River Usk

Nutrient Management Plan

USK
CATCHMENT PARTNERSHIP

April 2025

Usk Catchment Partnership Members as of March 2025

Dŵr Cymru Welsh Water
Powys County Council
Monmouthshire County Council
Bannau Brycheiniog National Park Authority
Wye and Usk Foundation
Save The River Usk
Tirweddau Cymru
Action for Conservation
Cardiff University Water Research Institute
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Abbreviations

AR – AtkinsRéalis	NRW – Natural Resources Wales
AGOL – Arc GIS Online	P - Phosphorus
BWG – Beacons Water Group	PSS – Private Sewage Systems
CaSTCo – Catchment Systems Thinking Cooperative	SAC – Special Area of Conservation
CG - Core Group	SAGIS – Source Apportionment Geographical Information System
DCWW – Dŵr Cymru Welsh Water	SSSI – Special Site of Scientific Interest
ICM – Integrated Catchment Management	SRM – Sustainable Resource Management
KH – Knowledge Hub	UCP – Usk Catchment Partnership
LPA – Local Planning Authority	UNP – Usk Nutrient Portal
NbS – Nature-based Solutions	WwTW – Wastewater Treatment Works
NFM – Natural Flood Management	4RFL – Four Rivers For LIFE
NMP – Nutrient Management Plan	IPM – Integrated Pest Management

Executive Summary

The Nutrient Management Plan (NMP) for the River Usk Catchment outlines one of many critical issues affecting the river's health and the strategic actions proposed to address them. The River Usk, a Special Area of Conservation (SAC), has been significantly impacted by elevated phosphorus levels, primarily due to agricultural practices and wastewater discharges. This plan aims to improve water quality and naturalise flows to support the recovery of SAC features and enable sustainable living development within the catchment.

The NMP is written by the **Usk Catchment Partnership**, a coalition of organizations, individuals, and communities working together to address the catchment's issues through a whole catchment approach. This NMP is the first iteration of a pathway to nutrient neutrality for affordable housing, SAC feature recovery and catchment resilience, which will be updated regularly as new evidence and needs emerge. This iteration is relevant to 2030, but many of the solutions here will outlast that date, and there is a need to secure funding for delivery and evidence collection into the future. The NMP will be updated by the secretariat bi-annually to reflect the emergence of new data and actions. We recognise that water quantity and nature recovery are also critical in recovery of the SAC features, resilience and safety of our communities and these elements will be dealt with in this management plan and in parallel with other work streams of the Partnership and integrated catchment management plan.

This plan recognises the importance of the wider benefits of Nature Based Solutions (NbS) to human society and so includes a focus on flood mitigation. The **Usk nutrient portal** has been designed to have a strong emphasis on increasing infiltration through improving soil health as this is a foundation for nutrient loss and runoff reduction/flood storage.

Key components of this NMP include:

- **A discussion on root causes of water quality declines.** This plan outlines the benefit of soil health improvements as part of the need to investigate the real drivers of freshwater quality issues and deal with these ‘head on’ to ensure future improvements in SAC Feature health, as well as wider biodiversity recovery.

- **Background and Evidence:** The plan is supported by extensive research and data, including the State of the River Usk report, compliance assessments against phosphorus targets and recent scientific understanding of the pressures on river catchments.

- **Nature-based Solutions (NbS):** The plan emphasises the use of NbS to reduce nutrient runoff from agricultural land and enhance biodiversity. Examples include soil management practices, wetland creation, and tree planting. Soil health improvements are a cross-cutting theme of the NbS suitable for nutrient and flood mitigation – and this will be a foundation for delivery work, achieved through engagement and knowledge exchange.

- **Usk Nutrient Portal:** An online GIS portal has been developed to facilitate planning and implementation of NbS by providing field-scale options and detailed information on nutrient reduction and infiltration measures.

- **Planning and delivery of the NMP.** A delivery plan is outlined based in the needs of the currently failing waterbodies**.** These, alongside an analysis of the catchment flood reduction potential in the Upper Usk (above Crickhowell) form part of a prioritisation exercise to reduce nutrients and flood peaks in failing waterbodies through the promotion of suitable land management techniques.

- **Valuing Knowledge:** The portal will be used to integrate both the knowledge and ideas of those who live and work within the catchment with the scientific knowledge used to create the portal. This will ensure interventions are tailored to the specific needs and conditions of the area, making them sustainable.

- **Supporting agriculture and communities:** The plan will build on existing ways of working in the Usk. Farmer and community collaboration will be supported to share the opportunities of nutrient management for farm businesses and the environment. The plan emphasises enabling farmers, land-managers and local communities to be active decision-makers.

- **Monitoring and Evaluation:** There is a need for development of case studies and set up robust monitoring protocols around certain delivery sites to bolster the evidence available for efficiency of nutrient removal under NbS techniques. This will ensure progress towards achieving SAC favourable conditions. The NMP represents the beginning of a collaborative effort to restore the health of the River Usk and its catchment, balancing strategic policy objectives with practical, on-the-ground solutions to address water quality, whilst supporting communities to thrive.

- **Evidence gaps:** There are many gaps in data and evidence, which creates serious issues for the development of solutions. **A major gap in data is Farmscoper which the UCP wishes to advocate for an update – to bring into a Welsh context and incorporate recent data.**

1.0 Introduction

Stretching from the rugged uplands of Bannau Brycheiniog to the tidal reaches near Newport, the River Usk (Yr Wysg) with a length of 125km it is the longest river entirely within Wales; it was once an internationally renowned fishing destination[1] and is one of Wales's most cherished waterways. The river could support a rich variety and abundance of wildlife and is also designated as a Special Area of Conservation (SAC), which covers several Sites of Special Scientific Interest (SSSIs).

[1] River Usk - Wikipedia

Nutrient pollution of the Usk was first brought to widespread attention in 2021 following the publication of the first Natural Resources Wales (NRW) report of compliance against phosphate targets for protected rivers.[2] Excess levels of this nutrient in water courses are widely understood to be harmful to aquatic species. Elevated phosphate concentrations can, in combination with other factors such as low flows and warmer water temperatures, lead to dominance by algae, loss of characteristic plant species, and poor substrate conditions for fish and invertebrates.[3]

1.1 The Usk Catchment Partnership (UCP)

As part of the Welsh Government's pro-active approach to river pollution, funding was provided to establish localised Nutrient Management Boards. As a direct response to only 12% of the Usk waterbodies achieving their phosphorus targets in the compliance assessment the Usk Catchment Partnership was formed. The Partnership was established through a co-design process with key stakeholders. The need for a voice for the river was recognised and a Nature Guardian was appointed as part of the Partnership. The Partnership's role is to formulate a plan for the ecological restoration of the River Usk, including but not limited to reducing nutrient loading within the Usk to help facilitate nutrient neutral development.

The Usk Catchment Partnership brings together statutory bodies and interested parties with relevant experience, expertise or interests that are willing to build a response around a shared aim to restore the ecological health and resilience of the River Usk and its catchment. The diverse makeup of the Partnership ensures that the unique set of skills carried by the different members that are relevant to the holistic understanding of the pressures and solutions needed to bring the catchment back into good health.

The Partnership is hosted by Bannau Brycheiniog (Brecon Beacons) National Park Authority.

Vision and Values of the Partnership

> By 2043, everyone will be able to enjoy a river full of thriving wildlife, sheltered by trees, bordered by a diverse mosaic of thriving habitats where regenerative practices produce high quality foods, manage the flows of water whilst storing/managing carbon and in doing so supporting a sustainable local community.

Figure 1: The vision of the Usk Catchment Partnership

[2] compliance-assessment-of-welsh-sacs-against-phosphorus-targets-final-v10.pdf

[3] Common Standards Monitoring Guidance for Rivers

The Partnership believes that an Integrated Catchment Management (ICM) is essential for maintaining healthy, productive and resilient ecosystems that support vibrant communities and sustainable development. An integrated approach includes:

- Understanding the root cause drivers of ecosystem decline
- Taking a holistic approach - considers the entire catchment area, including rivers, lakes, groundwater, and the surrounding land, and the human influences within it. This holistic view helps in understanding how different elements interact and impact each other.
- Taking a Sustainable Management of Natural Resources (SMNR) approach: by managing resources at the catchment level, SMNR promotes sustainability. It ensures that water, soil, biodiversity, and other related resources are resilient and can support current and future needs.
- Community Involvement. Engaging local communities in decision-making processes fosters a sense of ownership and responsibility and ensures that outcomes are tailored to the specific needs and conditions of the area.

This Nutrient Management Plan is part of a series of nested component plans that the Partnership is developing, and sits alongside the following documents delivered so far by the UCP with the aim that each will have relevance to the intended audience:

- State of the River Usk (Technical Report)
- Online GIS Usk Nutrient Management Portal (The Usk Portal)[4]
- Citizen 'Involvement/Engagement' work

1.2 The Usk approach to Nutrient Management: opportunities to be shared

Managing nutrients on the land that drains into the streams and rivers of the Usk is crucial for several reasons, and the Partnership seeks to work towards solutions that are of wide benefit to nature, communities and the local economy. Maintaining soil health reduces soil and nutrient loss from farms to the environment and can help farm business productivity.

The Plan is focused on nature-based solutions (NbS) as advised by Welsh Government, while also recognising their potential to deliver wider benefits for people and wildlife across the catchment. It is also recognised that some more human-engineered interventions are needed in some situations; in large these have been committed to already under the DCWW AMP 8 workstreams.

The Partnership seeks to build upon ways of working that have emerged in the Usk over the last few years and facilitate its continuation and establishment across the catchment. There is further detail on this in the Delivery part of this NMP. Farmer clusters, collaboration and peer-to-peer knowledge exchange in the Usk have already

[4] River Usk Nutrient Management Plan

enabled benefits for farm businesses and the environment, by sharing practices that reduce soil and nutrient losses. The whole catchment needs an open sharing of opportunities, to enable farmers, land managers and local communities to be active decision-makers and to choose the actions most suited to their part of the Usk catchment.

Additionally, the UCP will develop a charter with shared commitments that members will agree to deliver towards. These commitments will be in line with and suited to the members' ways of working and usual responsibilities as organisations. Members will also agree to embed the ways of working to enable strategic alignment with this NMP.

2.0 The current status of the river

2.1 The State of the Usk Report[5]

The Usk Catchment Partnership co-produced a State of the Usk Report in June 2024. This describes the catchment morphology, habitats and land uses from the open uplands at the source in the western Bannau Brycheiniog National Park to the largely agricultural land of Monmouthshire, before the tidal reaches at Newport. The report provided an overview of the ecological, environmental, cultural and social condition of the Usk catchment, as of July 2024, as far as was possible given the limits of available evidence at the time.

2.2 SAC Compliance

The river Usk Special Area of Conservation (SAC) comprises 24 waterbodies and includes many of the tributaries in the upper catchment. NRW's Compliance Assessment of Welsh River SACs Against Phosphorus Targets in 2021 did not include data for all the waterbodies, and it is also recognised that there are other non-designated waterbodies in the catchment. The assessments covered the following attributes:

- Phosphorus (P)
- Dissolved Oxygen (DO)
- Biochemical Oxygen Demand (BOD)
- Total Ammonia
- Unionised Ammonia
- pH
- Acid Neutralising Capacity (ANC)
- Trophic Diatom Index (TDI)

These were monitored for all the river Usk SAC waterbodies for the period 2020-2023 and this provides new data for phosphorus and ammonia levels. The State of the Usk report was released before this new data had been published, but did include an unofficial assessment of the new phosphorus data. The 2021 assessment (Figure 2 below) showed

[5] State-of-the-Usk-Report_final.pdf

widespread failure throughout the catchment, with 88% of waterbodies failing their phosphorus targets.

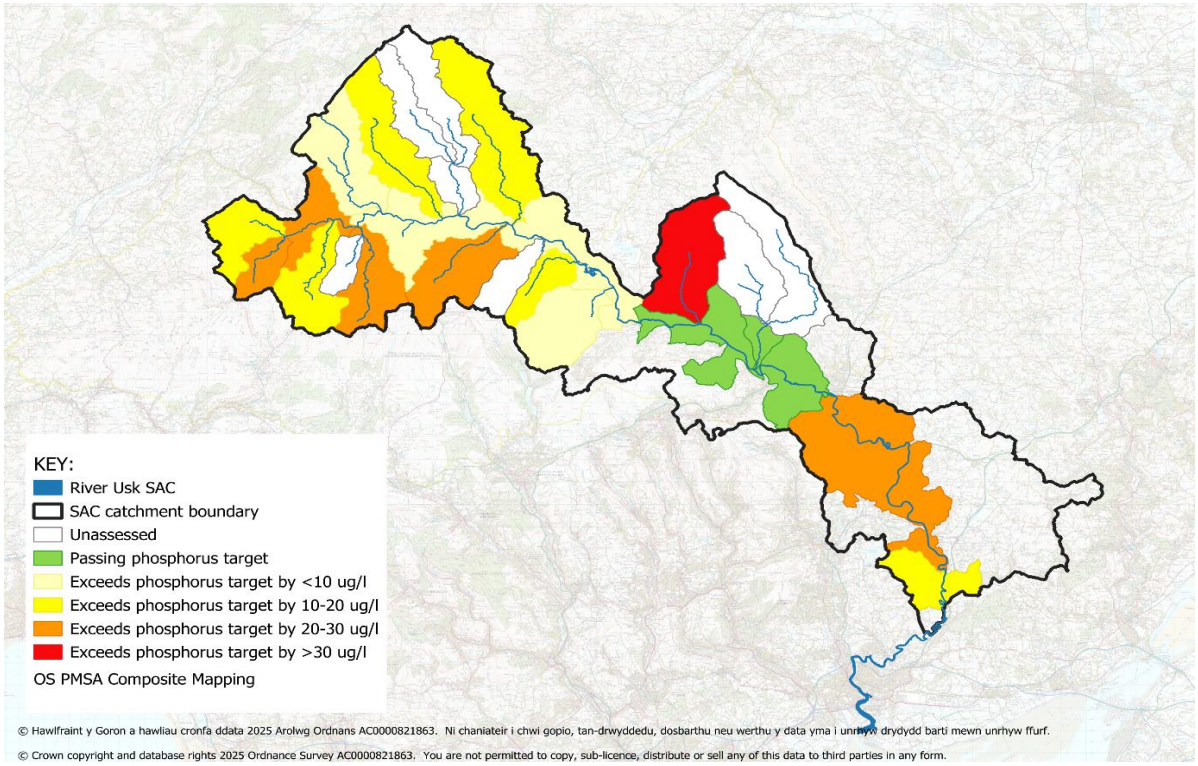


Figure 2. Phosphorus compliance map for the River Usk 2017-2019

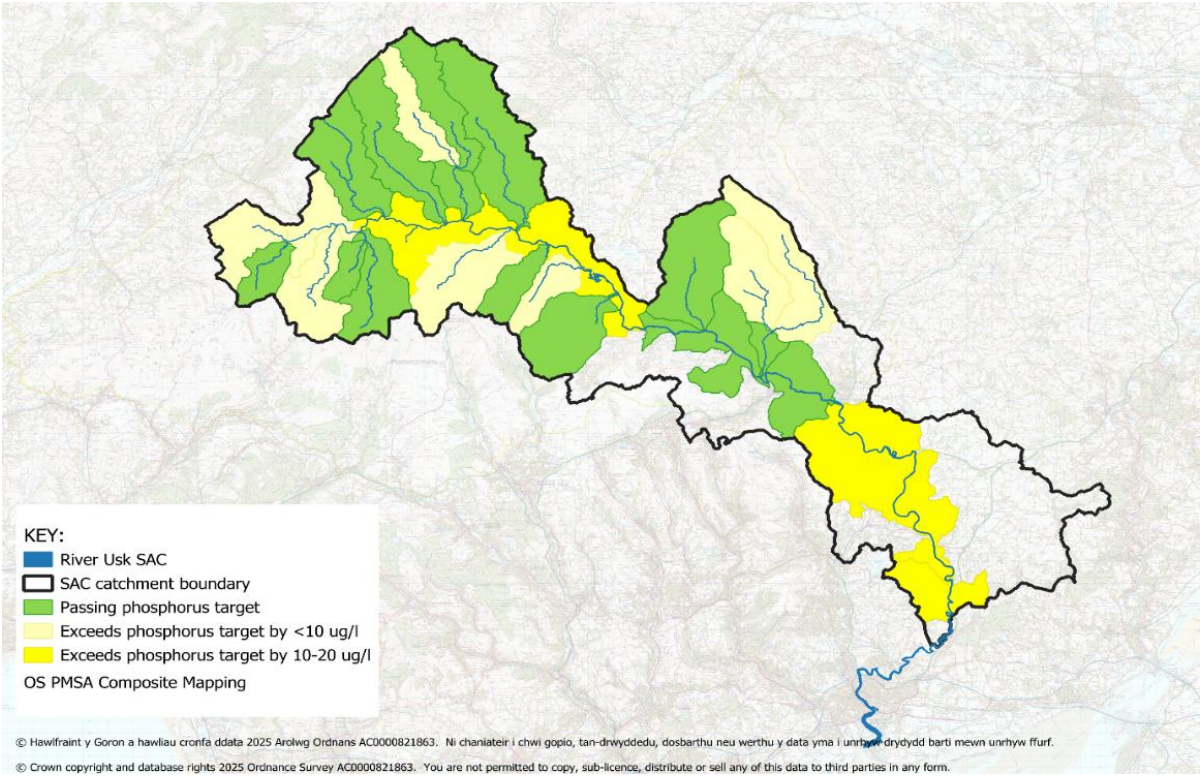


Figure 3. Phosphorus compliance map for the River Usk 2020-2023

The new SAC compliance data (Figure 3) show that 54% of waterbodies in the Usk catchment are now passing their phosphorus targets. Some waterbodies that were previously failing are now passing; however, waterbodies that were not previously assessed, such as the Grwyne Fawr (GB109056040000) and Grwyne Fechan (GB109056039960), are now shown as failing. There are other failures, including in the downstream waterbodies, meaning nutrient neutrality is required across the whole Usk Catchment and further improvements and actions are needed.

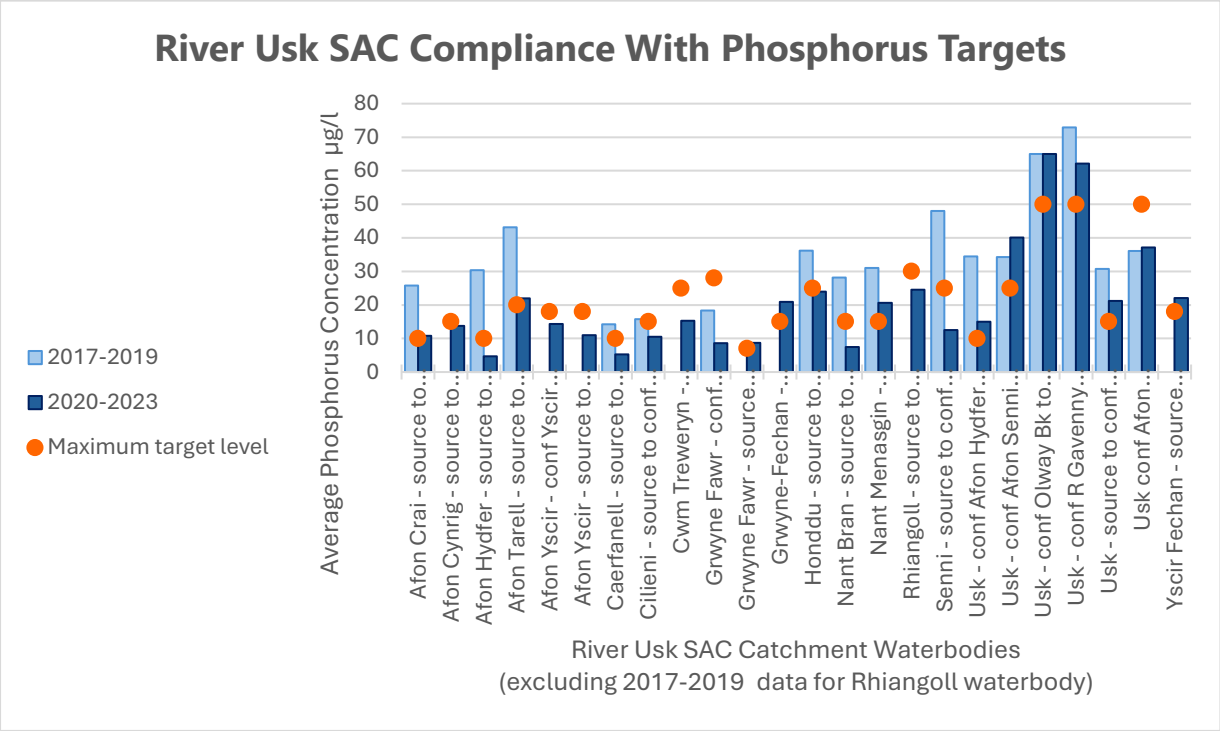


Figure 4. Comparison between 2017-19 and 2020-2023 compliance data, along with Maximum Target Level of Phosphorus in each Usk Catchment waterbody

2.3 Water Framework Directive

Natural Resources Wales has also produced interim classifications under the Water Framework Directive (WFD) for all WFD waterbodies across Wales; this is based on a different type of assessment of waterbodies for several different features referred to as elements. Any failed element means that the whole waterbody is classed as failing. The waterbody that includes Sennybridge and Brecon has moved from passing to failing, as has the Grwyne Fechan (GB109056039960) and the failures at Llanbedr and Abergavenny have worsened. The Afon Yscir - conf Yscir Fechan to conf R Usk (GB109056040020) was good in 2021 but moderate in 2024. The Berthin Brook (GB109056026950) has moved from moderate in 2021 to poor status in 2024, as has the Afon Lwyd - source to Mon and Brecon Canal (GB109056032912). However, the Grwyne Fawr (GB109056040000) and three upper catchment waterbodies are now passing. Elsewhere, there is no change.

2.4 SAGIS modelling

Using the 2016 – 2019 Compliance dataset, Source Apportionment Geographical Information Systems (SAGIS) modelling work for the Usk catchment was undertaken by DCWW in collaboration with NRW and published in February 2023. It is important to recognise that this is a modelling approach to identify water company assets where controls on effluent quality are required. It can also be used to test the theoretical impact of changes in effluent quality at a range of catchment treatment works.

The SAGIS modelling identified that approximately 180kg of phosphorus is discharged from the Usk catchment daily; effluent from sewage treatment works accounts for 21% of the average daily load (kg/d) with rural land use contributing 67%, storm overflows contributing 1% and a further 11% from other sources including septic tanks, and urban run-off. This has been used to inform the latest Asset Management Programme (AMP8) works to several Wastewater Treatment Works across the catchment. This modelling is subject to review and DCWW are currently looking at updating their models for AMP9 planning.

3.0 Wider evidence – beyond the Usk SAC

The focus of recent political and public gaze has been on agricultural and wastewater influences on water quality, yet while there are moves within these industries to address their inputs, there is much to do as we look to turn the corner of ecological decline and create resilience to the growing challenges of population growth, further ecological extraction and climate change.

The River Wye experienced unusually large-scale algal blooms in 2020 and 2022, resulting in public and academic attention on this catchment, with some of the resulting research and learning having direct relevance to conditions in the Usk where climatic and some land management conditions are similar.

3.1 RePhokus Project (The Role of Phosphorus in the Resilience and Sustainability of the UK Food System)

This is a collaborative project between a number of universities looking at phosphorus (P) needs and use in the UK. The RePhokus[6] report produced in 2022 by Lancaster University looks at P in the context of the wider food system and raises the importance of the historical impact of land management. This link between past management to current levels of soil phosphorus describes surplus levels that have built up over years of application (via animal and bagged fertiliser sources) that have remained unused in the soil profile with upper deposits being prone to sheetwash erosion. P that has migrated into the lower soil layers, can encounter groundwater, highlighting this as an additional route of P into freshwater systems. This is termed legacy phosphate. In some areas, it will potentially take decades to 'draw down' (remove) those levels of P from the soil.

[6] Project Summary – Resilience Phosphorus UK

This report also introduced the Mass Balance approach whereby the imports, exports and cycles of P within catchment were mapped and the concept of circularising systems on Welsh farms introduced. Cycling of nutrients on farms is not a new concept, but as farms have become reliant on imported fertilisers and enhanced feed, imported nutrients have taken up a larger portion of those put on the land, and the offtake of P in crop and stock has not kept up with these. The farming industry is becoming much more aware of these concepts and farm nutrient circularity is available as a learning module through Farming Connect[7].

Understanding soil nutrient levels at field scale and ensuring what is in the soil is available for uptake by plants (bioavailable) and not limited by a simple factor such as pH will be helpful both in achieving drawdown and reducing the cost of production to the farm business.

3.2 Wye Algal Bloom Study

The recent (2024) Cardiff University Algal Bloom study also has relevance to the Usk system,[8] [9] with this report suggesting that it is misleading to focus on a sole nutrient as the cause of water quality issues in the Wye. It found that there is unlikely to be a P driven issue in the Wye catchment, but that the algal blooms occurring in 2020/2022 were caused by a complex series of current and historic land management influences.
These combined with interactions between several nutrients (including phosphorus, ammonia and nitrates) alongside climate change-driven low flow/high water temperature conditions in those years. This study makes it clear that despite the focus on P, the nutrient status of the Wye has not shifted considerably in recent years, but the erosion of the general resilience of the river ecosystem and its ability to cope with multiple pressures has allowed the algal blooms to occur. The algal blooms are an indication that a shift has occurred in the ecosystem profile, from one of macrophyte dominance, to one of algal dominance. If erosion of ecosystem resilience is not stopped, a similar shift could potentially happen in the Usk – there is time to arrest this decline.

3.3 The Quantum Project

The Quantum Project (University of Bristol)[10] is working with scientists, farmers, industry and regulators to identify and quantify the wider range of substances that are entering our rivers through various means. This includes nutrients, pathogenic and ecotoxicological elements of human, pet and livestock health management. Evidence is emerging of common household pet treatments such as Fipronil, as well as a wide range of pharmaceuticals entering rivers via WwTWs. This is a significant and growing issue and is recognised by the UCP and will inform the NMP next stages.

[7] What is Circular Economy? - 03/01/2023 | Farming Connect
[8] Wye Algae Project: What is this study telling us we need to do? - The Wye & Usk Foundation
[9] Focus on phosphate not a "silver-bullet" for River Wye's water quality problems, report finds - News - Cardiff University
[10] https://quantumfreshwaters.org/

Although not directly researching on, or referencing the Usk River, these are among many relevant reports that have important principles and learning to bring over to this catchment, with these specific areas being directly applicable:

- Root cause interventions are needed
- The food system is one of the main drivers of environment degradation in the UK, and a systemic approach to tackling this is needed
- Historic land use is more influential than previously thought
- No single nutrient is driver of water quality issues
- Resilience of freshwater ecosystems has been undermined for years and so the adaptability of our rivers to various pressures has been significantly weakened.

Any measures to address water quality issues must have benefits to the wider system, thus due to the integrated and multiple impacts of NbS, these are the most effective way of dealing with the current problems.

4.0 Pressures on water quality and the SAC

The root causes of freshwater and terrestrial declines across Wales are beyond the scope of this NMP but warrant mention when it comes to the wider understanding and creating appropriate solutions. It is recommended that these are considered for inclusion in the next steps of creating an Integrated Catchment Management Plan.

4.1 Agriculture

SAGIS modelling currently apportions 67% of P in the Usk SAC system from rural land use which includes agriculture (all types). Since the 1950's, the main agricultural practices have been incentivised by longstanding national policy and subsidy, as well as drivers within the wider national and global based food system.

A growing body of research is indicating that the reduction of biodiversity in the UK (and globally in general) is caused by the food system failing to offer fair prices for the commodities grown by UK farmers.[11]. Pressures on the financial bottom line of farms in Wales can cause intensification of practices, with resulting knock-on effects being outsourced to the natural environment [12] [13]. The Sustainable Food Trust report 'True Cost Accounting'[14] details how the price of UK food production is passed on to the population via taxation, lost income due to ill health and the price of mitigating and adapting to climate change and environmental degradation. The cost to the NHS to treat humans made unwell by eating ultra-processed foods is estimated at £268 billion per year[15].

[11] United Kingdom Food Security Report 2024: Theme 3: Food Supply Chain Resilience - GOV.UK

[12] Farmers caught on 'agricultural treadmill' as incomes fail to improve in 50 years | Farm News | Farmers Guardian

[13] Paying the Price - Food, Farming and Countryside Commission

[14] True Cost Accounting | Sustainable Food Trust

[15] Paying the Price - Food, Farming and Countryside Commission

Farmers, who have largely been squeezed out of the decision-making process for food provision in the UK, should be at the forefront of the route back to localised food markets, selling nutrient dense foods that have positive impact on the land and water in the areas they are grown.

The Wellbeing of Future Generations (Wales) Act 2015 and Environment (Wales) Act 2016 provide the necessary high-level framework around which to structure societal changes to tackle root cause issues. Appropriate bodies must now act with strong leadership and urgency to empower communities with knowledge and policy (e.g. integrated land use frameworks) that will provide the leverage needed to protect the river and foster local food systems that benefit the health of both people and the environment.

4.2 Dŵr Cymru Welsh Water Assets

Discharges from Wastewater Treatment Works (WwTWs) are a point source pressure on river water quality and were identified as the second largest contributor of phosphorus within the River Usk catchment, with a 21% source apportionment in the SAGIS modelling of 2023[16].

In February 2023, NRW published details of a proposed review of existing environmental permits for larger WwTWs (those with a dry weather flow, final effluent discharge of more than $20m^3$ per day) against the revised water quality targets for SAC rivers. This work was done as an appropriate measure under Article 6(2) of the Habitats Directive and was completed in June 2024. It resulted in new or revised P limits of at least 5mg/litre being placed on all WwTW Environmental Permits for assets that discharge to watercourses in SAC river catchments with daily flows above $20m^3$ per day, as well as a few smaller discharges - affecting 30 WwTWs[17].

The SAGIS modelling is a tool used to identify the WwTWs where further tightening of the phosphorus limits and investment is required through the next Asset Management Programme (AMP8); this is in addition to any investments and works already underway or completed as part of AMP7.

Dŵr Cymru Welsh Water produced a Phosphorus Reduction programme for all SAC rivers with the aim of delivering their 'fair share' of phosphorus reduction by 2032; this is linked to and aligned with NRW's Review of Permits work. Within the Usk catchment, 10 sites were identified as requiring schemes to meet the newer, tighter limits of the revised permits.

[16] SAC Rivers: Source Apportionment Reports | Dŵr Cymru Welsh Water

[17] Natural Resources Wales / Phosphorus limits on environmental permits for waste water treatment work discharges

WwTW Name	Permit Number	Issue date of reviewed permit	P limit (1) mg/l	Effective date P limit (1)	P limit (2) mg/l	Effective date P limit (2)
LLANFOIST	AB0038201	06/11/2023	5mg/l	13/11/2023	2mg/l	31/12/2025
BRECON	AB0041501	21/11/2023	5mg/l	28/11/2023	2mg/l	31/12/2025
TALYBONT	AD0001701	14/02/2024	5mg/l	21/02/2024	1mg/l	31/03/2030
SENNYBRIDGE ARMY CAMP	AC0140301	18/01/2024	5mg/l	25/01/2024	3.5mg/l	31/03/2030
LLANDDEW BRECON	AC0140701	19/06/2024	5mg/l	26/06/2024	4mg/l	31/03/2030
LIBANUS	AB0076001	08/12/2023	5mg/l	15/12/2023	2mg/l	31/03/2030
LLANFYRNACH	AD0002101	31/07/2024	5mg/l	28/01/2028	2.5mg/l	31/03/2030
TRECASTLE	AD0000901	21/12/2023	5mg/l	03/01/2024	0.75mg/l	31/03/2030
LLANBEDR	AA0003101	19/06/2024	5mg/l	26/06/2024	1mg/l	31/03/2032
GOYTRE	AC0116401	27/11/2023	5mg/l	04/12/2023	1.4mg/l	31/03/2030

Figure 5: Wastewater Treatment Works where phosphorus reduction schemes will be delivered to comply with tighter phosphorus limits (April 2025)[18]

Phosphorus-reduction infrastructure is currently being installed at two of the largest WwTWs in the catchment - at Brecon and Llanfoist - which will serve the towns with the largest populations in the Usk catchment. This will reduce phosphorus loading from existing discharges as well as from any new flows. These schemes were due for implementation by 2030 but were brought forward for completion by 30th December 2025 because of accelerated funding that was committed at the First Minister's River Summit in 2022.

An additional 18 WwTWs were identified in NRW's review of permits to have a phosphorus limit of 5 mg/l (sometimes referred to as a 'backstop' limit), with some becoming effective over the coming AMP (2025 – 2030).
By 2032 Dŵr Cymru Welsh Water forecasts that its largest phosphorus load removal across Wales will be in the Usk catchment, with an estimated 36.3 kg/day or 13,250 kg/year removed; this will deliver a 20% reduction, in accordance with the fair share principle.

There is currently no proposal to review the environmental permits for most of the smaller Wastewater Treatment Works (those with flows less than $20m^3$ per day that did not require a phosphorus limit in order to achieve 'fair share'). Therefore, the discharges from these WwTWs will remain without P limits on their permits and development proposals connecting to such a works will continue to need to demonstrate nutrient neutrality.

Potential future growth across the catchment will require the developer to demonstrate nutrient neutrality. The publication of the Welsh Government's nutrient calculator and mitigations menu will be an essential tool for developers to demonstrate this. The nature-based solutions in this Nutrient Management Plan, along with the Usk Nutrient Portal alongside and the nutrient calculator will assist developers to plan development and mitigation sites.

[18] Natural Resources Wales / Phosphorus limits on environmental permits for waste water treatment work discharges)

The other contribution from Dŵr Cymru Welsh Water assets to the phosphorus load in the river is from Storm Overflows; under normal (permitted) discharges, the SAGIS model results identified this to be a contribution of 1% of the total daily load of phosphorus in the Usk catchment, though it is recognised that there could be discharge outside of the permitted levels and this figure may be higher. Schemes to reduce the operation of Storm Overflows are being addressed across DCWW's operational area in order of ecological impact. In the period 2020-2025, £140 million was invested into assessing the worst performing overflows, with a further £1.1billion planned for the 2025-2030 period, to continue investigating and improving those causing most ecological harm first. Ten storm overflows in the Usk catchment are identified for improvement in the period 2025–2030. These will require varied solutions for removing surface water using nature-based solutions and grey engineered solutions. This is in addition to a £10 million scheme that is underway at Usk Sewerage Pumping Station (SPS) and Wastewater Treatment Works (WwTW) to reduce the volume and frequency of storm overflow operation.

Storm Overflow Location
Mill Street, Abergavenny SO
Brecon east of WwTW SO
Brecon Main SPS SO
Crickhowell Legar SO
Sennybridge WwTW
Brecon WwTW
Little Mill WwTW
Llanbedr WwTW
Llanfoist WwTW
Trecastle WwTW

Figure 6: Storm overflows identified for improvement in the Usk catchment in the period 2020–2030

DCWW are investigating the implementation of Nature-based Solutions at several WwTW sites within AMP8 as a means of removing phosphorus to meeting tighter permit limits. Scoping and detailed investigations are ongoing and the confirmation of delivery of NbS is not yet certain for all sites. Further sites which may require investment to control overflow discharges will be identified through AMP8.

4.3 Private Sewage Systems (PSS)

Most rural areas cannot connect to the mains sewerage network and are reliant on private sewage systems for the treatment of foul drainage. These are principally septic tanks and package treatment plants, although there is also some use of cesspits (sealed systems). The level of phosphorus coming from households that are not connected to the mains sewerage network can be significant. The SAGIS modelling showed that 11% of the average daily load of phosphorus was from "other sources", including septic tanks and urban run-off. The unpublished SAGIS data breaks this down into 2.5% from septic tanks (and 8.5% from urban run-off), but the methodologies are based on small studies and national assumptions and further investigation in the catchment is needed.

Septic tanks (STs) must discharge to ground; there is no treatment of the sewage within the tank, so the breakdown of effluent is achieved within the drainage field, which provides the necessary secondary treatment. Some older septic tanks may have deteriorating structures or inadequate drainage fields and may also be near/discharge directly to a watercourse, with an associated risk to the water environment. Package treatment plants (PTPs) can provide treatment of the waste within the tank and treat effluent to a very high standard. The resultant discharge is cleaner than that from septic tanks, but they usually require an electricity supply for operation.

NRW currently requires households to register their systems and resultant discharges (to ground or to water)[19]and provides online resources and advice to those who have this type of system. However, many existing discharges are not registered, and it is difficult to estimate the full scale of the potential contribution to nutrients in the catchment. Private systems need regular attention to work well and without a proper maintenance regime there is significant potential for local environmental harm. PTPs registered for an exemption can continue to discharge to local watercourses.

Upgrading and maintenance can be achieved through a variety of ways, and it is up to the property owner/manager to ensure their system is in good working order and regularly emptied. In some areas of the UK, community projects are available[20] to help reduce the impact of these systems, and similar projects could and should be set up in the Usk Catchment. There will be opportunity to replace septic tanks with package treatment plants and to ensure that drainage fields are located, sized and constructed appropriately. New drainage fields must be built in accordance with The Building Regulations 2010, Document H[21].

New development must connect to a public foul sewer where possible, in accordance with the Welsh Government's Drainage Hierarchy[22]; otherwise, the installation of a PTP is the next preferred option. New septic tanks are only acceptable if it is justified that a PTP cannot be accommodated. All drainage fields must be constructed to the relevant British Standard and located more than 40 metres from any watercourse. New discharges to watercourses within SAC catchments are unacceptable unless it can be demonstrated that a discharge to ground is not possible or is replacing an inadequate system, and that any new discharges will not result in exceedance of SAC water quality targets or prevent their achievement in the future. An Environmental Permit will be required for new discharges to, or within 500 metres of, SAC watercourses.

Research into nutrient recovery and re-use provides insight into the potential for circularity of nutrients on-farm [23] and trading of phosphorus removed from private

[19] Natural Resources Wales / Register your septic tank or small sewage (package) treatment plant
[20] Grants for septic tank schemes – The Lake District Foundation – Charity of the Lake District
[21] https://www.gov.wales/approved-document-h-drainage-and-waste-disposal
[22] https://www.gov.wales/sites/default/files/publications/2019-05/planning-requirements-for-private-sewerage-in-new-development-wgc-0082018.pdf
[23] NutriReValorise

systems; this is in its early stages, but potential for effective phosphorus removal from septic tanks is promising.

4.4 Biosolids

While it can be an important soil nutrient enhancer, biosolids (sewage sludge) contain a very concentrated levels of nutrients, and potentially other elements toxic to the natural environment. Its use is a concern for water quality and soil health due to the potential build-up of heavy metals. Spreading is regulated to ensure nutrient supply is not above that of crop or soil need, and to this end DCWW provide a full soil testing service[24], which tests for nutrient levels but not other potentially harmful chemicals such as pharmaceuticals. The practice comes under the voluntary Biosolids Assurance scheme [25] and the Water Resources (Control of Agricultural Pollution) (Wales) Regulations 2021. Land spreading must result in agricultural benefit and be a waste recovery activity.

4.5 Housing need

Full details of the development need and the way this will impact the Usk are in Annex 2 By 2032, for most settlements (other than those served by the smallest WwTWs and private treatment systems), NRW's restorative Permit Review and the AMP 8 upgrade work to the WwTWs planned by DCWW will be sufficient to enable immediate housing needs to be met in the catchment through the short – medium term up until 2032.

Development proposing to connect to smaller WwTWs without a phosphorus limit in the environmental permit (usually those in rural locations) and within a failing SAC catchment will be required to demonstrate nutrient neutrality. This is likely to involve securing nature-based solutions on land, or upstream of the development site. Calculations of specific requirements in terms of nutrient neutrality have not been given in this document.

At the time of writing, the publication of an 'all-Wales' nutrient calculator by Welsh Government is awaited. This will enable the quantification of nutrients generated by development to assess suitable mitigation and off-setting measures are in place and functioning prior to development taking place. The measures will need to be delivered upstream of any impacts at a Wastewater Treatment Works and adopt a precautionary approach to avoid any uncertainty of the delivery of neutrality via NbS.

4.6 Climate Change

Climate change presents a very high risk to healthy functioning ecosystems in Wales, and we are very likely to see direct impacts on our rivers. The overall rainfall levels will remain constant but be distributed less evenly throughout the year, leading to fluctuations in water quantity (flow rates) with events of extreme high and low flows, which are expected to increase in frequency as we move towards the middle of the century. Increases in water temperatures will also result in changes to the ecology of the

[24] Biosolids for agriculture | Dŵr Cymru Welsh Water
[25] Water-Resources-Regulations-Wales-Standard-PS.pdf

river and its tributaries. NRW has used the Met Office Hadley Centre led UK Climate Projections 18 (UKCP18) model[26] to determine the variety of effects on Wales's weather patterns.

Risk analysis of flood trends show several communities being at higher risk of flooding as rainfall events of increased duration and intensity occur with more frequency. Risk of communities to flooding is a priority area of concern for the UCP, and in December 2024 the Partnership heard 'in person' testimonies from the Flood Wardens of Crickhowell who were badly impacted through the Storm Dennis in Spring 2020

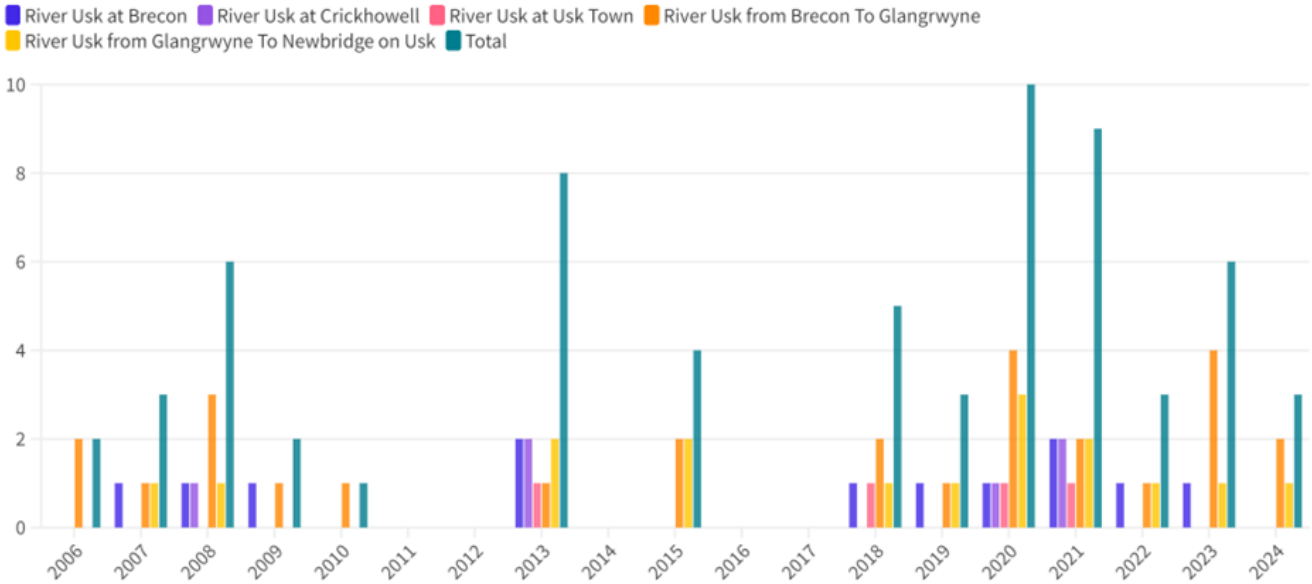


Figure 7 showing the frequency of flood warnings/alerts for Usk Catchment for the period 2006-2024. Data Source DataMapWales[27]

As well as impacting the catchment's communities, high flows have significant impacts on river ecology with increased erosion, sediment input, washout of fish redds and damage to water-crowfoot (Ranunculus spp.) beds increasing pressure on the healthy functioning of the river system.

Low rainfall events, combined with higher temperatures and increased evaporation rates will lead to low flow conditions which will have their own set of impacts on river ecology. Higher water temperatures and less habitat availability for aquatic species will increase the pressures on these species and some sections of river may 'dry up' (disappear into gravels) completely, leaving disconnected pools of water as the only haven for species mobile enough to avoid the dry areas.

4.7 Modified Watercourses

The main reason for rivers across Wales failing to reach 'Good' status under Water Framework Directive elements is due to modifications that have been imposed on rivers

[26] UK Climate Projections (UKCP) - Met Office

[27] Historic Flood Warnings and Flood Alerts | DataMapWales (gov.wales).

for many centuries in the UK. In-channel weir structures to divert water to mills, bring water to settlements intensified in the mid-19th Century, largely because of the Industrial Revolution. As agriculture became mechanised and population expanded, a new wave of modifications occurred, encouraged by government policy including channel straightening, floodplain disconnection, and drainage of land.

4.8 Abstraction

Water resources for anthropomorphic uses can affect water quantity and quality. Water is taken from the river for public supply at Brecon and at Prioress Mill (near Usk town) and there are four large reservoirs on designated tributaries of the Usk SAC - the Usk, Crai, Talybont and Grwyne Fawr reservoirs, some of which supplies drinking water to the South Wales valleys; currently 94% of licensed take from the river is for potable water supplies, with daily abstraction limits to ensure ecologically sustainable water levels. Water is also abstracted for agricultural and recreational uses, with the Brecon and Monmouthshire canal abstraction at Brecon being a large (up to 30% of the flow in drought conditions) amenity user, which until recently did not require an abstraction licence. NRW imposed licensing on the Brecon abstraction point in 2022, and after appeal this decision was upheld; now all canal abstractions, along with abstractions by DCWW for drinking water will be linked to the river's flow level which will reduce allowable abstraction as river levels fall.

5.0 Existing Interventions

There is already a significant body of work being undertaken within the catchment, some of which are listed below. Much of this work is happening in collaboration with the agricultural community, and this NMP will build on those projects already in existence and build trust to continue delivery. The extent to which these are focused on nutrient savings varies, although the NbS solutions focus is likely to have improvements on sediment and associated nutrients entering watercourses.

The Wye and Usk Foundation[28] have been leading projects in the catchment for many years, including CaSTCo[29], and NRW are leading the Four Rivers For LIFE[30] project which will deliver some major interventions for overall river health up to 2027. The Beacons Water Group and 'we are Nature Based' CiC have led on Natural Flood Management interventions in the Upper Catchment. The outcomes of these are likely to deliver reductions in nutrient levels within the aquatic environment. The charity Stump up for Trees[31] aims to work with farmers and landowners to plant a million trees in the National Park and South Wales, to improve air, water and overall ecological resilience.

DCWW's AMP 8 programme, which is in the early stages of development, will run from April 2025 – March 2030, and along with general improvements and proofing for future

[28] Home - The Wye & Usk Foundation
[29] Catchment Systems Thinking Cooperative (CaSTCo) - The Wye & Usk Foundation
[30] Natural Resources Wales / Four Rivers for LIFE
[31] Stump up for trees - aiming to plant a million trees in the Brecon Beacons

growth is likely to focus on phosphorus reduction infrastructure at the water companies' main assets, but will also include NbS solutions, where these are appropriate to deliver within the Water company's owned land. DCWW have new environmental obligations in AMP8, as identified through NRWs' Water Quality National Environment Programme (WQ NEP). The NEP outlines the improvements needed for DCWW to comply with new or amended environmental legislation and identifies investigations needed to inform, in an evidence-led way, potential investment requirements in subsequent AMP periods.

5.1 The use of Constructed Wetlands.

Though there are currently no wetlands used as tertiary treatment sites in the catchment, they exist in other areas and usually comprise of one or more wet areas containing native emergent vegetation. They will be designed and maintained to receive and treat waters / effluents / wastewaters so that any discharge from the constructed wetland will not pollute the surface or ground water. DCWW are considering using NbS at their own sites to aid in the removal of P and other ecotoxic chemicals which are currently not considered for removal but are present in the outfall from works. Any use of wetlands in this way would need to consider the NRWs current position statement[32] on using these for treatment of sewage effluent. As it stands, any third party with such a wetland on their land would need to have a waste transfer licence and be classed as a waste operator for the wetland. The landowner would be legally responsible for water quality exiting the site.

Constructed wetlands are not permitted for use in treating agricultural effluents, liquors and washings. These are covered under current legislation and must be collected, stored and disposed of in a legally compliant way.

6.0 Citizen Science (Cit Sci)

Citizen Science monitoring plays an important part in helping to improve river condition. As an action from the SAC Rivers summit, NRW have released guidance on the acceptability and use of Citizen Science for improving water quality[33] in Wales. The UCP recognises this as an important monitoring tool for the implementation of the mitigations set out in this NMP. The Cit Sci work will sit alongside regulatory and other monitoring to help complete the bigger, complex picture when it comes to understanding the health of the Usk.

[32] Natural Resources Wales / Constructed wetlands for improving water quality

[33] An assessment of the use and acceptability of citizen science data to support better water quality for Wales

6.1 Case studies - Citizen Science

Save The River Usk (STRU)[34]
STRU are a voluntary community group, set up in 2021 to involve the communities of the Usk valley in restoring the Usk to ecological health. It is not a membership organisation but has registered several hundred supporters and trained about 80 volunteers to do 'citizen science' water quality testing.
STRU's citizen scientists now test weekly at around 55 locations all around the catchment using a kit provided by STRU. In the last 3 years, STRU's citizen scientists have accumulated a database of over 3000 samples. Each sample is tested for phosphates, nitrates, ammonia, electroconductivity, turbidity and temperature. These data are uploaded onto a single database maintained by Cardiff University and shared with WUF as part of the CaSTCo project. In addition, STRU undertakes periodic E. coli sampling; these samples are processed at the University of South Wales.

Public education is an integral part of STRU's role. This includes opportunistic chats with people at the riverside, as well as organised events - in 2024, STRU organised the first River Usk Festival and delivered an average of more than one talk every week to community groups and schools.
Currently, STRU receives a grant via WUF for its contributions to the CaSTCo data but otherwise is dependent on small donations from local supporters to cover its running costs.

River Gavenny Catchment Partnership
This group has developed a Community Action Plan informed by NRW's River Restoration plan and extensive community consultation involving Town and Community Councils, NGO's, and other local interest groups.
The Community Action Plan aims to:

1. Aid the restoration of the River Gavenny and its biodiversity.
2. Increase community engagement with the river.
3. Raise public awareness of the benefits of the river.

The costed and part-funded (via Gwent Green Grid, Heritage Lottery Fund Nature Networks) action plan for 2025-2026 includes development of a River Gavenny Healthy Rivers project (with Groundwork Wales); it also involves engagement and awareness raising, along with an exploration of landowner collaboration for the rural stretch of the Gavenny catchment, which stretches north of Abergavenny (and into Bannau Brycheiniog National Park).

[34] SAVE THE RIVER USK - www.savetheriverusk.org

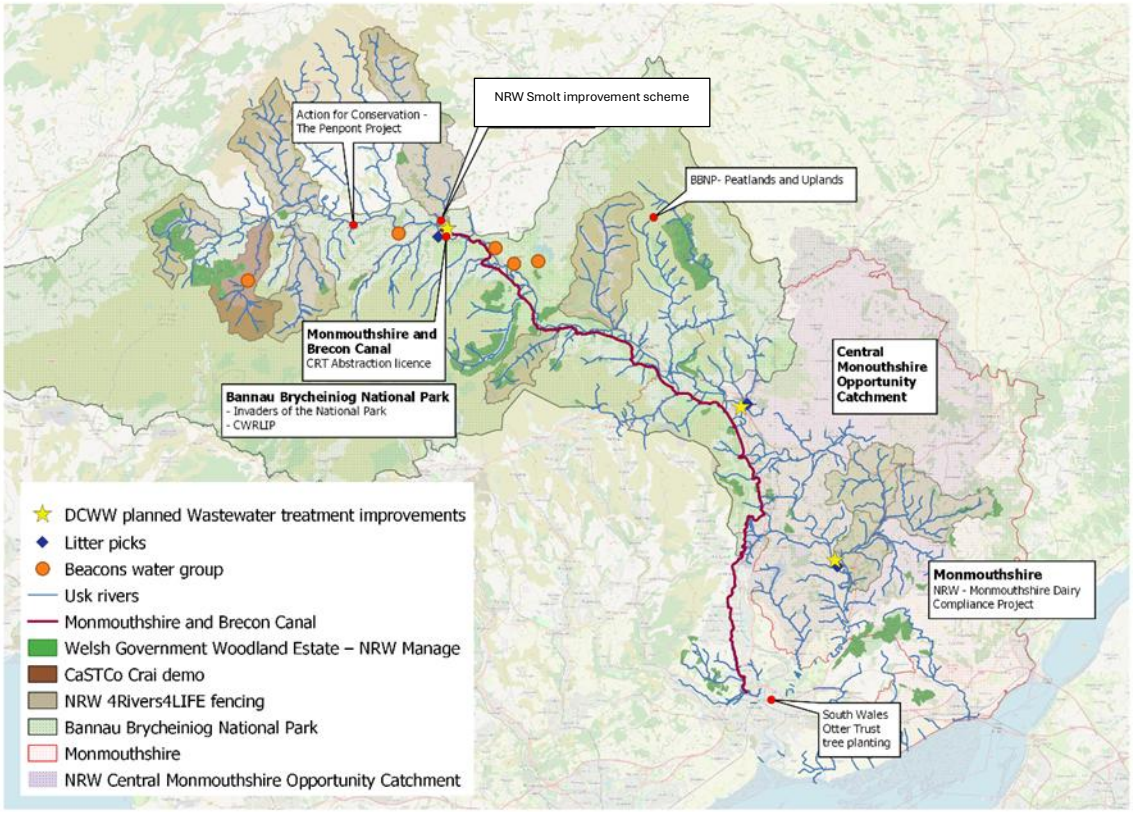


Figure 8: Preliminary spatial map of current interventions in the Usk catchment, data collected in 2023, not all partners contributed.

Lead Organisation	Partners	Project/Activity name	Timeframe	Location
Wye and Usk Foundation	DCWW, farmers, Ofwat, Rivers Trusts, United Utilities	Catchment Systems Thinking Cooperative (CaSTCo) demo – land management for river health	To end 2025	Afon Crai
OurFood1200/EinBwyd1200	BBNP/Farmers	Our Food 1200 – modern regenerative horticulture	Ongoing	BBNP/Monmouthshire/Powys
Brecon Canoe Club	Canoe Wales	Glanhad Mawr wrth Badlo / The Big Paddle Clean-up	Annual	Brecon
BBNP	Landowners, NRW, Herbicide contractor	Invaders of the National Park – invasive plant species control	To 2024	BBNP
BBNP	Farmers and landowners, research-based orgs, conservation orgs, policy makers, farming unions, general public	CWRLIP – encourage wet grassland habitat		BBNP
DCWW		Brecon Wastewater Treatment Works improvements - £9m	End 2025	Brecon
Canal and River Trust	NRW	Salmon smolt pass improvement		Brecon
NRW		Central Monmouthshire Opportunity Catchment – NBS, compliance works		Central Mons Opportunity Catchment
Monmouthshire CC	Blaenau Gwent, Caerphilly, Newport, and Torfaen local authorities and Natural Resources Wales	Gwent Green Grid – NFM plans	To 2026	Gwent
NRW	BBNP, River Restoration Centre, Coleg Sir Gâr and the Woodland Trust, Dŵr Cymru/Welsh Water, Welsh Government	Four Rivers for LIFE – fencing and tree planting	To 2027	Various
DCWW	Monmouthshire CC	Llanfoist WwTW improvements	End 2025	Llanfoist
Gwent Wildlife Trust		Floodplain meadows demo site	Ongoing	Lower Usk
NRW		Monmouthshire Dairy Compliance Project	Ongoing	Monmouthshire
NRW		Forest Resource Plans	NRW	Ongoing for forestry in upper catchment
Action for Conservation	Penpont Estate, landowners, tenants, young people, teachers, foresters	The Penpont Project – restoration, innovative farming and forestry, youth leadership	Ongoing	Penpont Estate
Beacons Water Group Beacons Water Group	DCWW	Farmer led group piloting agricultural practices	Ongoing	Upper catchment
Keep Wales Tidy	Community groups	Litter picks	Ongoing	Usk, Abergavenny, Brecon
Swansea University	Affan Valley Angling Club, Afonydd Cymru, West Wales Rivers Trust, Welsh	Reconnecting the Salmon Rivers of Wales – fish barrier removal	to 2024	Various

	Water, The Wye & Usk Foundation and Natural Resources Wales			
Menter a busnes	Farmers, Welsh Government, Lantra Wales, IBERS, Welsh Innovation Farm Network, ADAS Wales, Kite Consulting, Innovis, Bangor University	Farming Connect – farm advice – nutrient management, water flow and infrastructure to	March 2025	Whole catchment
Wye and Usk Foundation	Natural Resources Wales, Natural England, Beacons Trust and riparian owners	Giving Up the Weed – control of non-native plant species	Ongoing	Whole catchment

Figure 9: A snapshot of current activities in the Usk Catchment.

7.0 The impact of Regulations

The Control of Agricultural Pollution Regulations (CoAPR)[35] came into force in 2021 and will enable a certain amount of reduction in nutrient levels from agricultural sources. Promotion and awareness of the new agricultural pollution regulations will form a part of the delivery work the UCP undertakes. Natural Resources Wales (NRW) is responsible for assessing compliance and it will do this by inspecting farms and checking records. The Regulatory Impact Assessment[36] considered, under Option 2 'All Wales Approach' with the option of an earned autonomy category. Under the Option 2 assessment, if this approach were taken, an estimated reduction of nutrients through these proposed measures (shown in figure 10 below) would be 6%.

Measure
Use a fertiliser recommendation system
Integrate fertiliser and manure nutrient supply
Do not apply manufactured fertiliser to high-risk areas
Avoid spreading manufactured fertiliser to fields at high-risk times (to End of March)
Avoid spreading manufactured fertiliser to fields at high-risk times (to End of February)
Increase the capacity of farm slurry stores to improve timing of slurry applications
Do not apply manure to high-risk areas
Do not spread slurry or poultry manure at high-risk times
Do not spread farmyard manure (FYM) to fields at high-risk times

Figure 10: From the CoAPR Regulatory Impact - Measures under policy option 2 as applied to the whole of Wales.

The CoAPR also requires:

- Nitrogen management planning (including risk analysis)
- Fertiliser application levels linked to crop need
- Protection of water from pollution related to when, where and how fertilisers are spread and
- Manure and silage storage standards.

The regulator will work proactively with farmers to ensure breaches are remedied and not repeated by providing advice and guidance.

The recent publication of the 4-year review[37] of these regulations highlights some improvements that may have direct positive impacts for rivers, including adding flexibility of the closed spreading period, and mandatory precision spreading for slurry and a recommendation for soil protection regulations to be part of the future CoAPR.

[35] The Water Resources (Control of Agricultural Pollution) (Wales) Regulations 2021: guidance for farmers and land managers | GOV.WALES

[36] Explanatory Memorandum to the Water Resources (Control of Agricultural Pollution) (Wales) Regulations 2021.

[37] Statutory review of the Control of Agricultural Pollution Regulations: 2025 review

7.1 Sustainable Drainage Systems (SuDs)

SuDs are an additional tool in the reduction of pollutants into the freshwater system and can also reduce localised flood risk. They are designed to mimic natural drainage through the management of surface water runoff as close to the source as possible and will be considered further as part of the Integrated Catchment Management Plan. (ICMP). The UCP will support the implementation of SuDs to reduce flood risk in the catchment.

All new developments are required to comply with the Sustainable Drainage Statutory Standards[38] in compliance with the Flood and Water Management Act 2010; developers (housing and agricultural) must gain approval before beginning construction. NRW have also issued guidance.[39].

Types of SuDs include –

- Swales
- Rain Gardens / Tree Pits
- Permeable Paving
- Filter Drains
- Filter Basins and Detention Basins
- Infiltration Basins
- Ponds and Constructed Wetlands
- Green Roofs

Marine SACs and Nitrogen

At the time of writing this NMP, the Marine SAC guidance has not been released by NRW. It is not yet known whether restrictions on nutrients will extend beyond the principal one of concern, nitrogen.

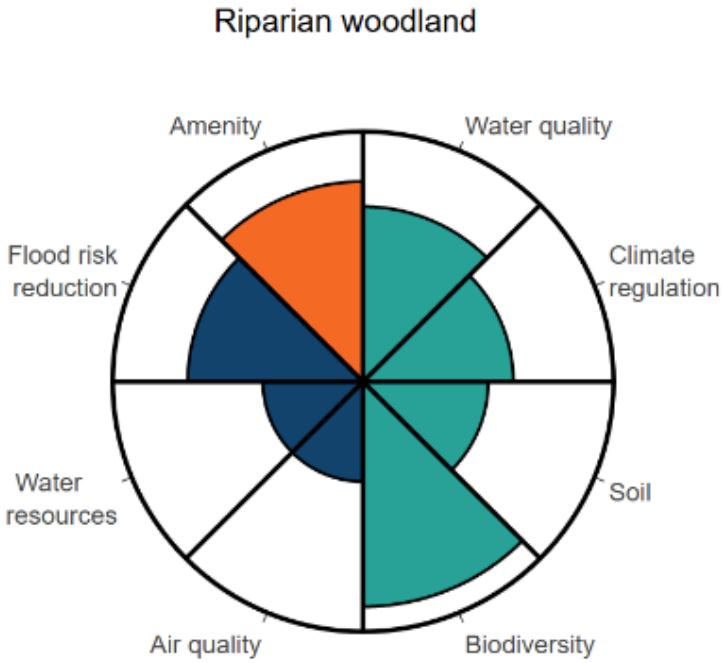
8.0 Nature-based Solutions (NbS)

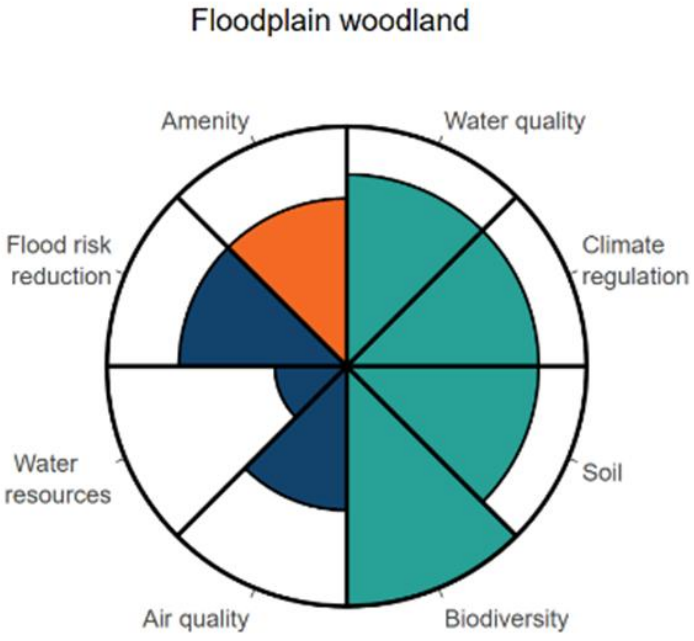
Nature-based Solutions are defined by the IUCN[40] as 'actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits'. Through the right intervention in the right place, the use of NbS can deliver multiple benefits across freshwater and terrestrial ecosystems and cannot be underestimated in terms of dealing with the complex issues of developing resilience across nature. NbS aim to enhance biodiversity, improve ecosystem services, and provide sustainable benefits to human societies[41].

[38] statutory-guidance.pdf
[39] Natural Resources Wales / Sustainable Drainage Systems (SuDS)
[40] https://portals.iucn.org/congress/assembly/motions/print?langua
[41] Overview of Nature-based solutions | UNEP - UN Environment Programme

Soil health improvements are a cross-cutting theme of the NbS suitable for nutrient and flood mitigation – and this will be a foundation for delivery work, achieved through engagement and knowledge exchange.

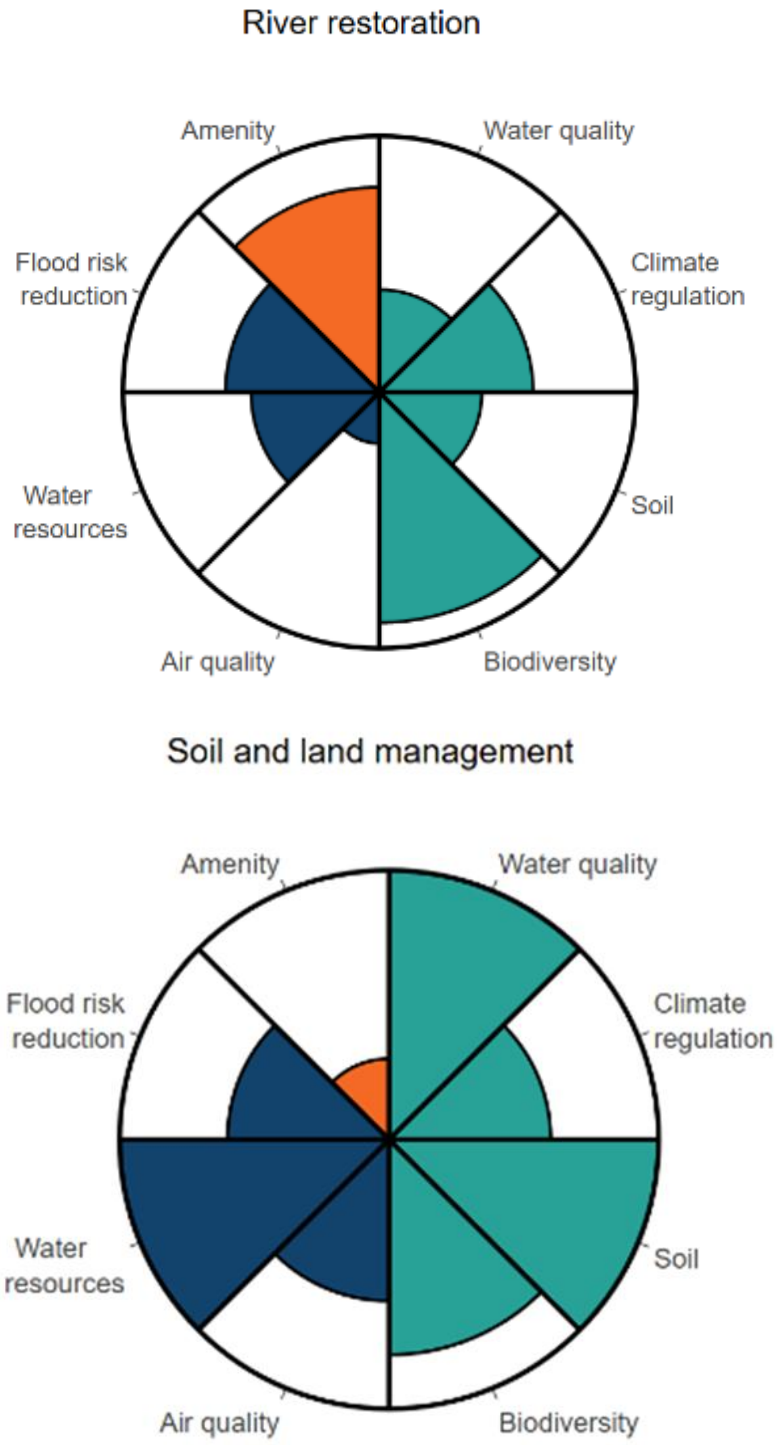
The benefits of NbS to nature and society are broad as shown in figures 11-14 below.





Figures 11 and 12 - Selected examples of multiple benefits of Nature Based Solutions from ENVIRONMENT AGENCY. 2025. Working with Natural Processes – Evidence Directory. [Online]. Environmental Agency, FRS21232. Available from[42]

[42] https://www.gov.uk/flood-and-coastal-erosion-risk-management-research-reports/working-with-natural-processes-to-reduce-flood-risk-2024



Figures 13 and 14 - Selected examples of multiple benefits of Nature Based Solutions from ENVIRONMENT AGENCY. 2025. Working with Natural Processes – Evidence Directory. [Online]. Environmental Agency, FRS21232. Available from[43]

[43] https://www.gov.uk/flood-and-coastal-erosion-risk-management-research-reports/working-with-natural-processes-to-reduce-flood-risk-2024

9.0 Nature-based Solutions and Farming

NbS are also well documented as directly benefitting farm productivity. Benefits are realised through productivity gains and cost savings. Examples include stock and crop health improvements achieved through increasing the availability of nutrients and trace elements that are in the soil[44]. Disease burden can be reduced through Integrated Pest Management (IPM) by encouraging beneficial plants and insects. IPM is currently listed as one of the proposed Universal Actions in the Sustainable Farming Scheme.[45] More on-farm benefits are listed in Figure 15 below

NbS	**On Farm benefit**
Soil health (increased organic matter content, reduced compaction)	Improved flood and drought resilience. Greater infiltration rates mean less pasture damage during wet times, increased subsoil and aquifer recharge (more water availability in drought conditions) and more nutrient retention on land.
Biodiversity – plant and insect	A higher range of species that stock graze (pasture or hedgerow) is beneficial for stock health and meat quality[46]. Predatory insect species also benefit arable crops through pest control.
Water resources	Cleaner water upstream, means reduced disease potential flowing to those who abstract water for stock drinking downstream.
Climate regulation (localised)	Contour hedgerow and other forms of tree planting provide shelter (reduce windspeed, increase shading) and fodder for stock.
Amenity value	Greater business diversity potential on farm.

Figure 15: A selected range of on farm benefits of Nature-based Solutions (NbS)

10.0 The Usk Nutrient Portal

The Portal is accessed via this link -
https://storymaps.arcgis.com/stories/37105c44064e47cba09796bbb7b5ad65

Welsh Government issued a Mitigations Menu [47] highlighting which methods are appropriate for use to deliver solutions on land that will, among other benefits, reduce the nutrient run off. The UCP saw this as an opportunity to develop a planning tool that will support decision making on the ground benefitting both farmers and the natural

[44] How Does Soil Biology Impact Nutrient Availability? | Science Societies
[45] Sustainable Farming Scheme: proposed scheme outline (2024) | GOV.WALES
[46] Species composition determines forage quality and medicinal value of high diversity grasslands in lowland England - ScienceDirect
[47] mitigation-measures-menu.xlsx

environment, and in doing so allow a scale of delivery that will go some way towards providing certainty of outcomes.

The UCP commissioned consultancy AtkinsRéalis (AR) to produce an online GIS Portal to facilitate the delivery of nature-based solutions and begin to quantify nutrient reductions across the Usk catchment; they were supported by a steering group including members from the Knowledge Hub. The Portal shows Waterbody, Catchment and field-scale options for Nature-based Solutions (NbS) to address diffuse pollution from rural land use. The methodology used to build the tool and how to use it is explained in further detail in Annex 1 below.

This portal is hosted on the Usk Catchment Partnership website[48] with full access for farmers, advisors, developers and any others who are working in the diverse arena of nature recovery, water quality and flow mitigation for rivers. The Usk Portal is designed to be an accessible tool, with a strongly visual component ensuring using it is quick and simple to use. There is a detailed database of information that sits behind the portal which is also accessed online in an easily readable format.

As well as the Flood Mitigation Data described in the Flooding section below, other key outputs of the Usk Nutrient Portal are:

- Nutrient removal rates, with an approximation of certainty (based on NRW's Mitigation Measures Menu and a wider literature review).
- A qualitative assessment of nutrient removal effectiveness.

It shows NbS at various scales, allowing land management planning for water and nutrient retention opportunities. These opportunities fall into these broad categories:

- Land and soil management – e.g. stock grazing levels, deep rooting herbal leys and other soil health improvement techniques.
- Flow pathway measures – e.g. bunds, ditch blocking and swale creation to intercept surface runoff.
- River Restoration e.g. floodplain reconnection – enhancing natural floodplain processes and allowing sediment and nutrients to be deposited on land.

The information held within the Portal includes GIS layers containing:

- Land prone to soil loss (erosion)
- Land use (idealised farm types across the Usk Catchment – figure 16)
- Estimated load from point and diffuse sources from field to catchment scale
- The type of NbS considered most appropriate at field scale
- The potential water storage capacity of each NbS
- The expected reduction in load of total phosphorus, total nitrogen and suspended solids

[48] https://uskcatchmentpartnership.wales/

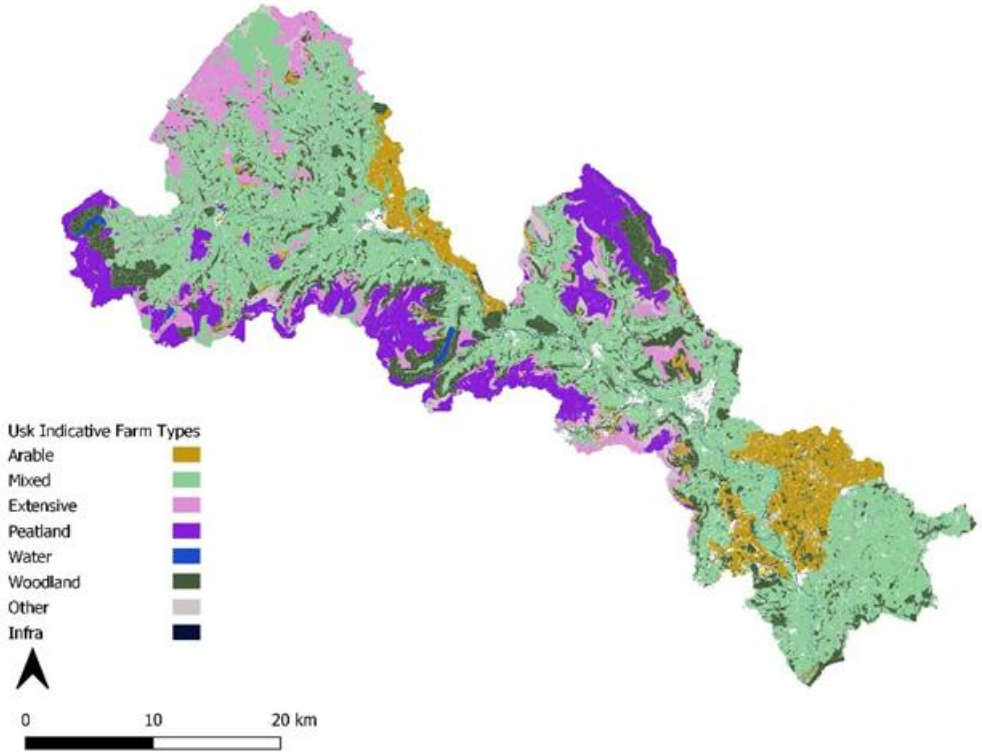


Figure 16 from the Usk Nutrient Portal showing indicative farm types across the Usk catchment (Usk Nutrient Portal)

This tool will sit at the foundation of decisions made around the way that projects are developed and how the UCP engage with stakeholders including farmers in the catchment to make plans that will deliver both nutrient reductions and normalised flow rates (via soil health/infiltration options) while helping to improve the farm business bottom line across the Usk catchment.[49.]

The challenge of capturing the full spatial scale of an 11,000Ha catchment at a resolution that is both i) useable and ii) representative of the catchment conditions, has led to a number of assumptions being taken, and these are listed in the Assumptions below.

When used alongside the detailed real-world knowledge that people have of their land, the Usk Nutrient Portal gives the information needed to make informed decisions about changes that can be made to prevent valuable nutrients moving from soil into groundwater and rivers. Field parcels can be viewed alongside a series of datapoints that indicate precautionary rates of Nitrogen, Phosphorus and sediment loss from that field. To aid design of interventions on specific fields the portal shows an associated 'Optimal Measure' – i.e. a mitigation measure most suited to that field to achieve soil and nutrient loss reduction.

The full portal methodology can be found in the Usk Portal Methodology annex.

[49] Farming Connect sampling highlights opportunities to improve soil health on Welsh farms | Farming Connect

Figure 17: List of Mitigation Measures (refined for suitability from mitigation menu). *Precautionary removal rates have significant site and temporal variation. More detail can be found in the Portal Measures Database[50]

Mitigation Measure Group	Measure type	Description	Precautionary* Removal rate	Precautionary Removal Rate	Precautionary Removal Rate
			TP (Total Phosphorus)	TN (Total Nitrogen)	SS (Suspended Sediment)
Woodland Planting	Catchment woodland	Large scale view of areas of the catchment that will benefit from increased tree cover	85%	38%	76%
	Riparian woodland	Trees planted alongside streams and rivers them helps reduce water temperature, erosion risk and intercept runoff	75%	63%	86%
	Cross slope planting (contour planting), e.g. hedgerows	Planting across slope to intercept runoff containing sediments.	81%	78%	94%
Agricultural practice/soil management	Land use change	Finding alternative ways to use land at risk of losing nutrients	78%	78%	77%
	Reduce livestock densities[51]	Actively reducing grazing pressure to allow sward to grow deeper roots and increase leaf surface area to support growth	Not yet quantified	Not yet quantified	Not yet quantified
	Low/Min tillage	Top seeding, shallow or non-inversion ploughing as an	78%	78%	77%

[50] River Usk Nutrient Management Plan
[51] Understanding grass growth for beef rotational grazing | AHDB

		alternative to deep plough methods that invert the soil			
	Cover crops	**Crops that are sown at the same time as the main crop to ensure there are no bare soils when crop is harvested**	**42%**	**23%**	**63%**
	Soil compaction remediation	**Techniques that reduce the compaction of soils, can include subsoiling and tramline disruption**	**90%**	**86%**	**87%**
	Peatland restoration	**Restoration through ditch blocking and peat seeding/planting**	**Not yet quantified**	**Not yet quantified**	**Not yet quantified**
	Inorganic fertiliser management	**Reducing or stop addition of bagged fertiliser spread on the land**	**46%**	**4%**	**-**
Farm infrastructure improvements	**Slurry storage**	**Increasing the storage capacity on farm to reduce pressure to spread at inappropriate times**	**Not yet quantified**	**Not yet quantified**	**Not yet quantified**
	Clean/dirty water separation	**Ensuring that clean rainwater isn't contaminated with slurry and other pollutants**	**Not yet quantified**	**Not yet quantified**	**Not yet quantified**
Flow pathway management	**Rural SuDS (sediment traps/interception ponds)**	**A range of yard, track and in-field options to intercept flow pathways**	**44%**	**28%**	**47%**
	Leaky barriers/engineered log jams	**In-ditch and stream methods to hold back flows at the top of catchments**	**<33%**	**Not yet quantified**	**Not yet quantified**

	Wetlands (free surface, rain fed)	**Open water wetlands to intercept and hold water back in catchments**	**<80%**	**<80%**	**<70%**
	Buffer strips	**Areas alongside watercourses and field boundaries designed to intercept flow, sediments and increase infiltration rates**	**<60%**	**60%**	**76%**
	Ditch blocking	**Structures and bunds in ditches to hold water back**	**<30%**	**38%**	**86%**
River Restoration	**Channel restoration**	**Restoring natural processes in modified (e.g. straightened) river channels**	**Not yet quantified**	**Not yet quantified**	**Not yet quantified**
	Floodplain reconnection	**Allowing rivers to connect to their floodplains in high flow situations**	**Not yet quantified**	**Not yet quantified**	**Not yet quantified**
SuDS (urban)	**Various rainscapes**	**Structure designed to increase rainfall infiltration to ground in urban settings**	**Not yet quantified**	**Not yet quantified**	**Not yet quantified**

All figures are drawn from best available evidence to date

Where significant uncertainty (due to a wide range of effectiveness and/or a lack of data) exists for a measure's pollution reduction effectivity meaning that it is not possible to provide a removal rate, these measures have been retained in the database and highlighted, to draw attention to the need for more evidence. These evidence gaps will be priority work areas for the next stages of the NMP as we facilitate the targeting of further research into these measures.

Water Body ID	Water Body Name	Water Body Length (km)	SAC P Target µg/l	2020-2023 SAC Phosphate Compliance Assessment			% change needed to reach target	Planned WwTW improvements			Storm Overflow improvement plans
				Result µg/l	Compliance	Confidence		WwTW name	Planned kg /year change	% change	
GB109056033080	Afon Crai - source to conf R Usk	9.59	≤10	10.8	Fail	Low	-7				
GB109056033020	Afon Cynrig - source to conf R Usk	9.84	≤15	13.8	Pass	Low	0				
GB109056033030	Afon Hydfer - source to conf R Usk	8.32	≤10	4.7	Pass	High	0				
GB109056033070	Afon Tarell - source to conf R Usk	15.16	≤20	22	Fail	Low	-9	LIBANUS	-156.04	-60	
GB109056040020	Afon Yscir - conf Yscir Fechan to conf R Usk	5.69	≤18	14.3	Pass	Low	0				
GB109056040070	Afon Yscir - source to conf Yscir Fechan	17.63	≤18	11	Pass	High	0				
GB109056033000	Caerfanell - source to conf R Usk	18.37	≤10	5.3	Pass	High	0	TALYBONT	-162.43	-80	
GB109056040030	Cilieni - source to conf R Usk	16.36	≤15	10.5	Pass	High	0				
GB109056033040	Cwm Treweryn - source to River Senni	4.04	≤25	15.3	Pass	High	0				
GB109056032980	Grwyne Fawr - conf Grwyne-Fechan to conf R Usk	6.21	≤28	8.6	Pass	High	0	LLANBEDR	-71.18	-80	Llanbedr WwTW
GB109056040000	Grwyne Fawr - source to conf Grwyne-Fechan	18.48	≤7	8.7	Fail	Low	-20				
GB109056039960	Grwyne-Fechan - source to conf Grwyne Fawr	13.88	≤15	20.9	Fail	Low	-28				
GB109056040060	Honddu - source to conf R Usk	23.16	≤25	24	Pass	Low	0	LLANDDEW BRECON	-9.58	-20	

GB109056040040	Nant Bran - source to conf R Usk	16.42	<15	7.5	Pass	High	0				
Water Body ID	**Water Body Name**	**Water Body Length (km)**	**SAC P Target µg/l**	**2020-2023 SAC Phosphate Compliance Assessment**			**% change needed to reach target**	**Planned WwTW improvements**			**Storm Overflow improvement plans**
GB109056033010	Nant Menasgin - source to conf R Usk	10.62	≤15	20.6	Fail	Low	-27	LLANFRYNACH	-37.30	-50	
GB109056039990	Rhiangoll - source to conf R Usk	15.80	≤30	24.5	Pass	High	0				
GB109056033050	Senni - source to conf River Usk	14.36	≤25	12.5	Pass	High	0				
GB109056039980	Usk - conf Afon Hydfer to conf Afon Senni	9.96	≤10	15	Fail	Low	-33	TRECASTLE	-89.20	-85	Trecastle WwTW
GB109056040081	Usk - conf Afon Senni to conf Afon Crawnon	34.41	≤25	40.1	Fail	High	-38	*BRECON*	*-3951.58*	*-60*	Brecon WwTW
								SENNYBRIDGE ARMY CAMP	*-308.65*	*-30*	Sennybridge WwTW
								Waterbody total	-4260.23	-56	Brecon Main SPS SO
											Brecon East of WwTW SO
GB109056026890	Usk - conf Olway Bk to New Br	4.94	≤50	65*	Fail*	High	-23				
GB109056040083	Usk - conf R Gavenny to conf Olway Bk	31.91	≤50	62.1	Fail	Low	-19	*LLANFOIST*	*-7833.36*	*-60*	Llanfoist WwTW
								GOYTRE	*-630.72*	*-72*	Usk Pumping Station and WwTW
								Waterbody total	-8464.08	-61	
GB109056039970	Usk - source to conf Afon Hydfer	11.66	≤15	21.2	Fail	Low	-29				
GB109056040082	Usk conf Afon Crawnon to conf Gavenny R	31.85	≤50	37.1	Pass	Low	0				Crickhowell Legar SO

Water Body ID	Water Body Name	Water Body Length (km)	SAC P Target µg/l	2020-2023 SAC Phosphate Compliance Assessment			% change needed to reach target	Planned WwTW improvements			Storm Overflow improvement plans
GB109056040050	Yscir Fechan - source to conf Afon Yscir	7.33	≤18	22.1	Fail	Low	-19				
					* Result rolled forward						
GB109056026950	Berthin Bk - source to conf R Usk		Not assessed								Little Mill WwTW
GB109056032990	Gavenny - source to conflence R Usk		Not assessed								Mill Street, Abergavenny SO

Figure 18: SAC compliance results v planned actions. This table summarises the minimum reductions needed on the failing Waterbodies to achieve compliance. The remaining 67% - equivalent to 120kg/day, or 43,800kg per year attributed to rural land use indicates a significant effort needed by the agricultural community towards removal under the fair share principle as described by the Environment Act (Wales) 2016

11.0 Gap analysis and our approach to delivery

With support from the CaSTCo programme, a systems analysis of the Usk catchment was undertaken by Cardiff University in 2023.[52].

The report highlighted the previous siloed approach to understanding and addressing freshwater needs, that favoured small-scale and fragmented interventions. Interventions have tended to focus on a handful of practical actions on the land or in the water with high visibility of outputs (e.g. INNS removal, fencing) that are often the 'low hanging fruit'. The more complex, multifaceted 'thorny' issues such as the supply chain, exacerbated by diverse and often conflicting interests of various actors were not being addressed. These areas will be addressed more directly in the Usk ICMP.

Diffuse and point source pollution sources present very distinct challenges.

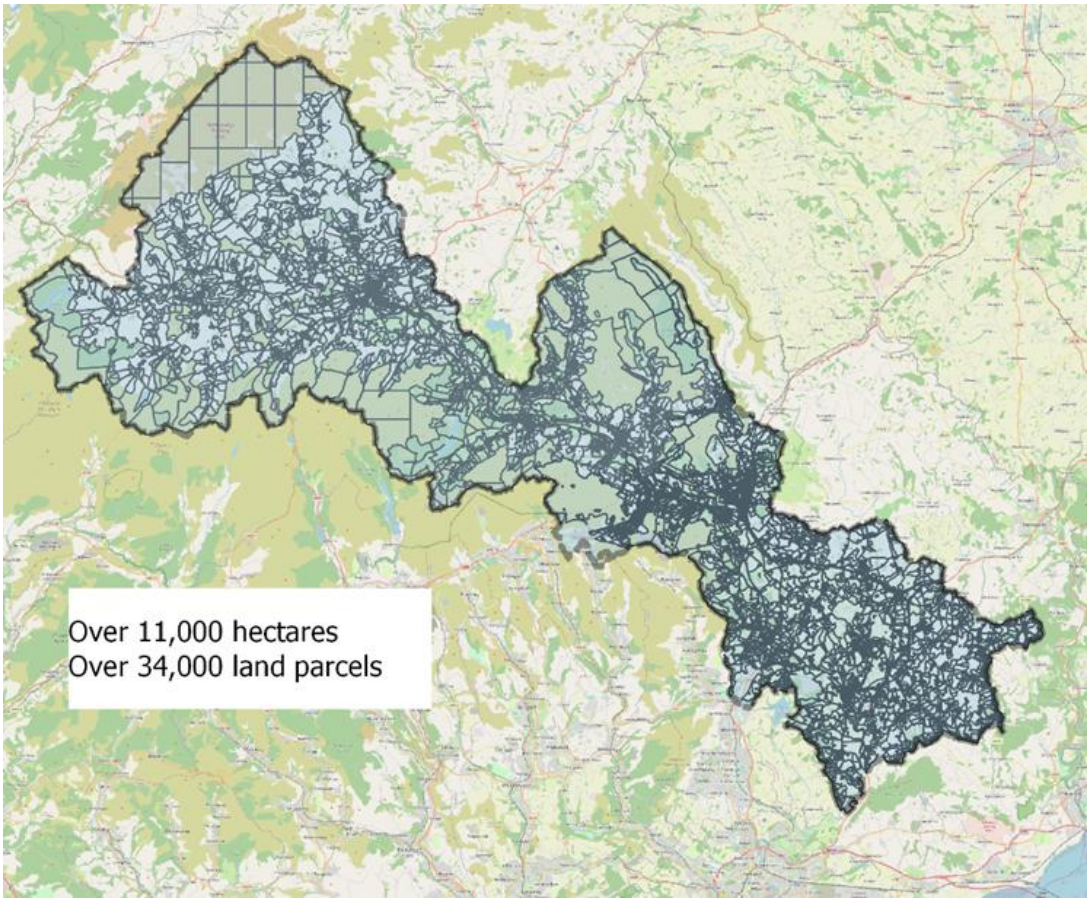


Figure 19: Indicative extent and position of registered freehold properties within the Usk Catchment Partnership Area[53]

The SAGIS apportionment work highlights the phosphorus contribution of rural land use to the river as by far the biggest contributor. The difficulty of dealing with diffuse sources is in part highlighted above with figure19 showing the scale and number of land parcels that are spread across the catchment. Mobilising multiple landowners into positive

[52] CaSTCO-Usk-systems-Final-Dec-2023.pdf
[53] https://use-land-property-data.service.gov.uk/datasets/inspire/download#local-authorities-for-P

action, with no immediate means of raising long term financial support for behaviour/management change is extremely challenging. However, it is through interventions in the diffuse sector that we will realise the wider benefits such as flood and drought resilience.

In contrast, point sources (at Wastewater Treatment Works) are relatively easy to identify (Figure 20 below) and to design solutions for quantifying reductions and funding is secured through water company business plans and the water bill.

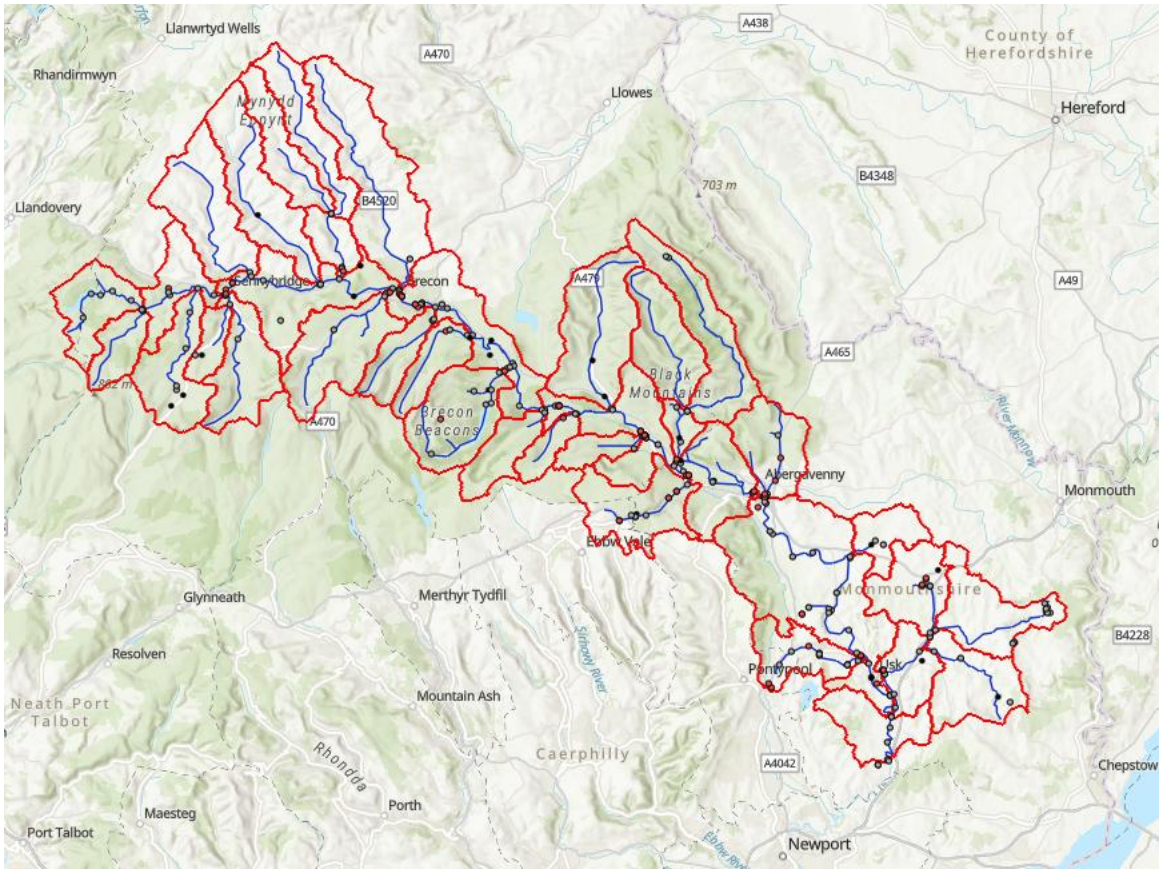


Figure 20: P point sources (WwTW's,CSO's) across the catchment (from Usk Nutrient Portal)[54]

The issues with using the SAGIS modelling have been outlined above, and this section highlights that comparisons between wastewater treatment and agriculture oversimplifies a complex issue that can demonise both sectors, muddying progress towards solutions.

11.1 Genuine collaboration with the agricultural community

The agricultural community must remain front and centre of any decision process, possess the knowledge of the land, and have the skills and equipment to deliver solutions. Past agri-environmental schemes, work with eNGO's and other delivery

[54] Usk Nutrient Management Plan - Supporting Evidence

partners have allowed many improvements across farmland – a real testament to the continued involvement of the farming community across the Usk.

Any meaningful change will rely on co-design with farmers, and the UCP values the knowledge within the system as much as the expert led 'top down' approach, with the understanding that both methods have merit and the development sustainable projects with long lasting outcomes will depend on both approaches coming together. This has been successful in the approach taken by the Beacons Water Group (case study, below), using methods that the UCP will support as a successful way to engage farmers for long term behaviour change.

The delivery plan will ensure support for current and ongoing projects (eg CaSTCo, BWG and we are Nature Based CIC), thus supporting the UCP members who are currently operating in the catchment to deliver NbS on farms. The delivery plan will seek opportunities to develop case study areas to field test the Usk Nutrient Portal and recruit more stakeholders.

A full funding plan exploring funding options, including for 'doing more' than delivering just this NMP as the UCP starts to develop the Integrated Catchment Management Plan is already in development.

The Beacons Water Group (BWG) and the Wye and Usk Foundation (WUF) have a history of developing and working with farmer networks in the Usk catchment, and the peer-to-peer method of learning and information dissemination a highly successful model for engaging and enabling learning and behaviour change, which the UCP will support. The current UCP secretariat BBNPA is developing similar work areas under Ffermio Bro, the Upper Usk South project and the Peatlands Action Plan, all of which will deliver multiple benefits to the Usk, including nutrient reductions.

Case Study

Beacons Water Group (BWG)[1]
The Beacons Water Group is a cluster of farmers that have established a partnership within the Bannau Brycheiniog National Park to improve on farm efficiency alongside improving water quality including using NbS. The group became a CIC in 2021 and has delivered some NbS across their land and are monitoring the outcomes and benefits to nature and their farm businesses. Alongside this, as farmers running productive businesses they are delivering peer-to-peer learning events and to date, across 10 events have spoken to around 250 farmers.[2] At these visits there has been a consistent positive willingness from farmers to get involved, change farming approaches and learn more about farming sustainably - for the land, water and efficiency of farm businesses. Post-event engagement has demonstrated how much farmers have learnt whether from group members themselves or knowledge shared by guest speakers.

[1] Introduction to Beacons Water Group | Dŵr Cymru Welsh Water
[2] BWG End of year report, (unpublished)

As part of a recent trial study with IBERS across five farms the group has investigated the infiltration ability of different grass mixes. The results from this trial will help the farmers to decide which productive buffer is most suitable on their land for the future to ensure a maximum infiltration rate.

Mr Roderick, after an initial review of the Usk Catchment Portal compared with his own knowledge of the land said.
"*I have had a look at the portal online and, while it isn't as accurate as my own knowledge, I see it as a starting point to think about possible changes, and I would be happy to consider some natural flood management on areas shown by the mapping tool. I recognise that these changes could benefit those who are living and using the river downstream of me. The portal will be an important tool in assessing the costs and value of on-farm changes to downstream communities.*"

12.0 Delivery of Nutrient Neutrality

The phosphorus reductions associated with the AMP 8 works give an estimated reduction of just under 21% per day, which is the apportionment allocation to the Wastewater industry using SAGIS, meaning that DCWW will achieve full reductions in its fair share by 2032.

A large proportion of nutrient contributions (67% - equivalent to 120kg/day, or 43,800kg per year) is attributed to rural land use; therefore, significant effort is needed across the Usk catchment to achieve compliance. Delivery of the suite of NbS at scale, alongside robust monitoring will be required to achieve the phosphorus conservation target of the Usk SAC. The UCP will work together to promote reductions in these sources via coordinated response, including the uptake of SFS and adherence to the CoAPRs.

The two Lower Usk waterbodies – the Usk - conf R Gavenny to conf Olway Bk (GB109056040083) and the Usk - conf Olway Bk to New Brook (GB109056026890) - are failing compliance, with levels between 10-20 µg/l. Therefore, development throughout the catchment will need to demonstrate nutrient neutrality.

Some reductions in the rural land use contribution will be delivered through the implementation of the CoAPR (6%); further reductions through the upcoming Sustainable Farming Scheme[55] are predicted, the consultation period for which closed in March 2024 – full details of the scheme are not available yet.

Potential Universal/Collaborative Actions under the SFS that can be planned using the Usk Nutrient Portal for quantifying P reductions are:

- UA7: Habitat Maintenance
- UA8: Create Temporary Habitat on Improved Land

[55] https://www.gov.wales/sustainable-farming-scheme-guide

- UA12: Woodland Maintenance
- UA13 Tree Planting and Hedgerow Creation Opportunity Plan

While those failing waterbodies will be initial areas of focus for delivery prioritisation, with an exploration of voluntary delivery as an initial phase, followed by more focused work through the UCP and project development. The Partnership will work with BWG and WUF stakeholder links as demonstration farms to showcase the outcomes of delivering NbS.

All waterbodies within the SAC will benefit from interventions – whether to maintain the passing status, or to benefit flow normalisation and overall resilience to climate change and other pressures. In some cases, it will be suitable to implement works simply because there is agreement with the landowner, and this can and should happen whichever sub-catchment the land is based in.

The delivery of Nature-based Solutions (NbS) at scale are essential to realising neutrality. A detailed delivery plan using the NbS methods, with a particular focus on soil health and legacy P will be co-developed by the UCP and wider partners. Co-design will continue to form the backbone of planning with farmer groups, and planning will be done on a farm basis with reduction quantifications achieved on a farm (or field by field) basis. Other measures to reduce P loading will be implemented and explored, as will forming groups to enter the collaborative layer of the SFS when this becomes available for entry.

Working within failing waterbody catchments will be a priority for project planning. The work to be delivered under AMP 8 will reduce the levels of P by the amounts shown, and NbS are predicted to deliver the further reductions indicated.

Maintaining status

For those waterbodies passing with little headroom, and for those that become compliant due to measures implemented under the current AMP, it is recognised that future failure may occur because of ongoing management practices, or climate change-exacerbated rainfall events. As a result, there is need for work across all sub catchments, backed by robust regulatory measures and WG support for infrastructure improvements to enable farms to become compliant with the regulations.

13.0 Flooding – Options to reduce flooding using NbS

Flooding is a critical area of concern in the Usk Catchment. The Ciria Natural Flood Management Handbook[56] describes Natural Flood Management (NFM) as a tool to help reduce flood risk, '…which can be tailored to and applied across landscapes…'. The NbS focus of this NMP lends itself well to flood mitigation planning, through various solutions

[56] The natural flood management manual

designed to suit the different landscape characteristics in the Usk. This methodology is supported by the Wales National Infrastructure Commission Report on Flooding 2024.[57]

The Usk catchment is dominated (72%) by freely draining, slightly acid loamy soils (Soilscape 6)[58], which should respond positively to land management changes to improve infiltration.

The Usk Nutrient Portal has been designed to model flood mitigation as well as nutrient reductions, with the NFM studio modelling outcomes already being used to help develop a business case for flood mitigation using NFM on the Legar stream in Crickhowell – one of the worst flood-affected communities.

Research by Rothamsted Research suggests that simply increasing soil organic matter helps to improve soil biomass, retain nutrients and increase water infiltration rates. This research has suggested that a one per cent increase in organic matter could give the soil 354,000 litre increase of water storage per hectare in the top 30cm[59], and while infiltration varies greatly across soil types and land use, this and other research shows the potential of interventions to reduce flood peaks. As described above, the frequency of big storm events is predicted to increase significantly. Storm Bert (November 2024) deposited 17,000 Mega Litres (17 million m^3) on the Upper Usk Catchment. Using the Portal, figures show predicted water storage in m^3 under different management scenarios in catchments upstream of Crickhowell. The success of these measures will be reliant on scale of delivery, and much data is yet to be gathered, but this information gives us a useful tool to gain support (funding and resource) for these actions in the catchment.

Case study – Flooding

Flood Wardens/Flood victims, Crickhowell.

Crickhowell is recognised as one of the most flood prone communities in the Usk catchment[60] David and Graham joined the UCP for our December 2024 in-person meeting.

They have both been involved as flood wardens in Crickhowell since the warden scheme was set up after Storm Dennis in 2020[61]. They gave a very moving account of the devastating effects on property and livelihoods each time the town floods.

They have asked how the UCP work can help their community, and we discussed with them ways in which work on soils in the in the Upper Catchment can reduce flows downstream, and how the NbS focus of the NMP will potentially help with flood peak reduction if the work is delivered on a wide enough scale.

[57] Building Resilience to Flooding in Wales by 2050 – The National Infrastructure Commission for Wales

[58] Cranfield University (2024). Soilscapes Viewer on LandIS website https://www.landis.org.uk/soilscapes/

[59] Connectivity might be the secret to healthy soils – Farmers Guardian - Hutchinsons

[60] Communities at Risk Register 2024 – Present Day (CaRR) | DataMapWales

[61] FLOODING - FLOOD WARDEN SCHEME - Llangattock Community Council

WUF and the BWG are investigating the benefits of increased soil organic matter on infiltration rates in the upper catchment area, with a view to making this a marketable commodity to draw in Nature Finance to deliver land management changes.

The Usk Nutrient Portal has layers to help identify areas for soil improvement under agricultural management methods and calculates the potential water storage of healthy soils and NFM techniques at field and catchment levels (see Figure 19 below).

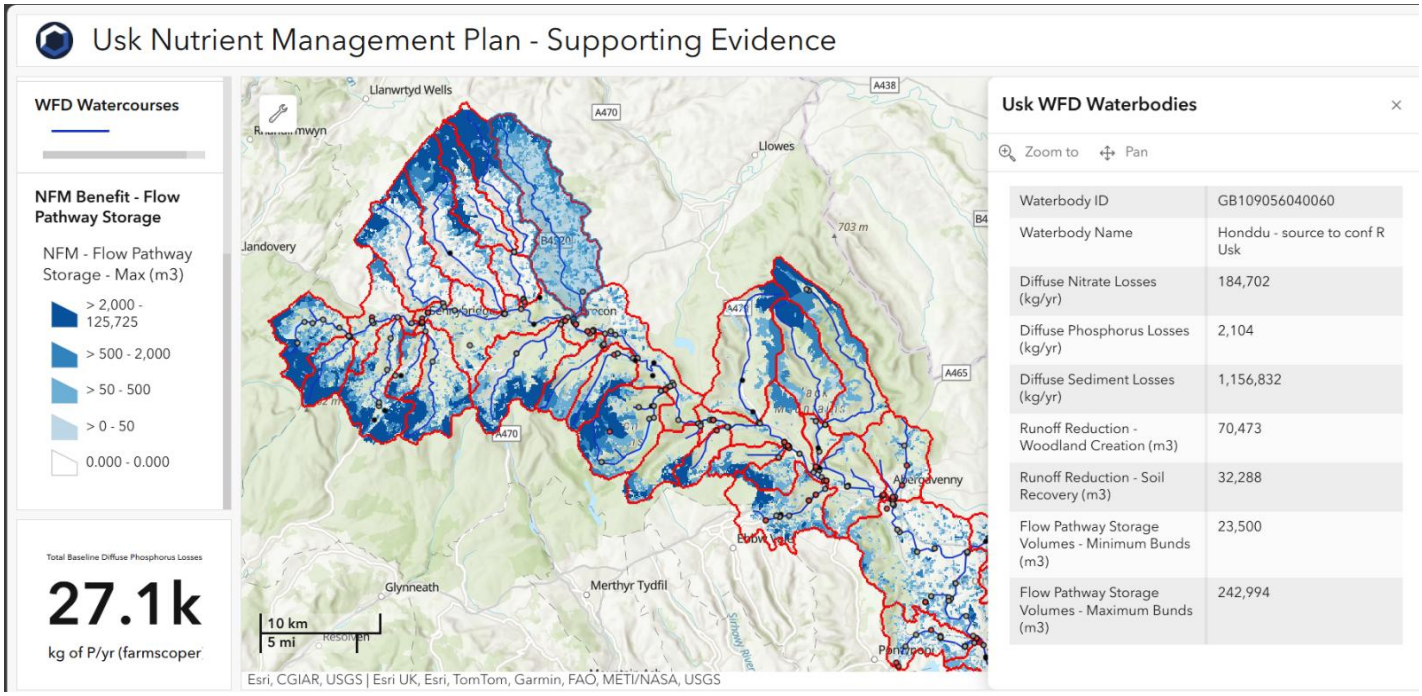


Figure 20: Example screen shot from the Usk Nutrient Portal showing Flow pathway storage layer.

The Nutrient Portal has the added function of showing waterbody level outputs for a particular sub-catchment (Figure 20 above). This gives indicative amounts of diffuse nitrates/phosphates/sediment losses, and in this layer also shows potential runoff reduction achievable via soil health improvements and NFM 'holding the water back' interventions in m^3.

There is significant potential for water storage in the sub-catchments upstream of Crickhowell, some of which are failing waterbodies, and nutrient runoff would be alleviated under certain NFM measures. These are prime areas within which to develop projects - to begin mitigation of nutrient losses and as flood peak reduction projects.

NFM-Studio tool has been used to assess runoff volumes at the field (and extrapolated to catchment) scale to identify opportunities for NBS. NFM Studio is a decision-support tool designed to assist in prioritising the implementation of Natural Flood Management (NFM) measures (see below), by calculating the potential volumetric benefits of these measures. The following broad categories of intervention have been evaluated for water attenuation:

- Land use changes – e.g. tree planting, peatland restoration and soil health measures.
- Flow pathway measures – e.g. bunds, ponds, and swales to intercept surface runoff.
- Floodplain reconnection – enhancing natural floodplain processes.

NFM Studio outputs will estimate the water storage capacity for each field. As well as signifying potential for flood mitigation, this will help to understand the reduction and disruption of over land flow routes which contribute to the delivery of diffuse pollution across the catchment.

Water storage potential m³

WB id	GB109056032950	GB109056040020	GB109056040060	GB109056040070	GB109056040040
WB Name	Nant Onnau - source to conf R Usk	Afon Yscir - conf Yscir Fechan to conf R Usk	Honddu - source to conf R Usk	Afon Yscir - source to conf Yscir Fechan	Nant Bran - source to conf R Usk
Measure 1	9532.154797	11757.43385	48541.28412	8300.062294	26852.37
Measure 2	22499.557	27739.97231	116042.2008	20488.7384	77342.2
Measure 3	12845.47707	15955.29887	70472.86129	11605.56032	33847.47
Measure 4	30746.11829	37733.08487	165407.4781	28362.88433	94041.22
Measure 5	8672.177817	8244.599788	32287.99853	5016.441929	20141.35
Measure 6	20136.68595	19357.66727	72858.49804	12617.12609	61370.47
Measure 7	3550.205918	2360.699426	23499.99545	4839.421852	24074
Measure 8	29709.37322	25410.02096	242993.5778	46196.68706	319506.5

Water storage potential m³

Waterbody name	Cwm Treweryn - source to River Senni	Senni - source to conf River Usk	Usk - conf Afon Senni to conf Afon Crawnon	Afon Tarell - source to conf R Usk	Usk - conf Afon Hydfer to conf Afon Senni	Usk - source to conf Afon Hydfer
WB id	GB109056033040	GB109056033050	GB109056040081	GB109056033070	GB109056039980	GB109056039970
Measure 1	4620.081779	27523.19329	72978.53962	21967.38799	12884.99	6681.079648
Measure 2	11471.11068	65249.12214	164265.5004	51950.30913	29345.11	21202.16813
Measure 3	6287.848191	33948.74116	133881.4907	31561.31731	17559.02	8992.593158
Measure 4	15445.6869	80551.10936	293818.0885	75616.52226	40477.72	26734.4108
Measure 5	2952.315366	21277.00988	75735.03237	15759.08067	8213.8	4388.450571
Measure 6	7496.534449	50367.99805	156651.304	38405.50658	18212.49	15669.92547
Measure 7	5326.144376	11583.53796	17691.61624	6761.685513	7034.338	23359.45805
Measure 8	64446.39986	168292.244	114074.2902	102133.7293	101123	239447.3588

WB id	GB109056040030	GB109056033030	GB109056033080	Afon Cynrig - source to conf R Usk	Caerfanell - source to conf R Usk	Rhiangoll - source to conf R Usk

Water storage potential m^3	WB Name	Cilieni - source to conf R Usk	Afon Hydfer - source to conf R Usk	Afon Crai - source to conf R Usk	GB109056033020	GB109056033000	GB109056039990
	Measure 1	21617.14323	6053.0009	19174	9909.26809	15643.73	39644.5
	Measure 2	57726.44867	15886.771	44869.63	22424.8661	40943.46	92262.9
	Measure 3	28747.31524	7982.79029	24326.3	16168.0377	21449.21	76696.8
	Measure 4	75026.43145	20483.2975	57157.85	38745.7126	54600.82	165487
	Measure 5	14501.95151	4123.2115	14027.65	8942.28506	15678.36	53211.6
	Measure 6	40456.00592	11290.2445	32581.42	21857.0523	41127.99	111189
	Measure 7	11536.93539	44790.7168	31838.58	1856.32742	5560.138	2851.55
	Measure 8	132546.9542	676533.443	475930.9	26879.2197	116541.9	35577.1

Figure 20: Potential flood mitigation levels outputs m^3 modelled for Waterbodies upstream of Crickhowell.

Measure 1	Land use change reduction in run off from 1 in 2 yr return period
Measure 2	Land use change reduction in run off from 1 in 100 yr return period
Measure 3	Woodland creation reduction in run off from 1 in 2 yr return period
Measure 4	Woodland creation reduction in run off from 1 in 100 yr return period
Measure 5	Soil recovery reduction in run off from 1 in 2 yr return period
Measure 6	Soil recovery reduction in run off from 1 in 100 yr return period
Measure 7	Flow pathway storage volume – minimum scenario – 1 bund per flow pathway per field
Measure 8	Flow pathway storage volume – maximum scenario – series of bunds per flow pathway per field

14.0 Conclusion

The Usk Catchment Partnership's Nutrient Management Plan (NMP) represents the first major step forward in a truly collaborative effort to restore the health of the River Usk and its catchment. By leveraging Nature-based Solutions, engaging stakeholders, and implementing strategic actions, the Plan aims to address the critical issues of nutrient pollution and to support sustainable development within the catchment. The Usk Nutrient Portal will play a pivotal role in facilitating the planning and implementation of these solutions, ensuring the integration of both the valuable knowledge and ideas of those who live and work within the catchment with the scientific knowledge used to create the portal. Ongoing monitoring and evaluation will be essential to measure progress and adapt the plan to emerging challenges.

The benefits of this approach are many. Nature-based Solutions not only address nutrient pollution but also provide multiple benefits such as improved soil health, enhanced biodiversity, and increased resilience to climate change. Networked collaboration within the Usk Catchment Partnership allows for effective work in contested and complex spaces, ensuring that diverse perspectives and expertise are integrated into the decision-making process. It is important to acknowledge the limitations of the modelled approach and the nutrient focus. To achieve a healthier and more resilient catchment at scale, we need to implement the techniques described in this report and where necessary add value to this NMP by developing additional plans, strategies, and proposals that enable delivery across the catchment that address root causes through taking a systems approach.

14.1 Next steps

A coordinated response from UCP members will be set in place to achieve the reduction in the P levels apportioned to the various sources (ie DCWW infrastructure, Rural land use/Private Septic tanks, Package Treatment plants/ Urban and ‘other’) and together we will raise awareness of the issues within the wider public domain. The UCP will also promote the uptake of SFS through enabling the formation of farming groups under the collaborative layer, and adherence to the CoAPRs.

Initial next steps of this NMP are to obtain funding to begin delivery of the NbS in the report, in priority areas as highlighted by the Portal, alongside finalising the monitoring plan detailed in this NMP. Further modelling of the outcomes of the NbS with a geographically appropriate tool (eg updated Farmscoper) will be a useful way to increase the value of the Usk Nutrient Portal, and this, alongside ground based monitoring is a recommended pathway to increase certainty of P removal rates of the NbS.

Specific project deliverables in response to this plan will be decided via the UCP’s collective way of working, and in the short term we will publish and promote this NMP and Nutrient Management Portal, along with the development of case studies with landowners.

The UCP will develop a charter with shared commitments that members of the UCP will agree to deliver towards. Members will also agree to embed the ways of working to enable strategic alignment with this NMP.

15.0 How will we know if it's working?

Ongoing monitoring and review of the implementation of the Usk NMP, and how it is moving the river towards compliance with the Habitats Directive, is vital in order to measure its success in delivering nutrient neutrality, with the wider objective of ensuring SAC favourable conservation status.

There are existing monitoring programmes in place across the catchment, including those that are Regulatory as well as citizen science based. The NMP can utilise those efforts to ensure that it supports and is supported by current actions. Gaps in monitoring will be identified and addressed.

The full monitoring proposal is found in Annex 3

16.0 Annex 1

16.1 Usk Portal - Detail of methodology

This methodology aims to identify sources and risks of nutrient inputs to the Usk catchment and explore opportunities for nature-based solutions (NBS) to address diffuse runoff, recognized as the primary source of phosphorus in the catchment. This work will support an options appraisal and provide stakeholders with actionable insights. The key deliverable will be the Nutrient Management Online Portal, that highlights opportunities to address diffuse pollution, serving as a valuable engagement tool for the **Usk Catchment Partnership (UCP)** and facilitating discussions with landowners on intervention strategies.

Figure 1 below provides an overview of the methodology. There are four main work streams consisting of different spatial and nutrient modelling methods to provide the spatial information on baseline loads and fields at higher risk. Identifying appropriate NBS will primarily depend on existing literature. The following sections provide a detailed description of the methodology.

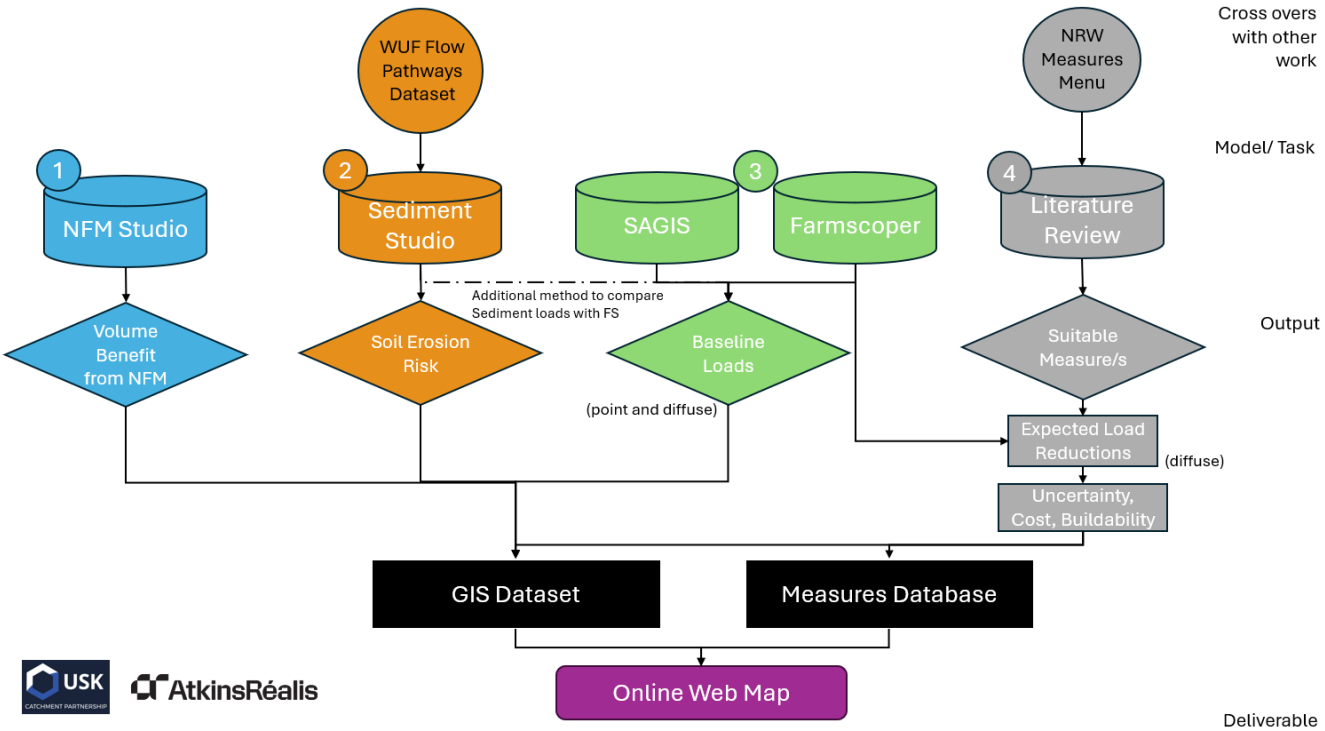


FIGURE 1: FULL METHOD OVERVIEW DETAILING KEY DATA INPUTS, MODELLING METHODS, OUTPUTS AND FINAL DELIVERABLE

The information within the GIS dataset deliverable will be a vector layer of the field polygons containing:

- Estimated load from point and diffuse sources
- The risk of soil erosion
- The type of nature-based solution considered most appropriate
- The potential water storage capacity of various NBS in each polygon
- The expected reduction in load of phosphorus and suspended solids
- Information on the certainty, consenting and design complexity and indicative price of the nature-based solution/s.

Methodology

Collating Existing Information

To develop an accurate and evidence-based NBS opportunity map, AR have revised existing data sources and studies, including:

- State of the Usk Report (Usk Catchment Partnership, July 2024).
- River Usk SAC Nutrient Management Opportunity Assessment (Greenshank, Jan 2024).
- Nutrient Management Plans Steer (Natural Resources Wales).
- Natural Resources Wales Mitigation Measures Menu.

Data were collected and compiled from open-source geospatial datasets, including:

- LiDAR elevation data.
- Land cover classification.
- Geology and soil properties.
- Characterisation of point sources (e.g., sewage treatment works, septic tanks, CSOs).

This also included the following datasets contributed by stakeholders:

- Usk Catchment Partnership (UCP) provided additional localised data, such as peat locations and land cover classifications.
- Welsh Water provided information on point source contributions via their SAGIS model.
- Wye and Usk Foundation (WUF) provided additional spatial data on erosion risk mapping (RUSLE) they had undertaken in the upper Usk catchment and detailed flow pathway mapping.

Where datasets are unavailable, we have used appropriate surrogate data (e.g., national-scale soil maps) or assumptions based on similar catchments to ensure timely project completion.

Spatial Modelling Methods

The following subsections correspond to each of the workstreams presented above.

Quantifying Volumetric Benefits from Nature-Based Solutions

We used the NFM-Studio tool, co-developed with the Environment Agency, to assess runoff volumes at the field scale and identify opportunities for NBS. NFM Studio is a decision-support tool designed to assist in prioritising the implementation of Natural Flood Management (NFM) measures, by calculating the potential volumetric benefits of these measures. The following broad categories of intervention have been evaluated:

- Land use changes – e.g. tree planting, peatland restoration and soil health measures.
- Flow pathway measures – e.g. bunds, ponds, and swales to intercept surface runoff.
- Floodplain reconnection – enhancing natural floodplain processes.

NFM Studio outputs will estimate the water storage capacity for each field. This will help to understand the reduction and disruption of over land flow routes which contribute to the delivery of diffuse pollution across the catchment.

Identifying Soil Erosion Risks

To maximize the impact of NBS in the catchment, a soil erosion risk mapping exercise was undertaken to enable prioritisation of engagement and implementation of measures. This will enable targeting of fields at higher risk of soil erosion and therefore key sources of diffuse nutrient pollution. To do this we will apply the Sediment Studio tool to model soil erosion risk, identifying locations where phosphorus losses are most likely to occur due to sediment transport[62]. Figure below provides an outline of the datasets and risk factors considered in Sediment Studio.

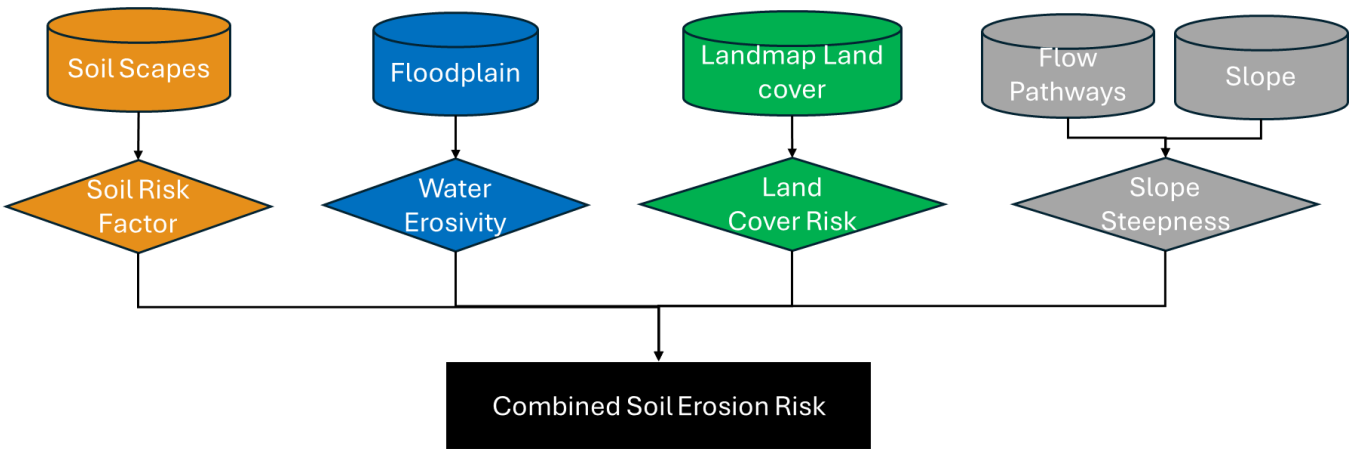


FIGURE 2 - SEDIMENT STUDIO METHOD DIAGRAM AND RISK FACTORS

[62] In rural catchments, the predominant form of phosphorus is typically particulate phosphorus that is attached (i.e., through sorption) to sediment (e.g., Sandström *et al.*, 2020; https://doi.org/10.1016/j.scitotenv.2019.134616)

The Wye and Usk Foundation (WUF) have previously undertaken a similar assessment of mapping soil erosion rates using the RUSLE method[63]. This was applied to the upper Usk catchment, which is a smaller spatial scale than this project. WUF shared the outputs of the RUSLE assessment for comparison with the Sediment Studio outputs.

Quantifying Baseline Loads

Baseline Point Source Pollution Analysis

Point sources (e.g., data regarding sewage treatment works, CSOs, and septic tanks have been derived from the Welsh Water SAGIS model data. The locations of the point sources have been incorporated into the baseline pollution analysis. While detailed cost-benefit analysis of point source interventions is outside the project scope, we have provided estimated pollutant loads from key point sources.

Baseline Diffuse Pollution Analysis

To quantify the baseline pollutant loads at the field scale across the Usk catchment FARMSCOPER has been applied. FARMSCOPER is a decision support tool to assess diffuse agricultural pollutant loads on a farm, widely used in nutrient mitigation planning. It can also quantify the impacts of farm mitigation methods on these pollutants. FARMSCOPER will be applied to five representative farm types in the Usk catchment area. The purpose is to assess baseline pollutant losses, identify appropriate mitigation measures, and predict nutrient removal rates.

The archetypal farm types have been located based on land cover and OS Master Map classifications (Figure 3). The input datasets utilized for FARMSCOPER are detailed below:

- **Farmscoper Upscale** – taking agricultural census data from the 2015 Defra June Agricultural Survey.
- **Wales Land Management Forum Report, 2024** – Phosphorus and Agriculture in Special Area of Conservation (SAC) River Catchments in Wales.
- **agCensus** gridded outputs for 2014, derived from the regular Agricultural Censuses.

The pollutant loss rates have then been scaled up using geospatial analysis to identify hotspot areas for baseline diffuse pollutant losses across the catchment.

[63] https://web.jrc.ec.europa.eu/policy-model-inventory/explore/models/model-rusle2015/

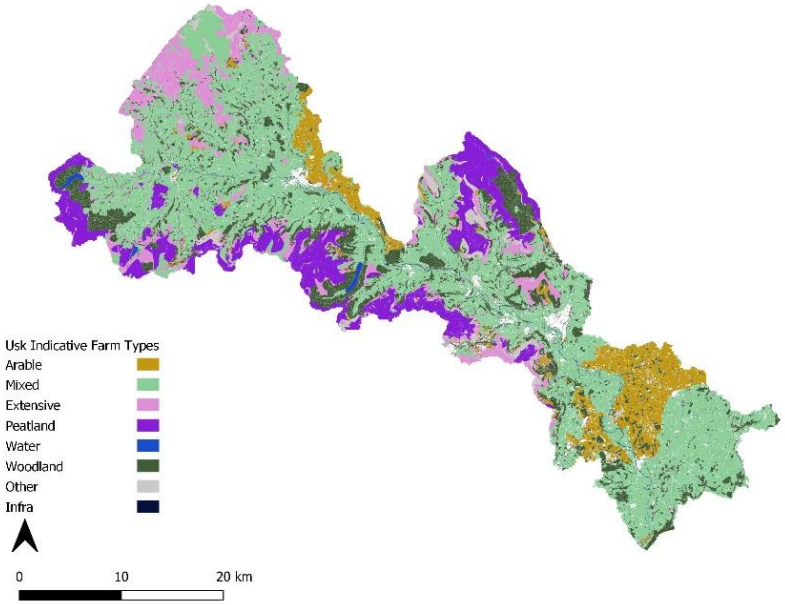


Figure 3: The location and distribution of the archetypal farm types across the Usk catchment.

The diffuse phosphorus losses from the farms have been compared and analysed against the SAGIS diffuse phosphorus loads to increase confidence in FARMSCOPER outputs. Although this provides additional confidence in the FARMSCOPER outputs, the different modelling outputs are not directly comparable. FARMSCOPER outputs are modelled losses from the farms, whereas SAGIS outputs are the loads entering the watercourse. Therefore, we would expect the FARMSCOPER losses to be greater than the SAGIS loads due to losses along the pollutant transport pathway in the catchment.

Identifying Suitable Nature Based Solution Measures

A literature review has been conducted to build upon the existing Natural Resources Wales Mitigation Measures Menu, with the objective of identifying appropriate measure types for each field. This review includes metadata on the effectiveness and certainty of these measures. A database has been created to record all this information, accessible vis the online Portal.

Details are provided for each NbS intervention type:

- Pollutant removal rates (where appropriate), with an approximation of certainty (based on NRW's Mitigation Measures Menu and literature review).
- Qualitative assessment of effectiveness.
- Design/implementation complexity, permitting and maintenance requirements (High/Medium/Low scale).
- Indicative capital cost ranges, informed by literature review, web searches and the consultants' experience from similar projects.

The list of measures has been reviewed and agreed with the Usk Catchment Partnership.

The NBS measures considered focus on the reduction of diffuse pollution, therefore NbS measures for the treatment of point source discharges, e.g. 'closed' Integrated Constructed Wetlands[64], have not been considered, though there is opportunity for their use in failing catchments.

Nutrient mitigation solutions vary widely in effectiveness due to various independent natural processes and their combined effects. Nevertheless, we acknowledge that a degree of certainty is essential for the implementation of a measure within a nutrient management plan. Where significant uncertainty for a certain measure's pollution reduction effectivity means that it is not possible to provide a removal rate, either due to a wide range of effectiveness and/or a dearth of data, these measures have been retained in the database and highlighted in order to draw attention to the need for more evidence. We recommend that these evidence gaps be highlighted in the Nutrient Management Plan to facilitate the targeting of further research into these measures.

[64] The term 'closed' refers to the loading of water and pollutants entering the system (the influent) being known and will not vary markedly over time, unlike wetlands designed to intercept catchment runoff, driven by rainfall.

The measures have then been spatially located based on expert judgement on suitability and applicability of the measure types. For example, measures targeting diffuse pollution from arable sources are located in areas identified as arable within the open source spatial landcover datasets (LANDMAP and CEH's LandCoverMap).

Deliverables

The methodology will have two main deliverables, namely:

- GIS vector datasets containing:
  - Estimated pollutant loads from point sources.
  - Soil erosion risk assessment.
  - Optimal NBS locations with estimated water storage capacity.
  - Expected reductions in phosphorus, nitrate, and sediment loads.
  - Effectiveness, certainty, consenting complexity, and indicative cost for each intervention.
- Interactive online map to support stakeholder engagement and decision-making.

16.2 Intended Application of Deliverables

The GIS and Measures databases produced through this project are intended to guide and target measures to the locations which are contributing to elevated runoff and are at high risk of generating diffuse pollution. Efforts have been made to provide quantitative outputs where possible.

The method described here is a top-down approach, run at the catchment scale using open-source GIS datasets. Key assumptions from the spatial modelling are documented below. It is important to understand these assumptions when considering the intended use of the outputs. The use of NBS measures to tackle diffuse pollution remains a rapidly developing field of research.

Figure 4: Key Assumptions of Modelling Approach

Key Assumptions	
Farm types	The farm types assessed in Farmscoper are indicative for the catchment. This assessment does not provide a comprehensive list of agricultural businesses within the catchment area. However, it categorizes broad classes of these businesses to better understand the sources of diffuse agricultural pollutants.
Sediment studio risk factors	The incorporation of additional risk factors, such as rainfall erosivity and slope length, was undertaken to align the sediment studio method with the Revised Universal Soil Loss Equation (RUSLE). However, these risk factors were excluded from the method after sensitivity analysis due to insufficient confidence in the datasets. Adding complexity to the modelling approach was deemed unsuitable in this case because the spatial resolution of the additional datasets did not accurately describe the additional risk of soil erosion.

Key Assumptions	
Load reductions	The expected load reductions, uncertainties, costs, and other metadata for the NBS measures are compiled from various data sources in the measures database. However, as further research is undertaken into these measures and their local specificity these load reduction estimates presented in these outputs are likely to change.
Identified suitable measure types for the fields	The recommendation of measures is based on a series of assumptions and professional judgement. These examples have been provided to illustrate potential opportunities and to foster further collaboration with landowners. Site investigation and suitability assessment will have to be undertaken before any implementation.
Input soils dataset	We have based the modelling approach on open-source soils data and available reports on soil nutrient contents. The outputs of this modelling exercise are not based on site specific soils data. This is recommended to be built into future considerations for the nutrient management plan as soils (and their management regarding nutrient levels) are naturally very heterogenous.
Adaptability of method	The effect of NBS on water quality is a rapidly developing field. The modelling methods applied have been designed to be easily editable e.g. building in additional risk factors where suitable. However, the outputs presented on the ArcGIS Online portal are not live calculations. **Updates may be needed after major land use changes or when new data becomes available.**
Literature review	The effectivity rates from the literature review are based on a wide variety of sources. Searches for academic literature were made using Google Scholar and by entering keywords and phrases. Searches for 'grey' literature used the Google search engine. Article abstracts were examined to screen for relevance and where so, were retained for full review. Where possible, review focussed on studies that evaluate effectiveness via the change between influent and effluent pollutant load or concentration (i.e., a percentage of the inlet load). For more extensive measures such as tree planting, most evidence was gathered from modelling studies. Some efficacy values were sourced from meta-analysis papers, where results from multiple independent studies had been synthesised. In these cases, it was not always practicable or possible to access the full details of the source data (e.g., experimental design). The effectiveness of measures is affected by a range of factors including study location and seasonality, and hence the review prioritised the inclusion of papers that had a monitoring period longer than one-year and were UK based. However, this was often not possible.
Appropriate Nutrient Mitigation	Since the entire length of the River Usk is classified as a Special Area of Conservation (SAC), nutrient reductions in one part of the catchment may not serve as mitigation in another part of the catchment. Nutrient offsetting for constructing new overnight accommodation should be implemented at the site of the new development or upstream of the impact area. This ensures that there is no 'depleted reach' when

Key Assumptions	
	demonstrating nutrient neutrality at the Appropriate Assessment stage of the Habitats Regulations Assessment (HRA) for planning or water discharge environmental permit application. The GIS outputs will not capture this level of detail.

17.0 Annex 2

17.1 Enabling Housing

Having reviewed the latest Local Housing Market Assessments for Powys[65], Monmouthshire[66], Torfaen[67] and Blaenau Gwent[68] ("LHMA") across the SAC catchment, a picture of housing needs up to 2028 has been established.

The analysis focusses on areas draining to waterbodies within the compliance assessment and therefore omits areas within Torfaen draining out of catchment (e.g., Mamhilad Park Estate), the settlement of Brynmawr in Blaenau Gwent and the Chepstow LHMA Area within Monmouthshire. The analysis indicates a need for approximately 1000 homes to be built (See figure 1 below), the vast majority being one- or two-bedroom affordable homes.

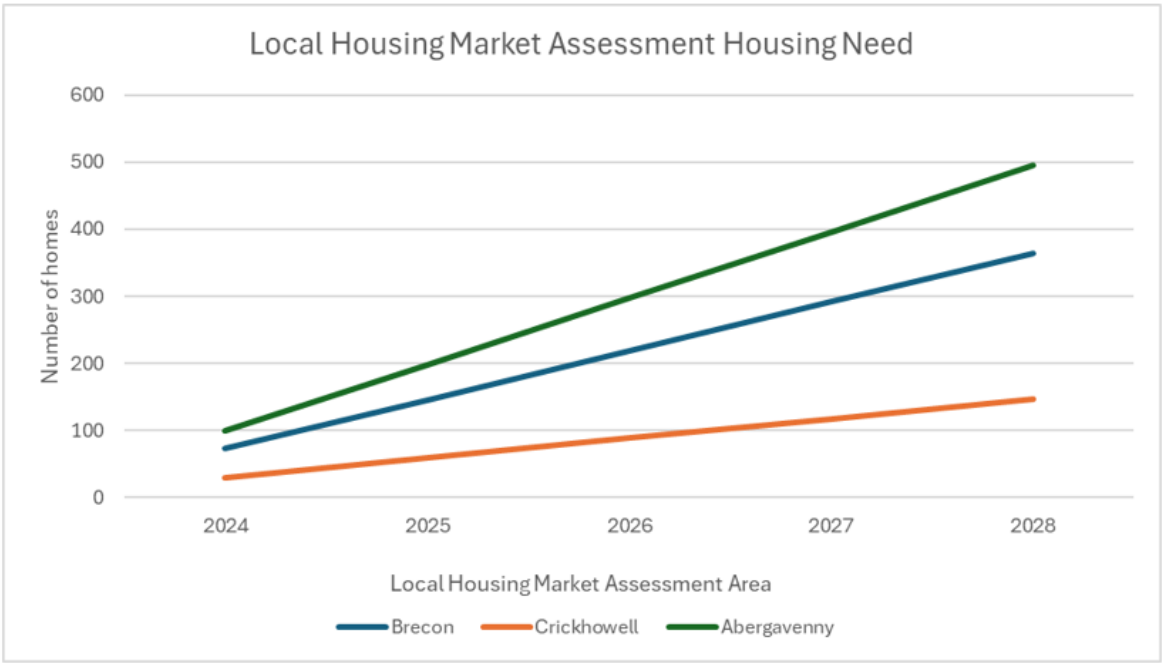


Figure 1: Cumulative Housing Need to 2028 in the key Local Housing Market Assessment Areas of Brecon Crickhowell and Abergavenny.

[65] Powys County Council Local Housing Market Assessment Agreed Cabinet 18 Feb 2025
[66] Monmouthshire-Local-Housing-Market-Assessment-Refresh-2022-2037
[67] Torfaen Local Housing Market Assessment 2020
[68] Blaenau Gwent Local Housing Market Assessment 2019

FIGURE 2: REDUCTIONS OF PHOSPHORUS EXPECTED UNDER AMP 8 WORKS.

WWTW NAME	PERMIT NUMBER	ISSUE DATE OF REVIEWED PERMIT	P LIMIT (1) MG/L	EFFECTIVE DATE P LIMIT (1)	P LIMIT (2) MG/L	EFFECTIVE DATE P LIMIT (2)	PRE SCHEME TP MG/L	PRE SCHEME KG/DAY	POST SCHEME KG/DAY	KG/DAY CHANGE	KG REDUCTION PER YEAR
LLANFOIST	AB00382 01	06/11/2023	5MG/L	13/11/2023	2MG/L	31/12/2025	5	35.76875	14.3075	-21.4613	**7833.3563**
BRECON	AB00415 01	21/11/2023	5MG/L	28/11/2023	2MG/L	31/12/2025	5	18.04375	7.2175	-10.8263	**3951.5813**
TALYBONT	AD00017 01	14/02/2024	5MG/L	21/02/2024	1MG/L	31/03/2030	5	0.55625	0.11125	-0.445	**-162.425**
SENNYBRIDGE ARMY CAMP	AC01403 01	18/01/2024	5MG/L	25/01/2024	3.5MG/L	31/03/2030	5	2.81875	1.973125	-0.84563	**308.65313**
LLANDDEW BRECON	AC01407 01	19/06/2024	5MG/L	26/06/2024	4MG/L	31/03/2030	5	0.13125	0.105	-0.02625	**-9.58125**
LIBANUS	AB00760 01	08/12/2023	5MG/L	15/12/2023	2MG/L	31/03/2030	5	0.7125	0.285	-0.4275	**-156.0375**
LLANFRYNACH	AD00021 01	31/07/2024	5MG/L	28/01/2028	2.5MG/L	31/03/2030	5	0.204375	0.102188	-0.10219	**37.298438**
TRECASTLE	AD00009 01	21/12/2023	5MG/L	03/01/2024	0.75MG/L	31/03/2030	5	0.2875	0.043125	-0.24438	**89.196875**
GOYTRE	AC01164 01	27/11/2023	5MG/L	04/12/2023	1.4MG/L	31/03/2030	5	2.4	0.672	-1.728	**630.72**
LLANBEDR	AA00031 01	19/06/2024	5MG/L	26/06/2024	1MG/L	31/03/2032	5	0.24375	0.04875	-0.195	**71.175**
TOTAL REDUCTION DUE TO AMP 8 WORK										36.3 KG/D	13,250kg/yr

Focussing on Total P, analysis of the improvements at each WwTW from NRW's recent review of Environmental Permits [69] (excluding those small works with descriptive environmental permits) as a restorative measure has been undertaken and cumulative reductions across the SAC Catchment (Compliance Assessment waterbodies) are now clear over the short – medium term up until 2032.

17.2 Fair share principle - Dŵr Cymru Welsh Water response

The **Environment (Wales) Act 2016**[70] emphasises the fair share principle through its focus on the **sustainable management of natural resources**. The fair share principle in water quality management in Wales is designed to ensure that the responsibility for maintaining and improving water quality is distributed equitably among all sectors, businesses and individuals. The key aspects of this principle are: Proportional Contribution, the Polluter Pays Principle and Collaborative Efforts to address the pollution.

Under this principle, DC/WW have committed to implement improvements as restorative measures. This investment will significantly reduce the amount of phosphates entering the water environment from the treatment works (also referred to as point source), enabling environmental restoration.

In the Usk catchment - if fully delivered, the environmental permit review of Wastewater Treatment Works will reduce Total P point source inputs by 13,249kg each year by 2032. This accounts for 20% of inputs according to the SAGIS apportionment, suggesting that by 2032 a 67% 'fair share' reduction from land use as a restorative measure alone would amount to some 44,388kg per annum.

The latest development planning positions within Powys[71], Parc Cenedlaethol Bannau Brycheiniog [72] and Monmouthshire have also been reviewed [73], providing a better understanding of the development aspirations of each of the Local Planning Authorities by both WFD waterbody being monitored within in the SAC the compliance assessment and treatment works.

This analysis indicates an aspiration for levels of development more than the needs identified in the Local Housing Market Assessments, most notably in Abergavenny which connects to the Llanfoist Wastewater Treatment Works.

It is the opinion of Powys and Monmouthshire County Councils (both are Competent Authorities under the Habitats Regulations) that this level of development would not hinder the pace of the recovery to favourable status of either water quality or designated features of the SAC.

[69] Public register - Customer Portal
[70] Environment Act 2021
[71] Powys Replacement LDP - Background paper Housing Land Supply
[72] Annual Monitoring Report | Bannau Brycheiniog National Park Authority
[73] https://www.monmouthshire.gov.uk/app/uploads/2024/10/Housing-Background-Paper.pdf

For Powys' Local Development Plan (LDP) (Preferred Strategy Stage) and Monmouthshire LDP (Deposit Stage) the positions may be summarised as follows:

17.3 Powys[74]

There are no fundamental HRA-related reasons why the Preferred Option should not be pursued from a water quality perspective (i.e. adverse effects are not obviously unavoidable irrespective of how housing is delivered at the project stage, although this will be reviewed further as the plan is developed to ensure that appropriate controls are incorporated into the plan). When considering potential effects the following should be recognised:

- The maximum number of homes proposed is relatively modest, therefore meeting nutrient neutrality requirements based on NRW guidance is inherently more achievable than for areas where several thousand new homes are needed. Policy controls and development-level assessment / mitigation are not unrealistic options (rather than a need to precisely quantify effects and identify strategic mitigation solutions at the plan level).

- The Preferred Strategy notes that "New development within SAC catchments must achieve nutrient (phosphate) neutrality which acts as a constraint to development. Development is only able to connect to a Waste-Water Treatment Works (WWTWs) with phosphorous reduction technology installed and where capacity exists within the limits of an Environmental Permit for a WWTWs. This constraint is a significant consideration in the preparation of the Replacement LDP and its strategy". There should be no new housing in areas where works continue to breach of their permit, and where there is evidence of failing overflows.

- The Powys Housing Need and Supply: Housing Supply Background Paper also notes that new housing development in phosphorus-sensitive river catchments (i.e. the Wye and Usk in Powys) will be located within settlements that are served by wastewater treatment works (WwTWs) that have been identified for improvement (including the installation of phosphorous reduction equipment) in Dŵr Cymru Welsh Water's (DCWW) seventh Asset Management Programme (AMP 7) 2020 - 2025.

17.4 Monmouthshire[75]

DCWW have confirmed that a workable and achievable solution to phosphates has been identified for both the Monmouth Wastewater Treatment Works (WwTW) (benefitting the River Wye Catchment) and Llanfoist Wastewater Treatment Works (WwTW) serving Abergavenny (benefitting the upper River Usk catchment).

[74] https://ldp.powys.gov.uk/document/41 and Phosphate Position Statement FINAL 23-07-2024.pdf

[75] monmouthshire.gov.uk/app/uploads/2024/10/HRA-of-the-Monmouthshire-RLDP-Deposit-Plan.pdf

In addition, NRW's Environmental Permit review has confirmed the potential to use existing capacity within a number of existing wastewater treatment plants which will enable sustainable growth in various settlements in the affected catchment areas over the Plan period.

17.5 Parc Cenedlaethol Bannau Brycheiniog

Whilst the National Park Authority has yet to commence preparation of a replacement Local Development Plan, it considers applications for development on a case-by-case basis in accordance with the existing Local Development Plan (2007-2022) and its detailed 'nutrients statement'.[76]

17.6 Mid Wales Strategic Development Plan

Within Future Wales: The National Plan 2040 a regional growth zone is identified around the town of Brecon. To date, the Mid Wales Corporate Joint Committee is yet to provide greater definition on what this means for development in the area and has not started work on preparing a Strategic Development Plan.

17.7 Conclusion

By 2032, in all but the settlements served by the smallest works and the countryside areas not served by the public sewer network, it is considered that NRW's restorative Permit Review will be sufficient to enable immediate housing needs to be met in the catchment if development proposals prioritise meeting the assessed housing need.

At the smallest wastewater treatment works in and around rural locations, development proposals will need to demonstrate nutrient neutrality, which may involve securing nature-based solutions.

In the long term, more strategic interventions enabling larger scale development are likely to be required, unless further investment is made to increase capacity of WwTW within the catchment through future iterations of the Dŵr Cymru's Asset Management Plan (hereafter "AMP").

At the time of writing, the publication of an 'all-Wales' nutrient calculator is awaited. This will enable the quantification of nutrients generated by development and which therefore need to be offset. The detail of proposals which are to be included within the AMP8 programme is also awaited from DCWW. A greater understanding of the implications of the UK Government's Planning and Infrastructure Bill for Wales is also awaited.

[76] Phosphates | Bannau Brycheiniog National Park Authority

18.0 Annex 3 – Monitoring and Evaluation

18.1 Overall evaluation approach

- Be **agile,** include time in core group and knowledge hub meetings for learning and adapting the plan, taking into account both the local Usk context and evidence advances from elsewhere.
- **Dynamic and adaptive.** At least annual review of the monitoring and evaluation approach will be taken so that we can be flexible and adaptive to unforeseen circumstance and emerging challenges.
- Not seek to replace existing monitoring, but to **work in a collaborative way** to integrate and visualise in a way that supports collaborative planning and evaluation. The plan assumes the continuation of statutory and regulatory monitoring.
- Focus on **Multiple benefits,** not just nutrient levels
- **Aim for high impacts** (e.g. biodiversity, natural river processes), not just nutrient levels, whilst recognising species and ecosystems have different response times to interventions, and other factors outside of may cause decline.
- **Make good use of funds.** Be strategic in planning monitoring so as not to disproportionately spend on monitoring over action. Make use of existing data, calculators, tools, guidance etc where appropriate to ensure good use of existing knowledge.
- Recognise and support **monitoring activities for different purposes:**
    - Monitoring the progress of the plan
    - Evaluating the effectiveness of the plan (including re-examination of priorities for action)
    - To attract investment (and associated baselining)
    - To attract more farmers, land managers, businesses and communities to take action, by demonstrating positive outcomes.
    - To contribute to the wider evidence-base on the effectiveness of NbS interventions and thus making outcomes more robust.
- **Good data governance**:
    - Careful consideration needs to be given to the handling and storing of data that could identify farmers. Need for anonymising some data.
    - Data ownership: The UCP recognises that data are always owned by the data generator, unless they are commissioned, in which case the commissioner owns the data

18.2 Indicators of delivery

Assess if the NMP is being implemented as designed. This describes process evaluation: how inputs and outputs will be measured.

Monitoring of the success of the NMP will require a series of complex measures across Environmental/Social and Economic factors. Outputs that occur because of outcomes delivered through the project may be measurable across a series of differing timescales and spatial areas – from field scale to sub and whole catchment scales.

Indicator	How	Timescales	Spatial scale	Who
Delivery of DCWW committed investment programme	Updates to UCP core group	Quarterly	Site	DCWW
Uptake of NbS interventions, route of funding/support	Record schemes with date and location. Online map with form for updates. Identify gaps and more challenging areas, prevent stakeholder fatigue. Identify if uptake of certain intervention types is lower than expected.	Ongoing collection, quarterly summary	Summarised at sub catchment and catchment	All responsible for collecting and reporting to secretariat. Secretariat responsible for summarising.
Appropriate quantifiable activities and outputs per NbS type (e.g. number of hectares, kms, farms…)	Agree common monitoring guidelines for each intervention type, at different levels of detail (e.g. minimum/extended/case study). Informed by existing guides e.g. RRC, and data collected	Ongoing collection, quarterly summary	Per intervention, summarised at sub catchment and catchment	Knowledge Hub to ID guidelines by Autumn 2025. All responsible for collecting. Secretariat responsible for summarising.

	for rural payments/SFS			
Longevity of outputs (e.g. changes in tree cover)	As above	Dependent on type (e.g. tree cover - 5 yearly		Dependent on output (e.g. tree cover - LPAs Treescapes)

18.3 Indicators of impact

Assess if the NMP achieves its goals. This describes impact evaluation: how outcomes and impact will be measured.

It will be challenging to prove causal links between interventions and impact. Ecological responses to any intervention can still be occurring for many years, and for some species or habitats there can also be a time-lag in response. These ecological responses along with the unquantified legacy stored phosphorus and its potential long time for depletion, mean long-term monitoring is vital. Additionally, monitoring results, especially at large spatial scales such as the Usk catchment, can be noisy/messy due to the influence of other environmental, social and economic drivers operating across the catchment.

A mixture of measurements and modelling will therefore be necessary. Some direct assessment of individual features may be necessary (e.g. to contribute to case studies), but to assess the cumulative impact of interventions at catchment scale modelling will be necessary. The data will need to be synthesised, analysed and visualised in a way that that is appropriate, accurate and accessible to all partners.

	Indicator	**How**	**Timescales**	**Spatial scale**	**Who**
Environmental	Change in nutrient load on the Usk (modelled and non-modelled sources), taking into account other explanatory variables e.g. rainfall	Integrate statutory monitoring, citizen science and modelled. Requires resource as not currently undertaken.	SAC compliance (every 3 years) Could data be reviewed more frequently e.g. annually? Citizen Science available on UskViz continuously updated. Annual means are appropriate.	Whole catchment and sub catchments	NRW monitoring for SAC compliance Citizen Scientists – need support in terms of funding kit and data collation, analysis/visualisation (currently UskViz). UCP to support data integration and modelling.
	SAC feature condition/ Favourable	NRW collate evidence using variety of methods which are	6 yearly	Sub catchments and Catchment	NRW

	Conservation Status	species specific			
	Water quality (wider range of elements)	WFD status – including examining individual elements due to one in one out rule Riverfly?	3 yearly ? ?	Sub catchment and catchment ?	NRW Citizen Scientists /WUF
	Physical river habitat	Fluvial audit Geomorphological assessment Morph	Seasonal – post winter/post flood event Varied	Reach scale	Knowledge Hub to discuss existing data Citizen Scientists / WUF / NRW (4 Rivers for Life)
	Reduction in extremes in flows	Comparison of storm event peak water levels, timing of water peaks Storm and annual hydrographs	After storm events, with annual review	Sub catchments and Catchment	NRW record Secretariat to summarise for review
	Reduction in soil losses	Field testing to generate Usk case studies Modelled reduction in soil erosion risk WFD measures (TSS, Turbidity)	Before and after interventions Annual 6 yearly	Farm Sub catchment Sub catchment	Farmers/WUF/BWG etc. WUF already has some. Secretariat Supported by WUF collected data NRW
	Groundwater recharge		Annual	Dipwell/borehole testing	NRW
Social/ Economic	Farmers are	Survey	Annual review		Collectively design survey

	actively engaged, and feel part of, and positive about the NMP/UCP				questions that could be used by partners across any related project in the catchment.
	Farm business margins as a result of delivering measures	Voluntary reporting/development of Usk case studies	Ongoing		Farmers, WUF, BWG
	Appropriate development enabled		TBC	Catchment	Collaboration between LPAs (PCC, MCC, BBNPA)
	Reduced flood risk	Estimates for ££ of avoided flood damage		Town and Whole catchment	
	Land Use change	Using agricultural data – not currently summarised at catchment scale	When occurs	Farm and Catchment	Welsh Government/NRW
Unknown	Unforeseen benefits/dis-benefits/challenges	Ad-hoc reporting via multiple channels e.g. UCP meetings, feedback via website, farming groups. community engagement activities	Ongoing	Any	All

Additional multiple benefits e.g. reduced water temperature as a result of tree shading, increased catchment biodiversity (as opposed to instream biodiversity) etc. could also be captured. Wider social and economic impact assessment, similar to donut model used in for Dyfodl y Bannau e.g. Health and well-being impacts.

There are some things which were reported in the State of the Usk report which do not feature as an indicator of delivery or impact of this plan (e.g. storm overflow EDM,

abstraction and impoundment volumes, INNS that disturb soils), or of which little is known about their impact in the Usk (e.g. septic tanks). These should also be reviewed periodically by the UCP.

18.4 Learning and review of priorities

Learning is the process through which the information generated through monitoring and evaluation is used to improve the NMP.

Priorities for action will be re-examined and additional actions and targets included where necessary. This will be how new challenges are addressed, scientific advances or regulatory changes incorporated.

Spatial priorities will be identified by the Knowledge Hub taking into account the Portal, and updates to NRW SAC compliance, DCWW SAGIS modelling and from citizen scientists (UskViz). These priority areas will be reviewed at least annually. This would greatly be supported by the annual reporting of annual means from nutrient data, by sub catchment from both statutory and citizen science.

18.5 The wider context

Whilst the UCP wishes to take a systems-based approach and to improve the interconnected ness between projects, we recognise that we are a system within a larger system. Even as a partnership, we do not operate in isolation: there are many factors and other organisations, individuals, context, processes that potentially impact the achievement of our intended outcomes. We should seek to understand these more. In doing so, we will be better able to identify relevant factors that influence success or failure.

Usk NMP monitoring and evaluation should align with related policies and projects. This will require an exercise to share the objectives and evaluation plans including, but not limited to:

- Local Authority Treescapes Strategies
- LCA
- FCS
- SSSI condition assessments
- NRAP

Consideration will be given to the creation of evaluation templates so that ongoing and new projects are designed evidence is gathered in a way that can be easily fed in.

On a Wales and wider scale, we will seek to share approaches to evaluation of interventions, and the results, so as to speed up the building of collective evidence base and to avoid duplication. Standardisation of approaches would be helpful.

18.6 Knowledge Gaps

The Partnership identified a need to increase its collective knowledge of the soils and associated data in the catchment. Whilst some data have been shared by individual schemes (e.g. farmers who have taken part in CaSTCo) we are aware of data on Farming

Connect that is not available to the Partnership. If this were available (assuming appropriate anonymisation), it would allow greater understanding, and prediction, of where intervention is needed and has worked.

Greater understanding of the soil-nutrient relationships, i.e. the mobility of nutrients within the soil, and leaching, and related chemical properties of the soil and soil conditions. Along with greater understanding of the hydrology and sediment/nutrient regimes.