Nature for Water FACILITY

WARWICKSHIRE AVON

Nature-Based Solutions Programme

Business Case Summary

2025

Environment Agency

Warwickshire Wildlife Trust

Warwickshire County Council

SEVERN TRENT

Contents

Acknowledgements

Lead Authors: Lola Grundmann, Jack Beard

Contributors: Thomas Skurtis, Mehdi Mestassi, Michael Vice, Ian Jelley, Nicola Edgar, Richard Smith, Matthew Palmer, Georgina Flower, David Lowe

Executive Summary

A Shared Vision for a Resilient Future

We imagine a thriving Warwickshire Avon catchment where Nature-based Solutions (NbS) secure water resilience, restore biodiversity, support sustainable economic growth and empower communities through long-term collaboration, investment and stewardship.

A Unique Partnership

Warwickshire Wildlife Trust, Warwickshire County Council, Severn Trent, and the Environment Agency have formed a pioneering partnership to scale NbS across the catchment.

Critical Challenges across the Catchment

The region faces growing flood risk, poor water quality, and biodiversity loss driven by land use pressures, ageing infrastructure, and climate change. While flooding is the immediate concern, future climate-driven drought and water shortages could threaten food security and economic growth. These impacts hinder sustainable development, harm public health, and degrade quality of life and natural habitats.

Working with Nature: Our Holistic Solution

NbS offer a cost-effective alternative to traditional grey infrastructure – reducing flooding, improving water quality, and enhancing groundwater recharge – though their benefits extend well beyond this. When implemented catchment-wide, NbS provide a regenerative, long-term approach delivering water and food security, biodiversity, carbon capture, and community wellbeing. They also enhance existing infrastructure by extending its lifespan, easing pressures, and enabling adaptation to climate change and climate shocks.

A New Model for Delivery

The proposed solution represents a shift in how water is valued and delivered. A new delivery model is needed – collaborative, cross-sectoral, and designed to deliver multiple benefits. The core partners are committed to formalising collaboration, with decision-making protocols and delivery structures to be defined and iterated upon in the next phase. Options are being explored to balance broad stakeholder participation with prioritising optimal NbS for catchment health.

Science and Technical Analysis

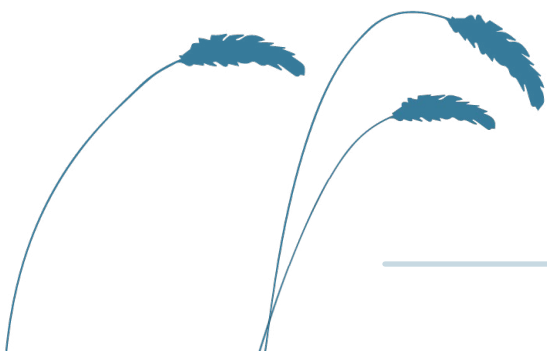
Our specialist team applied best-practice NbS optimisation – GIS mapping, advanced hydrological modelling, and spatial analysis – to propose a robust, catchment-wide approach. The models show that at-scale NbS can significantly reduce flooding, improve water quality and availability, and deliver major benefits to people and nature.

What Will This Cost, and What Will it Return?

We undertook a rigorous analysis of costs and benefits to implement the proposed catchment-wide NbS approach through a partner-led investment Programme (the “Programme”). The full Programme could require up to £700 million over 30 years and is expected to generate around £2 billion in economic benefits – a benefit-to-cost ratio of approximately 2.7 to 1. Crucially, this level of investment is not needed upfront: early funding can already deliver meaningful outcomes such as reduced flooding, while building momentum for wider-scale implementation.

What Shall We do Next? Urgent Call to Action

Over the next three years, the partners aim to establish a Water Hub – a coordinated collective to manage investment and track benefits for at-scale NbS. For this start-up phase, the partners will expand their network and seek to raise £4.4 million to fund initial projects, including technical assistance, programme management, and monitoring. Importantly, the core partners have already committed £300,000 in support of this effort. A roadmap defines key steps to establish governance, delivery models, and stakeholder participation to ensure long-term viability.



Overview & Vision

Warwickshire Wildlife Trust (WWT), Warwickshire County Council, Severn Trent, and the Environment Agency have partnered to explore ways to collaboratively address the water-related challenges in the Warwickshire Avon Catchment leveraging Nature-based Solutions (NbS).

The partners all have a track record of implementing NbS on their own, and recognise more collaboration and greater scale of implementation are needed in order to address the catchment's challenges holistically. Therefore, the partners' vision is to pioneer a collaborative partnership model for a resilient water future. Over the past year, the Nature for Water Facility (N4W) has supported the partnership in refining its vision and assessing the case for large-scale NbS implementation.

This work is grounded in robust technical analyses – including stakeholder mapping, GIS-based spatial assessments, hydrological modelling, and cost-benefit analysis. The findings provide a strong, action-oriented evidence base to support fundraising efforts and inform the next phase of the Programme focused on piloting and delivering NbS interventions.

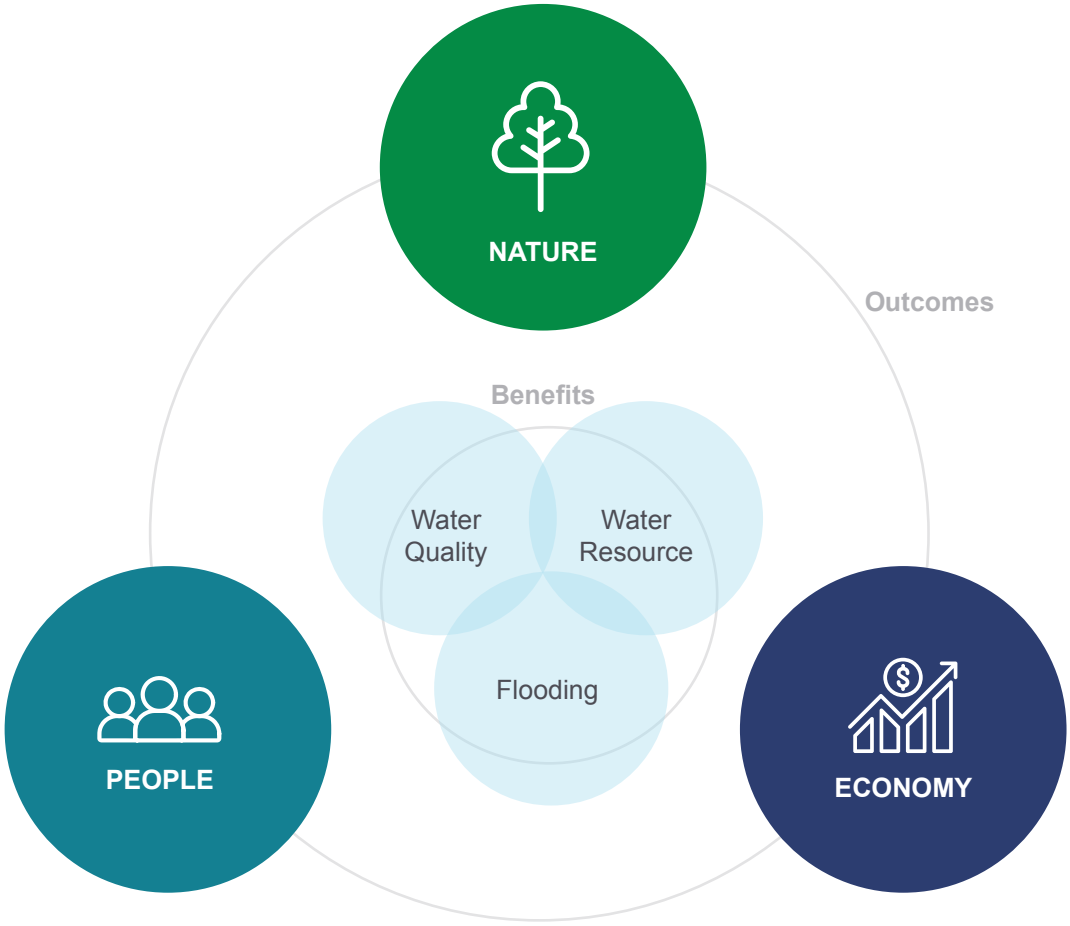


Figure 1: Vision statement for the Programme

The aim of this Programme is to pioneer a collaborative partnership model in the Warwickshire Avon to scale up funding for Nature-based Solutions that secure a resilient water future.

The Programme's vision is to deliver a catchment that is resilient to climate and nature-related water risks delivering tangible benefits for Nature, People, and the Economy. It will identify sustainable and holistic land and water management interventions which tackle water security challenges including flooding, water quality and water availability across the catchment.

Water and Nature-related Challenges in the Warwickshire Avon Catchment

The Warwickshire Avon catchment *(see Figure 2)* is facing escalating environmental and social challenges. The intensification of agriculture and urban development, combined with physical modifications to waterways, has profoundly degraded the landscape. This has reduced the catchment's natural capacity to manage water, resulting in frequent and severe flooding and failing water quality[1].

These pressures not only threaten homes and infrastructure but also harm wildlife, degrade aquatic ecosystems, and limit the recreational use of rivers and streams. Flooding is a serious challenge for local communities, damaging homes, infrastructure, and livelihoods, in addition to hindering economic development by restricting land available for sustainable housing and investment[2].

Climate change and population growth are compounding these issues by increasing demands on the river and its capacity to manage increasingly erratic rainfall, driving more frequent and severe flood events that disrupt industry supply chains, affect transport, and impact daily life across the region. As a result, insurance premiums are rising to unsustainable levels, placing additional strain on local communities[3].

By 2080, over 18,000 homes across the catchment are projected to be at risk of flooding[4].

98% of water bodies in the catchment continuously fail to meet good ecological status under the Water Framework Directive (WFD).

Figure 2: Map of the Warwickshire Avon catchment

[1]Severn Rivers Trust, Warwickshire Wildlife Trust, Catchment Based Approach. Warwickshire Avon Catchment Plan (2023). Link.
[2]River Severn Partnership. Unlocking opportunities for the Severn Regional Growth Zone (2021). Link
[3]Deloitte (2024), Guardian (2024)
[4]*Environment Agency, 2100+ River Severn adaptive pathways report, draft version*

Nature-based Solutions to Build a Water Resilient Future

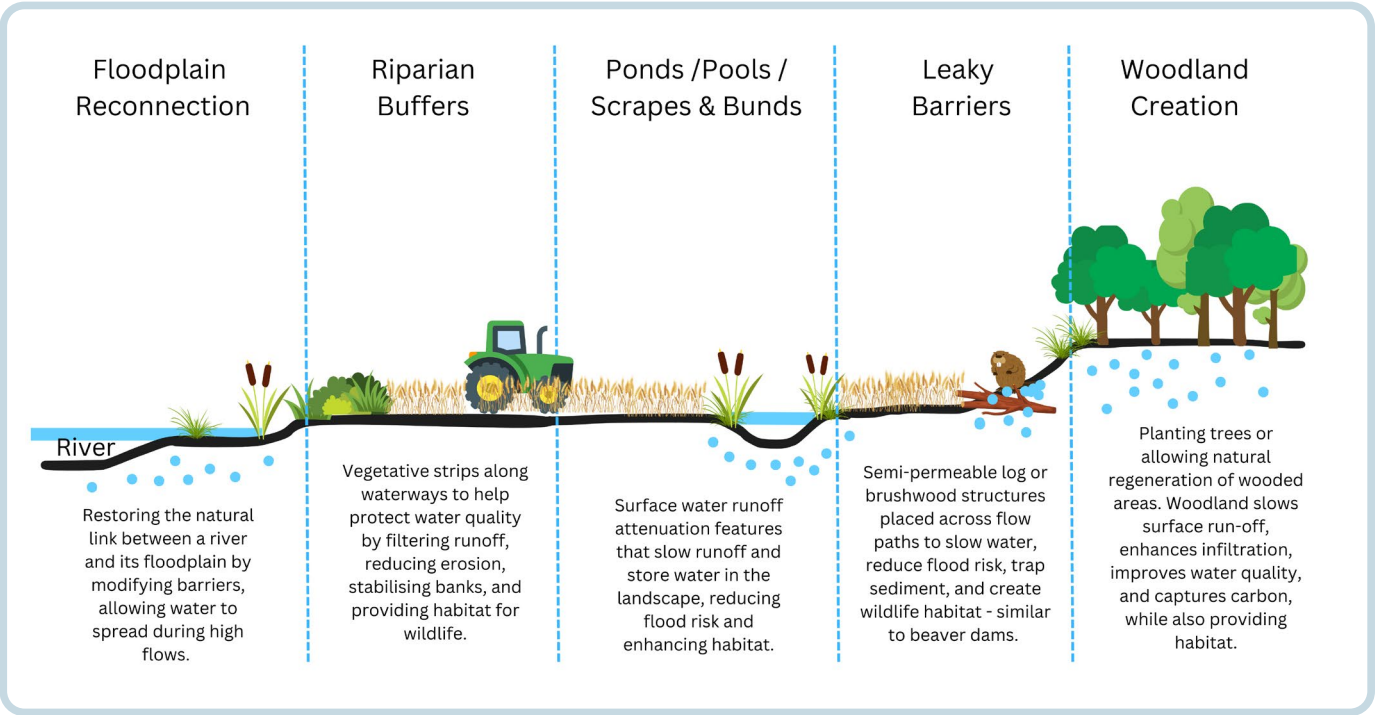


Figure 3: Shortlist of priority NbS

NbS offer a cost-effective and adaptive approach to managing water-related challenges. For example, in the Warwickshire Avon catchment, delivering conventional flood defences to small and dispersed communities has often proven prohibitively expensive or technically complex[5].

In this context, NbS present a practical and scalable opportunity to strengthen local water security – either on their own or in combination with grey infrastructure – while also delivering a wide range of additional benefits. By working with natural processes, NbS can help reduce flood risk, improve water quality, and enhance the resilience of water resources, while supporting biodiversity, creating recreational spaces, and promoting community wellbeing. Recognising this potential, N4W and the core partners have identified a shortlist of NbS approaches tailored to the Warwickshire Avon through the integration of GIS mapping, hydrological modelling, and local expertise.

[5]*Green Finance Institute. Financing Natural Flood Management (2023). Link*

The Need for Collaboration and a New Delivery Model

Investment in NbS in the region to date has been fragmented and opportunistic, often triggered by specific water-related crises. While some local interventions have been delivered, many proposed schemes remain unviable due to persistent challenges around deliverability, economic justification, and funding shortfalls. This approach is falling short at a time when communities are facing increasingly urgent and interconnected challenges.

Each of the partners is already investing in solutions, strategies, or on-the-ground delivery. However, they recognise that isolated individual action will not be enough to meet this challenge – especially when relying solely on conventional grey infrastructure. This delivery model is no longer fit for purpose. We need to fundamentally rethink how we manage water resilience to enable catchment-wide adaptation. This requires an approach that is:

1. **Cross-sector and catchment-wide** – to tackle water resilience at the appropriate scale.

2. **Focused on maximising wider benefits** – to unlock partnership funding and collaborative delivery.

3. **Truly collaborative** – moving beyond a single-organisation model and recognising that many stakeholders are affected by and responsible for water resilience in the catchment. Working together, we can deliver more impactful and lasting outcomes.

The partners are committed to formalising and expanding their collaboration and have begun exploring what a new delivery model could look like – reflecting a necessary shift toward more integrated, proactive, and nature-based approaches to water and land management.

The core partners are committed to formalising collaboration, with decision-making protocols and delivery structures to be defined and iterated upon in the next phase. Options are being explored that allow for a wider range of stakeholders to come onboard. Examples include a hosted programme within one of the partners existing organisational structures or a newly incorporated entity.

Relevant Stakeholders

Recognising the need to expand the partnership, N4W and the core partners have undertaken a comprehensive stakeholder engagement process to better understand the problem, stakeholder interests and economic incentives, potential roles, and barriers to participation. They also explored the level of evidence stakeholders would require to get involved, engaged with other catchment projects, and began conversations with potential funders.

Steering Group (Core Partners)

- Severn Trent (ST)
- Warwickshire Wildlife Trust (WWT)
- Environment Agency (EA)
- Warwickshire County Council (WCC)

Inform and Consult

- District Councils (Rugby, Stratford, Warwick)
- Water Resources West
- River Severn Partnership
- Solihull Metropolitan Borough Council
- Coventry City Council
- Steering Group

Operational Group

- Severn Rivers Trust
- Woodland Trust
- National Farmers Union
- Heart of England Forest
- Natural England
- Forestry Commission
- Warwickshire Rural Hub
- Local Food Action Groups
- Warwickshire Association of Local Councils
- Country Land and Business Association

Other Stakeholders

- Agricultural Supply Chain Actors
- Farmers and Landowners
- Wider Public
- Insurance Companies
- Flood Re
- Manufacturing Industry
- Housing Developers

Restoring Natural Function: Technical Evidence that NbS Reactivate Ecosystem Services and Deliver Tangible Benefits

N4W conducted a state-of-the-art scientific analysis, involving mapping and modelling the catchment-scale implementation of NbS. It showed that NbS delivered across the Warwickshire Avon could significantly reduce flooding, improve water quality and groundwater recharge, while also providing multiple co-benefits for biodiversity, climate, and local communities.

Opportunity mapping *(Figure 5)* revealed widespread potential for the delivery of NbS across the Warwickshire Avon catchment with minimal impact on productive agricultural areas. Specifically, it demonstrated that interventions that store water (leaky barriers, ponds, pools, scrapes, and bunds), riparian buffers, and floodplain reconnection can be implemented in low productivity, naturally wet areas, with changes in land use (woodland creation) limited to headwater areas.

These maps were produced through spatial analysis based on physical factors, e.g. where runoff naturally accumulates, and proximity to watercourses. These outputs will help guide Warwickshire's Local Nature Recovery Strategy (LNRS) to target the implementation of priority habitats – an important first step that requires additional on-the-ground delivery mechanisms to realise the strategy's water aims.

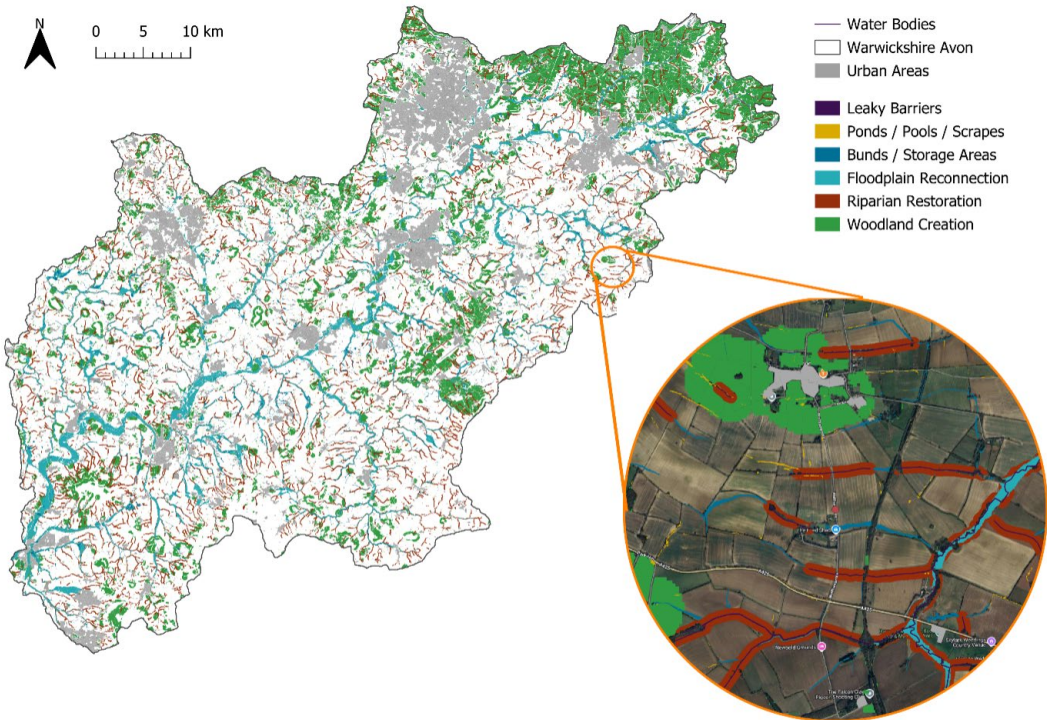


Figure 5: Opportunity mapping for the Warwickshire Avon

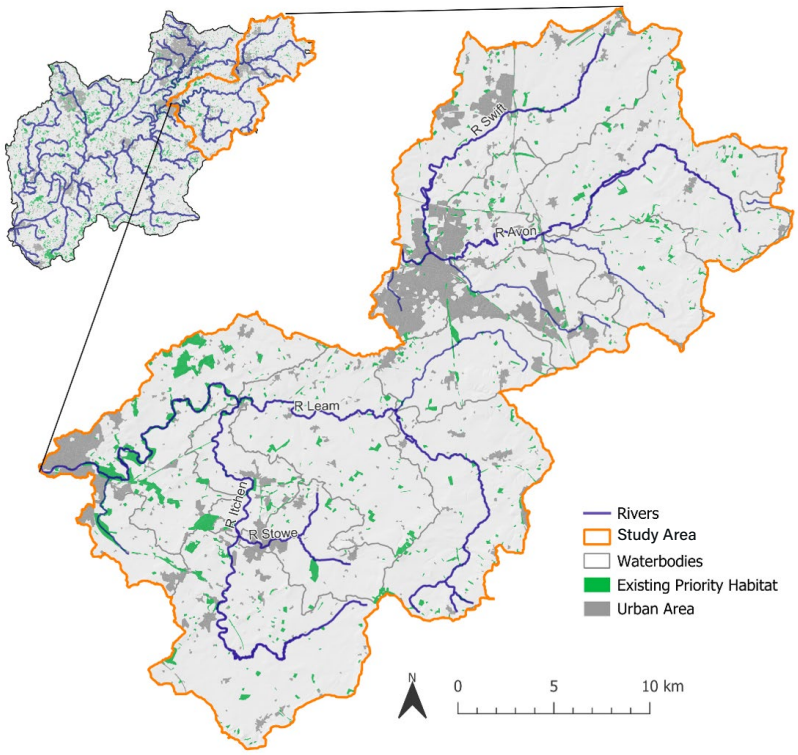


Figure 6: Targeted area of interest for the Warwickshire Avon

Detailed modelling was conducted for a specific study area covering 14 water bodies upstream of Rugby and Leamington Spa *(Figure 6)* and findings were extrapolated across the entire catchment. In the study area we have modelled flood flows, water quality, recharge potential, and biodiversity impacts along with several other ecosystem services identified in the Government's Green Book. The modelled area was identified as a priority due to having clear water security challenges, an existing willingness to implement NbS from partner organisations, and physical opportunity to deliver NbS.

Scenario modelling showed that the maximum efficiencies in terms of environmental benefits could be achieved at lower implementation levels (around a quarter of the total opportunity areas shown in Figure 5). This finding helped prioritise a final portfolio of NbS, which was deemed realistic in terms of implementation capacity across the catchment and composed of a blend of interventions delivered across the modelled area of interest *(See Table 1 on following page)*.

This portfolio accounts for approximately 5% of the modelled area of interest, delivering a substantial amount of high-quality habitat while minimising impacts on productive agricultural land. Modelling of the final portfolio of NbS showed that these interventions would lead to significant positive impacts on water-related outcomes, including reduced flooding, improved water quality and securing water resources, as well as benefitting the quality of habitats and biodiversity.

Flood flow modelling showed that this portfolio would lead to around a 20% reduction in peak flood flows in Leamington Spa, and a 10% reduction in Rugby *(Figure 7)*. This translates to a significant decrease in the frequency

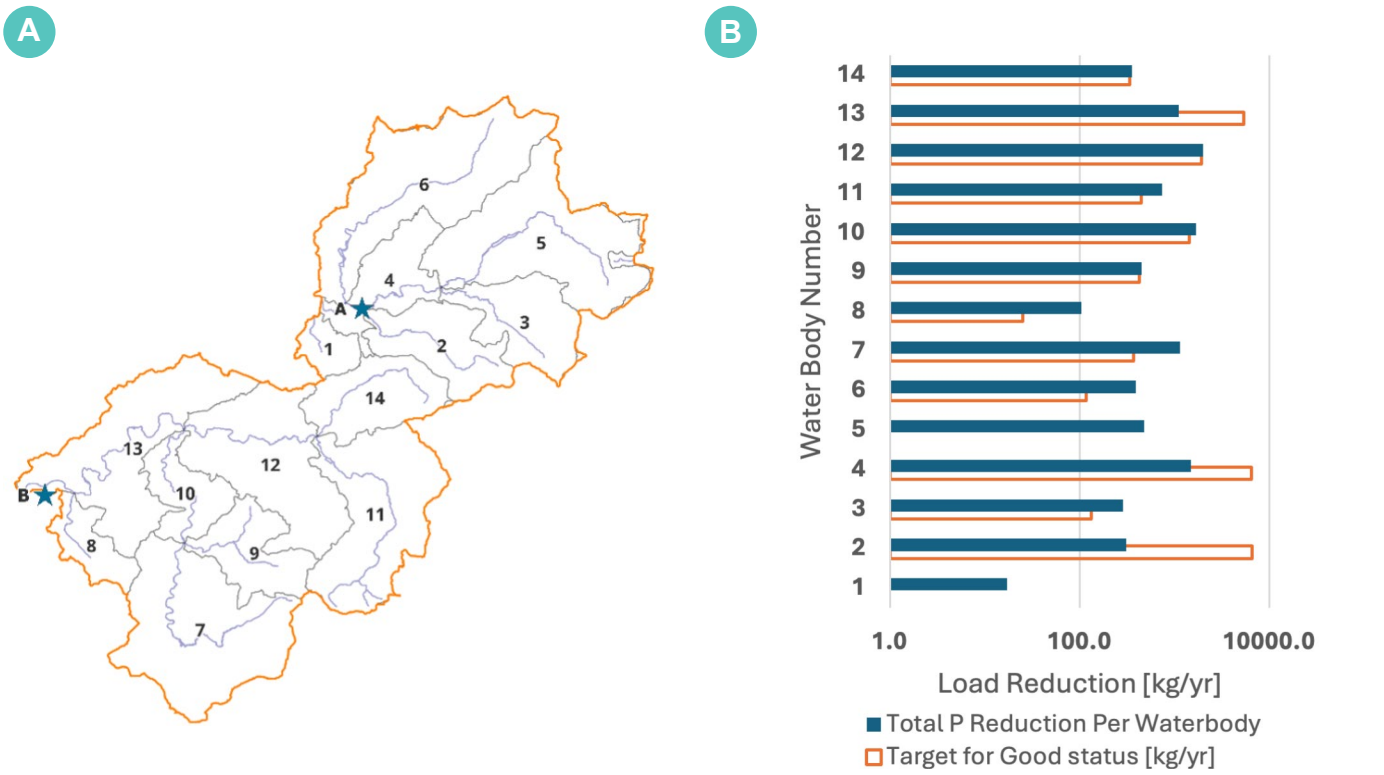
and severity of river flooding in these areas. In real terms, this means fewer homes and businesses flooded, less disruption to communities, and better protection for critical infrastructure and agriculture.

Reductions of a similar magnitude were also predicted for smaller, more dispersed communities that are often difficult to protect using traditional grey infrastructure, as they fail to meet return-on-investment criteria due to the combination of small population size and high capital costs. In these contexts, NbS represent not just an alternative, but the only feasible approach to mitigating flood risk, highlighting their critical role in building safer, more resilient communities across the Warwickshire Avon.

For water quality, the picture is equally promising – model results show that the implementation of this NbS portfolio could significantly reduce nutrient export from the landscape into watercourses. When compared with Water Framework Directive targets for the area, these results indicate that nine out of fourteen modelled water bodies could be brought to good status for phosphate – a key limiting factor in reaching overall good status for many areas in the Warwickshire Avon *(Figure7)*.

NbS	Delivery Area (ha)	Percent of total modelled area (%)
Woodland Creation	2,430	3.4%
Riparian Zone Restoration	736	1%
Floodplain Work	375	0.5%
Leaky Barriers	6	0.01%
Bunds	363	0.5%
Pond Scrapes	66	0.1%
Totals	3,975	5.51%

Table 1: NbS portfolio prioritised within the modelled areas of interest



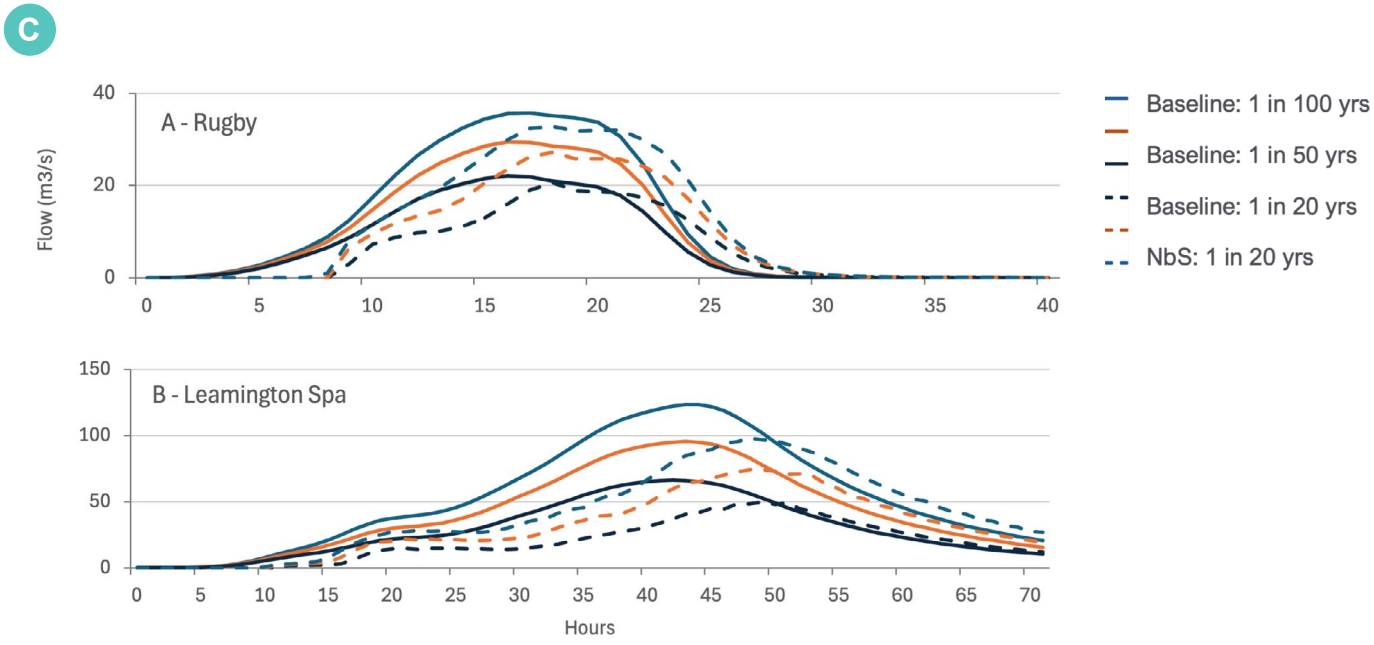


Figure 7: Modelled changes in peak flow for storm events in Rugby and Leamington Spa resulting from NbS portfolio implementation

Investing in NbS Pays Off: £2.70 Return for Every £1 Spent, Plus Lasting Co-Benefits

A Cost-Benefit Analysis (CBA) was conducted to assess the financial and economic feasibility of the proposed partnership model for delivering catchment-scale NbS across the Warwickshire Avon.

The analysis focused on the study area of the 14 water bodies in the Leam and Upper Avon river catchments. Final results were then extrapolated across the entire Warwickshire Avon to roughly estimate the costs and benefits at the catchment scale. The figures below are for the modelled area unless specified otherwise The CBA compared all the costs to implement and maintain the NbS portfolio with the anticipated economic, social, and environmental benefits over 30 years. The costs and benefits were structured as illustrated in the diagram *(Figure 8)*.

The analysis demonstrates that over 30 years, the Programme would hold strong economic viability. For every £1 invested, it is expected to generate at least £2.50 in socio-economic and financial benefits across the study area. If scaled to the entire catchment, the benefits per £1 increase to £2.70 from the economies of scale, requiring an investment of ~£700 million over the 30 years, which will return ~£2 billion of economic benefits,

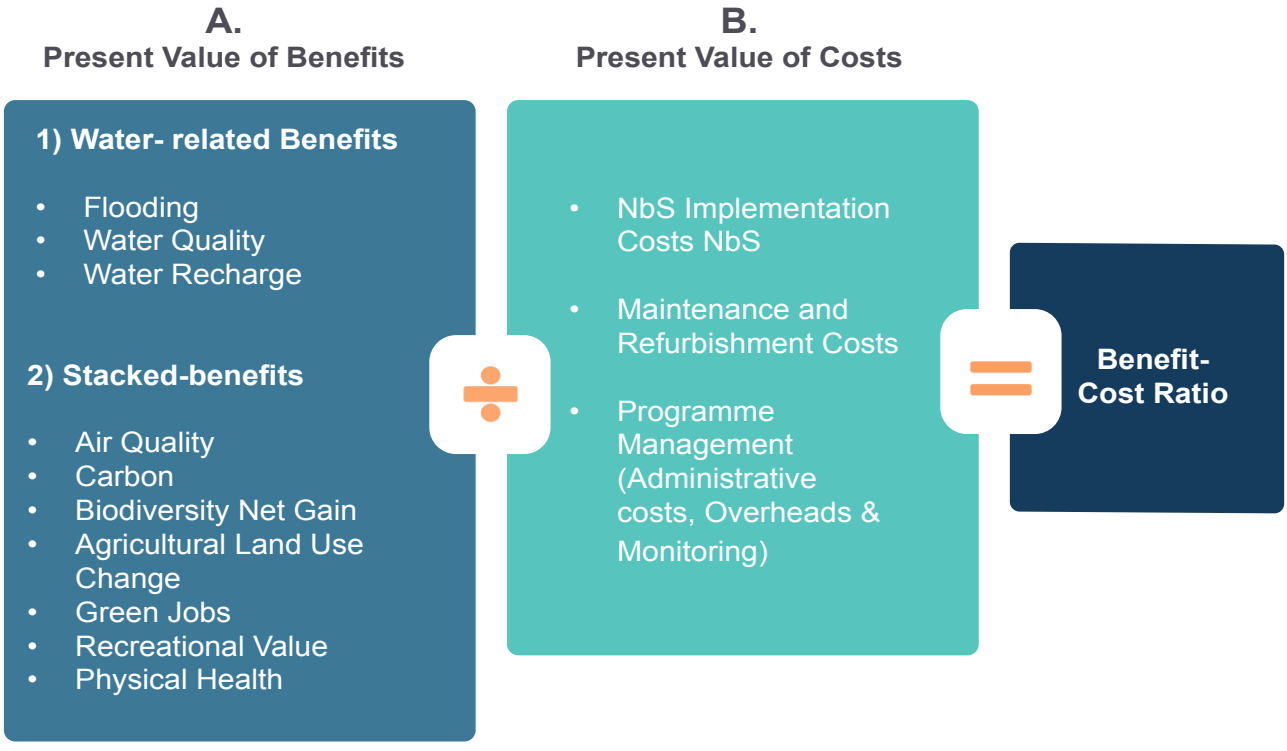
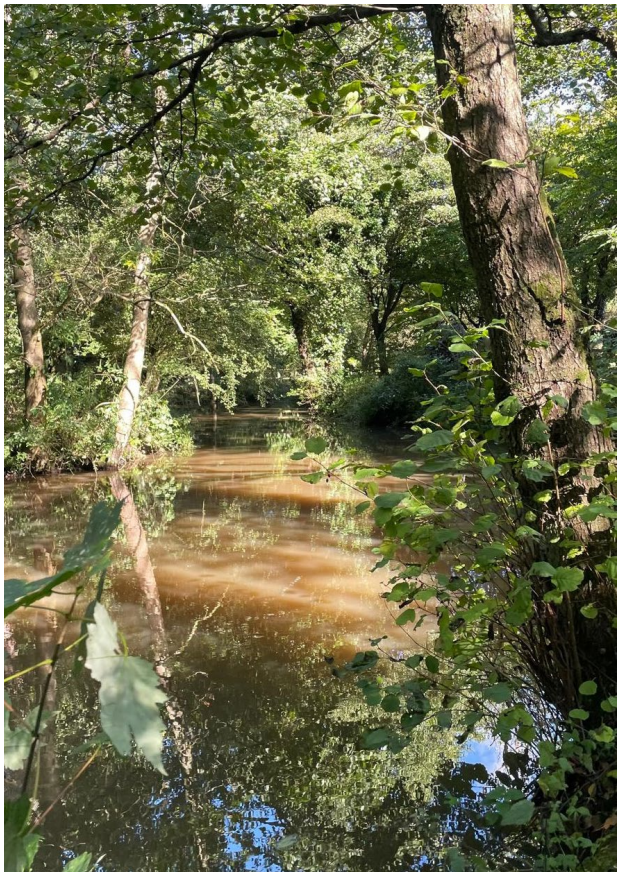


Figure 8: Structure of the CBA

in present-day terms. Crucially, this level of investment is not needed upfront: early funding can already deliver meaningful outcomes such as reduced flooding and improved water quality, while building momentum for wider-scale implementation.

The findings support the use of NbS to achieve the partner's vision of securing a resilient water future. The Programme would generate substantial water benefits (across flooding, quality and recharge) worth £161M, which alone outweigh the costs of the Programme, valued at £149M *(Figure 9)*.

The additional stacked benefits centred around Climate, Biodiversity and Community contribute a further £221M, demonstrating strong economic viability and wide-ranging impacts of the Programme *(Figure 9)*.



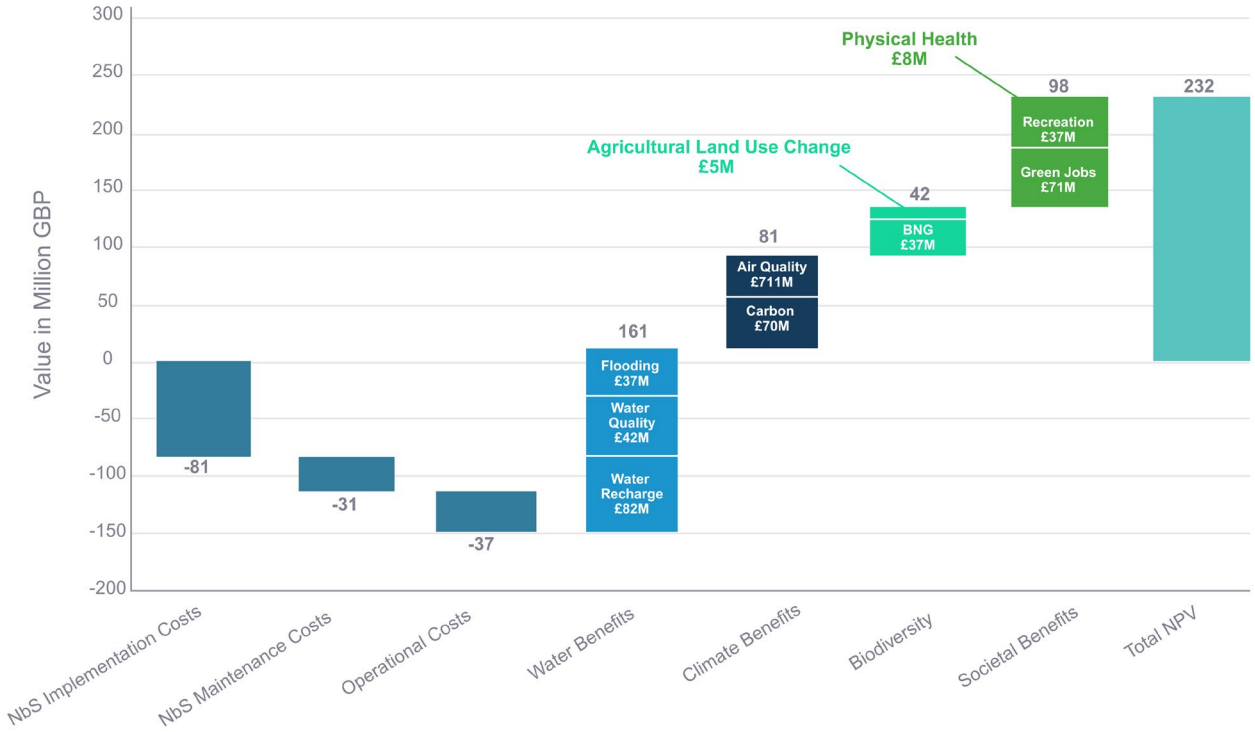


Figure 9: Waterfall chart of costs, benefits and NPV in the study area

This Programme demonstrates the wide-ranging and measurable benefits that NbS can deliver – across water, climate, biodiversity, and communities – making a strong case for targeted investment at scale.

The Programme delivers clear value across sectors. For water companies, it provides a practical, nature-based route to achieving regulatory and environmental targets. Local authorities progress their climate, biodiversity, and wellbeing agendas.

Businesses manage nature and water-related risks while advancing ESG commitments. Landowners and farmers benefit from greater resilience and new income opportunities through nature-based approaches. And communities enjoy reduced flooding, cleaner rivers, and better access to green space. Beyond these direct outcomes, the Programme helps reduce combined sewer overflows, lower insurance costs, and improve water quality – unlocking broader resilience and economic opportunity across the region.

The measurable benefits of Nature-based Solutions

WATER BENEFITS	**Water Resources** 8 million m^3/year of water recharged	**Water Quality** 11/14 Water Bodies with improved Water	**Flooding** 2,692 properties with reduced flood risk
CLIMATE BENEFITS	**Air Quality** 1,076 tonnes of harmful pollutants removed risk	**Carbon** 386,152 tonnes of CO2 mitigated (Across 30 Years)	
BIODIVERSITY BENEFITS	**Biodiversity Net Gain** 3,383 BNG units	**Agricultural Land Use Change** 4.5M productivity gain due to land use change and improved biodiversity flood risk	
COMMUNITY BENEFITS	**Physical Health** Over 300K visits/year, of which 156K are active, with positive health impacts	**Recreational Value** 3,500 ha of new recreational area	**Green Jobs** 1,350 Green Jobs created

Figure 10: Key impact metrics for each benefit category across the study area

A New Paradigm for Water Resilience:
Scaling Nature-Based Solutions in the Warwickshire Avon

This feasibility study highlights a compelling opportunity for the partners to lead the way in building a resilient water future through the strategic use of NbS. The findings show that a catchment-scale roll out of NbS can deliver significant economic, environmental, and social benefits – providing a holistic approach to the catchment's complex and intertwined challenges that grey infrastructure failed to address on its own.

By working together, Warwickshire Wildlife Trust, Warwickshire County Council, Severn Trent, and the Environment Agency can leverage their complementary strengths and aligned visions to unlock co-funding opportunities from a wider network of stakeholders. The strong synergies between partners and shared interests across sectors-spanning flood resilience, water resources and quality, biodiversity, and community wellbeing-create fertile ground for collective investment and delivery.

Nature must be central to the solution. As pressures on traditional infrastructure grow, NbS offer a scalable, adaptive, and cost-effective way to enhance overall system performance-particularly in rural areas that need to be both protected and revitalised.

This Programme offers the chance to rethink how we value and manage our natural systems, enabling bold action and lasting change for people and the environment.

Partners Are Ready-

Join Us in Turning the Vision for NbS into Reality

The core partners are committed to advancing this Programme and establishing lasting governance and funding mechanisms to scale NbS. Partners recognise the need to widen the partnership network and are envisioning a Water Hub – a coordinated collective that manages investment and tracks benefits in the long-term. They have a strong track record of delivering proof of concept projects on the ground and the right mix of delivery, industry and regulatory insight needed to turn the vision into a reality.

The roadmap to achieving this vision is outlined below:

1. **Establish a Coordinating Function**
   Formalise the partnership structure.
2. **Assess Short-Term Funding Opportunities**
   Identify and secure initial financial resources to cover the revenue costs of establishing the approach.
3. **Prioritise Interventions at Field-scale**
   Analyse priority areas based on the existing opportunity mapping.
4. **Develop a 5-Year Implementation Plan**
   Outline strategic actions and milestones.
5. **Define the Governance Structure**
   Clarify decision-making processes and roles.
6. **Design the Delivery Model and Capacity**
   Establish how the Programme will be executed in practice and build readiness and capacity for delivery.
7. **Develop a Monitoring and Evaluation Framework**
   Track progress and measure impact.
8. **Implement Initial Partnership Projects**
   Outline strategic actions and milestones.
9. **Formulate a Sustainable Funding Strategy**
   Ensure long-term financial viability.
10. **Engage Stakeholders**
    Continuous alignment with key actors.

To support this next phase, the Programme will require £4.4 million, with £300,000 already committed by core partners.

The majority of this funding – over 70% – will be dedicated to the implementation and maintenance of initial partnership projects, laying the foundation for large-scale NbS deployment. The remaining funds will support the technical assistance, programme management, and monitoring needed to ensure the Programme is implementation-ready and backed by strong evidence. The costs are broken down as follows:

Cost Breakdown

- **£300,000**
  In-kind contributions from core partners (already committed)
- **£200,000**
  Technical assistance
- **£750,000**
  Programme management (Over 2 years)
- **£190,000**
  Monitoring (2 years)
- **£3,000,000**
  Implementation and maintenance of initial partnership projects

Total: **£4,440,000**

This figure represents the funding required for the start-up phase, supporting the transition toward readiness for scaling up NbS implementation across the catchment. Beyond this initial transition phase, the fundraising target is expected to be significantly higher.

Pressures on the River Avon

- Intensive Agriculture / Activity
- Heavily Modified Watercourses
- Urban Development
- Ageing and Overloaded Drainage and Sewer System
- Climate Change

Impacts

- Frequent and Severe Flooding
- Water Quality Degradation
- Loss of Biodiversity and Ecosystem Health
- Reduced Recreational Opportunities System
- Declining Public Health and Wellbeing

The Warwickshire Avon Water Hub

A collaborative approach to create resilient water future for all by investing in Nature-based Solutions.

- Riparian Buffers
- Ponds/Pools/ Scrapes and Bunds
- Woodland Creation
- Leaky Barriers
- Floodplain Reconnection

Outcomes (Over 30 Years)

Water Benefits

Water Resources
8MCM/year of water recharged

Water Quality
11/14 Water Bodies with improved Water Quality

Flooding
2,692 properties with reduced flood risk

Climate Benefits

Air Quality
1,076 tonnes of harmful pollutants removed

Carbon
386,152 tonnes of CO_2 mitigated (Across 30 Years)

Biodiversity Benefits

Biodiversity Net Gain
3,383 BNG units

Agricultural Land Use Change
4.5M productivity gain due to land use change and improved biodiversity

Community Benefits

Green Jobs
1,350 Green Jobs created

Recreational Value
3,500 ha of new recreational area

Physical Health
Over 300K visits/year, of which 156K are active, with positive health impacts

www.nature4water.org