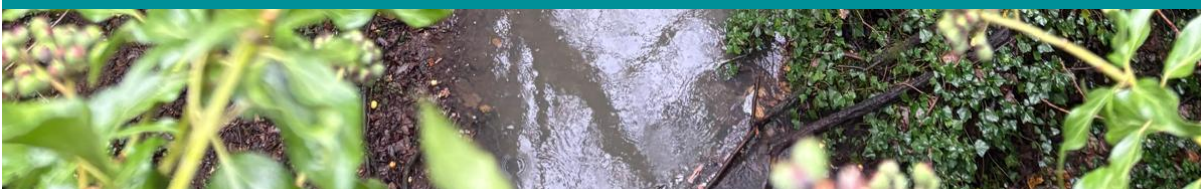




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1. EXECUTIVE SUMMARY

This report, written by Thames21, is designed to feed into the design of Natural Flood Management (NFM) proposals in Bloxham, Oxfordshire. Thames21 is a charity that improves rivers through nature-based solutions across the Thames basin, with an ethos that is grounded in evidence based approach with effective community participation and buy-in.

This report presents a feasibility assessment of NFM opportunities within the Bloxham catchment, Oxfordshire. The study combines desk-based analysis and site surveys to identify locations where interventions can intercept, store, and attenuate surface water runoff before it reaches downstream receptors.

A total of five land Groups spreading over 1.81km² of the total 7.18km² catchment were assessed, resulting in the identification of a series of field-corner bunds, storage pond enhancements, and leaky dams. Terrain-based flow path analysis suggests that these interventions could provide approximately 3,535 m³ of temporary flood storage, equating to an estimated 1.3% reduction in runoff during a rainfall event comparable to that experienced in November 2024. Comparing to EA historic datasets suggests a 3.5% runoff reduction when calibrated to an average significant storm event since records began.

The proposed measures are most effective during smaller, more frequent storm events, where storage capacity is unlikely to be exceeded and attenuation benefits can be maximised. During more extreme events, while capacity may be exceeded, the interventions will still contribute to delaying peak flows and reducing downstream pressure.

The study demonstrates that a distributed, catchment-scale approach to NFM can deliver cumulative benefits, particularly when implemented across multiple landholdings. However, current proposals cover approximately 25% of the upstream catchment, and wider landowner participation would significantly increase overall effectiveness.

The findings support a phased approach to implementation, prioritising deliverable interventions while building evidence, landowner confidence, and partnership momentum to enable future expansion.

1.1 Key findings

- A total of 3,535 m³ of temporary flood storage has been identified across five land Groups upstream of Bloxham.
- This equates to an estimated 1.3% reduction in runoff during an event comparable to the November 2024 flood, based on volumetric analysis of the 7.18km² upstream catchment.
- A 3.5% reduction in runoff from common significant storms.
- The most effective interventions include field-corner bunds, pond desilting and expansion, and leaky dams, all located at high-impact flow convergence points.
- SCALGO flow-path modelling and site surveys showed strong alignment, increasing confidence in the proposed intervention locations.
- Landowner engagement is noted as positive across all participating land groups, though current proposals cover only ~25% of the upstream catchment, limiting full catchment-scale benefits.
- NFM measures are expected to be most effective during small to medium storm events, with reduced but still meaningful benefits during extreme events.

1.2 Key Recommendations

- Prioritise delivery of interventions in Groups 1, 2 and 4, where storage potential and hydrological impact are greatest.
- Expand landowner engagement to additional upstream farms to increase cumulative storage and slow-the-flow benefits.
- Undertake outline design (RIBA Stage 2) for all proposed bunds, ponds and leaky dams, including cross-sections and cut-fill balance.
- Secure funding through Countryside Stewardship, Higher Tier, and emerging private environmental markets (NEIRF, water company investment).
- Implement a catchment-wide monitoring programme to measure hydrological, ecological and community benefits.

- Develop a phased delivery plan, starting with low-cost, high-impact features to build momentum and confidence.

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2. INTRODUCTION

2.1 Importance of Natural Flood Management (NFM)

Natural Flood Management (NFM) is becoming increasingly important in the UK's approach to flood risk management, especially as climate change intensifies. Traditional flood defences, like flood walls and embankments, are being complemented by NFM techniques that work with natural processes to manage flood risk more sustainably.

Key benefits of NFM

- Reduction in flood peak and volume: NFM techniques, such as leaky barriers and increased upstream storage, help to absorb and slow the flow of water, reducing flood peaks and volumes.
- Enhanced soil and water management: Trees and vegetation under NFM increase water evaporation and improve soil structure, leading to better water retention and reduced surface runoff. This improves soil permeability and decreases the risk of surface and near-surface flooding. Reduction in soil mobilisation and water turbidity also assists in keeping critical top-soil in place and protects ecological functions within streams to support species richness.
- Ecological and social benefits: NFM provides ecological advantages by enhancing biodiversity and creating wildlife habitats. It also offers social benefits, such as recreational spaces and aesthetic value for communities, fostering a connection with the natural environment.
- Complementary to traditional measures: Combining NFM with engineered solutions ensures a more comprehensive and resilient flood management strategy, addressing both immediate and long-term challenges.

NFM utilises a suite of nature-based techniques and holistic management to improve flood resilience across the target area. In this case, interventions in the Bloxham catchment will improve resilience downstream in the village by attenuating water in the surrounding landscape. For this to be effective, holistic solutions to specific problems that Bloxham faces need to be addressed, meaning that interventions suggested in this report expand outside of the river channel and immediate riparian zone, and across the whole catchment.

2.2 Background

Bloxham is a village and civil parish located in northern Oxfordshire, roughly 3 miles southwest of Banbury. The most recent census of 2011 indicates that there are around 3,374 residents in the Bloxham area. The village sits on the edge of a valley which has an underlying geology of ironstone and clay which increases the likelihood of surface water flooding. This flood risk is further increased by a combined sewage system in the village. In addition to surface water issues, Bloxham has fluvial flood risk from Bloxham Brook flowing down to Sor Brook. There have been several serious flood events in recent years with sandbags being used around the village on Tadmarton Road to protect properties. This NFM report will primarily cover solutions to surface water and fluvial flooding.

In November 2024, storm Bert caused significant fluvial and surface water flooding in Bloxham village. The Met Office reported that Oxfordshire received its monthly rainfall average across a three day period of 22nd-24th November. The nearest rain gauge (Grimsby gauge), recorded 68mm of rain across this period with 47mm falling on the 24th alone making it the ninth highest since records began. UK Centre for Ecology and Hydrology data states that this equates to a 9.8 year return period. This means that there is a 10.2% chance that a storm of similar magnitude will occur in any given year.

During the November 2024 event, roads became impassable, and more properties suffered flood damage than those expected on available models. The Section 19 investigation found that up to 35 properties were reported to have flooded. The Cherwell Green & Blue Infrastructure Strategy highlights that fluvial flood risk is a major concern in the district, especially along tributaries of the River Cherwell including its smaller brooks.

The strategic priorities set out by the Cherwell & Ray Catchment Partnership strongly support the role of NFM in the Bloxham area. Their catchment vision explicitly includes flow management, acknowledging that abstractions, rapid runoff, and flooding are pressing issues in this clay-dominated and rural landscape.

The partnership's action plan calls for restoring floodplain connectivity, raising awareness of floodplain–river interactions, and promoting flood storage schemes in suitable locations. These measures should be coordinated with

enhancements in natural capital, such as riparian planting, wetland creation, and soil-health improvements, to deliver biodiversity, climate resilience, and community benefits alongside flood risk reduction.

Importantly, the plan emphasizes working with landowners to identify feasible NFM opportunities and integrating such interventions into planning and development policy which have driven the objectives of this study.

2.3 Objectives

This report has been prepared as a technical note to support the application for delivery funding for NFM projects in Bloxham. This report will identify NFM opportunities in the catchment as well as initial conceptual studies to identify potential projects and set them up for RIBA stage 2 and future funding opportunities.

This report will then be used to support applications to Countryside Stewardship (CS) or Higher Tier (HT) schemes for capital and revenue payments for NFM interventions. These schemes would produce revenue for managing NFM features on arable land for flood and drought resilience.

Working alongside the Bloxham Parish Council, Bloxham Flood group, Cherwell Farm Cluster, Environment Agency and Berkshire Buckinghamshire Oxfordshire Wildlife Trust (BBOWT), Thames21 are producing this report to carry out NFM scoping and feasibility where a list of suitable opportunities to slow the flow and store water in periods of high rainfall are created across the Bloxham Brook catchment. This will be a priority list of NFM opportunities where there is a good level of confidence of successful delivery when capital funding is secured.

This project will draw on the Nature Investment Readiness Fund (NERIF) project being delivered in the Upper Cherwell catchment and will allow opportunities for private match funding to be realised through developing environmental markets. This is for both capital but also revenue funding that will be vital for the onboarding of farmers and landowners who are often the gatekeepers to such projects being delivered. Conversations are ongoing between the NECFC, Thames Water, Network Rail and Scottish Southern Energy Network about investments in up-catchment solutions to protect their assets and infrastructure and farms in the Bloxham Brook catchment are well placed to receive this.

It's important to acknowledge that these farmer-led design principles are also being applied across the Thames Basin by Thames21 and other project partners listed above. Locally there is the Evenlode Landscape Recovery project where they aim to reduce flood risk in Lyneham, the creation of flood retention ponds, swales and river restoration on the Hook Norton Brook, and floodplain reconnection on the Deddington Brook.

The aim of this NFM Opportunity Study is to assess the potential of nature-based interventions to reduce both surface water and fluvial flood risk within the Bloxham catchment and particularly Bloxham village. The study focuses on 5 main land Groups located upstream and around the village, where interventions have the greatest potential to slow runoff, increase temporary water storage and moderate peak flows into Bloxham Brook and Sor Brook.

The specific objectives of the study are:

1. Identify Flood Pathways and High Impact Areas

- a. Map overland flow routes and points of convergence using GIS and field-survey evidence.
- b. Understand how these flow paths interact with existing features such as field boundaries, hedge lines, ditches and roads.

2. Assess Opportunities for NFM Interventions

- a. Identify and evaluate NFM opportunities across the participating landowners.
- b. Consider their suitability to specific high impact locations.

3. Prioritise feasible, landowner supported interventions with the Greatest Catchment-Scale Benefit

- a. Determine which measures have the greatest impact on slowing flow and reducing flood peaks within Bloxham.
- b. Assess opportunities for cumulative benefits where multiple sites contribute to wider catchment resilience.

4. Align Recommendations with Local and Catchment Strategies

- a. Ensure proposed NFM options support the aims of the Cherwell & Ray Catchment Partnership, the Cherwell Green & Blue Infrastructure Strategy, and relevant Environment Agency guidance on Working with Natural Processes (WWNP).
- b. Highlight opportunities for collaborative delivery with landowners, community groups, and statutory bodies.
- c. To engage with farmers, landowners and the wider community to raise awareness of NFM.

5. Outline next steps

- a. Develop a clear set of recommended interventions for each farm, supported by maps and feasibility assessments.
- b. Outline next steps for design, funding and delivery enabling partners to move efficiently towards implementation.

2.4 Stakeholders

This project has been developed in collaboration with a range of public and private stakeholders, community groups, and land management organisations. Key stakeholders include Oxfordshire County Council, Thames21, the Cherwell and Ray Catchment Partnership, the North Cotswold Farmer Cluster, Natural England, the Environment Agency, and the Bloxham Community Flood Group.

This list of stakeholders is not exhaustive; while engagement was sought across the study area, participation varied and not all landowners elected to be involved in the project. For the purposes of privacy, landowners have not been identified in this report.

2.4.1 Acknowledgement: North East Cotswolds Farmer Cluster (NECFC) / Cherwell Farmers Cluster and Catchment Sensitive Farming (CSF) Partnership

A significant and essential contribution to the early stages of this project was made by the North East Cotswolds Farmer Cluster and the Cherwell Farmers Cluster and Catchment Sensitive Farming (CSF). The NECFC/CSF Partnership Officer Tom Hall led on initial farm engagement work that underpinned this study, including desk-based scoping, identification of suitable farm holdings, and initial on-farm visits to assess potential NFM intervention locations across the Bloxham Brook catchment.

Without this foundational engagement work, the farm groups assessed within this report would not have been accessible. The relationships built through the NECFC/CSF partnership were important in establishing the trust and landowner willingness that enabled the feasibility study to proceed.



3. METHODOLOGY

The feasibility assessment followed a two-stage approach, combining desk-based data analysis with targeted site surveys to identify, verify and refine NFM opportunities within the Bloxham area.

3.1 Data Collection

A desk-based assessment was undertaken to develop an initial understanding of catchment processes, surface water behaviour, and potential locations where NFM measures could be most effective. Multiple spatial datasets were reviewed and analysed to identify overland flow routes, flow convergence points, and landscape features influencing runoff generation. There was no strict hydraulic modelling undertaken during this feasibility study however, overland flowpaths were modelled using the tools explained below.

3.1.1 Land Cover (Scalgo)

Land cover data was reviewed to understand how existing land use may influence runoff rates, infiltration capacity, and sediment mobilisation across the catchment. This included agricultural land use, grassland, woodland, hedgerow, and impermeable surfaces. Land cover was sourced via the SCALGO platform which integrates UKCEH Land Cover data with high-resolution aerial imagery.

This information is best to inform the suitability of different NFM interventions, such as changes in land management, buffer strips or targeted tree planting.



Figure 1: Land cover in the Bloxham Catchment

Land cover within the Bloxham catchment is dominated by intensively managed agricultural land, which contributes to rapid surface runoff generation and limited natural water storage. Woodland is primarily confined to headwater zones and river corridors, where it provides valuable natural attenuation. Urban areas are concentrated within Bloxham village and act as rapid runoff sources due to impermeable paved surfaces.

The spatial distribution of land cover highlights significant opportunities for NFM, particularly within arable headwaters and upstream rural areas where interventions can intercept overland flow before reaching downstream receptors.

3.1.2 Topography and Elevation

Topographic analysis was undertaken using Environment Agency LiDAR-derived Digital Terrain Models (DTMs) available through the SCALGO watershed tool. Elevation and slope data were used to understand surface water movement, identify steep contributing areas, and locate low-lying zones with potential for temporary water storage.



Figure 2 Topography of Bloxham Catchment

This analysis provided the basis for subsequent flow path and catchment delineation.

3.1.3 Flow Path Analysis

To identify areas where NFM interventions could provide the greatest benefit, surface water flow behaviour across the catchment was analysed. Overland flow pathways and areas of flow convergence were analysed using the SCALGO Watershed tool, which integrates the following datasets:

- Environment Agency LiDAR DTMs
- UKCEH land cover data
- Environment Agency flood risk mapping
- British Geological Survey (BGS) geological data
- Advanced digital imagery

The SCALGO surface water tools use flow direction and flow accumulation algorithms to identify likely overland flow routes and accumulation zones during high rainfall events. These outputs were used to establish surface water behaviour and identify overland flow convergences to determine the location of potential NFM measures such as leaky dams, corner field bunds and storage ponds.

To increase confidence in the analysis, SCALGO-derived flow paths were cross-referenced with the Environment Agency's mapped overland flow pathways. Areas where multiple datasets aligned were considered higher-confidence locations for potential intervention. Flow paths were also confirmed in person on site visits.



Figure 3 Overland Flow in Bloxham

Figure 4 shows an example of flow path convergence. Flowpaths running from north to south can be seen converging into larger flows represented by thicker darker blue lines.

Figure 4 Example Showing Detailed Flow Path

3.1.4 Hydrology, Soils and Groundwater Considerations

Hydrological features such as watercourses, ditches, field drains, and existing floodplain areas were reviewed using Environment Agency datasets and aerial imagery. Soil and superficial geology data from the British Geological Survey were studied to understand infiltration behaviour and runoff potential.



Where available, groundwater susceptibility information (e.g. Envirocheck or BGS groundwater maps) was reviewed to identify areas where infiltration-based measures may be constrained or where groundwater emergence may influence surface water flooding.

3.2 Site Survey

Following the desk-based assessment, a site survey was undertaken to ground-truth spatial datasets and refine the identification of potential NFM opportunities.

The site visit took place on Tuesday 9th December 2025, following a period of sustained rainfall, with an average of approximately 5.1 mm per day recorded in the preceding week. These wet conditions provided an opportunity to observe active surface water processes,

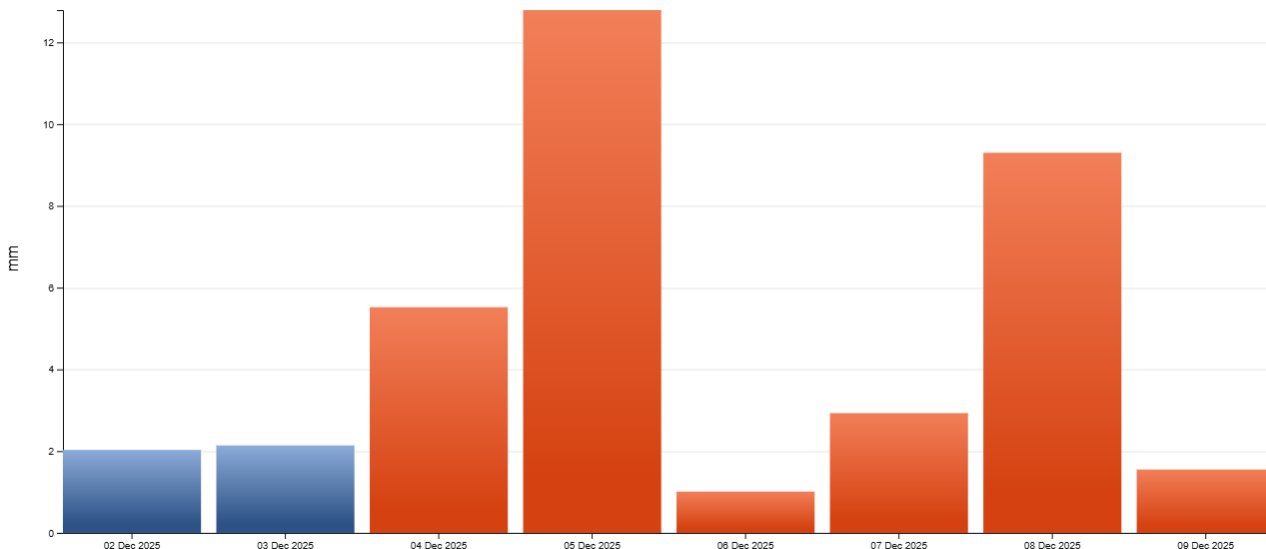


Figure 5 Rainfall Data at Grimsbury Gauge during the lead up to the site visit

including overland flow routes, flow convergence, ponding, and sediment

ment movement.

The survey was undertaken collaboratively by representatives from Thames21, Natural England, and the Cherwell & Ray Catchment Partnership. Observations focused on:

- Verifying mapped overland flow pathways and flow accumulation areas
- Identifying visible evidence of surface water runoff, erosion, and sediment deposition
- Confirming the presence, condition, and connectivity of ditches, drains, and watercourses
- Identifying physical constraints and practical considerations for NFM delivery

Overall, site observations were largely consistent with the desk-based overland flow mapping. In most locations, visible flow routes and areas of surface water accumulation aligned closely with modelled SCALGO overland flow paths, increasing confidence in the spatial analysis.

3.3 Assessment Criteria

Potential NFM interventions were identified and assessed using a qualitative framework based on the combined outputs of the desk-based analysis and site survey. Each opportunity was evaluated against the following criteria:

- **Hydrological effectiveness:** Likely ability to slow, store, or intercept surface water flows
- **Feasibility:** Physical constraints, land use compatibility, and site access
- **Deliverability:** Practicality of construction, ongoing maintenance, and long-term management
- **Landowner engagement:** Current landowner willingness to participate

Landowner engagement was a key consideration in prioritising interventions for further assessment. This report therefore focuses primarily on land Groups where landowners have engaged positively with the feasibility study and expressed interest in NFM measures. This approach reflects a pragmatic emphasis on deliverable opportunities within the scope of the study. Landowner engagement and expressions of interest do not constitute any formal commitment to implementation, and all proposed interventions remain subject to further agreement.

4. CATCHMENT OVERVIEW

Figure 6 below shows the red line boundary of the Bloxham Brook catchment overlaid with rainfall data of a storm event of similar size to the November 2024 Storm Bert event which caused widespread flooding in Bloxham. The main source of surface water to Bloxham comes almost entirely from West of the village towards Milcombe and up Tadmarton Road. As such, this report focusses on 5 land Groups West of the village as these are the surface water flows affecting flooding in Bloxham. The figure also shows flow accumulations as well as overland flow paths. The total catchment area upstream of Bloxham is approximately 7.18km² with a total runoff volume of 265,668m³ for an



Figure 6 Bloxham Brook (Source to Sor Brook) EA Operational Catchment and Watercourse (1% AEP)

event of equal magnitude to the November 2024 flood event. Findings from the Oxfordshire County Council Section 19 Flood Investigation Report for the November 2024 event highlight that flooding in Bloxham was caused by a combination of intense rainfall, rapid surface water runoff, and exceedance of channel capacity, compounded by infrastructure constraints such as blocked culverts, debris accumulation, and surcharging drainage systems.

The spatial distribution of flooding across multiple hotspots demonstrates the interconnected nature of fluvial and surface water processes within the catchment. This reinforces the need for a distributed, catchment-scale approach to flood management, where interventions are implemented upstream to intercept and attenuate flows before they reach constrained downstream locations.

The NFM measures proposed within this study directly respond to these mechanisms by reducing runoff rates, increasing temporary storage, and lowering pressure on existing drainage infrastructure. While these measures will not prevent flooding during extreme events of the magnitude experienced in November 2024, they will contribute to reducing the frequency and severity of flooding and improve overall catchment resilience.

The 5 main land Groups in relation to the catchment boundary can be seen in figure 7 below. These cover around 25% of the total upstream catchment area (1.81km² of 7.18km²).

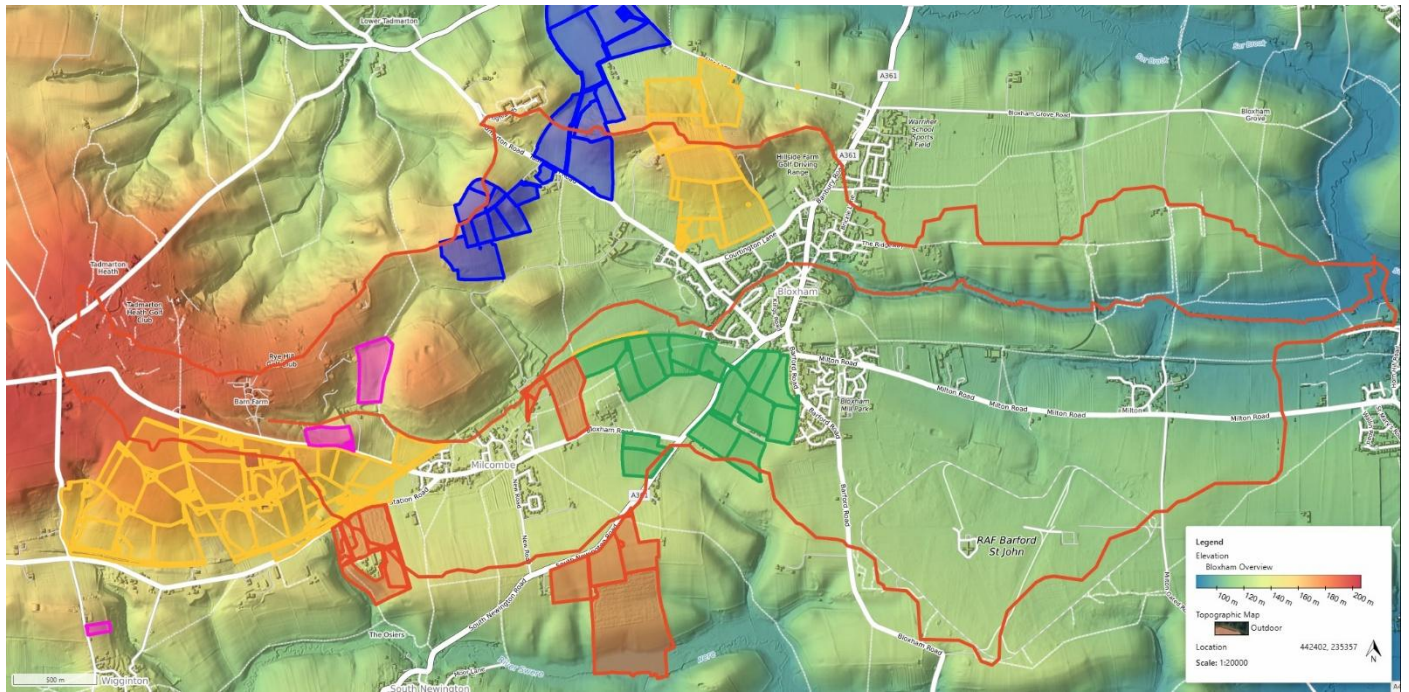


Figure 7 Locations of Main Land Groups in Analysis. Key: Group 1, Group 2, Group 3, Group 4, Group 5.

5. FARM BY FARM ASSESSMENT

5.1 Group 1

5.1.1 Overview

Group 1 is located approximately 500 m north-east of Milcombe and has been identified as a suitable location for NFM interventions due to the convergence of multiple overland flow pathways within close proximity to Bloxham Brook. The Group occupies a strategically important position within the upper catchment, where intercepting and temporarily storing surface runoff would help reduce the volume and velocity of flows entering the main watercourse during high rainfall events.



Figure 8: Group 1 Location

Topographic analysis indicates that runoff generated from the surrounding agricultural land naturally concentrates within this field before draining towards Bloxham Brook. This makes the site well suited to attenuation features designed to slow, store, and gradually release surface water, thereby contributing to downstream flood risk reduction.

An additional advantage of this group is the willingness of the landowner to engage with NFM delivery. Although the landowner manages several neighbouring fields, this is the only field under their ownership that lies within the defined catchment boundary and is therefore the only location where interventions would directly contribute to catchment-wide flood attenuation objectives. Focusing measures within this field therefore represents an efficient use of resources while maintaining strong prospects for deliverability.

The combination of favourable hydrological function, proximity to the receiving watercourse, and confirmed landowner support makes Group 1 a viable and strategically valuable site for targeted NFM implementation.

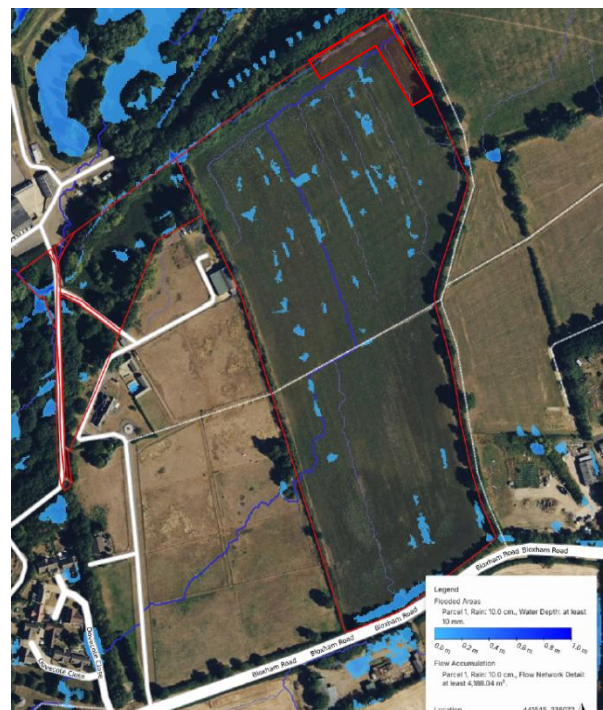


Figure 9: Group 1 Intervention Location

5.1.2 Intervention 1.1

A field-corner bund is proposed to intercept the flow convergences identified above, providing a means of slowing and temporarily storing surface runoff before it concentrates further downstream. The conceptual design illustrated below demonstrates the predicted influence of a 97 m long bund on flow attenuation and temporary surface water storage. Topographic analysis indicates that the feature could provide approximately 323 m³ of storage during high rainfall events, reducing runoff velocities, attenuating peak flows, and decreasing downstream flood risk.

To improve deliverability and reduce construction costs, the bund alignment has been designed to tie into the existing embankment along the northern field boundary. Integrating the new earthwork with this established landscape feature would reduce cut-and-fill requirements, minimise the need for imported materials, and limit disturbance to surrounding agricultural land.

In accordance with the Environment Agency Natural Flood Management Design Specification Catalogue, the bund has been designed with a crest width of 1 m and side slopes of 1:6 (approximately 17% gradient). In line with NFM design guidance, the feature is assumed to drain 50% of stored water within 24 hours, enabling effective temporary attenuation while restoring storage capacity between rainfall events.

In addition to hydrological benefits, the bunded storage area presents opportunities for biodiversity enhancement and habitat creation. The formation of seasonally wet margins and shallow temporary ponds can support wet grassland and marginal vegetation, providing habitat for aquatic invertebrates, amphibians, and foraging birds. The bund itself may be seeded with tussock-forming grasses and wildflower mixes to create structurally diverse field margins that offer shelter and nesting opportunities for invertebrates and small mammals. Over time, these features can contribute to improved habitat connectivity across the farmed landscape while enhancing local landscape character.

Overall, the proposed bund represents a practical, low-impact intervention capable of delivering measurable flood risk reduction alongside meaningful ecological and landscape co-benefits.

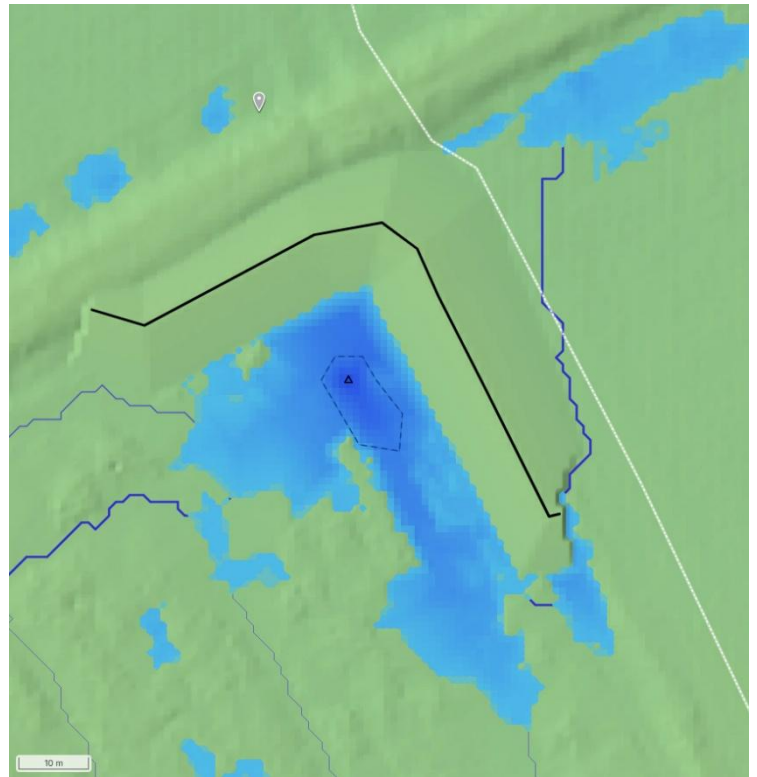


Figure 10: Intervention 1.1

5.2 Group 2

Group 2 is located in the North East of the catchment around 1km from Bloxham. The focus of this group of land will be the fields bordering Tadmarton Road. As identified in the 2024 Section 19 Report, surface water running down Tadmarton Road has been identified as a major issue and contributed greatly to the November 2024 flood. The two fields on the north side (figure 12) border Tadmarton road for approximately 600m, offering great NFM opportunities to



Figure 11: Group 2 Location

hold water back and prevent fast flashy flows down the road into Bloxham.



The two fields on the north side (figure 13 and 14) border Tadmarton road for approximately 600m, offering great NFM opportunities to hold water back and prevent fast flashy flows down the road into Bloxham.



Figure 13 West Field

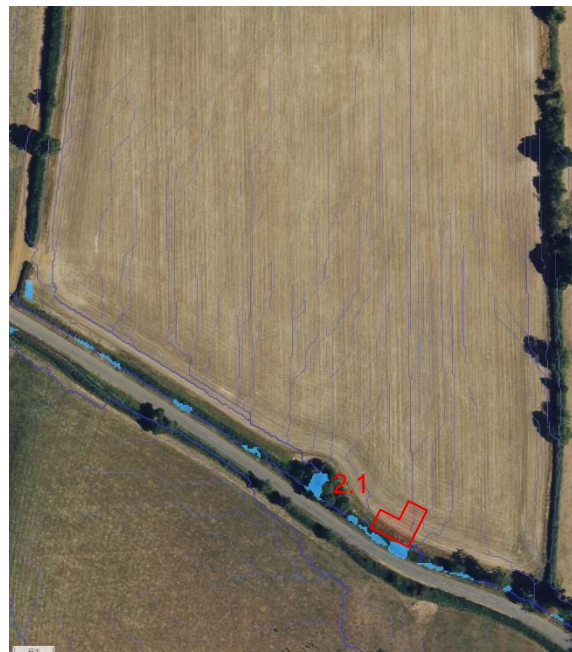


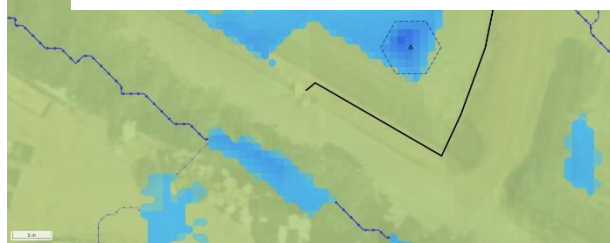
Figure 14 East Field

5.2.1 Intervention 2.1 West Field

A field-corner bund can be implemented to intercept the flow convergences identified above. The design illustrated below demonstrates the predicted impact of a 46 m long bund on flow attenuation and temporary surface water storage. Analysis indicates that this feature could provide approximately 315 m³ of storage during high rainfall events. Where cut-and-fill volumes can be balanced on site, this represents a cost-effective measure to slow runoff travelling toward Bloxham via Tadmarton Road, while also delivering biodiversity and habitat creation benefits.



Figure 15 Image at Location



In accordance with the Natural Flood Management Design Specification Catalogue, the bund has been designed with a

Figure 16 Intervention 2.1

crest width of 1 m and side slopes of 1:6 (approximately 17% gradient). The feature is assumed to drain 50% of stored water within 24 hours, enabling effective temporary attenuation while restoring storage capacity between rainfall events.

5.2.2 Intervention 2.2 East Field Storage Pond

As shown in Figure 17, the eastern field contains an existing offline storage pond situated at a natural convergence of overland flow pathways near Tadmarton Road. Topographic analysis indicates that runoff from the surrounding agricultural land drains towards this local low point, making it a naturally suitable location for temporary water storage during periods of intense or prolonged rainfall.

Site inspections confirmed that the pond is currently partially infilled with sediment, reducing its effective storage capacity and limiting its flood attenuation function. There is clear potential to enhance performance through desilting and modest expansion of the basin footprint. The existing pond is estimated to provide approximately 100 m³ of storage. Proposed desilting and enlargement works are predicted to increase storage capacity by approximately 278 m³, resulting in a total potential storage volume of 378 m³. Increasing storage at this location would help intercept and temporarily retain runoff before it concentrates further downslope, thereby reducing peak flow contributions to downstream receptors.

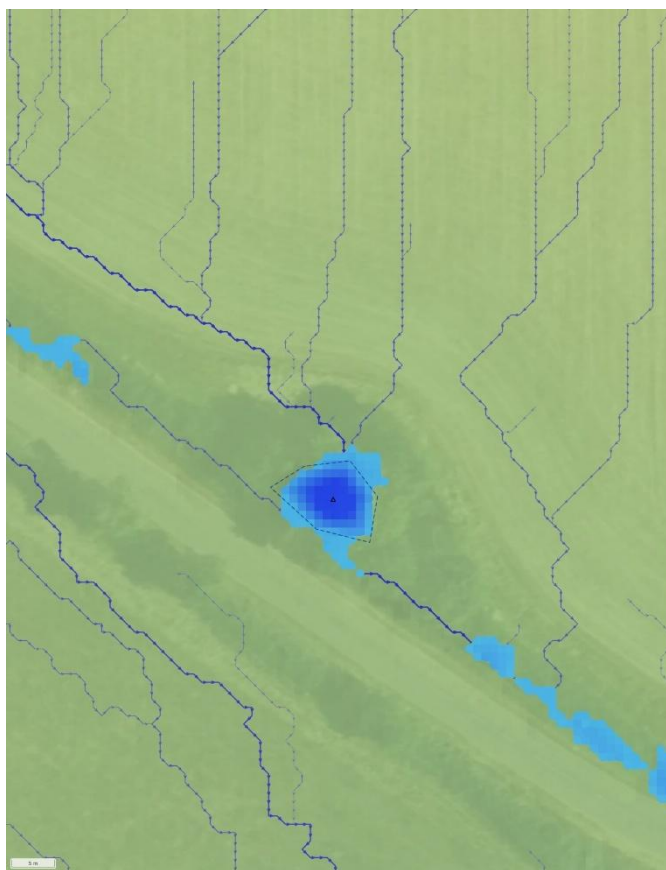


Figure 17 Intervention 2.2

In accordance with the Flood Management Design Specification Catalogue, the expanded pond has

been designed with a maximum depth of 1.5 m and side slopes graded at 1:3 (approximately 33% gradient). These parameters provide a balance between maximising storage capacity, ensuring structural stability, enabling safe maintenance access, and supporting ecological value. The design also assumes that approximately 50% of stored water would drain within 24 hours, ensuring the feature functions as a temporary attenuation measure while maintaining capacity for subsequent rainfall events.

Beyond hydrological benefits, enhancement of the pond would deliver important ecological co-benefits. The existing feature already provides marginal and aquatic habitat, and expansion would increase habitat extent and complexity. This would improve suitability for aquatic invertebrates, amphibians, and wetland vegetation, while also contributing to local biodiversity connectivity across the farmed landscape. Seasonal site photographs (July 2025 and December 2025) illustrate the pond's existing habitat value and demonstrate how water levels fluctuate in response to rainfall



Figure 19 Location July 2025



Figure 18 Location December 2025

patterns.

Overall, enhancement of this feature represents a highly efficient opportunity to build upon an existing landscape asset, delivering increased flood storage capacity alongside biodiversity and landscape benefits with relatively limited land take and construction requirements.

5.2.3 Intervention 2.3 East Field Corner Bund

A field-corner bund presents an effective opportunity to intercept the flow convergence identified in the East field. Positioned across the natural runoff pathway, the bund would function by temporarily impounding surface water during rainfall events, reducing flow velocities and attenuating peak discharge before water continues downslope.

The conceptual design illustrated below demonstrates the predicted impact of a 44 m long field-corner bund on flow attenuation and temporary water storage. Topographic analysis indicates that the feature could provide approximately 400 m³ of on-site storage during high-flow conditions. By slowing and storing runoff at this location, the bund would reduce the volume and speed of water entering downstream drainage pathways that ultimately discharge toward Bloxham via Tadmarton Road.

Subject to confirmation that cut-and-fill earthworks can be balanced on site, this measure represents a cost-effective intervention. Using excavated material from the upstream storage area to form the bund structure would minimise material import requirements, reduce construction traffic, and lower overall delivery costs.

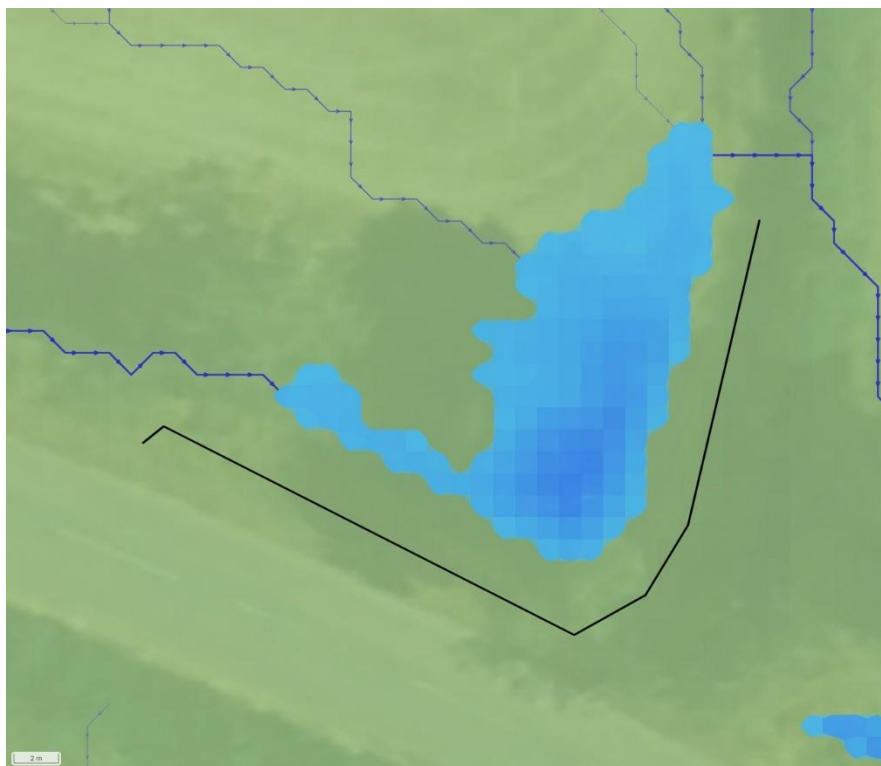


Figure 20 Intervention 2.3

In line with the Natural Flood Management Design Specification Catalogue, the bund has been designed with a crest width of 1 m and side slopes graded at 1:6 (approximately 17% gradient). This shallow profile improves structural stability, facilitates farm machinery access for maintenance, and ensures safe integration within the agricultural landscape. The design assumes that approximately 50% of stored water would drain within 24 hours, allowing the feature to provide temporary attenuation while recovering storage capacity between rainfall events.

In addition to hydrological benefits, the bunded storage area would provide valuable opportunities for biodiversity enhancement and habitat creation. Temporarily wet grassland and seasonally inundated margins can support wetland plant communities, invertebrates, and foraging habitat for birds and amphibians. The feature would also contribute to improved habitat connectivity across the farmed landscape while integrating with existing field boundaries.

Overall, the field-corner bund represents a practical, low-impact intervention capable of delivering meaningful flood risk reduction alongside biodiversity and landscape benefits.

5.3 Group 3

5.3.1 Overview

Group 3 is located around 700m Northeast of Milcombe and has been identified as a suitable NFM site due to the convergence of overland flow paths in close proximity to Bloxham Brook and an interested landowner. The landowner owns many more fields in the area, however, this is the only workable field they own within the catchment boundary that isn't undergoing development other than the field east of that shown in figure 22 below which already accumulates vast quantities of water and lies directly next to a development site. This Group directly to the west of the



Figure 21: Group 3 Location

field corner bund in Group 1.

In figure 22, overland flows can be seen running towards the north east corner of the field with a large flow path on the northern edge.

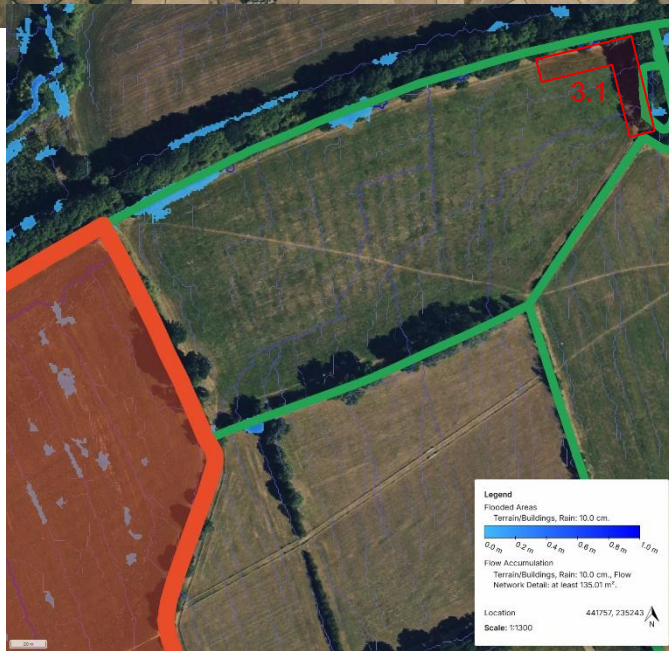


Figure 22 Overland Flow and Intervention 3.1 Location

5.3.2 Intervention 3.1 Field Corner Bund

A field-corner bund is proposed to intercept the flow convergences identified above. The conceptual design illustrated below demonstrates the predicted influence of a 79 m long bund on flow attenuation and temporary surface water storage. Analysis indicates that the feature could provide approximately 600 m³ of storage during high rainfall events, reducing runoff rates and attenuating peak flows.

To improve deliverability and reduce construction costs, the bund alignment has been designed to tie into the existing embankment along the northern field boundary. Integrating the new earthwork with this established landscape feature would reduce cut-and-fill requirements and minimise disturbance to the surrounding land.

In accordance with the Natural Flood Management Design Specification Catalogue, the bund has been designed with a crest width of 1 m and side slopes of 1:6 (approximately 17% gradient). The feature is assumed to drain 50% of stored water within 24 hours, enabling effective temporary attenuation while restoring storage capacity between rainfall events.

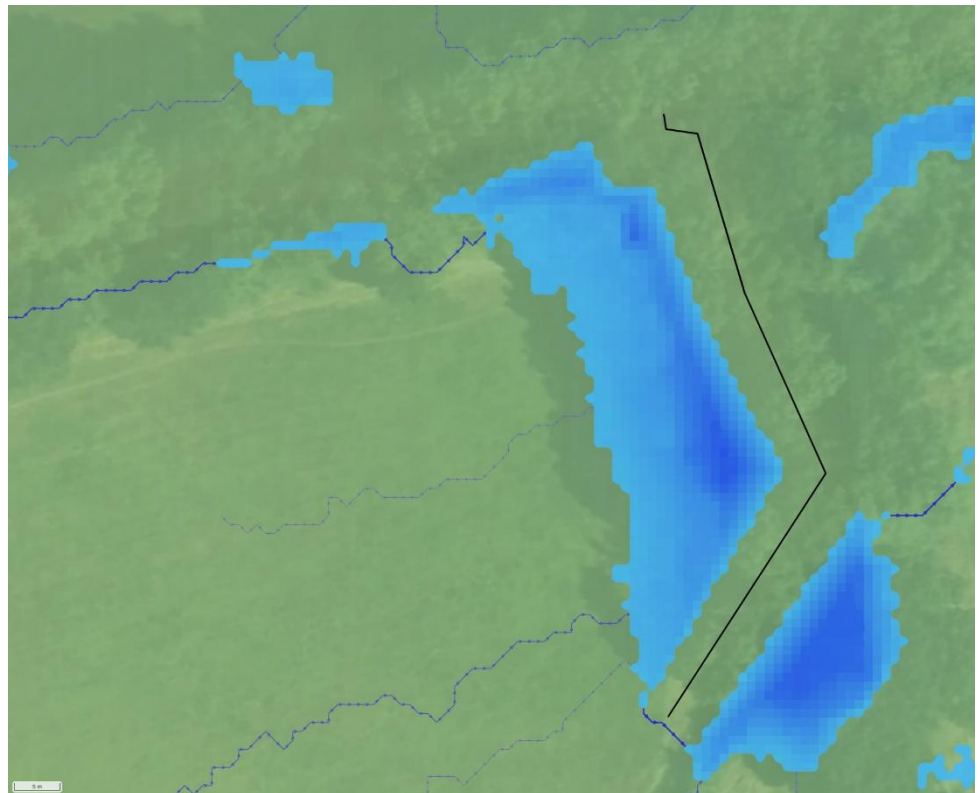


Figure 23: Intervention 3.1

5.4 Group 4

5.4.1 Overview

Group 4 is situated along the western and northern fringes of the catchment. The land to the north of Bloxham is currently subject to ongoing development and is therefore not considered suitable for NFM interventions within the scope of this study. However, several fields adjacent to Rye Main Road have been identified as potentially suitable locations for NFM measures due to the presence of pronounced overland flow pathways and areas of flow

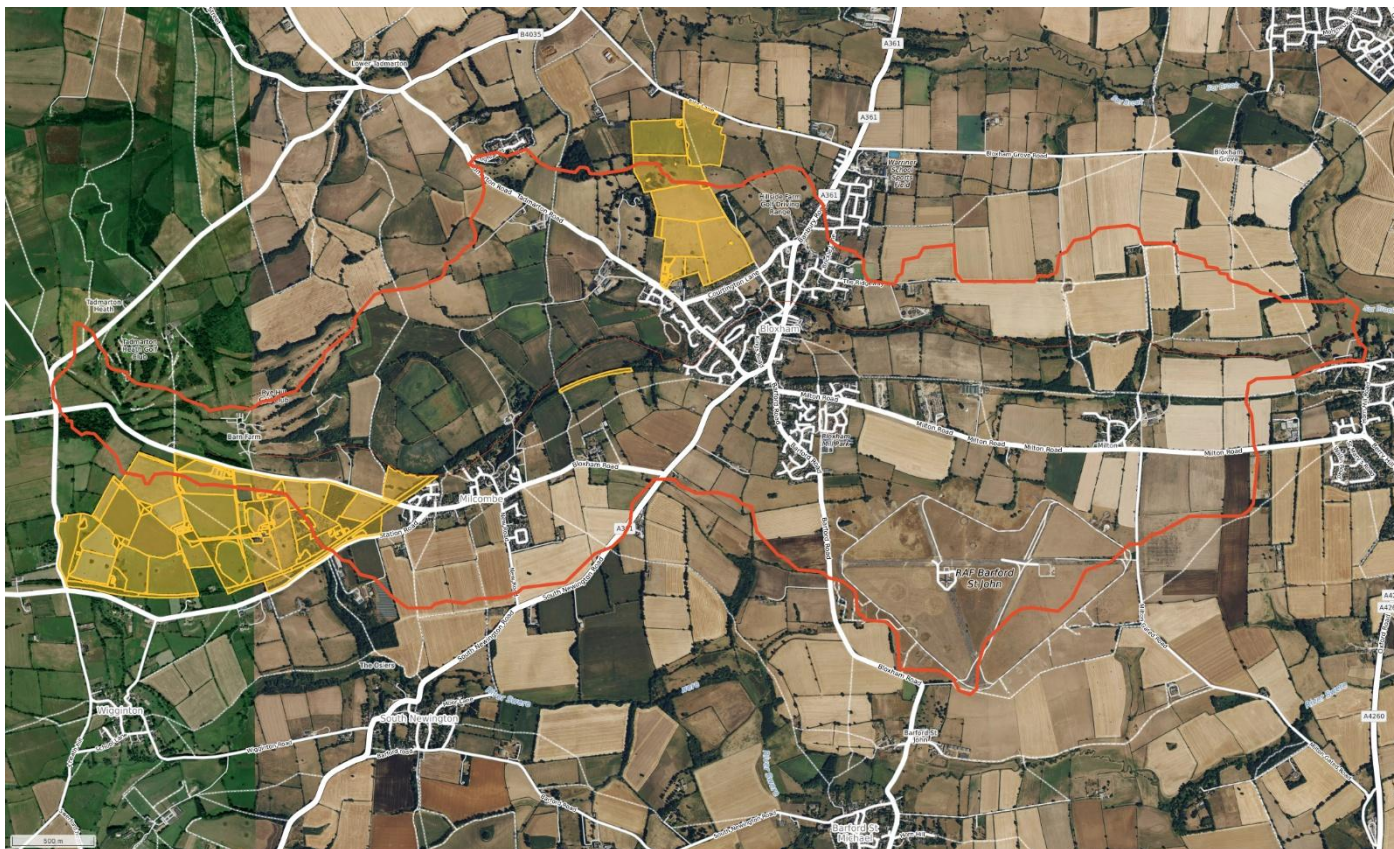


Figure 24: Group 4 Location

convergence.

As illustrated in Figure 25, overland flow routes are predicted to move predominantly toward the south-eastern corner of the fields, where topographic low points encourage surface water accumulation. Bloxham Brook can be seen flowing along the northern field boundary. In addition, significant concentrated flows are evident within the narrow corridor of the former railway line forming the southern boundary of the Group, which appears to act as a preferential drainage pathway through the landscape.

Together, these features indicate that Group 4 plays an important role in conveying surface runoff within the wider catchment and may offer opportunities for interventions designed to intercept, slow, and temporarily store flows before they reach downstream receptors.

5.4.2 Intervention 4.1 Field Corner Bund

A field-corner bund is proposed to intercept the flow convergences identified above. The conceptual design illustrated below demonstrates the predicted influence of a 67 m long bund on flow attenuation and temporary surface water storage. Analysis indicates that the feature could provide approximately 100m³ of storage during high rainfall events, reducing runoff rates and attenuating peak flows.



Figure 25: Overland Flow and Intervention Locations



Figure 26: Photo at location

Figure 27 illustrates that this area of land forms a natural topographic low point where surface water accumulates during rainfall events. This characteristic makes the location well suited for the proposed field-corner bund, as the feature would capitalise on existing drainage patterns to intercept and temporarily store runoff efficiently.

In accordance with the Natural Flood Management Design Specification Catalogue, the bund has been designed with a crest width of 1 m and side slopes of 1:6 (approximately 17% gradient). The feature is assumed to drain 50% of stored water within 24 hours, enabling effective temporary attenuation while restoring storage capacity between rainfall events.

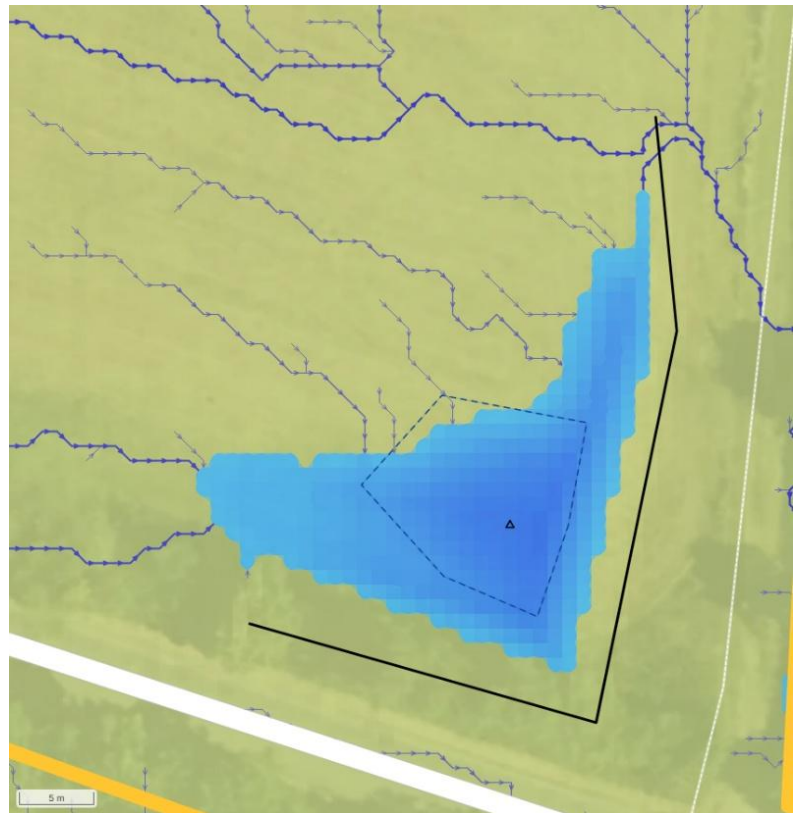


Figure 27: Intervention 4.1

5.4.3 Intervention 4.2 Field Corner Bund

A field-corner bund is proposed to intercept the flow convergences identified above adjacent to intervention 4.1. The conceptual design illustrated below demonstrates the predicted influence of a 61 m long bund on flow attenuation and temporary surface water storage. Analysis indicates that the feature could provide approximately 153m³ of storage during high rainfall events, reducing runoff rates and attenuating peak flows.

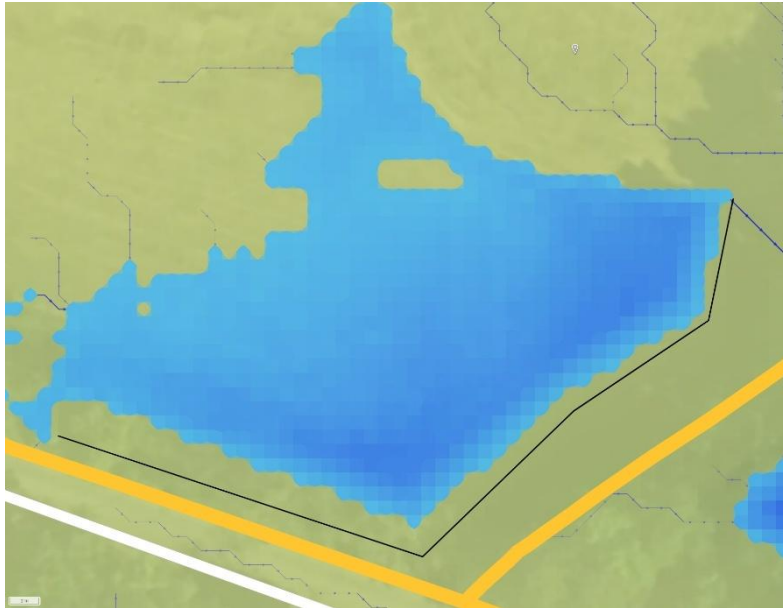


Figure 28: Intervention 4.2

5.4.4 Intervention 4.3 Field Corner Bund

A field-corner bund is proposed to intercept the flow convergences identified above on the south side of the Rye Main Road. The conceptual design illustrated below demonstrates the predicted influence of a 89 m long bund on flow attenuation and temporary surface water storage. Analysis indicates that the feature could provide approximately 71m³ of storage during high rainfall events, reducing runoff rates and attenuating peak flows.

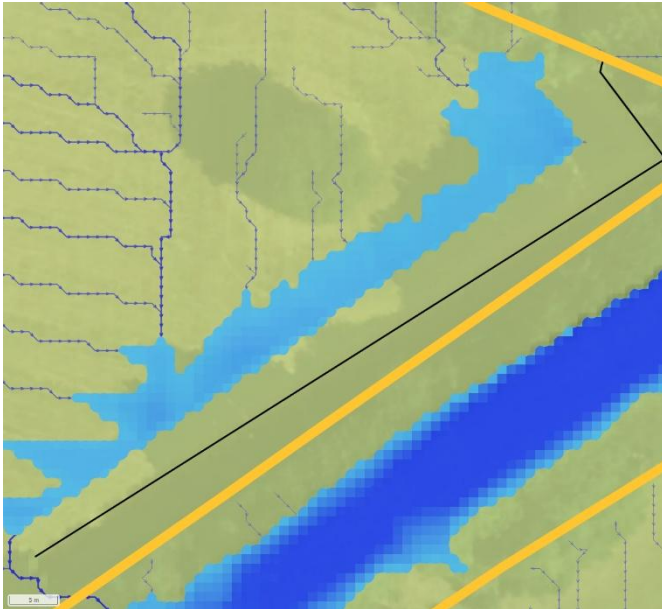


Figure 30: Intervention 4.3



Figure 29: Photo at location

5.4.5 Intervention 4.4 Leaky Dams

A series of leaky dams is proposed along the former railway corridor to slow flows within the channel that drains directly into Bloxham Brook. This landform comprises a natural Holloway approximately 270 m in length, providing a strong opportunity for temporary storage of surface water. The conceptual layout shown in Figure 32 proposes a sequence of 11 leaky dams spaced at intervals of 10–25 m, allowing flows to be progressively slowed along the reach. Hydraulic analysis indicates that these features could provide approximately 550 m³ of additional storage during high rainfall events, reducing runoff velocities and attenuating peak flows before they reach downstream receptors.

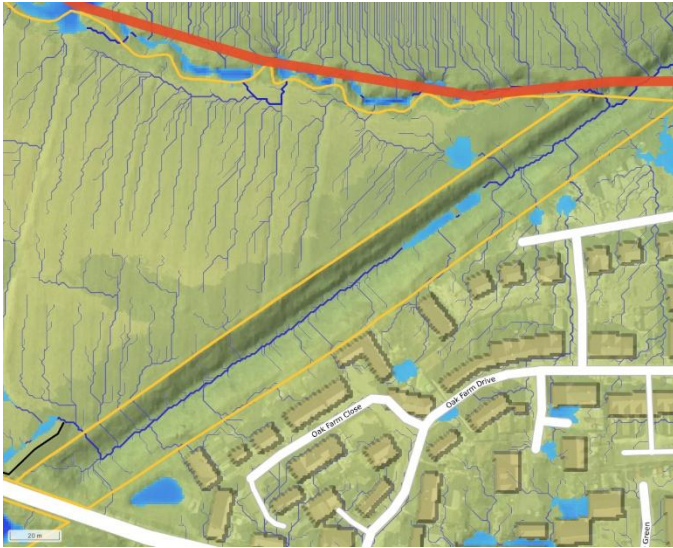


Figure 31: Current overland flow

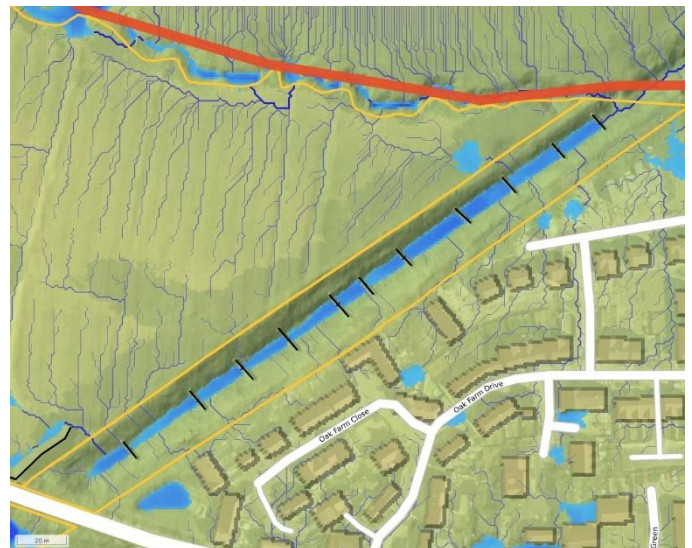


Figure 32: Overland flow with leaky dams

Leaky dams are designed to partially obstruct high flows while allowing normal and low flows to pass through the structure. They are typically constructed from untreated timber or large woody material secured into the channel bed and banks. Permeable gaps are incorporated to prevent complete blockage and to maintain flow connectivity and sediment transport.

The locations shown in Figures 33 and 34 demonstrate the suitability of this area to accommodate such features. Channel morphology, bank form, and the confined nature of the corridor provide stable anchor points and promote effective upstream ponding during high flows. Notably, the feature shown in Figure 33 illustrates a natural accumulation of woody material forming a partial flow obstruction, closely resembling the function and form of a leaky dam. This natural feature indicates that similar structures would be compatible with existing geomorphological processes and channel behaviour at this location.



Figure 34: Photo of Location



Figure 33: Photo of Location

Design parameters for the proposed structures follow recognised good practice for in-channel NFM measures. Individual barriers would be installed perpendicular to flow and keyed securely into the banks to prevent outflanking. Crest levels would be set below bank height to ensure exceedance flows remain within the channel corridor. Vertical permeability gaps and a notched or varied crest profile would allow baseflow to pass freely while encouraging temporary upstream ponding during higher flow conditions. Spacing between structures is designed to create a stepped water surface profile, maximising attenuation while avoiding excessive localised impoundment.

Beyond hydrological benefits, a network of leaky dams can provide valuable ecological enhancements. Temporary backwatering upstream of each structure promotes deposition of fine sediment and organic material, supporting marginal vegetation establishment. The introduction of woody material increases channel roughness and habitat complexity, creating refuge areas for aquatic invertebrates and amphibians.

Overall, the proposed series of leaky dams represents a low-impact intervention that works with existing landscape features to reduce downstream flood risk while delivering meaningful ecological and geomorphological benefits.

5.5 Group 5

5.5.1 Overview

Group 5 is situated on the West side of the catchment. Several fields north of the Rye Main Road have been identified as potentially suitable locations for NFM measures due to the presence of existing storage ponds and areas of

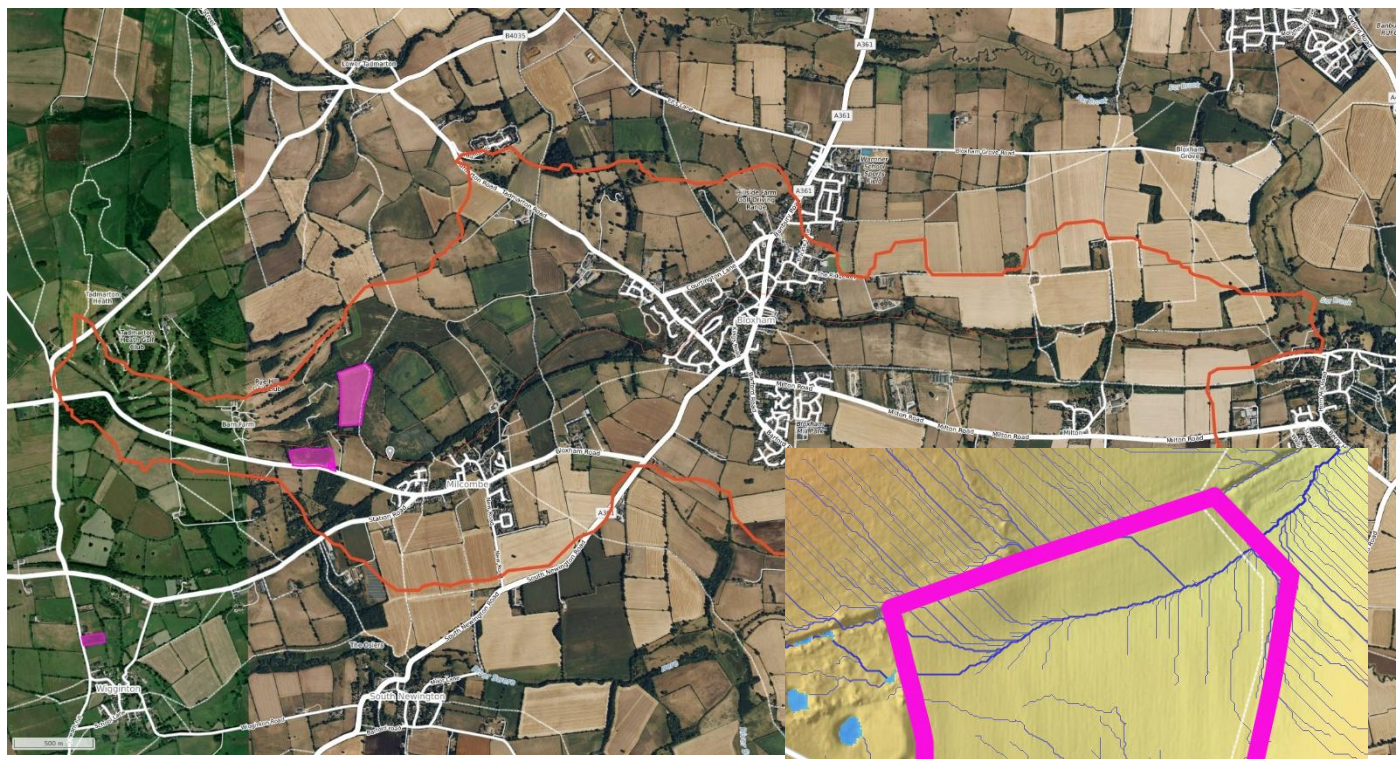


Figure 35: Group 5 Location

overland flow convergence.

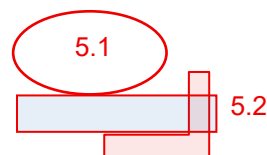
As illustrated in Figure 36, overland flow routes are predicted to move predominantly toward the south-eastern corner of the fields, where topographic low points encourage surface water accumulation. Bloxham Brook can be seen flowing along the southern field boundary. In addition, significant concentrated flows are evident along the south side of the area where there is an existing storage pond.



Figure 36: Overland Flow and Intervention Locations

This area represents a strategic location for intercepting surface water flows originating from Rye Hill Golf Club, which lies immediately upstream. Its position near the head of the catchment makes it particularly valuable for NFM interventions, as measures implemented here would reduce runoff volumes and peak flow rates before water enters the wider drainage network. By attenuating flows at this early stage, interventions in this area would help alleviate flood risk and reduce hydraulic pressure on receptors located further downstream throughout the catchment.

5.3



5.5.2 Intervention 5.1 and 5.2 Storage Pond Desilting + Leaky Dams

Desilting works to remove accumulated sediment and restore the original basin profile of the storage pond could significantly increase its attenuation capacity. A uniform desilt depth of approximately 0.2 m is estimated to increase available storage by around 545 m³, improving the pond's ability to temporarily retain runoff during high rainfall events.

In addition, the installation of a series of three leaky dams, spaced at approximately 15 m intervals would provide further incremental attenuation. These features are estimated to contribute an additional 100 m³ of temporary storage by slowing inflows and promoting shallow upstream ponding during peak flow conditions. Collectively, these measures would enhance the overall flood storage performance of the site while working with existing

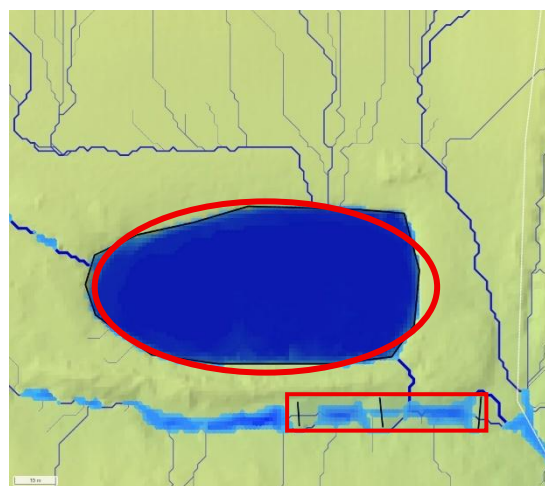


Figure 37: Intervention 5.1 and 5.2

landscape features.



Figure 38: 5.1 Location

Sediment arising from the desilting works could be reused beneficially in the construction of nearby NFM measures, such as field-corner bunds. Reusing excavated material on site would reduce the need for off-site disposal and imported fill, lowering construction costs, minimising vehicle movements, and reducing the overall carbon footprint of the works while maintaining a sustainable materials management approach.

5.5.3 Intervention 5.3 Field Corner Bund

A field-corner bund is proposed to intercept the flow convergences identified above. The conceptual design illustrated below demonstrates the predicted



Figure 39: Photo of Location

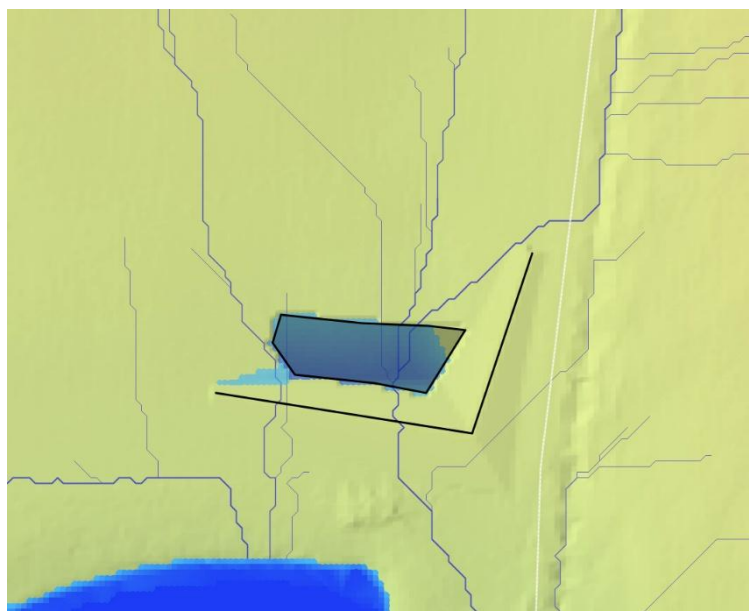


Figure 40: Intervention 5.3

influence of a 80 m long bund on flow attenuation and temporary surface water storage. Analysis indicates that the feature could provide approximately 100m³ of storage during high rainfall events, reducing runoff rates and attenuating peak flows.

5.6 Design Specifications

The concept design of the proposed NFM interventions has been informed by the Natural Flood Management Design Specification Catalogue (2021), which provides nationally recognised standards for the construction, operation and long-term management of NFM features. These specifications have been adapted to the hydrological, geomorphological and land-use characteristics of the Bloxham catchment, ensuring that each intervention is appropriately scaled, safe under exceedance conditions, and deliverable within an agricultural landscape.

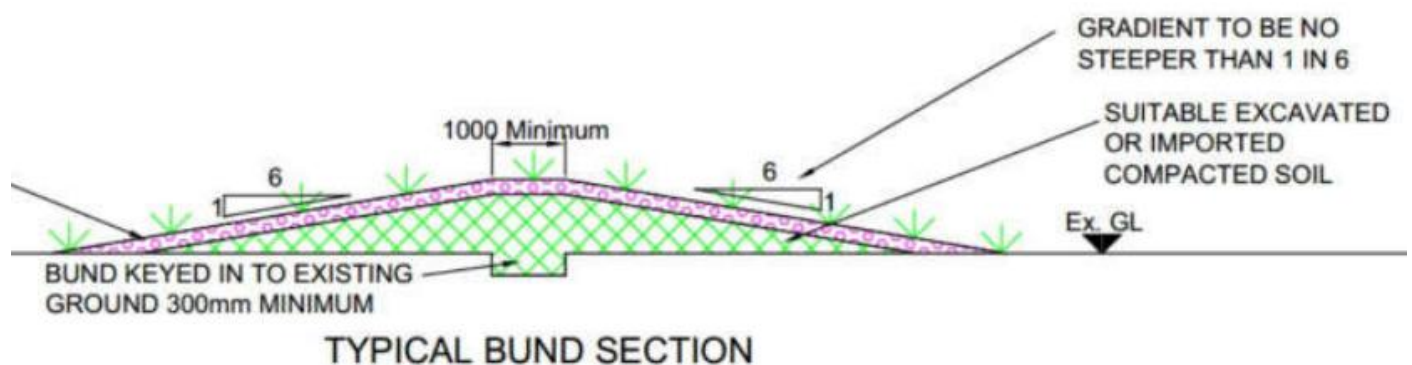
These design principles should be carried into the delivery of the proposed interventions. Across all intervention types, the design philosophy should prioritise the safe attenuation of surface water, the use of locally available materials, and the creation of features that integrate naturally into the surrounding land. All structures should be designed with exceedance in mind, ensuring that during extreme rainfall events water can bypass or overtop features without causing erosion or structural instability. The following sections outline the design specifications for each intervention type proposed within the study area.

5.6.1 Field-Corner Bunds

Field-corner bunds are proposed in Groups 1, 2, 3,4 and 5 where overland flow converges naturally before entering the main watercourse or road network. These features are intended to intercept and temporarily store runoff, reducing the rate at which water travels downslope and enters Bloxham Brook or Tadmarton Road.

In accordance with the design catalogue, bunds have been conceptualised with a crest width of approximately one metre and side slopes of 1:6. This gradient provides a stable earthwork that can be constructed using on-site clay-rich soils, which are well suited to temporary water storage. Bund heights typically range from 0.6 to 1.2 metres depending on local topography, with storage volumes in the Bloxham catchment falling within the small to medium range (approximately 200 m³ per bund) and can be coupled with excavations on the upstream end to balance cut and fill and the associated earthwork costs.

The bunds are designed to drain gradually following rainfall, restoring storage capacity between events. A shallow, grassed spillway or designated low point should be incorporated into each design to ensure that exceedance flows are conveyed safely without causing erosion.



This form allows water to spread across a shallow, stable storage area, reducing flow velocity and promoting sediment deposition.

5.6.2 Offline and Online Storage Ponds

Design specifications for storage ponds, as outlined in the catalogue, include gently sloping sides (typically 1:4 to 1:6), a maximum water depth of 1.5 metres, and a stable embankment where required. Storage volumes for small to medium ponds range from 100 to 1,000 m³.

A defined spillway is required to manage exceedance flows safely. This will take the form of a shallow, grassed channel positioned at the pond's lowest perimeter point. The design should also incorporate access for periodic desilting, which is essential given the sediment-rich runoff generated by the surrounding arable land. The shape should support safe access, stable banks and effective temporary storage.

5.6.3 Leaky Barriers and Woody Dams

Leaky barriers are proposed in Groups 4 and 5, where small watercourses and ditches provide opportunities to slow the movement of water downstream. These structures are designed to allow low flows to pass freely while attenuating higher flows by creating temporary upstream ponding.

Typical design parameters include barrier heights of 0.5 to 1.0 metres, spacing of 5 to 20 times the channel width, and the use of hardwood timber with diameters of 150 to 300 millimetres. Gaps of 50 to 150 millimetres under lower logs allow water to pass under normal conditions while providing resistance during storm events. Storage volumes per barrier are modest (typically around 5-50 m³), but cumulative effects can be significant when multiple structures are installed in series.



Figure 41 Leaky Dam

Timber will be sourced locally where possible to reduce cost and environmental impact.

The design should ensure that barriers are keyed securely into the banks to prevent bypassing or displacement during high flows.

5.6.4 Soil Management and Complementary Measures

Although the primary focus of this study is on structural interventions, complementary land management practices such as reducing soil compaction, establishing herbal leys and creating vegetated buffer strips offer great potential for NFM opportunities in Bloxham. These measures improve infiltration, reduce sediment transport and enhance the performance of structural features. While not included in the current intervention package, they represent opportunities for future phases of work and may be eligible for Countryside Stewardship funding.

6. NFM OPPORTUNITIES ANALYSIS

The preceding assessment has identified a range of NFM opportunities distributed across five groups within the Bloxham catchment. These interventions have been selected to work with existing topography, flow pathways, and land management practices in order to intercept, slow, and temporarily store surface water runoff before it reaches downstream receptors.

The proposed measures include field-corner bunds, storage pond creation and enhancement, and in-channel leaky dams, providing a combination of offline and in-channel attenuation. This distributed approach increases overall catchment resilience by spreading storage across multiple upstream locations rather than relying on single large-scale infrastructure.

Flow path and topographic analysis indicates that the combined interventions could provide approximately 3,535 m³ of additional temporary flood storage across the catchment. Storage provision varies between groups depending on topography, drainage connectivity, and suitability for different NFM techniques.

Group	Intervention No.	Intervention	Storage Increase
Group 1	1.1	Field Corner Bund	323m ³
		Group 1 total	323m³
Group 2	2.1	Field Corner Bund	315m ³
	2.2	Storage Pond	278m ³
	2.3	Field Corner Bund	400m ³
		Group 2 total	993m³

Group 3	3.1	Field Corner Bund	600m ³
		Group 3 total	600m³
Group 4	4.1	Field Corner Bund	100m ³
	4.2	Field Corner Bund	153m ³
	4.3	Field Corner Bund	71m ³
	4.4	Leaky Dams	550m ³
		Group 4 total	874m³
Group 5	5.1	Storage Pond	545m ³
	5.2	Leaky Dams	100m ³
	5.3	Field Corner Bund	100m ³
		Group 5 total	745m³
		OVERALL TOTAL	3,535m³

Table 1 Intervention Storage

Field-corner bunds provide the largest proportion of storage due to their suitability along converging overland flow routes and their ability to utilise natural depressions and field margins. Storage pond enhancement represents an efficient method of increasing attenuation by expanding existing features, while leaky dams provide incremental attenuation and regulate flow velocities within confined corridors.

By attenuating runoff at multiple upstream and mid-catchment locations, the proposed measures provide cumulative downstream benefits, reducing peak flows and lowering flood risk throughout the catchment.

Intervention Type	Typical Storage Volume	Key Advantages	Constraints/Considerations
Storage Pond Expansion (Desilting & Enlargement)	100-400 m ³ (site dependent)	<ul style="list-style-type: none"> • High storage gain from existing feature • Efficient use of natural low points • Enhances pond habitat and biodiversity • Minimal land take 	<ul style="list-style-type: none"> • Requires sediment disposal or reuse • Potential ecological disturbance during works • May require periodic maintenance desilting
Field-Corner Bund	Approximately 200m ³	<ul style="list-style-type: none"> • Cost-effective earthwork solution • Slows and stores overland runoff • Can utilise on-site cut-and-fill balance • Creates wet grassland and margin habitats • Low visual impact 	<ul style="list-style-type: none"> • Requires suitable topography • Potential loss of small area of productive land • Needs landowner agreement and maintenance access
Leaky Dams (In-Channel Barriers)	Varying 0-100m ³	<ul style="list-style-type: none"> • Slows channel flows progressively • Works with natural processes • Low-cost natural materials • Improves aquatic and riparian habitat diversity • Enhances sediment and nutrient retention 	<ul style="list-style-type: none"> • Requires secure anchoring • Risk of debris accumulation if poorly maintained • May require regulatory approval
Riparian Buffer Strips & Planting	Direct Storage	<ul style="list-style-type: none"> • Slows runoff conveyance • Improves water quality • Stabilises banks and 	<ul style="list-style-type: none"> • Limited direct flood storage • Requires land use change • Benefits accrue gradually over time

		reduces erosion • Strong biodiversity benefits • Enhances landscape character	
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Table 2 NFM Intervention Types

The proposed suite of NFM interventions across the Bloxham catchment has been estimated to provide approximately 3,535 m³ of temporary storage. Using historical Environment Agency datasets since records began in 1989 to calculate the average intense rainfall event for the Bloxham area (24mm over 24 hours), 3.5% of total runoff would be attenuated. When considered in the context of a rainfall event of a similar magnitude to that experienced in November 2024 (47mm in 24 hours), this equates to the attenuation of approximately 1.3% of total runoff generated across the upstream catchment.

While this proportion may appear modest in isolation, it is important to recognise the role of NFM within the wider flood risk management framework. NFM measures are not typically designed to fully contain extreme or prolonged storm events; rather, their primary function is to reduce and delay peak flows, thereby lowering the likelihood and severity of flooding downstream. Even relatively small reductions in peak discharge can have a meaningful impact where receptors are sensitive to threshold exceedance.

NFM interventions are particularly effective during smaller, more frequent rainfall events, where available storage is less likely to be exceeded. Under these conditions, features such as field-corner bunds, storage ponds, and leaky dams can operate at or near their full design capacity, intercepting and attenuating a greater proportion of runoff. This leads to more consistent reductions in flow rates, improved lag times, and a decreased frequency of downstream flooding incidents.

During larger storm events, such as that experienced in November 2024, the cumulative storage capacity of NFM features may be exceeded. However, these measures still provide benefit by delaying the timing of peak flows, distributing runoff more evenly over time, and reducing pressure on downstream drainage networks and watercourses. In combination with other measures and as part of a distributed catchment-wide system, NFM interventions therefore play an important role in improving overall hydrological resilience, particularly when considered across a range of storm magnitudes and frequencies.

6.1 Maintenance Requirements and Responsibilities

All NFM features proposed within this study will require periodic inspection and maintenance to ensure continued performance over their intended design life. Although NFM measures are generally low-maintenance compared with engineered flood defences, regular monitoring and upkeep are essential to sustain effectiveness and maximise their flood attenuation and ecological benefits.

6.1.1 General Maintenance Principles

Commonly, the landowner is responsible for the implementation and maintenance of any NFM measure on their land and will retain liability for the feature during its design life. Regular inspections, particularly after prolonged or intense rainfall events, are recommended to identify emerging issues such as erosion, sediment accumulation, or structural instability.

Maintenance should include:

- Visual inspections: Following storm events to confirm that structures such as bunds, leaky dams, and ponds are performing as intended and have not been undermined by overtopping, scour, or animal activity.
- Vegetation management: Ensuring that tussock grasses, wetland plants, or buffer strip vegetation remain healthy and dense to help stabilise soil and prevent erosion, while also maintaining surface roughness.
- Sediment management: Periodic removal of excessive sediment build-up within storage ponds and behind leaky barriers to sustain design storage capacity and prevent loss of function.
- Debris clearance: Removal of large debris that could obstruct baseflow through leaky dams or block inlet/outlet structures, while balancing ecological sensitivity.
- Structural repairs: Addressing any damage to bund faces, timber fixings, or water control features identified during inspections.

6.1.2 Maintenance Expectations by Feature Type

Storage Ponds & Offline Basins

- Desilting may be required every 5–10 years depending on sediment inputs and local land use.
- Vegetation around embankments and spillways should be maintained to reduce erosion risk.

Field-Corner Bunds

- Earthwork features should be checked post-storm and annually to ensure no overtopping breaches or internal erosion pathways have formed.
- Vegetation cover should be maintained through light grazing or mowing to reduce surface runoff and enhance structural stability.

Leaky Dams & In-Channel Barriers

- Ensure logs and fixings remain secure; replace or re-tie as needed.
- Clear accumulated woody debris where it restricts low flows or threatens structural stability — carefully, to avoid compromising habitat improvements.

6.1.3 Operational Considerations

Landowners should be made aware that:

- Maintenance needs are predictable and manageable, but should not be deferred, as minor issues can escalate if left unattended.
- Maintenance can often be integrated into routine land management operations (e.g., stock movement, mowing), which helps minimise costs.
- Liability rests with the landowner unless alternative arrangements (e.g., agri-environment agreements, partnership maintenance plans) are formally agreed.

In summary, while the ongoing maintenance demands of the proposed NFM measures are relatively modest, consistent stewardship is crucial to ensure the interventions continue to deliver flood attenuation, ecological enhancement, and other co-benefits throughout their design life.

6.2 Construction Considerations

Construction of the proposed interventions will require careful planning to minimise disruption to agricultural operations and ensure long-term functionality. Most sites are accessible via existing farm tracks, although temporary matting may be required during wet conditions. Bunds can be constructed using on-site soils, reducing the need for imported materials and lowering both cost and carbon footprint. All bunds will require a clearly defined overflow route to ensure safe conveyance of water during exceedance events.

Sediment management is an important consideration, particularly for the existing pond in Group 2, which has already experienced significant infilling. Regular desilting will be required to maintain storage capacity. Ecological constraints, such as nesting birds or amphibian presence, should be assessed prior to construction, and works should be scheduled to avoid sensitive periods. No major utilities were identified during site visits, but pre-construction checks are recommended.

6.3 Risk Register

Delivery of the proposed interventions is subject to several risks, including landowner withdrawal, sediment infill, ecological constraints and funding uncertainty. Sediment accumulation is likely to be a recurring issue, particularly in ponds and at the upstream toe of bunds and will require regular maintenance. Extreme rainfall events may exceed the capacity of the interventions, but this risk can be mitigated through careful design of overflow routes.

Funding shortfalls represent a significant risk, particularly given the scale of investment required for full catchment coverage. This risk can be reduced by pursuing a blended funding model and by demonstrating early successes through phased delivery. Clear maintenance agreements with landowners will be essential to ensure long-term functionality.

7. CATCHMENT SCALE OPPORTUNITIES

NFM measures deliver the greatest benefit when implemented as a distributed network across the wider catchment. Although the interventions identified in this study are located on individual land groups, they are hydrologically linked via shared overland flow pathways and tributaries that drain to Bloxham Brook. Consequently, upstream attenuation provides cumulative downstream benefits by progressively reducing runoff rates and volumes entering the watercourse.

7.1 Cumulative Hydrological Benefits

The proposed field-corner bunds, storage ponds, and leaky dams function collectively to intercept, store, and slow surface water movement. Distributed attenuation across the catchment could help to reduce peak flow rates entering main watercourses, increase temporary flood storage across the landscape, extend runoff travel times and reduce downstream flood risk to receptors, including Bloxham village.

This networked approach improves resilience during high-intensity rainfall events, where reliance on isolated interventions would provide limited benefit.

7.2 Strategic Attenuation Zones and Connectivity

Catchment-scale topographic and hydrological analysis has identified priority zones where natural flow convergence presents opportunities for coordinated attenuation and storage. These typically occur:

- Along concentrated overland flow corridors
- At slope breaks where diffuse runoff becomes channelised
- Within natural topographic depressions
- In upstream locations where interception yields catchment-wide benefits

Targeting these areas maximises hydrological efficiency and enables individual measures to operate as connected components within a wider catchment storage system.

7.3 Cross-Boundary Coordination and Partnership Delivery

Several priority flow pathways extend across multiple landholdings, creating opportunities for coordinated cross-boundary delivery. Aligning interventions between adjacent farms would improve attenuation performance and enable more efficient construction and maintenance.

Collaborative delivery mechanisms provide many advantages such as:

- Hydrological alignment of upstream and downstream measures
- Shared earthworks where attenuation features span landownership boundaries
- Opportunities for joint funding applications and agri-environment agreements
- Improved cost-efficiency through coordinated design and implementation
- Strengthened long-term asset stewardship

The Cherwell and Ray catchment partnership and Cotswold farming cluster may provide the appropriate governance frameworks to support coordinated delivery.

7.4 Complementary Land Management Measures

Whilst this assessment focuses on NFM interventions which intercept converging overland flow paths, broader land management practices can also provide additional hydrological benefits at the catchment scale.

Measures including riparian buffer strips, improved soil management, and land use change can reduce runoff generation, improve infiltration, and limit sediment transport. Buffer strips adjacent to watercourses can slow overland flow, stabilise banks, and deliver water quality and ecological enhancements.

Woodland creation and agroforestry systems can further reduce runoff through rainfall interception, evapotranspiration, and improved soil structure. Targeted tree planting within headwater areas can contribute to moderating catchment hydrological response during storm events.

However, implementation within productive agricultural systems presents constraints. Land use change may reduce agricultural output and dissuade landowners while woodland creation can restrict machinery access and alter established land management practices. Consequently, uptake is typically dependent on long-term stewardship incentives and alignment with farm business objectives.

Where opportunities arise, particularly along field margins, watercourse corridors, or areas of lower agricultural productivity, these measures could complement the proposed interventions and enhance overall catchment resilience.

7.5 Integrated Catchment Approach

The coordinated implementation of NFM measures across multiple groups represents a strategic transition from isolated, site-level interventions to a catchment-scale framework for flood risk management. This approach recognises that runoff generation and flow responses are driven by landscape processes occurring throughout the catchment, and that attenuating flows at multiple upstream locations delivers more resilient outcomes than standalone measures alone.

The network of field-corner bunds, storage ponds, and leaky dams identified through this feasibility assessment collectively intercept, store, and slow surface water movement along key flow pathways before water enters Bloxham Brook. By slowing the progression of rainfall runoff and increasing temporary storage across the landscape, these interventions are expected to reduce peak discharges, extend lag times, and diminish the probability of flooding in downstream areas.

This catchment-wide approach directly supports the overarching vision and strategic objectives of the Cherwell & Ray Catchment Partnership, whose vision is to ensure that rivers within the Cherwell and Ray catchments are *clean, healthy and full of wildlife, enjoyed and valued by all and managed sustainably for the long term*. The partnership promotes coordinated catchment actions that improve hydrological resilience, water quality, and ecological condition through collaborative delivery, monitoring, and shared evidence-based decision-making.

Specifically, the catchment partnership emphasises:

- **Working at a catchment scale** to maximise the cumulative impact of interventions
- **Supporting landowner engagement and positive land management actions** that contribute to flow management
- **Generating coordinated investment and monitoring** to improve water environment outcomes
- **Addressing both ecological and flow management challenges** through multi-partner action and evidence sharing

The NFM interventions proposed in this study align with these strategic aims by contributing directly to positive catchment-wide flow management outcomes. They complement ongoing efforts within the partnership to address water quality, flood risk, and ecological challenges, and provide a measurable platform for collaborative delivery with landowners, local authorities, environmental NGOs, and statutory bodies.

By embedding site-specific interventions within the broader partnership strategy, the Bloxham NFM programme can both amplify its hydrological impact and contribute to wider environmental targets set out in catchment planning frameworks, including improved river condition, habitat enhancement, and climate resilience.

8. RECOMMENDATIONS AND NEXT STEPS

The NFM interventions identified within this study represent a practical and deliverable set of measures that can contribute to reducing flood risk within the Bloxham catchment. The proposed network of field-corner bunds, storage ponds, and leaky dams provides a distributed approach to attenuating surface water runoff, working with existing landscape features to intercept, store, and slow flows before they reach downstream receptors.

These measures are expected to be particularly effective during smaller, more frequent rainfall events, where available storage capacity is unlikely to be exceeded. Under such conditions, NFM features can operate at or near their design capacity, reducing peak flows and increasing lag times, thereby lowering the frequency and severity of localised flooding. During larger and more prolonged storm events, such as those experienced in November 2024, the capacity of these features may be exceeded. Nevertheless, they will continue to provide benefits by delaying runoff and reducing peak discharge. However, it is important to recognise that additional measures and wider catchment-scale implementation would be required to significantly reduce flood risk associated with extreme events of this magnitude.

In terms of delivery, interventions should be prioritised based on their hydrological benefit, feasibility, and level of landowner engagement. In the short term, efforts should focus on sites where landowner support is already established and where relatively simple, high-impact measures can be implemented quickly, such as field-corner bunds and the enhancement of existing storage ponds. Medium-term opportunities include expanding interventions along key flow pathways and developing coordinated measures across landholdings, while longer-term delivery should aim to increase the overall coverage of NFM across the catchment and explore opportunities for larger-scale storage and land management change.

Progressing these opportunities will require further work to move from feasibility to implementation. This includes undertaking detailed topographic surveys, refining designs, and developing cost estimates for priority interventions. Consideration should also be given to securing appropriate funding, through agri-environment schemes, partnership funding, or Environment Agency programmes. Early engagement with regulators and relevant authorities will be important to ensure that any necessary consents or permits are obtained in advance of works.

Monitoring will be an important component of delivery, both to ensure that interventions are functioning as intended and to build an evidence base for future NFM implementation. A proportionate approach is recommended, combining

visual inspections during and after storm events with simple monitoring techniques such as fixed-point photography and, where appropriate, basic water level measurements. Over time, monitoring data should be used to refine intervention design, improve understanding of catchment response, and demonstrate the effectiveness of NFM to stakeholders and funding bodies.

Landowner engagement remains a critical factor in the success of NFM delivery. This study has focused on groups where landowners have expressed interest in implementing measures; however, these areas represent approximately 25% of the upstream catchment. There is therefore significant potential to increase the overall effectiveness of NFM through wider participation. Demonstrating the success of existing projects within the catchment, such as the leaky dam installation project at Slade Nature Reserve, will be important in building confidence and encouraging further uptake. As more landowners become involved, the cumulative benefits of NFM are likely to increase substantially.

Finally, consideration should be given to incorporating river condition assessments, including geomorphological (morphological) surveys, to better understand baseline channel processes and inform future intervention design. This will help ensure that NFM measures are appropriately aligned with natural river function and contribute to wider environmental objectives.

Overall, the interventions identified within this report provide a strong foundation for NFM delivery within the Bloxham catchment. With continued engagement, monitoring, and expansion across a greater proportion of the catchment, these measures have the potential to form part of a robust, long-term approach to flood risk management and environmental enhancement.

8.1 Climate Change Considerations

Climate projections for the Thames Basin indicate that winter rainfall intensity is likely to increase by 10–20% by the 2050s, with more frequent short-duration, high-intensity storms. These changes will increase soil saturation, reduce infiltration capacity and amplify the speed and volume of surface water runoff.

The proposed NFM interventions remain relevant and effective under future climate scenarios. By increasing temporary storage, slowing overland flow and improving soil structure over time, they help to moderate the impacts of more intense rainfall. However, the frequency with which storage features reach capacity is likely to increase, particularly during prolonged wet periods. This reinforces the need for a distributed network of interventions across a larger proportion of the catchment, as well as the potential value of designing features that can be expanded or adapted in future.

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10. MAPS

- **Figure 1** – Land cover in the Bloxham Catchment
- **Figure 2** – Topography of Bloxham Catchment
- **Figure 3** – Overland Flow in Bloxham
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- **Figure 7** – Locations of Main Land Groups
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