fails to meet objectives 2-5: Previous FCRM assessments have discounted this option for all locations (for a variety of technical and economic reasons).
Option 3b: Flood Walls	Construction of flood walls/ embankments at specific locations.	Where cost/benefit score permits delivery, would enable specific level of flood risk improvement to be defined.	<p>Very dispersed nature and small scale of affected communities would entail multiple walls in remote locations.</p> <p>Topography of catchments and historic nature of developments – often very close to the watercourses make flood walls difficult and disproportionately expensive to construct.</p>	Rejected: Fails to meet objectives 2-5: Previous FCRM assessments have discounted this option for all locations for a variety of technical and economic reasons.
Option 3c: Temporary Defences	Installation of temporary defences at strategic locations.	Where cost/benefit score permits delivery, would enable specific level of flood risk improvement to be defined.	<p>Very dispersed nature and small scale of affected communities would entail multiple walls in remote locations.</p> <p>Only cost effective in easily accessible locations and where the time scale for implementation allows mobilisation.</p> <p>Steep catchments result in rapid flood response, giving inadequate time for implementation in isolated communities.</p> <p>High maintenance and management costs.</p>	Rejected: Fails to meet objectives 2-5: Previous FCRM assessments have discounted this option for all locations for a variety of technical and economic reasons.
Option 3d: Property	Provision of a range of Property Resilience Measures, e.g waterproof doors, drop boards.	Where cost/benefit score permits delivery, would enable	PLR reduces the risk of damage during a flood event, but does not reduce the risk of a flood event occurring.	Rejected: Fails to meet objectives 2-5:

Resilience Measures		specific level of flood risk improvement to be defined.	<p>Flooding continues to impact on communities and will increase with climate change.</p> <p>In many instances construction of houses, especially historic buildings, makes PLR inappropriate or ineffective.</p> <p>PLR Measures have a short effective lifespan and require maintenance and replacement.</p>	PLR is being promoted through other FCRM schemes. The preferred NFM option will add benefits to the PLR schemes, through reductions in flood risk and climate change resilience.
Option 4: Natural Flood Management	Natural Flood Management encompasses a wide range of measures that seek to replicate natural river processes, slowing flows and utilising natural floodplain to store and slow waters in the upper catchment to reduce flood risk to downstream communities and to improve water quality, river and riparian habitats.			
Option 4a: Leaky Woody structures	Install large Woody Structures in the headwaters and tributaries of the Cheaton / Ridgemoor, Cogwell, Bodenham, Brimfield, Pentaloe, Norton/Redbrook/Tyfford, Dulas, Tedstone catchments.	Experience from the Stroud Rural SuDS project has shown that LWS can have a substantial impact on peak flows and flood levels in events impacting on properties at "Very Significant" risk.	The risks associated with this option are generic to all NFM measures and are outlined below and detailed in <i>Table 8: Risks</i> .	Progress option. Fulfils objectives 1-7. As part of an integrated NFM project
Option 4b: Earth bunds and attenuation pools	Construct earth bunds, small scale off-line retention pools, swales and other floodplain features.	Experience from the Stroud Rural SuDS project has shown that small scale constructed features can have a substantial impact on peak flows and flood levels in events impacting on properties at "Very Significant" risk.	The risks associated with this option are generic to all NFM measures and are outlined below and detailed in <i>Table 8: Risks</i> .	Progress option. Fulfils objectives 1-7. As part of an integrated NFM project
Option 4c: Woodland Management	Encourage management of existing woodlands, including woodland tracks, to reduce run-off and encourage redevelopment of ground flora to slow and divert flows. Promote new woodland planting in key areas to reduce run-off and trap sediment from agricultural areas.	Experience from the Stroud Rural SuDS project has shown that management of existing woodland can have a substantial impact on peak flows and flood levels. Evidence from Forest Research indicates that new woodland (and hedgerow) planting can have a substantial impact on surface run-off and sedimentation from agricultural land.	The risks associated with this option are generic to all NFM measures and are outlined below and detailed in <i>Table 8: Risks</i> .	Progress option. Fulfils objectives 1-7. As part of an integrated NFM project

<p>Option 4d: Agricultural Land Management</p>	<p>Promote good land management, e.g: reducing soil compaction, changing arable land to permanent grassland or to zero and minimum tillage methods. Etc.</p>	<p>There is substantial evidence that promoting improvements in agricultural land management can have significant benefits for reducing surface run-off, sedimentation and flood risk.</p>	<p>The risks associated with this option are generic to all NFM measures and are outlined below and detailed in <i>Table 8: Risks</i>.</p>	<p>Progress option. Fulfils objectives 1-7. As part of an integrated NFM project</p>
<p>Option 4e: Implement a mosaic of NFM Measures</p>	<p>The catchments included in the project are very diverse in their topography and land use. No single NFM measure will be appropriate throughout a catchment and landowners will have a preference as to what measures they will support. It is essential to ensure that projects retain flexibility in the approaches and techniques used in any given location.</p> <p>Delivery is best achieved through a partnership with the LLFA (Herefordshire Council) and local community flood action groups, a series of catchment wide NFM projects.</p> <p>Working with landowners to implement a range of Natural Flood Management measures to attenuate and slow surface flows; e.g. Large Woody Structures in watercourses, soil bunds in field, hedgerows and woodland management and planting, soil management.</p>	<p>Working in partnership with the LLFAs and RMAs and local communities, develops:</p> <ul style="list-style-type: none"> • Shared ownership and understanding of the flood risk. • Shared ownership of the implementation flood management action plan. • Broader base of expertise and resources to support delivery. • Additional funding opportunities, e.g. Countryside Stewardship / HLF. <p>NFM Measures will add resilience to current and planned flood risk improvements.</p> <p>NFM will reduce flood risk in high frequency events (circa 20%AER) for properties not included in other schemes.</p> <p>Opportunities to achieve the projected environmental improvements and WFD Good Status by 2021.</p>	<p>The risks associated with all NFM measures are outlined below and detailed in <i>Table 8: Risks</i>. Including:</p> <ul style="list-style-type: none"> • Reluctance of partners to sign up to common objectives • Reluctance of landowners to support project activity • NFM fails to deliver anticipated benefits (monitoring evidence). • Failure of NFM features though lack of maintenance/ incorrectly installed • Project does not use full budget allocation 	<p>Preferred option. Fulfils objectives 1-7.</p> <ul style="list-style-type: none"> • Contribute towards alleviating flood risk. • Contribute towards improvements to WFD Status • Community led NFM partnerships. • Enhance the evidence base of natural flood management. • Additional funding contributions from local sources and partnership initiatives <p>Working in partnership with the LLFAs and RMAs and local communities to deliver NFM offers the most effective means of delivering integrated flood risk and environmental benefit within all these catchments.</p>

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Appendix E: Example Community Monitoring Plan

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