A Reset for Water

An evidence-led approach to the management and restoration of freshwaters for nature recovery

Adapted for input to the Independent Water Commission

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EXECUTIVE SUMMARY

To date, the management of freshwater ecosystems has mainly focused on larger rivers and lakes, overlooking the critical role of smaller waters. A growing body of evidence shows that these smaller waterbodies harbour a disproportionate share of freshwater biodiversity, and offer cost-effective, scalable opportunities to drive rapid nature recovery. This report – originally prepared as part of our Headstart project - advocates a new approach to harness the potential of headwater catchments and small waters as a focus for landscape-scale freshwater restoration, facilitated by targeted policy reforms.

Key Findings

New Evidence on Freshwater Biodiversity

- Freshwater life is more reliant on smaller waters (headwaters, ponds and small wetlands) than previously recognized.
- Networks of smaller waterbodies are critical for maintaining biodiversity. Small waters act as clean water refugia, support both habitat specialists and generalist species, and enhance overall ecosystem resilience.
- Creating and restoring small freshwater habitats - particularly through clean water pond creation - has been shown to significantly boost landscape-scale freshwater biodiversity.

Headstart

Headstart proposes a much greater focus on headwater catchments to deliver rapid and tangible biodiversity gains across entire landscapes. Key pillars include:

- **Targeting headwater catchments**: focus on headwaters to create unpolluted hotspots of freshwater biodiversity and accelerate nature recovery.
- **Cleaning up pollution**: in small headwater catchments, pollution sources are tractable and can be properly addressed. Small wastewater treatment works are prioritised for upgrading; agricultural measures are concentrated to substantively reduce pollution emissions in smaller catchments.
- **Creating clean water ponds**: create clean water ponds and wetlands to enhance connectivity and resilience of the entire freshwater system.

This approach is evidence-based and cost-effective. With regulatory reform, most of this could be delivered through existing water industry environmental improvement programmes, and would not require significant additional funding.

Policy recommendations

The existing policy framework remains rooted in traditional assumptions, many of which are now outdated and have become barriers that inhibit rapid progress at scale. Shifts in policy that would support progress are:

- **Amend the Water Environment (WFD) Regulations**: Incorporate headwaters and small waterbodies into monitoring and River Basin Management Plans to create a statutory driver for their improvement.
- **Adapt water sector regulations**: Incentivise water industry investment in headwater catchments, and extend the scope of catchment management to encompass creation and restoration of clean 'offline' waterbodies, including ponds and wetlands.
- **Refine Environment Act targets**: Shift focus from gross pollution volumes to ecological impacts, ensuring targets drive freshwater biodiversity recovery.

Taken together, these changes have the potential to unlock significant biodiversity gains, restore ecosystem resilience, and drive rapid, cost-effective freshwater recovery at a landscape scale.

Contents

1 Introduction and aims

Traditional approaches to understanding and managing freshwaters for biodiversity are out of step with current evidence, and often ineffective.

Historically, the focus has been on larger rivers and lakes, leading to a significant underestimation and neglect of the vital role played by small waters (including small streams, ponds, small lakes, ditches and small wetlands). As a result, the considerable power of small waters - to protect freshwater biodiversity and drive nature recovery - remains largely untapped.

During 2024, Freshwater Habitats Trust was commissioned by Anglian Water to conduct an evidence review examining the regulatory framework for smaller waters, and the policy, social, technological and environmental context in which the framework exists. The full report is available on request from the authors. What follows is a summary of the report's key findings, informed by feedback from subsequent stakeholder engagement, and further examination of available evidence.

This summary report covers:

- The new evidence
- The status quo and ongoing threats
- Our proposed new approach
- Policy barriers to this approach
- Policy recommendations.

2 A summary of new evidence

2.1 A new understanding of freshwater habitats

Where freshwater life really lives

Over the past two decades, there has been a fundamental shift in our understanding of where freshwater biodiversity is found in the landscape. The most important freshwater ecosystems were generally assumed to be larger waterbodies (rivers and lakes), but mounting evidence reveals that, in most places, smaller waters are the primary hotspots of freshwater biodiversity. This has led to a complete reassessment of their ecological importance.

The role of headwaters in supporting biodiversity

Headwater streams, defined here as 1st to 3rd order streams,[1] make up around 70% of Britain's river network by length, running for 150,000 km in England alone (Biggs *et al*. 2017; Riley *et al.*, 2018). Headwaters often contain unique species absent from lower in the river system, together with most of the species present there. Because of their position at the top of the river network, headwaters have small catchments, and many remain relatively unpolluted, which is virtually impossible to achieve in lower river reaches (Davies *et al.*, 2010). Headwaters therefore provide critical habitat for species that are intolerant of poor water quality (Biggs *et al.*, 2017).

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[1] Stream order indicates the level of branching in a river network. In Strahler stream order (used here), a first order stream has no tributaries. Where two first order streams meet, they make a second order stream. Where two second order streams meet, they make a third order stream. If two streams of different orders meet, the resulting stream is given the higher of the two numbers.

The vital role of ponds

Over the last two decades, ponds have become widely recognised as keystone habitats for freshwater biodiversity. Despite their small size, they support disproportionately high species diversity compared to larger waterbodies. Consistently, ponds have been found to support more freshwater plant and animal species at a landscape scale than rivers or lakes, (Williams *et al.*, 2004; Davies *et al.*, 2008; Dema *et al.*, 2022; Khanzada, 2024), often including a high proportion of rare and specialist taxa not found elsewhere in the landscape (Biggs *et al.* 2017).

Diversity across small freshwater habitats

New data also show the importance of other small freshwater habitats, such as springs, ditches and small wetlands in supporting critical species. Their ecological value is influenced by the surrounding land cover, with waterbodies in less intensive agricultural or natural landscapes often exhibiting exceptional biodiversity (Šefferová, Šeffer and Janák, 2008; Clarke, 2015).

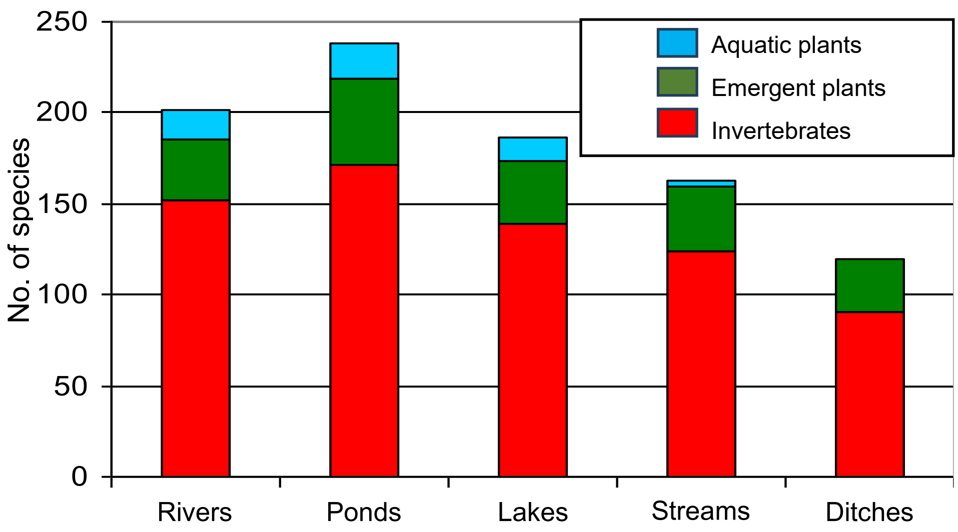

Figure 1. The number of aquatic plants and macroinvertebrates in all freshwater habitats (Gamma richness) in a 9x9km agricultural area of Oxfordshire/ Wiltshire. *Adapted from Williams et al. (2004) 'Comparative biodiversity of rivers, streams, ditches and ponds in an agricultural landscape in Southern England', Biological Conservation 115 (2), 329-341.* ***This was the first of many studies worldwide, identifying the unexpectedly essential value of ponds in the landscape.***

2.2 The critical value of ecological networks

As the science of freshwater ecology has developed, the interconnected nature of freshwater ecosystems - and therefore the critical value of networks - has become increasingly evident.

In particular, it has been revealed that:

- Although some freshwater species are habitat specialists, favouring a single habitat type, many are more catholic in their tastes, and are found in standing and running waters of multiple types. This includes the vast majority of freshwater plants, and almost half of freshwater invertebrates (Figure 2) (Biggs *et al.*, 2017; Tomingas *et al.*, 2024).
- Metapopulations[2] exist across inter-reliant networks of running and standing waters, and maintaining these is important to allow species to move between standing and running waters, recolonize after disturbances, and maintain genetic diversity (Lane *et al.*, 2018; Schofield *et al.*, 2018). This interconnectedness underpins ecosystem resilience in the face of pollution, habitat fragmentation, and climate change (Schofield *et al.*, 2018).

[2] A metapopulation is a group of populations of the same species which are separated by space but interact with each other – a 'population of populations'.

- Extinction debt: there are very high rates of *local* extinction in all habitats – they just go unnoticed because the species will often recolonise from the surrounds. Networks of high-quality freshwater habitats are critical to ensure that this recolonisation can occur – especially for threatened species (Kuussaari *et al.*, 2009; Hanski, 2013; Montgomery, Reid and Mandrak, 2020).

Resilience Through Connectivity

Key benefits of connected freshwater networks are:

- **Enhanced ecosystem resilience**: The presence of a variety of habitat types (e.g. clean streams, ponds, fens) ensures that species can find refuge during local disturbances (Schofield *et al.*, 2018; Deacon, Samways and Pryke, 2024)
- **Climate change adaptation**: Networks allow species to move across landscapes, tracking suitable conditions as temperatures, hydrology and rainfall patterns shift (Riley *et al.*, 2018).
- **Reduced extinction debt**: Restoration and creation of small waterbodies adds habitats to buffer against waterbody isolation which otherwise drives high rates of localised extinctions over time.

The unique role of ponds in networks

- Ponds emerge as particularly vital components of freshwater networks because of their widespread occurrence and ability to support highly diverse species assemblages. At a landscape scale, ponds can be seen as ecological 'hubs', providing a disproportionately large contribution to regional biodiversity relative to their size (Williams *et al.*, 2004; Davies *et al.*, 2008).
- In degraded landscapes, ponds can often offer clean water refugia, supporting pollution-sensitive species unable to survive in impacted rivers or lakes (Biggs *et al.*, 2017).

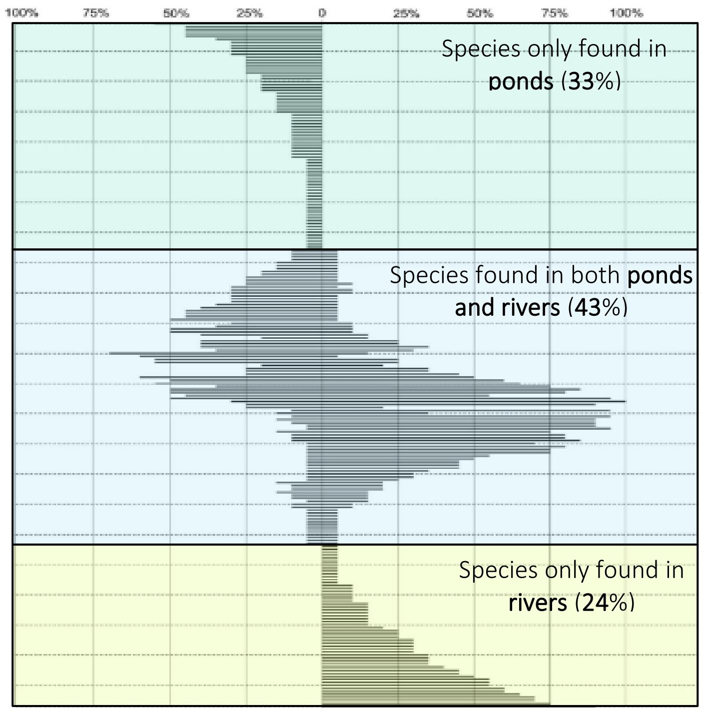

Figure 2. Aquatic invertebrate species occurrence in pond and river sites in a 9x9km agricultural area of Oxfordshire/Wiltshire*. Adapted from Biggs et al. (2017) 'The importance of small waterbodies for biodiversity and ecosystem services: implications for policymakers', Hydrobiologia 793, 3-39.* ***The results show that although some species are unique to ponds and rivers – almost half are found in both, and ponds alone support over three-quarters of all species.***

3 The status quo and ongoing threats

The majority of our freshwater habitats are degraded, with a stagnating or declining future trajectory. Significant changes to management of the water environment will be necessary if we are to meet our domestic and international nature and water recovery commitments.

3.1 Rivers: historic change, current state and major threats

Freshwater monitoring in the UK is mainly restricted to larger lakes and rivers, and has been driven by the requirements of the Water Framework Directive, transposed into UK legislation as the Water Environment (WFD) Regulations (WFDR). For these larger waterbodies, monitoring trends indicate some improvement to river water quality and macroinvertebrate metrics since the 1990s. This partial recovery has generally been linked to implementation of the Urban Wastewater Treatment Directive (Vaughan and Ormerod, 2014; Pharaoh *et al.*, 2023), demonstrating the initial efficacy of 'grey' infrastructure upgrades, particularly to sewage treatment works, in delivering environmental improvements. However, these are limited improvements from a low starting point, and **recovery is now widely perceived to have stalled**, **with the vast majority of the river and stream network still in a degraded state**. Only 16% of assessed surface waters (rivers, large streams and lakes) currently achieve high or good ecological status in England.

3.1.1 Reasons for poor river and stream quality

Environment Agency assessments of WFD Reasons for Not Achieving Good (RNAGs) suggest that the most significant degrading factors affecting rivers are **pollution and physical modification.** For pollution, there is considerable uncertainty about the individual and interactive ecological effects of most pollutants. However, phosphorus and nitrogen are relatively well-understood to be important drivers of eutrophication. The main sources of phosphorus and nitrogen in the UK's rivers and lakes are sewage effluent, runoff from agricultural land and urban surface runoff. The exact contribution of these sources varies strongly between catchments according to land cover. However, across England, Reasons for Not Achieving Good status in WFD reporting (RNAGs – cycle 2) assigned 29% to agriculture, 26% to the water industry and 13% to urban and transport (Environment Agency, 2016).

3.2 The rest of the small water environment: current status and major threats

The historic focus on monitoring rivers and lakes means that there is little high-quality monitoring data for other freshwater habitats (including ponds, ditch networks and wetlands). Given the ecological significance of these smaller habitats, this means that we have little idea of what is happening to freshwater biodiversity across most landscapes.

Data collected by the Botanical Society of Britain and Ireland show a long-term decline in the occurrence of wetland plants. Because the BSBI's biological recording is spread across all habitats, these data are likely to reflect landscape-scale trends better than WFD data (Walker *et al.*, 2023).

Ponds, one of the key biodiversity hotspots in landscapes, have been little monitored. However, pre-2010 data from the Countryside survey showed **that 92%** of countryside ponds were degraded, and there had been a marked decline in ecological quality during the previous decade (Williams *et al.*, 2010).

Small mires including fens, flushes and bogs provide another key freshwater biodiversity hotspot in the landscape. Although the importance of larger wetlands has long been recognised, the abundance and value of smaller wetlands remains underappreciated. Recent work provides evidence of significant biodiversity, habitat decline and loss of these habitats in many areas through drainage, pollution, lack of management and fragmentation (Hogg, Squires and Fitter, 1995; Morris, in prep).

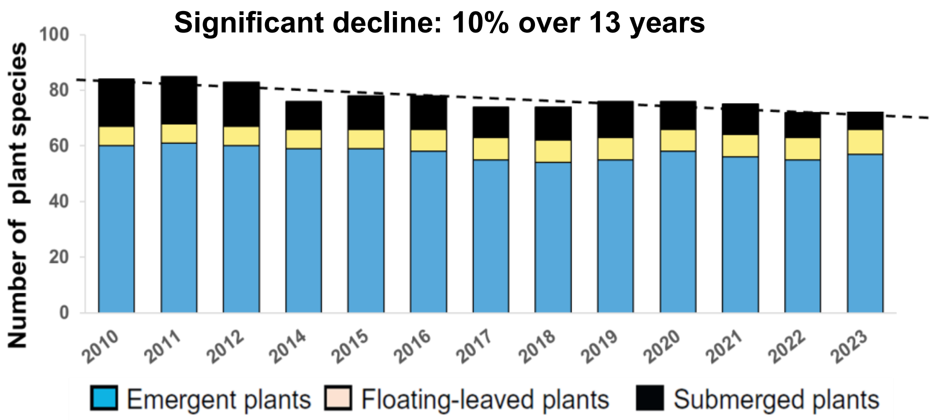

Figure 3. Whole-landscape wetland plant censuses 2010-2023, showing a 10% loss in diversity across the 10km² Water Friendly Farming project area, Leicestershire

More recently and relevantly, research into trends across the whole of the water environment provides evidence of **persistent downward trends in wider-countryside freshwater biodiversity** across **all waterbody types. From 2010 to 2025 (ongoing)**, census data collected in Freshwater Habitats Trust's Water Friendly Farming project, within a typical farmed landscape, show a consistent annual decline in the diversity of wetland plants across the 10 km^2 project area. Very recent data from other areas show similar trends (Williams *et al.*, 2020; Williams, 2024)

3.2.1 Reasons for the poor quality of ponds and other small waterbodies

As with rivers and streams, ponds and other small waters show evidence of widespread degradation, with much of this attributable to intensive agricultural pollution (Williams *et al.*, 2010).

In addition, small 'offline' waters face critical impacts that affect rivers and streams to a far lesser extent. Rivers and streams are drainage systems that are hard to remove from the landscape, so although they may be modified, channel habitats still remain. In contrast, small waterbodies such as ponds, small fens and flushes can be completely destroyed – so that the remaining habitats are highly isolated and exceptionally vulnerable to extinction debt. This makes habitat loss and isolation a critical risk. Since the 19th century, more than half of all ponds have been lost from England's landscapes, largely due to agricultural intensification and development. Fens, another biodiversity hotspot, have been similarly affected: for example, approximately 95-98% of lowland fens have been lost since 1940 (Šefferová, Šeffer and Janák, 2008).

4 Improving outcomes with a new approach

4.1 Introduction

Drawing on the lines of evidence above, we suggest a new approach to managing freshwaters which complements the existing focus on cleaning up large rivers and lakes but puts greater emphasis on work to improve small catchments and high-quality pond creation. This is a game-changing strategy for freshwater biodiversity recovery.

These interventions are cost-effective, deliver rapid results and create refugia for vulnerable species. Specifically, they rebuild resilient freshwater networks to secure long-term gains for biodiversity. This approach offers an opportunity to address freshwater biodiversity loss at scale while maximizing ecological and economic efficiency.

In short, the new approach consists of:

A) Working 'top-down' in rivers, focusing on headwaters and targeting pollution mitigation measures, including sewage treatment, where they will have greatest impact. Initially, this will often be catchments which already have a high proportion of low-intensity land use, and high biodiversity potential.

B) Adding high quality clean water habitats across the landscape (ponds, fens and more) to prevent loss of sensitive species and increase connectivity and resilience.

4.2 A new approach to headwater catchment management

Headwater catchments are ubiquitous across all landscapes, covering most of the area of England (Mainstone *et al.*, 2014). Each catchment is small - typically less than 100 hectares in lowland England (Davies *et al.*, 2010).

The small size of headwater streams makes them easy to pollute – headwater streams have limited capacity for dilution, so can be badly degraded by relatively small amounts of wastewater (Büttner *et al.*, 2022). However, headwater streams' small catchments mean they are also easier to keep entirely clean. This duality is evidenced by 2007 Countryside Survey data, which show **a greater proportion of headwaters at high status (37%) compared to larger rivers (31%)**, **but also more headwaters in the worst categories** (46% moderate/poor/bad, compared to 35% of lower catchment sites) (Figure 4).

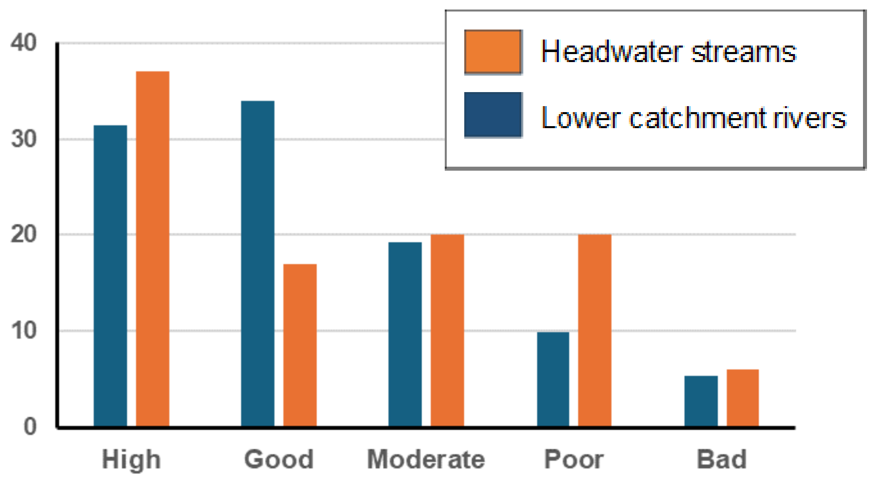

Figure 4. Invertebrate status of England's lower course rivers (WFD data) vs. headwaters (Countryside Survey data), 2007.

The results show that headwaters tend to be in either better or worse condition than rivers – a function of their small catchments (see text)

4.2.1 Sewage is a particularly significant polluter of headwaters

A recent study indicates that headwater streams in England and Wales are likely to be particularly strongly impacted by sewage effluent (Büttner *et al.* 2022). This study used data on river flows and discharges from sewage treatment works across European nations to calculate the percentage of water originating from wastewater treatment works in rivers and streams, and compared this to WFD ecological status. **The authors found that 1st - 3rd order streams declined consistently with increasing proportion of effluent.**

The Büttner study makes no attempt to account for other pressures (e.g. diffuse pollution from agriculture), and yet demonstrates a consistently strong relationship between sewage discharge fraction and WFD ecological status. This suggests that, in many small streams, sewage effluent is the predominant pressure. **It follows that mitigating problematic discharges could deliver fast ecological improvements in the headwater context.**

4.2.2 The 6.5% 'safe operating space' concept

The Büttner study found that streams where the amount of sewage effluent exceeds 6.5% of stream volume - the '**safe operating space'** - are unlikely to achieve high or good ecological status under the Water Framework Directive (Büttner *et al.*, 2022). This relationship broke down in larger waters, presumably because of increased dilution and stronger cumulative effects of upstream pressures. **The 'safe operating space' concept is a highly valuable tool for identifying target effluent limits needed to enable headwater streams to recover to high quality status.**

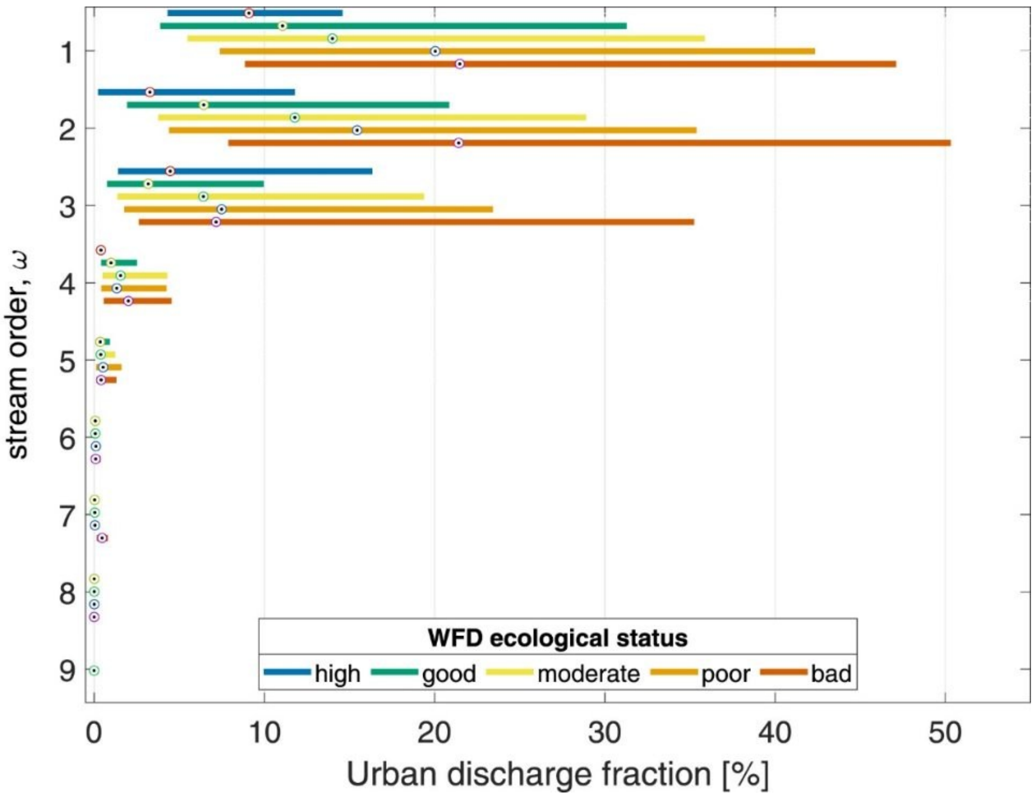

Figure 3. WFD ecological status by stream order, with corresponding urban discharge fraction – the percentage of water in the river which originates from wastewater treatment works. *From Büttner et al. (2022) 'Why wastewater treatment fails to protect stream ecosystems in Europe', Water Research 217, 118382*

Our own preliminary investigations suggest that this threshold is readily exceeded by smaller works, including ‘descriptive’ sewage treatment works, which treat effluent for ≤ 250 person equivalents. The impacts of effluent from descriptive works and other small wastewater sources (e.g. septic tanks) remain poorly understood, but are likely to be extensive.

4.2.3 Tools to mitigate the impacts of sewage in headwater streams

In England and Wales, the percentage of river water originating from sewage works can be assessed remotely using Low Flows 2 software (Wallingford HydroSolutions) to generate flows for upper catchments (which are typically ungauged) combined with industry estimated values for sewage works effluent flows. This permits rapid screening of sewage treatment works, including descriptive works, to assess the likelihood that works discharging into headwaters are exceeding Büttner’s ‘safe operating space’ of 6.5% effluent.

Where descriptive works are exceeding the safe operating space, impacts can be mitigated through a suite of measures including source control, treatment process upgrades and re-routing of discharges to lower reaches, where dilution will reduce ecological impacts.

4.2.4 Addressing agricultural pollution

Mitigation of sewage pressures (e.g. from descriptive works), may be sufficient to clean up headwater catchments if they are dominated by low intensity land use. However, in many cases desirable water quality outcomes will only be achieved through land management: particularly working with the agricultural sector to reduce pollutant emissions from agricultural land.

Several government and third sector schemes have sought to address agricultural pollution, with mixed results. The most extensive has been the Defra-administered Catchment Sensitive Farming (CSF) programme. This achieved significant *on-farm* reductions in pollutant emissions of up to 40%. However, the environmental response was minimal: river water quality improvements were in the order of 1-6%, and there were *no* measurable ecological improvements (Natural England, 2019).

This contrast: failure at the catchment level despite demonstrable on-farm success, can be largely attributed to the number of land holdings involved in the projects. In practice, CSF measures would have to be applied across nearly every land holding in a catchment to deliver reductions in line with Environment Act agricultural pollution targets (40% reduction in N, P and sediment emissions by 2038 relative to a 2018 baseline). In large catchments it is exceptionally difficult to engage a high percentage of land area because of the very large numbers of landholdings involved. In typical headwater catchments of c.100 hectares, implementing measures across most of the catchment is an ambitious but plausible proposition, requiring engagement with only a handful of land holdings and involving only modest land take. Note that upscaling this approach to cover large swathes of England’s headwaters would require greater investment in CSF and other nature friendly farming schemes.

4.2.5 Physical restoration

Even more than larger rivers, many headwater streams have been transformed by extensive physical modification, including channel modification and realignment (Riley *et al.*, 2018).

However, headwaters are also far easier to restore successfully, not least because water quality can be improved in tandem – something usually unachievable for larger streams and rivers. For rapid recovery and the most cost-effective results, physical restoration measures should be initially targeted at headwater streams where water quality is high and should focus on increasing habitat heterogeneity both within-channel and across the floodplain.

4.3 The wider freshwater network – a new approach

4.3.1 Creating clean water ponds, and protecting small waters

As outlined in Section 2, ponds are major repositories of freshwater biodiversity and play a key role in maintaining the integrity of freshwater ecosystems across landscapes. However many are degraded and present at low density, with more than half of all ponds lost from the landscape since the 19th Century (Wood, Greenwood and Agnew, 2003; Biggs *et al.*, 2017). This fragmentation of freshwater habitats across catchments is highly detrimental to their long-term resilience.

By restoring and creating clean water ponds, we can promote recovery across the whole freshwater environment, including running and standing freshwaters, and linked terrestrial ecosystems.

Small mires, particularly including fens, flushes, and bogs, can also be surprisingly critical biodiversity hotspots in many areas. They cannot easily be created, and can be more difficult to restore and maintain than ponds; however, their often unique value means that we need to place greater focus on recognising and protecting these areas in policy and practice. This includes prioritising their conservation, implementing evidence-based management strategies, and acknowledging their role as irreplaceable refuges for rare and specialist species in the face of ongoing habitat loss and climate change.

Table 1. The restorative power of ponds	
Rapid biodiversity gains	Clean water ponds quickly support a diverse range of freshwater plants, invertebrates, amphibians, and other species. International evidence shows consistent positive effects on biodiversity following pond creation (Oertli, 2018; Rannap *et al.*, 2024)
Refugia for sensitive species	Ponds provide pollution-free habitats for species that cannot survive in degraded rivers or lakes, acting as ‘lifeboats’ for freshwater biodiversity (Biggs *et al.*, 2017; Lewis-Phillips *et al.*, 2020)
Stepping stones for connectivity	Ponds and small wetlands in headwater catchments create interconnected habitat networks, enabling species to move across landscapes and recover from local disturbances (Lane *et al.*, 2018; Schofield *et al.*, 2018)
Supporting entire freshwater systems	Clean water ponds in headwaters not only benefit species living within them, but also enhance downstream biodiversity by increasing connectivity and acting as refugia, permitting recolonization of downstream habitats following disturbance. This strengthens the ecological integrity of the entire freshwater system.
Co-benefits for terrestrial ecosystems	Ponds provide essential aquatic-terrestrial subsidies, such as emerging insects that feed birds, bats, and other wildlife. Riparian habitats around ponds further support terrestrial plants and pollinators (Lewis-Phillips *et al.*, 2020; Walton *et al.*, 2021)

4.3.2 Evidence for landscape transformation using pond creation

Evidence from the Water Friendly Farming project demonstrates the power of clean water pond creation within small catchments. To double existing pond densities, 20 ponds were created across a 10 km^2 area of Leicestershire farmland, collectively covering less than 3 hectares. The ponds were sited to avoid pollution sources. Over 9 years, the creation of these ponds increased the whole landscape species diversity of wetland plants (i.e. looking at the total of species in all freshwater habitats) across the 10 km^2 project area by 16%. The number of regionally rare plants increased by 80% (Figure 6).

This success highlights the enormous potential for restoration of small catchments when clean water habitats are prioritized. Despite widespread agricultural pollution, clean water ponds reliably restored biodiversity across the project area, showing that small waters can serve as critical drivers of freshwater recovery.

The Water Friendly Farming project adds to a large body of international evidence demonstrating consistent positive effects of pond creation and restoration on freshwater biodiversity (Oertli, 2018; Lewis-Phillips *et al.*, 2020; Rannap *et al.*, 2024). Despite widespread recognition of this phenomenon amongst freshwater biologists, it is underutilised within freshwater management.

Alongside supporting freshwater biodiversity, pond creation and restoration provide well-documented benefits to terrestrial ecosystems. These may take the form of 'aquatic-terrestrial subsidies', for instance where emerging insects provide food for birds and bats (Lewis-Phillips *et al.*, 2020), or result from the creation of riparian habitat (Walton *et al.*, 2021).

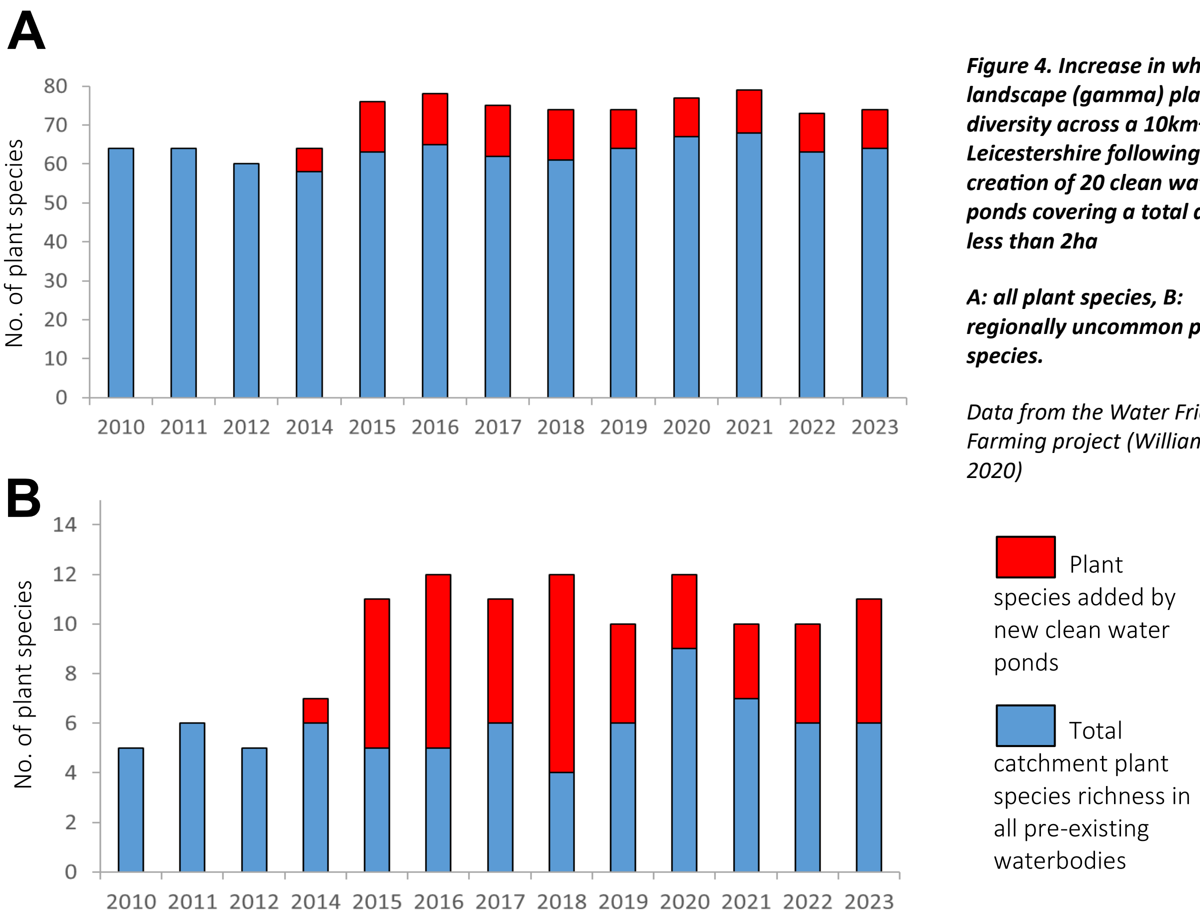

Figure 4. Increase in whole-landscape (gamma) plant diversity across a 10km² area in Leicestershire following the creation of 20 clean water ponds covering a total area of less than 2ha

A: all plant species, B: regionally uncommon plant species.

Data from the Water Friendly Farming project (Williams et al., 2020)

5 Policy barriers to a Reset for Water

5.1 Outdated water management framework

The regulatory framework for freshwater management was mostly developed prior to widespread understanding of:

- the disproportionate biodiversity value of small waters (Biggs *et al*., 2017)
- the strong interactions (biological, physical, chemical) between freshwater habitats which lack surface connections (Lane *et al*., 2018; Schofield *et al*., 2018).

For example, the Water Framework Directive was ratified in 2000, before the first peer-reviewed study showing the distribution of freshwater biodiversity between habitats across a landscape was published in 2004 (Williams *et al*., 2004).

As a result, water environment policy is now out-of-step with contemporary evidence on the distribution and drivers of freshwater biodiversity in two key ways:

- Small waters are excluded from statutory practices. Water Framework Directive Regulations (as currently applied in the UK - 'System A') exclude almost all standing waters of less than 50 hectares (all ponds, most lakes) from monitoring and management plans. Headwater streams are generally either bundled with downstream waters or omitted from waterbody maps. As a result, small waters are deprioritised in efforts to restore freshwater ecosystems.
- Freshwaters are managed in silos, with rivers and large lakes managed under WFD, and other freshwaters encompassed more haphazardly by nature policy (e.g. Habitats Regulations). The result of this regulatory segregation is that efforts to improve the status of freshwater ecosystems have tended to focus on individual habitat types. For instance, River Basin Management Plans are overwhelmingly focused on improvement of the main river channel and do not encompass offline habitat restoration.

5.2 Shortcomings of statutory environmental targets

The Environment Act targets for wastewater pollution and habitat restoration currently provide a barrier to effective management of the water environment. There is a focus on input-driven measures (area affected/volume treated), as opposed to biodiversity improvement itself. Establishing more outcome-focused targets would ensure value for money on environmental investment, and accelerate progress towards nature recovery goals.

5.2.1 Environmental Targets (Water) (England) Regulations 2022

By 2038, the Environment Act wastewater target aims to reduce the load of phosphorus discharged to freshwaters in treated wastewater by 80%, relative to a 2020 baseline. Because this target focuses solely on the *gross* volume of phosphorus emitted, it directs the overwhelming majority of water sector investment towards large rivers. This is because the total quantity of P entering lower reaches is relatively high, and is generally discharged from larger sewage treatment works, so it costs less to achieve a given reduction in total P emitted. In headwater streams, investment is deprioritised, because the total volume of effluent emitted is low, making improvements unattractive (in terms of achievement of the P target) even at works operating far outside the safe operating space of the receiving water.

5.2.2 Environmental Targets (Biodiversity) (England) Regulations 2023

The Environment Act also provides for two habitat targets: to protect 30% of land and sea by 2030, and to restore or create 140,000 hectares of wildlife-rich habitats outside protected sites by 2038. Both of these targets are purely area-based. This makes for simple metrics, but has the effect of disincentivising the creation or restoration of small freshwater habitats, because these interventions are expensive relative to their contribution to area-based targets – but not relative to their biodiversity benefits.

Small freshwater creation and restoration is supported, albeit indirectly, by the Environment Act species abundance and species extinction targets, simply because all freshwater plants, more than 90% of the freshwater invertebrates and a third of fish listed in the species *abundance* indicator can be found in small waters (Wildlife and Countryside Link, 2024). On its own, however, the abundance indicator is inadequate as a driver to prevent the ongoing decline of freshwater biodiversity and effectively stimulate its recovery.

5.3 Water sector regulatory steer

A growing portion of water sector investment (£20 billion in AMP8) is directed towards environmental improvement. This investment constitutes the biggest funding source for restoration of freshwater ecosystems.

Almost all of this investment is directed towards direct mitigation of wastewater pressures, through infrastructure upgrades. Because the Environment Act phosphorus target is based on gross volumes of P, the vast majority of this investment is targeted at large works in large rivers, where reductions are generally cheapest to achieve. This will make real world delivery of actual environmental improvement more difficult for the water industry, because large rivers are universally impacted by a cornucopia of other upstream pressures beyond the reach of the water sector.

Adopting a Catchment Nutrient Balancing approach could pave the way for more effectively targeted investment (United Utilities, 2023) but, ultimately, environmental benefits are still constrained by the requirement to deliver equivalent N and P emission reductions to the WFD waterbody.

Far greater environmental benefits could be secured if a portion of water industry investment were freed up to invest *away* from heavily impacted rivers, to make possible the creation and restoration of unpolluted freshwaters which would strengthen the resilience, connectivity and integrity of freshwater ecosystems as a whole.

6 Recommendations

By shifting the current regulatory steer, the approach outlined in Section 4.2 could be delivered through existing water industry environmental improvement programmes without significant additional funding. There is considerable public appetite for reform to the water sector, but initial political responses have been wedded to an outdated model of water management, and are unlikely to deliver desired environmental benefits. Adopting the approach outlined here would help ensure that reforms to the regulatory framework for water management deliver the meaningful environmental improvements which the public expect to see.

6.1 Water Environment (WFD) Regulations (2017)

Amend WFD Regulations to properly incorporate headwaters and ponds in mapping, monitoring, management and restoration

The approach to water monitoring and management enshrined in the Water Framework Directive concept has failed to stem declines in whole landscape freshwater biodiversity. Moreover, it has resulted in a significant opportunity loss, by failing to promote the restoration of small waterbody networks.

Amending the current WFD approach - using options already available within WFDR - would go a considerable way to enabling the implementation of the Reset approach advocated here. Specifically, WFD should be amended to:

- Adopt 'System B' to incorporate standing waters <50 hectares into WFDR monitoring and management, enabling management of ponds and other small waters as networks.
- Mandate stratified monitoring of headwater reaches within existing WFDR waterbodies to identify headwater-specific Reasons for Not Achieving Good (RNAGs), and set headwater-specific restoration actions within River Basin Management Plans.
- Give catchment partnerships a clear role in management of the *entire* network of freshwaters, including restoration/creation of small standing waters.

Enabling these changes to incorporate smaller waters into WFDR will:

(i) Enable the first real assessment of the status and trajectory of the whole freshwater environment

(ii) Provide a significant driver to support the protection and recovery of freshwaters through small water networks.

6.2 Environment Act (2021)

Revise Environment Act targets to drive improvements in whole-catchment freshwater biodiversity, from source to sea

The Environment Act sets out ambitious statutory targets for nature recovery. These targets require refinement in order to effectively direct investment, particularly in relation to the water sector.

Government should:

- Modify sewage pollution targets to focus on ***impacts*** of sewage pollution, rather than the gross volume of pollution emitted.
- Establish a new freshwater biodiversity target which better focuses water environment investment on nature recovery, incorporating whole landscape assessment of freshwater biodiversity.

These amendments will ensure environmental investment is directed towards programmes which deliver the greatest environmental benefits – rather than simply the greatest progress against targets.

6.3 Water regulatory framework

Create a water sector regulatory framework which unlocks the power of headwater catchments for nature recovery

There is scope for non-legislative amendment to water sector regulations to incentivise greater investment in headwater catchments, and facilitate the development of the Reset approach.

Water sector regulation should be adapted to:

- Direct greater water sector investment towards headwater catchments by, for example, issuing new strategic priorities for Ofwat.
- Extend water industry catchment measures to encompass freshwaters across the whole catchment, and recognise clean water pond creation as a solution to cross-catchment water pollution issues.
- Establish a demonstration programme to provide catchment managers with a comprehensive toolkit of techniques underpinning the Reset for Water approach to headwater management.

By reforming the water sector's regulatory framework to promote investment ***upstream and across catchments***, the substantial investment directed by the sector towards environmental improvement could be spent more efficiently, delivering rapid and long-term habitat quality and biodiversity benefits.

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