Assessing the multiple benefits of Natural Flood Management

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Prepared for:

Royal Society of Wildlife Trusts commissioned in partnership with Intact Insurance

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Foreword from The Wildlife Trusts

Craig Bennett

CEO, The Wildlife Trusts

The Wildlife Trusts are experts in natural flood management. For decades we have been delivering solutions to slow the flow of water through catchments, helping to reduce flood risk for homes and businesses in our communities and local areas. As of 2024, across the UK we have over 150 different schemes. Many of these schemes are being delivered in partnership with farmers, landowners and local authorities across rural and urban areas.

We know that the work we do is becoming ever more critical in a changing climate; we need to see a lot more of it, because we will not succeed in tackling rising fl ood risk – projected to double in the next 25 years - without throwing everything we have at the rising threat. While there remains high interest in natural fl ood management, investment is not yet fl owing. Just 1% of the most recent fl ood budget for England was allocated to natural solutions.

The evidence of the potential for natural flood management in differen t places is well advanced. But we know less about the wider benefits that it delivers to people, nature and the climate. Understanding this is important to make a comprehensive economic case for natural flood management, in part to inform the investment decisions by businesses - including insurance companies.

We were delighted to work with Intact Insurance, an Intact Company, and Stantec to deliver this new research, focussing on quantifying the full benefits of a selection of Wildlife Trust natural flood management schemes. The economic and social benefits are becoming crystal clear, whether we're looking at woodland planting, river re-wiggling or the affects of beavers in the landscape. This report considers the effects on communities of our schemes, and what lessons we can learn from the wider literature on natural flood management. We make several key recommendations to Government to mainstream, standardise, and support.

We received amazing support from our advisory group for this report, and look forward to working together to continue to make the case for natural flood management, so that everyone who can benefit from it, does.

Foreword from Intact Insurance

Ken Norgrove
CEO of UK & International,
Intact insurance

Climate change is one of the defining trends of this century for insurers. Climate-related events caused £253bn (USD $320bn) in losses globally in 2024, a third higher than the previous year. In the UK, one in six properties could be at risk of flooding by 2050 as the threat increases due to climate change. Two-thirds of England is reliant on infrastructure at risk of flooding.

Intact Insurance has been on the frontline of extreme weather events alongside our customers for decades and sees the devastation they can cause. Our teams are often on the ground within the first few hours of a flood, helping people, business owners, and communities recover and rebuild. Intact has invested heavily in building resilient communities since its inception in 2009, funding over a hundred climate resilience projects from coast-to-coast in Canada. All these actions are aligned to our global purpose to help people, businesses and society prosper in good times and be resilient in bad times.

Insurance plays a crucial role in helping people prepare for the growing threat of flooding. Reducing the financial, environmental, and social impacts of climate change is vital to creating a sustainable future. That's why we're committed to sharing our knowledge, tools, learnings, and best practice with the communities we protect and operate in and investing in projects that develop practical solutions to flooding.

A growing threat needs investment in innovative solutions and collaboration between the private, public and not-for-profi t sectors to make the biggest impact.

I'm delighted that this report is being published through our partnership with the Wildlife Trusts, after over a year of thorough research. The benefits of natural flood management are clear, and the report highlights the opportunity to implement these approaches on a larger scale. If we do this successfully, we can have a meaningful impact on building communities that are more resilient to the impacts of climate change – one of the greatest challenges of our generation.

Executive Summary

Flooding and multiple benefits

- Natural Flood Management (NFM) projects can mitigate the impacts of flooding by reducing the peak from high flows in urban and rural settings. Flood mitigation projects should consider natural solutions first.
- A review of other projects highlights that NFM projects tend to function best for flood risk mitigation when installed in smaller catchments, however there are currently few larger scale catchment projects with long term datasets.
- NFM projects deliver significant economic, social and environmental benefits for people, climate and nature.
- NFM projects have positive cost-benefit ratios, which increase when viewing multiple benefits. A review of a small number of Wildlife Trust projects, with limited data and independent of reserve management, highlight additional environmental and social benefits beyond flood risk management (the average cost-benefit from six assessed Wildlife Trust project sites was £1:£4.47 over 10 years; increasing to £1:£10.79 over 30 years)
- A national, standardised approach describing NFM, and for project development, monitoring, and understanding of likely outcomes is lacking. Without this, scaling of benefits to a national level is difficult.

Communities

- Communities located near NFM projects see benefits in reducing the impact from flood risk, and increased biodiversity, recreational opportunities and health & wellbeing.
- Communities are concerned about climate change and the impacts climate change is currently having on their community (96% of respondents, n=345). Communities have seen an increase in flooding in the past five years and are concerned about the future impacts of flooding.
- NFM projects must be developed with communities and in collaboration between multiple stakeholders including landowners, land managers, public sector, community groups and private sector interests. A key challenge is to engage private businesses, in particular private landowners, in discussions around flood risk management.

Funding and Finance

- Public funding for NFM remains a small proportion of overall flood risk mitigation. The largest current fund in England is the £25m Natural Flood Management Programme.
- A blended financial approach to NFM can be highly successful in meeting project objectives (especially for multiple beneficiaries for flood risk mitigation, or multiple benefits), but to meet the levels of funding & finance required, increased confidence in the market is required for private investors. Current private investment in NFM is very limited.

A number of barriers / challenges exist for investors engaging with NFM projects. Unless these are removed, and confidence is increased, private investment will remain limited.

Governance

The type and method for data collection against individual interventions or at project scale is not standardised across current NFM projects, increasing uncertainty in the success or comparison between projects for investment in NFM. Government should create better frameworks for investment in NFM and help in standardising monitoring frameworks and KPIs.

Longevity of NFM projects, including responsibility for long term maintenance of infrastructure, is uncertain. Firming up what 'maintenance' is for each intervention, and the 'lifetime'of NFM might be is one of the gaps we require addressing. For some types of intervention (like tree planting) 100 years with limited 'maintenance' is probably achievable but other interventions will require more regular maintenance and therefore increased cost.

Summary findings

Natural Flood Management (NFM) is increasingly recognised as a valuable and cost-effective complement to traditional flood defences in the UK. By working with natural hydrological and geomorphological processes, NFM can effectively mitigate the impact of river, coastal, and surface water flooding, while delivering a range of additional social, environmental, and economic benefits. With climate change intensifying flood risks, there is growing interest in NFM as a sustainable solution to help to manage these challenges.

Over the past decade, substantial efforts have been made to quantify and map the potential of NFM, including the Environment Agency's National Strategic NFM Opportunity Maps (England only) and research conducted for the UK Climate Change Risk Assessment. While these efforts have advanced our understanding of NFM's spatial potential, less research has focused on quantifying the full spectrum of NFM's benefits—especially those related to people, climate, and nature. This research gap is particularly important for informing future investment decisions, for public sector funds and private sector engagement and financing, where the lack of quantitative data on NFM's flood alleviation and other benefits makes return on investment difficult to measure.

- To address these gaps, a research project was commissioned in partnership between Intact Insurance, and The Wildlife Trusts. The project had two main objectives:
- To assess the full range of benefits from NFM schemes already implemented or in progress by local Wildlife Trusts.

To synthesise existing literature on the societal net benefits of NFM, with a particular focus on implications for decision-makers, including insurance providers.

The project considered several high-level research themes around community engagement, investment, data collection, and barriers to increased private sector funding for NFM. It also explored how policymakers can facilitate greater private sector involvement.

- To achieve these objectives, the project employed a three-pronged approach:
- Literature Review: The project gathered existing evidence on the societal, environmental, and economic benefits of NFM, including private finance engagement. This involved reviewing both peer-reviewed and grey literature to better understand how NFM can be measured and financed, and how it aligns with broader ecosystem service objectives.
- Community Impact Assessments and Stakeholder Engagement: In collaboration with a group of local Wildlife Trusts, the project evaluated the effects of NFM schemes on local communities, including changes in mental and physical health, well-being, and perceptions of flood risk.
- Site-Level Quantification of Benefits: The project conducted detailed assessments of completed or ongoing NFM schemes led by a group of local Wildlife Trusts, measuring their impact on ecosystem services such as water flows, biodiversity, and carbon storage. These findings were reviewed for their potential to scale nationally.

Key Findings from the Literature Review

- **Social, Environmental, and Economic Benefits:** NFM schemes contribute to reducing peak flows during flood events, enhancing flood risk resilience for properties, infrastructure, and key utilities. Beyond flood alleviation, NFM provides measurable co-benefits such as improved biodiversity, mental health, carbon sequestration, and better water quality.
- **Investment and Financing:** Despite growing recognition of NFM's potential, both public and private sector investment in this method remains limited. The lack of standardised design guidelines, insufficient data on NFM's effectiveness at various scales, and uncertainties around return on investment are major barriers. However, there are opportunities to attract capital through blended finance models that combine public, private, and philanthropic funding. Key drivers for investment should consider the multiple benefits to society and include flood risk reduction, biodiversity credits, carbon credits, mental health and social engagement, and flood mitigation in urban settings.

Insurance Sector Engagement: The insurance industry is an important stakeholder in NFM, especially as climate change exacerbates flooding risks. This role is varied and may include provision of data, finance, and collaboration with other private business and society. However, commercial incentives for insurers to invest directly in NFM are currently limited, due to regulatory uncertainties, the risk of 'free riding' (enjoying the benefits without contributing to the funding of schemes), and the lack of clear financial models. Increasing engagement from the insurance sector will require clear frameworks, improved data, and robust evidence of NFM's long-term benefits.

Key findings from the Community Surveys

This report outlines the stakeholder engagement process and data analysis for four NFM project sites (Limb Brook in Sheffield, Gloucester & Cheltenham Waterscapes, Sherbourne Valley in Warwickshire, and River Otter in Devon). The primary objective was to gather community and business input on NFM approaches, measure awareness, and identify opportunities for enhancing local engagement and project success.

A comprehensive suite of communication materials was developed to promote survey participation, including press releases, social media posts, and posters. A total of 359 survey responses from local communities were received across all sites, with 75% being members of their local Wildlife Trust, and other environmental NGOs. This potential bias towards understanding of environmental and natural risks due to the membership base does lead to a limitation to the findings.

- **Climate Change Awareness:** 96% of respondents expressed being concerned about climate change, with 78% believing it is already impacting their local area to some degree.
- **Connection to Nature:** A majority of respondents (80%) felt highly connected to nature, which correlates with positive mental health outcomes and pro-environmental behaviour. Most participants indicated that nature contributed significantly to their overall happiness in the past year.
- **Community Awareness and Knowledge of NFM:** While 58% of respondents reported 'some knowledge' of NFM, 24% claimed 'good knowledge'. Over 70% support methods such as tree planting and wetland restoration. Traditional hard engineering methods like concrete walls and sandbags received much lower support. A small percentage (3%) of respondents were directly impacted by flooding 'a great deal' in the past five years, but 15% reported being impacted 'to some extent.' The remaining 60% had not been affected by flooding at all. Overall, a strong preference for nature-based flood management solutions was evident.

- **Impacts on mental health:** The majority (59%) reported no impact on mental health from flooding, while 14% felt their mental health had been negatively affected 'to some extent', though these numbers will be affected upon by the number of individuals directly impacted by flooding in the project areas.
- **Impact of Local NFM Sites:** 49% of respondents perceived that NFM measures at their local sites had reduced flood risks. Additionally, many respondents cited the NFM sites as positively affecting their health and well-being, particularly through exposure to nature, quiet spaces, and opportunities for physical activity.
- **Concerns About Future Flooding:** 59% were 'very concerned' (12%) or 'fairly concerned' (47%) about future flooding in their area, with respondents near Gloucester & Cheltenham expressing the highest level of concern (64%).
- **Local NFM and Wellbeing:**
    - 85% of respondents believed their local NFM site encouraged physical health and exercise, and 92% felt it was beneficial for mental wellbeing and exposure to nature.
    - Respondents viewed NFM sites positively in terms of environmental quality, with 82% feeling these areas made existing spaces greener and 83% appreciating the variety of plants and wildlife. Local NFM sites were seen as accessible, well-maintained, and providing opportunities to meet others, see nature, and reduce concrete surfacing.

The business interviews yielded limited participation, with only three interviews conducted from non-business focused organisations, despite numerous approaches. However, this highlighted challenges in engaging the business community, with many businesses not actively involved in the NFM discussions.

The focus group with business sector representatives revealed key insights on enhancing NFM investment and success metrics. Participants identified the need for clearer communication of NFM's benefits, more standardised measurement of benefits (including flood risk reduction) and more robust data on flood risk reduction to attract private sector investment.

- **Barriers to NFM Engagement:** The biggest barriers to NFM adoption were the lack of consolidated monitoring and evaluation, difficulty in demonstrating clear monetisable outputs, and limited understanding of NFM among stakeholders.
- **Actions to Increase NFM Investment:** Participants suggested the need for a framework to quantify the multiple benefits of NFM projects (flood risk, ecology, carbon capture) and more standardised monitoring practices to demonstrate impact.
- **Beneficiaries of NFM Projects:** Key beneficiaries identified included water management sectors, residential developers, local communities, businesses in flood-prone areas, agriculture, infrastructure, and environmental organizations.

The stakeholder engagement process demonstrated strong community support for NFM, particularly around increasing awareness, improving local involvement, and addressing concerns about flood risk. While the focus group and business interviews offered valuable insights, there is an ongoing need to improve participation and awareness within the business community to drive broader NFM adoption. Moving forward, more targeted communication and education efforts will be essential in fostering deeper engagement with both the local communities and business sectors.

Key Findings from the Valuation Analysis

This report presents a detailed assessment and valuation of the ecosystem services provided by NFM projects across six sites managed by Wildlife Trusts (in Gloucestershire, Warwickshire, Sheffield, Devon, Yorkshire and Surrey). The aim was to quantify the ecological and socio-economic benefits of these projects and provide a clear understanding of their value principally using the Environment Agency's 2023 EHOV (Environment and Historic Environment Outcomes Valuation) Guidance.

The analysis undertaken was dependent on data already collected by The Wildlife Trusts. Each project collected different data depending on the needs of the project, the stakeholders and the funders. It was therefore not feasible to directly compare each project against other projects. This highlights the need for a consistent data framework to enable comparisons for funders and stakeholders.

Data from the six sites were categorised using the ecosystem services framework, encompassing:

- **Regulating services:** Flood regulation, air pollutant removal, and carbon sequestration.
- **Provisioning services:** Food, timber, water supply, and fish.
- **Cultural services:** Recreation, physical health, education, and volunteering.
- Supporting services: Biodiversity and water quality.

These benefits were quantified in physical units (e.g., flood alleviation benefits in terms of water storage or number of properties protected) and monetised where possible, drawing primarily from the ENCA (Enabling a Natural Capital Approach) framework and statutory biodiversity credit prices. The results provide both lower and upper estimates of annual and total benefits for each site:

- **Screening and Impact Assessment:** We conducted a screening process to identify the most relevant ecosystem service impacts for the six sites where sufficient data was available. These benefits were assessed using a quantitative approach covering natural asset extent, ecosystem service flows, and beneficiary populations. All sites had data gaps and where these existed, qualitative and semi-quantitative assessments were provided wherever possible. The six sites considered in this report show significant valued benefits, particularly for Gloucester & Cheltenham Waterscapes which has better data on number of properties protected, and therefore demonstrates the largest flood regulation benefits.
- **Aggregated Benefits and Valuation:** We aggregated the ecosystem service benefits across sites and considered both 10-year and 30-year appraisal periods, to reflect the potential lifetimes of the measures being considered. These benefits were discounted at rates following HM Treasury Green Book and FCERM guidelines. The results show positive net present values and benefit-to-cost ratios for most sites even on the basis of the limited data available on benefits across the sites, indicating that the benefits of NFM schemes generally outweigh the associated costs (including loss of agricultural land).
- **Scenario Analysis:** To address uncertainties related to valuation, a scenario analysis was conducted. This considered changes to some of the key assumptions underlying the valuation process, specifically in relation to flood risk (the number of flood events avoided as a result of the schemes), biodiversity (using market-based biodiversity credit prices rather than ENCA), education/volunteering (with benefits tailing off after the initial funding period) and water storage (drought and flood mitigation, with additional benefits associated with tree planting considered).

- **National Valuation and Scaling Up:** The total benefits for each of the reviewed sites were normalised to the 2024 price year. Total benefits were normalised to the 2024 price year and re-calculated on a per hectare basis for each site to provide consistency across the six sites. This normalisation highlights significant variation in benefits across the project sites. The report emphasizes that while this data provides valuable insight into the potential benefits of NFM projects, the small sample size (six Wildlife Trust sites) means that scaling up to a national level requires further research and data consistency.

The valuation of NFM projects across the six sites demonstrates substantial economic, environmental and social benefits, not only in terms of flood risk reduction but also through wider ecosystem services such as biodiversity, recreation, and health. It is important to note wide variation in benefits across each site, which is partially a causation of the available data. Upper examples of valuation from a range of ecosystem services across the sites at different time ranges (aggregated totals per site) include:

- **Biodiversity:** £4.47m (10-year scenario) to £7.72m (30-year scenario) on the River Otter in Devon
- **Education and volunteering:** £2.97m (10-year scenario) to £6.55m (30-year scenario) on the Gloucester and Cheltenham Waterscapes programme, Gloucestershire
- **Water Storage:** £2.99m (10-year scenario) to £6.79m (30-year scenario) on the Gloucester and Cheltenham Waterscapes programme, Gloucestershire

The cost-benefit analysis considered upper and lower limits, and confirms that these projects offer a net benefit, with positive benefit-to-cost ratios, in particular through the upper limits and when the appraisal period is 30 years. In the couple of projects where projects did not show positive benefits inside of the 10-year timeframe, projects lacked significant carbon or flood risk reduction benefit, whereas projects more focused on biodiversity often achieved net positive benefits within 3-5 years. All projects achieved positive benefits by the 30-year window.

The findings provide a strong case for continuing and expanding NFM projects, supporting their potential as effective and economically viable strategies for managing flood risks and enhancing environmental and community well-being. The findings also point to a strong need to more standardised monitoring to enable the valuation of a full suite of benefits across sites.

Funding

At present, NFM projects are predominantly funded through public or philanthropic sources, such as government Flood and Coastal Erosion Risk Management (FCERM), Lead Local Flood Authorities (LLFAs), or agri-environment schemes. However, the value of NFM funding compared to the wider flood management budget is considered very low proportionally to hard defences. Private financing for NFM (and in particular NbS) is gaining traction, often as part of a blended approach for multiple reasons. In particular, private financiers tend to focus on projects with a clear material risk, such as water companies using Sustainable Drainage Systems (SuDS) to reduce surface flow and alleviate pressure on sewer systems.

Despite the potential for increased private investment, several barriers remain to wider private financing of NFM:

- Lack of confidence in the effectiveness of NFM measures at various scales.
- Absence of nationally accepted design standards for NFM.
- Insufficient data and evidence demonstrating the success of NFM projects in delivering multiple benefits.
- Uncertainty around long-term maintenance responsibilities and the duration of project effectiveness.
- No central, regularly maintained database to track NFM project progress, successes, failures, valuations, and lessons learned.
- Lack of commercial incentives due to the potential for ‘free-riding’, regulatory gaps (such as the role of planning), and the difficulty in pricing NFM-related risk reductions.

- Limited regulatory or government drivers to compel private investment.
- Uncertainty in return on investment, given the lack of standardised monitoring and assessment of NFM outcomes

In light of these challenges, private companies with material business risks caused by flooding, and financial and insurance sectors could play a key role in advancing NFM projects. However, for this to make a significant difference to funding for NFM projects and bearing in mind the multiple societal benefits from NFM projects, national and local government need to drive this approach.

While NFM offers significant potential for reducing flood risk and providing broader environmental and social benefits, **achieving its full impact requires increased and alignment of public and private investment, standardised monitoring, and stronger engagement from multiple private sectors involved in risk management including utilities, insurance and financial sectors**. This research aims to support the necessary evidence base for a more comprehensive approach to NFM investment, helping decision-makers and investors to make more informed choices in response to the challenges posed by climate change.

Future Directions

To enhance the success and scalability of NFM projects, **greater consistency and standardisation** in project development, monitoring, and data collection is crucial. This would not only provide a clearer understanding of the potential benefits and costs of NFM but also boost investor confidence (public, private, and philanthropic). If these challenges are addressed, NFM projects have the potential to attract greater private investment, paving the way for more widespread implementation and further societal benefits.

Recommendations for Future Action

- **Improved Data and Standardisation:** A standardised approach to project design, monitoring, and valuation is needed to increase investor confidence. This includes the development of clear NFM design standards and comprehensive datasets on NFM outcomes.
- **Government Support:** A government-led framework, including support for private finance markets and improved data collection, is essential for increasing NFM investment. This could include the creation of a natural capital assessment tool framework, updates to funding processes, and guidance on ecosystem service ‘stacking’ (combining a range of revenue streams by delivering different ecosystem services on the same parcel of land).
- **Private Sector Opportunities:** The private sector, including insurers, can play a more active role in NFM investment by engaging with blended finance models and recognizing the broader economic and environmental benefits of NFM. Private investors are particularly interested in projects that align with their sustainability goals and offer clear, measurable benefits. PRA rules amendments to allow for a proportion of nature-based investments under Solvency UK could allow for greater investment.

Recommendations for Decision Makers

Prioritisation of NFM

Current evidence highlights the success of NFM implementation for flood risk management and multiple other benefits for environmental and social drivers. Whilst NFM is unlikely to be the single solution to flood risk management in the majority of catchments or scenarios, it is not prioritised as a critical element in the decision-making process for FCERM in England. Until such time that natural solutions are considered as a priority, and funded accordingly, it will remain an 'add-on' to hard engineering projects.

Recommendation:

All FCERM projects undertake an approach to 'mainstream NFM' decision making ensuring natural solutions are considered in all situations.

Responsible body:

Defra, Environment Agency, LLFAs, RFCCs

Standardised data collection

All NFM projects are funded for different reasons, by different funders, and are undertaken by different project leads or partnerships. This inevitably leads to a wide variation in data collection including methods used, types of data collected, timeframe involved and a lack of baseline monitoring. Without a consistent and standardised approach to data collection by NFM projects a national picture of NFM opportunities, outcomes and projects is untenable.

This lack of consistency in data collection results in a lack of confidence in the approach by funders and financial investors. As with other NbS, NFM opportunities provide a wide range of potential benefits and returns on investment for private investors, but only with market confidence.

Current measurement of flood risk management programmes in England contains a number of KPIs but do not provide detail into the outcomes of measures, rather the outputs i.e. area of habitat created value of expenditure etc. Standardised data, and a standardised approach to scaling to national level i.e. normalisation of data using an area-based approach) for ecosystem service outcomes could help develop precise forecasts for the development of future projects across the country, and at a variety of scales.

Recommendation:

A framework/established methodology for standardised, quantified data collection is developed. This should include guidance on techniques and tools (i.e. use of Nature Tech), baselining (particularly important for agricultural reversion to understand all valuation), all ecosystem service categories and the data required to enable their consistent measurement. The framework must also consider the 'normalisation' of data to enable like-for-like comparison between projects and to ensure that data collection requirements do not make a project non-economic.

All government funded or supported NFM schemes (including through FCERM, LLFAs, RFCCs or agri-environment schemes), use the framework to undertake standard data collection.

Responsible body:

Defra, Environment Agency

Increased support to understand financial investment opportunities

There are a number of pilot projects underway or being developed that consider a blended financial approach to NFM development. A number of government initiatives also exist enabling projects, often developed by eNGOs or the public sector, to become 'investor ready'. However, there remains a lack of standardisation inevitably leading to inconsistent results in the development of such projects. Many are not investable. For a market i.e. NFM, to become financially investable, there requires confidence in the market. Opportunities to increase private investment in NFM may be linked to the multiple benefit outcomes i.e. removal of surface water from utilities (e.g. combined sewer overflows), the value of biodiversity credits or current carbon credits, or requirements through Biodiversity Net Gain, as well as flood risk mitigation. A clear understanding of opportunities for 'stacking' is also a requirement before a market can be determined. Governmental support for developing a clear market is essential to provide confidence.

Recommendation:

Development of a government-led framework and guidance to develop a private investment market in NFM, by providing regulation, support and confidence to private buyers.

Responsible body:

Treasury, Defra

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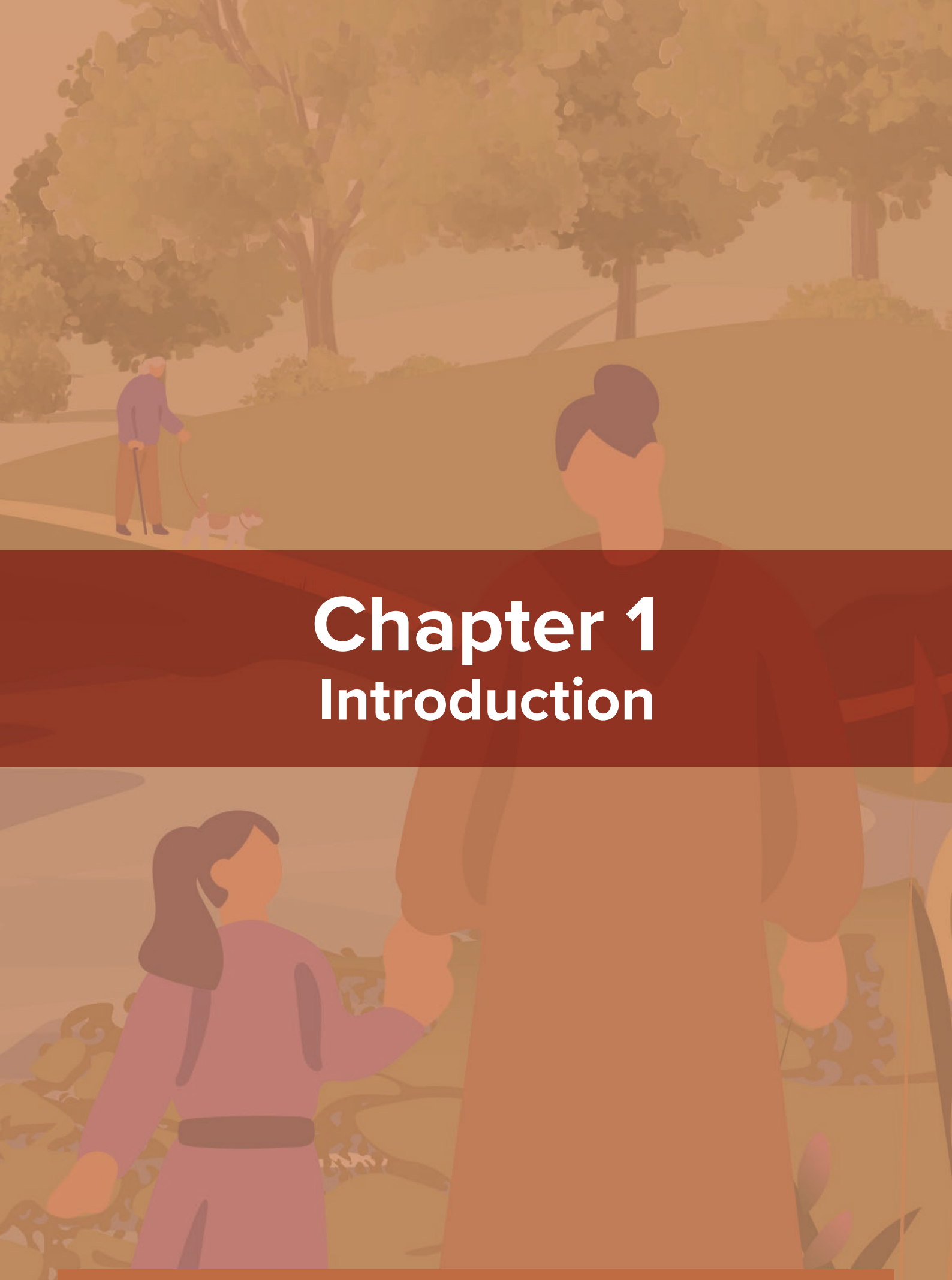
Acronyms / Abbreviations

EA	Environment Agency
FCERM	Flood and Coastal Erosion Risk Management
eNGOs	Environmental non-governmental organisations
GDPR	General Data Protection Regulation
GFI	Green Finance Initiative
KPI	Key Performance Indicator
LLFA	Lead Local Flood Authorities
NbS	Nature-based Solutions
NFM	Natural Flood Management
PSG	Project Steering Group
RFCC	Regional Flood and Coastal Committees
RSWT	Royal Society of Wildlife Trusts
SAG	Stakeholder Advisory Group
WT	Wildlife Trust
WWNP	Working with Natural Processes



Chapter 1
Introduction

1 - Introduction

1.1 Introduction

Natural Flood Management (NFM) is gaining traction as a relatively low-cost, multi-benefit complement to traditional 'hard' flood defences to help to protect communities across the UK from the effects of river, coastal and surface water flooding.

NFM refers to a set of strategies that use the natural environment to reduce flood risks. Instead of relying solely on engineered solutions like dams, embankments, or flood barriers, NFM aims to enhance or restore natural processes that can help absorb, slow, or store floodwater. The goal is to work with nature rather than against it to reduce the impact of flooding on communities, ecosystems, and infrastructure. For this project, both rural and urban interventions are considered.

Examples of NFM include:

1. **Wetland Restoration:** Wetlands can act as sponges, absorbing excess water during heavy rainfall and gradually releasing it over time. Restoring or creating wetlands in flood-prone areas helps prevent flash floods and reduces downstream flooding.
2. **Woodland Planting and Forest Management:** Trees and vegetation in riparian zones (along rivers and streams) help absorb water, slow surface runoff, and stabilize riverbanks. The roots of trees and plants reduce soil erosion and improve water infiltration.
3. **Floodplain Reconnection:** This involves allowing rivers to flow naturally across their floodplains. By removing or modifying embankments and barriers, floodwaters can spread across the land, slowing down and reducing the intensity of floods.
4. **Soil Management:** Practices like planting cover crops, creating buffer zones, or introducing controlled grazing can improve soil structure and infiltration, which helps prevent surface runoff during storms.
5. **Leaky Dams or Check Dams:** These are small, low barriers built in streams or rivers that slow the flow of water. Unlike traditional dams, leaky dams allow water to flow through them at a controlled rate, reducing peak flood flows.
6. **Riverbank Restoration:** Reinstating natural meanders and stabilizing riverbanks with vegetation can prevent erosion, slow down the water, and reduce sediment transport that can block drainage systems.
7. **Sustainable Drainage Systems (SuDS):** These are urban measures that mimic natural drainage patterns. Examples include permeable pavements, rain gardens, and green roofs, which help absorb rainwater and prevent overwhelming traditional drainage systems.
8. **Catchment Management:** This involves managing entire river catchments to improve water retention, reduce runoff, and increase infiltration. Techniques can include restoring vegetation, managing land use, and reducing impermeable surfaces.

Work has been carried out over the past ten years to quantify and map the potential for NFM to help to address growing flood risk, including from the effects of climate change. Significant evidence programmes include the Environment Agency's National Strategic NFM Opportunity Maps[1], and the projections of the contribution that NFM can make to adaptation for flooding from the third UK Climate Change Risk Assessment[2]. The evidence base looking at the current and future potential for NFM from a spatial point of view is fairly well advanced.

1 Working with natural processes to reduce flood risk - GOV.UK

2 Government publishes UK's Third Climate Change Risk Assessment - GOV.UK

What is less well-researched is the identification and quantification of the full benefits of existing NFM schemes for people, climate and nature. Understanding this is important to make a comprehensive economic case for NFM, in part to inform investment decisions for both public funding and private finance. While there is general recognition that NFM is beneficial, it is challenging, or indeed can prove impossible, to include in financial investment and insurance models due to the paucity of quantitative data on effectiveness for flood alleviation, as well as other benefits, including return on investment. These constraints and lack of certainty of benefit makes the role of private investors difficult to define.

This research project, commissioned in partnership through Intact Insurance, and The Wildlife Trusts, aimed to:

a) assess the full benefits of a selection NFM schemes already completed or underway by local Wildlife Trusts, and

b) to bring together existing literature on the societal net benefits of NFM schemes and the implications of this evidence for decision makers, including insurance providers.

1.2 Approach

This project considered the following high-level questions:

- What impact do current NFM projects have on the environment and local communities impacted by flooding?
- How do communities engage with NFM projects?
- What benefits are a result of NFM projects?
- Which sectors benefit from NFM projects? How are they measuring success?
- Who is investing in NFM? i.e. what types of organisations.
- How do NFM investors measure success?
- What are the key issues and barriers facing investors, that if addressed, could help unlock greater levels of private sector investment into NFM?
- What are the key actions that could help increase NFM investment?
- What could be done to improve the collection and analysis of data and information?

Answering the foundational question of understanding the value of selecting NFM measures to complement or, though unusual, to replace grey solutions depends on identifying opportunities that increase sustainability and reduce maintenance in ways that maximise social, climate and nature values.

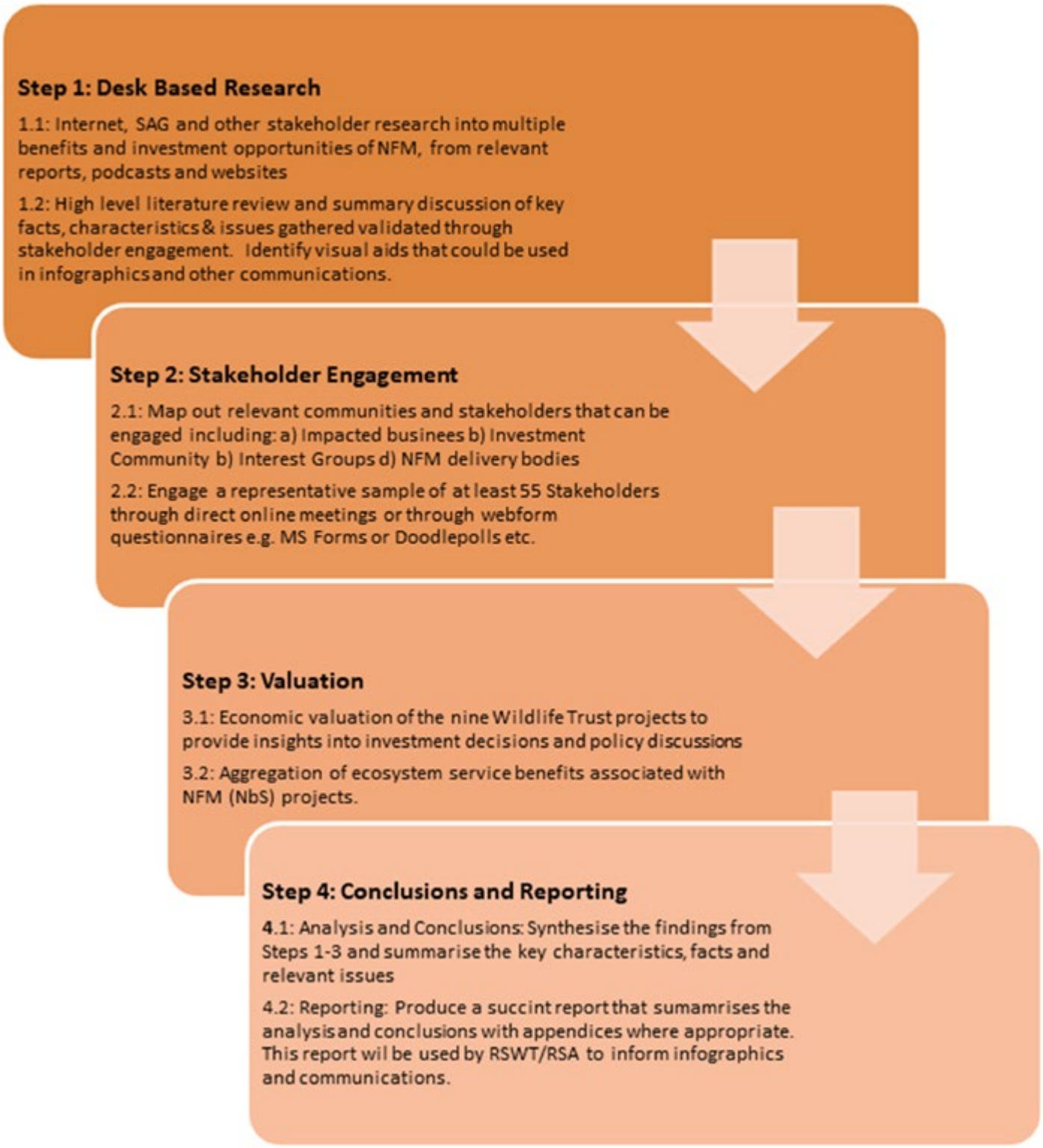
To develop an approach to meet the two aims noted in Section 1.1., the project developed three key workstreams:

- Bring together evidence from the literature on the economic, environmental and societal benefits of NFM schemes, to help inform decision makers and investors including insurance companies on the full economic value of NFM schemes and therefore the rationale for investment. This entailed both literature review and stakeholder engagement with relevant bodies undertaking work in this area (Section 2).
- Work with local Wildlife Trust communication and stakeholder engagement teams to assess how the presence of the scheme has made a difference to people and businesses in the local area, including any changes to mental or physical health and wellbeing or perception of flood risk and impact (Section 3).
- Work with local Wildlife Trusts to quantify the benefits to people, climate, and nature from a selection of completed or ongoing NFM schemes across England. This research entailed site-level assessments of changes in water flows, biodiversity, and carbon as far as possible. Project data were reviewed to determine the ability to undertake a suitable valuation of the services provided by each project. Having reviewed the local data, the project then considered the ability to scale to a national level (Section 4).

Framed by the context points set above, the overall objective of the project is to gain a better understanding of the economic valuation of NFM for multiple outcomes and benefits to make better investment and asset management choices.

The deliverables of the project will also provide the partnership with:

- Evidence that will create a shared understanding of the overall valuation of delivering NFM in a social, climate and nature context using, where suitable, real-world data.
- Evidence of how different methods of NFM can optimise valuation.
- An understanding of the impacts of NFM on local communities and businesses.
- Recommendations that will support the future investment in NFM for the insurance sector.


Step 1: Desk Based Research
1.1: Internet, SAG and other stakeholder research into multiple benefits and investment opportunities of NFM, from relevant reports, podcasts and websites
1.2: High level literature review and summary discussion of key facts, characteristics & issues gathered validated through stakeholder engagement. Identify visual aids that could be used in infographics and other communications.
Step 2: Stakeholder Engagement
2.1: Map out relevant communities and stakeholders that can be engaged including: a) Impacted businees b) Investment Community b) Interest Groups d) NFM delivery bodies
2.2: Engage a representative sample of at least 55 Stakeholders through direct online meetings or through webform questionnaires e.g. MS Forms or Doodlepolls etc.
Step 3: Valuation
3.1: Economic valuation of the nine Wildlife Trust projects to provide insights into investment decisions and policy discussions
3.2: Aggregation of ecosystem service benefits associated with NFM (NbS) projects.
Step 4: Conclusions and Reporting
4.1: Analysis and Conclusions: Synthesise the findings from Steps 1-3 and summarise the key characteristics, facts and relevant issues
4.2: Reporting: Produce a succint report that sumamrises the analysis and conclusions with appendices where appropriate. This report wil be used by RSWT/RSA to inform infographics and communications.

1.1 Geographic scope

The project initially reviewed information and data gathered by NFM projects across ten Wildlife Trust project locations that were offered to the project team in England and Wales. Table 1.1 provides information on each project including the types of interventions used at each location.

Table 1.1 - Wildlife Trust NFM Projects

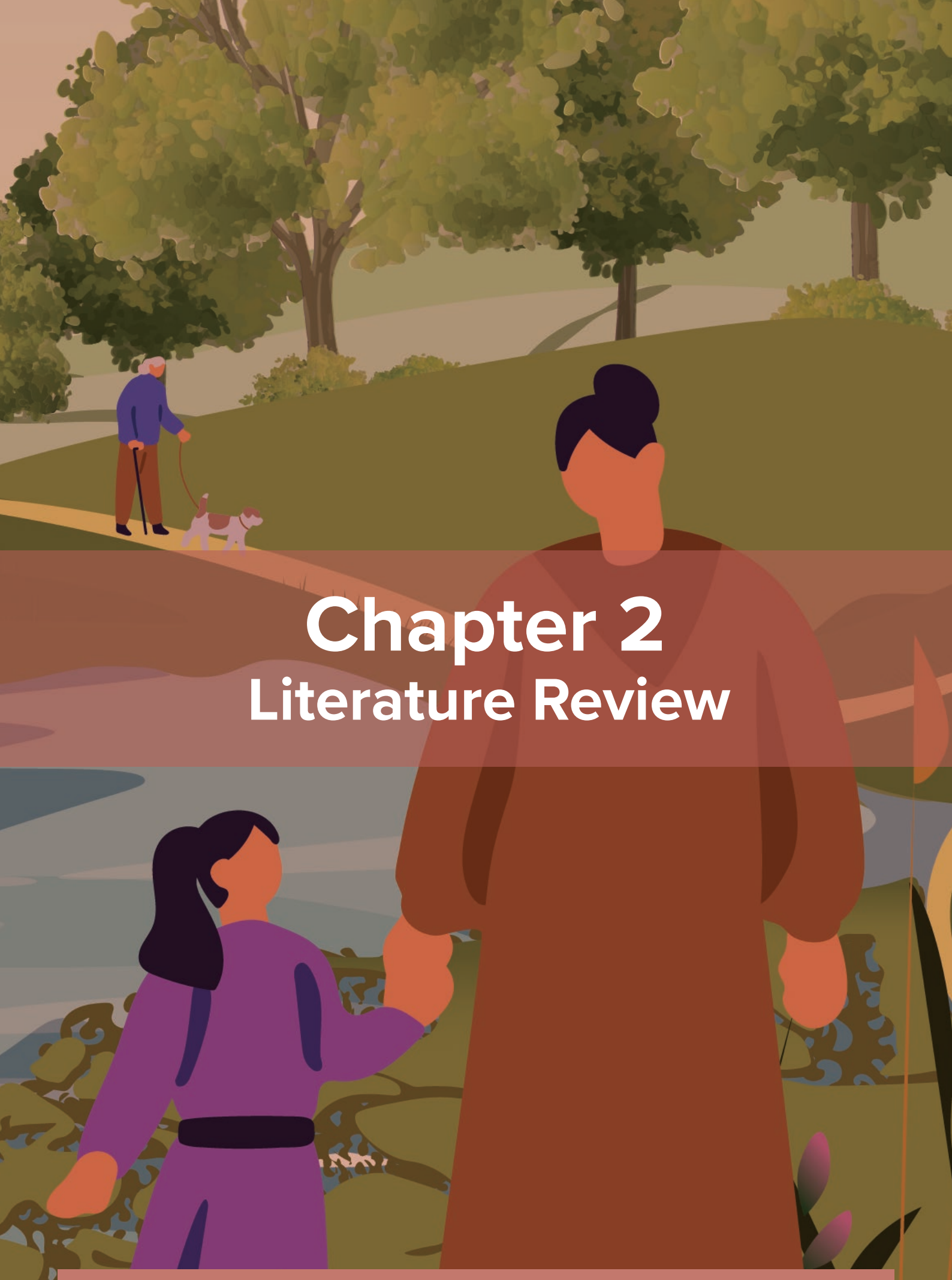
Site Name	Wildlife Trust	Rural/Urban Type	NFM Intervention
1. Upper Sherbourne, Warwickshire	Warwickshire WT	Rural	Leaky dams, retention pools
2. Upper Aire Catchment, Yorkshire	Yorkshire WT	Rural	Leaky dams, riparian fencing, bank restoration
3. Limb Brook, Sheffield	Sheffield & Rotherham WT	Urban	Leaky dams, attenuation ponds, bog creation
4. Gloucester and Cheltenham Waterscapes	Gloucestershire WT	Urban	Rain gardens, green verges, attenuation ponds
5. Barossa, Wishmoor Bottom, Surrey	Surrey WT	Rural	Optioneering for leaky dams, ponds
6. River Otter Beavers, Devon	Devon WT	Rural	Reintroducing beavers, wetlands
7. Milkwelburn Wood, Durham	Durham WT	Rural	Leaky dams, bypass channel
8. North Devon Natural Solutions, Devon	Deveon WT	Rural	Leaky dam
9. Derwent Living Forest, Derbyshire	Derbyshire WT	Rural	Woodland restoration, wetland restoration, leaky barriers
10. Wilder Lugg, Radnorshire	Radnorshire WT	Rural	Agricultural reversion, woodland restoration

Figure 1.1 shows the locations of the Wildlife Trust NFM projects involved in this review. The map also provides information on the level of engagement and analysis undertaken with each project. Appendix A provides further detail for the nine sites (excluding Wilder Lugg which was added later).

All projects were partially or wholly focused on implementing measures under NFM, though many had other drivers for being developed and funded. The projects are at different stages of maturity, age and development. The projects were not necessarily directly compliant with nature reserve management planning but may have been incidental or additional to overall management. All projects collected data relevant to their drivers, needs and funders requirements. The projects varied between urban and rural focus and therefore had different implementation, community engagement and design depending on their circumstances. These multiple variables led to the Valuation exercise (Section 4) looking at the projects as whole entities rather than breaking down individual interventions and valuing these separately.

The set up of each project does not enable the setting of recommendations or insights into which measures achieve which benefits or their individual valuation. These insights would be welcome to provide a true comparison between individual interventions (with associated caveats based on geography, geology, hydrogeology, hydrology, local politics and needs etc.). Any insights that can be provided into what works better, what works worse, and how to improve project outcomes is an essential output for NFM projects. The design and development for monitoring interventions and projects would need to be agreed prior to the outset of future projects to enable such comparisons.

Figure 1.1 - Locations of Wildlife Trust NFM projects in England and Wales



Chapter 2
Literature Review

2 - Literature Review

This section sets out the approach to reviewing current literature on Natural Flood Management, the potential benefits and funding and financing opportunities. It covers the summary and key findings from the review.

2.1 Literature Review

The literature review considered peer reviewed literature and grey literature against the following key questions:

- What evidence exists for social, environmental and economic benefits from NFM?
- How can or have those benefits been measured?
- What evidence exists for private finance investment or blended financial investment in NFM?

The review considered a number of topics:

- An introduction to NFM
- Urban vs Rural
- Evidence for social, environmental and climate benefits
- Measurement
- Maintenance
- Spatial Scale
- Financing
    - Public Spend
    - Private investment
- Insurance engagement in NFM
- Challenges to increasing investment in NFM
- Future Development

Appendix B shows the full literature review. Section 2.1.1 provides a summary of the findings.grazing can improve soil structure and infiltration, which helps prevent surface runoff during storms.

Key findings

- NFM projects can mitigate the impacts of flooding by reducing the peak from high flows
- Current data show that NFM projects tend to function best for flood risk mitigation when installed in smaller catchments, however there are currently fewer larger scale catchment projects with long-term datasets
- NFM projects function in both urban and rural settings
- NFM projects provide multiple benefits and services to improve environmental and social drivers and climate risk mitigation
- The type and method for data collection is not standardised across current NFM projects increasing uncertainty in the success or comparison between projects for investment in NFM
- NFM is largely funded by public bodies (in England predominantly through the Environment Agency, LLFAs and agri-environment schemes), though the overall amount of FCERM funding spent on NFM is low
- A blended financial approach to NFM can be highly successful, but to meet the levels of funding & finance required, increased confidence in the market is required for private investors
- Longevity of NFM projects, including maintenance of infrastructure is uncertain
- A national, standardised approach to project development, monitoring, and understanding of likely outcomes is lacking

2.2 Summary

The UK economy, and indeed global economy, relies on natural resources and there are a range of benefits that nature provides society, including for flood risk mitigation. It is estimated that £930 billion of UK bank and insurer financial assets are moderately to directly dependent on ecosystem services[3]. However, the preservation, conservation and restoration of nature has been historically underfunded. With a clearer understanding of the importance of ecosystem service provision, there is also a need to better understand the finances involved in preserving their function, and how a blended financial approach can be developed.

Flooding is currently the UK's most costly natural hazard, with damages and the associated investment in flood risk reduction costing the UK around £2.2 billion annually. According to the Green Finance Institute, this is projected to increase by 27% for businesses by 2050[4]. There are further economic impacts from the loss of natural functionality including water quality, water resource management, biodiversity and carbon storage. Beyond these costs, flooding impacts businesses, homes, and physical and mental health. As the climate changes, managing flood risk is likely to cost significantly more in the following decades. Indeed, flooding has been identified as a priority risk by the UK Committee on Climate Change. Continued investment in traditional flood risk infrastructure, even at today's record levels, will not be enough to cover potential costs. A more holistic approach to flood risk management and how it is funded, will be required going forward.

A definition of Natural Flood Management (NFM), is a type of Nature-based Solution (NbS) requiring engagement with multiple stakeholders and working with natural hydrological and geomorphological processes at a whole-catchment scale as a comprehensive approach to flood risk management.

NFM provides a wide range of benefits (Figure 2.1) from a range of different actions. The Environment Agency's Working With Natural Processes (WWNP) report[5] published in 2021, outlines the multiple benefits associated with NFM measures, indicating the varying levels of benefit each NFM measure provides in three categories (environmental, social, cultural) and 10 subcategories. For example, leaky barriers are recognised for their positive impact on water quality, habitat creation, flood regulation, and climate regulation, although may not score as highly in terms of aesthetic appeal. However, it is important to note that these 'wheels' do not consider the economics of NFM measures, such as their cost to implement, maintenance costs, or financial benefit – factors which are a key consideration when choosing and siting NFM measures.

A key service provided by natural processes is flood alleviation. Natural disasters, including flooding, have increased in frequency and intensity in recent decades with predictions of increased risk and harm due to climate change. Continual declines in nature make the impacts of climate change worse, and there is a need to improve the sustainable management of river catchments to decrease the risks from flooding.

NFM has been highlighted as key to reducing flood risk by the UK Government within the current capital programme, and as part of the Third National Adaptation Programme for England. NFM tends to be better suited to lower intensity, higher frequency floods in small to medium catchments, rather than to the larger, 1 in 200-year or greater events[6]. However, more research is required into the impact of NFM as a hybrid solution to flood risk management at a range of scales, including large catchments. There are a small number of projects underway where NFM is a key element of reducing flood risk for larger catchments, alongside hard engineered flood mitigation measures, but the data to highlight the success of such projects is not currently available. The current thinking is that NFM complements rather than replaces existing traditional flood risk infrastructure, though it can be used as a standalone measure in certain circumstances. By delaying and reducing the maximum flood peak, NFM can enhance the efficacy of traditional flood infrastructure. Furthermore, NFM provides the potential for multiple benefits across a wide range of ecosystem services, over and above flood risk management.

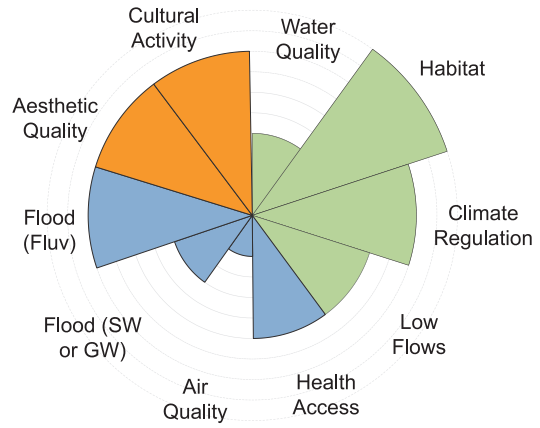
3 Degradation of nature could reduce UK GDP by 12 per cent - UNEP-WCMC

4 GFI – Financing NFM Report (2024)

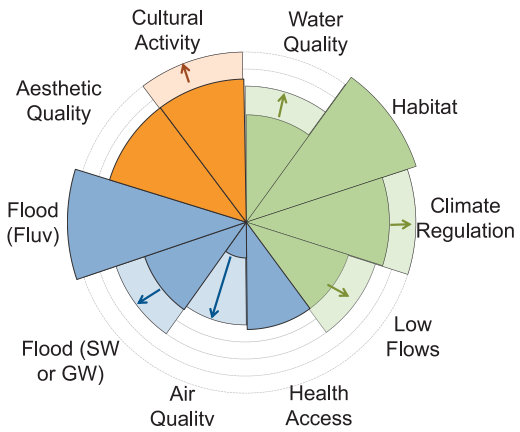
5 Working with natural processes to reduce flood risk - GOV.UK

6 GFI – Financing NFM Report (2024)

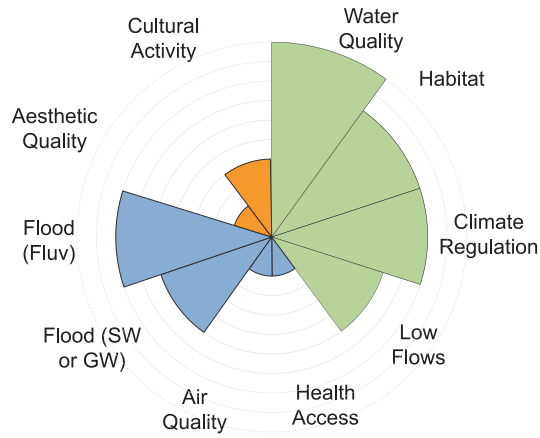
River Restoration



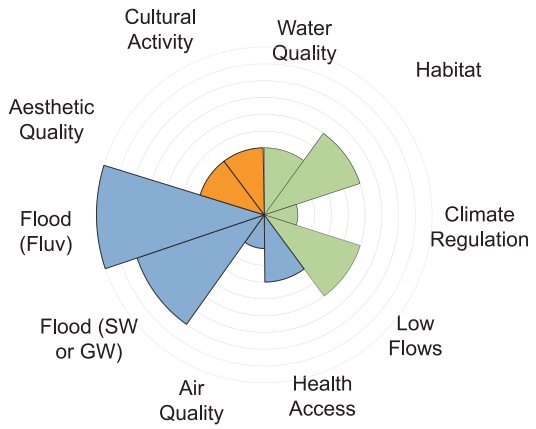
Floodplain Restoration



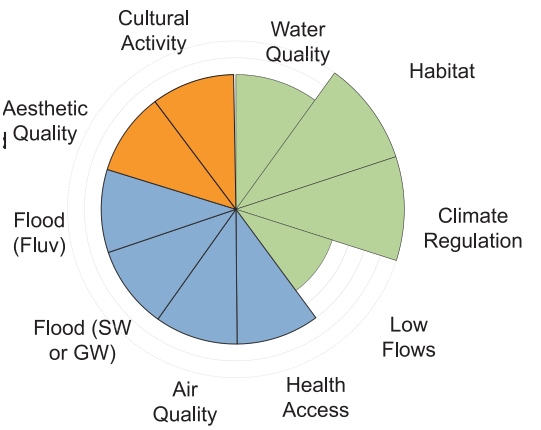
Leaky Barriers



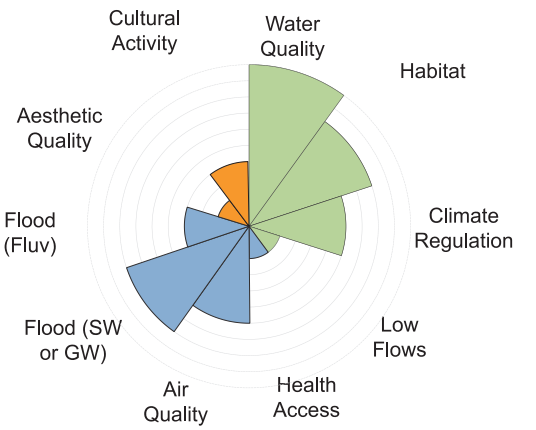
Offline Storage



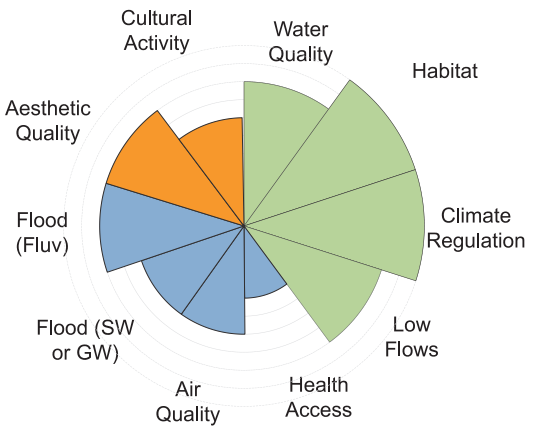
Catchment Woodlands



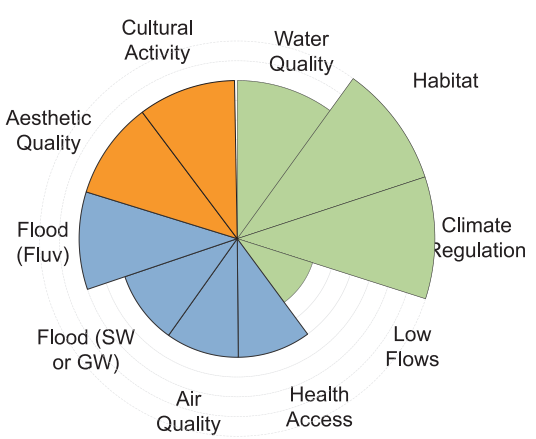
Cross-slope Woodlands



Floodplain Woodlands



Riparian Woodlands



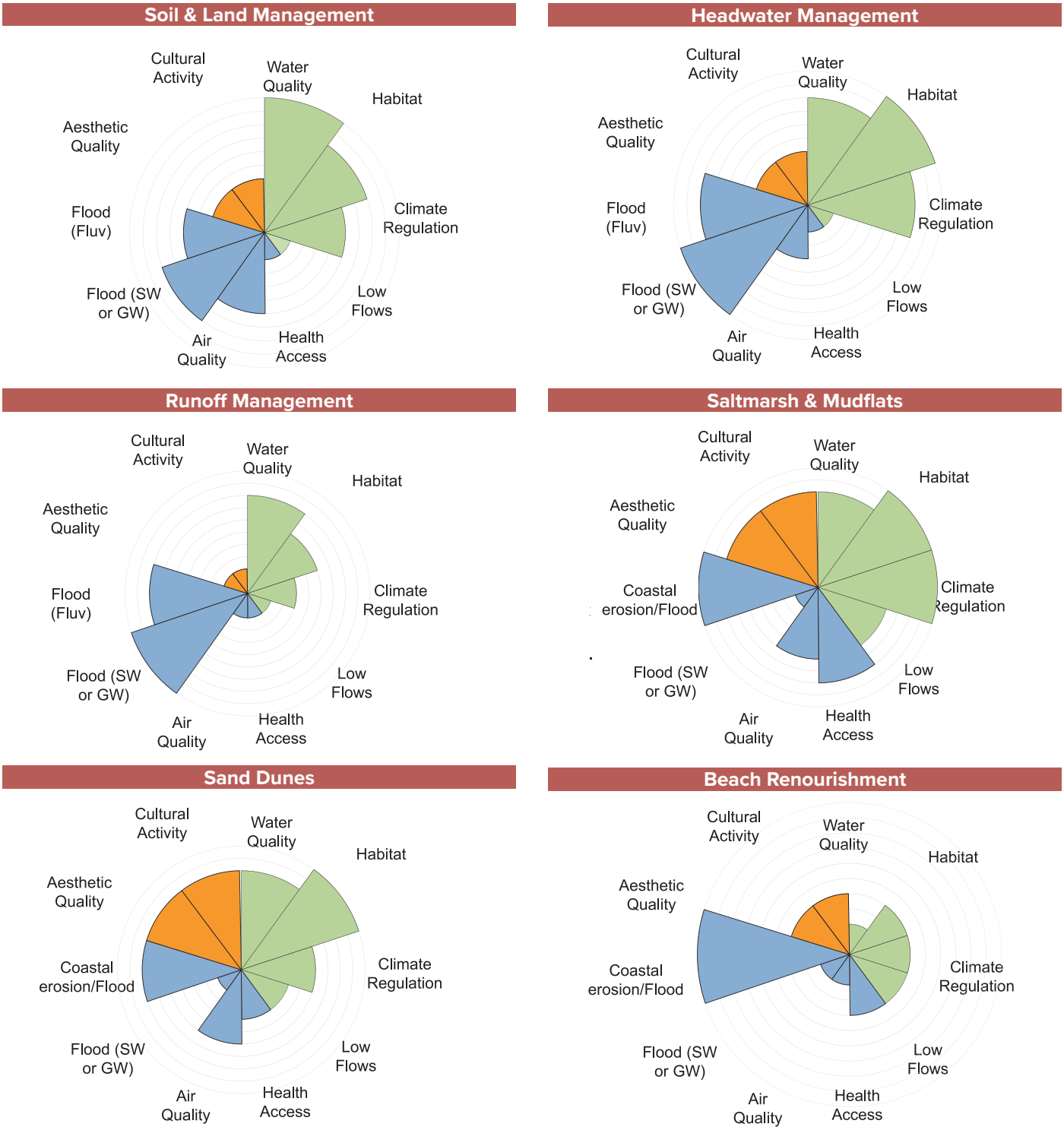


Figure 2.1 - Benefits Wheels of different methods for NFM (Source: Burgess-Gamble et. al., 2018)

However, NFM currently receives a small proportion of all flood risk management spending and will require increased funding going forward if it is to be delivered at the scale required to address the challenges associated with climate change. In March 2020, the government at the time announced that in the next six-year investment programme the total capital budget for FCERM for England would double to £5.2 billion. This figure includes funding for creating or improving 5,440 hectares of natural habitat and enhance 830 kilometres of rivers. There is the opportunity for NFM to attract private sector capital, relieving some of the burden on the public purse. There are examples in the UK of NFM projects where the private sector has paid for flood risk reduction, but these are currently limited in number.

There has been a growth in society's understanding of the importance of nature in climate change mitigation and adaptation, the reduction of impacts of natural disasters and our economic reliance on nature. This knowledge has led to a growth in political and economic action towards a blended financial approach towards the restoration of nature, such as the Natural Environment Investment Readiness Fund[7]. The blended approach considers public and philanthropic funding, and private financing combining to meet agreed objectives. The private company actors in this growth will have multiple drivers, statutory and voluntary, and multiple commercial reasons, often material risks to the current and future business models. However, the private finance market in NFM (and indeed NbS in general), in particular private equity investment, is still in its infancy, and there remains a great level of uncertainty to the return on investment, the direct benefits, and the best approach to engagement. The 2024 GFI report into NFM finance highlights a number of barriers to private investment and a strategy to overcome these issues for government to direct[8 9].

Opportunities to increase private investment in NFM may be linked to the multiple benefit outcomes i.e. removal of surface water from utilities (e.g. combined sewer overflows), the value of biodiversity credits or current carbon credits, or requirements through Biodiversity Net Gain, as well as flood risk mitigation. This will be dependent upon the investor and their drivers.

There are a number of positive outcomes from NFM projects that need to be considered by all stakeholders:

- NFM measures can lead to a reduction in peak flows during flood events, protecting properties, commercial premises, key infrastructure and utilities.
- NFM provides opportunities for multiple benefits (see Figure 2.1) for multiple ecosystem services.
- NFM projects can be successful in both urban and rural areas utilising different techniques depending on the location, and at different scales.
- Blended finance provides opportunities for projects to engage multiple funders and financiers, often with multiple drivers, to secure investment into NFM projects.

However, a number of barriers to private financing of NFM which need to be removed to secure the levels of investment required, alongside continuing public and philanthropic funding:

- Despite a growing evidence base as a flood risk management tool, and for other ecosystem services, there is still a lack of confidence in the success of NFM measures at a range of catchment and project scales.
- There remains a lack of nationally accepted design standards for NFM. Whilst there are a range of accepted methods and activities under the umbrella of NFM, i.e. coastal realignment, leaky barriers, wetlands, there are no NFM design standards and guidance from government.
- For current and completed projects, there is insufficient data and evidence gathered for the success of NFM focused projects looking at multiple benefits, and potential disbenefits.
- A question remains about who is contractually responsible for long term maintenance of NFM measures to meet the original objective of the intervention, its funding, and how long measures are to be monitored for their suitability (and if required, maintained).
- Each project collects data relevant to its partners or funders needs. There is a lack of consistency of the type, range and timeframe of project monitoring.
- Whilst a NFM project database for England and Wales exists, providing relevant information on NFM focused projects, it is not being maintained, and therefore is an inaccurate portrayal of the number of NFM schemes being undertaken. Therefore, a single source of information is missing from the knowledge base.

7 50 projects receive up to £100,000 to boost investment in nature - GOV.UK

8 GFI Financing NFM (2024)

9 GFI NFM Research Fund (2024)

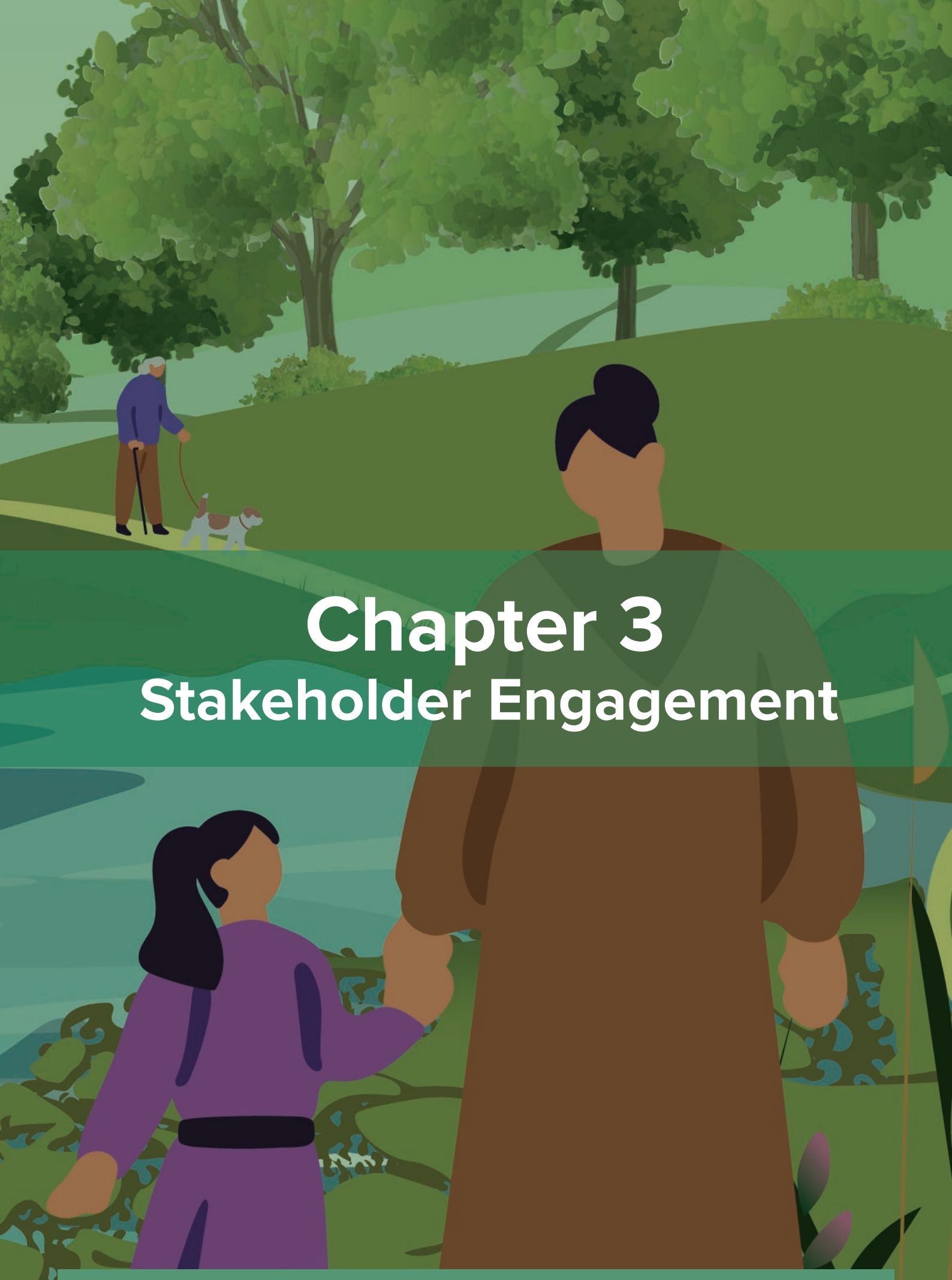
- A government-led framework and guidance are a key requisite to the success of private investment markets to develop in NbS and NFM, by providing support and confidence to private buyers. Due to long lead in times for developing a market, these actions need to be developed as soon as possible.

Given that NFM provides potential benefits for all in society, multiple sectors have an opportunity to influence and engage in the future of the technique. One sector considered here is the insurance industry. Private sector stakeholders could help fund delivery of NFM, by acting as a potential buyer of services from NFM projects. For example, purchasing the outcome of reduced flood risk, given that the increased risk of flooding due to climate change going forward may increase material risk to companies and their assets. Whilst there is currently a lack of commercial incentives for private investors to directly invest in NFM measures (including increased premiums, free riding, the role of Flood Re in housing cover, and a lack of regulation or government drivers), there is increasing interest in furthering the understanding of NFM and the impact it may have on business, in particular in light of increasing risk due to climate change. However, there is also currently a general lack of uptake of NFM interventions by private business to reduce their own flood risk

Other key barriers were highlighted by the Green Finance Initiative (GFI) in their two publications Financing Natural Flood Management and NFM Research Fund (2024). It is important to note that the GFI focused their research on the insurance sector. We include the barriers here as written by the GFI as they provide an excellent summary of remaining barriers for increased investment in NFM. Whilst the GFI report was focused on insurance, these barriers, and those mentioned above, are relevant to all funders and financiers. The following are needed:

- Strategic prioritisation of NFM: A free and open-access mapping application to highlight NFM opportunities across England for reducing flood risk, and for delivering wider social and environmental co-benefits. [Note. In addition to this particular barrier as described in the GFI report, it is also important to consider no-regrets forms of NFM that provide results against stated sub-catchment drivers. For example, improve soil health and enhanced soil ecology, compared to a poorly designed check dam with the potential to produce an adverse, combination flood outcomes, if it becomes fully charged prior to the upper reach of a peak flow event].
- Natural capital assessment tool framework: Development of a natural capital assessment tool framework to guide the valuation of NFM co-benefits in scheme applications.
- Funding for buyer facilitation and partnership development: Funding for the effective facilitation of buyer engagement and demand aggregation for the development of NFM projects.
- Clarity on ecosystem service stacking: Prioritised development of an NFM ecosystem service market standard or code, including clarity on the stacking (combining a range of revenue streams by delivering different ecosystem services on the same parcel of land) of individual ecosystem services alongside NFM.
- Update to FCERM grant-in aid funding processes: Co-funded FCERM schemes generate verified units and/or credits and apportioned between public, private and third sector stakeholders.

Ultimately, there remains uncertainty for investors from multiple sectors in the likely results or return on investment of any particular NFM project. If private financing is to be made available directly for the NFM projects, it requires a standardised approach to project development, monitoring, and understanding of likely outcomes to provide assurance to public, philanthropic and private investors.



Chapter 3
Stakeholder Engagement

3 - Stakeholder Engagement

This section sets out the approach to engagement, an overview of the local communities associated with four of the NFM sites, methods and tactics, and key stakeholders contacted. It covers the analysis of data collected from stakeholder surveys, a small number of business and local interest group interviews, and a focus group including investors and project developers. The surveys have been analysed under a set of themes.

3.1 Stakeholder Engagement

Engagement methods

We selected four Wildlife Trust NFM project sites for stakeholder engagement – Limb Brook in Sheffield; Gloucester & Cheltenham Waterscapes; Sherbourne Valley in Warwickshire; and the River Otter in Devon. These projects were identified according to available data across social, environmental, and economic criteria, as well as providing four different types of NFM measures.

We developed four online community surveys, tailored to each NFM site, hosted on Qualtrics and disseminated via Wildlife Trust regional communications teams.

Business interviews were scheduled with identified businesses in the vicinity of the four NFM sites. The response from this stakeholder group was low and those responses received include local interest groups. The final stakeholder engagement activity was an online Focus Group with investors, project developers and interest groups.

Stakeholder mapping

We worked with Wildlife Trust regional communications teams to identify stakeholder groups, for example members, or volunteers on NFM schemes. Using Google Maps, we mapped businesses according to four categories - Farming / land community; Food and beverage; Retail (independent); Underrepresented groups – which covered charitable organisations, community groups.

A Stakeholder Database (owned by Stantec) was built to compile Focus Group participants featuring UK-wide stakeholders in investment, green finance, project development, and interest groups.

Online Community Surveys

The online community survey was the primary mechanism of engagement, given the geographic breadth of the sites and time constraints. Working with data insights and communications managers, the questions aligned with the Great Big Nature Survey – run by RSWT annually – and the People and Nature Survey for England by Natural England. The full surveys can be seen in Appendix C.

Survey design

The surveys were built using Qualtrics. Each survey opened with an introduction about the survey objectives, data collection and General Data Protection Regulation (GDPR) compliance. Sections and questions followed the format below:

Understanding Natural Flood Management and what it means: a breakdown of NFM measures; information pertaining to the specific NFM site, with site imagery, and an infographic from National Flood and Coastal Erosion Risk Management Strategy for England

- Understanding your relationship to nature
- Your local Natural Flood Management site and your experience
- Connecting NFM to our changing world
- NFM and their impact on your wellbeing
- About You
- Our data analysis has followed these themes and connected key findings where appropriate.

Survey dissemination

Each survey was shared with the respective Wildlife Trust communications and engagement teams. These were accompanied by a press release or news story for websites, an email for Wildlife Trust members, draft social media posts, and a poster.

Key findings

Local communities (359 responses)

- Whilst respondents had a bias towards being members of local environmental NGOs, a large majority are concerned about climate change
- Nearly half of all respondents felt that flooding had worsened in the past five years, with more concerned about the future impacts of flooding
- Many residents were aware of the local NFM projects undertaken by their local Wildlife Trust and nearly half felt that their local NFM project had reduced flooding
- Flooding within the last year is impacting on local communities around the project sites, including the mental health of those impacted by flooding

Local businesses (03 responses)

- There was a lack of response from local businesses across all project sites.

National Focus Group (22 attendees)

- The top barriers / challenges facing investors in engaging with NFM projects
  - The lack of consolidated monitoring & evaluation of effectiveness
  - Engagement - landowners, communities, public sector (it can't be top-down)
  - Hard to see the monetisable outputs
- The top key actions to increase investment in NFM
- A framework/established methodology to quantify multiple benefits (including flood risk and ecology, carbon etc) which can be applied to many different scenarios
- Selling multiple benefits that might be important to investors
- Monitoring NFM schemes and measure their impact in communities
- More approved monitoring standards

The response target for each NFM site was 100. We aimed to focus on people who were living or working in close proximity to the sites. This was more of a challenge for the River Otter Devon site as this is more remote and inaccessible to visitors or locals. Social media posts by regional Wildlife Trusts were targeted to regional followers, however other social media posts were shared by project team members and not targeted to region, with a wider audience. Groups such as Parish Councils and community groups were local to each site. We asked responders to add the first 3 letters of their postcodes to capture the number of local responses. The time for surveys was extended until September 16, 2024, to allow for more responses. The total number of responses was 359 across the four sites.

Table 3.1 - Final Survey Responses per NFM Site

Limb Brook, Sheffield	Gloucester & Cheltenham Waterscapes	Sherbourne Valley, Warwickshire	River Otter Devon
110	41	74	134

Business interviews

Businesses were mapped using Google Maps and categorised into:

- Farming / land community
- Food and beverage
- Retail (independent)
- Underrepresented groups.

Topic guides were produced for each NFM site and stakeholder group and entered into a data collection template using MS Excel. A full list of stakeholders and the topic guides can be seen in Appendix D.

Businesses were contacted through email and telephone and requested for a recorded 1-hour interview on MS Teams. Where stakeholders requested, a survey was produced featuring questions aligned to the topic guides, which would be asked during interviews.

In total 97 businesses were contacted across the 4 sites. Despite regular following up and extending the reach of stakeholders geographically for each NFM site, there were only 3 participants in the business interviews. Two interviews were scheduled but the participants did not dial into the meetings. Observations from the 3 interviews have been written as pull quotes and grouped into themes.

Focus Group

On September 24, 2024, a virtual focus group was held including investors, project developers, and interested parties such as non-for-profit organisations, universities and charities. A Stakeholder Database was created, combining Stantec contacts across the different audiences, and invitations issued to over 100 individuals. The focus group had 22 participants from:

- Rebalance Earth
- Federated Hermes
- Restor Eco
- Finance Earth
- RSWT
- Intact Insurance
- Salesforce
- GFI Green
- Yorkshire Water
- Exeter University
- Cyfoeth Naturiol Cymru
- The Land Banking Group
- Shropshire County Council
- Heart of England Forest
- Environment Agency
- JBA Consulting

Focus Group Structure

The focus group was split into 2 parts covering:

PART A: Investing in NFM projects

- Key issues and barriers facing investors, that if addressed, could help unlock greater private sector investment into NFM
- What are the key actions to increase NFM investment

PART B: Measuring success in investment

- Which sectors benefit from NFM projects
- How do NFM investors measure success (outcomes, metrics, tech)
- How do investors use data and information to define NFM interventions and benefits

3.2 Data Analysis: Online Community Survey

About the Community

In total, 75.5% of the respondents are members of or support the Wildlife Trusts through donations, volunteering or signing petitions. Gloucester & Cheltenham had the highest number of respondents who were members or supporters at 87.7% and Sherbourne had the lowest number at 58.1%. The main reasons for having membership or supporting the Wildlife Trusts were recorded by respondents: **'The UK's wildlife is threatened, I want to help' (34.8%), 'I want to protect nature for future generations' (20.9%) and 'I want to make a difference to my local area, or an area I love' (17.3%)**. Many respondents are also members or supporters of other environmental charities:

- WWF (13.6%)
- Greenpeace (16.7%)
- RSPB (37.9%)
- Friends of the Earth (12.3%)
- National Trust (46.0%)
- Woodland Trust (22.3%)
- The Rivers Trust (5.0%)
- Wildfowl and Wetlands Trust (6.1%)
- British Trust for Ornithology (8.1%)
- Surfers Against Sewage (5.6%)
- Butterfly Conservation (15.6%)
- Marine Conservation Society (6.4%)
- Other (11.7%) including: Plantlife (5 respondents), English Heritage (5 respondents) and South Yorkshire Badger Group (3 respondents).

For Gloucester and Cheltenham, 87.8% of respondents lived within 20km of the NFM site and 12.2% lived outside 20km.

For Limb Brook, 91.0% respondents lived within 20km of the NFM site and 9.0% lived outside 20km.

For Sherbourne, 93.2% respondents lived within 20km of the NFM site and 6.8% lived outside 20km.

For River Otter, 91.9% respondents lived within 20km of the NFM site and 8.1% lived outside 20km.

The majority of respondents across all four sites were aged 50+ (70.9%). River Otter had the highest proportion of people aged 50+ (82.1%) whereas Sherbourne had the lowest proportion (59.5%). Sherbourne also had the highest proportion of respondents under the age of 40 (24.3%).

In relation to ethnic group and backgrounds, the majority of respondents across all four sites reported being 'White' (91.9%). The highest percentage was recorded for Gloucester & Cheltenham (100%) with the lowest percentage recorded for Sherbourne (85.1%). The only other ethnic group identified from the survey was 'Mixed or multiple ethnic groups' (0.6%) (other respondents did not give a grouping). In relation to nationality, the majority of respondents identified as 'British' (64.3%) and 'English' (10.0%). Other common responses included: 'UK' (2.8%), 'Welsh' (1.1%) and 'Irish' (0.8%).

Across the four sites, 45.1% of respondents identified as 'Male'. The highest percentage of 'Male' respondents was recorded at River Otter (53.0%) and the lowest was recorded at Sherbourne (36.5%). Across the four sites, 46.5% of respondents identified as 'Female'. The highest percentage of 'Female' respondents was recorded at Gloucester & Cheltenham (63.4%) and the lowest was recorded at River Otter (41.8%). 1.4% of respondents across the four sites identified as 'Non-binary', 'Intersex' or 'Prefer to self-describe' and 7.0% of respondents preferred not to answer.

Understanding Natural Flood Management

To learn about the communities' understanding of NFM we asked respondents a series of questions about their knowledge of NFM, whether they have visited sites with NFM features and how effective they perceived NFM methods to be for reducing the impacts of flooding.

Question under analysis: *Have you visited a site that could be classed as having NFM features?*

In total, 74% of respondents, across all sites, said they had visited a site that could be classed as having NFM features, 10% replied they had not visited a site with these features and 16% replied that they were 'not sure'.

Question under analysis: *How much knowledge do you have about NFM?*

Fifty-eight (58%) (n=208) of respondents said they had 'some knowledge' about NFM, while 24% (n=85) said they had 'good knowledge', 4% (n=15) said they have 'excellent knowledge', and 14% (n=51) said they had 'no knowledge', see Figure 3.1.

Using a virtual whiteboard and slides, 3 breakout groups and facilitators discussed each topic. Topics were grouped and compiled into 2 MS Forms for participants to rank at the end of the focus group. These results can be seen in the Data Analysis Section below.

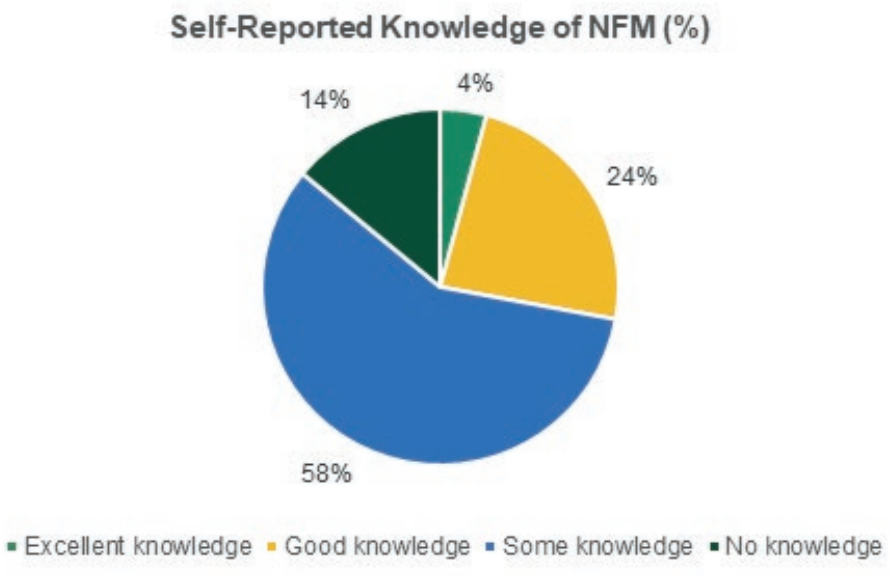


Figure 3.1 - Self-Reported Knowledge of NFM

We also asked communities about their knowledge around the effectiveness of flood management techniques to manage flooding. They responded:

- **Moderate Knowledge:** The majority of respondents (61%) have some knowledge about the effectiveness of flood management methods.
- **High Knowledge:** 19% of respondents feel they know a great deal about these methods.
- **Low Knowledge:** 18% of respondents said they did not know too much about flood management.
- **No Knowledge:** A small fraction (2%) of respondents said they had no knowledge about the effectiveness of flood management methods.

This suggests that while most people feel they have some understanding around the effectiveness of flood management techniques, there is still a significant portion that could benefit from increased education and awareness.

Question under analysis: *What other methods did they think were effective at reducing flooding (e.g., concrete wall, sandbags for housing, deepening of riverbeds)?*

This was an open text box. We received 255 text responses which we have grouped into relevant topics, and summarised below.

Communities responded with 2 themes standing out as the most common of identified methods, which were for **natural and sustainable** methods, including:

- **Planting (trees, wildflowers, natural hedges, willows, rushes, water meadows):** This method is the most popular, with 24% of respondents (n=60) identifying it. This indicates an awareness of green infrastructure and nature-based solutions, which are known for their multiple benefits, including flood mitigation, biodiversity enhancement, and aesthetic improvements.
- **Reconnection to floodplains / allowing floodplains / not building on floodplains:** With 18% (n=46) of respondents identifying this method, it suggests a growing awareness of the role floodplains play in absorbing excess water and reducing flood risks.

There was moderate support for permeable and restoration methods, such as:

- **Permeable areas (sustainable urban drainage, driveways, car parks, near watercourses), create soakaways:** At 15% (n=39), this method is moderately identified. It reflects an understanding of the need to manage urban runoff and increase infiltration to reduce surface water flooding.
- **Wetland Habitat Restoration / River Restoration / peatland restoration:** With 12% (n=31) of responses, this method underscores the value of restoring natural habitats to enhance flood resilience. Wetlands and peatlands act as natural sponges, absorbing and slowly releasing water.

There were mixed views on traditional and hard engineering methods such as:

- **Upstream flow management / river realignment / meandering / reinforced riverbanks:** This method received 11% (n=27) of responses, indicating some identification of engineering solutions that work with natural processes.
- **A combination of hard defences and NFM is required:** 4% (n=9) of respondents identified a hybrid approach, combining traditional engineering with natural methods to achieve comprehensive flood management. This answer can be combined with the answer above, regarding natural and engineering processes for rivers.
- **Concrete walls, sandbags, and dredging rivers:** These traditional methods were identified less, each with around 4-5% of responses (in total, n=36). This suggests a shift away from hard engineering solutions towards more sustainable and integrated approaches.
- **Keep road gullies clear / clear drains:** With 5% (n=14) of responses, this method emphasises the importance of regular maintenance to prevent blockages and ensure effective drainage.
- **Above examples don't solve the issue (divert it elsewhere):** 8% (n=21) of respondents believe that the example methods – in the question: concrete wall, sandbags for housing, deepening of riverbeds – listed merely divert the problem rather than solve it. This highlights a critical perspective on the effectiveness of certain flood management strategies.

A small proportion of respondents highlighted the need for **community awareness**:

- **Community Awareness:** Although only 2% (n=6) of responses, some respondents identified a need for educating and involving communities in flood management efforts.

Some respondents, highlighted the need for innovative and combined approaches for flood management such as:

- **Rooftop water collection / green roof / grey water harvesting for toilet flushing:** This method, with 4% of responses, reflects innovative approaches to managing water sustainably at the property level.

Overall, the data suggests a strong identification of natural and sustainable flood management methods, with support for planting and maintaining natural floodplains. There is moderate support for permeable surfaces and habitat restoration, while traditional hard engineering methods are less favoured. The responses also highlight the importance of maintenance, community involvement, and innovative approaches to flood management. It is not necessarily surprising that respondents demonstrated a higher understanding and identification of nature-based solutions, given that 75% of respondents are Wildlife Trust members.

Understanding Relationships to Nature

Question under analysis: *How frequently do you visit natural spaces?*

Figure 3.2 shows that on average across all sites, 38% (n=135) of respondents reported visiting natural spaces at least 'every day' and 38% (n=135) of respondents reported visiting 'more than twice a week, but not every day'. 0.55% of respondents (n=1) reported 'never' visiting natural spaces. Respondents near the Gloucester and Cheltenham site reported the highest 'daily visit rate' (48.9% / n=22).

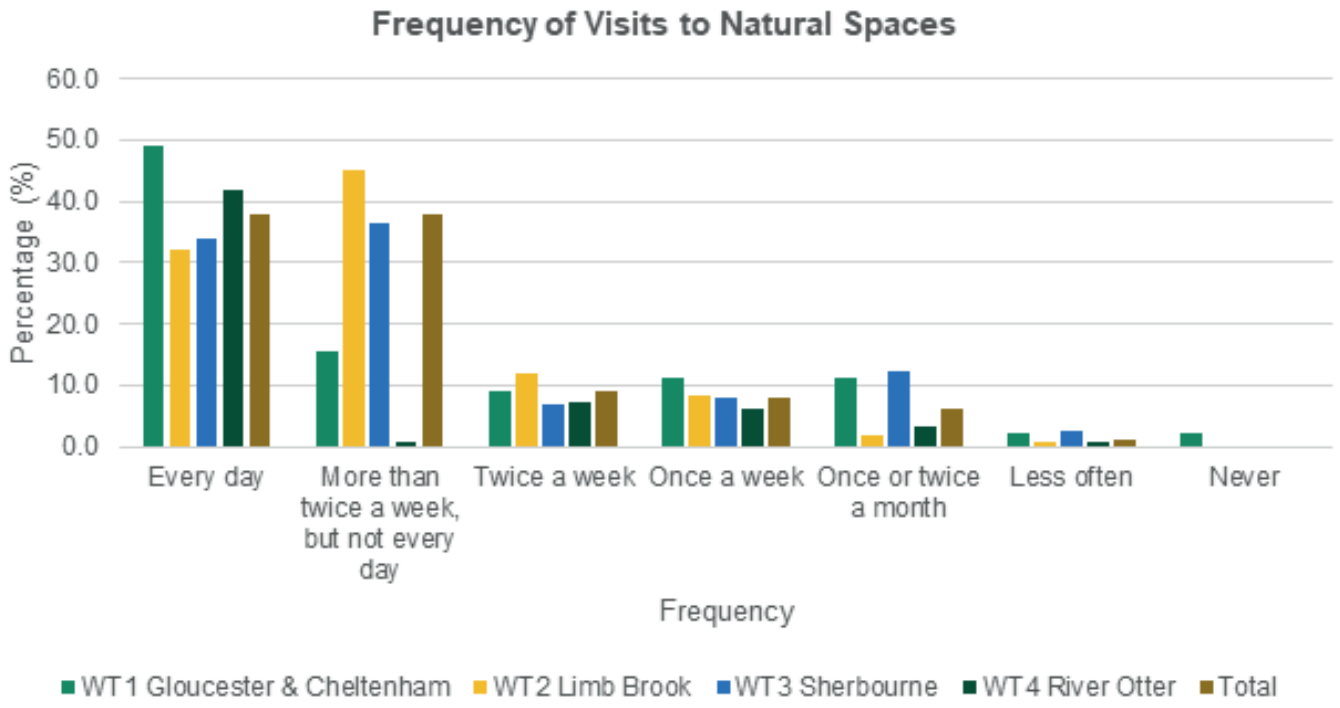


Figure 3.2 - Frequency of Visits to Natural Spaces by Site

Question under analysis: *Choose the pair of circles that best describes your relationship to nature, where A represents being completely separate to nature, and G represents being completely part of nature.*

Evidence from Natural England suggests that connection to nature is associated with certain wellbeing, educational outcomes and pro-environmental behaviours (Natural England, 2016). Respondents were asked to select images from the 'Inclusion of Nature in Self'[10] scale indicating how connected they feel to nature. Respondents selected one of seven diagrams, shown below in Figure 3.3, containing two circles, one with the outline of a person titled 'me' and the other with a nature filled scene titled 'nature'. Each diagram includes a degree of overlapping to represent how 'close' respondents feel to nature. Applying this method, 80% (n=282) of respondents felt highly connected to nature (diagrams E, F and G), 16% (n=59) felt moderately connected to nature (diagram D), and 4% (n=13) felt low levels of connection to nature (diagrams A, B and C), see Figure 3.3.

10 Measuring Connection to Nature—A Illustrated Extension of the Inclusion of Nature in Self Scale (mdpi.com)

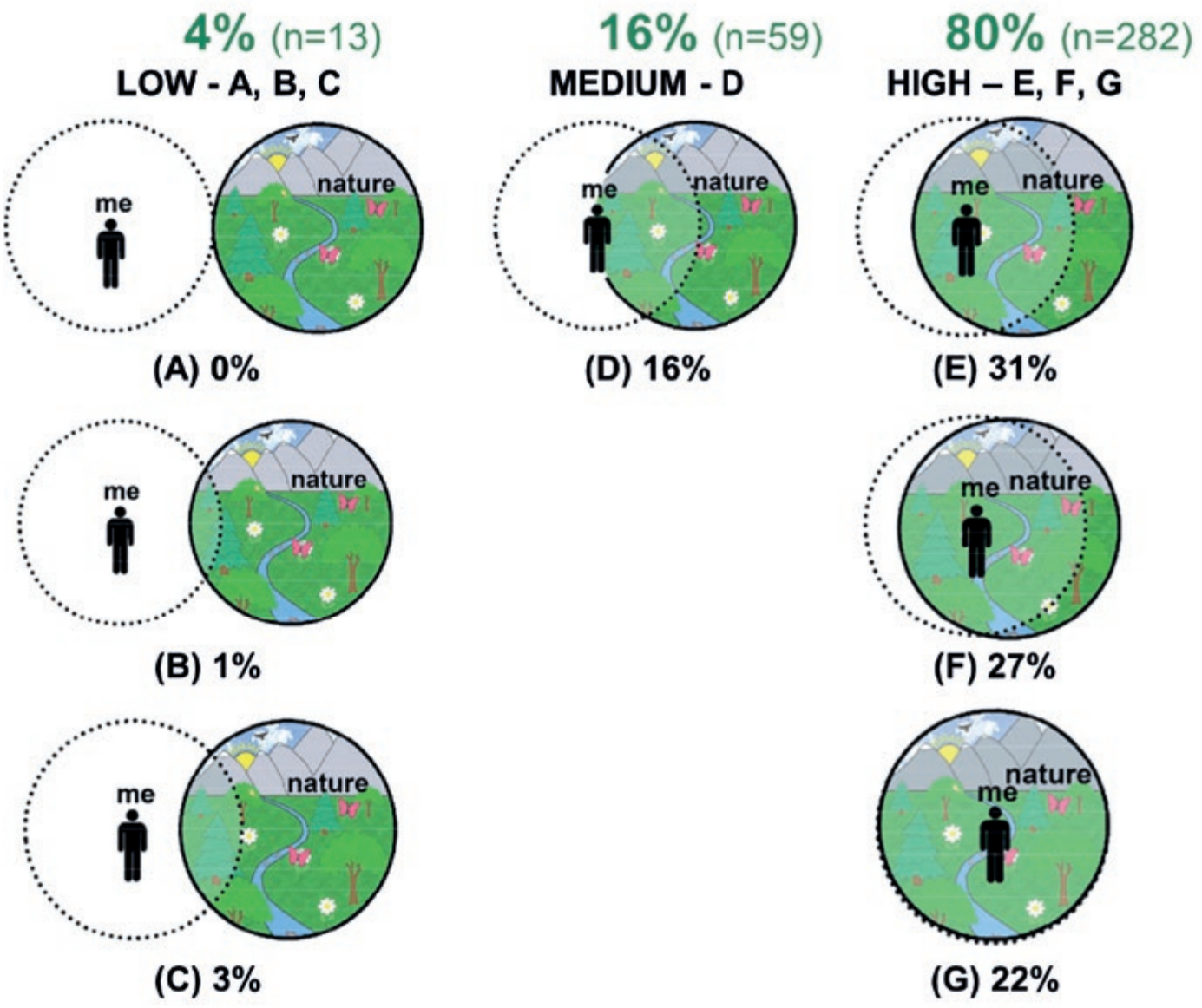


Figure 3.3 - Connection to Nature - 'Inclusion of Self in Nature' Rating

Question under analysis: *In general, how happy do you feel? - Please select a number from 1-10. 1= Unhappiest, 10= Happiest*

We asked respondents to score from one to ten 'in general' how happy did they feel (1 = Unhappiest and 10 = Happiest). The majority of respondents scored their happiness between 6-10, with 19% (n=70) of respondents rating their happiness at level 7 and 35% (n=127) of respondents rating their happiness at level 8, see Figure 3.4.

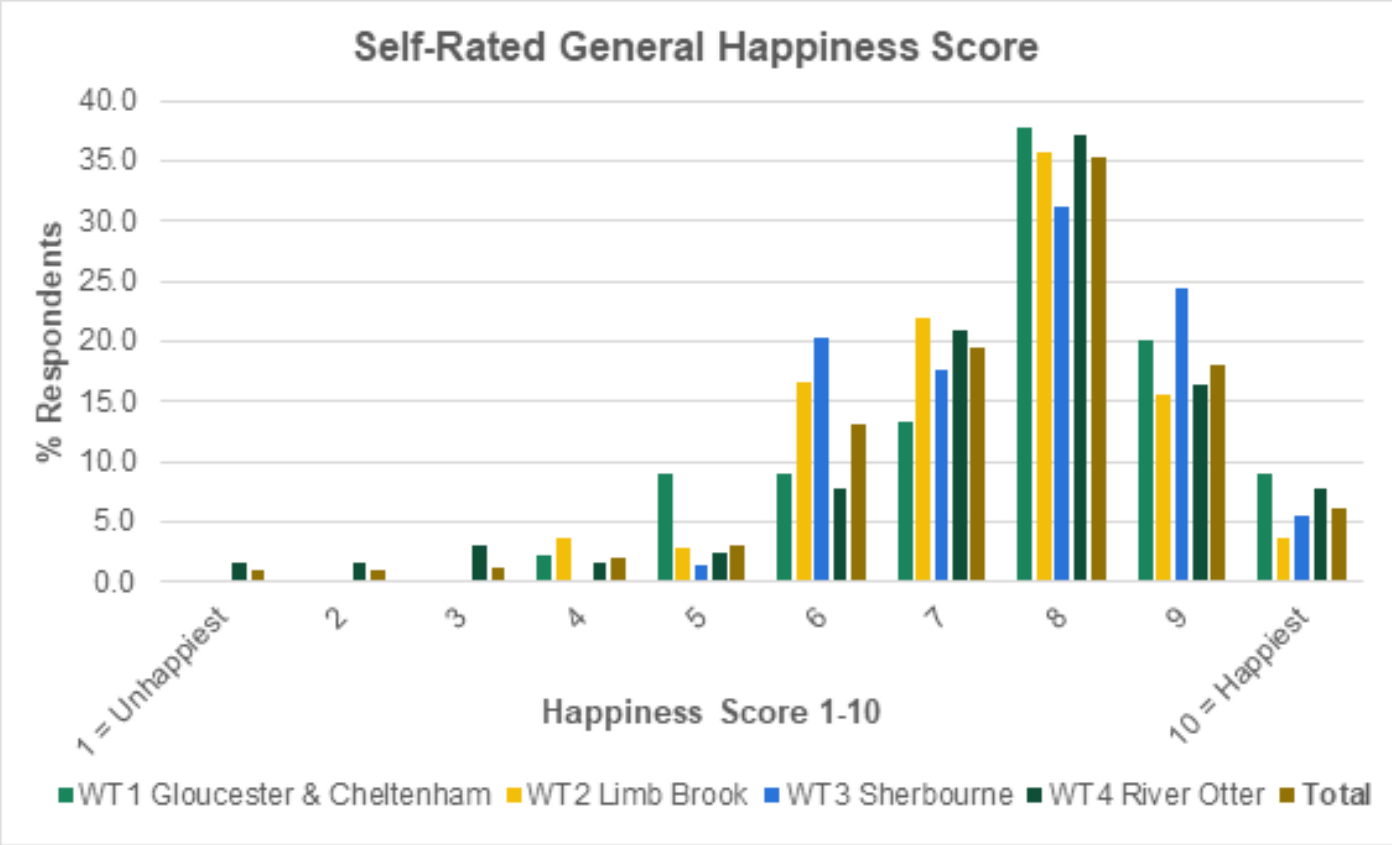


Figure 3.4 - Self-Rated General Happiness Score

Question under analysis: *Over the past year, do you feel that nature has contributed to your overall happiness? - Please select a number from 1-10. 1= Nature has had nothing to do with my happiness*

We found that:

- A high percentage of respondents (36.3%) rated nature's contribution to their happiness as 10, indicating a significant positive impact.
- Scores 8 and 9 also ranked highly (24.9% and 21.1%, respectively), suggesting that the majority of respondents feel nature greatly contributed to their happiness.
- The above combined, indicates that 82.3% of respondents regarded nature as having a moderate to high contribution to their sense of happiness.

Experiences and Perceptions of Local Natural Flood Management Sites

Question under analysis: *To what extent do you think your local NFMs, including rain gardens, are impacting the risk of flooding since they have been established*

We asked respondents to what extent they felt their local NFM sites had impacted the risk of flooding since they were established. In total, **49%** perceived that their **local NFM sites had reduced flooding** *'by a great deal' (4% / n=6) or 'to some extent' (45% / n=69) since they were established, 12% (n=19) said they reduced flooding by 'not too much', 3% (n=5) said they had not reduced flooding 'at all' and 36% (n=55) said 'I don't know'.*

Question under analysis: *To what extent were they worried about the risk of flooding when nearby a NFM site*

In total, 18% (n=64) of respondents said they were worried *'to some extent'; 36% (n=127) said 'not too much';* and 39% (n=136) said they were *'not at all'* worried.

We wanted to understand which elements, attributable to the NFM sites, that respondents felt positively affected their health and wellbeing. Figure 3.5 shows respondents' selections across a number of evidence-based domains that are linked to positive health and wellbeing outcomes. Nearly 30% of all respondents reported that enjoying nature and wildlife positively affected their health and well-being. Quiet and tranquil spaces were also highly valued, suggesting this is important for many people's wellbeing. Having space and opportunities to be physically active was also a significant factor and a number of respondents also stated that the NFM sites were good for their mental health. The top four selections were often made in combination with one another. A smaller proportion of respondents also said that participating in outdoor activities and meeting friends and socialising in NFM sites also positively affected their health and wellbeing.

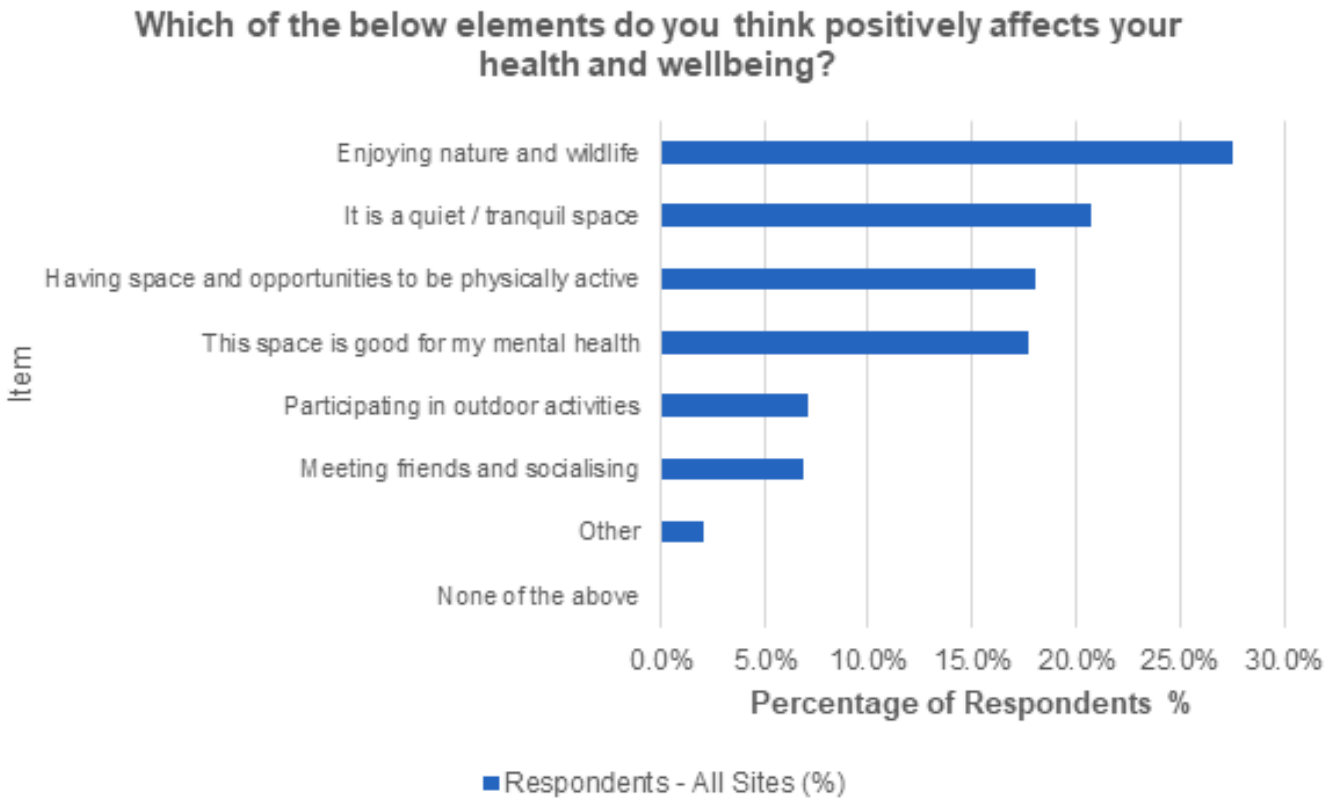


Figure 3.5 - Elements that positively affect health and wellbeing

Question under analysis: *Thinking about when you spend time in this space, which of the below elements do you think positively affects your health and wellbeing?*

For River Otter, Devon respondents we asked how they felt about the presence of beavers and NFM in their local area. Table 3.2 summarises our findings which show that 63.6% of respondents were 'very positive'. Combined with 'positive' response this shows that 95% of respondents held a favourable view towards the presence of beavers in the River Otter site with very few neutral or unsure responses.

Table 3.2 - *Views on the presence of beavers and NFM in the River Otter area.*

How do you feel about the presence of beavers and NFM in your area?		
Score	**WTF4 (n=)**	**WTF (%)**
Very positive	75	63.6%
Positive	37	31.4%
Mostly positive	1	0.8%
Neutral	4	3.4%
Unsure	1	0.8%

River Otter respondents overall held positive views about the presence of beavers in their local NFM sites and perceived they effectively contributing to flood management and increasing biodiversity.

Very pleased they are in river otter and spreading. Good for flood management and biodiversity.
River Otter Survey Respondent

Very happy to have beavers and NFM in area. Do a great natural job at controlling flooding and increasing biodiversity at the same time.
River Otter Survey Respondent

Connecting Natural Flood Management to Our Changing World

Question under analysis: *Perceptions and experiences of flooding [multiple questions]*

We asked communities about their experiences and perceptions of flooding, generally, in their local area. These are summarised below.

- **Directly impacted by flooding in past five years:** 3% (n=12) of total respondents reported being directly impacted *'a great deal'* by flooding in the past five years; 15% (n=53) reported being impacted *'to some extent'*; 22% (n=80) reported being impacted *'not too much'*, while 60% (n=215) reported they were *'not at all'* impacted. Responses were similar across all sites, however respondents near the Sherbourne and River Otter sites were more likely to report that had been directly impacted by flooding *'to some extent'* (15-24%) compared with those near the Gloucester & Cheltenham and Limb Brook sites (7-10%).
- **Impacts of flooding on mental health:** all respondents, including those not subject to flooding, were asked if the flooding impacts had negatively impacted their mental health. The majority, 59% (n=189) responded that their mental health had been impacted *'not at all'*, while 14% (n=45) responded *'not too much'*. A smaller proportion reported that their mental health had been affected to *'to some extent'* (14%) (n=45) or by *'a great deal'* (2% / n=7)). Ten percent (10%) responded 'I don't know' (n=32).
- **Changes in the extent of flooding, locally in past five years:** 47% of total respondents reported that the extent of flooding in their local area has gotten worse by *'a great deal'* (13% / n=38)) or *'to some extent'* (34% / n=108) in the last five years.
- **Future of flooding in local areas:** 59% of respondents reported that they were *'very concerned'* (12% / n=44)) or *'fairly concerned'* (47% / n=167) about future flooding in their area, while 42% were *'not very concerned'* (31% / n=111) or 'not at all concerned' (11% / n=38).
- **Concerns about risk of flooding to health and wellbeing:** 42% (n=153) of respondents were *'not very concerned'* about the risks of flooding to their health and wellbeing. About 27% (n=96) of respondents were *'fairly concerned'* and 4.5% (n=19) reported feeling *'very concerned'*.

We also asked communities about their perceptions around climate change:

- **Concerned about climate change:** In total, 96% of respondents were *'very concerned'* (68% / n=245) or *'fairly concerned'* (28% n=100) about climate change.
- **Is climate change currently impacting your local area:** In total, 78% of respondents thought climate change was currently impacting their local area *'a great deal'* (25% / n=89) or *'to some extent'* (63% / n=225).

Question under analysis: *What do you think are the most important issues facing the United Kingdom at the moment?*

Respondents were asked to rank what they perceived to be the most important issues facing the United Kingdom at the moment (Figure 3.6).

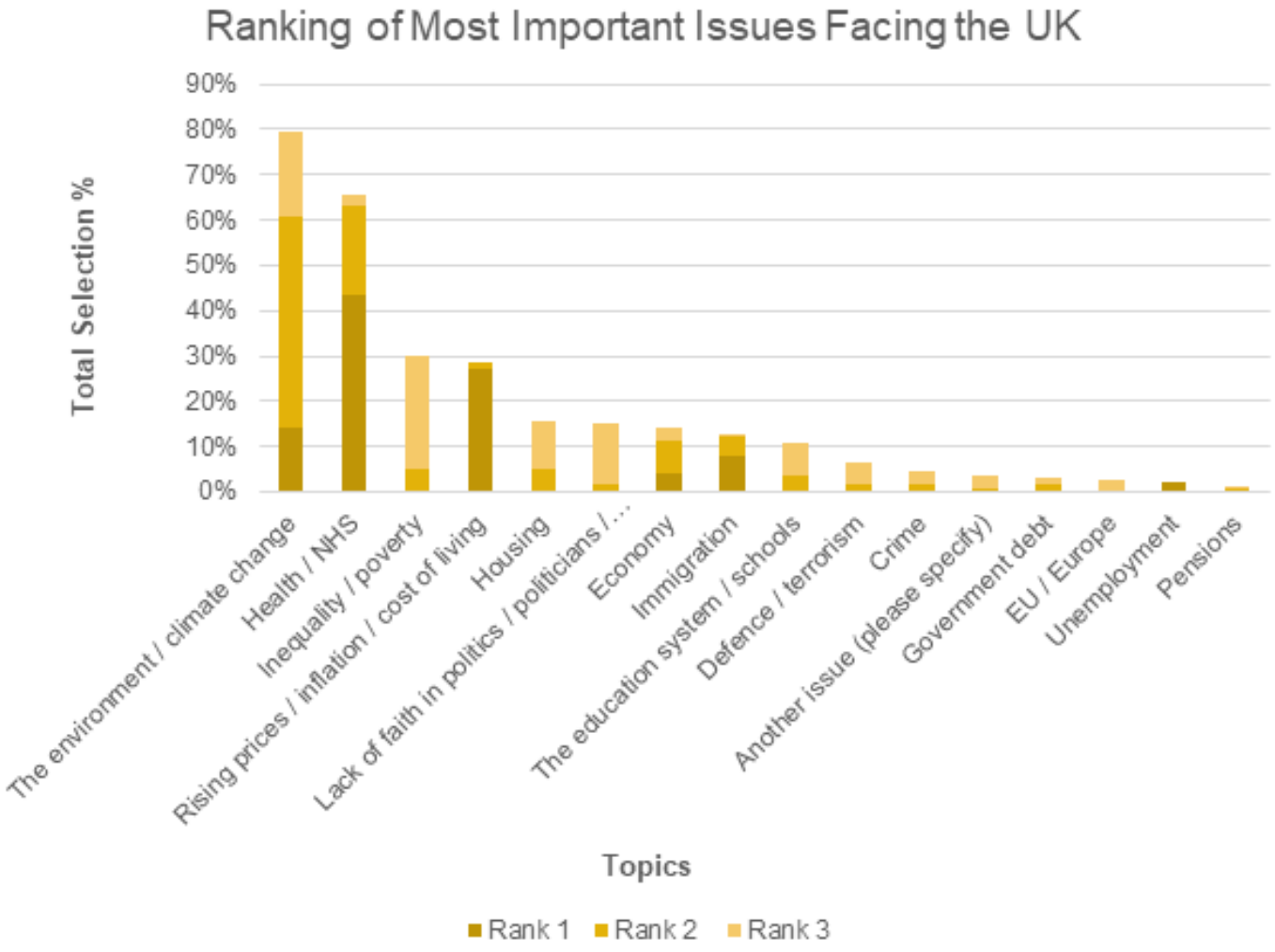


Figure 3.6 - Ranking of Most Important Issues Facing the UK

Question under analysis: *Below is a list of environmental issues. Please pick the four issues that you are most concerned about.*

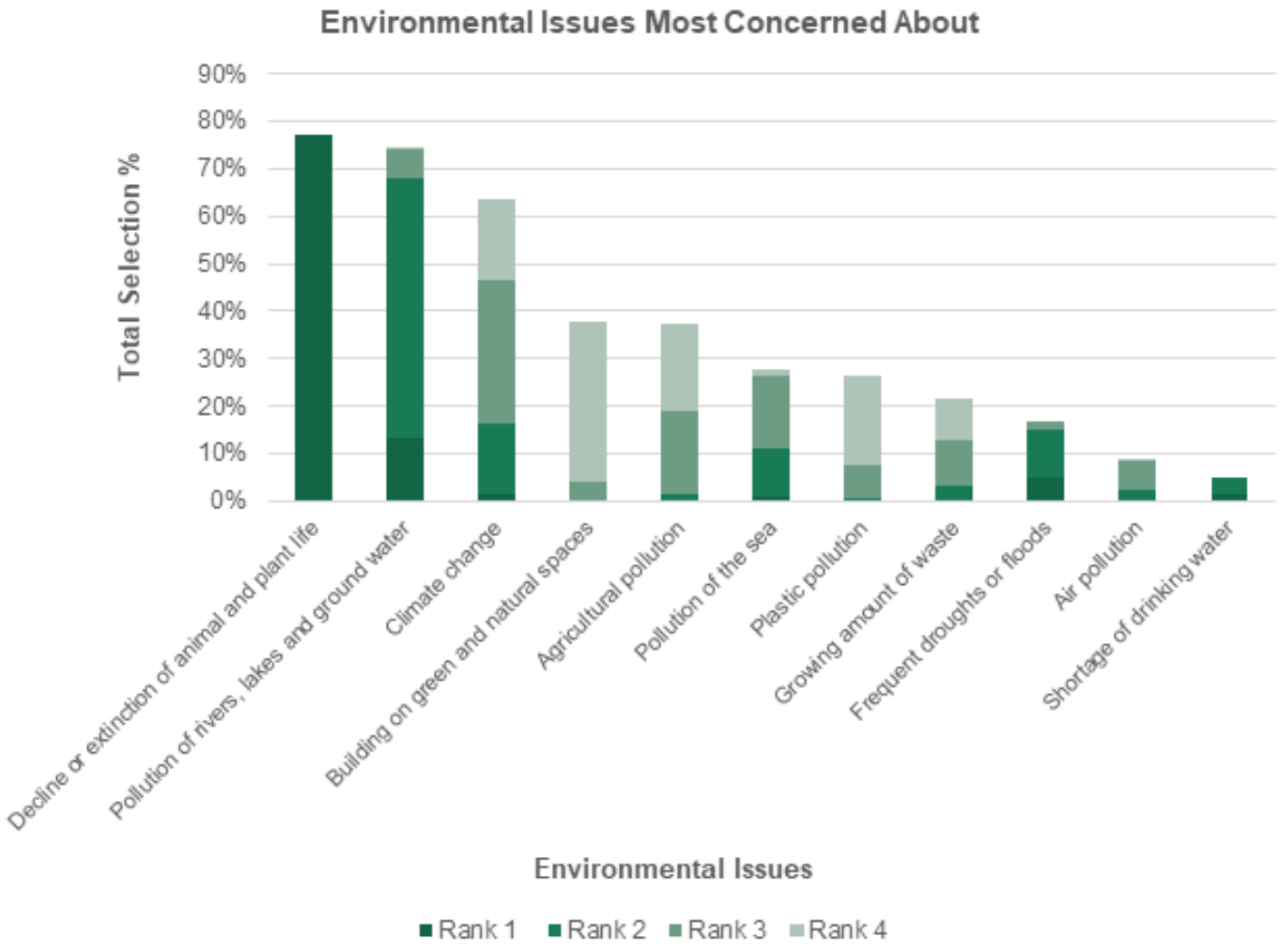


Figure 3.7 - Ranking of environmental issues most concerned about

We asked communities about the environmental issues they are most concerned about. The majority of respondents (77%) said that they were most concerned about the 'decline or extinction of animal and plant life', this was followed by concerns about the 'pollution of rivers, lakes and ground water' selected by 55% of respondents and 'climate change' selected by 30% of respondents. Other prominent issues selected by 20-40% of respondents include 'building on green and natural spaces', 'agricultural pollution', 'pollution of the sea', 'plastic pollution' and 'growing amount of waste'.

Only 10% of respondents said they were most concerned about 'frequent droughts or floods'. However, this may be lower than expected, as 3% (n=12) and 15% (n=53) of total respondents reported being directly impacted 'a great deal' or 'to some extent' by flooding in the past five years; respectively.

Less than 10% said they were most concerned about 'air pollution' and a 'shortage of drinking water' respectively.

Natural Flood Management and Wellbeing

Question under analysis: *Thinking about your local NFM sites – as part of the [specific Wildlife Trust site] – how much do you agree or disagree with the following statements*

We asked respondents for the Gloucester and Cheltenham Waterscapes, Limb Brook and Sherbourne sites to rate the presence of features in their local NFM that are linked to health and wellbeing (Table 3.3). Only these 3 sites were featured in this question as the River Otter site is not accessible to the public. These are summarised for all sites below.

Response rates and sample sizes vary across each question with some respondents choosing not to answer some at all. The maximum number of responses was 217 (when ranking: Within easy walking distance for most people); the lowest number of responses was 43 (when ranking: Making the existing space(s) more green and pleasant).

Overall, most respondents were positive about their local NFM sites. More than 85% of respondents felt their local NFM encouraged physical health and exercise while 92% felt they were good spaces for positive mental wellbeing and provided opportunities to see nature.

Around 82% of respondents said that their local NFM sites made the existing space(s) more green and pleasant and 83% agreed that their local NFM sites were places with a variety of plants and wildlife. More than 84% agreed that their local NFM sites reduced the amount of concrete surfacing.

Table 3.3 - *Features link to health and wellbeing in local NFM sites*

My NFM sites are:	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Within easy walking distance for most people	9%	33%	37%	18%	3%
Good places for mental health and wellbeing	41%	51%	7%	0%	0%
Of a high standard to encourage time spent there	19%	50%	29%	2%	0%
Good places for children to play	14%	49%	31%	5%	0%
Places that encourage physical health and exercise	26%	58%	14%	1%	0%
Good places to meet others	12%	44%	40%	4%	0%
Places that provide opportunity to see nature	41%	51%	7%	0%	0%
Make the existing space(s) more green and pleasant	35%	47%	19%	0%	0%
Reduce the amount of concrete surfacing and surroundings	40%	44%	14%	0%	2%
Places with a variety of plants and wildlife	23%	60%	15%	2%	0%
Place with adequate facilities (e.g., car parks, playgrounds, benches, toilets)	6%	28%	52%	12%	1%
Accessible and well maintained	12%	44%	37%	5%	2%
There is lots of litter / dog mess / graffiti	1%	12%	44%	37%	6%
Welcoming and safe	15%	54%	28%	2%	0%

3.3 Data Analysis: Community Group Interviews

The intention was to conduct business interviews, but this was not possible due to lack of interest or response to business surveys. A survey was developed and shared with businesses which requested the questions, instead of time given to an interview. However, no survey responses were received. The situation does not suggest that business have a lack of interest in flooding or flood risk. Further work would be necessary to understand the motives and requirements of businesses to engage in this particular economic risk.

A total of 3 community organisations were interviewed – all of which were connected to Gloucester & Cheltenham Waterscapes Project, either directly involved as part of the project implementation or through wider communication of the project. Two sites were identified: Naunton Park, and raingardens at Royal Gloucestershire Hospital. Interviewees have been anonymised, but their organisations were: Friends of Naunton Park Community Group; NHS Hospital Trust; and Charlton Kings Parish Council. These organisations were also involved in other environmental measures such as tree planting, boosts to biodiversity, and allotments.

Perception of flood risk to organisations

Two interviewees were aware of NFM measures in this site, as they were directly involved in the projects. Their awareness of flood risk and the benefits of NFM were high. Gloucestershire as a region can be significantly impacted by flooding; the floods of 2007 were mentioned during the interviews. Damage included destruction of property, no access to water, and cuts to gas and electricity supplies.

> 2007 was a particularly bad time for this part of Gloucestershire, with 2 big flooding events: and that is still vivid in people's memories. When there is a flood, nothing else matters, it's the main thing on people's memories and mind. Flooding is a massive impact for the local community, irrespective of the damage - the inconvenience is significant. Being flooded out, like in 2007, completely wrecks people's lives, with their whole lives in a skip outside because their property is flooded out. We have now had the wettest 18 months on record, but it didn't flood this year.
>
> Friends of Naunton Park Community Group

Perception of risk and concern of future flooding

Interviewees stated how people's and business understanding of flood risk and connection to climate change had increased. During the 2007 floods, employees at NHS Hospital Trust were unable to get to work or to patients in need of treatment. The organisation acknowledged how the inability to access services due to flooding will have a detrimental impact on health and wellbeing. Other impacts were the *'real connection between human species and environmental health, air pollution, and increased risk of cardiovascular disease through lack of access to green space'*. Every year, information about increased risk of flooding is shared with NHS staff for awareness, especially as the NHS is the second largest employer in the area.

> The NHS is doing things to benefit the environment, such as committed to being carbon neutral by 2040, and establishing an organisation called NHS Forest that runs tree planting programmes across NHS sites. There is a recognition across the NHS that it can have a big impact due to being such a massive landowner. This is one reason why the NHS is teaming up with Wildlife Trust for projects like NFM.
>
> NHS Hospital Trust

For those living near Naunton Park, this understanding had also increased, due to more information in the media, and personal experiences.

> You can't turn on the news without information about climate change, flooding, and biodiversity. 25 years ago, this information would cause people to glaze over, they weren't interested, even though the connections between flooding and climate change were understood. People's background understanding has significantly proved as to what it was a few years ago.
>
> Friends of Naunton Park Community Group

Impact of NFM sites on wellbeing

The raingardens and benches at Royal Gloucestershire Hospital are being used a lot by people, as stated by the interviewee. Temporary signage explaining the purpose has been set out near the benches, with permanent signage in production as well as a map brochure for all users to indicate the green spaces within the hospital grounds. One point made was that these areas had not been vandalised as much as other parts of the hospital – 'the NFM site seems to deter anti-social behaviour.'

As for the NFM project at Naunton Park – featuring a swale, wildflower areas, tree planting and a circular pathway around the park – the work was noted as 'appreciated'. However, local context and connection to extreme weather events was a factor.

> Anecdotally people like the NFM project - they appreciate it for its biodiversity value, and they understand its purpose. Are they going to be knocking on the Council's door for other similar projects? I don't know. These issues tend to be very localised and if you have a flood issue, it really matters to you. But if you live say, even only 30 doors down, it doesn't impact you, then it won't take that precedence.
>
> Friends of Naunton Park Community Group

The interviewee from Charlton Kings Parish Council echoed the importance of local context and understanding, of NFM sites and benefits. They were not aware of specific locations for Gloucester & Cheltenham Waterscapes project.

> We are aware of water areas within Gloucestershire but not aware if we were part of the NFM. We are aware of other flood alleviation spaces at a local meadow, supported by Environment Agency. The Parish Council is interested in NFM sites, but mainly those within our direct local area. Increasing the awareness of the NFMs and educating the local community would impact our understanding. Currently we are mapping a lot of paths around the parish, and it would be useful to be able to map NFMs.
>
> Charlton Kings Parish Council

Two interviewees expressed positive opinions about NFM, and greater awareness of the issue of flooding through partnerships with the RSWT.

> In urban areas, any green space is going to benefit the area – whether planting, digging up concrete, creating pervious layers, or a green roof on a shed is a good process, as well as the byproducts and benefits, such as biodiversity. We create a more climate resilient landscape because we know that greenery, especially trees, create shade and mitigate against excessive heat, so there are benefits to these interventions. There are numerous reasons as to why I recommend natural flood management measures to others, saying 'you should do this'.
>
> Friends of Naunton Park Community Group

For Charlton Kings Parish Council, benefits of NFM projects include *'funding from Wildlife Trust, and volunteering opportunities to improve the local environment.'*

3.4 Data Analysis: Focus Group

Ranking of top barriers / challenges facing investors in engaging with NFM projects

In Part A of the Focus Group, participants were asked to gather and share their barriers and challenges in 3 breakout rooms on a Miro board and PowerPoint slides. These were collated and grouped into relevant themes. At the end of the meeting, they were asked to rank these barriers and challenges, in order of priority. These are ranked below, from most challenging to least challenging:

1. Lack of consolidated monitoring & evaluation of effectiveness
2. Engagement - landowners, communities, public sector (it can't be top-down)
3. Hard to see the monetizable outputs
4. Return on investment - return model needs to be clearer
5. Unlocking education and knowledge (upskilling) on a basic level for investors
6. a) Lack of pipeline of projects

   b) Not enough of the strategic big projects, as majority are smaller scale
7. Understanding and education of what is NFM (means different things to different people)
8. No flood risk regulator for SUDS (Water Industry)
9. a) There is a focus on flooding rather than the wider benefits

   b) NFM work needed within a catchment is complex with regards to water resource management

Ranking of key actions to increase NFM investment

In Part B, participants were asked to share actions on how to increase NFM investment, from their experiences in their respective organisations and projects. They then ranked their suggested actions to increase NFM investment and break down the above barriers, from highest to lowest priority:

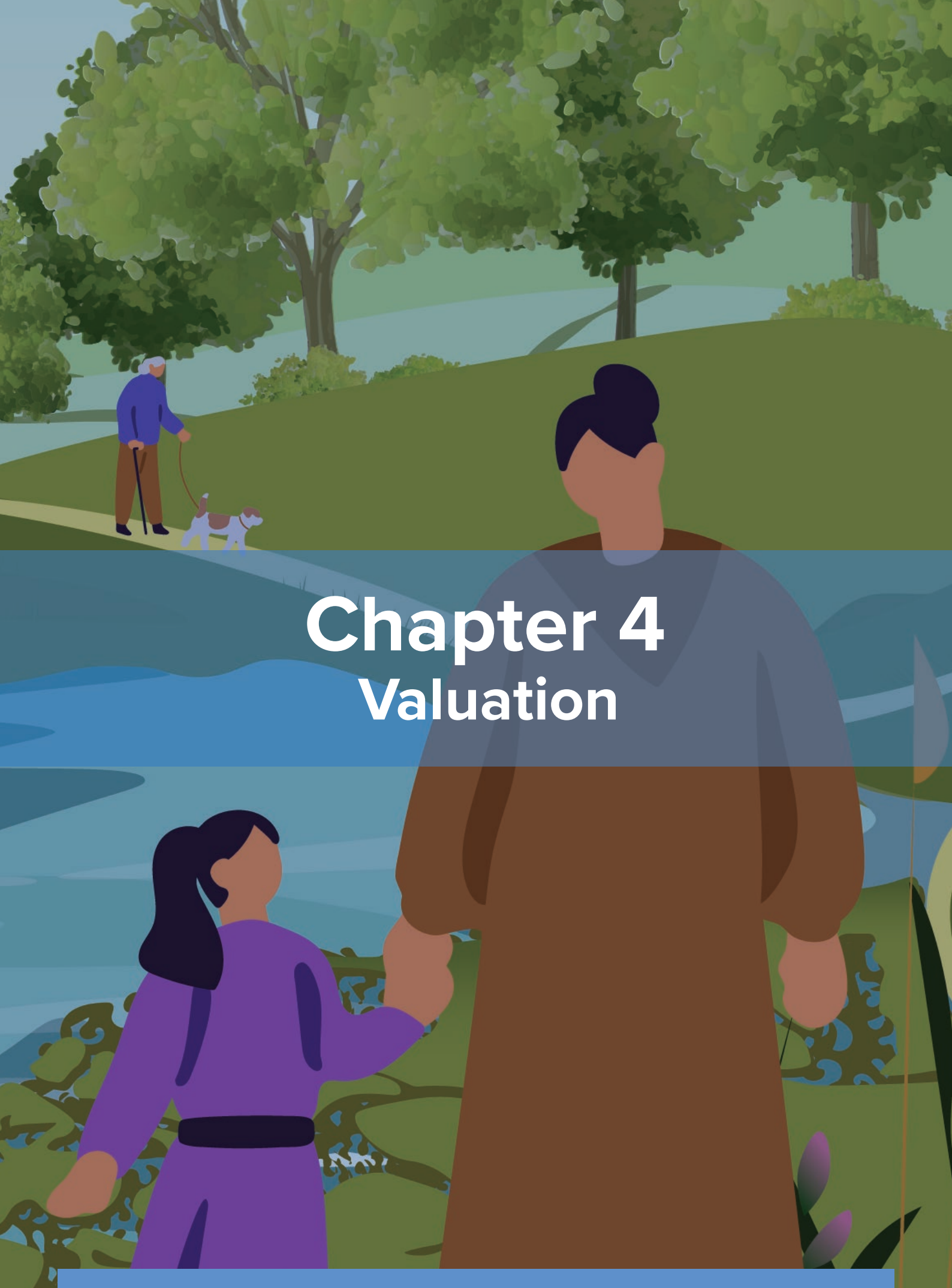
1. A framework/established methodology to quantify multiple benefits (including flood risk and ecology, carbon etc) which can be applied to many different scenarios
2. ~ Selling multiple benefits that might be important to investors

   ~ Monitoring NFM schemes and measure their impact in communities
3. More approved monitoring standards
4. Mix of public vs private investment
5. More money available for monitoring is needed to prove the benefits
6. Messaging around projects and that the evidence base is improving

Beneficiaries of NFM projects

Participants noted a wide range of sectors and industries which would, or do currently, benefit from NFM projects, including:

- Water Companies – all assets by rivers
- Residential developments and developers, both an insurance and environmental perspective
- Lenders / banks
- Communities
- Councils / local authorities
- Businesses in flood risk areas
- Agriculture – with a focus on soil quality, biodiversity
- Infrastructure including railways and roads
- Tourism, health and wellbeing
- Hospitality
- Environmental organisations – Environment Agency, Natural Resources Wales, Natural England



Chapter 4
Valuation

4 - Valuation

Stantec undertook an initial review of ten NFM projects undertaken by local Wildlife Trusts across England and Wales. This review in turn helped to identify requirements for detailed analyses of social, climate and nature benefits associated with each project. The review also provided an analysis on available data for each project.

We conducted an economic valuation to quantify the societal benefits of the selected Wildlife Trust schemes in order to enable policy-level decisions and investment-level decision making.

We collaborated with ten identified Wildlife Trust NFM project sites (Figure 1.1), and their respective Wildlife Trusts to assess data availability and coverage. Following advice from the stakeholder advisory group, the project team standardised the necessary data requested from all sites to feed into the valuation, though the data received was not necessarily consistent. These findings also informed the development of community and business survey questions (Section 3). The outputs ensure coverage across urban and rural locations and various intervention methods, considering the social, climate, and nature benefits of NFM measures. Where data was unavailable, we looked for and, where appropriate, used proxy or generic information based on experience of assessing benefits in other contexts, e.g. for the WINEP (water industry national environment programme). Ultimately the number of projects considered for valuation analysis of available data was reduced from ten sites to six (see Appendix E for the data).

Key findings

- Natural Flood Management (NFM) projects can mitigate the impacts of flooding by reducing the peak from high flows in urban and rural settings.
- Communities located near NFM projects see benefits in reducing the impact from flood risk, and increased recreational opportunities and health & wellbeing.
- NFM projects deliver significant economic, social and environmental benefits for people, climate and nature.
- NFM projects have positive cost-benefit ratios which increase when viewing multiple benefits, for example:
    - **Biodiversity:** £4.47m (10-year scenario) to £7.72m (30-year scenario) on the River Otter in Devon
    - **Education and volunteering:** £2.97m (10-year scenario) to £6.55m (30-year scenario) on the Gloucester and Cheltenham Waterscapes programme, Gloucestershire
    - **Water Storage:** £2.99m (10-year scenario) to £6.79m (30-year scenario) on the Gloucester and Cheltenham Waterscapes programme, Gloucestershire

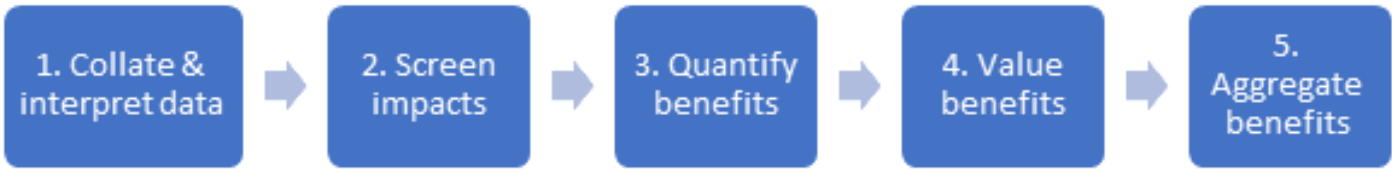
A standardised approach to project design, monitoring, and valuation is needed to increase investor confidence.

A government-led framework, including support for private finance markets and improved data collection, is essential for increasing NFM investment

4.1 Valuation

Figure 4.1 illustrates our approach to the assessment of benefits of Wildlife Trust schemes, as described further below.

Figure 4.1 - Overview of proposed approach to Task 6



Collate and interpret Data

We categorised and organised the data available from each Wildlife Trust for the ten sites to support the valuation process. Benefits for NFM projects were categorised using the ecosystem services framework, which includes provisioning, regulating, cultural, and supporting services.

We applied the Environment Agency's 2023 EHOV (Environment and Historic Environment Outcomes Valuation) Guidance[11] categories[12]:

- **Regulating services:** Food, Timber, Water supply, Fish
- **Provisioning services:** Flood regulation, Air pollutant removal, Carbon reduction
- **Cultural services:** Recreation, Physical health, Education, Volunteering, Amenity
- **Supporting/bundled services:** Biodiversity, Water quality

Available data for each impacted ecosystem service was specified in appropriate units. For example, flood alleviation benefits were measured by the volume of additional water stored or the number of properties at reduced flood risk.

Screen Impacts

We implemented a screening step to identify the most relevant ecosystem service impacts for the valuation exercise, as detailed in Table 4.1. Sites needed a diverse range of data across various service categories to proceed with the valuation.

11 Environment and Historic Environment Outcomes Valuation Guidance - GOV.UK (www.gov.uk)

12 Other ecosystem services included in the EHOV Guidance were not considered relevant to or significant in relation to the NFM schemes. These are renewable energy, noise reduction, temperature regulation, soil, landscape, non-use values, and invasive species

Table 4.1 - Screening of ecosystem service impacts

Benefit category	Question	Sub questions
Provisioning services		
Food	Does the scheme change food production?	Does the scheme reduce or create areas for direct food production (e.g. farmland, allotments)? Does the scheme reduce or create areas for indirect food production (e.g. pollinators for honey)?
Timber	Does the scheme change timber production?	Does the scheme include commercial woodland? Will existing woodland be managed for timber production?
Water supply	Does the scheme change water available for use?	Will the scheme help retain or increase flows or boost drought resilience in water bodies used for abstraction? Will the scheme include rainwater harvesting that reduces water demand?
Fish	Does the scheme change fish stocks?	Does the scheme reduce or create areas for fish habitat? Will the scheme result in changing fish densities or diversity?
Regulating services		
Flood regulation	Does the scheme change the likelihood or impact of flooding?	Are there properties, buildings, areas, or infrastructure (including transport) at risk of flooding currently? Is the scheme expected to change local flood risk?
Air pollutant removal	Does the scheme change the level of air pollution?	Is the site in an air quality management area? Does the scheme involve green infrastructure (e.g. tree planting, green roofs)? Is the scheme in a populated area or a transport corridor?
Carbon reduction	Does the scheme change levels of atmospheric carbon?	Does the scheme involve planting (particularly trees) over and above that which would occur without the scheme? Does the scheme involve new planting (particularly trees) rather than replacement?

Benefit category	Question	Sub questions
Cultural services		
Recreation	Does the scheme change the available facilities for recreation and leisure?	Is the site currently used for recreation (e.g. walking, fishing, birdwatching, sports - including water sports)? Is the scheme expected to improve facilities or opportunities for recreation?
Physical health	Does the scheme impact the health and wellbeing of local residents?	Does the scheme involve green infrastructure (e.g. tree planting, green roofs)? Could the scheme encourage residents or others to spend more time outdoors or participating in physical activity/exercise?
Education	Does the scheme lead to greater awareness of water and surface water management?	Could the scheme lead to increase in number of children engaged about water and flooding? Could the scheme lead to more educational visits/talks? Could the scheme lead to increase in number of community events or open days?
Volunteering	Does the scheme lead to increased opportunities for volunteering?	Could the scheme lead to increase in number of local people engaged about water and flooding? Could the scheme lead to more action days or events?
Amenity	Does the scheme change the attractiveness or desirability of the place?	Does the scheme involve new/improved surface water bodies/features, landscaping or greening? Is the scheme in a populated area, or an area used for recreation, work, commuting, tourism, etc? Is the scheme visible to those living nearby or passing by?
Supporting/bundled services		
Biodiversity	Does the scheme lead to a change in habitats for plants and animals?	Does the scheme involve components that may enhance biodiversity and ecology? Does the scheme create new sites that support habitats and the growth of biodiversity and ecology? Does the scheme significantly improve connectivity between sites?
Water quality	Does the scheme change the water quality of rivers, wetlands, peatlands, lakes, or the sea?	Are there pollution/water quality issues in water courses? Is the scheme expected to reduce pollution or improve water quality (and may result in avoided costs)?

Table 4.2 - Screening of data available for valuation at each site by ecosystem service impacts. Blue = services included. Two sites were omitted prior to this stage.

	Provisioning Services				Regulating Services		
	Food prod'n	Timber prod'n	Water supply	Fish Stocks	Flood regul'n	Air Quality	Carbon reduc'n
1. Upper Sherbourne, Warwickshire							
2. Upper Aire Catchment, Yorkshire							
3. Limb Brook, Sheffield							
4. Gloucester & Cheltenham Waterscapes							
5. Barossa, Wishmoor Bottom, Surrey							
6. River Otter Beavers, Devon							
7. Milkwellburn Wood, Durham							
8. Derwent Living Forest, Derbyshire							

Cultural Services						Supporting Services	
Recr'n	Physical Health	Mental Health	Educ'n	Volunt	Amenity	Biodiversity	Water Quality

Quantify Benefits

For the 'screened in' benefits, we completed a quantitative assessment for six sites (there was insufficient information for the final four sites to proceed with an assessment) using outputs from previous tasks. This assessment includes changes in the provision of relevant ecosystem services, expressed in physical units suitable for subsequent monetary valuation. The quantification includes:

- **Natural asset extent and/or condition:** For example, carbon sequestered per hectare of wetland. Changes in condition are assessed using categorical scales, such as waterbody status.
- **Ecosystem services flows:** Direct assessment of physical quantities, such as tonnes of fish landings or carbon sequestered.
- **Beneficiary population:** For cultural services, these are based on changes in the number of potential users for a recreation site.

The EHOV guidance document (Table 4.3) lists common metrics for all ecosystem services. The outputs for the six sites, including any assumptions, are shown in Appendix E.

Table 4.3 - Quantified units for valuation by ecosystem service impacts.

Benefit category	Quantified Units
Food	Ha lost/gained for food production
Timber	Tonnes of timber added/ removed
Water supply	Cubic metres of additional/ reduced water supply
Fish	Increased/decreased number or weight (kg) of fish
Flood regulation	Volume of additional water stored, water stored by trees, or number of houses benefiting from reduced flooding
Air pollutant removal	Number of additional trees planted
Carbon reduction	Number of additional trees planted
Recreation	Number of visits per year
Physical health	Number of visits per year
Mental health	Number of houses benefiting from reduced flooding
Education	Number of attendees per year
Volunteering	Number of volunteer hours per year
Amenity	Ha of additional/reduced green space
Biodiversity	Ha and type of additional/ reduced habitat, or biodiversity units gained/improved[13]
Water quality	Tonnes of pollutant removed

13 Statutory biodiversity metric tools and guides - GOV.UK (www.gov.uk)

Value Benefits

We applied monetary values to the quantified impacts where possible drawing primarily on ENCA (Enabling a Natural Capital Approach)[14] and statutory biodiversity credit prices[15]. ENCA supports the 'value transfer' approach, adjusting existing values for the sites of interest and its use enabled us to estimate lower and upper estimates of monetary benefits for each category at each site, noting any assumptions made in the process. These values strike a suitable balance between the level of appraisal effort and the level of uncertainty that can be accommodated in valuations. The limitations associated with this valuation stem from the data itself being limited to what is currently measured and available, leading to variations between sites as shown in Tables 4.2 and 4.4, which complicates inter-site comparisons. The absence of data for an ecosystem service category does not necessarily indicate that NFM benefits are absent at the site, but rather that they are not being recorded, thus impairing the ability to undertake a robust assessment and valuation of benefits at this time. Additionally, the upper and lower source values from the ENCA workbook, used to valuate benefits, were selected based on professional judgement and may therefore be subjective. Consequently, further work is needed to ensure consistency in monitoring, data capture, and ENCA source value selection as to continually evolve and improve confidence in valuation.

The annual valuation ranges are displayed in Table 4.4 with further information regarding the assumptions made to reach these values detailed in Appendix E. All values used to calculate the upper and lower range valued benefits for each site have been sourced from the ENCA workbook, and each originate from a specified price year, as shown in the final row in Table 4.4.

Where NFM schemes may lead to a reduction in flood risk to properties, we assessed the benefit in terms of both avoided property damage costs and mental health benefits to householders. To quantify these benefits, we assumed that the NFM will lead to a 2-10% reduction in peak flow for smaller, more frequent (e.g. 1 in 10 year) events, which is a conservative estimate based on work undertaken for the Third UK Climate Change Risk Assessment[16]. Based on this, we assume that the NFM scheme will lead to a 10% reduction in properties flooded per year.

Whilst peak flow reduction doesn't necessarily mean that a flood event will be avoided, it does lessen the damage caused by the event. To value avoided damages, we use HM Treasury Green Book values of £9,500 (lower) and £42,500 (upper) per event. Further details of the quantification and valuation for individual schemes are shown in Appendix E.

It should be noted that valued benefits vary significantly across the NFM schemes. This is to be expected, as they vary in terms of scale, maturity and location. The comparability of schemes is discussed further in Section 4.3.

14 Enabling a Natural Capital Approach (ENCA) - GOV.UK (www.gov.uk)

15 Statutory biodiversity credit prices - GOV.UK (www.gov.uk)

16 Sayers et al (2020), Final Report prepared for the Committee on Climate Change, UK. July 2020. Figure 6.4: Natural flood management – Percentage reduction in peak flow (1in10 year return period).

Table 4.4 - Annual monetary valuation (benefit) prices for each site by ecosystem service impacts

	Food prod'n	Flood Regul'n	Air Quality	Carbon Reduc'n
ENCA Yardstick Value		10% of £9,500 - £42,500 per property, £0.11 - £1.32 per m^3 volume	£391 - £5,582 per Ha	£124 - £373 per tonne
1. Upper Sherbourne, Warwickshire		£5,550 - £38,250	£27 - £391	£54 - £162
2. Upper Aire Catchment, Yorkshire			£5,591 - £79,823	£20,994 - £33,070
3. Limb Brook, Sheffield		£79 - £950	£352 - £5,024	£692 - £2,081
4. Gloucester & Cheltenham Waterscapes		£47,500 - £212,500	£39 - £558	£77 - £231
5. Barossa, Wishmoor Bottom, Surrey		£14 - £165		
6. River Otter Beavers, Devon	-£684 - -£2,632	£329 - £7,050		
Price Year	2024	2021	2022	2020

We adjusted the profile of values over the appraisal period, recording the price year for each valuation unit (blue row in Table 4.4 above) and using a GDP at Market Prices calculator[17] (Table 4.5) to update all monetised benefits to 2024 prices (Table 4.6). These values are further visualised in Figure 4.2. providing an indication of the wider benefits associated with different NFM projects at this snapshot in time, based on the data currently available.

Table 4.5 - GDP Deflator Market Prices by calendar year

Gross Domestic Product Deflators at Market Prices (calendar year)	
2008-09	69.854
2009-10	70.799
2010-11	72.133
2011-12	73.405
2012-13	74.752
2013-14	76.189
2014-15	77.116
2015-16	77.671
2016-17	79.438
2017-18	80.682
2018-19	82.384
2019-20	84.329
2020-21	88.921
2021-22	88.192
2022-23	94.134
2023-24	100

17 GDP deflators at market prices, and money GDP June 2024 (Quarterly National Accounts) - GOV.UK (www.gov.uk)

Physical Health	Mental Health	Educ'n	Volunt	Biodiversity	Water Quality
£3.52 - £15.29 per active visit	10% of £1,878 - £4,136 per adult	£2.08 - £6.90 per visit	£14.79 - £911 per volunteer hour	£8/Ha grassland, £53/Ha blanket bog, £55/ha hedgerows, £454/Ha wetland	£0.82 - £1.52 per kg
	£3,127 – £6,886		£1,486 - £22,775	£17 - £112	
		£414 - £1,373	£1,923 - £30,063	£11 - £59	
		£333 - £1,104	£5,413 - £83,812	£152 - £558	
	£17,372 - £38,258	£4,131 - £13,703	£2,130 - £32,796		
		£125 - £414			
£46,519 - £200,743		£379 - £1,256	£1,035 - £22,775	£80 - £681	£820 - £1,520
2022	2018	2017	2022/ 2020	2010/2015	2021

Table 4.6 - Annual monetary valuation (benefit) prices for each site by ecosystem service impacts, at 2024 price year. Note that only the food production values include a negative number in the range (dis-benefit)

	Upper Sherbourne, Warwickshire	Upper Aire Catchment, Yorkshire	Limb Brook, Sheffield	Gloucester & Cheltenham Waterscapes	Barossa, Wishmoor Bottom, Surrey	River Otter Beavers, Devon
Food prod'n						-£684 - +£2,632
Flood regul'n	£9,615 - £43,016		£89 - £1,069	£53,418 - £238,976	£15 - £186	£370 - £7,928
Air quality	£31 - £443	£6,340 - £90,510	£399 - £5,696	£44 - £633		
Carbon reduc'n	£64 - £192	£24,895 - £39,216	£821 - £2,568	£91 - £274		
Physical health						£52,747 - £227,621
Mental health	£3,876 – £8,535			£21,531 - £47,418		
		£521 - £1,729	£419 - £1,390	£5,200 - £17,250	£157 - £521	£477 - £1,581
Volunteering	£1,685 - £27,007	£2,180 - £35,650	£6,138 - £99,387	£2,415 - £38,892		£1,174 - £27,007
Amenity						
Biodiversity	£24 - £146	£15 - £76	£215 - £724			£112 - £883
Water quality						£922 - £1,709

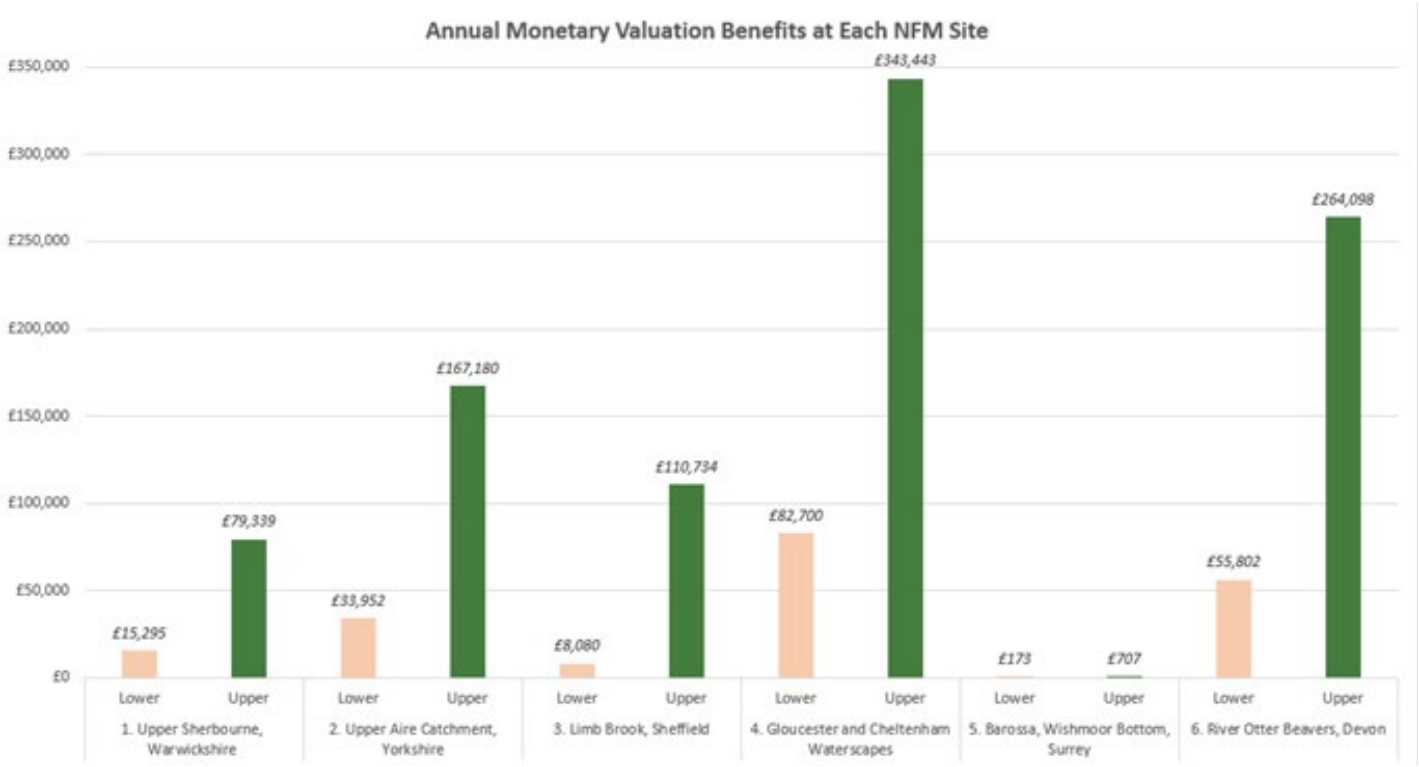


Figure 4.2 - Annual Monetary Valuation of Benefits at Each NFM Site, at 2024 Price Year

We recorded quantitative and qualitative impacts that couldn't be monetised, providing a comprehensive view of the scheme's impacts. Where possible, we included physical quantifications and assessed their significance qualitatively and through scoring, using a multi-criteria approach. The full valuation outputs for each site, including values, units, and assumptions, are recorded in Appendix E. As displayed in Table 4.6 and Figure 4.3, each NFM site displays a range of monetised benefits across the service category, beyond solely flood alleviation. As previously mentioned, the challenges borne from inconsistent data monitoring and recording limit the accuracy of this valuation exercise, and therefore these results should be interpreted with awareness that these may not be fully reflective of the full wider benefits associated with NFM at each site. The consideration of the multiple benefits associated with NFM projects is important to highlight the multiple ecosystem services provided from such projects, which may provide economic value to an individual project beyond flood mitigation only.

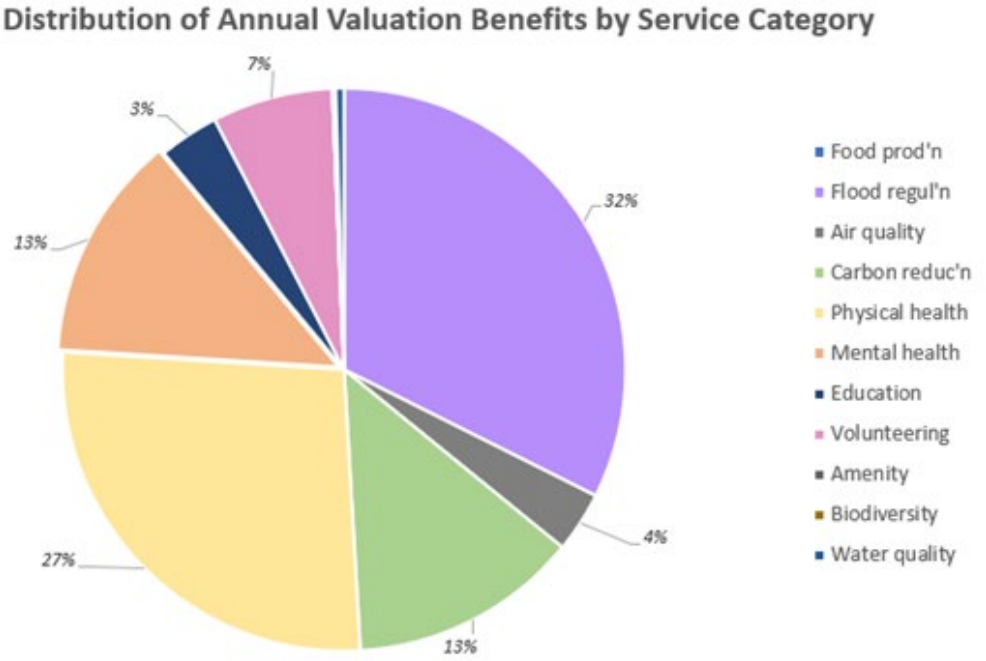


Figure 4.3 - Distribution of Annual Monetary Valuation of Benefits by Service Category

Aggregate Benefits

We aggregated the ecosystem service benefits described previously across different ecosystem service categories over the appraisal period. Two options are presented for the appraisal period, both 10-year and 30-year, as to best highlight how some impacts occur early on (e.g. capital costs), some may occur throughout the period (e.g. maintenance costs), and some tend to occur later in the period (e.g. benefits of tree planting). The aggregated benefits for both appraisal periods are shown below. It should be noted however that the government's flood and coastal erosion risk management (FCERM) appraisal guidance suggests 100 years as the most appropriate appraisal period, but this was deemed inappropriate due to the maintenance of NFM interventions favouring a shorter timescale, such as those ultimately opted for. Using a shorter timeframe will have the effect of giving more weight to short-term costs and benefits. Those occurring further in the future and beyond the 10 or 30-year appraisal horizon (typically benefits, as ongoing operational and maintenance costs tend to be low) will be ignored using this approach.

Benefits were discounted at 1.5% for physical and mental health categories, and 3.5% for all other categories, following HM Treasury Green Book and FCERM appraisal guidance. The lower value for health is because the 'wealth effect', or real per capita consumption growth element of the discount rate, is excluded (i.e. increased future wealth does not diminish the welfare associated with health).

Tables 4.7 and 4.8 show there are that there are significant valued benefits at most of the six sites, especially for Gloucester & Cheltenham Waterscapes. This partly reflects the number of ecosystem service categories assessed at each site, and partly the nature and extent of the benefits at the sites. Gloucester & Cheltenham Waterscapes for example has the largest quantified flood regulation benefits as far more properties are recorded as being protected due to NFM interventions at this location than others (50 homes back onto where the swale was constructed and trees planted).

Table 4.7 - Aggregated 10 Year Total Benefit Values for each Site

	Upper Sherbourne, Warwickshire	Upper Aire Catchment, Yorkshire	Limb Brook, Sheffield	Gloucester & Cheltenham Waterscapes	Barossa, Wishmoor Bottom, Surrey	River Otter Beavers, Devon
10 Year Aggregated Total	£0.13mn -£0.69mn	£0.29mn - £1.44mn	£0.07mn - £0.95mn	£0.73mn - £2.99mn	£0.001mn - £0.006mn	£0.52mn - £2.44mn

Table 4.8 - Aggregated 30 Year Total Benefit Values for each Site

	Upper Sherbourne, Warwickshire	Upper Aire Catchment, Yorkshire	Limb Brook, Sheffield	Gloucester & Cheltenham Waterscapes	Barossa, Wishmoor Bottom, Surrey	River Otter Beavers, Devon
10 Year Aggregated Total	£0.31mn -£1.56mn	£0.65mn - £3.18mn	£0.15mn - £2.11mn	£1.69mn - £6.79mn	£0.003mn - £0.013mn	£1.34mn - £6.24mn

4.2 Cost-Benefit Analysis

Each of the sites provided an estimate of total capital costs, annual operational cost and project length. The total cost was calculated as capital cost + (operational cost x project length) for each site, as shown in Table 4.9.

Table 4.9 - Project Cost Calculations for Each Site

	Total Capital Costs	Annual Operating Costs	Project Length	Assumptions	Total Project Cost
1. Upper Sherbourne, Warwickshire	£64,000	£27,000	7 Years		£253,000
2. Upper Aire Catchment, Yorkshire	£250,000	£55,000	5 Years	Operating costs for 2023/24 assumed for full project length, project length assumed.	£525,000
3. Limb Brook, Sheffield	£100,000	£4,000	5 Years	Operating costs vary £3,000-£5,000 p/a, so average taken.	£120,000
4. Gloucester and Cheltenham Waterscapes	£68,040	£111,958	2 Years		£291,956
5. Barossa, Wishmoor Bottom, Surrey	£93,883	TBC	TBC	Feasibility study so no project length or operating costs.	£93,883
6. River Otter Beavers, Devon	£14,174	£2,996	30 Years	In perpetuity, so full benefits timeframe assumed as project length.	£104,054

Using the results of the valuation outlined above in Table 4.9, a cost-benefit analysis was then conducted to determine whether the valued benefits of NFM projects outweigh their costs to provide a net benefit, and by how much. Table 4.10 and 4.11 show the results, including Net Present Value (benefits minus costs) and Benefit/Cost Ratio (benefits divided by costs), for 10-Year and 30-Year appraisal periods, respectively.

Table 4.10 - 10-Year Total Cost Benefit Analysis Values for Each Site

		10 yr Benefit Total	Total Project Costs	Net Present Value	Benefit/Cost Ratio
1. Upper Sherbourne, Warwickshire	Lower	£134,572	£253,000	-£118,428	0.5
	Upper	£689,347		£436,347	2.7
2. Upper Aire Catchment, Yorkshire	Lower	£292,245	£525,000	-£232,755	0.6
	Upper	£1,439,033		£914,033	2.7
3. Limb Brook, Sheffield	Lower	£69,552	£120,000	-£50,448	0.6
	Upper	£953,165		£833,165	7.9
4. Gloucester and Cheltenham Waterscapes	Lower	£728,067	£291,956	£436,111	2.5
	Upper	£2,991,944		£2,699,988	10.2
5. Barossa, Wishmoor Bottom, Surrey	Lower	£1,485	£93,883	-£92,398	0.0
	Upper	£6,083		-£87,800	0.1
6. River Otter Beavers, Devon	Lower	£520,034	£104,054	£415,968	5.0
	Upper	£2,444,636		£2,340,569	23.5

Table 4.11 - 30-Year Total Cost Benefit Analysis Values for Each Site

		30 yr Benefit Total	Total Project Costs	Net Present Value	Benefit/Cost Ratio
1. Upper Sherbourne, Warwickshire	Lower	£311,849	£253,000	£58,849	1.2
	Upper	£1,555,850		£1,302,850	6.1
2. Upper Aire Catchment, Yorkshire	Lower	£646,295	£525,000	£121,295	1.2
	Upper	£3,182,400		£2,657,400	6.1
3. Limb Brook, Sheffield	Lower	£153,814	£120,000	£33,814	1.3
	Upper	£2,107,910		£1,987,910	17.6
4. Gloucester and Cheltenham Waterscapes	Lower	£1,689,246	£291,956	£1,397,290	5.8
	Upper	£6,790,921		£6,498,965	23.2
5. Barossa, Wishmoor Bottom, Surrey	Lower	£3,285	£93,883	-£90,598	0.0
	Upper	£13,453		-£80,430	0.1
6. River Otter Beavers, Devon	Lower	£1,343,915	£104,054	£1,239,849	12.9
	Upper	£6,242,881		£6,138,814	60.0

The results of the cost-benefit analysis in Table 4.10 and Figure 4.4 indicate that most lower range net present values for the 10-year appraisal period are negative, suggesting that if these lower estimations accurately depict real-world benefits, then these generally begin to outweigh project costs at some point later than 10 years after inception, but before the 30 year point at which the majority of net present values are positive (Table 4.11 and Figure 4.5).

However, Barossa is an exception to this due to being in the feasibility study phase and thus has not yet begun to accumulate benefits irrespective of the appraisal period duration.

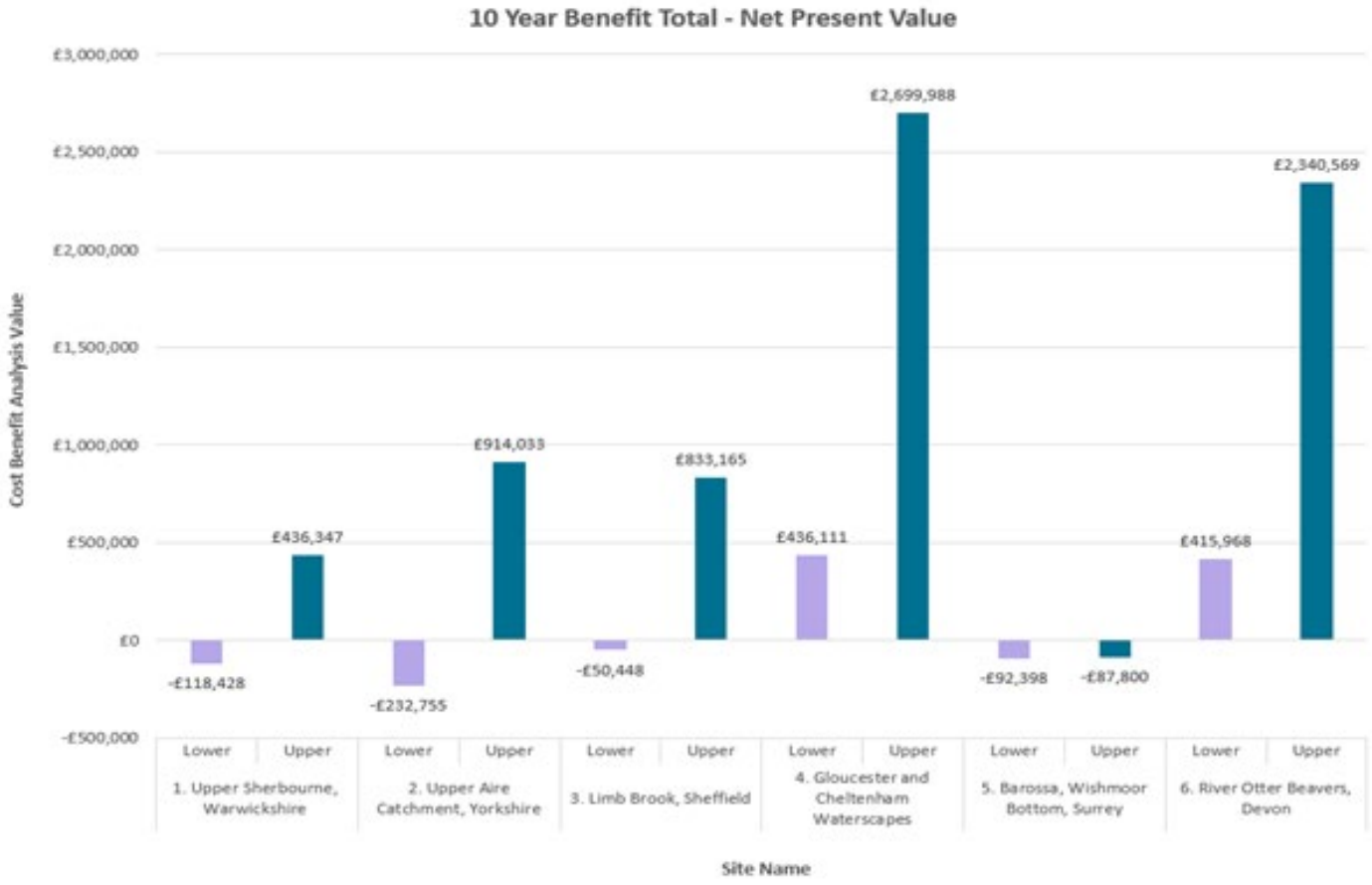


Figure 4.4 - Net Present Value for Each Site, using the 10-Year Benefit Total

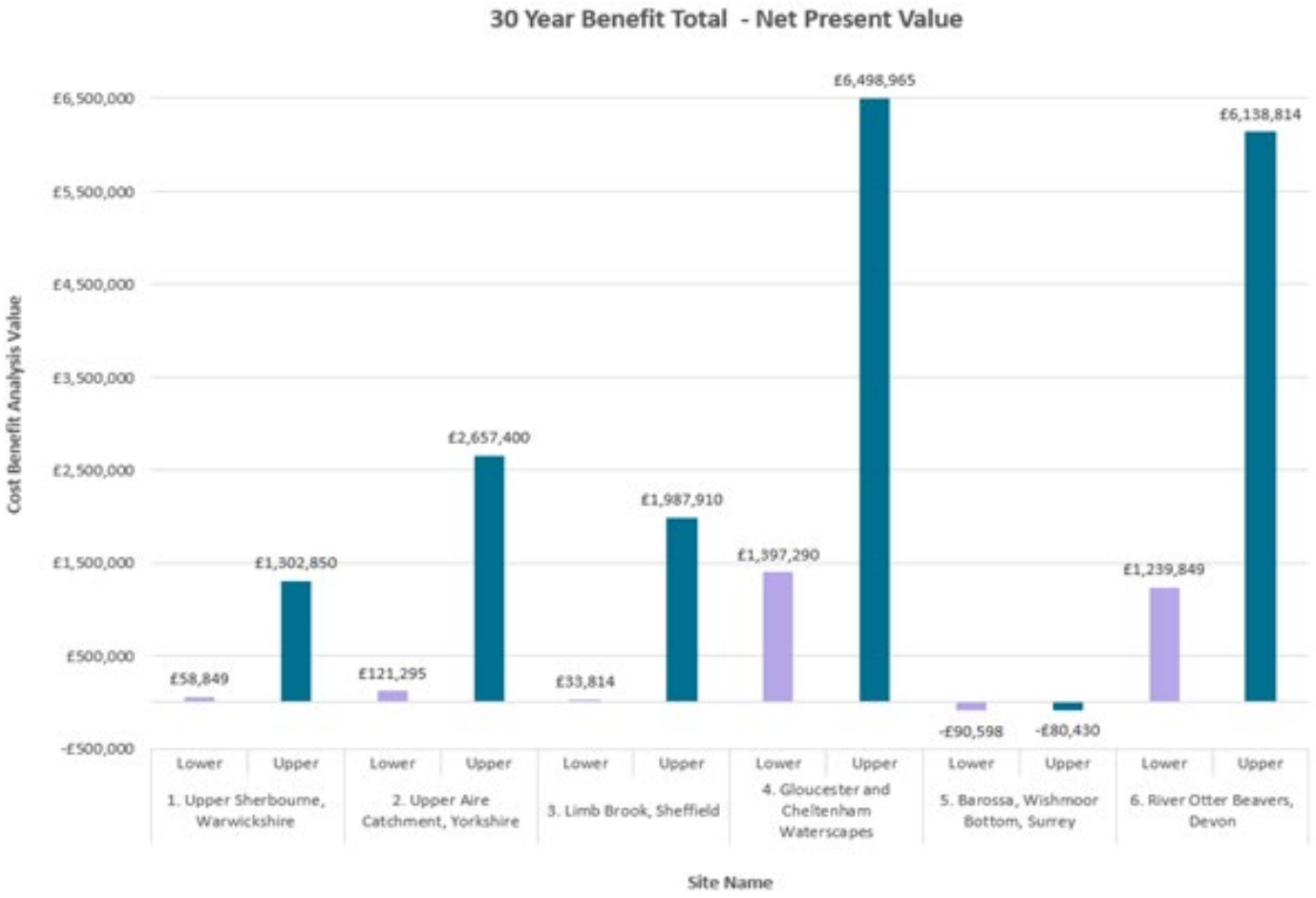


Figure 4.5 - Net Present Value for Each Site, using the 30-Year Benefit Total

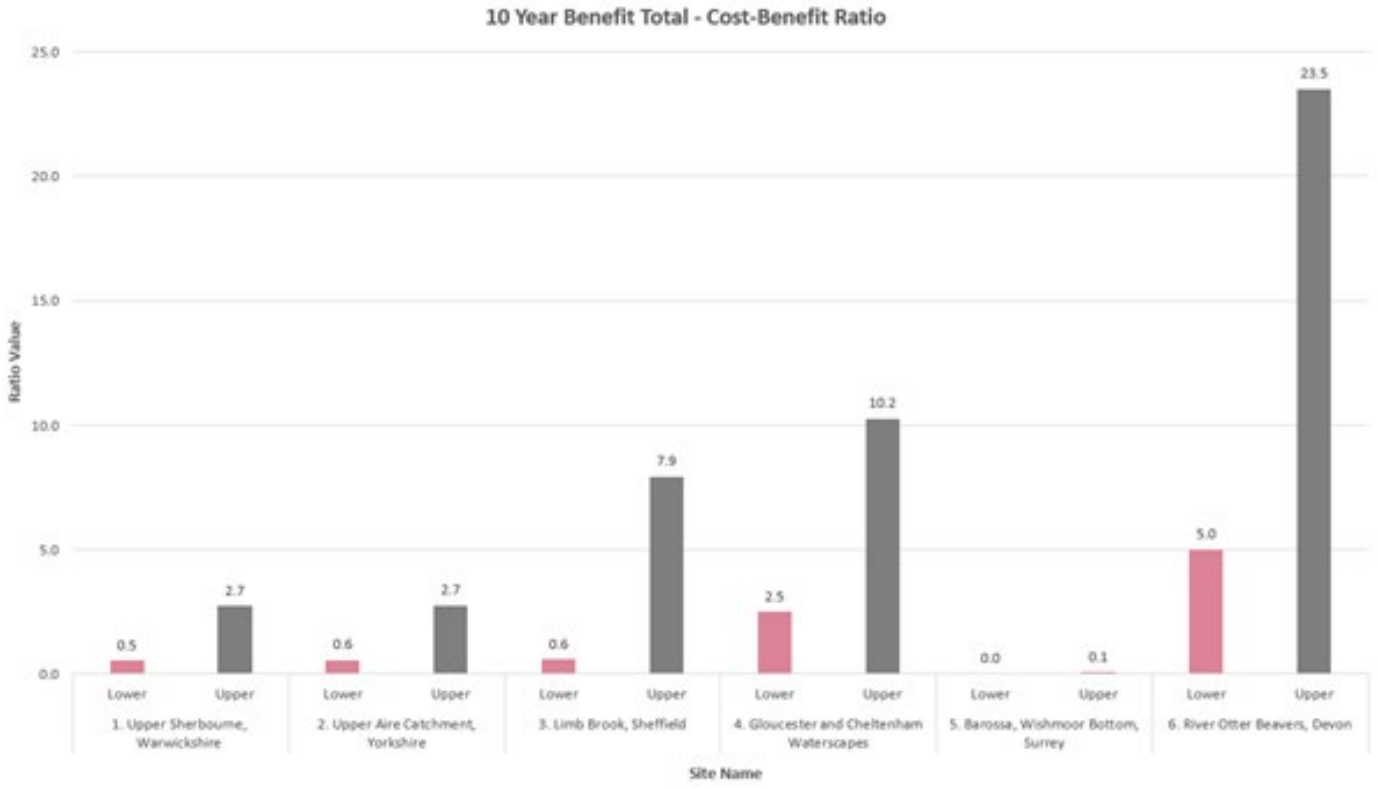


Figure 4.6 - Benefit:Cost Ratio Analysis Values for Each Site, using the 10-Year Benefit Total

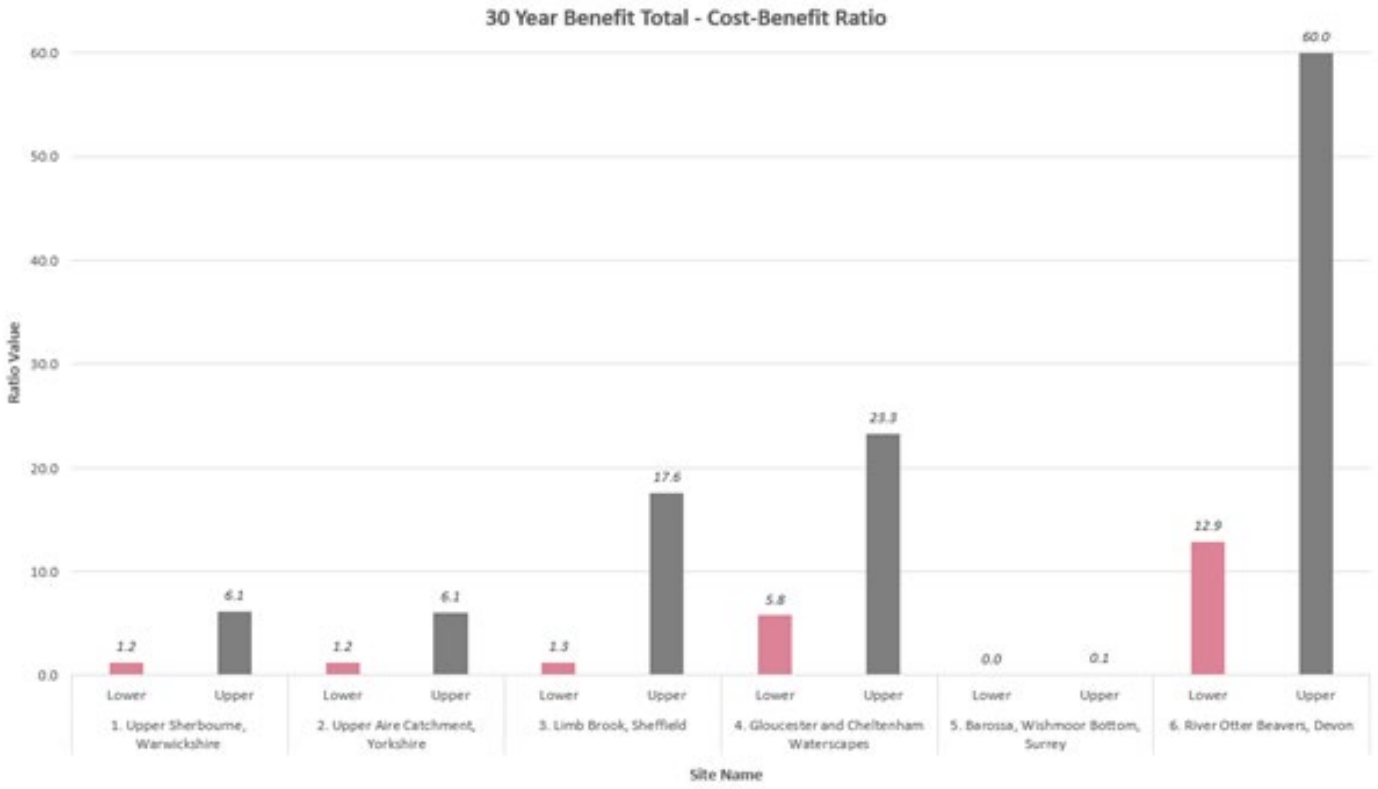


Figure 4.7 - Benefit:Cost Ratio Analysis Values for Each Site, using the 30 Year Benefit Total

Scenario Analysis – Climate Change

Due to inherent uncertainty in the method, as well as its application and particularly in relation to the impacts of climate change (Table 4.12) and evolving understanding of the value associated with biodiversity (Table 4.13), a scenario analysis was undertaken to address this uncertainty and test the robustness of the results presented above. To account for future climatic changes and their impact on valued benefits, an alternate flood alleviation scenario was considered for the two sites with benefits based on avoided property flooding events. Initially, we assumed a 2-10% reduction in peak flow for 1 in 10-year return events (based on CCRA3[18]), leading to a 10% reduction in flooding per year. In this scenario, we assumed the impact of climate change doubles flood risk, leading to a 20% reduction per year. This scenario results in greater total aggregation values at both a 10- and 30-year appraisal period.

Table 4.12 - 10- and 30-Year Total Aggregated Valued Benefits for Relevant Sites under a Climate Change Scenario

	Upper Sherbourne, Warwickshire	Gloucester and Cheltenham Waterscapes
Prev. 10 Year Aggregated Total	£0.13mn -£0.69mn	£0.73mn - £2.99mn
Scenario 10 Year Benefits Total	£0.17mn - £0.74mn	£0.92mn - £4.11mn
Prev. 30 Year Aggregated Total	£0.31mn -£1.56mn	£1.69mn - £6.79mn
Scenario 30 Year Benefits Total	£0.37mn - £1.64mn	£2.03mn - £9.10mn

These totals indicate an increase for both sites at both appraisal period durations in the scenario compared to previous total aggregated values (in grey), highlighting a minor change for the valuation of Upper Sherbourne compared with a much larger increase for Gloucester and Cheltenham Waterscapes. This is due to the difference in number of properties affected by flooding at these two sites, with Gloucester and Cheltenham Waterscapes recording 50 homes that will directly benefit from a decreased risk of flooding compared with nine houses in Upper Sherbourne. While this analysis is only indicative, it reflects that climate change will increase the importance of natural flood management measures further where it reduces overall property damage in a scenario with greater flood risk.

18 Sayers et al (2020) Third UK Climate Change Risk Assessment (CCRA3) Future flood risk. Main Report prepared for the Committee on Climate Change. This report suggests that the impact of catchment measures on flood risk is determined by catchment potential, scale of NFM ambition and impact across different return period flows. The 2-10% figure is based on Figure 6-4 'Natural flood management – Percentage reduction in peak flow (1in10 year return period)', though it varies geographically based on topography, rainfall, etc.

Scenario Analysis – Biodiversity

There is considerable uncertainty associated with valuing biodiversity impacts, so an alternate method was also undertaken to re-value these benefits at these sites using the Defra statutory biodiversity metric calculation tool. Due to limited information around the original baseline habitat type, we effectively assumed habitats were created rather than changed. It should be noted that the biodiversity credit price (which is based on the cost to create, maintain and monitor different habitat types) is assumed to equal the 'shadow price' of biodiversity-related services, even though the government requires developers to purchase 2 credits to offset each unit of habitat loss. This is consistent with the approach proposed by Frontier Economics in their recent work for the Wildlife Trusts[19].

Table 4.13 - 10- and 30-Year Total Aggregated Valued Benefits for Relevant Sites under a Climate Change Scenario

	Upper Sherbourne, Warwickshire	Upper Aire Catchment, Yorkshire	Limb Brook, Sheffield	River Otter Beavers, Devon
Change in Units	6.62	6.8	42.99	11.79
Annual Valuation	£326,110	£300,960	£2,507,310	£1,473,750
Prev. 10 Year Aggregated Total	£0.13mn -£0.69mn	£0.29mn - £1.44mn	£0.07mn - £0.95mn	£0.52mn - £2.44mn
Scenario 10 Year Aggregated Total	£0.46mn - £1,02mn	£0.59mn - £1.74mn	£2.58mn - £3.49mn	£2.20mn - £4.47mn
Prev. 30 Year Aggregated Total	£0.31mn -£1.56mn	£0.65mn - £3.18mn	£0.15mn - £2.11mn	£1.34mn - £6.24mn
Scenario 30 Year Aggregated Total	£0.64mn - £1.88mn	£0.95mn - £3.48mn	£2.66mm - £4.61mn	£2.82mn - £7.72mn

This alternative method for valuing biodiversity results in significantly greater monetary values compared with the original ENCA-based approach for every site included in the analysis. The ENCA-based approach is largely based on average UK willingness to pay estimates for enhancements to 'charismatic and non-charismatic species', and 'sense of place', associated with a significant improvement in habitat condition as a result of full implementation of UK Biodiversity Action Plans. These ENCA-based values represent only a partial value of improving biodiversity and habitats. Economic valuation techniques for biodiversity are the focus of much debate and ongoing research, and the market-based approach described above and used for this scenario may be more appropriate.

19 Frontier Economics (2023) Approaches for valuing biodiversity – a pro bono project for The Wildlife Trusts

Scenario Analysis – Education and Volunteering

Education and volunteering benefits may be overestimated in both the 10- and 30-year aggregated benefit totals, as it is possible that benefits associated with these two service categories may end, or 'tail off', once the initial funding period ends. Though additional funding opportunities could be realised through alternative means, this remains uncertain, and therefore this scenario looks to account for this by retaining the full benefits associated with both education and volunteering for the first 5 years of the appraisal period, before reducing these down by half for the remainder. Results are shown in Table 4.14 below and highlight generally a negligible change, or else a small reduction, in aggregated values for both 10- and 30-year appraisal periods. This indicates that using a consistent rate for benefits associated with education and volunteering across the appraisal period in the main analysis is of little impact to the total aggregated values.

Table 4.14 - *10- and 30-Year Total Aggregated Valued Benefits for Relevant Sites under an Alternate Education & Volunteering Scenario.*

	Upper Sherbourne, Warwickshire	Upper Aire Catchment, Yorkshire	Limb Brook, Sheffield	Gloucester and Cheltenham Waterscapes	Barossa, Wishmoor Bottom, Surrey	River Otter Beavers, Devon
Prev. 10 Year Aggregated Total	£0.13mn -£0.69mn	£0.29mn - £1.44mn	£0.07mn - £0.95mn	£0.73mn - £2.99mn	£0.001mn - £0.006mn	£0.52mn - £2.44mn
Scenario 10 Year Aggregated Total	£0.13mm - £0.68mn	£0.29mn - £1.43mn	£0.07mn - £0.92mn	£0.73mn - £2.97mn	£0.001mn - £0.006mn	£0.52mn - £2.43mn
Prev. 30 Year Aggregated Total	£0.31mn -£1.56mn	£0.65mn - £3.18mn	£0.15mn - £2.11mn	£1.69mn - £6.79mn	£0.003mn - £0.013mn	£1.34mn - £6.24mn
Scenario 30 Year Aggregated Total	£0.30mn - £1.44mn	£0.63mn - £3.03mn	£0.13mn - £1.68mn	£1.66mn - £6.55mn	£0.003mn - £0.011mn	£1.34mn - £6.12mn

Scenario Analysis – Water Storage

Previously, water storage benefits were calculated based on the additional volume of water stored, while the benefits of trees planted were assessed in terms of carbon reduction and air pollution. Consequently, the water storage benefits provided by these additional trees were not accounted for. Although these benefits were excluded from the original scenario so as to avoid double counting when using the same data for multiple benefit categories, this scenario in Table 4.15 analysis explores the potential additional value of water storage benefits resulting from tree planting. The impact of this scenario on aggregation totals is generally negligible, or else a marginal increase, for both 10- and 30-year appraisal periods, indicating that the non-inclusion of water storage benefits brought about by trees in the main analysis is of little impact.

Table 4.15 - 10- and 30-Year Total Aggregated Valued Benefits for Relevant Sites under an Alternate Water Storage Scenario

	Upper Sherbourne, Warwickshire	Upper Aire Catchment, Yorkshire	Limb Brook, Sheffield	Gloucester and Cheltenham Waterscapes
Prev. 10 Year Aggregated Total	£0.13mn -£0.69mn	£0.29mn - £1.44mn	£0.07mn - £0.95mn	£0.73mn - £2.99mn
Scenario 10 Year Benefits Water Storage Total	£77 - £178	£15,822 - £36,351	£996 - £2,288	£111 - £254
Scenario 10 Year Benefits Total	£0.13mn - £0.69mn	£0.31mn - £1.48mn	£0.07mn - £0.96mn	£0.73mn - £2.99mn
Prev. 30 Year Aggregated Total	£0.31mn -£1.56mn	£0.65mn - £3.18mn	£0.15mn - £2.11mn	£1.69mn - £6.79mn
Scenario 30 Year Benefits Water Storage Total	£218 - £502	£44,623 - £102,523	£2,808 - £6,453	£312 - £717
Scenario 30 Year Benefits Total	£0.31mn - £1.56mn	£0.69mn - £3.28mn	£0.16mn - £2.11mn	£1.69mn - £6.79mn

4.3 National Valuation

Total valued benefits for each site, updated to the common 2024 price value year, were normalised by site area to ensure comparability and facilitate scaling up of benefits to a national level.

Table 4.16 - Normalised 10- and 30-Year Total Aggregated Valued Benefits per Hectare

	Upper Sherbourne, Warwickshire	Upper Aire Catchment, Yorkshire	Limb Brook, Sheffield	Gloucester & Cheltenham Waterscapes	Barossa, Wishmoor Bottom, Surrey	River Otter Beavers, Devon
10 Year Aggregated Total	£0.13mn -£0.69mn	£0.29mn - £1.44mn	£0.07mn - £0.95mn	£0.73mn - £2.99mn	£0.001mn - £0.006mn	£0.52mn - £2.44mn
30 Year Aggregated Total	£0.31mn -£1.56mn	£0.65mn - £3.18mn	£0.15mn - £2.11mn	£1.69mn - £6.79mn	£0.003mn - £0.013mn	£1.34mn - £6.24mn
Site Area (Ha)	595.7	35,600	558	1.005	498	9.49
Normalised 10 Year Benefits per Ha	£226 - £1,157	£8 - £40	£125 - £1,708	£0.72mn - £2.98mn	£3 - £12	£54,798 - £257,601
Normalised 30 Year Benefits per Ha	£523 - £2,612	£18 - £89	£276 - £3,778	£1.68mn - £6.76mn	£7 - £27	£141,614 - £657,838

The above normalisation results (Table 4.16), combined with Figures 4.8 and 4.9 below, show a wide range of valued benefits are available for different NFM projects, with that of Upper Aire seeming significantly lower due to its significantly large area over which benefits were normalised, and Barossa appearing significantly lower due to it being a pilot project so having less accrued benefits at this stage. Gloucester & Cheltenham Waterscapes normalised benefits appear significantly greater than the other sites, due to the site area being relatively smaller than its counterparts. These differences are due to a lack of consistency in reporting site areas. Some Wildlife Trusts report hectares to which NFM interventions have been applied, while others report hectares of the area that will benefit from NFM. As a result other normalisation factors have been used when needed to provide more realistic estimates.

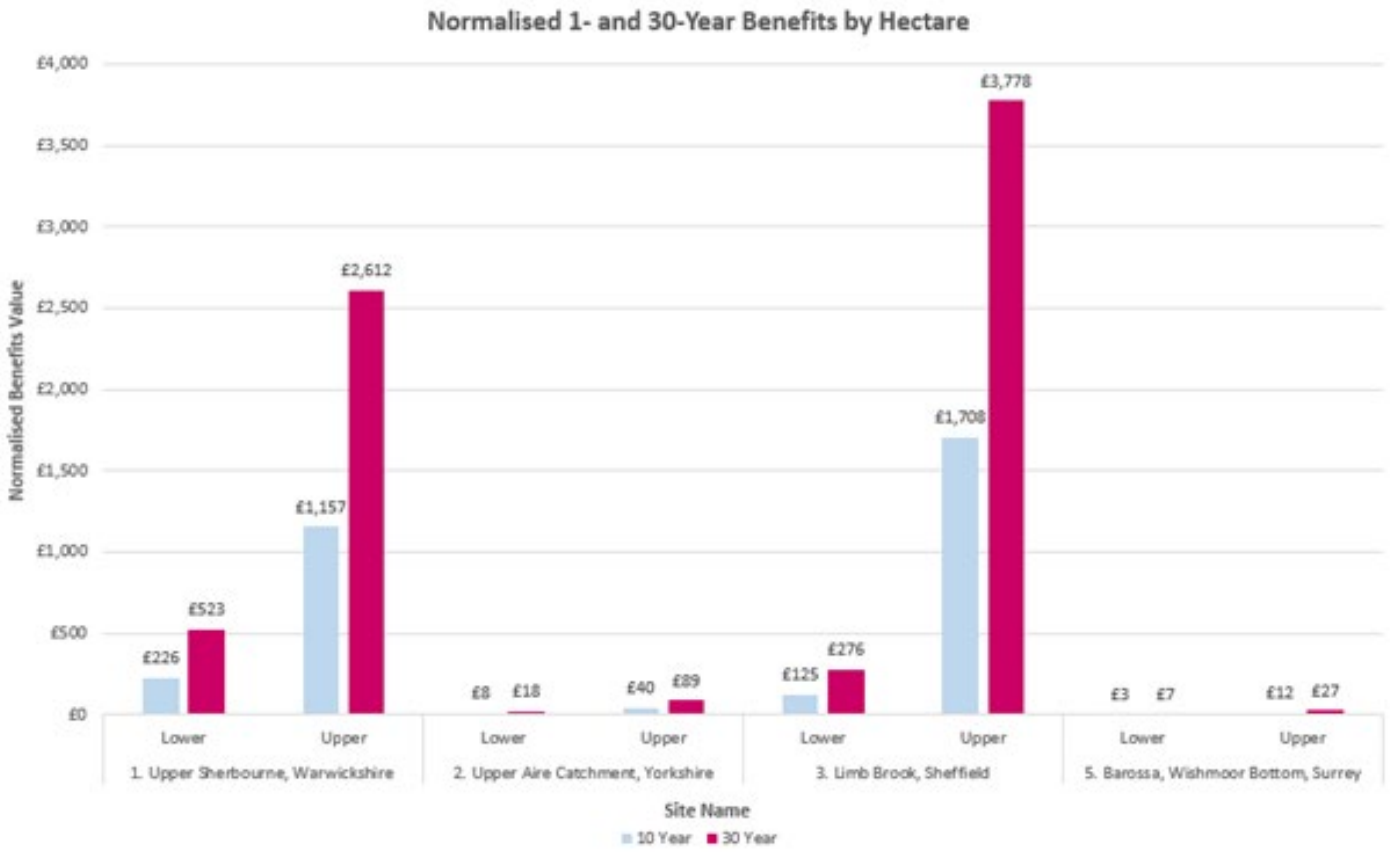


Figure 4.8 - Normalised Total 10- and 30-Year Aggregated Benefits per Ha for Sites

These variations in outcomes coupled with the small sample size of 6 sites, means that it is not possible to provide a rigorous data set to enable scaling up of benefits to a national (UK) level. These variations could be down to a number of factors, including:

- Lack of consistency in data collection
- Lack of consistency in focus on potential benefits in the implementation of NFM
- Lack of consistency in definition of boundaries for assessment (e.g. whole catchment area vs. area of NFM improvement)

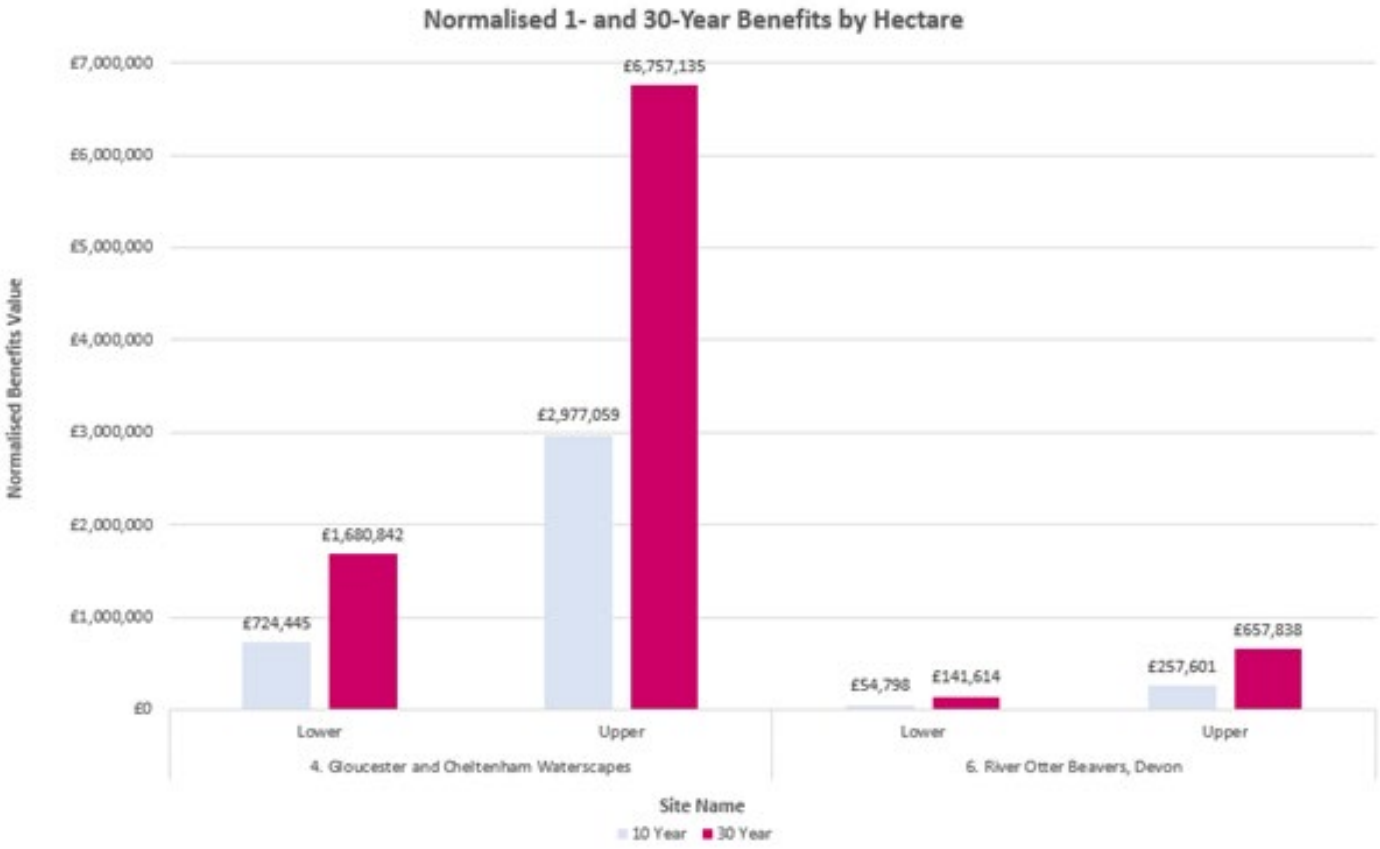


Figure 4.9 - : Normalised Total 10- and 30-Year Aggregated Benefits per Ha for Sites

We have therefore summarised the benefits from the six sites combined in Table 4.17. This data can be used to estimate the potential benefits that could be expected from future NFM projects, although it must be acknowledged that the factors listed above impact the potential accuracy of these estimates.

This table includes both quantified values as well as upper and lower monetary values. This enables a site-specific estimate to be made, as well as upper and lower monetary valuations (including per ha values). In the future this table could be further segregated to provide data specific to rural vs urban sites, and the interventions implemented (such as done in Table 1.1) this would enable more specific forecasts to be made.

Table 4.17 - Summarised benefits by ecosystem service category

	Total Quantified Benefits	Valuation (2024 prices)	Normalised valuation	No. Sites
Food prod'n	1.29 Ha arable land flooded & seed costs	-£684 - -£2,632	-£530 - -£1,831 per Ha	1
Timber prod'n				
Water supply				
Fish stocks				
Flood regul'n	Reduced flooding at 59 homes	£63,033 - £281,992	£1,068 - £4,780 per home	2
	1545 m^3 additional water stored	£475 - £9,183	£0.31 - £5.94 per m^3	3
Air quality	144,730 trees planted	£6,814 - £97,282	£0.05 - £0.67 per tree	4
Carbon reduc'n	144,730 trees planted	£25,871 - £42,150	£0.18 - £0.29 per tree	4
Recr'n				
Physical health	Increased footfall count +13,215.5	£52,747 - £227,621	£4 - £17 per count	1
Mental health	Reduced flooding at 59 homes	£25,407 - £55,953	£4,306 - £6,940 per home	2
Education	2,587 total attendees	£6,774 - £22,471	£2.62 - £8.69 per attendee	5
Volunteering	810.5 volunteer hours	£13,592 - £227,942	£16.77 - £281.24 per vol hour	5
Amenity				
Biodiversity	5.61 Ha	£366 - £1,829	£65 - £326 per Ha	4
Water quality	1000kg nitrate removed	£820 - £1,520	£0.82 - £1.52 per kg	1

The case studies from the 65 pilots carried out in the 2017 EA NFM pilot programme[20] could also provide a useful source of data on potential benefits, and if analysed as suggested below, could provide some initial national level benchmarks. Unfortunately, and as reviewed as part of Section 2, these benefits were not collated into a summary table so there is no simple way of interrogating them, apart from their categorisation into five intervention types of:

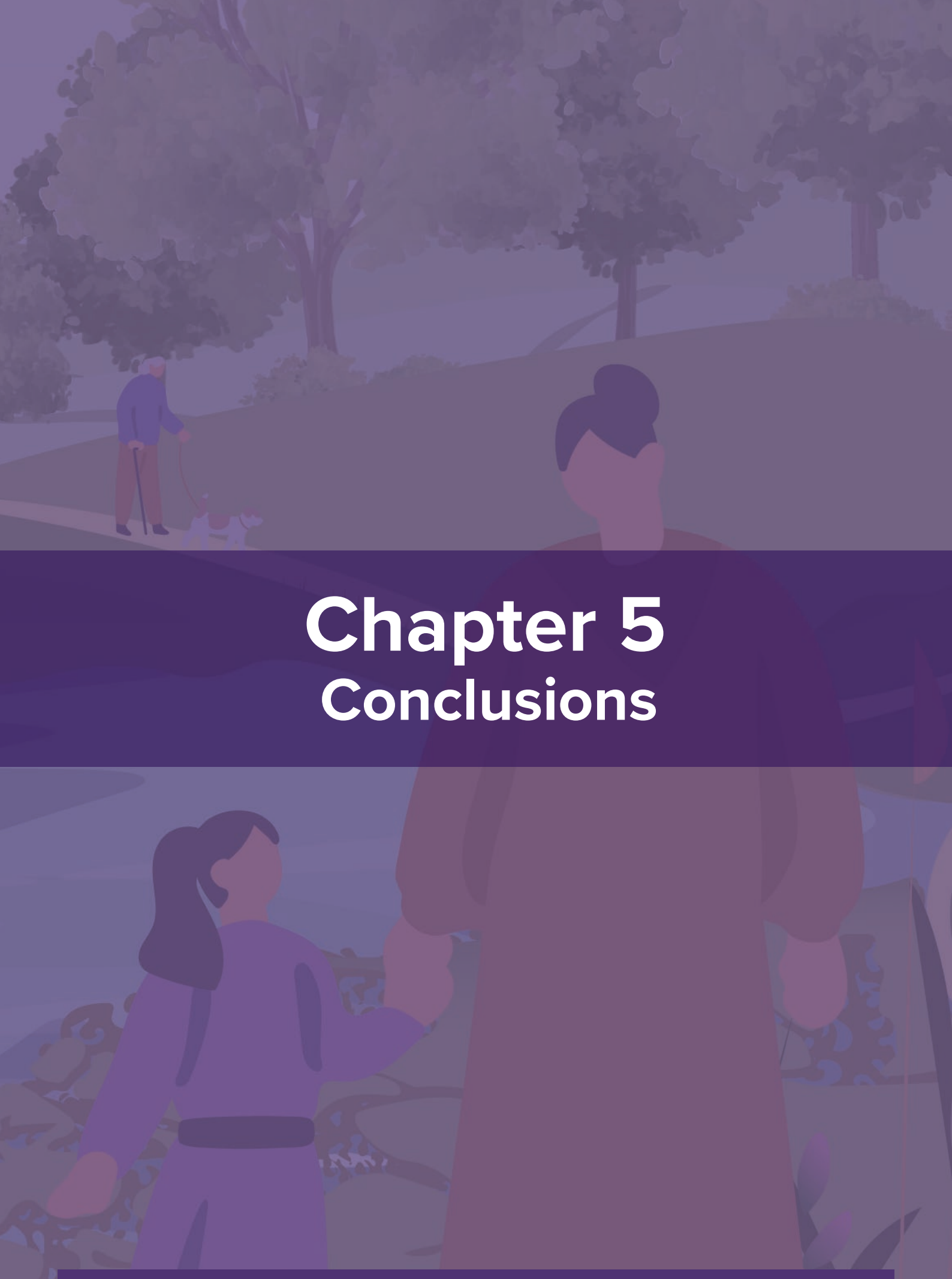
- Tree planting
- Runoff attenuation features (RAFs)
- Floodplain re-connection
- Gully blocking
- Soil structure improvements

The 65 case studies are contained in four zip files, which can be downloaded from Working with Natural Process to reduce flood risk web page[21], and Appendix 1 of the document provides a key that links the case studies to the five intervention types above[22]. If time is available, benefits from these relevant case studies could be supplemented to the data collated in this project to provide potentially more precise forecasts. This approach should be used in the short-term while better data is collated and analysed.

20 Natural Flood Management Programme: evaluation report - GOV.UK (www.gov.uk)

21 Working with natural processes to reduce flood risk - GOV.UK (www.gov.uk)

22 Working_with_natural_processes_using_the_evidence_base_appendix_1_flood_risk_matrix.xlsx (live.com)



Chapter 5
Conclusions

5 - Conclusions

The original aim of the project was to consider the following questions:

a) assess the full benefits of a selection NFM schemes already completed or underway by local Wildlife Trusts, and

b) to bring together existing literature on the societal net benefits of NFM schemes and the implications of this evidence for decision makers, including insurance providers.

5.1 Benefits

The ten Wildlife Trust NFM projects are part of a much larger number of projects underway across the country, predominantly led by eNGOs, LLFAs or the Environment Agency.

The data available from each of the projects is highly variable with each project collecting data relevant to the Trust's own requirements including their strategic aims, funder requirements or stakeholder needs. This situation provides difficulty in providing a comparison of analysis of data as no two projects are the same.

The data that does exist highlights that NFM projects have a positive impact on reducing flood risk, and provide additional, multiple benefits to other ecosystem services.

Both urban and rural focused NFM projects provide multiple benefit to ecosystem services.

The communities surrounding the four project sites where we undertook community engagement surveys have a good awareness of climate change risk in general, and the effectiveness of flood management methods – though by nature of their engagement with eNGOs they are likely to be more informed on these subjects than the general population.

Communities are generally aware of their local NFM project. They have concerns about climate change on their local community, and that they are already seeing the impacts. These include the impacts of flooding, with nearly half of respondents believing that flooding had worsened in the past five years, and a greater percentage of respondents concerned about future impacts of increased flood risk. It is important to note therefore, that respondents from the four projects, generally felt that their local NFM project had been positive in reducing flood risk.

There is a wide range of data available for each service against each project. There is a need to develop standardised data collection from all future NFM projects. This standardisation will enable much more rigorous and consistent quantification and normalisation (i.e. carbon reduction per ha, flood reduction per 1,000 properties) of benefits, which in turn could be used to provide more reliable national forecasts.

A normalisation of the financial benefits for multiple services was undertaken for the project sites to consider a national valuation. This analysis highlighted a wide range of valued benefits are available for different NFM projects for a number of reasons i.e. scale of project, maturity of project, data available.

5.2 Literature

There is a large amount of peer-reviewed and other literature looking at NFM projects across the country. However, attempts to quantify the economics of the multiple benefits provided by NFM projects have been limited. It is clear that there are a number of positive outcomes from NFM projects:

- NFM measures can lead to a reduction in peak flows during flood events, protecting properties, commercial premises, key infrastructure and utilities.
- NFM provides opportunities for multiple benefits for multiple ecosystem services.
- NFM projects can be successful in both urban and rural areas utilising different techniques depending on the location, and at different scales.
- Collaboration of multiple stakeholders is an important element of success in NFM projects.
- Blended finance provides opportunities for projects to engage multiple funders and financiers, often with multiple drivers, to secure investment into NFM projects.

NFM is currently funded, largely, through public or philanthropic funding sources. Those NFM projects with private financing as well, tend to be as part of a blended financial approach. Private funded projects, as with public funded projects (i.e. LLFA or EA funding to directly reduce flood risk) tend to be linked to a material risk to the investor i.e. a water company using SuDs as part of a removal of surface flow from sewerage systems.

Whilst there are current opportunities being developed for blended finance, there remain a number of barriers to increased private financing of NFM. These are wide ranging and are largely around increasing confidence. Current barriers include:

- A lack of confidence in the success of NFM measures at a range of catchment and project scales.
- A lack of nationally accepted design standards for NFM.
- Insufficient data and evidence gathered for the success of NFM focused projects looking at multiple benefits
- A lack of certainty or consistency about who is responsible for long term maintenance and how long measures are to be maintained
- A lack of consistency of the type, range and timeframe of project monitoring.
- There is no, regularly maintained central database for NFM projects in the UK providing details of programme, successes, valuation, data collection, lessons learnt etc.

Given that NFM provides potential benefits for all in society, multiple sectors have an opportunity to influence and engage in the future of the technique. A key sector considered in the literature review has been the insurance industry. Stakeholders in the insurance sector are already engaging in NFM projects across the country, and for multiple objectives and have an important role to play, in collaboration with other sectors. However, due to the wider societal benefits, the principal drive must come from central and local government.

Whilst there is currently a lack of commercial incentives for the insurance industry to directly invest in NFM measures (including increased premiums, free riding, the role of Flood Re in housing cover, and a lack of regulation or government drivers), there is increasing interest in furthering the understanding of NFM and the impact it may have on business, in particular in light of increasing risk due to climate change.

Ultimately, there remains uncertainty for investors from multiple sectors in the likely results or return on investment of any particular NFM project. If private financing is to be made available directly for NFM projects, there requires a standardised approach to project development, monitoring, and understanding of likely outcomes to provide assurance to public, philanthropic and private investors. The multiple benefits realised from NFM projects, for climate, environment and people, provides the case for increased investment from the public sector, and if a framework associated with new projects can remove the uncertainties described here, the opportunity for increased investment from multiple sources can increase the benefit.

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